Managing Young Forests in the Douglas-Fir Region

Proceedings of a Symposium held June 15-18, 1970
Edited by Alan B. Berg

Volume 3

September 1972
School of Forestry
OREGON STATE UNIVERSITY
This is the third volume of a series of short courses held by the School of Forestry on the management of young forests in the Douglas-fir region. The two preceding volumes are:


Managing Young Douglas-Fir and Western Hemlock—Economics, Yield Control, and Thinning. September 1971. 5½ x 8¾ inches. 175 pp. $5.00.
Managing Young Forests in the Douglas-Fir Region

Symposium held June 15-18, 1970

Volume 3
Compiled and edited by
Alan B. Berg
Professor of Forest Management

September 1972
Paper 734

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School of Forestry
Oregon State University
Corvallis, Oregon 97331

COVER PHOTOGRAPH: Red alder in the Coast Range of Oregon.
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FOREWORD

These are the proceedings of the third short course in the management of young Douglas-fir and western hemlock conducted by the School of Forestry, Oregon State University, June 15-18, 1970.

The course included one day of lectures and discussion on the campus of Oregon State University, two all-day field trips to observe management, and one day of a "sound-off" session in which all participated. The 53 registrants came from Oregon, Washington, and California.

The opportunities in young-growth management are great. European foresters have managed Douglas-fir successfully longer than foresters in the Pacific Northwest and, even though both the economics and ecological conditions in Europe differ from ours, foresters in the Pacific Northwest will profit from knowing about their experiences.

Administration and operation of partial cuttings are more complicated than final harvest cuttings and the economics of the management program have not been determined completely. The knowledge and experience, then, of foresters active in research and management of young forests are especially relevant.

But young-growth management not only must be financially sound but also ecologically safe and esthetically acceptable. For instance, red alder, a valuable species economically, is also valuable biologically because it fixes nitrogen in the soil. And it may play an important role in the control of Poria weirii, a serious root rot of Douglas-fir. Skillful management can maintain or improve esthetic qualities of the forest. This short course was oriented toward those goals.

I would like to thank my colleagues in the School of Forestry who participated as instructors. I especially would like to thank the instructors from Paul Barber Hardwoods Company, Freres Lumber Company, Longview Fibre Company, Oregon State Forestry Department, Bureau of Land Management, Willamette National Forest, and Pacific Northwest Forest and Range Experiment Station. Without their help this short course could not have been presented.

Alan B. Berg, Short Course Director
WELCOME

J. Richard Dilworth
Head, Department of Forest Management
Oregon State University
Corvallis, Oregon

I WELCOME YOU with pleasure to our third symposium on the management of young Douglas-fir and western hemlock. Young-growth stands are our hope for the future. We must tend them well and learn about and adapt to their peculiarities. New management systems, new equipment for culture and harvest, and new economic relations, along with adequate concern for the environment, must be developed and put into use.

The Forest Research Laboratory conducts research in the areas of forest management, wood utilization, and analysis of harvesting systems. The Pacific Northwest Forest and Range Experiment Station and other federal agencies, certain firms of the forest products industry, and equipment companies also are engaged in research and development programs that contribute to the broad goals of young-growth management. The main objective of this series of short courses is to keep you, the professional forester, abreast of what is new in this important area. Proceedings are available that record the activities of the two earlier symposia. I commend them to you along with this volume as sources of information to help round out your professional background in managing young forests.

I join with Alan Berg in expressing our appreciation to the instructors who are sharing their experiences and providing counsel on what lies ahead. We also are grateful for your participation and for the exchange of ideas your presence should bring about. I am sure the combined efforts of all assembled here will make each of you a better informed and more capable manager of young-growth stands. That is our goal.
DOUGLAS-FIR was first planted in Europe in 1828. The planting was in Scotland. The seed source, as well as anyone can guess, was somewhere near Fort Vancouver, Washington, across the river from Portland. Many other early plantings were made in Europe, starting about 1850. Although Douglas-fir planting in Europe started in Scotland and England, early plantings also were made in France and Germany. Douglas-fir was planted as far east as Moscow and the Ukraine, and as far south as northern Italy and southern France. Most of these were specimen plantings, which gave people an idea of what a fine tree Douglas-fir was, but not many mass stands were available on which to observe volume production. My review of European literature suggests that, today, quite a few stands as old as 80 to 90 years have been under some sort of management. Unfortunately, records on yields and thinning schedules for most of these older stands are rather scarce.

Consider one of the most important influences on Douglas-fir growth—the climate. Most of England and northwest Europe has a climate strongly affected by the ocean. Winters are moderate and rainfall fairly heavy. Generalizations about rainfall cannot be made, however, because like the Olympic Peninsula where some areas have 200 inches of rain, some areas in Wales have 180 inches of rain. The southeastern side of Great Britain is in a rainshadow similar to that at Sequim, Washington, but not quite so pronounced. Precipitation is quite variable.

Generally speaking, England has mild winters and considerable rain through the cool summers. The climate of northwestern Europe differs from that of northwestern United States. No coastal mountain range is present; the terrain of northwestern Europe is basically that of a broad plain with a few hills that don’t interrupt the incoming ocean air. Therefore, a maritime climate is more prevalent in northwestern Europe than in northwestern United States. Looking for areas that were more similar to northwestern United States, I found that southern France and northern Italy have mountain ranges with fir plantations at elevations around 2,000 to 4,000 feet. These areas, at the border of the dry Mediterranean climate, because of their altitude have moderate rainfall through the year. They do, however, have dry periods in July and August, similar to some parts of the Northwest.
As I noted earlier (3), I couldn’t find anything that would say some part of Europe is exactly like some area in the United States—no exactly similar sites and climates on which we can compare plantation growth.

Of interest are the varieties that were planted in Europe. The coast fir, which in Europe is called var. *viridis*, meaning green, was the earliest planted. The Germans in their plantings found this variety wasn’t frost hardy, so they tried the interior variety, which they called var. *glauca*. As this variety is susceptible to needle diseases caused by the fungi *Rhabdocline* and *Phaeocryptopus*, it was totally unsuccessful.

Later, Europeans found in British Columbia what they consider an intermediate form of fir—var. *caesia* which means greenish-blue. This isn’t recognized as a variety by our geneticists, but review of the European literature shows it is intermediate between the frost-hardy interior variety and the rapidly growing coast variety. In this country, it is classified as a form of coast fir.

The data that I have on growth are for the coastal type, because the European discovery of var. *caesia* in British Columbia is recent and none of the plantings is as old as 40 years.

“How many do they plant per acre?” is a frequent question. In general, Europeans used to plant many trees and start with dense stands. I did not find anything in recent literature that said exactly how many trees they recommend planting. I doubt that they still go down to 1-meter spacing, as suggested for Norway spruce in literature of many years ago. The main clues I have are the numbers of trees surviving at various ages in the production tables I have reviewed. But before I get into numbers, I should define production tables.

A production table is a thinning guide. It lists all the stand statistics for various production classes—which are yield classes. It shows for various ages what proportion of the stand should be cut, the statistics for the stand after thinning, and the statistics for the material removed. These production tables should be looked at more as thinning guides than as yield tables.

Here are some of the numbers per acre at various ages. In the Netherlands at 5 years on all sites, I found 1,600 trees, which is spacing in squares about 5¼ feet on a side. In France, at 15 years on site 160 they have 850. On site 130 at 23 years, which was the beginning of thinning, they also had 850 stems per acre. That is about 7¼-foot spacing. In Italy, at 20 years on site 170, they showed about 500 trees, which is about 9½-foot spacing. On site 120, they showed 800, which is about 7½-foot spacing. Germany at 20 years, site 147, indicated about 1,200 trees, which is 6-foot spacing. Most of the rest range between 5½- and 7½-foot spacing at
the start of thinning. They may allow for a certain amount of loss from their initial planting—I can’t answer how much.

The British, the French, and the Italians suggest spacings of about 6 to 7 feet for planting. This is aside from what I found in the production tables.

In the installation of a plantation in Europe, the general practice—and this is not stated in the production tables—includes site preparation and annual weeding if needed until the trees are above the annuals and brush.

In Europe, a recent trend is to use production classes instead of site classes. This is the total volume yield—the final stand plus thinnings determines what the production class will be. Determination of site indexes equivalent to their production or site class means is difficult because these are thinned stands—many of them thinned from below. This tends to make heights uniform, and thus the mean height of the stand may be close to dominant-codominant height of a natural stand.

Another recent trend in Europe is to use what is called top height; this is the average height of the largest 40 trees per acre or 100 trees per hectare. This measurement is less affected by thinning than stand mean height, which is the height of the tree of mean basal area. Top height is quite close to what we call dominant height and is a much more useful figure in identifying similarities in site than height of dominants and codominants or height of the mean tree.

Johnston and Bradley (6) in England and Assmann (1) in Germany have stated recently that volume yields vary for the same site as determined by height growth. Johnston and Bradley said that the volume yields could be as much as 50 percent higher or lower on a given site than indicated by stand height, so they used three local production classes for each general production class. Differences of about 25 cubic feet per acre per year occur between each of these classes. If cubic feet per acre are hard to talk or think about, maybe cords are more familiar—about 80 to 90 cubic feet equal one cord. Statistics for small stands are difficult to express in terms of board feet because of rapidly changing conversion factors for small trees.

Assmann, one of the authorities on yield in Germany, suggests that coastal sites may have relatively better diameter growth than height growth because of the rainfall through the summer months. Height growth in most conifers comes early in the season and is completed early in the summer, normally before the rains stop. Diameter growth usually starts somewhat later than height growth and continues until soils dry to the stage where growth is restricted for the rest of the summer. If rain
continues through the summer, better diameter growth may take place for the same height growth than where soils dry in midsummer.

The British have long experience with plantation management, much longer than we have in this country. Most of their natural forests succumbed to early cuttings and practically all the forestry they practice today is on the basis of planting.

Definitions of some terms they use to describe thinnings are of interest. We often think of thinning intensity as heavy or light, applied to a single thinning. The British do not use the term this way. The thinning intensity is the average annual volume cut between the first and last thinning, up to the time the stand is ready for its final harvest. Thus, they may have a high-intensity thinning where each cut is extremely light if the cuts are at frequent enough intervals. The weight of a thinning, according to Johnston and Bradley (6), is the volume removed in any one thinning. The thinning cycle is just what we know it to be—the interval between thinnings.

The British point out in their management tables that the thinning of the heaviest intensity indicated by silviculture comes closest to the type of thinning called for by economics. They show that, even if the thinnings are of small material, the realization of the thinning yield is so much earlier that the expectation value of thinnings may be greater than the expectation value of the main crop harvest.

Choosing the best terminology to describe the type of cuts that appear in the production tables is difficult. Are they low thinnings? Crown thinnings? Selective thinnings? The best approach to what a thinning really is in a production table is to look at the ratio of average diameter of the material removed to the diameter of the remaining stand. If this is about 70 percent, we can be certain it is a low thinning. Eighty percent is probably a low thinning. When 90 or 100 percent is reached, probably the thinning is mainly for spacing. Above 100 percent, we are definitely getting into crown thinnings, but, just as likely, the cutting may be aimed at improving the stand for further thinnings. I have used this ratio of diameters of material removed to diameter of the residual stand in Tables 1 to 5 as a clue to what sort of thinning actually was planned in the thinning guide.

Table 1 is an excerpt from a production table. It is supplemented by Figure 1, which shows volume production. Table 1 is based on the highest production class in the yield guides by Hummel and Christie (5). They consider that their first thinning can be at age 10 years. According to the 91-percent diameter ratio, the material removed will average 3.2 inches. As this is small, removing it is probably part of the work needed to get the
Table 1. Douglas-Fir Production in Great Britain in 1953 (Site Index 146). Based on Hummel and Christie (5).

<table>
<thead>
<tr>
<th>Time after planting</th>
<th>Main crop after thinning</th>
<th>Dbh ratio, thinning main crop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trees per Acre</td>
<td>Mean Height</td>
</tr>
<tr>
<td>Years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1,160</td>
<td>22</td>
</tr>
<tr>
<td>13</td>
<td>795</td>
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<tr>
<td>16</td>
<td>565</td>
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<td>22</td>
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<td>28</td>
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<td>31</td>
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</tr>
<tr>
<td>45</td>
<td>138</td>
<td>100</td>
</tr>
<tr>
<td>50</td>
<td>125</td>
<td>107</td>
</tr>
</tbody>
</table>

1 Square feet per acre.

Figure 1. Douglas-fir production in Great Britain, 1953, site index 145, based on Hummel and Christie (5).
stand under control. They prescribe thinnings at 3-year intervals up to age 31, following with 5-year intervals for the older ages. At 19 years, 83 percent of the 7.3-inch mean dbh after thinning indicates they are removing material averaging 6 inches. Here, they may have reached some trees they could sell. From then on, I presume they consider their thinnings commercial. You will notice their first thinnings have started before the stand has reached 100 square feet of basal area. They let the stand grow to a basal area of about 200 square feet per acre at 50 years.

One point of difference in the tables is that the British base their thinning production tables on years since planting. As far as I could determine from translations of Italian, French, and German authors, the age quoted was age from seed in the rest of the European tables.

In Figure 1, the control is the total production line, which is the volume of the current stand plus what has been removed in thinning. In making production tables, the custom in Europe is to plot volume over height, not over age. Height-over-age curves by sites enable them to translate the basic volume-over-height curve into terms of site quality and age.

On each of Figures 1 to 5, I have made a circle at 14,000 cubic feet total production at 50 years, which is 280 cubic feet per acre per year, or very nearly 3 cords per acre per year. This circle gives an index for comparison of charts. All the graphs are for site index of about 145. On each graph the total production line comes close to the circle.

The differences in shape of the total production lines probably are based on the authors' field observations of Douglas-fir plantations. In making these tables, most of the authors examined from 50 to 100 plantations. Sometimes they had good records of intermediate yields—sometimes they did not. They made their best estimates of total production for planted Douglas-fir. Obviously, not all the stands they examined followed the course of the thinnings that they finally recommended.

Many authors think it is unnecessary to follow rigid thinning schedules to reach these total production lines. The level of the other lines in these figures—the thinning yields and the current stands—are fixed by the time thinning starts and by the amount removed at each entry. The thinning yield line (dashed) indicates the cumulative volumes removed.

Current stand, of course, is the stand as it exists between thinnings and after thinning. This tells quite a lot about thinning philosophy. As long as this line is rising, the cut is less than the growth. When it is horizontal, as in the Swedish tables, all the growth is being cut. If the line
Table 2. Douglas-Fir Production in Great Britain in 1966 (Site Index 146). Based on Bradley Christie, and Johnston (2).

<table>
<thead>
<tr>
<th>Time after planting (Years)</th>
<th>Main crop after thinning</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trees per Acre</td>
<td>Mean Height</td>
<td>Mean dbh</td>
<td>Basal area'</td>
<td>Main crop dbh ratio, after thinning</td>
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<tr>
<td>10</td>
<td>1,240</td>
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<td>3.5</td>
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<td>48</td>
<td>134</td>
<td>29.0</td>
<td>222</td>
<td>0.99</td>
</tr>
</tbody>
</table>

'Square feet per acre.

Figure 2. Douglas-fir production in Great Britain, 1966, site index 146, based on Bradley, Christie, and Johnston (2).
should droop, the cutting would exceed the growth. I haven’t found any European tables that indicate this.

When the thinning yield is below the current stand volume, the thinning intensity can be considered either light or moderate, depending on how far below. When the thinning yield is at the level of the current stand (Figure 2), the thinning intensity is heavy. This is not to say that any individual thinning is heavy, rather that the cumulative thinning intensity is heavy.

Other things can be deduced from these curves. A line from the origin of the stand that just touches the total production line indicates the culmination of growth. Note that these charts start at 10 years instead of zero. Visualize a line from zero cubic feet and zero age that is just tangent to the total production line. At the point of tangency, mean annual growth culminates. If the straight line through the origin is close to the total production line for any period of years, however, the final removal cut can be made either earlier or later than the culmination without any notable loss in volume production.

In Figure 2, which is based on the most recent British forest management tables (2), the point of tangency or culmination of mean annual production is about 50 years, but the cut could be at 60 years or as early as 40 years without changing greatly the average annual volume yield. I don’t suggest that cutting earlier is a good practice, but cutting later will give additional years of growth on crop trees and hence larger crop trees in the final harvest and also defer regeneration costs.

Next, I will mention a few highlights of each thinning regime. The production tables for Great Britain for 1953 were prepared by Hummel and Christie (5). Figure 1 represents a thinning that is moderate throughout the life of the stand, 50 years. In this moderate thinning, the British appear to be cutting about half the growth in each thinning after the first.

Figure 2 shows a change in thinning philosophy in Great Britain. They have changed their cycles from 3 years to 5 years to increase the amount of material they can remove in each cut. Johnston and Bradley claim that, on good sites, a change from a 3-year to a 6-year cycle can be made with no noticeable effect on yields, and on poor sites, from 4 to 8 years. You will notice the thinning yield stays right with the current stand, which means that half of the production at 80 years is thinnings and half is in the final stand.

Figure 3, based on measurements of plantations in Denmark and Sweden (7), has two distinctive features. The thinning cycle is 2 years until the stand reaches 40 years and then becomes 3 years. At about 45 years,
Table 3. Douglas-Fir Production in Sweden in 1961 (Site Index 149), Based on Karlberg (7).

<table>
<thead>
<tr>
<th>Age</th>
<th>Trees per Acre</th>
<th>Mean height</th>
<th>Mean dbh</th>
<th>Basal acre</th>
<th>Thinning ratio, main crop</th>
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<td>303</td>
<td>66</td>
<td>9.2</td>
<td>139</td>
<td>0.74</td>
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<tr>
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<td>258</td>
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<td>0.76</td>
</tr>
<tr>
<td>32</td>
<td>224</td>
<td>75</td>
<td>10.9</td>
<td>145</td>
<td>0.76</td>
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<tr>
<td>34</td>
<td>196</td>
<td>79</td>
<td>11.7</td>
<td>147</td>
<td>0.77</td>
</tr>
<tr>
<td>36</td>
<td>173</td>
<td>83</td>
<td>12.5</td>
<td>148</td>
<td>0.77</td>
</tr>
<tr>
<td>38</td>
<td>153</td>
<td>86</td>
<td>13.4</td>
<td>148</td>
<td>0.78</td>
</tr>
<tr>
<td>40</td>
<td>136</td>
<td>90</td>
<td>14.2</td>
<td>149</td>
<td>0.78</td>
</tr>
<tr>
<td>43</td>
<td>115</td>
<td>95</td>
<td>15.4</td>
<td>149</td>
<td>0.77</td>
</tr>
<tr>
<td>46</td>
<td>99</td>
<td>99</td>
<td>16.6</td>
<td>150</td>
<td>0.78</td>
</tr>
<tr>
<td>49</td>
<td>86</td>
<td>104</td>
<td>17.8</td>
<td>149</td>
<td>0.78</td>
</tr>
<tr>
<td>52</td>
<td>75</td>
<td>108</td>
<td>19.0</td>
<td>148</td>
<td>0.79</td>
</tr>
<tr>
<td>55</td>
<td>66</td>
<td>112</td>
<td>20.2</td>
<td>147</td>
<td>0.79</td>
</tr>
<tr>
<td>58</td>
<td>59</td>
<td>116</td>
<td>21.3</td>
<td>145</td>
<td>0.79</td>
</tr>
<tr>
<td>61</td>
<td>52</td>
<td>119</td>
<td>22.4</td>
<td>144</td>
<td>0.77</td>
</tr>
</tbody>
</table>

1 Square feet per acre.

Figure 3. Douglas-fir production in Sweden, 1961, site index 149, based on Karlberg (7).
the thinning removes practically all the growth. This means that the current stand or growing stock is held at a much lower level than that in other production tables.

Figures 4 and 5 are similar. They suggest late and light first thinnings and fairly heavy thinnings after the smaller stems in the stand become merchantable. Such deferred thinnings may make it easier to control brush and to get early natural pruning.

One final comment concerns the effect of site on mean annual volume production. Obviously, production is greater on better sites. Figure 6, which is taken from Figure 1 of Research Paper PNW-87 (3), shows this relation derived from several European production tables. If the center of the group of curves is taken as the average cubic foot production, with some unproven conversion factors for board feet, we see that mean annual potential production ranges from about 160 cubic feet per acre per year on site 110, to 365 on site 170. In board feet, this may be 500 to 1,450. On site 140, this would be 245 cubic feet and 900 board feet per acre per year.

I hope I have given you some insight into how Douglas-fir can be managed intensively. Such knowledge should be useful as we in the Northwest intensify our forest management.

LITERATURE CITED


Table 4. Douglas-Fir Production in France in 1967 (Site Index 145), Based on Decourt (4).

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Trees per acre</th>
<th>Top height (Feet)</th>
<th>Mean dbh (Inches)</th>
<th>Basal area(^1) (main crop)</th>
<th>Dbh ratio, thinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>850</td>
<td>49</td>
<td>5.0</td>
<td>116</td>
<td>--</td>
</tr>
<tr>
<td>25</td>
<td>603</td>
<td>62</td>
<td>6.9</td>
<td>156</td>
<td>0.73</td>
</tr>
<tr>
<td>30</td>
<td>462</td>
<td>74</td>
<td>8.3</td>
<td>172</td>
<td>0.70</td>
</tr>
<tr>
<td>35</td>
<td>350</td>
<td>84</td>
<td>9.8</td>
<td>183</td>
<td>0.69</td>
</tr>
<tr>
<td>40</td>
<td>277</td>
<td>93</td>
<td>11.3</td>
<td>192</td>
<td>0.70</td>
</tr>
<tr>
<td>45</td>
<td>226</td>
<td>101</td>
<td>12.6</td>
<td>193</td>
<td>0.70</td>
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<td>198</td>
<td>108</td>
<td>13.6</td>
<td>198</td>
<td>0.69</td>
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<tr>
<td>55</td>
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<td>114</td>
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<td>170</td>
<td>118</td>
<td>14.9</td>
<td>206</td>
<td>0.67</td>
</tr>
</tbody>
</table>

\(^1\)Square feet per acre.

Figure 4. Douglas-fir production in France, 1967, site index 145, based on Decourt (4).
Audience. What timber species were on the lands before Douglas-fir was planted?

Bruce. Most of the areas planted to Douglas-fir originally had a mixed hardwood-conifer forest, with, typically, beech and other hardwoods, Norway spruce, and, in some areas, Scotch pine. I'm not positive about all the species. This forest type occurs north of the oak-chestnut type of southern Europe. The general forest of northwest Europe is mixed conifer-hardwood. Incidentally, Douglas-fir, particularly the green coastal variety where it is not severely frost-damaged, is one of the best wood producers in Europe. Douglas-fir surpasses most of the native species anywhere that it will grow in Europe without frost-damage.

Audience. Do European foresters believe that height growth of trees in the stand can be influenced by stand management?

Bruce. I don't think so. This is not a generally accepted thesis in plantation management. Usually, the effects of stand density on height growth are in overdense stands where height growth is suppressed. Of course, some few indications hint that height growth is slightly better in very open stands, but I have seen it shown both ways with species of pine. I'm not familiar enough with Douglas-fir measurements to be able to answer authoritatively. The only evidence I have seen of much change in height growth in Douglas-fir are the Wind River plantations on low sites with 4-by-4-foot spacing that definitely suppressed height growth.

Generally, suppression of height growth in ponderosa and lodgepole pine is on poor, not on good sites. With southern pine, suppression occurs occasionally in overdense, seedling stands on poor sites. On the better sites, even pines express dominance. For Europe, I don't know the answer specifically, but I don't think much effect on height growth in management is anticipated, because all the managed stands are reasonably open.
Table 5. Douglas-Fir Production in Germany in 1956 (Site Index 147), Based on Schober (8).

<table>
<thead>
<tr>
<th>Age</th>
<th>Main crop after thinning</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Trees per acre</td>
<td>Mean height</td>
<td>Mean dbh</td>
<td>Basal area¹</td>
</tr>
<tr>
<td>Years</td>
<td>Feet</td>
<td>Inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>1,206</td>
<td>38</td>
<td>4.4</td>
<td>128</td>
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<tr>
<td>25</td>
<td>854</td>
<td>52</td>
<td>5.7</td>
<td>152</td>
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<tr>
<td>30</td>
<td>596</td>
<td>65</td>
<td>7.2</td>
<td>167</td>
</tr>
<tr>
<td>35</td>
<td>419</td>
<td>77</td>
<td>8.9</td>
<td>180</td>
</tr>
<tr>
<td>40</td>
<td>302</td>
<td>88</td>
<td>10.6</td>
<td>186</td>
</tr>
<tr>
<td>45</td>
<td>229</td>
<td>96</td>
<td>12.3</td>
<td>190</td>
</tr>
<tr>
<td>50</td>
<td>184</td>
<td>104</td>
<td>13.8</td>
<td>191</td>
</tr>
<tr>
<td>55</td>
<td>155</td>
<td>110</td>
<td>15.1</td>
<td>192</td>
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<td>60</td>
<td>133</td>
<td>115</td>
<td>16.3</td>
<td>192</td>
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<td>65</td>
<td>117</td>
<td>119</td>
<td>17.4</td>
<td>193</td>
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<tr>
<td>70</td>
<td>106</td>
<td>123</td>
<td>18.3</td>
<td>194</td>
</tr>
<tr>
<td>75</td>
<td>97</td>
<td>126</td>
<td>19.2</td>
<td>195</td>
</tr>
</tbody>
</table>

¹Square feet per acre.

Figure 5. Douglas-fir production in Germany, 1956, site index 147, based on Schober (8).
Audience. In the British and Swedish stand tables, the number of trees per acre drops below 100, even to between 60 and 70. Does the openness of such a stand create brush problems?

Bruce. They made no comment on this. I would anticipate that brush problems would occur. What bothers me most about carrying extremely low numbers of trees per acre is the mechanics of spacing. With 60 trees per acre, removing a tree will make an opening one-sixtieth of an acre in size. It might take quite a while for the surrounding trees to take advantage of an opening that large. I should imagine that brush would establish itself in an area where brush species exist.

Figure 6. Total Douglas-fir production at about 50 years, from Bruce (3).
Audience. What percentage of the total volume production in European countries would be Douglas-fir?

Bruce. A relatively small amount now. As to area planted, in some countries that amounts to about 20 percent of the planted area today.

Audience. Is the seed of Douglas-fir produced in Europe viable?

Bruce. Yes. For instance, a Douglas-fir stand, from an unknown seed source, in Scotland is a favorite source of seed.

Audience. Are Europeans primarily concerned with Douglas-fir for pulp or are they interested in sawtimber?

Bruce. Mostly construction lumber, I imagine. The Europeans are growing Douglas-fir to large sizes, which is not necessary to produce pulpwood. For instance, in Scandinavia in some areas the average tree cut is about 15 inches and 100 years old. They are not trying to grow more pulpwood in those areas. I would say that generally they are growing Douglas-fir for sawtimber production, with some thinnings for pulpwood.

Audience. Are thinnings at 2-year intervals profitable?

Bruce. I don't believe that the small volumes removed in European thinning would be profitable under our circumstances, even in the Southeast. We tend to cut more heavily. In areas with easy access, however, it is amazing how light the cut will be.

Audience. Do European foresters prune trees?

Bruce. I have seen some mention of it. Usually, in plantations the dead limbs are knocked off. I don't know whether green pruning is done.

Audience. In a forest in east-central Germany the managers were pruning to 17 feet, in two stages.

Bruce. In pine, the lower one-third of the crown can be removed without much effect on growth and with considerable improvement in quality. The knotty core can be limited to 3½ or 4 inches by stage pruning.

Audience. Has damage by logging been a deterrent factor to frequent and light thinnings?

Bruce. I don't think so. In stands with a large number of trees, the material removed is small, so damage is light. After repeated thinnings, the stand is opened up with few trees, so that even if material removed is large the damage is light.

Audience. I presume that most of the plantations are on gentle ground. Is that right?

Bruce. No. The mountains in southern France and northern Italy are up to 5,000 feet. Generally, in England and the northern part of Europe, the slopes are gentle.
THE ROLE OF ALDER IN IMPROVING SOIL FERTILITY
AND GROWTH OF ASSOCIATED TREES

R. F. Tarrant
U.S. Department of Agriculture
Pacific Northwest Forest and Range Experiment Station
Forest Service
Corvallis, Oregon

ONE OF THE EARLIEST systematic observations of the alder nodule as a site of atmospheric nitrogen fixation was published by Meyen (39). The potentially great significance of *Alnus* as a widely occurring, non-leguminous, nitrogen-fixing organism led a surprisingly great number of nineteenth century scientists to investigate the nature of the symbiosis (63).

Hiltner (23) noted that *A. glutinosa* grew abundantly in sterile, nitrogen-free soil inoculated with alder root material, but plants in uninoculated soil remained small and nitrogen deficient. He further elucidated the biology and physiology of the alder nodule as a center of free N-fixation (24, 25) as did Nobbe and Hiltner (42). By the beginning of the twentieth century, the research of early scientists had authenticated inclusion of alder in a list of “nitrogen-gathering plants” published in the U.S. Department of Agriculture Yearbook (29).

The greatest advances in knowledge of the major role of *Alnus* in N-fixation were made, of course, during the twentieth century. A voluminous literature is available on the biochemical and microbiological aspects of N-fixation by *Alnus* and on the silvics of the various species of the genus.

This discussion is oriented toward exploitation of red alder (*Alnus rubra*) for environmental improvement, so we will not trace in detail recent research developments concerning the mechanisms of N-fixation. Summaries of the important works of Bond and his associates, and those of Quispel, Roberg, and Virtanen, to mention but a few, are to be found in Uemura (63), Schaede (49), and Tarrant (57).

The importance of alder in maintaining a healthy ecosystem is firmly established after more than 140 years of recorded research. *Alnus* belongs to a group of eight genera of angiosperms that symbiotically fix atmospheric nitrogen. Bond (4) sums up the importance of these plants: “Here we have a group of plants which show every sign of extreme antiquity and which are still of widespread occurrence . . . where agriculture has not modified the original flora . . . . These plants must be
recognized as important sources of fixed nitrogen, along with the legumes, for plants in general. In some temperate regions... nonlegumes such as *Alnus* may well be the main, original sources of symbiotic nitrogen in the post-glacial era. The effect of agriculture has been to substitute legumes for them... In view of the lack of recognition given to these plants in the past, we have in them virtually a newly found group of nitrogen-fixing plants... of ecological... significance.”

Bond noted further that, despite indications in early literature, alder might be to forestry as legumes are to agriculture; up to 1958, little interest had been shown in exploiting the beneficial effects of alder in forestry. In this paper, I summarize the considerable evidence now available on the effect of *Alnus* on forest soil properties and on increased vigor and growth of vegetation associated with alder. Examples of the growing number of instances of worldwide employment of alder in improving the forest environment also will be cited. My purpose is to establish that increased exploitation of alder by forest managers deserves immediate attention, especially in response to widespread current concern for quality of the forest ecosystem.

**ALDER IMPROVES SOIL FERTILITY**

Atmospheric nitrogen is fixed symbiotically in root nodules of *Alnus*. New nitrogen, thus introduced into the ecosystem, reaches the soil through several different pathways.

Alder litter has almost three times the nitrogen content of Douglas-fir litter (Table 1). Decomposition of alder litter adds substantial amounts of nitrogen to the soil (Table 2). Mikola (40) concluded that the contribution of nitrogen from alder leaf litter is probably more important than that from sources within the soil. Stewart (54) found a steady transfer from the nodule to the alder plant of about 90 percent of the nitrogen fixed during the first growing season. Daly (11) found that annual nitrogen accumulation in soil beneath *A. rugosa* was largely nitrogen from litter.

Another major route of symbiotically fixed nitrogen from plant to soil is through direct excretion from living roots or nodules. Virtanen (67) showed that a considerable amount of nitrogen was supplied to soil directly through excretion from roots or nodules. Uemura (64) also commented on the apparent importance of this source of nitrogen to soil. Zavitkovski and Newton (75) estimated that about 60 percent of the nitrogen added to soil beneath a stand of *A. rubra* came from root excretions or free-living microorganisms. Tarrant et al. (60) found that the
Table 1. Nitrogen Concentration in Litterfall: Red Alder Compared with Douglas-Fir.

<table>
<thead>
<tr>
<th>Red alder</th>
<th>Douglas-fir</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>2.50</td>
<td>0.98</td>
<td>46</td>
</tr>
<tr>
<td>2.36</td>
<td>.85</td>
<td>58</td>
</tr>
<tr>
<td>2.17</td>
<td>.79</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 2. Weight of Annual Litterfall of Red Alder and of Nitrogen Therein.

<table>
<thead>
<tr>
<th>Litterfall</th>
<th>Nitrogen</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lb/acre</td>
<td>Lb/acre</td>
<td></td>
</tr>
<tr>
<td>COAST RANGE, OREGON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,490</td>
<td>100.3</td>
<td>60</td>
</tr>
<tr>
<td>4,895</td>
<td>97.9</td>
<td>75</td>
</tr>
<tr>
<td>CASCADE RANGE, WASHINGTON</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,172</td>
<td>27.6</td>
<td>58</td>
</tr>
<tr>
<td>1,593</td>
<td>21.1</td>
<td>46</td>
</tr>
</tbody>
</table>

Average annual accretion of nitrogen to soil beneath *A. rubra* was substantially greater than could be accounted for in annual accumulation of litter and enriched throughfall during late years in a 40-year-old stand.

Decomposition of dead roots and nodule tissue is possibly another great source of nitrogen to soil. Zavitkovski and Newton (75) estimated that nodule weight could be more than 200 pounds per acre in a coastal Oregon stand of *A. rubra*. Analyses of root nodules indicate these organisms are indeed high in nitrogen.

Free-living, nitrogen-fixing microorganisms may be an additional source of nitrogen to soil beneath alder. Tarrant (56) noted that bacterial
populations were appreciably higher in soil beneath an alder-conifer forest than beneath pure conifer. Bollen and Lu (3) showed that transformation of nitrogen in organic matter of soil was much more rapid beneath alder than conifer in a highly acid forest soil in coastal Oregon. Evidently, strains of nitrifying bacteria that are effective at low pH are present in alder forests. Zavitkovski and Newton (75) estimated that as much as one-third of the total nitrogen accretion to soil observed in a greenhouse study with alder could be attributed to nitrogen-fixing microorganisms.

A small amount of nitrogen is moved to the soil by precipitation, which either washes through the tree canopy or flows down the tree stem. Such precipitation in a stand of A. rubra contained substantially more nitrogen than that in an adjacent conifer stand (46, 59). Although nitrogen concentration was greater in precipitation that flowed down the tree stem than in precipitation that washed through the tree canopy, the contribution of nutrient ions in stemflow was small compared with that in throughfall because of differences in volume. Leaf washing by precipitation is one source of conveyance of nitrogen to soil, but the net effect appears to be minor compared with that of other mechanisms.

Recorded estimates of annual nitrogen accretion in soil beneath alder vary widely because of differences in species, climate, and other environmental conditions and also because of differences in experimental techniques used by various investigators. According to several studies, however, enhancement of soil nitrogen by red alder (Table 3) averages about 150 pounds per acre per year.

<table>
<thead>
<tr>
<th>Period of accretion</th>
<th>Total soil depth</th>
<th>Soil nitrogen accretion</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>Inches</td>
<td>Lb/acre</td>
<td></td>
</tr>
<tr>
<td>2-14</td>
<td>12</td>
<td>267</td>
<td>75</td>
</tr>
<tr>
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<td>186</td>
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<td>7</td>
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<td>75</td>
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<tr>
<td>1</td>
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<td>89</td>
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<td>40</td>
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</tr>
<tr>
<td>26</td>
<td>24</td>
<td>36</td>
<td>58¹</td>
</tr>
</tbody>
</table>

¹Douglas-fir plantation interplanted with red alder at age 4 years.
Under current practices of forest fertilization in the Pacific Northwest, about 200 pounds of nitrogen per acre is applied at 5-year intervals. An alder forest adds a conservatively estimated 700 pounds of nitrogen per acre over 5 years. Cost of the chemical fertilizer application is about $25 per acre. At this rate, the nitrogen added by alder may be valued at nearly $90 per acre over a 5-year period.

The amount of nitrogen added by alder also generally exceeds amounts contributed by legumes (5, 15, 17). Ample precedent exists for using alder in forestry as legumes are used to improve soil in agriculture. At least eight species of *Alnus* have been employed successfully in many parts of the world to remedy unfavorable soil conditions (Table 4).

Although alder is not a cure-all for pedologic ills, it has been used as an ameliorating agent for a wide range of unfavorable soil conditions. Problem soils at both low and high elevations, poorly drained and excessively drained soils, and soils that are stable to the extent of having developed a raw humus layer compared with those represented by freshly deposited landslide materials are all included. One deficiency, however, is common to all examples—available nitrogen and incorporated organic matter are both low.

A typical example of the introduction of alder for soil improvement is seen in New Zealand (41). There, *A. viridis* was planted in rocky soils at high altitudes. The ability of this pioneering species of alder to improve soil fertility is thus being exploited to modify soil conditions so that *Pinus* spp. eventually can be grown, as has been done successfully under similar environmental conditions in Europe, Japan, and Korea.

Physical properties of soil also may be improved by growing alder. Tarrant and Miller (61) found greater organic matter in the soil beneath a plantation with mixed red alder and Douglas-fir than in a pure Douglas-fir stand, and bulk density in the soil was lower beneath the mixed stand. Crocker and Major (8) and Ugolini (65) also found that bulk density is reduced under alder stands. These findings have important implications hydrologically. Increased soil porosity associated with soil low in bulk density provides improved infiltration of water and better control of soil moisture both for tree growth and for water supply in the dry season.

**ALDER BENEFITS ASSOCIATED TREES AND OTHER VEGETATION**

Forest trees of several genera have been improved in productivity through association with alder (Table 5). The list, including both conifers and hardwoods, is sufficiently broad to indicate that the growth-improving
Table 4. Some Documented Examples of Soil Improvement by Alder.

<table>
<thead>
<tr>
<th>Soil problem</th>
<th>Country</th>
<th>Alnus species used</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>Japan</td>
<td>tinctoria, multinervia</td>
<td>13, 64</td>
</tr>
<tr>
<td>Erosion</td>
<td>Korea</td>
<td>hirsuta</td>
<td>50</td>
</tr>
<tr>
<td>Erosion</td>
<td>Roumania</td>
<td>incana, viridis</td>
<td>62</td>
</tr>
<tr>
<td>Mining spoils</td>
<td>Denmark</td>
<td>incana, glutinosa</td>
<td>53, 55</td>
</tr>
<tr>
<td>Mining spoils</td>
<td>Germany</td>
<td>incana, glutinosa</td>
<td>22, 31, 55</td>
</tr>
<tr>
<td>Mining spoils</td>
<td>Great Britain</td>
<td>glutinosa</td>
<td>73</td>
</tr>
<tr>
<td>Mining spoils</td>
<td>Holland</td>
<td>incana, glutinosa</td>
<td>2, 55</td>
</tr>
<tr>
<td>Mining spoils</td>
<td>United States</td>
<td>incana, glutinosa</td>
<td>9, 34</td>
</tr>
<tr>
<td>Exhausted farmland</td>
<td>Formosa</td>
<td>formosana</td>
<td>71</td>
</tr>
<tr>
<td>Exhausted farmland</td>
<td>Denmark</td>
<td>glutinosa</td>
<td>27</td>
</tr>
<tr>
<td>Exhausted farmland</td>
<td>Germany</td>
<td>incana</td>
<td>69</td>
</tr>
<tr>
<td>Degraded forest land</td>
<td>Germany</td>
<td>glutinosa</td>
<td>26</td>
</tr>
<tr>
<td>Degraded forest land</td>
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<td>Degraded forest land</td>
<td>United States</td>
<td>rubra</td>
<td>56</td>
</tr>
<tr>
<td>Raw glacial till</td>
<td>United States</td>
<td>crispa</td>
<td>8</td>
</tr>
<tr>
<td>Mass soil movement</td>
<td>Germany</td>
<td>incana, glutinosa</td>
<td>68</td>
</tr>
<tr>
<td>Rocky soil, high altitude</td>
<td>New Zealand</td>
<td>viridis</td>
<td>41</td>
</tr>
<tr>
<td>Peatlands</td>
<td>Ireland</td>
<td>glutinosa</td>
<td>37</td>
</tr>
<tr>
<td>Sandy soil</td>
<td>Czechoslovakia</td>
<td>glutinosa</td>
<td>45</td>
</tr>
<tr>
<td>Sandy soil</td>
<td>Russia</td>
<td>glutinosa</td>
<td>28</td>
</tr>
<tr>
<td>Raw humus with iron pan</td>
<td>Germany</td>
<td>incana, glutinosa</td>
<td>48</td>
</tr>
<tr>
<td>Compacted subsoil</td>
<td>Czechoslovakia</td>
<td>glutinosa</td>
<td>35</td>
</tr>
<tr>
<td>High water table</td>
<td>Poland</td>
<td>incana, glutinosa</td>
<td>32</td>
</tr>
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</table>
Table 5. Some Documented Examples of Improved Growth of Vegetation Associated with Alder.

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOREST TREE</strong></td>
<td></td>
</tr>
<tr>
<td><em>Fraxinus</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Liquidambar</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Liriodendron</em></td>
<td>10</td>
</tr>
<tr>
<td><em>Picea</em></td>
<td>21, 67</td>
</tr>
<tr>
<td><em>Pinus</em></td>
<td>10, 30, 40, 44, 64, 72</td>
</tr>
<tr>
<td><em>Populus</em></td>
<td>7, 19, 33, 38, 47, 55, 66</td>
</tr>
<tr>
<td><em>Pseudotsuga</em></td>
<td>20, 56</td>
</tr>
<tr>
<td><em>Robinia</em></td>
<td>18</td>
</tr>
<tr>
<td><strong>CULTIVATED TREE</strong></td>
<td></td>
</tr>
<tr>
<td><em>Malus</em> (apple)</td>
<td>12</td>
</tr>
<tr>
<td><strong>FOREST UNDERSTORY</strong></td>
<td>16, 43, 51</td>
</tr>
<tr>
<td><strong>AGRICULTURAL CROPS</strong></td>
<td>71</td>
</tr>
</tbody>
</table>

effect of alder as a soil-improving rotation or as an admixture with other tree species is worthy of wider application.

Most findings concern increases in height or diameter growth of trees. Tarrant (56) found, in addition to increased height growth of Douglas-fir interplanted with red alder, that the form of the tree was improved—that is, a more nearly cylindrical bole was produced on dominant conifers. A broader, more vigorous upper crown also was seen in the conifer component of the mixed stand.

Ovington (43) noted that the nitrophilous plant *Urtica dioica* was especially prevalent under stands of *A. incana* in England. Here, the total dry weight of ground flora beneath the alder was substantially greater than that beneath *Betula* or *Larix*. Smirnova and Sorogovets (51) found a greater abundance of herbs in stands of *A. incana* than in those of aspen or birch and suggested encouragement of alder for improvement of herbage quality. Franklin and Pechanec (16) found that understory vegetation was much better developed under *A. rubra* forest cover than beneath conifers of coastal Oregon.

Delver and Post (12) made the interesting observation that an alder hedge adjacent to an apple orchard improved nitrogen content of apple tree foliage, increased fruit yield by 37 percent, and caused better growth of woody portions of the trees.
Typical of many systematic observations of the growth-promoting effect of alder on associated vegetation is that of Heilman (21). He found in Alaska that black spruce (Picea mariana) that grew with alder was more vigorous and had darker green foliage than spruce that grew on sphagnum moss sites. Only the spruce associated with alder had a nitrogen content in the foliage that exceeded the critical level of 1 percent.

Several undocumented reports of similar instances of growth-promoting effects of various Alnus species on associated plants have come to our attention. Again, we see the parallel between legumes to maintain agricultural production and alder for forest production.

**EXPLOITING ALDER IN FOREST MANAGEMENT**

Worldwide experience with Alnus species indicated that alder contributes significantly to the supply of nitrogen in the ecosystem. This attribute creates a significant, beneficial impact on soil fertility and, in turn, on vegetation associated with or succeeding alder.

Most alder species are shrubby in form and size, but red alder of the Pacific Northwest is a rapidly growing tree that can outproduce Douglas-fir at ages up to about 30 years (1, 52, 56, 70, 74). On good sites, red alder may be 40 feet tall or more at the end of 10 years. Smith (52) reports a red alder 32 feet tall and of 6.4-inch dbh at age 5 years from seed. He also predicts growth of as much as 40 square feet of basal area per acre in 1 year under high stand densities. These reports of high growth rates are, of course, for unmanaged, unimproved trees.

Alder wood is similar in properties to that of yellow-poplar (Liriodendron tulipifera) or ponderosa pine (Pinus ponderosa). Alder is highly regarded as a pulp species and competes successfully with eastern hardwoods in West Coast furniture plants. Because of its properties for good machining, gluing, and painting and its ability to maintain form under changing moisture conditions, alder is well suited for the manufacture of novelties and small miscellaneous wood products.

Current research eventually may demonstrate an ecological role of alder that could outweigh all other considerations of its value. Indications are that red alder has a role in controlling Poria weirii, a root disease that causes an annual loss of about 32 million cubic feet of Douglas-fir in coastal forests alone (6). James Trappe discusses this potentially significant development in these Proceedings.

Despite its sterling ecological and physical attributes, red alder often is regarded as a problem by forest managers whose only experience has been with unmanaged, unimproved trees—"weeds", according to the
Role of Alder in Improving Soil Fertility

economics-oriented, dictionary definition: “a tree or shrub of low economic value that tends to grow freely and, by its presence, to exclude or retard more valuable plants.” And I have no illusion that under present conditions a case can be made for economic supremacy of red alder over the large, old conifers upon which the forest industry of the Pacific Northwest is based.

But we are on a course of rapidly changing social attitudes toward natural resources. A large management agency for public forest land recently announced plans to reduce allowable cut sharply, on the basis of environmental concern. Another such organization, under fire from all sides as usual, reportedly is questioning the direction and quality of its overall management of forest land. Private timberland managers now advocate intensive “farming” of only those forest lands of highest productivity. Groups for conservation and wilderness preservation demand that a larger amount of the nation’s forest land be reserved from timber harvest. And the forest-land base shrinks constantly because of such developments as urban expansion, extensions of powerline rights-of-way, and huge water impoundments. A forest management system unlike what we now have or can envision probably will be necessary to meet resource needs of the doubled or tripled population predicted within a timespan of the current forest rotation.

Radical changes in forest management concepts will be required in developing systems that can be effective under ground rules of the new ball game. Professional foresters must take a hard look at preconceived ideas that have developed in a region geared largely to harvesting the bounty of several hundreds of years of wild coniferous forest growth.

Such radical or perhaps “advanced” thinking is being done elsewhere. Pulpwood rotations of 10, 5, or even 2 years are being considered in the southeastern United States (36). Here, sycamore planted at 4- by 4-foot spacing annually yields more than 10 tons of green wood per acre. Harvesting, which may occur at intervals as short as 2 or 3 years, will be done mechanically. An estimated 350 to 400 tons of green wood could be harvested over a 30-year period (the usual rotation for pine pulpwood) by cutting and replanting sycamore at 5-year intervals. Growth potential of sycamore in this instance is much the same as that of red alder. No one can predict with any certainty future demand as to form of forest products. The rapidly increasing population and promise of great technological advances seem to argue for greatly increased demand for wood fiber at the expense of structural timber products as we now know them.

Several possibilities for exploitation of red alder in an enlightened forest management program are immediately evident. The enhancement of
nitrogen capital of the forest ecosystem may well be of first consideration under highly intensified forest management. With the example of legumes to maintain soil for agricultural productivity, we may employ a crop rotation system. Short rotations of small trees high in total cubic volume per acre would offer additional benefits of mechanical harvesting, short-term investments and taxes, reduction of labor costs, and restoring to productive use many thousands of acres such as those now lost to powerline rights-of-way.

Another possibility for using red alder to improve the forest environment is creating mixed plantations of alder and other tree species. In the only known plantation of red alder and Douglas-fir, Tarrant (56) found that at age 27 years, alder and fir on an upland site were the same average diameter, and dominant Douglas-firs were significantly larger than those in an adjacent pure fir plantation. In addition, total volume of wood produced in the mixed plantation was more than twice that of the pure Douglas-fir plantation. This plantation was composed of alternating rows of fir and alder at 4- by 4-foot spacing.

On moist sites, red alder grows naturally as a fairly permanent and dominant component of the vegetative mass. On such sites, red alder is probably the best adapted tree species. Productivity of wood fiber on such sites, however, might be increased substantially through admixture of another tree species such as black cottonwood (Populus trichocarpa). The mixture of Alnus and Populus is well documented in the literature as compatible and productive (Table 5).

These are only a few examples of silvicultural systems that might be employed in a management situation radically different than now exists in the Pacific Northwest. We have little background of experience in red alder management, a factor that contributes strongly to our present lack of appreciation of the potential value of this species for producing wood fiber, maintaining and enhancing soil fertility, and offering other environmental benefits.

I especially urge the younger foresters to consider alder as a potentially valuable tree species. Let us take a fresh look at alder, not as an aggressive weed, as it often now occurs, but as a dark horse that may run strongly in a more mature forest economy.

We people in forestry are notoriously conservative in our outlook, and we could probably make the same accusation of early-day farmers who fought to control unwanted vegetation such as clover, alfalfa, and other aggressive nitrogen-fixing plants that occurred as "weeds" in their fields. Scientists had to elucidate the role of such plants in maintaining soil fertility and develop ways in which these legumes could be managed and harnessed for the benefit of man.
We already possess a sizable body of knowledge that concerns the beneficial effects of alder on the forest environment. We must increase our efforts to understand the nature of this potentially valuable tree species and develop ways to build a better forest environment with it, not only to achieve associated tree growth but perhaps also to achieve a more productive balance of species and ecological interactions.

LITERATURE CITED


QUESTIONS

Audience: I will ask a nasty question about the possibility of alder causing stream contamination.

Tarrant. Alder has been with us longer than most other plants in this region. We don’t see fish being killed or people dying from drinking water flowing through stands of alder. We have measured the nitrate increase from alder and it is in the nature of the increase we see after forest fertilization. You may be thinking of a paper I referred to in which the author measured the nitrate content of streams in New Hampshire in a watershed with a full cover of alder. The nitrate level was about twice the background level of nitrate from non-alder areas. But, I don’t think this can be referred to as pollution.
REGULATION OF SOIL ORGANISMS BY RED ALDER: 
A POTENTIAL BIOLOGICAL SYSTEM FOR 
CONTROL OF *Poria weirii*

James M. Trappe 
U.S. Department of Agriculture 
Forest Service 
Pacific Northwest Forest and Range Experiment Station 
Corvallis, Oregon

MOST WESTERN FORESTERS realize that *Poria weirii* (Murr.) Murr. is among the more destructive tree root pathogens of western North America, that it lethally attacks many species of native conifers, and that mortality occurs primarily in infection centers that may extend over many acres. Annual losses of timber volume from *Poria* have been estimated at 32 million cubic feet of just Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) in western Oregon and Washington alone (4). Most foresters do not fully realize, however, that *P. weirii* kills young growth as well (Figure 1).

Recently, I visited several seriously infected stands of young Douglas-fir in western Oregon. Plantations as young as 10 years already had suffered substantial mortality. Examination of roots of live but slightly yellow saplings revealed widely distributed infection, which poses the prospect of a continuing high rate of mortality. The Tillamook Burn appears to have large areas of this kind in plantations from 20 to 30 years old. In the Coast Range near Corvallis, many stumps of cut trees in a thinned, 35-year-old stand showed infection, even though few trees had shown obvious symptoms.

My guess is that once foresters learn to recognize *P. weirii* damage in young stands, they will find it is widespread and sometimes devastating. This outlook raises several questions. How and why does *P. weirii* become a killer in young stands? What will be the impact on intensive forest management? And what can be done to reduce losses?

*Poria weirii*—A “DISEASE OF THE SITE”

Trees, not sites, become diseased, but the phrase “disease of the site” helps us to visualize the endlessly continuing damage that root diseases such as *P. weirii* can inflict. Once established in a site, *Poria* can persist in infected roots or buried wood for dozens of years (3). Logging, burning, or other standard practices seem to have little effect on longevity
Figure 1. Young Abies trees killed by Poria weirii (light colored trees, large seedling at left and two saplings in center). Roots of the Douglas-fir stump in center were infected heavily with P. weirii.

of the fungus in the soil. When roots of a young tree grow down and come in contact with Poria that has survived in rotted roots, a new infection can start. The disease then works along the root system to the root collar of the tree, which dies either from decimation of roots or from girdling. Adjacent trees become infected when their roots touch the diseased roots
of infected trees (18). The persistence of *Poria* from one generation of trees to the next, coupled with the gradual expansion of the infected area, adds up to a grim prospect: damage generally can be expected to spread and intensify from rotation to rotation unless steps are taken to stop it.

**PROBLEMS IN CONTROL OF ROOT DISEASES IN FORESTS**

The technical literature is replete with recommendations for preventing new infections in stumps or wounded tree stems from spores of root pathogens such as *Fomes annosus* (Fr.) Cooke. Little has been published on how to control such diseases after they are established in forest soil. The problem is particularly difficult in north temperate to boreal forests, because the soil under the surface remains relatively cool throughout the year. The pathogens accordingly have a low metabolic rate and can persist for many years in buried wood without exhausting their food base.

The fact that root pathogens live underground compounds the difficulty of devising controls. The pathologist faces the frustrating challenge of pinpointing specific, subterranean sources of the fungus if he wants to study its biology in nature. He must deal with the most complex and variable of environments—a forest soil teeming with diverse, interacting organisms and replete with radically different microhabitats. Moreover, the chemical, physical, and microbiological characteristics of these microhabitats change in the course of the seasons and with changes in age and composition of the forest vegetation.

**CONTROL ALTERNATIVES FOR *Poria weirii***

The forest manager has the option of establishing trees resistant to *P. weirii* where it is severe. The trees most resistant to *Poria* however, are hardwoods, pines, and western redcedar (*Thuja plicata* Donn), species that are often poor alternatives for sites in the Douglas-fir region in terms of value or adaptability. Resistant strains of Douglas-fir and other susceptible species may exist and are being sought, but so far none has been found.

Mechanical removal of buried wood that contains *Poria* might be possible on some clearcuttings. The Canadian Department of Fisheries and Forestry is testing this approach in British Columbia, but results have not yet been evaluated. If effective and practicable, mechanical removal could be helpful on some sites that would be highly productive except for extensive infection centers. Presumably, however, mechanical treatment would not change the site characteristics that permitted *Poria* to flourish in the first place; reinfection of the site then remains a possibility.
Fertilization, especially with nitrogen, may help reduce the viability of buried *Poria*. Nitrogen might encourage growth of soil organisms that compete with, inhibit, or parasitize *Poria* itself (13, 15, 16). Other chemicals that reduce the viability of the fungus in soil also might be found, but none is known at present. Of course, widespread application of chemicals, even fertilizers, is currently under challenge, and the outlook for its continuation is uncertain. Whether such chemicals would alter site characteristics enough to reduce spread and reinfection over extended periods is unknown.

I want to emphasize the ecological desirability of long-term alteration of sites to the detriment of *P. weirii*. The most likely and quite possibly the most economical way of attaining this goal is by establishing perennial, nitrogen-fixing plants. With present knowledge about factors that reduce survival of *Poria* in soil (13, 16), the nitrogen-fixer ideal for this purpose should result in a high content of nitrate nitrogen in the soil. It should add other pathogen-inhibiting compounds to the soil. It should be resistant to infection by the pathogen to be controlled. It should be able to grow over a wide range of habitats. If it can produce a marketable product in addition, so much the better. Species of *Alnus*, especially red alder (*A. rubra* Bong.), appear to meet these criteria for the Douglas-fir region better than any others.

**RED ALDER AS A REGULATOR OF SOIL ORGANISMS**

**Direct Effects**

Red alder resists attack by *P. weirii* (18). The fungus, therefore, lacks a satisfactory, living food base in pure alder stands. Much of the buried *Poria* in clearcuttings likely would be starved out if a rotation of alder were grown for several decades. Alder mixed with susceptible conifers also might reduce damage, because *Poria* spreads primarily along root contacts. Root systems of the interspersed alders would reduce chances for root contact between healthy and infected conifers. We should note that alder is susceptible to *Armillaria mellea* (Fr.) Kummer, so would be unlikely to help in combating spread of that disease. Alder's susceptibility to *Fomes annosus* is not well established.

Red alder produces large amounts of *Poria*-inhibiting compounds such as phenolics and fatty acids (5, 8). Such compounds are probably important in its resistance to infection by *P. weirii*. Oxidation of the phenolics in air accounts for the reddish-brown color that develops in freshly cut alder wood. Some of these compounds occur in soil under alder (8, 9), leached from leaves or litter and possibly secreted by roots. Such
compounds undoubtedly contribute to the change in populations of soil organisms that occurs with colonization by alder and subsequent development of the stand.

Root surfaces of alder harbor quite different populations of bacteria than does Douglas-fir (11), a phenomenon dependent largely on the particular substances contained in or secreted by the roots. The bacteria that form nitrogen-fixing nodules with alder (Figures 2 and 3) are in the

Figure 2. Excavated, nodulated root system of young red alder (photograph courtesy of Dr. Harold Evans, Dept. of Bot. and Plant Path., Ore. State Univ.).
Figure 3. Nitrogen-fixing nodules on red alder root.

Order Actinomycetales (1), which includes such renowned antibiotic producers as *Streptomyces* spp. Most mycorrhizal fungi of alder seem to be different from those of conifers (12; Trappe, unpublished data), so that the presence of alder introduces these quite specialized fungi to the soil (Figures 4 and 5).

For control of root disease, the planting of alder, which resists *Poria* and adds substances to the soil that inhibit pathogens, obviously has potential value. Effects of alder on other soil organisms may not seem pertinent, but these effects may be equally or more significant than root secretions in reducing damage from root rot. Through such organisms, alder may exert indirect as well as direct control of pathogens.

**Indirect Effects**

The profound influence of alder on chemical properties of soil centers around its ability to fix nitrogen and its production of unusual amounts of phenolic compounds, fatty acids, amino acids, and other organic compounds. The chemical quality of the environment is as important to soil organisms as it is to us. In anthropomorphic terms, the
Biological Control of Poria weirii

Figure 4. Mycorrhizae of red alder mantled by a dark brown, symbiotic fungus.

Figure 5. Alpova cinnamomeus Dodge, a subterranean-fruiting mycorrhizal fungus associated with red alder.
soil provides its organisms with the breath and food of life. Toxic substances in this environment are infinitely more hazardous to soil organisms than pollution is to man, because the organisms cannot leave for fairer places.

As R. F. Tarrant has pointed out in these proceedings, a large increase of total nitrogen in the soil results from alder’s nitrogen-fixing nodules. The nitrogen increment is largely nitrate (2). Many soil organisms can utilize nitrate-nitrogen; others, including *Poria weirii*, cannot for lack of the requisite enzyme system (6, 7). The high nitrate under alder naturally works to the competitive advantage of those organisms that can use it. Alder’s production of phenolics and other organism-affecting compounds couples with the high nitrate levels to produce radical differences in populations of soil microorganisms between stands containing alder and pure conifer stands. The precise quality and quantity of these differences are difficult to assess. They vary with season and locality, but clearly they do exist (10, 17). Definitive, comparative studies are in progress by the U.S. Forest Service in cooperation with Oregon State University Department of Microbiology.

The important consideration for the forest manager is the net effect of alder-induced populations of soil organisms on root pathogens. In a current study by the Pacific Northwest Forest and Range Experiment Station, early data indicate that the numbers and proportions of organisms that inhibit growth of *P. weirii* are vastly greater in soils of alder-conifer mixtures than in soils of pure conifer stands (Figure 6). For example, samples from the mixture contained some 600,000 inhibitory *Streptomyces* per gram of soil, but those from the pure conifer stand had only about 175,000 (C. Y. Li and K. C. Lu, personal communication).

**FIELD EVIDENCE ON EFFECTS OF RED ALDER ON *Poria weirii***

An initial field experiment at the Cascade Head Experimental Forest of the Pacific Northwest Forest and Range Experiment Station indicated that *P. weirii* survived longer in wood cubes buried under a pure conifer stand than under pure alder or alder-conifer mix (14). Subsequent studies have not confirmed this first result, however, so more extensive experiments are being installed to resolve the conflict (E. E. Nelson, personal communication).

More positive indication has come recently from a comparison of six pairs of adjacent, equal-aged, pure Douglas-fir and alder-Douglas-fir stands in western Washington (J. M. Trappe and J. T. Wortendyke, unpublished
CONCLUSIONS

The direct and indirect effects of alder on *Poria weirii* discussed here are hypothetical; they are derived primarily from analysis of field samples and experiments in the laboratory. We have no data to confirm that these direct and indirect effects occur together in nature in the same way that they occur individually in laboratory experiments. Indeed, the complexity of the soil ecosystem in nature may well preclude isolation of the effects of any one factor from the other. We can, however, construct a theoretical, biological control model from the individual pieces of information. This must be done and be continually refined if we are to understand the processes involved in biological control. An understanding of the components of the system and how they interact can help enormously in the development of usable measures for biological control.

A tentative and incomplete model has evolved from the knowledge outlined in this paper. In summary, alder produces *Poria*-inhibiting
compounds that are added to the soil—compounds that could reduce the pathogen's longevity in buried inoculum. These compounds, together with the relatively high nitrate-nitrogen levels under alder, result in a selective increase in populations of organisms that actively compete with, inhibit, or parasitize _P. weirii_. As a _Poria_-resistant species, moreover, alder provides no satisfactory food base for maintenance of the pathogen's viability. The net hypothetical potential of these phenomena is a decrease in viable _Poria_ in the soil; if alder prevails on a site long enough, _Poria_ might well be eradicated from the site. How long this might take is unknown at present.

What are the implications to forest management in the Douglas-fir region if this model is confirmed by future research? I would not propose that foresters engage in wholesale spewing of alder seed on cutover land. Rather, let us think primarily of sites that have heavy incidence of _P. weirii_. Such sites offer poor chance of producing a well-stocked merchantable stand of Douglas-fir or other susceptible species. The best management alternative clearly is to restock with resistant species. If our hypotheses about alder are correct, and I think they are, a rotation of alder not only would produce a potentially marketable crop and improve soil fertility, but also might cleanse the site of _P. weirii_.

To go a step farther, sites with a scattering of _P. weirii_ pockets might be planted largely to Douglas-fir or a Douglas-fir-alder mix, with pure alder established in the _Poria_ pockets. Unfortunately, the silviculture of alder-conifer mixtures has yet to be developed for the Douglas-fir region—perhaps we should get at it!

A final postscript: _P. weirii_ can survive indefinitely and extend its area of occupancy through successive generations of conifers. Apparently, no widespread resistant strains of host species such as Douglas-fir have evolved, even though the pathogen and its host seem to have coexisted from long-past geological periods. Why, then, has not _P. weirii_ virtually wiped out its host species in habitats where it thrives? I would suggest one reason: until the advent of forest management, coniferous forests that were catastrophically destroyed generally were replaced by seral communities of brush and hardwoods. In the Douglas-fir region, red alder was often the dominant invader; at higher elevations and eastward or southward, the nitrogen-fixing genus _Ceanothus_ often predominated. The successional intervention of such species between destruction of and subsequent redomination by conifers may well have reduced periodically the carryover of buried _Poria_. Perhaps a deeper appreciation of the phenomena involved in natural succession can lead to solution of silvicultural problems that are aggravated by forest management practices.
LITERATURE CITED


QUESTIONS

Audience. How do you identify Poria?

Trappe. Many kinds of fungi grow around the base of trees, but typically, Poria on an infected tree can be found by scraping away the humus around the root collar and down among the root crotches and then
digging in the bark with a jack knife for small pockets of white mycelium. Look at the mycelium with a hand lens for little brown hairs—they may be very sparse, or they may be so abundant that they make the fungus look brown. If you find even a few little brown hairs associated with the white mycelium, it is a good indicator of Poria. Armillaria mellea differs from Poria. Often with Armillaria, resin exudes from the bark around the base of the tree. You may have white mycelium but no little brown hairs. If you chop into the base of the tree you often will find a heavy felt of mycelium in the inner bark; Poria never has this.

_Audience._ Will Ceanothus have the same effect as alder? I’m thinking of sites where alder will not grow.

_Trappe._ We don’t know. My guess would be yes, but I’ve not made even cursory observations on this. Good opportunities for observation occur in the Oregon Cascades, where Poria infects mountain hemlock and true fir.

_Audience._ Does Poria attack incense cedar?

_Trappe._ My guess is yes, but I’m not sure. It might be a butt rot similar to that in western redcedar.

_Audience._ Have any studies indicated the magnitude of Poria infestation in Douglas-fir in southwestern Oregon? For instance, in the Roseburg area?

_Trappe._ We have very little data on mortality. Estimates are very rough, because no systematic survey has been made. The managers of a particular tract of forest land probably would know better than anyone else. Even then, unless you know what to look for, it often goes unnoticed because its occurrence is spotty and does not affect entire stands. My guess is that it is common because a lot of Poria occurs in mountain hemlock and true fir in the higher Cascades—Diamond Lake and Windigo Pass, for instance.

_Audience._ Have you noticed an increase in Fomes annosus around alder?

_Trappe._ No. None of our studies has been in an area in which Fomes annosus was present. But that’s something we should investigate.

_Audience._ Dr. Charles Driver, forest pathologist at the University of Washington, made the comment the other day that Poria weirii is hard to distinguish from Fomes annosus in the field. Have you had any experience with this?

_Trappe._ To my knowledge, the sites that we have studied specifically have not had Fomes annosus, and I have not had occasion personally to make this kind of comparison. Fomes does not produce brown setal hyphae, but often they’re not conspicuous on Poria weirii either.

_Audience._ Does Fomes separate into rings as Poria does?
Trappe. No. *Fomes annosus* is more of a pocket rot.

Audience. Can *Poria* be identified by examining the roots?

Trappe. Yes. The common name is laminated root rot because well-rotted wood separates along annual rings. The rotted rings can be pulled apart like so many leaves of paper. But this is at a very advanced stage, and at the younger stages this lamination effect is not obvious. On young trees, cut stumps for example, *Poria* will show initially as a crescent-shaped, brown stain on the stump, and then with more advanced infections the crescent shape may consume half or most of the stem. This brown crescent shape follows the annual rings initially so that this is a good indicator. I don’t remember whether *Fomes* does that or not; I haven’t looked at enough *Fomes* to be sure.

Forest Pest Leaflet No. 48 (3) describes *Poria*, its symptoms, and what it does.

Audience. Does Europe have the entomological and pathological problems that we have?

Bruce. We certainly didn’t invent the root rot problem in this country. Plenty of *Fomes annosus* occurs in European countries.

Trappe. *Poria* is confined to western United States and Japan. It may be in Siberia and parts of China.

Audience. You said you didn’t find *Poria* where an alder was nearby. What did you mean by nearby? Is this 10 feet or 100 feet?

Trappe. We can’t say at present. In our survey, we found no *Poria* where Douglas-fir were separated by alder. Now, I don’t mean to say that without this separation we always found *Poria*, because many, many Douglas-firs in pure stands didn’t have *Poria*. But only in stands of pure Douglas-fir did we find *Poria*.

Audience. Could *Poria* be controlled with commercial fertilizers?

Trappe. Dr. Earl Nelson at the Forestry Sciences Laboratory has experiments on that now. The first field experiment produced no significant difference between any of the nitrogen fertilizer treatments and the control in the field. But when the nitrogen was incorporated into soil at the same rate as fertilizer broadcast in the field and *Poria*-infected wood was incubated in this soil in boxes in the laboratory, the differences were significant. In other words, the more nitrogen, and particularly the more nitrate, the shorter the time the *Poria* survived.

Audience. What was the rate of application in the field?

Trappe. It was 150, 300, and 600 pounds of nitrogen per acre.

Audience. How much free nitrogen is in an alder stand?

Tarrant. In the Coast Range, we’ve measured up to 16,000 pounds per acre; Cascades, about 3,000 to 4,000 pounds per acre.
Audience. In the laboratory tests, what rate of fertilization was used?

Trappe. Six hundred pounds per acre foot.

Audience. In addition to whatever nitrogen was in the soil?

Trappe. Yes, the soil was collected from the field fertilization site. Nelson now has an experiment on a combination of wood chips and nitrogen. Wood chips with a high nitrogen content are a good medium to grow inhibitory organisms in the laboratory. He thought that, because we’re concerned with residues in the woods, chipping and fertilizing might be worthwhile if they would increase the number of Poria-inhibiting organisms. He’s doing this both by surface application and by incorporating the fertilized chips around Poria-containing wood. If chips and fertilizer must be incorporated into the soil to have an effect on Poria, then this mechanical problem would need to be worked out.

Audience. How much free nitrogen is in an average Douglas-fir stand?

Tarrant. You mean available to the plant?

Audience. Available to the plant.

Tarrant. I don’t know. I don’t think anybody does.

Trappe. If it’s put there by alder, it’s all free. If you fertilize, it’s $25.00 an acre.

Berg. About 2 months ago, Dr. Driver and Dr. Gordon Wallis from British Columbia expressed a concern that thinning was spreading both Poria weirii and Fomes annosus in the stands. Both of them recommended that we use borax on all cut stumps in thinning. They have found spores generally in the forest—also infected stumps. Have you had any experience with this, Jim?

Trappe. No. We’re talking about two different breeds of cats when we talk about Fomes annosus and Poria weirii. Fomes produces a tremendously heavy spore cast and, when it’s fruiting, the spores are all over, flipping through the air, seeking out a freshly cut stump to light upon. Now, if a spore lights upon a freshly cut stump and the conditions are right for germination, the mycelium grows into the wood. If other organisms light on the stump first and colonize it, Fomes, because it is a very poor competitor, is crowded out.

We really don’t know, at this point, how Poria spreads. Poria does not produce the heavy spore cast over a good part of the year that Fomes does. Poria fruiting bodies are brown crusts that form in root crotches or the underside of Poria-infected logs. If the weather is a bit too wet, the fruiting bodies develop mold on the surface and the spores can’t get out. If conditions are a bit too dry, the fruiting bodies will produce no spores at
all. As the fruiting bodies are annual, the prevention of spore production ends it for that year. But it does produce spores—and I would think if one were going to go around producing spores, that one should have a purpose for doing so, and presumably that purpose would be to increase the population of *Poria*.

*Fomes* spores are very hardy and long-lived and they can be blown apparently for miles, even in rather dry winds, and retain viability.

We have trouble keeping *Poria* spores alive for more than 30 days under what we believe to be ideal conditions of temperature and humidity in the laboratory. Dr. Nelson has a study on infecting stumps with spores, but he has had difficulty getting enough spores from fruiting bodies to attempt to infect stumps. Several years ago, he got very good spore cast from *Poria* fruiting bodies, but then the woods were closed because of fire danger and he couldn’t get out and cut trees for about 45 days. By the time he could go back to cut his selected trees, he had zero viability of the spores that were stored in the lab.

*Audience.* This possibly is why *Poria weirii* hasn’t gobbled up the whole Pacific Northwest.

*Trappe.* Possibly. I might mention that some cursory observations have suggested to us that certain habitats as defined by vegetation (the habitat-typing system) seem to be completely free of *Poria* and other adjacent habitats are riddled with it. This may be a difference of soil or something else. Some habitats are highly susceptible, highly favorable for *Poria* and others are not. What these differences are, we don’t know.

*Audience.* Is *Poria* still considered a species with different genotypes that will not intermingle?

*Trappe.* Yes, at least this is one way that Dr. Childs has used to determine whether two nearby but not contiguous *Poria* centers were formed by the same original colony. When you grow them in culture, one on one side of the petri plate and the other on the other side, they intermingle and the hyphae fuse if they are the same genotype. If, as often happens, they grow towards each other and then stop—some of these will actually grow back upon themselves rather than grow toward each other—they are two different genotypes.

If Childs had *Poria* pockets separated by some distance, he used this method to determine whether or not they were actually two different centers of infection started by spores of two different genotypes. If they grew together in the culture plate, he interpreted this to mean that he had found an originally large center of infection in the middle of which the *Poria* had died.
Audience. Has anyone identified the antibiotic, or whatever it is that keeps the two colonies from fusing?

Trappe. It would be most interesting and useful to know what it is, but the identification calls for biochemical expertise not now available in our disease research projects.

Audience. How would you treat an area that you know is infected with *Poria weirii*? It is old-growth Douglas-fir in the Cascades in an area that will not grow alder but will grow pine, Douglas-fir, and *Ceanothus*. What would you do?

Trappe. If I could, I would grow pine, because the pines seem by far the most resistant members of the family Pinaceae.

Audience. Would you attempt to grow mixed pine and fir?

Trappe. It would depend on how bad the incidence of *Poria* was. If it was my land, I think I would grow a good merchantable pine species that was resistant to *Poria weirii* and forget the susceptible Douglas-fir for at least a rotation. Of course, alder will grow in surprising places. Bob Tarrant mentioned the only plantation of alder and Douglas-fir that I know of. This is on a site that is not an alder site, and yet the alder has grown rather decently there. At higher elevations we might think of different types of management, perhaps *Ceanothus*. We hope to find out more about that. Three species of alder grow at high elevation, *Alnus rhombifolia*, *A. tenuifolia*, and *A. sinuata*. These are just shrubs, as a rule, but you might think of using a shrub alder just for its effect on the soil and the *Poria*. Here again, we have management problems of how to do this. If the alder is established first, will it suppress the conifers? These things, of course, can be worked out.

Audience. Is grand fir susceptible?

Trappe. Yes, all the species of *Abies* are, apparently as much or more so than Douglas-fir.

Audience. Have you been able to determine how long *Poria* persists in the field condition, say in the Coast Range?

Trappe. I don’t know that anyone has specifically studied the Coast Range. Child’s data, mostly from the Cascades, points out that, without question, *Poria* can survive for at least 50 years in some of the areas he has studied. He says he would guess 100 years. In the Coast Range along the coastal fog belt in the spruce-hemlock area, very little *Poria* occurs. Whether it is the soil, the climate, or something else, we don’t know. Above the fog belt in the Coast Range, *Poria* is prevalent.
AS A REPRESENTATIVE of the hardwood industry, I appreciate the invitation to come before this group of professional people this morning, to discuss with you the hardwood industry in the Pacific Northwest and red alder, the dominant Northwest hardwood species, in particular.

We are all familiar with the undesirable characteristics of this tree that have undeservedly placed it in the “weed tree” category, and we have been slow to fully appreciate it as a respected member of the Northwest forest community, not only for the quality of the lumber it produces, but also for the contribution it can make to the management of the Douglas-fir forest.

I refer specifically to its potential as a nurse tree for the Douglas-fir. We have all seen this occur naturally. Can we, as forest land managers, develop and improve this idea as a management technique? It is worthy of further serious study!

Red alder with its nitrogen-fixing capability cannot be overlooked as a constant natural source of nitrogen for our forest land. What makes our forest land in the Coast Range one of the most productive areas in the country? Not only the abundant rainfall. What part does red alder play?

Current work in this and other areas by our forest scientists is providing us with a fresh approach to some old problems. It is certainly worthy of your close attention because of the potential value to you in your Douglas-fir management programs.

The environmentalists are telling us, “Stop trying to conquer nature, but rather live with it!” Haven’t we been trying to conquer red alder?

The hardwood industry differs widely from the softwood industry, basically because the products are different. Furniture is the primary product of the hardwood industry, as compared to the structural products of the softwood industry. The hardwood lumber market rests upon a narrow base compared to the much wider use and distribution of softwoods.

The manufacture of Douglas-fir and other softwoods, which begins in the forest and extends through the production and marketing chain to the ultimate consumers, lends itself to volume production, automation, and, consequently, lower production costs. Production costs of hardwood at every comparable point in the production chain are substantially
greater. Costs that double and triple softwood production costs are not unusual.

For example, 90 percent of our annual production is in 4/4 lumber, and we employ 11 men to produce an average of about 30 M fbm (thousand feet, board measure) per 8-hour shift. With the same equipment and probably fewer men, we could produce a minimum of from 65 to 70 M fbm or more of softwood dimension lumber.

In softwood lumber production, we would realize a substantial scale overrun in the conversion of logs to lumber. In hardwoods, we break even because our customers demand the full thickness of a board. The rough-green thickness of the 1-inch board is 1 3/16 inches plus a 5/16-inch saw kerf, or 1 ½ inches total wood per line. All logs must be sawed to produce the maximum grade recovery. To do otherwise would increase the percentage of low-grade lumber that is present in every hardwood log and, of course, would result in a critical lowering of the lumber sales average.

The industry often is criticized for maintaining a 10-inch minimum diameter for sawlogs, and the pressure is always to reduce the minimum diameter. The reason for the 10-inch minimum diameter under today's operating conditions is valid. For example, an alder log, 8 feet long and 9 inches in diameter, in a normal rundown will produce a 2- or 2½-inch, boxed-heart, grade-3 back stand, which will account for a minimum of 45 percent of the volume of the piece. The effect is an increased recovery of low-grade lumber and increased production cost.

Past history of the hardwood industry here in the Northwest was one of instability, poorly manufactured products, and a widely fluctuating market that was caused by an extremely limited marketing area.

In the mid-1950's, a number of responsible people recognized the problems and were determined to upgrade the industry. The Northwest Hardwood Association was formed, and through the efforts of the Association and its Lumber Rules Committee, a Red Alder Lumber Grading Rule was written and soon afterward was adopted by the National Hardwood Association. Since that time, the rule has been the basis upon which virtually all alder lumber is sold.

With the adoption of the standard lumber grading rule, new marketing areas were opened. And as more manufacturers become familiar with the species, its markets continue to broaden.

Today, the distribution of red alder lumber is nationwide. It is marketed in eastern and southern areas such as High Point, North Carolina; Miami, Florida; Racine, Wisconsin; Ontario, Canada; the Pacific Coast, and, of course, here in the Northwest.

A report on the hardwood industry in Oregon (2) estimated that 21 hardwood mills in western Oregon provided employment for about 600
men, with an estimated annual payroll of $3,500,000. These mills had an estimated installed annual capacity of 75 million fbm. The report computes total employment, logging through lumber shipping, at 2 man-days per M fbm.

An earlier report on furniture manufacturing in Portland estimated the annual payroll in the industry at $7.5 million, with about 14 million feet of hardwood lumber, primarily alder. At that time, one of the large factories employed 650 men and women and consumed about 9 million fbm of alder and maple annually. Six hundred and fifty jobs–9 million board feet of lumber. Here, red alder undeniably asserts its importance to the economy.

I am always impressed by the number of people employed in the alder furniture manufacturing industry. We recently visited a few manufacturing plants in the Los Angeles and San Diego areas. The total employment in these areas numbers in the thousands. These are jobs in the unskilled and semiskilled categories that are becoming increasingly difficult to provide. The social implications are obvious and are seldom seen by the forester, but are no less important to the economy.

Nationwide, hardwood lumber is in decreasing supply, and our nation is increasing its hardwood lumber imports to meet the needs of the furniture industry. Our company competes with hardwood imports in several marketing areas, notably in the Los Angeles area.

As you people convert your alder stands to Douglas-fir production, the supply of hardwood timber in the Northwest also will decrease. This trend has caused manufacturers to turn to other products. The use of a flake board with a veneer overlay is increasing. Plastics are making substantial inroads into areas that previously were held by wood.

The future outlook for alder lumber in the furniture industry is bright. It is as versatile in manufacturing as it is in the forest. Because of its many desirable characteristics, the demand for it should increase. An aggressive national sales promotion campaign would be of great benefit. All that is lacking is the capital to finance such a campaign.

Red alder's use as a pulping species still is in the future. As the Douglas-fir mill wastes are absorbed by the pulp industry, the demand for alder as a pulping species should increase. Here again, its versatility is evident. The comparative simplicity of acquiring regeneration, coupled with the characteristic rapid growth in its first 30 years, are plus factors that the land manager should keep in mind when planning future programs.

I have communicated with Dr. J. L. Keays, senior scientist with the Forest Products Laboratory, Canadian Forestry Service, Vancouver, B.C., about a report he will complete later this year. I recently received a
preliminary copy of the report titled "Wood Supply and Wood Products Demand to the Year 2000." The report is a review of the world demand for wood products and the potential wood supply over the next 30 years. The main emphasis is on wood fiber products, because by 2000 they will make up over 70 percent of the value of forest products. Fiber products include pulp, paperboard, composition board, and fiber board.

Dr. Keays predicts a shortage of 100 million cubic meters of wood available for wood fiber products by the year 2000. To give some idea of what this means, Canada’s present total cut is about 100 million cubic meters. I recommend this report to you for serious study.

Many owners of large timber holdings in the Northwest are members of the Hardwood Association. Through the years, I have enjoyed numerous informal discussions about alder with men responsible for the management of these lands.

In conclusion, I feel I can in a general way summarize their collective opinions about red alder. They are converting the alder off-site stands to Douglas-fir production as rapidly as possible. As they leave favorable alder sites to mature, they thereby postpone a final decision to convert to Douglas-fir. These sites often have a serious brush problem. In the problem areas of heavy brush, cost of converting these sites to Douglas-fir must be weighed against the probable disappointing results. Here, alder regeneration should be considered. It is certainly more valuable than salmonberry.

LITERATURE CITED


QUESTIONS

Audience. What was the title of Dr. Keays report?

Hildenbrand. "Wood Supply and Wood Products Demand for the Year 2000." Dr. J. L. Keays is Senior Scientist, Forest Products Laboratory, Canadian Forest Service, and this is Internal Report DP-52.

Audience. What is the market value of alder today and how does it compare to other hardwoods in use?
Hildenbrand. We now pay $54 a thousand board feet for alder logs 10 inches in diameter and over. We are paying $45 for alder logs 8 and 9 inches in diameter. I think we are just a bit above the market at present. Last year, we paid as much as $60 a thousand board feet for our logs. In the East, comparable species are about the same price if you add the differential between Doyle scale and Scribner's.

Audience. Do you use Doyle scale here?

Hildenbrand. No. We wouldn't dare. We have enough trouble with Scribner rule.

Audience. Is the market for maple about the same as alder?

Hildenbrand. Generally speaking, yes, although the maple market is much more selective. I dislike maple myself. It is good wood, but I don't like to manufacture it. It is used primarily for Early American and Provincial type furniture. In about the last 3 years, the ladies, bless them, have been purchasing the Spanish, the Moroccan—the heavier, more ornate types of furniture. As a consequence, the market for maple has really nose-dived. This is one of the reasons why plastics have made such an inroad, because obviously to get a competitive piece of furniture, a craftsman cannot do the hand-carving. It is too expensive, so the furniture must be mass-produced. The manufacturers are switching to plastics as a way of achieving this. But western maple is not inferior to eastern maple, even though it has more serious defects in it. I think the quality of the wood is comparable to that of eastern soft maple. One of the big problems with bigleaf maple is, in my own opinion, caused by the fact that on so much of our lower elevation lands when the Douglas-fir was logged 20 or 30 years ago the residual maple was badly scarred. The scars are now defects, which cause problems. Another serious problem in maple on the west side of the Cascades is mineral stain. This causes serious problems. As far as wood quality is concerned, however, I think it is as good as the eastern soft maple.

Audience. Do you have any problems drying alder?

Hildenbrand. No. It is just a matter of learning how to do it. Alder is an easy species to dry, probably one of the easiest. The hardwood industry has developed what is called the alder color—a very uniform rich honey color. The furniture industry loves it. We can't seem to sell alder without this color. The color is easy to develop by steaming the lumber to bring out some of these chemicals that are in it.

Audience. How long can alder logs lie in the woods after they are cut before they lose value?

Hildenbrand. This varies, of course, with the time of year, the season, but in the worst staining season we like to turn our inventory in
Managing Young Forests in the Douglas-Fir Region

about 5 to 8 weeks. Stain begins penetrating from the ends of the logs. It is a progressive thing, and as it develops it continues to degrade the log. In the first 6 weeks not much of a decline occurs in the volume of the wood, but a very marked decrease occurs in quality. This is one of the serious limiting factors confronting the industry in trying to lay up for winter inventory. I try to turn my inventory every 5 to 8 weeks. We are dry-decking aider so we mill the older logs. I don’t use a pond for storage.

Audience. The market in the Eugene area calls for logs in multiples of 10 and 12 feet. This makes it difficult for a logger to get a pay load. Is this a general practice in the industry or is this unique to this particular mill?

Hildenbrand. I suspect that it is a particular mill. We buy 8-, 10-, and 12-foot multiples. We sell 6-foot material, even 4-foot.

Audience. Do you take 16- to 18-foot logs?

Hildenbrand. We buy logs of any length other than 14 feet.

Audience. But the mills in Eugene won’t, which makes it difficult for loggers.

Hildenbrand. I can see that it doesn’t make sense from a milling standpoint except for one reason. The mill can cut a 12-foot log as fast as an 8-foot log and this gives an extra 4 feet of board. But it doesn’t seem sensible to me to penalize the woods operation by restricting log lengths.

Audience. We have the problem in managing alder of no market. Even when we have a market, the market is so inflexible, because of the way alder is produced. Also, the availability of alder in the woods is tied to the location of the softwood operations. If there is an abundance of alder in the woods, there may be no market, the industry doesn’t want it. If the hardwood industry wants alder logs, the logger may not be operating near an alder supply. It seems that the hardwood industry is always in a state of flux. It either has too much wood or too little wood. Personally, I don’t think we will ever run out of alder. But can we hope for a stable market for the landowner and the logger to sell alder? Right now our loggers are knocking alder down by the wayside and leaving beautiful logs in the woods because of no markets. The only stable market is for pulpwood, which doesn’t pay for logging costs. By the time the market does come back, the logger is so accustomed to treating alder as a weed that he doesn’t treat that log the way he should. The industry still doesn’t get the logs it needs. So, how can the market be stabilized so that foresters can manage alder as it should be managed, and the hardwood industry receive the quality of log that it needs?

Hildenbrand. That’s a real problem and, as a politician would say, I am glad you asked that question.

Audience. It is a real problem, but someone must finance inventory other than the logger and the mill. The furniture manufacturers must carry more inventory than in the past.
Hildenbrand. Unfortunately, we can’t simply tell the furniture manufacturers what to do. I think you must understand the furniture industry. Mills of the size of B. P. John, which is the single largest factory on the Pacific Coast, are very, very rare. Most manufacturers are small and they have absolutely no warehouse. They buy straight from the distribution yards, and the distribution yards are limited as to what they can handle. This is true in the South as well as on the Pacific Coast. Almost a straight pipeline leads from the sawmill to the furniture plant. So, when the market drops, the impact comes right back to the sawmill. How we can tell the furniture people to change their thinking escapes me. I am anxious to see some solution to this. I’m not sure the answer is installed mill capacity, because all you are doing then is choking the supply lines. This will make it difficult for everyone to operate. Frankly, it is a problem of logistics and I haven’t an answer.

Audience. Would a price established for log buying in large quantities stimulate volume buying by the mills, instead of buying from day to day?

Hildenbrand. Probably not, because the furniture people are dealing with a volatile market. The market is up and down like a yoyo for these people, too. So they are reluctant to commit. We have a few of our customers that do commit ahead. For instance, one customer in Florida gives us a firm order for the year ahead. We know through the year that we will have shipments to them. We would like to have all our sales on this basis. Then in turn we could schedule our log buying from the woods. Much of the time, we have far more installed mill capacity than logs available. During other periods the exact reverse is true.

Audience. Do you handle other species besides alder?

Hildenbrand. We are strictly hardwoods. We do produce maple lumber in very limited amounts. We are considering Oregon white oak. With a new process that we have and if we can develop a market, we have some hope that we can process oak in the new plant we have.

Audience. Most public land agencies are now under pressure to reserve hardwoods and buffer strips along streams where our best alder grows. How will this affect the hardwood industry?

Hildenbrand. Well, I suspect that this will pose a serious problem for us in the future. Much of the alder is left in logging operations now, however. We have resigned ourselves to this. But it will have an effect in the future. No question about that.

Audience. Do you believe that in the future sufficient markets will develop to take all the alder that will be grown?

Hildenbrand. I’m optimistic about the outlook for the alder market. As a matter of fact, I am very optimistic. And, as I said, I think that if we
had the money to finance a national advertising campaign, we could increase our markets. It is just a matter of telling the alder story. Furniture manufacturers are very cautious and understandably so. They are reluctant to switch to another species, because they don't know exactly how the species will react in manufacture or how the furniture made from it will sell on the market. So they are constantly testing. We send samples to manufacturers constantly. For example, our customer in Florida originally manufactured kitchen cabinets of beech. For over a year we sent him test samples of 200, 300, 400 board feet of alder. Finally, he gave us a firm order. They want to be sure that they won't have warp, twist, check, glue, or stapling problems or some other problem that may come up in a species. They want to know exactly what is going to happen with a species. After all, once they have manufactured a piece of furniture they have a total investment and it would be serious to them if the furniture developed defects or would not sell.

Audience. Who has the most influence on the market—the woman who chooses furniture or the furniture industry, by the choices it makes available?

Hildenbrand. I suspect it is the industry that is influencing the woman. After all, they are master salesmen. And they are creating the desire. Manufacturers are always looking for a new style or a new line to give their sales a shot in the arm. In the Los Angeles area right now, small portable bars are a really hot item. They consist of an alder plank about 8 to 10 inches wide, with a small cupboard at one end, glass storage underneath, and a light. They stress the edges a bit to make it look rustic, put the bar on rollers, and sell them like hotcakes. Each manufacturer tries a new gimmick to be competitive.

Audience. Often, though, the furniture companies will put out a product that will sell better than they anticipate and hurt their last line. For instance, they will push a maple and then find they can't sell a piece of walnut furniture. It absolutely will not sell. And they will have a whole warehouse full of it. I understand it happens time and again.

Audience. Is maple also used in the furniture industry and how is its use in relation to alder? A different or a similar use?

Hildenbrand. No, it's exactly the same. Maple has a much more limited use than alder, in that it goes primarily into the Early American type or Provincial type furniture. Alder has a much more universal use.

Audience. Is there a foreign market for alder?

Hildenbrand. Very little. The Japanese are looking at alder. I think they want to import logs.
For the past year, a group in the Newport area have been considering the installation of a chip unit for exporting alder chips. They have large land holdings, and they are financially responsible people. Wesley Ricard is working with them. The point I would like to make to you is that someone is looking at the alder opportunity. One of these days alder will come into its own.
ADMINISTRATION OF THINNING CONTRACTS

Howard Hopkins
Longview Fibre Company
Longview, Washington

A THINNING PROGRAM logically must begin with the administration of the organization that owns the timber. The decision to invest funds on roads and other improvements needed to develop the timber stand to the point of logging usually rests in the administrative head of the organization involved. The desire for increased yield and the periodic early income usually are cited as reasons for implementation of the thinning project. Providing that the decision to thin has been made and the funds are made available, either by a direct appropriation or by reduction of stumpage return, then the management goals of the organization must be defined.

The management goals for thinning young-growth timber are probably as diverse as the companies and other individuals and groups with thinning programs. Certainly the techniques and practices of thinning are different between organizations, and each may be right for a particular organization, though different from each other.

Longview Fibre Company's Program

The policy on thinning of our company, the Longview Fibre Company, is to maintain a high level of growing stock that has the capacity for fast growth and to maximize the dollar return from the timber cut, by judicious conversion to desired log products and prudent marketing. As a necessary adjunct of the thinning program, we also have a road network being developed that gives high protection benefits and maximum future versatility for subsequent logging.

Longview Fibre Company does all of its work, except road grading, through contractors. We enter into a contract that outlines work to be done and obligations of the contractor and our company (Table 1).

Background on the Operation

Our area of operation is, roughly, west from St. Helens, south of Clatskanie, east of Saddle Mountain, and north of Forest Grove. Vernonia is about the hub of this area. Our site class generally runs from lower site II to middle site III for the entire area. I assume from what information is available that the net expected growth under reasonable management will be about 1,000 board feet per acre. The topography is generally gentle to fairly steep with ground suitable for tractor logging predominating. The
rainfall is high with only July, August, and September as good bets for dirt road logging.

Log markets generally accept logs with a minimum of 12 feet in length and 6 inches scaling diameter. Normally, pulpwood with a minimum of 5 inches in diameter and 16 feet in length is purchased in the area. Except for some company operations, the logging is done by small contractors. Longview Fibre Company buys only about 2 percent of its own log production, and that is limited to Douglas-fir utility logs, salvaged concurrently with thinning operations, and alder pulpwood.

We work with 12 contractors who operate 15 tractors and produce from 10 to 12 million board feet per year from thinnings. We like to limit our thinning work from mid-August until late April to avoid the season of bark slippage. During the spring and summer months, we concentrate our logging on salvage clearcuts and rights-of-way.

**Thinning Roads**

Our roads are located by company engineers with special emphasis upon choice of adequate landing sites along the road. Roads are constructed by road construction contractors, usually 1 year before ballasting and logging. At the time of road construction, a forester marks the landings needed, and they too are cleared by the road construction contractor. The road construction costs are paid from company capital funds. We normally build a one-lane road, with turnouts, that has a rough subgrade width of 19 feet, which excludes the ditch. A ditch 3 feet wide is added where needed. We ballast for a 12-foot width with an average station that receives from 45 to 50 cubic yards of pit run. The minimum size of the drain culvert is 12 inches. We specify the right-of-way to be felled 5 feet wider than the slope stakes.

**Where to Thin**

The decision of which area to work is dependent upon several things. Market demands tend to become a great factor. If logs are in low demand or of low value, we try to shift into stands that produce other products, such as poles or pulpwood. We consider salvage an essential part of our thinning program. We make a special effort to salvage as needed, especially with regard to weather, insects, and disease damage; these items dictate where we will work in many instances. Even though thinning is our secondary goal, we try to work it along with the salvage project. Naturally, the need for revenue keeps us working the areas that produce the most income, when all other factors are equal.
Table 1. An Example of a Logging Agreement Between Longview Fibre Company and a Contractor.

Logging Agreement

This agreement, made and entered into this day of 19, by and between LONGVIEW FIBRE COMPANY of Longview, Washington, a Delaware Corporation authorized to do business in , hereinafter called the "Owner" and , whose post office address is , hereinafter called the "Contractor".

Witnesseth: That for and in consideration of the respective undertakings of the Owner and the Contractor as hereinafter set forth, the Contractor is to log all marked or otherwise designated trees and salvable dead and down material on designated portions, hereinafter sometimes referred to as the "Operating area", of the following described property of the Owner in County, :

1. Roads and Landings:

2. Logging: The Contractor shall, at his sole expense, fall, buck, yard, load and transport for delivery to the Owner, or to points and purchasers designated by the Owner, all logs and other products which can be produced from said designated trees and salvable material situated on the operating area. All forest products removed shall be identified by the Contractor with the log brand furnished by the Owner. In fulfillment of the obligations herein contained, the Contractor agrees to convert the trees to those products specifically requested by the Owner. All marketable material is to be cut to the satisfaction of the Owner.

For the purpose of this agreement, "marketable material" shall mean any log which has a net log scale of board feet or more and a net log scale of percent or more.

All second growth timber shall be utilized to a minimum diameter of inches and a minimum length of feet plus trim.

3. Scaling and Rafting: All logs removed from the operating area of the Owner shall be delivered to log dumps either on towable waters, reloading sites, or at mills as specified by the Owner, and shall be scaled and graded by the Columbia River Scaling and Grading Bureau, unless another basis for the sale of the logs is mutually agreed upon in writing between the Owner and the Contractor. Any and all costs incurred in dumping, booming and/or rafting shall be borne solely by the Contractor. The cost of scaling when a scaling charge is incurred shall be borne one-half by the Contractor and the remaining one-half by the Owner or any designated purchaser of the logs.

4. Snag Falling: The Contractor agrees to fall all non-merchantable snags within the immediate limits of the operating area that extend above the
canopy of the green timber stand, all snags over fifteen feet in height if within two hundred feet of any landing, and all snags on the operating area and along the boundary of the operating area which an authorized representative of the State or Owner requests to be felled to comply with State laws or to prepare the area for slash burning.

5. SLASH DISPOSAL: The Contractor shall in accordance with requirements established by the Department of ___ of the State of ___, construct fire trails around the areas of slash created by the operations of the Contractor hereunder, and shall burn and dispose of the slash to the satisfaction of said Department of ___ to the extent that said Department of ___ shall issue an official release of slash liability to the Contractor on the operating area described herein.

6. COMPENSATION: In full payment for all work required to be done by the Contractor hereunder, provided the same is performed in a good and workmanlike manner and in accordance with the terms and provisions contained herein, the Owner agrees to pay to the Contractor the following amounts:

   It is agreed that the Owner shall have the right to withhold from payments due to the Contractor any amount which the Contractor may owe to any agency of government or to any individual, company or corporation, for which amount the Owner could eventually be held liable, or for which the property of the Owner or any products produced under the terms of this agreement could become encumbered by lien or otherwise. In addition thereto, the Owner shall have the right to withhold from payments as they become due to the Contractor until the obligations of the Contractor contained herein are fulfilled, or as liquidated damages if the work required hereunder is not completed by the Contractor in accordance with the terms and provisions contained herein.

7. LAWS AND REGULATIONS - HUMIDITY: The Contractor shall comply with all the laws, rules and regulations, of the federal, state and other governmental units, including, but not limited to those relating to forestry, conservation practices and the prevention, suppression and control of fire, and all valid orders of federal and state officials pertaining thereto. All operations of the Contractor on the property of the Owner, except fire prevention, suppression and control, are to be suspended when the relative humidity of the air is ___% or lower, or such suspension is deemed prudent in the sole discretion and judgement of an authorized representative of the Owner. Operations shall not be resumed until authorized by said representative of the Owner.

8. OREGON TAXES: The Owner shall pay the Oregon yield tax on all material logged which originates from such of the above described land as may be classified as Reforestation Land by the State of Oregon.

9. FIRE SUPPRESSION: Upon discovery of a fire upon the operating area or within the visible area thereof, the Contractor shall immediately notify the nearest State Fire Warden and the Owner. The Contractor, unless prevented by circumstances over which he has no control, shall place his employees and his equipment at the disposal of any authorized forest officer of the State and/or the Owner for the purpose of fighting forest fires on or which threaten any lands of the Owner.
If the fire is one for which the Contractor has no legal responsibility, the employees and equipment of the Contractor shall be paid for at the fire fighting rates in effect at that time, which rates are established by the Department of ________ of the State of ________.

10. FIRE FIGHTING EQUIPMENT: The Contractor shall provide fire fighting equipment and tools as ordered by the Department of ________, of the State of ________, and in addition thereto,

11. WATCHMAN: The Contractor shall maintain a watchman on the operation hereunder for hours following cessation of operations for the day, or, in times of extreme fire danger, as determined by a representative of the Owner, until 8:00 o'clock p.m., whichever time is later. Said watchman shall have transportation or communications immediately available for his use in the event a fire starts on or in the vicinity of the operation.

12. LIENS: The Contractor agrees to pay all labor and other bills incurred by the Contractor under this agreement promptly before delinquency and to furnish the Owner, as it may require, with proof that all such labor bills and expenses are paid. The Contractor shall not permit or cause any lien to become attached to any property of the Owner, and if any lien shall attach to any of the Owner's property, arising directly or indirectly out of this agreement, the Contractor agrees to promptly discharge the same, and the Owner shall be at liberty to apply any money due or to become due the Contractor hereunder to the discharge of any such lien or liens.

13. INSURANCE: The Contractor agrees to subscribe to a Third Party Excess Property Damage Policy issued by Lloyds of London, which is made available to all Contractors operating on lands of the Owner, the limits of which policy shall be $650,000.00 in excess of $50,000.00. Part of the cost of this coverage shall be borne by the Contractor, but shall not exceed ________ cents per $100.00 of contract price. For the purpose of computing this premium, and the premium described in the following paragraph, contract price shall be the amount paid to the Contractor for work done under the terms of this agreement.

The Contractor also agrees to subscribe to a Third Party Excess Property Damage Policy issued by Lloyds of London which is made available to all Contractors operating on the Owner's land, limits of which policy shall be $50,000.00 in excess of $250.00. Part of the cost of this coverage shall be borne by the Contractor, but shall not exceed ________ cents per $100.00 of contract price.

The Contractor shall carry and maintain in an insurance company acceptable to the Owner Comprehensive Bodily Injury Insurance with limits of liability not less than the following:

Property Damage: For any one person -
For any one occurrence -

The Contractor shall carry and maintain in an insurance company acceptable to the Owner Property Damage Insurance on all vehicles used on the contract
area or in connection with the exercise of the rights of the Contractor here-under, with limits of liability not less than the following:

Property Damage; For any one occurrence -
For all claims in the aggregate
during the policy period -

All policies required hereunder shall provide the following:

A. In the event of cancellation or reduction of all or any portion of the coverage for any reason, fifteen days' prior notice of such cancellation or reduction will be furnished the Owner by registered mail by the insurance carrier.

B. The coverage for each and every occurrence includes liability assumed by this agreement.

C. In consideration of the premium charged, it is agreed that the exclusion for damage to property owned, occupied, used by, or in the care, custody, and control of the Contractor, as referred to in any Exclusion clause of any such insurance policy, does not apply to timber and timberlands belonging to others which are being purchased by the Contractor under contract, or being logged under contract.

D. The Contractor shall furnish the Owner with a Certificate of Coverage as evidence the above listed insurance, or at the sole option of the Owner the Contractor shall furnish a copy of such policies as provide the coverage required herein.

14. PROPERTY LINES: The Owner agrees to establish all necessary property lines and the Contractor agrees to confine Contractor's operations to the operating area on the property of the Owner and to take due and proper precaution to avoid trespass upon the property of adjacent owners while operating under this agreement. The Contractor shall be responsible for any trespass committed by the Contractor or by any agent or employee of the Contractor.

15. INDEMNITY: The Contractor shall indemnify and hold harmless the Owner against all claims or liabilities asserted by third persons resulting directly or indirectly from the Contractor's acts or omissions hereunder whether negligent or otherwise.

16. INDEPENDENT CONTRACTOR: It is agreed that the Contractor is and shall remain an independent contractor and that neither the Contractor nor any of the agents or employees of the Contractor are or shall be agents or employees of the Owner. It is further agreed that the Contractor is engaged in an independent established trade or business known as a "Logging Contractor", and that the Owner shall have no right to control or direct the Contractor in the manner of performance of this agreement, but only to exercise control over the final results.
The Contractor shall procure and pay the necessary premiums and contributions and secure the necessary registration numbers for all Industrial Insurance, State Medical Aid and Unemployment Compensation, etc., to cover the Contractor and his employees, which shall be required by the laws of the state within which this agreement is to be performed, and said Contractor shall indemnify and hold harmless the Owner from any and all liability of the same. Upon request of the Owner, the Contractor shall furnish any and all bonds or monies required as security for the payment of such premiums and contributions, all at the Contractor's sole cost and expense. Upon written demand of the Owner, the Contractor shall furnish evidence satisfactory to the Owner that all such premiums and contributions have been paid, and the Owner shall be entitled to withhold any sums which are otherwise owing the Contractor at any time until the Contractor has furnished satisfactory proof of compliance with all of his obligations pertaining to the premiums and contributions referred to herein.

17. ASSIGNMENT: Neither this agreement nor the rights of the Contractor hereunder, shall be assignable in whole or in part, by operation of law or otherwise, without the prior written consent of the Owner thereto. Any attempted assignment without such consent shall automatically make this agreement null and void.

18. LOGGING STANDARDS: The Contractor is to conduct all operations on the operating area in accordance with the best practice prevailing in the vicinity. The Contractor agrees to use maximum care in the methods of logging so as to prevent unnecessary damage to the residual timber and reproduction.

19. BREACH OF CONTRACT: In the event the Contractor shall commit any breach of this agreement, and shall fail to make such default good within 10 days after notice is given in writing by the Owner, the Owner may forthwith cancel this agreement and terminate all rights of the Contractor hereunder; however, such remedy shall not be exclusive and shall be in addition to any other rights of the Owner.

Any notice to be given by either party hereto to the other under the provisions of or with respect to this agreement, may be served personally or by registered mail, addressed to the party to be served at the latter's post office address hereinabove set forth, and such service by registered mail shall be equivalent to personal service.

20. TERM AND TERMINATION: This agreement shall remain in effect until after which date the Contractor shall have no right to enter upon the said premises unless the time for performance thereof shall be extended by the Owner in writing. The Owner reserves the right to suspend operations of the Contractor upon one week's written notice in the event the Owner is unable to use or otherwise dispose of the logs or other material from the operating area at a price acceptable to the Owner, and to require the Contractor to stop all delivery of logs and all other operations in connection with this agreement during such periods as the Owner shall determine. In the event the Owner exercises the right to suspend the Contractor's operations hereunder, the term of this agreement shall automatically be extended for the same length of time such suspension existed.
21. **ROAD MAINTENANCE:** The Contractor will keep existing roads that are used in his operation properly maintained and in a state of repair that will permit travel by passenger cars. At the termination hereof, said roads shall be left in as good or better condition than existed at the time of commencement of operations hereunder.

22. **OTHER PROVISIONS:**

Seasonal problems often dictate when the steeper ground is logged, for tractors are the only means of yarding presently available to us and, of course, working from rocked roads is essential in the fall, winter, and spring. We have discovered that some of our property has soil with such low bearing capacity that it should be logged only in the drier periods of the year; therefore, we will save this ground for early fall or late spring operations in subsequent thinnings.

**The Thinning Contractor**

A choice of contractors is an important advantage, especially in an operation like ours. I look for a man who takes pride in his work and has a history of cooperation with those he has dealt with previously. He must have a basic understanding of the economics of logging. We have had poor performance from the logger imbued with the "high-ball" attitude. Most of our contractors have been obtained by reference, although an increasing number of men have worked for one of our other contractors before going on their own.
The motivations to continue in this work seem to be independence, making a profit, and working near one's own home. We try to employ a contractor as near his home as possible for his convenience and to cut the cost of crew transporation to a minimum. Naturally, we also find most contractors are interested in improving the timber stand. Another advantage a corporation can give an independent contractor is the promise of year-around work to stabilize his income and crew. Sometimes, however, the freedom to take time to know where their favorite herd of elk is on opening day stands high in the rewards of our independent contractors.

**Contractor Equipment**

A thinning contractor beginning with Longview Fibre Company normally already owns or agrees to obtain equipment within the maximum size allowances that I consider acceptable. Thus, I have set an outside dimension of 8 feet as maximum for any piece of yarding equipment. Tractors on our thinning jobs are principally John Deere 450 and Allis Chalmer HD-6, favored in that order, with one Caterpillar D-4 tractor on the job. The John Deere 440-A wheeled log skidder is the hands-down favorite in our country, although we also have one Pettibone and one Clark machine.

Our people, without exception, choose one of the two popular, domestically made power saws. The model and accessory selection depend upon the preference of the faller-bucker. Log loaders come in various types and sizes, but most are grapple-equipped, heel-boom machines of from ½ to 5/8-yard rated capacities.

**The Logging Contract**

To arrive at our logging contract allowances (Table 2, 3), I first examine the area to make a rough estimate of the factors that I must consider. I try to estimate roughly the number of acres in a job and the average log volume we will remove per acre. I consider tree defects, tree size, number of logs per tree, and limbiness to arrive at the cutting cost allowance. To make my yarding cost estimate, I note particularly skidding distance, pieces available for each turn, average log size, topography, season, and obstacles to yarding, such as windfalls that are present on the ground.

I estimate loading allowance by log size and the number of sorts required. Log hauling allowances generally are based upon the Washington State Tariff Rates for the Longview area, which I adjust when necessary by elapsed time for the required trip and average load expected.
### Table 2

**LONGVIEW FIBRE COMPANY**  
Contractor Allowance Schedule  
**Log & Pulpwood**  

<table>
<thead>
<tr>
<th>Zone Definition:</th>
<th>Initiated by LFCo Cont________</th>
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<tr>
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**IBM CARD CODE**  
**Contractor Allowance**  

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*Specie Codes 16, 26 & 67  
Conversion 1M=6.85 tons*
Table 3.

<table>
<thead>
<tr>
<th>Pole &amp; Piling Zone Definition:</th>
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<table>
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<th>Specie Del.</th>
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<td>Export (09)</td>
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</table>

**Contract Allowances**

With my estimates in hand, I like to meet with my contractor on the show in question. I show him around and give him the utilization standards that we will require on his contract. I detail the market to which we will ship and indicate any problems that I foresee on the show. I also
outline the extra work required on the job before I offer my estimated allowance. We then either agree to the estimate or negotiate until we reach an impasse or an agreement. In the event of an impasse, which rarely occurs, we try to agree on another job.

Contract Payments

Our contract allowance schedule is written in two parts. The log portion details the dollar payment or logging allowance to be paid to the contractor based on the average grade log delivered to a specific market. We build into our contract an incentive to produce better grades, for the contractor receives an increased allowance for each increase in log grade that he produces. Conversely, for a log of lesser quality, the contractor gets less than the average payment. Of course, increased allowance is made for longer hauls.

Our present costs for logs loaded on the truck run from $22 per M fbm (thousand feet, board measure) for second or third thinnings in 60-year-old timber to $32 per M fbm for initial thinnings in 40-year-old timber. These allowances do not include hauling.

For poles and piling, the contractor is paid on a system by which payment is increased when the length or the class or both, are increased. Of course, the payment is affected directly by the length of haul and the equipment needed. For example, a pole that requires a steering trailer will have a greater contract allowance than a pole that can be hauled on a truck equipped with stinger and extendable-reach trailer. The allowances on poles and piling in the past year have ranged from 40 to 65 percent. The lesser percentage applies to the longer pieces and more desired classes, because the product values are much higher for these items. The smaller percentages still allow a bonus for doing the job when compared to log-making allowances.

Contractor Functions

The contractor also agrees to certain things, just as the company agrees to pay for the work performed. We stipulate the specifications for material deemed to be worth logging. Agreement on fire regulations is covered, as well as provisions for extra fire equipment and snag falling beyond that required by the law. Insurance coverage is specified. Term of the contract is set out. Of course, many other things are covered by the contract, which tends to have the two-fold purpose of clarifying the position of both the contractor and the company and protecting the company from acts of the contractor.
Supervising the Contract

Longview Fibre Company generally adheres to the policy of thinning from below. We think the maximum growth potential is in the dominant and codominant trees. This does not imply that the dominant trees are not cut in the thinning program, but unless a rough, limby tree occupies an excessive amount of crown space or a particularly well-located candidate will make a transmission pole, the dominant or strong codominant is likely to survive most of our thinnings. We do put first priority on marking for cutting dead, dying, diseased, and naturally damaged trees. The rest of the cut is made up of trees with crowns generally below the main crown level or with growth slow because of the position in the stand. Those trees with growth slowed by position usually can be characterized by crowding from the more vigorous trees in the stand. Of course, trees suffering from exposure to road cuts, logging damage, and other problems brought on by the operation are marked for removal at this time. We believe that our cut should be adequate to justify the capital expenditure of the company and the expenses of our contractor; therefore, we find it convenient to cut from 25 to 35 percent of the volume of the stand on the first go-around, dependent on the age and size of the timber.

Marking is accomplished by foresters and foresters' aides called markers. After the policy for marking has been determined, the forester is charged with training the aide and lending a hand when the marking falls behind. Because of the boring nature of marking, a marker should spend no more than 6 hours at a stretch in this work. To this end, we make our markers responsible for keeping tab on the logging damage and utilization. He also performs rudimentary cruising to determine the percentage of volume we have cut.

The tools for marking on our job are paint guns, staples, and plastic flagging. The primary marking is done with Nelson paint from disposable 1-quart cans and a Nelson “paint gun”. In special marking situations, where the marker must closely examine each tree, we use heavyweight, waterproof cards and staple devices. As you can imagine, this method is especially good for marking poles and piling where tree straightness, butt size, and defects are particularly important to the product. We also have occasion, when marking specialty items in heavy brush, to use plastic flagging, which we tie about the tree as high as we can reach. These methods are ordinarily used concurrently with paint.

In normal thinnings, we do not attempt to mark trees for specific products. We believe that the choice of products, especially for poles and piling, can best be made by the faller. After straightness is determined with
the tree standing, examination of dimensions and defects can be analyzed when the tree is lying on the ground. Our experience has indicated that a well-trained, conscientious faller-bucker normally will produce more poles and piling than the marker would indicate.

**Logging Damage**

Stand damage is affected by many factors, some of which the contractor cannot control, such as ground slope and density of trees. The duty of the owner's representative is to work with the contractor to reduce the damage as much as possible.

The most serious damage is caused by tractors that grade skid trails and yard logs. Roots are broken, soil is compacted, and trees are barked and otherwise damaged about the ground line alongside the tractor trails. This damage can be reduced by carefully planning skid-trail spacing, leaving high stumps for rub trees on the curves, pulling winch lines and thus confining tractors to the skid trails as much as possible, and refusing to permit blading of tractor trails to scrape off the mud for traction purposes. Damage to residual trees also is reduced when rigging cuts are made on both sides of the proposed skid trail before moving the tractor in. Because straight tractor roads reduce damage, we spend a considerable amount of time with each new contractor demonstrating the importance of laying out and maintaining straight skid trails.

Felling the marked tree to lead out through the remaining trees is extremely important, as is good limbing. I think, however, that one less obvious damage factor is that of rubbing a standing tree with a falling tree, for scars caused by felling preclude the use of the remaining damaged trees for poles and piling, not to mention the reduced growth potential when portions of the crown are knocked out. Low stumps receive a lot of our supervisory effort. Stumps cut close to the ground reduce damage during felling of each successive thinning cycle, and low stumps allow logs to lead out without hangups or unplanned siwashes. Such a practice also makes use of more available wood and allows passage of tractors with the minimum amount of trouble.

The final problem, I think, is damage to roads during the thinning operation, for in thinning we must plan to use the road system several times before the final cut. As you can appreciate, the fewer times that track-laying equipment turns upon a road, the less the road will be damaged. Therefore, we allow tractors on the roads as little as possible. Because of our many sorts that are required, however, we do allow some decking along and parallel to the road. To reduce the damage from
decking, we ask the operators to do all turning off the road or to make wide arc turns when they must turn on the roads.

Completion of the Contract Area

Before a contractor has completed his operation area, we try to get a man out to inspect his cleanup work. First, we want to know that he has shipped all the logs from the trees marked. He must fell certain snags as specified in his contract. We often take the option, however, of having him fell extra snags on his operation area and reimburse him for the extra work. He must clean the road, ditches, and culverts throughout his area and leave his landing with adequate drainage. Lastly, we may require cross ditches or water bars on skid trails that are likely to carry water for any distance. To assure compliance with these and other parts of his contract, our company withholds from 2 to 5 percent of all monies due under the terms of the contract. If the contract work is not completed to our satisfaction, we use all or a portion of the retention fund to have the work completed by a third party, or we may retain a portion of it for liquidated damages. This part of the agreement is rarely exercised, and the money is returned to the contractor immediately after the satisfactory completion of his job. In fact, if I had to exercise our option on this problem too often, I would not keep the offending contractor.

Thinning Safety

Accidents occur all too often in thinning operations, even though the equipment and trees are small and the log skidding is slow. A prime problem is that the falling tree is always directed into standing timber. This may cause the tops of small snags or branches of living trees to be snapped back at the faller. Hangups often result in a felled tree that lodges in a reserve tree. Where snag felling is done concurrently with the other felling, alertness, care, and experience can help. For the sake of everyone concerned, hangups should be pulled down by a tractor or knocked down by selecting another advantageously positioned tree that can be felled onto it to bring it down.

A sad occurrence we had points out another hazard that should be emphasized because the faller-bucker often works close to the yarding tractor. A small snag located alongside a skid trail fell because of the vibration of the tractor passing near it. The young fellow it hit might be working today if all the snags near the skid trails had been felled concurrently with the other tree felling.

Work around the landings produces new hazards when small logs from thinnings are handled. To build a load up to legal weight standards
Managing Young Forests in the Douglas-Fir Region

requires mounding logs above the top of the stakes. Good saddles are imperative, especially in the spring when the bark slips easily. I have seen the wing log at the top of the stake actually thrown several feet because of the load above and the slippery sap-soaked bark. I think the best solution to this problem is saving the larger logs for the top of the load and putting the smaller ones below in the main body of the load, which is enclosed within the stakes.

Another problem is that a husky driver with a chain binder can develop enough mechanical advantage to move logs about on top of the load while chaining up, which causes the upper logs to shift. Therefore, to bind the load lightly with the first two binders, then tighten the binders in successive stages is prudent.

SUMMARY

I want to emphasize a few items that seem important to me as a contract administrator.

The primary purpose of thinning is to carry out the management goals of the owner. Because Longview Fibre Company has goals that do not necessarily coincide with other owners, our thinning operations and the administration of these operations probably will differ from those of other companies.

In the operation of thinning contracts, roads must be located to serve suitable landings and the ground to be logged. Care must be taken to reduce the possibility of damage to roads during the thinning operation.

We must find a market for the material logged that will produce some stumpage value, and then we must find the physical conditions that will allow thinning to progress in such a way as to minimize damage to the residual stand.

The contractor is a key man in the operation. We must make thinning work attractive to him. He must understand our problems, and we must understand his. Most of all, I think a contractor must be free to work within his contract without excessive supervision, unless he demonstrates that close supervision is necessary to protect the owner’s interest. The contractor’s equipment should be a matter of personal preference, but I prefer to have broad guidelines that restrict the maximum width of tractors, because width seems to be a function of other tractor specifications.

The amount of payment for logging depends upon factors that are somewhat parallel in all logging shows. I negotiate with our contractor in each new show until we are both satisfied as to specifications and
payment. Our contracts are simple and, though somewhat general, they have worked very well for our purposes.

The tree marking and direct supervision are accomplished by a forester or his aide. We mark each tree that is to be cut. We train the contractor to make the most valuable product possible and to work in ways that avoid excessive damage to the reserve stand and the real estate involved.

The safety of all personnel working on our operations is especially important to us. We try to inform our contractor when any unsafe condition exists and then help him to correct it, if we can. If I have a philosophy about the administration of thinning contracts it would be: The contractor knows what he is doing. Therefore, I will “give him his head” until I know he is wrong or until I can be of help to him.

QUESTIONS

Audience. Do you have a comparison between the rubber-tired skidder and the conventional tractor as to which does the most damage? Do you require your contractors to remove the tractor blade when they are yarding logs to cut down on damage to the residual stand?

Hopkins. We haven’t made a study. I believe, however, that the rubber-tired tractor probably is more damaging because of soil compaction and the mud problem from the high rainfall in our area. To the second question, no. I’d think I’d sooner face a wildcat.

Audience. Do you get more damage from bark slippage and damage to the roots when you log in the later part of the season?

Hopkins. I am sure we get less compaction and less root damage in the summer. I believe bark damage is a psychological reaction more than a serious problem.

Audience. Does the contractor sell the logs?

Hopkins. No, we own the logs and sell them to the highest bidder. The logger takes care of just the logging. He is paid for logging by the thousand board feet.

Audience. If I understand your payment schedule, you pay a logger less for number three than for number two sawlogs. In many stands, the logs will be mostly number 3 because of size. So it costs him more per thousand to log number 3 than number 2 logs. Is that right?

Hopkins. Yes. But even in 40-year-old stands we get a considerable amount of number 2 logs. This winter, I thought we were logging in a very poor stand but it produced 30 percent number 2 logs.
Audience. The point, though, is that the logger received less for what cost him more.

Hopkins. Right. But if we agreed upon $30 for logging he would also get $30 for a number 2 log. So we take this into consideration when we negotiate.

Audience. So you actually pay on camp runs then?

Hopkins. Well, if he should log an old-growth tree with a peeler in it, for instance, and delivered it to us as a peeler, then he would get paid for a peeler.

Audience. Do you have scattered old growth in some of your stands, and if so, how does this affect your marking?

Hopkins. We have very few old-growth trees in our area. Normally, we log what few we do have after the thinning.

Audience. Do you re-mark for damaged trees?

Hopkins. We have made a point not to mark any damaged trees in the current operation. I've always suspected that this would encourage damage, so we try not to do that. We have a floating contractor with a small skidder who picks up scattered diseased and damaged trees in the forest. If an area is damaged to the point that it must be relogged, we will send him in the next year to do that.

Audience. You leave an occasional damaged tree then?

Hopkins. Right.

Audience. Do you penalize the contractor for damage?

Hopkins. We can, but we have yet to do it. It hasn't been a problem for us.

Audience. I'd like to know how many acres Longview Fibre Company owns and how you can log strictly by tractor and not use some type of high-lead operation? You must have some rough topography. Also, I'd like to know more about your road—the 19-foot-wide road plus ditch. That seems to be something between a single and a double lane. Do you have a reason for this?

Hopkins. I confined my paper to thinning, and so far I haven't found an adequate cable-thinning machine that I could recommend to our logger. Some are being developed. We do have a couple of towers working for us, but they are not thinning. The 19-foot road grade is the green grade for the year built. Normally, we end up with somewhat less than that. By the end of the first winter, the grade has settled and, before the rock is placed, we don't end up with that much width, normally.

Audience. How much per mile does road building cost? For winter logging, with extra draining measures and rock, how much extra does that cost over what it would for summer shows?
Hopkins. The cost is about twice as much. Some areas have rock available nearby; some do not. We are hauling rock for 20 miles. As an estimate, $5,000 will build a mile of road and $6,000 will put 50 cubic yards of pit run on it.

Audience. What is the maximum slope that you allow tractor logging on?

Hopkins. We try to hold to about 30 percent.

Audience. Does damage increase if you go steeper?

Hopkins. Yes.

Audience. What’s the spacing between roads?

Hopkins. It varies depending on the log size. Right now we are working on about a 900-foot skidding distance with a favorable grade.

Audience. What’s the minimum volume per acre that you feel you can enter a stand for?

Hopkins. I think that it takes about 10,000 board feet to make a reasonable first thinning. Topography or other problems may require more volume.
ADMINISTRATION OF PARTIAL-CUT SALES: AN AGENCY'S VIEWPOINT

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ADMINISTRATION of partial-cut sales was presented to you by Howard Hopkins, who has examined administration from a private company's point of view. Now let us shift our position and take a look from another angle—the point of view of a public agency.

First, let us discuss some generalities of the administration of a partial-cut sale, examine some specific administrative practices and problems, and some actual contract provisions and, finally, consider some of the new developments that may require changes in administrative practices.

"Partial cutting" can mean different things to different people—to some it may mean thinning, and to others it may mean stand management, sanitation salvage, selective cutting, or prelogging. For us all to have the same understanding of the term "partial cutting," let's define it as any type of cutting in which only a designated part of a stand is to be removed.

The administration of partial-cut sales is understandably somewhat different, and usually more complex, than the administration of clearcut sales. Generally, we can say that the partial-cut sale requires a more intensive administrative effort than a clearcut sale if we expect to obtain the desired results from the sale. Our chief concern in a partial-cut sale is centered more on what is left than with what is removed; our administrative effort is focused on the protection and the safeguarding of the remaining stand.

FACTORS THAT DETERMINE TYPE AND AMOUNT OF ADMINISTRATION

Factors that affect the administration for partial-cut sales include type and size of the sale, the market, the contractor, and the type of timber and ground to be worked.

We will compare two types of sales—cash sales and recovery sales. With the cash sale, the purchaser pays a set price or lump sum for all timber on a sale area. With the recovery or scale sale, the purchaser pays a certain price per thousand board feet for each species, based on the actual volume removed from the sale area.
Generally, recovery sale contracts require more time to administer than the cash sales, because the scale records must be kept for volume removal and payment purposes. Also, because the purchaser pays only for the actual volume he removes in the recovery contract, the sale administrator must spend more time on the sale area to insure that marginal and less desirable timber is removed along with the better material. With cash sales, this problem is almost eliminated because the purchaser is concerned with getting out all of the material he has paid for.

Although recovery sales may require more administrative time, they have at least three definite advantages. First, recovery sales take less field time for preparation. Second, the recovery contracts are administratively more flexible than cash contracts, because more changes or alterations can be made on recovery contracts without having to draw up supplemental transactions. Therefore, the sale administrator has more latitude and authority, which allows him to approve changes right on the ground that he could not do with a cash sale.

For example, if a sale administrator of a recovery sale finds that a number of trees have been damaged excessively during yarding operations, he can require the operator to remove the trees as part of the regular contract. Also, he can require the removal of trees that should have been marked but were missed during the original sale preparation. With a cash sale, these changes require that the sale administrator cruise the extra trees to be sold and prepare a special sale contract.

Third, the recovery sale offers more protection and less risk, both for the seller and the buyer, with stands of timber that present appraisal problems, either because of defect or breakage or other reasons, such as poor area control.

Size of Sale

The influence of the size of sales on administration is a little more difficult to evaluate than that of the type of sales. Most of our experienced sale administrators think that, comparatively, the larger the contracts the fewer the total administrative problems. They would prefer one large sale that contains 3 M fbm on 300 acres rather than ten small sales, each containing 300 M fbm on the same 300 acres. Some of the advantages of the larger sales are obvious, such as fewer operators with whom the administrator must work and fewer contract records to keep.

The administrators also have found that operations are usually more efficient on the larger sale contracts, partly because more opportunity exists for diversity of operations on the larger areas, which keeps more men and equipment busy doing different things for a longer time, and
partly because the larger contracts seem to attract better operators or, at least, those with better equipment, men, and finances.

To state what the optimum size of a partial cutting should be from an administrative standpoint is really sticking one’s neck out because of all the variables that must be considered, but sales between 1½ and 3 million board feet seem to be about the best size.

Markets
The market for logs during the time of the sale influences administration. During good market conditions, few problems arise relative to removal and utilization of logs. During a poor market, however, the sale administrator will spend more time on merchantability checks and log removal inspections, especially if sales contain small material or hardwood logs. Even during good markets, hardwood log removal can be one of the most difficult provisions of the contract to administer.

Contractor
Of all the factors that affect type and amount of administration required, the contractor himself is the major factor. Three different types of relations between the administrator and the contractor may be encountered.

The type of relation will be determined by who purchases the timber sale contract. If the sale is purchased by a company or mill and the logging is to be done by a company crew, then the sale administrator will work with a company representative, because the purchaser is also the contractor. If the sale is purchased by a company or mill and the logging is to be subcontracted to an independent operator, the sale administrator may deal directly with the subcontractor, work through a company representative or, most often, work with both the subcontractor and a company representative. If the sale is purchased by an independent operator, the sale administrator will deal only with the operator. Our administrators generally believe that fewer administrative problems arise with a company operation than with subcontractors or independent operators.

Type of Timber
By type of timber, we refer to such things as age and density of the stand and the species composition. Age, for example, may determine how much administration will be needed. We would recognize immediately that the first thinning in a dense 40-year-old stand would require a much more
intensive administrative effort than would a stand-management cut in a mature 80-year-old stand. Of course, the relation of the age of a stand to the type and amount of administration that may be required varies but, generally, we would say that the younger the stand in a partial cutting, the greater the need for intensive administration.

As an example of the effect that species composition might have on sale administration, let us assume that we have two sales identical in every detail, except that one sale contains only hemlock and the other only Douglas-fir. Knowing the characteristics of these two species, we might reasonably assume that more administrative attention would be given to protecting the thin-barked hemlock from mechanical damage than the thick-barked Douglas-fir. But more administrative attention might have to be given to checking the spacing for the Douglas-fir than for the hemlock. Thus, we can see that different standards for different species may have a decided influence on the amount and type of administration that may be required.

Type of Ground

Generally, the steeper and rougher the ground, the greater will be the administrative effort required to accomplish the desired goals of the sale. As we move from flat, benchy ground that can be tractor-logged to the steeper slopes that must be cable-logged, we find that not only does the type of equipment change and the difficulty of logging increase, but the administrative effort required to protect and safeguard the remaining stand must be intensified. Sale administration of an average short-lead-cable partial-cut operation will take just about twice the amount of time that an average tractor partial-cut operation will require to obtain the same results. Long-lead cable and skyline partial cuttings will demand even more administrative time.

Other Factors

Obviously, the number of people and the amount of time available for administration and the number of sales that must be inspected will determine whether administration will be intensive, extensive, or somewhere in between. The type and amount of administration of timber sales by the different public agencies vary considerably, as might be expected. If we assume that the number of personnel remains static from one year to the next, the ratio of partial-cut sales to clearcut sales at any one time will have a considerable effect on the amount and the type of administration. Experienced sale administrators find that partial-cut sales generally will require from three to four times the amount of administrative time that clearcut sales of similar size will require.
THE SALE ADMINISTRATOR

The principal individual responsible for the sale administration is the sale administrator. One man, and only one man, should be designated as the sale administrator. The only exception to this may occur when special project work is involved, such as bridge construction or primary road construction. In this event, both a sale administrator and a project administrator may be necessary, but their responsibilities should be clearly defined and understood, both by them and by the sale contractor. Also, the sale purchaser or contractor should designate only one man to act as the operation representative. Nothing but confusion and frustration result if this practice of assigning one man as sale administrator and one man as the operation representative is not followed.

The sale administrator, preferably one of the crew that was responsible for the sale preparation, should be intimately acquainted with the sale area. He should be familiar with all of the provisions of the sale contract, be able to explain all of the conditions of the contract to the purchaser or contractor, and able to answer any question regarding special requirements. He should have a good understanding of his employer's goals and objectives and be able to interpret the contract provisions as they relate to these goals and objectives.

One of the toughest jobs in the world is to try to tell a logger what he can and can not do. The toughest job in the world is to get the logger to do what you tell him to do without first convincing him that a darn good reason exists for doing it. The sale administrator must understand the reasoning behind the sale requirements and be able to explain them to the logger. He should know about logging methods, logging equipment, and logging terms. Nothing will turn a logger off faster than a "green-horn" trying to tell him what to do. The sale administrator who can't at least talk the loggers' language will end up frustrated and ineffective.

A good administrator must develop a good working relation with the operator. The benefits are well worth the time and effort. A good administrator makes an effort to understand the operator's problems and shows interest by trying to help him with his problems. He gains the confidence of the operator by showing that he knows what he is doing and can fully explain to the operator the reason for doing whatever is required by the contract. He is fair but firm in his dealings with the operator. He is consistent in his dealings with all operators even though he may personally like one operator better than another. Loggers respect a firm administrator as long as they think he is also fair.

A good administrator is available when needed. He does not ignore problems because he considers them relatively unimportant. If the
contractor needs his help or advice, he responds as quickly as possible. To maintain communications with the contractor, he visits the contract area frequently, even if it may only be a short stop on the way to another job.

The good administrator knows the limits of his authority and responsibility, and he knows exactly what he can and can not do. He also knows the proper channels through which to request assistance for areas beyond his authority.

ADMINISTRATIVE PRACTICES

Sale administration should have one prime objective, and that is to work with and assist the sale purchaser in accomplishing the requirements of the sale contract, through practices that will insure the objectives of the sale. This is especially critical for partial-cut sales, because the contract requirements are usually more complex and the contract objectives more difficult to obtain than they are for clearcut sales. The sale administrator, however, can do some things that will make his job easier and his administration more effective.

After the contract has been let, and before any operation, the sale administrator should arrange a meeting with the purchaser and the subcontractor, if any, to go over the timber sale contract, item by item. The administrator should make sure that the purchaser and contractor know any special problems or unique features of the sale and, if necessary, he should make a field inspection with them to examine details on the ground.

The sale administrator should explain thoroughly the reasons for and the objectives of the partial-cut sale program to the contractor and let him know that he, the contractor, is the key to the success of the program. He should work closely with the contractor in preparing a logging plan for the sale area and should double-check to make certain that both he and the contractor give the same interpretation to the items covered by the logging plan. He should encourage the contractor to notify him immediately of any problems that he may encounter, even if it means calling him at home in the evenings. Early notification of a minor problem may eliminate a major problem later.

After the logging starts, the sale administrator should try to visit the sale area every day or two to make sure that the operation gets a good start. After the first week or two, the frequency of inspections will be determined by the number of problems encountered, the complexity of the sale, the experience of the operator, and the amount of time that the sale administrator has available.
Every effort should be made by the sale administrator to develop and retain a number of good contractors for partial-cut sales. The extra time and effort to give the partial-cut operator some special attention is well spent if, in the process, the operator will be encouraged to continue to work on subsequent partial-cut sales.

SPECIAL CONTRACT PROVISIONS FOR PARTIAL-CUT SALES

In preparing contract provisions, we find that the partial-cut sale contract will contain almost all of the requirements found in a clearcut sale contract, plus special provisions that apply only to partial cutting.

Tractor Partial Cuttings

All partial-cut contracts on which tractor yarding is anticipated generally will contain both restrictions that will be enforced and those that may be enforced. For example, the size of the tractor will be limited by specifying the maximum width of the blade and the overall length of the tractor. Usually, for timber 80 years of age and older, we specify that the blade shall not be over 10 feet in width and the overall length of the tractor shall not be over 17 feet. In stands under 80 years of age, we generally require that the blade be not over 8 feet in width and the overall length of the tractor be not more than 16 feet. If excessive damage is noted in the older stands, we may reduce the blade width and tractor length to the standards normally designated for the younger stands.

For both ages of stands, additional restrictions may be required if the operator's activities threaten or cause damage to the soil or reserved trees, over and above that which is considered normal or acceptable. We may limit the number of logs in each yarding turn and the length of logs to a 24-foot maximum. We may require the operator to stop yarding during April and May, to use only those skid trails that are located and approved by the sale administrator, or to stop yarding during wet weather.

Short-Lead Cable Partial-Cutting

Tractor yarding is restricted to slopes not steeper than 40 percent, which means that on slopes of over 40 percent some method of cable yarding must be employed. For short distances, not over 600 feet, the most common yarding equipment on slopes will consist of a mobile yarder with a short tower or boom. The yarding restrictions for this type of operation will usually include measures with which the operator must comply. Chokers shall be of wire rope not greater than 9/16 inch in
diameter. Haul-back cables shall be strung through the sale area so that a minimum of contact is made with the "leave" trees. Landings shall be located so that yarding roads shall be no more than 20 degrees from right angle to the contour, unless otherwise approved by the sale administrator. No yarding of logs shall be done during April and May.

**Skyline Partial Cuttings**

Skyline partial-cut sales are still relatively new, both from the standpoint of layout and administration. The primary objective of this type of sale is to partial-cut long, steep slopes with a minimum of ground and stream disturbance and damage to the residual stand.

For this type of sale, the operator usually has written restrictions. He must use a logging method other than a high-lead or ground-lead system. Approved methods may include a skyline system, a sky-car system, or a similar system that is capable of lifting logs completely off the ground and reach logs a minimum distance of 150 feet on either side of the skyline roads.

The operator must mark skyroads in accordance with certain specifications. For example, skyroads shall be limited to the minimum number and minimum width necessary to transport logs above the ground without unnecessary damage to reserved trees. Never shall the skyroads exceed a specified number unless approved by the sale administrator. Skyroads shall not exceed 30 feet in width as measured between the boles of reserved trees on each side of the skyroad. Also, no felling of skyroad trees shall be done until the marking and the location of the skyroads have been approved by the sale administrator.

**PROBLEMS ENCOUNTERED IN PARTIAL-CUT SALE ADMINISTRATION**

The problems that arise during the administration of a typical partial-cut sale differ considerably from those encountered in an average clearcut sale. With a partial-cut sale, we will generally be more concerned with the residual stand and its protection than with the timber that is being removed.

**Unauthorized Cutting**

Unauthorized cutting is the severance of any tree not designated or marked for removal. We have encountered few instances of intentional cutting of nondesignated trees. Most of the violations have resulted from carelessness on the part of the cutters, lack of proper instructions from the
contractor to his cutters, poorly marked trees that may have been marked with too little paint or the wrong color of paint, or too much time having elapsed between the marking and the selling of a sale.

The sale administrator can reduce the chance of unauthorized cuttings in most instances if he inspects the sale area with the operator before any operations, to insure that the designated trees are readily identifiable and that the operator clearly understands which trees are to be removed. The importance of spending time with the operator before any sale activity cannot be overemphasized.

We recently had a sale where the leave trees were marked and the trees to be taken were unmarked, which was exactly opposite the usual procedure of marking the trees. The sale was purchased by a lumber company and subcontracted to an operator who had worked previously on several partial-cut sales. The subcontractor was not given any special cutting instructions from the purchaser. If the sale administrator had not taken the time to go over the sale area with the subcontractor, the wrong trees undoubtedly would have been felled.

During felling, the sale administrator should spend as much time as possible on the sale area to determine that only the designated trees are cut. Trees marked for removal generally are painted with a stripe across the bole and a spot below stump height. Sometimes the spot on the stump will be missed, and the only way to check the cutting is to inspect the trees before yarding. A marked tree can be matched to its stump, and even though the spot was not marked on the stump, no question will arise about the tree's having been designated for cutting.

The sale administrator should continuously inspect the sale area for unusual holes or openings in the stand. Being familiar with marking procedures, he should be able to spot easily those areas where more trees may have been cut than would be designated normally. If unauthorized cutting is suspected, the ultimate check can be made only by means of a stump count on the area after the felling is completed. An accurate check is possible because each tree to be removed has been counted and recorded. In our experience, however, few checks of this type have been necessary.

**Hangups During Cutting**

Hangups can be one of the toughest problems that the sale administrator of a partial cutting has to deal with. Some cutters will hang up almost every tree they cut, but others will have few problems. Recognizing that hangups can be related to such factors as stand density, topography, and attempting to fell to the lead, the sale administrator
should work as closely as possible with the operator to minimize the problems.

In the sale preparation itself, some consideration can be given to these factors in the process of marking the trees to be removed. For example, marking for the yarding lead is sometimes considered more important than marking for spacing in cable and skyline partial-cut sales simply because of the felling problems. Another practice is to plan the sequence of felling with the operator so that the least possible amount of interference from adjacent trees is experienced.

When hangups do occur, they can be knocked down with other marked trees or sometimes pulled down. They will sometimes have to be knocked down with an unmarked tree, in which event the sale administrator should be contacted for approval.

Because hangups create a safety problem, both the sale administrator and contractor should be aware of Workman's Compensation Board regulations regarding dangerous trees and hangups.

**Removal of all Merchantable Logs**

The sale administrator should make frequent checks to determine that all merchantable logs have been removed from the areas being yarded. This usually is more of a problem during poor market conditions and on recovery-type contracts. Another situation, however, may cause some problems for the administrator. The contractor may be interested in removing all of one type or species of logs at one time and then return later for the balance of the logs. The problem arises in assuring that all of the remaining merchantable logs are removed, especially because the best logs and logs of highest value often are removed first.

The type of logging also has a bearing on the difficulty of administering the merchantability requirement. In a partial-cut area, a tractor operator may return more willingly to a logged-over area to pick up one or two logs than will a cable or skyline operator. The best solution to this problem is to visit the area frequently enough that the operator does not have a chance to move his equipment from one setting to the next until all merchantable logs have been removed from the present setting.

**Damage to Residual Trees**

Residual trees can be damaged because of the type of machinery and equipment operated, the interest and experience of the operator, the topography, the ratio of timber removed to the timber left, and the marking job.
Carelessness and a lack of interest in, or a lack of understanding of, the objectives of partial cutting by the operator probably contribute more than any other factor to the amount of damage that occurs. Although the sale administrator will have little or no control over some of the causes of damage, the development of a close relation with the operator will definitely influence many of the factors. If the sale administrator can do nothing more than give the operator a better understanding of the reasons behind the sale requirements, the operator almost certainly will show more interest in the contract and in what he is doing. In the process, he probably will do a better job with less damage to the residual stand.

**Landings Excessive in Size and Number**

If not closely supervised, the average operator invariably will want to establish landing areas large enough to land a 707 and build enough landings to accommodate the entire 707 fleet.

In partial-cut sales, landings become an extremely important consideration. Every landing in a partial-cut area represents a non-productive area for some years, so every effort should be made to keep the size and number of landings to a minimum. Landings usually are not predetermined by the sale crew, because each contractor may have a different system for operating, and flexibility is oftentimes the key to a good partial-cut operation. Logging contractors are independent and appreciate the opportunity to select their own landing areas, yarding roads, and skid trails, whenever possible.

Some control of landing size must be exercised, however, and the sale administrator is responsible for working toward this end with the contractor. The sale administrator should be familiar with equipment requirements and logging practices so he can determine reasonable sizes and locations for landings for various combinations of equipment and practices.

In tractor-yarding areas, the administrator should encourage the contractor to use existing snag patches and natural openings for his landing areas whenever possible. In cable-yarding areas, road turnouts and natural openings should be used whenever possible because, generally, cable partial cuttings offer less flexibility for selection of yarder landings than tractor partial cuttings.

We asked one of our most experienced sale administrators which one of the above five problems gave him the most trouble. He said that he didn’t have any one specific problem, but that he encountered at least three of the five problems in felling alone! He thought that felling presented more administrative problems than any other operation. He had
seen unauthorized cutting that had resulted from uncertain or incomplete felling instructions, and he had seen hangups and damage to residual trees from careless or indifferent felling practices. This point of view would appear to indicate that maybe more administrative attention to felling could be a key to better total administration on partial-cut sales.

POSSIBLE FUTURE PARTIAL-CUT ADMINISTRATIVE CONSIDERATIONS

One of the most intriguing pastimes in the forestry profession is contemplating the changes that will take place in the next 10 or 20 years. One thing is almost certain. The forester's role as an administrator will bear little resemblance to his present role. He will be much more concerned about such things as water and air quality, recreational opportunities, esthetics, and meeting the public demands for more and greater use of the forested areas than he is now. Many of his activities and responsibilities will relate only casually to growing and harvesting timber.

At the same time, however, we can predict that the demand for wood and wood products almost surely will keep pace with population growth and that the forester will be challenged to meet these demands while satisfying the needs of the recreationist, the hunter and fisherman, the municipal water district, and all of the rest.

The forest land base will continue to shrink and only through intensive management practices and improved technology can the forester hope to meet these new challenges successfully. Clearcutting, as we know it today, will be practiced on fewer acres each year, although it may never disappear completely, and partial cutting in various forms will increase tremendously. As the old-growth stands are harvested, the younger stands will be given more attention, and intermediate cuttings will become the practice of the day. Partial cutting itself, however, will change to meet increasing pressures from many sides, and the administration of partial-cut sales will be a much more sophisticated activity than the type of administration we have today.

Any one man having the background and ability to administer the type of sale that we predict for the future is difficult to imagine. Instead, four or five men, each a specialist in a particular field, might administer each sale. Also, contractors for the partial-cut contracts might become specialists of a sort who operate only on certain types of partial-cuttings. Many of the smaller contractors will be limited by equipment alone to the type of logging they can do.
As sales become even more specialized, equipment requirements and specifications will be made more restrictive, and no one contractor will be able to afford all the equipment necessary to log every type of sale. Only the larger companies, running their own operations or company sides, will be able to maintain the machines and equipment needed to handle the variety of partial-cut practices a few years from now. At least, this is the way I see it.

Whether or not you agree with these predictions, I think you will agree that we are bound to see some interesting and exciting changes in young-growth management and administrative practices in the next 10 years.

QUESTIONS

Audience. We operate on timber sales administered by several agencies. We haven't had problems with the administrators but with the administrator's bosses. Does the State stand behind its administrator's decisions in such items as clean-up, utilization, and landings?

Hunt. I'm not long away from being an administrator. I have appreciated the state system because administrators of a timber sale area do get full backing from their supervisors. On the other hand, I think state administrators feel that if they don't know the answer to an important problem they won't make a decision until they have consulted with the supervisor. So they aren't leaving the supervisor on a limb on one hand or themselves on another. I think administrators are backed by their supervisors.

Audience. How many acres do you partial-cut or thin in a year?

Hunt. Statewide, we remove about 50 million board feet in partial cuttings. About half, or 25 million board feet of this, is from the Coos Bay area. We remove about 10 thousand board feet to the acre, on the average, so we thin about 5,000 acres each year.

Audience. What rotation is the state working on?

Hunt. We have abandoned the concept of rotation as such and, without getting too involved, the site quality of stands and levels of stocking have more influence on our cutting schedule than the age of a stand. For example, if we have a thrifty stand on site 1 or 2 that is 120 years old, we would probably hold that stand longer than we would a stand on site 4 or 3 with poor stocking and 80 or 90 years of age. We
might clearcut in these poorer stands rather than clearcut the better stand. Rotation is a term used less commonly in our department than it was several years ago. We don't have a set rotation. I'd estimate, however, that for our better stocked stands on site 2, the rotation age would be around 120 or 125 years.

Audience. You have an area regulation plan to cut so many acres a year, isn't that right?

Hunt. Yes.
The traditional role of forest management in our economy is challenged on a broad front. Who would have guessed 10 years ago, for example, that a Timber Supply Act would not even be brought up for vote for lack of Congressional support? Recently, the West Virginia State Legislature passed a resolution calling for a ban on clearcutting. The Bureau of Land Management is now proposing to reduce the allowable cut from O&C and Public Domain lands in western Oregon. One explanation for this reduction is public concern for environmental quality.

Proposals to create an Oregon Cascade National Park could have a significant impact upon allowable cuts from National Forests in western Oregon. Urban expansion represents a subtle, but very significant, challenge to the practice of forestry in the Pacific Northwest. For example, in the eastern part of the Olympic Peninsula as much as 200,000 acres of commercial forest land is expected to be converted to urban, agricultural, and recreational uses by the year 2000 (1). That is a 6.5-percent reduction in the commercial forest-land base.

Faced with fewer acres on which to practice timber management, with environmental quality constraints on how we can practice timber management on available acres, and, as always, with limited budgets, we must consider the relative economic efficiencies of alternative forest management programs.

For those of you who can look forward to managing young-growth timber indefinitely, the market prospects look pretty good. After all, with fewer acres, timber products could become more valuable. Investment in young-growth timber could be lucrative, but we do not want to be lulled into thinking we can squander our investments. Whether your goal is to realize maximum profits or maximum physical production, or to grow trees to a certain size, you need to articulate alternatives and to establish economic guidelines for choosing between these alternatives.

Today, I am going to review a number of economic studies which shed light on the subject of how forest managers can realize maximum return on their young-growth management dollars. To structure my comments, I am going to consider the following questions:
1. Which species of forest type should be given top priority in management?
2. Which cutover stands should be regenerated first?
3. How quickly should we construct roads for thinning operations?
4. What would be the economic loss of substituting alternative management systems for clearcutting?
5. How might economic criteria guide correlated forest management?

First, a couple of comments about my remarks. Obviously, from these questions, my treatment of the subject of young-growth management will not be exhaustive. The scope of my remarks is necessarily restricted by the dearth of economic analyses of young-growth management in the Douglas-fir region. Also, I will be considering the questions from a rather narrow economic vantage point. But I do appreciate the fact that forest managers must often base their decisions on noneconomic considerations.

**ECONOMIC GUIDES FOR RANKING FOREST TYPES**

If you were assigned the responsibility of deciding where to invest in intensified forestry, where would you start? This is the question that Marty and Newman (3) had in mind when they set about to screen and rank programs for management intensification for about 96 million acres of commercial forest land in the national forest system. The authors defined intensification to include additional regeneration treatment, weeding and precommercial thinning of young stands, and a series of commercial thinnings preceding the final harvest. Fire and pest protection were presumed to continue at current rates.

I spoke earlier of restricted budgets. Currently, the Forest Service is spending $17 to $18 million annually for reforestation and stand improvement. This amount is “peanuts” according to Marty and Newman. Their study disclosed that if we were willing to accept a 5-percent return on investments in reforestation and stand improvement, Uncle Sam could spend upwards of 20 times the current budget on intensified forestry. If the Budget Bureau’s cutoff point were 7 percent, the Forest Service could still spend $210 million on reforestation and stand improvement.

Well, the Budget Bureau probably won’t give the Forest Service everything it wants, and this leads us back to the question I posed earlier, “Where should we begin intensifying forest management?” We can get some clues by looking at how the various groups of timber types and site classes stack up in the Marty and Newman study. Although they
considered 60 different type and site class groups, I will only discuss those found in the Douglas-fir region (Table 1).

Table 1. Rate of Returns from Intensification of Management (from Marty and Newman, 3).

<table>
<thead>
<tr>
<th>Timber group</th>
<th>Site</th>
<th>Total area</th>
<th>Rate of return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Millions of acres</td>
<td>Percent</td>
</tr>
<tr>
<td>Sitka spruce--hemlock</td>
<td>I</td>
<td>2.14</td>
<td>15.4</td>
</tr>
<tr>
<td>Sitka spruce--hemlock</td>
<td>II</td>
<td>1.61</td>
<td>14.5</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>I</td>
<td>4.16</td>
<td>9.2</td>
</tr>
<tr>
<td>Sitka spruce--hemlock</td>
<td>III</td>
<td>1.26</td>
<td>8.7</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>II</td>
<td>2.79</td>
<td>7.7</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>III</td>
<td>3.87</td>
<td>6.4</td>
</tr>
<tr>
<td>Sitka spruce--hemlock</td>
<td>IV</td>
<td>0.10</td>
<td>6.1</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>IV</td>
<td>2.33</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Incidentally, the Sitka spruce-hemlock sites I and II represented the most lucrative management opportunities for reforestation and stand improvement. Although thinning would be possible, however, the national forest system does not provide any opportunities for reforestation and stand improvement in this timber type group. But I figured that the economic ranking of Sitka spruce-hemlock type relative to Douglas-fir would be of interest to those of you who are responsible for lands that offer management opportunities in both of these type groups.

Besides generating a 7-percent rate of return, investing $210 million in reforestation and stand improvement would increase yields by 347 million cubic feet per year. Even without the Sitka spruce-hemlock types, the rest of the Douglas-fir region would still account for about 67 million cubic feet, or nearly one-fifth of the impact on annual yield of the management opportunities for reforestation and stand improvement delineated by Marty and Newman.

I would like now to switch to another question—the choice between two forest types. Instead of “Where should we begin to intensify forest management?”, however, we will consider the specific question of “Where and when should we convert alder stands to Douglas-fir?” My remarks will be based upon a publication by Yoho, Chappelle, and Schweitzer (10).
In reviewing the highlights of this economic analysis, we should focus upon instances where retention of alder is advisable, because so few instances occur when conversion to Douglas-fir is not economical. Generally speaking, management of red alder is more profitable on poorer sites, in older existing alder stands, and where high conversion costs or low stumpage values, or both, prevail. High interest rates also have a tendency to favor red alder management, simply because the returns from Douglas-fir management are discounted over a greater number of years.

The present age of the red alder stand plays some interesting tricks with regard to the advisability of retaining it. The approach of harvest age for alder has the effect of increasing the economic cost of conversion simply because the major cost of conversion cannot be discounted.

Because annual management costs are insignificant relative to revenues as well as other costs, they have little or no effect upon the decision to convert or retain red alder stands. Likewise, whether or not one intends to thin Douglas-fir stands seems to make no difference.

So much for whether it pays to retain or convert alder stands. Given limited budgets, where should one begin to convert stands? Generalization is always dangerous, but I think one would be on safe ground if he were to start with his middle-age (25-35 years old), high-site alder stands first. Better yet, if you really want to pursue this question, check out a copy of PNW Research Paper 88 (10). This report has a very lucid explanation of the steps in conducting an economic analysis.

ECONOMIC GUIDES FOR DOUGLAS-FIR REFORESTATION

Now, let us consider the question of where and how to regenerate cutover lands. The basis for my remarks is a recently completed economic analysis of reforestation opportunities in southwestern Oregon undertaken by Dennis Teeguarden of the University of California (7).

This study included 180 treatment/site-class conditions. The basic question to be answered was, “Given a limited reforestation budget and a variety of regeneration alternatives, where and how should cutover land be reforested to contribute most to achieving the BLM’s reforestation objective?” A total of 180 treatment/site classes were defined and evaluated in terms of their relative cost effectiveness. Reforestation costs were differentiated on the basis of 15 treatment classes, and 12 site classes delineated the range of benefits from anticipated yield of wood. Variables that distinguished the 15 treatment classes included three kinds of reforestation activities: planting or seeding bare land; planting brush land or grass-covered tracts of land; and interplanting. Whether or not an area
would require postplanting chemical brush control was also a basis for distinguishing treatment classes.

Prospective yields of a particular tract of land were based on: site quality (site classes II, III, and IV); aspect (north and south); and tract size (small, 1 to 19 acres; and large, 20 acres or larger).

Table 2 is a partial ranking of investment opportunities for Douglas-fir reforestation in the Roseburg district in 1966.

Table 2. Partial Ranking of Investment Opportunities for Douglas-Fir Reforestation in the Roseburg District in 1966 (from Teeguarden, 7).

<table>
<thead>
<tr>
<th>Treatment--site class</th>
<th>Area</th>
<th>Benefit-cost ratio$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeding--bare land (class A and B), large tract, site II,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>north aspect</td>
<td>253</td>
<td>10.6</td>
</tr>
<tr>
<td>Planting--bare land (class B), large tract, site II,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>south aspect</td>
<td>69</td>
<td>6.2</td>
</tr>
<tr>
<td>Seeding--bare land (class A and B), small tract, site II,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>north aspect</td>
<td>109</td>
<td>5.9</td>
</tr>
<tr>
<td>Planting--bare land (class B), small tract, site II,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>south aspect</td>
<td>24</td>
<td>5.7</td>
</tr>
<tr>
<td>Interplanting--large tract, site II, north aspect</td>
<td>70</td>
<td>4.7</td>
</tr>
<tr>
<td>Seeding--bare land (class A and B), large tract, site III,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>north aspect</td>
<td>1,155</td>
<td>4.4</td>
</tr>
</tbody>
</table>

$^1$With 3 percent discount.
An interesting sidelight of this study was the development of probabilities of regeneration success. Because of the lack of empirical evidence, "expert opinion" of a panel of ten foresters provided the basis for developing probabilities of success ratios for both natural and artificial regeneration. Yield data were then multiplied by probabilities of regeneration success to obtain expected yields for each regeneration method.

Benefit-cost ratios were initially computed at a 3-percent discount rate. But a subsequent analysis disclosed only minor shifts in rankings with a higher discount rate of 5 percent. Likewise, the rankings of initial plantings and seedlings were the same whether or not one planned to thin. But inasmuch as most of the interplanting benefits can only be captured by intermediate harvesting, interplanting ranks lower if no thinnings are planned.

Because Teeguarden's findings are for very specific situations, his priorities and rankings are unlikely to apply to your situation. If you are interested in developing your own economic ranking of reforestation alternatives, however, I would commend to you his analytical methods.

**DOES ADVANCE ROADING PAY?**

Now, let us consider the question of how quickly to construct roads for managing young-growth stands. The subject of advance roading has received considerable attention during the last decade. Before proceeding, we all should understand what is meant by "accelerated" or "advance" roading. Advance roading is the building of roads at any rate faster than the minimum rate required to harvest the allowable cut from rotation-age and older stands.

Ten years ago, Fedkiw estimated we could increase the annual harvest from the Douglas-fir region by 4 billion board feet by accelerating road construction. Of this added volume, he estimated 1½ billion board feet would come from thinning young-growth stands—the remainder from mortality and prelogging operations in old-growth stands. The question I wish to explore is whether or not it pays to go after the additional 1½ billion board feet of thinnings per year. Or, more specifically, "Will increased revenues from thinnings justify quicker access to young-growth stands?"

To answer this question, the Station initiated a study of advance roading for the Bureau of Land Management of their 50,000-acre Tillamook Resource Area (6). At the time this study was initiated, less than one-half of the permanent road system had been completed—196
miles of a planned system of 500 miles. Even at this stage of development, the road system was already supporting an active thinning program. We knew advance roading could generate additional thinning volume, but didn’t know whether this volume would be enough to compensate for additional road maintenance and interest charges that resulted from constructing roads in advance.

The results of this study were conclusive. Although doubling the current rate of construction would increase thinning yields, the added stumpage revenues would not compensate for additional interest, timber sale administration, and maintenance charges. Investment in advance roading for such a plan could not be justified at any positive discount rate.

The results of this study may seem a bit surprising in light of Fedkiw’s earlier statements regarding advance roading. Results in the Tillamook area agree with those of other studies, however. For example, in a study of advance roading for old-growth management in the Umpqua National Forest, the rate of return to the program that would double the rate of road construction would earn only 3.6 percent rate of return—considerably less than the rate now required of Federal agencies (4).

The Douglas-fir Supply Study considered advance roading for the management of both old-growth and young-growth stands (8). The results of this study also suggest that advance roading is not a particularly lucrative investment alternative. For example, a plan to complete all National Forest roads in Region 6 in 20 rather than 40 years would not earn a positive rate of return. In summary, although advance roading might lead to significant increases in timber output, we have not as yet encountered situations where it would be economically feasible.

SUBSTITUTES FOR CLEARCUTTING—WHAT WOULD THEY COST?

I will touch briefly upon the question of what harvest methods might be substituted for clearcutting. The topic of old-growth cutting methods may not seem relevant to management of young growth, but how we liquidate old growth can affect the way a new stand is managed.

I think we can anticipate more pressure to find substitutes for clearcutting—particularly along heavily traveled highways and access roads. Shelterwood or conversion to tolerant types are two alternative ways to treat old-growth Douglas-fir stands. But given today’s stumpage prices and harvesting methods, accommodation of the public’s whims for more esthetically pleasing forested vistas is obviously (Table 3) not going to come cheaply (5).
Table 3. Present Values of Average Mature Douglas-Fir Stands at a 6-percent Rate under Three Management Alternatives (from Rickard, Hughes, and Newport, 5).

<table>
<thead>
<tr>
<th>Management alternatives</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearcut and regenerate with Douglas-fir</td>
<td>$1,961</td>
</tr>
<tr>
<td>Shelterwood cut and regenerate with Douglas-fir</td>
<td>1,346</td>
</tr>
<tr>
<td>Convert to tolerant type (partial cut)</td>
<td>817</td>
</tr>
</tbody>
</table>

ECONOMIC GUIDES TO CORRELATED FOREST USE

A short while ago Phil Briegleb (2) referred to the many instances where managers try to produce more than one product or service from the lands they manage as “correlated forest use.” I prefer this term because it, more than “multiple use,” connotes a concerted management effort. Our question today is, “How might economic guidelines aid in making decisions when noneconomic values are concerned?”

An economic analysis of investment opportunities for the National Forest in the Douglas-fir region disclosed a wide variation in returns on investment between working circles (9). This analysis covered an intensive forest management program costing $28 million annually. Intensive forestry included stepped-up commercial and precommercial thinning, reduction of regeneration lag, increased mortality and salvage operations, and more roads. An interesting relation developed when we considered how a partial budget might be allocated. The “rules” of capital budgeting dictated spending investment funds on the most efficient working circle, then the second most efficient working circle, and so on, until all available funds were exhausted (in this particular instance the measure of economic efficiency was the contribution to present net worth of investments in intensification practices). As shown in Table 4, one could spend about
Table 4. Economic Analysis of Investment Opportunities for the National Forest in the Douglas-Fir Region (from USDA, Forest Service, 9).

<table>
<thead>
<tr>
<th>Working Circles</th>
<th>Cumulative addition to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intensification</td>
</tr>
<tr>
<td></td>
<td>budget</td>
</tr>
<tr>
<td>South Willamette</td>
<td>6</td>
</tr>
<tr>
<td>North Willamette</td>
<td>13</td>
</tr>
<tr>
<td>Siuslaw</td>
<td>23</td>
</tr>
<tr>
<td>Gifford Pinchot</td>
<td>33</td>
</tr>
<tr>
<td>Umpqua</td>
<td>44</td>
</tr>
<tr>
<td>Mt. Hood</td>
<td>52</td>
</tr>
</tbody>
</table>

One-half of the $28 million on just six of the 16 working circles in the Douglas-fir region and capture better than three-quarters of the additional economic value and additional annual production of timber that would be generated by the expenditure of the total budget of $28 million. These data suggest that areas where nontimber values such as recreation, water, and aesthetics are the greatest will not earn very high returns on investments in timber production. Missing from the "top producers" are the Mount Baker, Snoqualmie, Peninsula, and Quinault Working Circles. These areas have received more attention from recreationists and preservationists than the more economically efficient working circles.

The economic data in Table 4 are much too rough to serve as operational guidelines—at the least, we would have to zone each working circle into timber productivity and environmental quality classes. The data do suggest, however, that correlated forest use could give us more timber without jeopardizing nontimber values. Wherever forestry is practiced, environmental quality considerations may dictate added management costs—for example, more culverts to prevent erosion. But other things being equal, we can best afford these added costs on the most economically productive acres.

I have neglected many important topics pertaining to young-growth management, such as the economics of protection, genetic improvement,
initial spacing, thinning cycles and rotations, alternative levels of growing stock, and fertilization, to name just a few. About all I can say about them is that economists will be dealing with them as soon as biological data become available. But what should a decision-maker do while researchers learn more about the biological and socioeconomic consequences of alternative management systems? I personally believe forest managers should reserve as many options as possible. Why adopt a rigid, inflexible production process that requires, for example, one species, one initial spacing prescription, a single stocking level goal, and a single rotation? Might you not be better off to accept what in the short run might seem to be a lesser gain for a program that would either lessen the chances for large, long-term losses or prevent the sacrifice of possible large gains? Just as an example, let us consider the question of alder-conifer mixtures. Other panelists have discussed the possibility of gains from alder-conifer mixtures in increased yields because of nitrogen fixation and the possible reduction in losses from Poria weirii. These possibilities suggest that forest managers could be overstressing monoculture management. Present management prescriptions might result in long-term losses or the sacrifice of large, long-term gains.

In closing, I would like to make an appeal. Don’t discount the value of economic analyses just because you don’t trust the underlying biological data. Large sums of money have been and will continue to be invested despite poor biological data. Are you not better off equipped with a good economic analysis and poor biological data than with no economic analysis and poor biological data? At least an economic analysis will tell you whether additional data are really needed. For instance, several reviewers were critical of an early draft of the alder conversion analysis. They thought the poor data on alder-Douglas-fir sites limited the study’s value. Well, subsequent analyses disclosed that one could err considerably regarding site before the basic findings of the study were affected significantly.

As I mentioned at the outset, pressures to convert forest land to uses other than timber production are increasing. Intensified forestry on our better acres could make up for acreage losses—provided private and public foresters can attract venture capital. Foresters should not overlook the opportunity to apply economic analysis in their quest for additional dollars.
LITERATURE CITED


QUESTIONS

Audience. Your alder studies concluded that alder sites should be converted to Douglas-fir. Is that right?

Schallau. Well, the study indicated that, in most instances, the landowner should convert to Douglas-fir. But, as I said earlier, this information was not tempered by later information that we received regarding the role of alder in fixation of nitrogen and the *Poria weirii* threat. We probably will be reworking this data. If you have ideas on this we would be more than glad to get proposals. If there are those of you who want to study the report and have questions, please send them to us, because we haven't dropped the subject of alder conversion. Incidentally, we have an expert on the subject in our midst. I don't want to embarrass Dennis Schweitzer, but he is going to be with you throughout this conference and if there are those of you who want to strike up a conversation on alder conversion he is your man.

Audience. On the alternative to clearcutting, it seems to me that shelterwood should not be much more costly than clearcutting.

Schallau. I think that the time lag made the difference. With the shelterwood system, you extend the time over which the stand is harvested. In other words, you incur a "time cost."
MARKING TREES FOR THINNING:
A COMPARISON OF FORESTERS

Alan B. Berg
Professor of Forest Management
School of Forestry
Oregon State University
Corvallis

A FIELD PROBLEM in marking Douglas-fir for thinning was conducted for the second year on two experimental plots in the 500-acre Black Rock Unit of the George T. Gerlinger State Experimental Forest, 3 miles west of Falls City at Black Rock. The stand was 60 years old.

Each participant marked trees for a commercial thinning on ¼ acre of an unthinned control plot and ½ acre of a plot that had been thinned three times. Their instructions were to assume that this marking in the previously thinned stand would be for the last thinning before final harvest at age 70 years, and that two thinnings would be made in the unthinned stand—one thinning now and another about 5 years from now before final harvest at age 70 years.

The exercise provided instruction in marking stands for commercial thinning and demonstrated the wide range of marking that can be performed in a stand. After the marking, the participants discussed reasons for either removing or leaving trees in the stand. In thinning, two factors will influence the growth of the residual stand; the amount of growing stock that is left and the quality of the remaining trees. The key, then, is to leave an adequate number of well-spaced, high-quality trees as growing stock. Thinning guides now applied in the Pacific Northwest have been discussed by Berg (1, 2, 3), Malmberg (4), and Worthington and Staebler (5).

The time required to mark depends upon the age, condition, and density of the stand; the number and volume of trees marked per acre; the topography; whether volume removed will be determined by cruise or scale; and the skill of the marker. Marking can be a tedious and time-consuming task and should not be done for long periods. It should be done during a portion of each day or on alternate days. Published data on time required to mark in Douglas-fir is scanty (2, 5). Table 1 shows data from Worthington and Staebler (5) and from small tests at Black Rock.

1A field trip was conducted at Black Rock as a part of the 1970 short course. The area was discussed in the proceedings of the short course of 1968 (2, p. 139-145).
Table 1. Time Required Per Tree and Per 1000 Fbm to Mark Douglas-fir Stands.

<table>
<thead>
<tr>
<th>Test</th>
<th>Stand age</th>
<th>Area marked in test</th>
<th>Marked per acre</th>
<th>Vol per tree</th>
<th>Marking time per Tree</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>M fbm</td>
<td>Fbm</td>
<td>No.</td>
<td>M fbm</td>
</tr>
<tr>
<td>1</td>
<td>60</td>
<td>18</td>
<td>3,400</td>
<td>188</td>
<td>1.32</td>
<td>7.08</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>27</td>
<td>4,300</td>
<td>159</td>
<td>1.26</td>
<td>8.04</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>40</td>
<td>1,100</td>
<td>28</td>
<td>0.78</td>
<td>28.68</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>84</td>
<td>10,680</td>
<td>124</td>
<td>0.36</td>
<td>2.89</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>180</td>
<td>22,680</td>
<td>126</td>
<td>0.44</td>
<td>3.53</td>
</tr>
</tbody>
</table>

Tests 1, 2, and 3 are from Worthington and Staebler (5); test 4 is in a previously thinned stand at Black Rock; and test 5 is in an unthinned stand at Black Rock.

The data indicate that marking few trees per acre, small volumes per acre, or small trees is expensive. Figure 1 shows that cost of marking each tree is related directly to the number of trees marked per acre.

On the previously thinned stand (Plot 18, Table 2), an average of 82 trees with a volume of 10,650 board feet per acre was marked (Table 3). Averages of 94 trees and 32,050 board feet per acre were left (Table 3).

Figure 1. Effect of number of marked trees per acre upon time required to mark each tree. Points 1, 2, and 3 are from Worthington and Staebler (5); points 4 and 5 are from tests at Black Rock.
Table 2. Basic Data for a Stand Thinned Three Times; Plot 18 (Douglas-fir Only, Site III).

<table>
<thead>
<tr>
<th></th>
<th>Trees</th>
<th>Avg</th>
<th>Basal</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>In.</td>
<td>Sq Ft</td>
<td>Cu Pt</td>
</tr>
<tr>
<td>Stand in 1956</td>
<td>344</td>
<td>10.8</td>
<td>221</td>
<td>7,748</td>
</tr>
<tr>
<td>Removed¹</td>
<td>130</td>
<td>--</td>
<td>93</td>
<td>3,441</td>
</tr>
<tr>
<td>Mortality</td>
<td>38</td>
<td>--</td>
<td>8</td>
<td>289</td>
</tr>
<tr>
<td>Growth</td>
<td>---</td>
<td>--</td>
<td>70</td>
<td>4,517</td>
</tr>
<tr>
<td>Stand in 1969²</td>
<td>176</td>
<td>14.1</td>
<td>190</td>
<td>8,535</td>
</tr>
</tbody>
</table>

¹The first intermediate cutting, a crown thinning, was made in 1956. The stand was cut a second time in 1961 and a third in 1965.
³Scribner log rule.

Table 3. Results of Marking in Previously Thinned Stand, Plot 18.

<table>
<thead>
<tr>
<th>Foresters</th>
<th>Trees</th>
<th>Basal area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Range</td>
<td>Avg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sq ft</td>
<td>Sq ft</td>
</tr>
</tbody>
</table>

TREES PER ACRE MARKED TO CUT

Private 13 58-114 82 36-116 59 6,710-21,800 11,500
Public 37 46-102 82 29-83 54 4,900-17,440 10,345
All 50 46-114 82 29-116 55 4,900-21,800 10,650
Berg 1 --- 84 --- 55 --- 10,390

TREES PER ACRE TO BE LEFT AFTER THINNING

Private 13 62-118 94 75-155 132 20,900-35,990 31,200
Public 37 74-130 94 108-162 137 25,260-37,800 32,355
All 50 62-130 94 75-162 136 20,900-37,800 32,050
Berg 1 --- 92 --- 136 --- 32,310

¹Scribner log rule.
The range of 62 to 130 trees per acre left by the participants is considerable, however, and illustrates the diversity of opinions among foresters as to the stocking necessary for adequate growth.

On the unthinned stand (Plot 19, Table 4), averages of 156 trees and 20,070 board feet per acre were marked (Table 5); 129 trees and 35,805 board feet remained. With a second thinning scheduled for this plot, excess growing stock could be left at this time.

Table 4. Basic Data for Unthinned Control, Plot 19 (Douglas-fir Only, Site III).

<table>
<thead>
<tr>
<th>Trees</th>
<th>Avg dbh</th>
<th>Basal area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand in 1956:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>In.</td>
<td>Sq ft</td>
<td>Cu ft</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Stand in 1956</td>
<td>391</td>
<td>10.0</td>
<td>215</td>
</tr>
<tr>
<td>Mortality</td>
<td>106</td>
<td>---</td>
<td>23</td>
</tr>
<tr>
<td>Growth</td>
<td>---</td>
<td>---</td>
<td>64</td>
</tr>
<tr>
<td>Stand in 1969¹</td>
<td>285</td>
<td>12.8</td>
<td>256</td>
</tr>
</tbody>
</table>

¹Volumes calculated using 1967 dendrometer volume table projected to 1969.
²Scribner log rule.

Table 5. Results of Marking in Unthinned Control, Plot 19.

<table>
<thead>
<tr>
<th>Foresters</th>
<th>Trees</th>
<th>Basal area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>No.</td>
<td>Range</td>
<td>Avg</td>
</tr>
<tr>
<td>MARKED TO BE CUT PER ACRE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>13</td>
<td>84-187</td>
<td>160</td>
</tr>
<tr>
<td>Public</td>
<td>37</td>
<td>100-216</td>
<td>152</td>
</tr>
<tr>
<td>All</td>
<td>50</td>
<td>84-216</td>
<td>156</td>
</tr>
<tr>
<td>Berg</td>
<td>1</td>
<td>---</td>
<td>180</td>
</tr>
</tbody>
</table>

TO BE LEFT AFTER THINNING

<table>
<thead>
<tr>
<th>Foresters</th>
<th>Trees</th>
<th>Basal area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>No.</td>
<td>Range</td>
<td>Avg</td>
</tr>
<tr>
<td>Private</td>
<td>13</td>
<td>98-201</td>
<td>125</td>
</tr>
<tr>
<td>Public</td>
<td>37</td>
<td>69-185</td>
<td>133</td>
</tr>
<tr>
<td>All</td>
<td>50</td>
<td>69-201</td>
<td>129</td>
</tr>
<tr>
<td>Berg</td>
<td>1</td>
<td>---</td>
<td>105</td>
</tr>
</tbody>
</table>

¹Scribner log rule.
As in 1969, two factors cloud the results. First, we don't know how much experience each participant has had in marking. I have found that beginners mark fewer trees for removal than markers who have been at the game for some time. Second, the attitude of each marker at the time of the exercise and the effort that each participant expended in choosing trees to take or leave cannot be evaluated.

The exercise showed that a marker has choices in selecting trees and that he has more choices in an unthinned stand than in one previously thinned. Also, in an unthinned stand, the trees are more likely to "mark themselves"—the stand is easier to mark.

The results of my marking are presented as an illustration of what one forester with considerable experience in marking stands to various densities will do (Tables 3, 5). I intend it not as the final word or the "only way" to mark. For instance, although I am satisfied with my marking of the unthinned stand, I believe I should have marked more trees to remove in the previously thinned stand.

Figures 2, 3, and 4 show the range of number of trees, basal area, and board-foot volume marked by the participants in 1970. Each participant can rate his marking against that of the group.

Figures 5, 6, and 7 show the range of number of trees, basal area, and board-foot volume marked by participants in both 1969 and 1970. A total of 114 foresters, 51 employed by private companies and 63 by public agencies, are represented. In these tests, foresters employed by public...
agencies were inclined, on the average, to remove more growing stock in thinning than were removed by those employed by private companies.

On the basis of research results, I judge that between 70 and 80 trees per acre and about 100 square feet of basal area would be most desirable as growing stock on Plot 18 after this thinning. Because of the dense stocking in the unthinned stand and because a second thinning is scheduled soon, more growing stock can be retained in Plot 19.

On the whole, foresters tend to be cautious and mark fewer trees for removal than would be beneficial. I believe that those participants who marked for removal fewer than 120 trees on Plot 19 and fewer than 80 trees on Plot 18 were not marking heavily enough.

LITERATURE CITED


Figure 4. Board-foot volume, Scribner log rule, marked in 1970 in marking problem at Black Rock: fourth thinning in Plot 18(A) and first thinning in Plot 19(B).
Figure 5. Number of trees marked in 1969 and 1970 in marking problems at Black Rock: fourth thinning in Plot 18(A) and first thinning in unthinned Plot 19(B).

Figure 6. Basal area worked in 1969 and 1970 in marking problems at Black Rock: fourth thinning in Plot 18(A) and first thinning in unthinned Plot 19(B).

Figure 7. Board-foot volume, Scribner log rule, marked in 1969 and 1970 in marking problems at Black Rock: fourth thinning in Plot 18(A) and first thinning in unthinned Plot 19(B).


Field Trip
Silver Falls Tract Commercial Thinning Program
Silver Falls Unit
LONGVIEW FIBRE COMPANY

Host
Richard Stonex
Tree Farm Manager

This 35-year-old forest is predominantly Douglas-fir, with some western hemlock and noble fir at higher elevations (Figure 1). A large part of the forest was burned by wildfire in 1929. The site quality varies from low III to low II. Elevations range from 1,500 to 4,500 feet. The forest is divided, generally, into two stands, merchantable and nonmerchantable (Table 1).

To provide access for management, the company is improving existing roads and constructing about 10 miles of new road each year (Figure 2). The cost of a one-lane road with turnouts and ballast is about $8,000 per mile.

Table 1. Volume Per Acre in Two 35-Year-Old Stands, One Merchantable, the Other Nonmerchantable, on the Silver Falls Tract of Longview Fibre Company.

<table>
<thead>
<tr>
<th>Item</th>
<th>Merchantable stand</th>
<th>Nonmerchantable stand</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF TREES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merchantable</td>
<td>100-160</td>
<td>125-140</td>
</tr>
<tr>
<td>Total</td>
<td>160-380</td>
<td>360-860</td>
</tr>
<tr>
<td>BASAL AREA, sq ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before thinning</td>
<td>220-260</td>
<td>240-300</td>
</tr>
<tr>
<td>After thinning</td>
<td>140-160</td>
<td>-----</td>
</tr>
<tr>
<td>VOLUME, fbm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before thinning</td>
<td>15,000-22,000</td>
<td>6,500-8,000</td>
</tr>
<tr>
<td>Average removed</td>
<td>4,500</td>
<td>-----</td>
</tr>
</tbody>
</table>
Two contractors are employed. One contractor has an HD6 tractor, two John Deere skidders, and a Bantam loader. The other contractor has a D4 tractor and a Franklin skidder. Together, the two contractors remove seven loads of logs each day. The minimum merchantable log is 6 inches in diameter and 12 feet long. Logging cost is $47.50 per M fbm delivered to the Silverton Market Area (Table 2).

Table 2. Logging Costs Per M Fbm in the Silverton Marketing Area.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felling and bucking</td>
<td>12.00</td>
</tr>
<tr>
<td>Yarding</td>
<td>18.00</td>
</tr>
<tr>
<td>Loading</td>
<td>7.00</td>
</tr>
<tr>
<td>Hauling 25 miles</td>
<td>10.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47.50</strong></td>
</tr>
</tbody>
</table>
Figure 2. Spur road developed for thinning in 35-year-old Douglas-fir, Silver Falls Tract, Longview Fibre Company.
DISCUSSION

Stonex. On this tree farm, we have 30,000 acres that were railroad logged by the Silver Falls Logging Company, and most of the area has burned over at one time or another; some of it burned two and three times. Most of the area is well stocked. About 12,000 acres is thinnable now. In the younger age classes that are dense, we thin precommercially. The trees at this location (Figure 1) are about 32 or 33 years old and a low site II by King’s tables. Higher elevations drop to a low site III. This area averages about 20,000 fbm to the acre.

Some of the land on the tree farm is restocked about like the area we are clearcutting down the road (Figure 2). That’s one of the worst areas, with only 5,000 to 6,000 board feet to the acre. The area was mostly vine maple. So our solution here is to harvest what we can, scarify, and plant next fall. We may do some burning, but the area is so full of old logs that we may have fire hanging in the old windfalls for a long time.

We salvage some wood logs from the windfalls, which we take to Crown Zellerbach at Canby. Most of this material is too decayed, however, because the logs have been on the ground for 40 years. This area was logged in the early 1930’s. The logs are yarded with rubber-tired skidders and loaded with a small Bantam loader.

We are leaving a basal area after thinning of between 120 and 160 square feet. We’re cutting about 4,000 board feet to the acre. We hope to be back in 5 or 6 years to thin again.

The area is predominantly Douglas-fir with a scattering of hemlock. More western hemlock occurs at this location than on the average over the area. With higher elevation, more western hemlock and noble fir are present. Small Douglas-fir logs are not difficult to sell, but small hemlock logs are. We are searching now for another market.

A slope of 35 percent, for instance the area below the road, is the steepest that we thin with tractors. On steeper slopes the cat must go around, they can’t back up.

Audience. Will you scarify in here?

Stonex. Not here. We do have some areas that we will scarify in the future, but nothing this year. Most of this area is medium stocked, so that not much needs to be scarified. We have several small areas of 15 or 20 acres that need to be scarified and restocked. We will drive through 250 acres that is poorly stocked and covered with brush. We are clearcutting this area now and will scarify and reforest immediately.

Audience. What is the age of this stand?
Stonex. We have counted from 29 to 31 rings on the stumps in here. Occasionally, we find a tree that is a year or two older.

Audience. What are your logging costs?

Stonex. The logging costs $30 at roadside, $7 for loading, and $10.50 for hauling costs to Silverton, so the total cost is $47.50. That’s on a short-log scale, by the way. We sell the logs by weight. If you’ve ever tried to scale a load of small logs like these, you know the problems. The scale is mostly a guess. We use a weight factor based on short logs—13 pounds per board foot.

Audience. Does the factor vary with location on the forest?

Stonex. Yes. You may have noticed that one deck along the road was cut into short logs. We will test-scale two or three loads from that deck. We test-scale to make sure the factor is the same. Two loads test-scaled recently averaged 12½ pounds per board foot and just under 12 pounds per board foot. The logs from the clearcutting are heavier. The logs from the open area above the road were heavy with sapwood and have a different factor.

Audience. Is the agreement between you and the logger?

Stonex. No. The factor, the scale, and the price per thousand is an agreement between the mill and Longview Fibre Company. The logger is involved, of course.

Audience. Then, the timber sale is to the mill?

Stonex. No. The agreement isn’t a sale as such. We market the logs using the factor. If for some reason we believe the factor has changed, we test-scale to develop a new factor. Both the mill and Longview must agree to the change.

Audience. What are your marking rules?

Stonex. Basically, we mark to remove trees with snowbreak and to provide spacing. The whole forest is susceptible to snowbreak. The elevation is about 2,200 feet here, and snowbreak is not too bad. This winter, the loggers worked all winter here—in fact, they didn’t lose a day until the 27th of April when one logger shut down 2 days because of snow. At 2,000 foot elevation, the snow will come and go, with shutdowns only during exceptional years. At about 2,500 feet elevation, however, the loggers were shut down for a month last winter because of snow.

Audience. What is the volume per acre removed?

Stonex. About 4,000 fbm.

Audience. Do you discriminate against hemlock?

Stonex. We haven’t, because we’ve been able to market it. If we lose the market, we will leave the hemlock and hope to take it out in the next
thinning. If we must sell it for pulp, we can barely pay for the cost of logging.

Audience. How do the diameters of the trees cut compare to the diameters of trees left?

Stonex. Smaller. We take some dominants that have heavy snowbreak. Until now, foresters have marked all trees to be removed, but next winter I plan to change to faller marking. These fallers have been working here for over a year, and they know what I’m going to mark as well as I do. In the first thinning, 80 percent of the trees that need to come out are obvious; the other 20 percent need a certain amount of judgment. The average load is about 70 pieces and two operators log about seven loads a day. That’s a lot of trees to mark, and marking is time-consuming. We hope that by next year the fallers will have enough experience that they can mark. We’ll sample mark and work with them, but they’ll do all the marking here.

Audience. Is this for the first thinning? What do you think you might do in the second thinning?

Stonex. We’ll do the marking for the second thinning. At that time, we’ll be removing a higher quality log. The logs now are No. 3 saw logs. We do not sell to small plywood mills. Small plywood mills in the Mehama area use that type of log, but they want a little bigger log. The second thinning will produce this type of log with higher dollar values. Finding poles and piling in here is difficult, because so many trees have old snow breaks and spike knots in them.

Audience. What is your smallest log?

Stonex. A 6-inch diameter, 12-foot length is the smallest log we take. We remove 5-inch logs if we can cut them 16 or 32 feet, because the 16-foot length is a good item for the mills. Rather than cut a log, say, at 26 feet and a 6-inch diameter, we go down to a 5-inch diameter and 32 feet. The mill can still get a stud out of a 5-inch log.

Audience. What price are you getting?

Stonex. $69 per M fbm.

Audience. What is your average log diameter?

Stonex. Average log diameter for a 16-foot log? As a guess, about 9 inches.

Audience. What is the weight factor for logs of different sizes?

Stonex. I can’t answer that. The logs range from 6 to 17 inches, and we haven’t tried to segregate the factor by size at all.

Audience. Will weight change from area to area?

Stonex. Yes.

Audience. Do you adjust the factor from winter to summer?
Stonex. No. We’ve used the weight factor since last summer and through the winter. The mill probably was buying a little snow and mud from us, occasionally. But not enough that I think it made much difference. We developed the factor at 3,000 feet elevation. We’ve checked it at 2,000 feet, and so far haven’t found much variation. We found variation in some of the heavy snowbreak areas from the winter before. When the tops were well broken out, the sap didn’t come up in those trees and they were lighter. In the clearcut area, the heavy-tapered grousy trees ran a little heavier in weight.

Audience. What’s the manpower in this operation?

Stonex. One operator in this thinning runs two skidders, a cat, and two fellers, so that’s five men including himself. He punches the road with an HD-6. The man who loads also has his own truck. He loads two trucks, and each hauls three loads a day. He loads his truck sometime during the day and takes a load in at night. The other operator has a three-man operation with a cat, a skidder, and a faller.

Audience. Eight men get seven loads a day, then?


Audience. Then you are logging long logs?

Stonex. The loggers remove long logs. We ship long logs, but sell them as short logs. We are paid on a short-log basis. One of the most costly items is falling—really, limbing. Studies last summer showed that the falling cost was about $12 a thousand.

Audience. Limbing, or getting the trees on the ground?

Stonex. We have very few hang-ups. The limbing is the time-consuming operation. The fellers limb each tree as best they can, but even so the skidder operator must stop before they get to the deck and remove more limbs. Sometimes the loader operator still must fight limbs. The most costly item is removing limbs.

Audience. How many logs per tree?

Stonex. Three 16-foot logs at best.

Audience. Little damage shows up in here. Do the operators cooperate well?

Stonex. They’re both fine operators. One operator is particularly skilled. The other operator has been thinning for only a year. He has some things to learn, but he’s coming along well. We try not to thin at this time of the year because of damage. The loggers work on clearcuttings or cutting rights-of-way. The soil is stable here and erosion is no problem. Late last fall, we did get some erosion on 40-percent slopes, so we stopped logging. The rock mixed in this soil prevents damage during wet weather. This area was logged in January during heavy rains.
Audience. How decayed are the old-growth logs that have been lying in the brush?

Stonex. Too decayed to make chips. Chip buyers are paying $17.00 a unit for chips in the Roseburg area and $30.00 here, so they're more selective here. They take anything but rot, and, in our material, more rot shows up. I was in Roseburg Monday and looked at the material there. Most of that rot is a sounder rot and they can still get a chip out of it, but ours explodes when it hits the chipper and the buyers don't want it. Everything else they'll take. I think the price differential has a bearing on it. I noticed that they were getting full scale on practically everything in Roseburg. Much of the area was logged 10 or 12 years ago, but the logs here have been on the ground about 40 years. The original timber in this area was of lower quality, and rough.

Audience. What scale are you getting on these old logs?

Stonex. The gross scale is deducted about 20 percent. We're not recovering enough money from these logs to fool with, but we're getting them off the ground. The logger gets most of the money. Removing the old logs will make scarifying much less expensive.

Audience. Are snags a problem too?

Stonex. Very few snags. We already cut nearly all of the snags—so, only an occasional one is still present.

Audience. How will you handle the slash in the clearcut area before planting?

Stonex. We will windrow the slash in some of the area and in other parts we will spread it enough to be able to plant trees. We will also spray the vine maple in 3 or 4 years, because I think it will sprout and compete with the planted trees.

Audience. What are your scarification costs?

Stonex. About $29.00 an acre.
Field Trip
WILLAMETTE NATIONAL FOREST
Detroit Ranger District

Hosts
Curley Behrens, Head Timber Sale Officer
Gale Larson, Timber Management Staff
Ed Whitmore, Recreation and Lands Staff

FISHER POINT INTERMEDIATE SKYLINE THINNING

The Fisher Point intermediate skyline thinning is located along the south side of the North Santiam River and North Santiam highway between Lynx Creek and the Parrish Lake road. The area is classified as a landscape management background. The 150-year-old stand was composed of 75 percent Douglas-fir, 15 percent white pine, and 10 percent western hemlock and other species (Figure 1). The volume per acre was 40 M fbm. Volume per acre removed was 12 M fbm.

The sale required 3.3 miles of road with a total cost of $61,310 (Figure 2). Logging, yarding, and loading costs were $32.74 per M fbm. Hauling cost was $21.03 per M fbm. The area was logged with a Bantam machine (Figure 3) with a gravity carriage and a maximum yarding distance of 600 feet. Logging was uphill from the river to the road.

The objectives of management were to remove dead and dying white pine and other species, suppressed Douglas-fir and western hemlock and the few remaining old-growth Douglas-fir, to construct a road for future management, and to provide an attractive background as seen from the highway.

DISCUSSION

This is the Fisher Point intermediate sale and it’s about completed. The operators are now cleaning up. The road cost us about $105,000 and the volume of the timber removed was 3,600,000 fbm, so the road cost was about $25.00 a thousand fbm. The stand is about 150 years old; volume per acre of the original stand was about 40,000 per acre and we removed about 12,000 per acre. Are there any questions?

Is the foreground zone from this road down to the river?

This is not foreground here; this is all background. Foreground is the immediate zone along a highway or main travel routes, where the public see individual tree stems. This is a landscape management background.
Figure 1. Douglas-fir stand, 150 years of age, after removal of 12 M fbm per acre by skyline thinning. The residual stand contains 28 M fbm per acre at Fisher Point, Detroit Ranger District, Willamette National Forest. The North Santiam Highway is below the cutting.
Figure 2. Road developed for timber removal in Fisher Point Intermediate skyline thinning, Detroit Ranger District, Willamette National Forest.
Then the old growth eventually will be harvested in the background zone, right?

Yes. We'll probably use partial cutting through the rotation.

You will regenerate before final harvest?

Right. We will not clearcut this area.

The machine that you see costs about $85,000. It's here on trial. The machine originally used here was not heavy enough to log the timber efficiently; it had one breakdown after another. That machine cost us $45,000. The one up above is a Lake belt speeder that has been modified to hold more cable than a regular loading machine.

How far will the equipment reach?

The machine has 1,000 feet of cable.

Can he reach that far?

I don't know. He hasn't any distances that far on the sale. The longest distance here is 800 feet.

Were any large logs removed?

Yes, some old growth was removed, with the small machine. The small machine could not handle large logs effectively, however. They had to buck the old growth into 17-foot lengths to yard them, and some of the old growth had to be bucked into 8-foot logs to get them out.
Did you require that a carriage be used?
Yes, one end of the log must be suspended from the ground. When you get back to the highway, look back and you will see very little impact on the area from logging. It is not noticeable.

We will discuss landscape management at the lunch stop.
What kind of a road system will you develop for this type of logging?
We will build another road above this one. This sale was laid out for uphill yarding only, because we didn’t have a machine that would log downhill in thinning. Now, we do have a machine—one is operating at Sweet Home—that yards a thousand feet up and a thousand feet down. It costs about $50,000. Skagit builds it for about $100,000, but the loggers made their own machine. All they got from Skagit was the tower. In the future, we will build our roads 2,000 feet apart. On this area, however, another road will be put about 1,000 feet up the hill.

How much damage is there in the stand from logging?
Negligible. We have marked perhaps 50 or 60 damaged trees.

Are the standards too high for this road?
I am glad you brought that up. We have been criticized on this road and we agree that the standards are too high. The road dead ends about 2 miles from here with no plans to extend it. The purchaser designed this road and he might have had a tendency to overdesign it because they were getting paid on his figures. This would increase the cost of the road.

What was the volume removed?
About 12 M fbm per acre. The original stand was 40 M fbm.

Could you have taken more?
I think we should have removed 30 percent of the basal area instead of the 15 or 20 percent that we did take. We have had comments both ways on this. Some foresters believe that the stand looks too thin and the cut was too heavy. Other foresters say we should have cut more heavily. I believe we should have cut a little more heavily.

What are your future plans for this stand?
We should be back in here in another 15 years.

When will you clearcut?
I don’t think we will clearcut in here.

In other words, this is a first cut in an eventual removal of the stand?
It wasn’t intended as a thinning; it was a first partial cut in removing the stand?

In the immediate area, yes. We removed the white pine, the suppressed and intermediate Douglas-fir, the dead and down trees.

You will remove the stand in three cuts?
Yes.
Will you get regeneration?
I think we will.
Douglas-fir?
Yes.
Regeneration is beginning in a few small openings.
Actually, I wouldn't care whether Douglas-fir or hemlock or some other species was established. A tree will be a tree in the future regardless of species. We will be growing chips, won't we?

WHITewater Intermediate landscape management unit

The Whitewater intermediate landscape management unit is located along both sides of the North Santiam highway from Whitewater creek to the Pamela Creek road and is classified as both landscape management foreground and background. The stand was 150 years and more in age and average diameter was 12.7 inches. An average of 8 M fbm per acre was removed.

The sale required 0.1 mile of mainline road and 1 mile of spur road. Logging and hauling costs were $39.07 per M fbm.

The objectives of foreground management were to maintain and enhance the esthetic values of the forest adjacent to the highway by creating scallops along the right-of-way to vary the view for travelers and to keep a thrifty stand by removing diseased and dying white pine and suppressed trees.

The objective of background management was to maintain and develop a thrifty, attractive forest, esthetically pleasing to highway travelers, by removing diseased and dying white pine, suppressed and intermediate trees that will die within 10 years, and all overmature old growth.

The slash along the highway will be hand piled and burned by the Forest Service at a cost of about $4000.

DiscussiOn

Foreground is immediately adjacent to a highway. The distance it extends back from the highway depends on how far you can see individual trees; from there on, it is background. The objective of management in the foreground is confusing to some. The objective is not to produce wood; it is to maintain or improve the esthetic qualities in the foreground. Sometimes good timber management is in conflict with foreground management, but the foreground objective has priority. In this particular
stand, the two objectives are compatible because this is a young-growth stand. We tried scalloping along the edge of the highway to break up the tunnel effect here. It was our first attempt at scalloping and we were too cautious. Next time, we will probably make larger scallops, to create areas for younger trees and even vine maple just to increase the esthetic qualities along the highway.

*What do you mean by scalloping?*

Scalloping is creating an unevenness in the timber edge along the highway. Pockets are cut to break up the tunnel effect that two straight edges of a forest give and also to establish areas where vegetation other than trees can grow.

*Is this done before or after a right-of-way is established?*

Either way, depending on circumstances. We don't want to completely eliminate tunnel effect, so we scallop along certain distances only.

The sale above Marion Forks has some old-growth Douglas-fir. It is also in a proposed campground area. We will remove the old-growth Douglas-fir in the area to be occupied, but on a bench by the river that has a good stand of old-growth Douglas-fir, we will only sanitize and retain the good old growth for as long as we can.

Other than removing trees in scalloping here, we removed the white pine, defective trees, and the very suppressed trees in this area.

*What's your practice on the slash?*

This is a Forest Service crew working here clearing slash. We collected $1.91 per M fbm to do this work— all hand work. Adjacent to the highway the tops were yarded to the landing.

*What is adjacent? What distance? How far would you have to do that?*

It depends on the stand, but it would be about 200 feet average.

*What do you do with breaks and long butts? Are they yarded out or left in the woods?*

They are yarded out.

*What is the cost per acre?*

This usually costs about $85 an acre.

*Why did you remove all the white pine?*

The pine is dying from blister rust.

Two circumstances allow us to clearcut in the foreground. One is when we are trying to create a viewpoint. For instance, we inventoried the Breitenbush road and Highway 22, from a helicopter just above the tree tops, looking for views of Mt. Jefferson and Three-Finger Jack from the road. If we find one, we can clearcut a small area to open up the view.
Now, only two views of Mt. Jefferson can be seen from the highway. The other circumstance would be when an area of timber was so decadent that we wouldn’t be able to hold the cover. We can then clearcut up to 2 acres at a time. We must comply with the objectives of foreground management or we can’t make a timber sale.

Do you have a given width for a foreground zone?

No, we don’t. Generally, it is from 200 to 400 feet from the highway, but it can vary. With a high cut bank, the foreground is almost to the highway. If it is a downslope from the highway, the foreground may extend 300 or 400 feet. It depends on how well the public can see into the area. I think that as we thin we will push the foreground strip back because the public will see further into the stand; the foreground strip will be wider then.

After you have logged in the background, the foreground can be moved back only so far?

Yes. This is why we don’t set a designated width to the foreground. If we establish the foreground distance as 200 feet so that we can clearcut in the background and then thin in the foreground, the strip of timber might as well not be there.

They you haven’t limited yourself to shelterwood or regeneration cut on these backgrounds?

No, we haven’t. We can clearcut in the background as long as the clearcutting looks like a snowslide or some natural opening rather than a square unit. This is called landscape pattern cutting.

I might read the foreground and background descriptions from the Management Direction for Wilderness and Primary Recreation Zones in the Oregon Cascades. “The foreground or nearview area consists of the immediately adjacent strip of land that is viewed directly and at close range. In this area, the viewer’s sight is directed at separate items. He is able to observe details of soil or plant cover and readily see variation from the natural. Foreground will vary in width depending on topography and plant cover. The background or the distant view area consists of that area beyond the foreground needed to provide an attractive backdrop. It is that portion of the zone where the view of the forest is directed to landscape or the forest as a whole rather than at individual trees. The background will vary in width depending on topography and on the need of a backdrop as a component of the scenery.”

How much of the forest is covered by this rule?

Landscape management zones have an allowable cut, not including wilderness areas. We cut 90 million feet in regular timber harvest allowable
cut and we have an 8½ million foot additional landscape management cut, so that is about 10 percent.

*How much area would that be?*

I don’t know. Probably close to 10 percent.

*Are you restricted to highways and main road areas?*

No, also recreation streams and trails. Some of our main roads to the wilderness boundary, such as the Marion Creek road and the Whitewater road, also are classified as landscape management unit foregrounds. If we can’t maintain the esthetics, we can’t log—until we have a logging method that we can do it with. Skyline logging is helping us to maintain the esthetic values.

*That is final?*

Yes. In mountainous country, it will have to be some type of skyline or a short high-lead.

*Can you build roads through your background zones?*

Yes.

*How far back is “background” here? The top of the ridge?*

Well, that depends. For instance, you can see Fischer Point Ridge from the highway, so the background extends to the top of the ridge. I don’t know how many of you noticed Bruno Mountain, but the part that you can see from the highway is classified as background.

*How far away is Bruno Mountain?*

It is about 2 or 3 miles to the top. Also, the entire area on the opposite side of Detroit reservoir from the highway is background.

*How about the clearcutting that you had on the other side of the reservoir last year?*

Well, we do have one there with soil showing. We also have a clearcutting that is just a little the other side of that and it’s bad. What we might do, even if we don’t own the land in the background, is to scallop our land adjacent to the clearcutting to break it up. This situation occurs quite often. For instance, a section of private land was clearcut and we are now thinking of logging on our land and frilling the edge of the private clearcutting.

*I didn’t think that clearcutting looked too bad this year.*

It isn’t very noticeable, is it? And we haven’t had any comments.

*Is this area a bid or a negotiated sale?*

It’s a bid sale.

*What stumpage price did you get?*

We got $86 for the Douglas-fir on this sale. Very few purchases are of road credits on it, too; most of the $86 is stumpage.
You must have sold this on a good market.

Yes, we did.

Do you have any idea what the difference in stumpage price would be between this kind of an operation and a clearcut?

Stumpage is based on logging cost. We have a subtotal on logging cost of $39.70. Probably in a clearcut that would be less, wouldn't it? Normal skidding is about 6 or 7 dollars. We have $14.15 for this sale—that would be the big difference. Perhaps add 50 cents for the falling, bucking. The rest would be just about the same. Your bid would be a little higher here.

Did you give us volume per acre cut?

Yes—8 M fbm per acre cut.
Field Trip
Little Rock Creek Thinning
North Santiam Timber Management Area
Salem District
BUREAU OF LAND MANAGEMENT

Host
Thomas H. Makey
Timber Manager

The sale area is on Little Rock Creek north of the Monument Peak Road in the North Santiam Valley near Gates, Oregon.

The thinning was in a thrifty, 70-year-old Douglas-fir stand with scattered hardwoods, western hemlock, and western redcedar and an overstory of old-growth Douglas-fir (Figure 1). Site index is 160 by standards of Bulletin 201, with average height of the stand 135 feet. Total basal area was 270 square feet per acre (normal basal area is 248 square feet by Bulletin 201). About 37 percent of the basal area was removed in thinning. Table 1 lists the area in the sale and the volumes removed.

The sale was purchased by Freres Lumber Company. Logging was subcontracted for $30.00 per M fbm plus hauling. A BLM Class IV road, 8,435 feet long with a 9-inch base of 2-inch-minus crushed rock, was built. Special loading equipment was required to load the large old-growth logs.

Table 1. Areas Logged and Volumes of Douglas-fir Removed from Little Rock Creek Thinning.1

<table>
<thead>
<tr>
<th>Area</th>
<th>Old growth</th>
<th>Young growth</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>M fbm</td>
<td>M fbm</td>
</tr>
<tr>
<td>Road</td>
<td>19</td>
<td>15</td>
<td>824</td>
</tr>
<tr>
<td>Thinned</td>
<td>151</td>
<td>495</td>
<td>1,368</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>510</td>
<td>2,192</td>
</tr>
</tbody>
</table>

1Cruising standards: 16-foot logs to a top diameter of 5 inches or 40 percent of DBH. Smallest tree cruised was 7 inches DBH.
FIGURE 1. A thinning, by the Bureau of Land Management, along Monument Peak Road in Linn County. The Douglas-fir stand is 70 years old with 170 square feet of basal area left.
No skidroads were laid out for the sale. Because damage to leave trees was light, no additional trees were marked for removal during logging.

The objectives of the thinning were to accelerate growth on the leave trees and to salvage present and potential mortality. Another light thinning is anticipated in 10 to 15 years depending upon the response of the stand to the present thinning. The stand is expected to regain full stocking before final harvest.

**DISCUSSION**

This is an active sale and the operator is not through logging. He will finish later this fall.

The Bureau of Land Management, as a general marking guideline for thinnings, reduces the stand basal area by 30 percent, but not to leave less than 60 percent of normal based on Bulletin 201. For this site, a basal area of 248 square feet would be normal. We started with a total basal area of 270 square feet per acre. We cut the stand more heavily than we had intended. I measured plots across the road to give you an idea of what was done in this specific area. The basal area here was reduced 37 percent and this, we think, is a little heavy. The age of the stand ranges from 60 to 80 years.

Before you cross the creek, look at the area that had a lot of old-growth Douglas-fir. The logger has most of the old-growth felled, but he still has logs on the ground that he hasn’t taken out. I think he did a tremendous job of felling the old-growth trees without damaging the young-growth trees. In the entire contract area, we had to mark three trees that had been damaged by felling old-growth. Over half a million board feet of old-growth volume were in this sale. Originally, we were a little reluctant to mark the old-growth. In thinning, the decision to mark big hooters or old-growth is a problem. They take a lot of space and suppress the young trees, but they also can damage the residual stand in felling and yarding.

_Who was the purchaser?_

Freres Lumber Company, whose mill you visited earlier. Much of this material is processed in that mill. The large logs go to Freres Veneer. The adjacent area with steep slopes will be marked for a high-lead thinning. We should have added that area to this sale and given the logger an opportunity to high-lead the steep ground in the winter and cat log the gentle ground in the dry season. I was going to brag about the small amount of damage to the soil, but the other operations I saw today were very comparable and I was pleased to see them. I don’t believe I have ever
seen as many thinnings as I have today with so little damage to the soil and
the residual stand.

*What is the rotation?*

We are on an 80-year rotation, but we anticipate that a stand like
this would not be clearcut for at least 20 years in this management area. We
have enough rotation age stands that we would not get back in the
thinned areas for 20 years. We think that our growth rate will recover in
10 years. We did salvage—I don't know the volume—considerable of the
windthrow in here. Many trees came down in the October 1962
windstorm. The wind damage was widely scattered so the salvage wasn't a
logging show by itself. Also, we will salvage the potential loss in the
suppressed trees during the 10-year period. So, at least by thinning in this
age we have salvaged all the merchantable trees that would die in the next
10 years, and we anticipate some growth recovery in here. In 20 years, I
think it will be significant.

*What is the maximum slope for tractor yarding?*

We tractor-thin on slopes up to 40 percent favorable. We will
tractor-yard on a slope of 60 percent if the distance is short.

*Is the logging cost for the thinning, or for the whole job including
the right-of-way?*

The cost was calculated after the road was constructed. Freres built
the road with their crew. The logger logged the right-of-way.

*Then this would be a true thinning cost? The right-of-way people
could operate cheaper?*

Well, the logger questions that. They claim that logging right-of-way
is not as cheap as you might expect. Yarding is short, but the logs must be
decked so that the road can be built.

*I thought you said the road was already built.*

The logger had to fell the right-of-way and deck it so the road could
be built. The logs from the right-of-way can be yarded for about ¼-mile
before road must be constructed to remove logs on the right-of-way
beyond.

*Are these figures BLM-appraised logging costs or actual logging
costs?*

No, Freres contracted the logging without hauling for $30 per M
ftm. Hauling cost was $6.00 per thousand. This area is near the mill so
hauling costs are reasonable.

*How does the BLM make an appraisal?*

I was afraid somebody would ask me that. I don't know how
familiar you are with BLM appraisals, but our calculations are difficult to
compare because of the way we tie in the profit and risk. But I compiled
the data for a comparison for what they are worth. BLM logging cost allowances on this sale amounted to $29.21 per M fbm. Profit and risk are computed at 13 percent of realization value, which amounts to $14.64. Adding that to the $29.21 gives $43.85 total logging costs. This may not be the best estimate, but I didn't know how else to approach it to even come close to what we might have allowed in there. Road construction allowance was $12.41 which gives $31.44 for the logging end. From those figures, we were within about $4.00 of the actual contracted price, which is not too bad.

Is the logging cost of $30.00 per thousand board feet based on long logs or short logs?

That is for mill scale on 32-foot logs. BLM cruises on the basis of 16-foot logs, so our cruises are always higher than those based on a 32-foot log. We expect about a 10-percent higher scale when cruised as 16-foot logs than when cruised as 32-foot logs on timber this size.

What would be your profit and risk?

Profit and risk are 13 percent of the realization value on this sale. That is a variable figure; each sale has its own profit and risk.

What was the bid price?

This sold at the appraised price of $32.25 for the Douglas-fir. The sale was made on June 18, 1968.

What is the maximum skidding distance?

I don't remember, but from our appraisal I would estimate between 400 and 500 feet. Probably 400 feet. We try to lay out the logging area so that tractor yarding is a maximum of 600 feet, except for long corners.

A maximum distance of 600 feet?

Yes.

Have you had any experience with stands this age? Do they pick up growth after thinning?

The Salem district has no experience with thinnings marked this heavily. In the past, most of our thinnings were in 70-year and older stands and usually, at most we removed only 4 thousand feet to the acre in dead and defective trees. So these were very light thinnings, and we have not had significant growth response from any of them. We expect a growth response from this stand because we have definitely released the residual trees.

Was the lack of response because you thinned the stand too late or not heavily enough?

Because we didn't thin heavily enough. I feel that any stand will respond to release thinning if given enough time. The older the stand, the slower the response. Also, the more suppressed the tree, the longer it will
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Was the lack of response because you thinned the stand too late or not heavily enough?

Because we didn’t thin heavily enough. I feel that any stand will respond to release thinning if given enough time. The older the stand, the slower the response. Also, the more suppressed the tree, the longer it will
take to respond. Some stumps of trees 200 years old or more that have been suppressed, as evidenced by rings close together, show wider rings on the outer circumference indicating release by logging or windthrow. So I think given time enough, any Douglas-fir tree up to 160 years old will respond. A stand this age should have been thinned 20 years ago, but even so I think that in 10 years a significant growth response will occur in a stand thinned this heavily.

Is the purchaser satisfied with this sale?

At first, the operator thought the volume in old-growth would be more than the cruise, but they had cut some of the better trees first. Later, they found more cull logs. Cedar Lumber Company at Mill City takes cull logs. They cut as much lumber from the cull log as they can and chip the rest. Also, Stout Creek Lumber Company at Mehama buys low-grade large logs, and some were sold there. Utilization of logs in this immediate area is excellent. We can market almost all material we have in a stand. For instance, we marked 8- and 10-inch trees with a 16-foot log or better, to a 5-inch top.

Do you construct a local volume table for these sales?

No, we don’t. We use the standard BLM volume table based on form, class, and log heights. For our 8- and 10-inch DBH trees we have a different set of tables that are based on total height. These trees are computed separately.

The operator apparently has used several kinds of equipment.

Right. He has tested several types of equipment here to find the most efficient one. He has tried several different loaders and had considerable trouble loading old growth, with the light loader. He finally loaded them with a fork-lift. Mostly, he has used the rubber tire skidder for yarding. We did not locate skid roads in here. The skidder works between the trees on a temporary road. Sometimes we will, together with the logger, decide where the road will go with as little soil disturbance as possible. But, mostly the logger skids as he wishes with a caution from us to disturb the area as little as possible. I believe that if the tractor does not break through the debris on the ground, we are getting minimum soil disturbance and compaction. Soil scientists say that compaction is the most critical damage in logging. So we like to spread yarding out and keep equipment on top of the brush.

One road dead ends about ¼ of a mile from here. The other road ends about ¾ of a mile from here and will be extended for about ½ mile for more thinning. I believe the State Forestry Department also expects to extend the road for another ¼ of a mile. This is the lowest grade permanent road that BLM builds. It was built with purchased crushed rock
because no rock is available around here. The rock is stock-piled near the town of Gates for $1.85 a cubic yard, which is inexpensive. This turn was soft and the trucks kept widening the turn so we put base rock in here. We will cover the base rock with crushed rock from the stockpile before the sale is completed. I think we need a wider turn than what we have here.

_The road seems wide. Is there a reason for that?_

Yes—three reasons. BLM sells on cruise, so additional volume is difficult to sell to a purchaser if it’s needed for construction. Therefore we tend to make our rights-of-way somewhat wider than those of land owners who sell on scale. All they need to do to increase volume is mark another tree, but we must process a modification to the contract. Also, along Little Rock Creek in the switchback, we removed all trees to prevent them from blowing down because they would be fully exposed to wind. This resulted in a small clearcut area. Removing the old growth also created small clearcut areas. But most of the right-of-way is typical.
Field Trip
Cascade Timber Management Unit
OREGON STATE FORESTRY DEPARTMENT

Hosts
George Schoppert, Unit Forester
Darrel Speisschaert, Assistant Unit Forester

10-ACRE STAND

This is a 10-acre stand of Douglas-fir, 70 years old (Figure 1). Site is a low II. Two thinnings have been made and the stand is marked for a third thinning (Table 1). Generally, thinning was from below and removed merchantable suppressed, intermediate, and unhealthy trees. Adequate spacing for leave trees was a secondary objective. Marking was “forester’s choice.”

A concern for windthrow, sunscald, and thinning shock resulted in the conservative approach of three thinnings in a short period of time. Experience indicates that the present stand condition could have been reached in two thinnings.

On the two previous thinnings a small tractor was used in yarding. No problems occurred.

Speisschaert. The figures of 91 trees and 75 square feet of basal area per acre removed in the two thinnings in 1964 and 1968 were based upon a recent sampling of stumps. The stand was marked again in 1969 and sold in August of 1969, but logging hasn’t started yet. We marked 33 trees, 43 square feet of basal area and 7,800 board feet volume per acre. The trees with orange paint on them are the ones that will be removed. After this third thinning, 80 trees per acre will be left with 207 square feet of basal area and 66 M fbm of volume. I think the basal area and the volume may be a little high for this stand.

Although about 6 years have elapsed since the first thinning, we have noticed no increase in crown development except that the foliage is a little more dense. The crowns are not much longer because, at this age, the rate of increase in height has slowed down considerably. We have noticed some epicormic branching on the boles and, as you can see, some hemlock coming in underneath the stand. After the thinning in 1968, we had a good seed year. Now we have almost 100 percent stocking of 2-year-old seedlings under the main stand. We took increment borings last week on 25 trees, and we found no appreciable increase in growth. The dominant
Figure 1. A 70-year-old stand of Douglas-fir on state land known as the “10-acre patch.” Two thinnings in 1964 and 1968 removed 91 trees and 11,700 board feet, Scribner, per acre. A third thinning in 1970 will remove 33 trees and 7,900 board feet and leave 80 trees and 66,600 board feet per acre. The stand is on the Cascade Timber Management Unit, Oregon State Forestry Department.
Table 1. Data on 10-Acre Stand, per Acre.

<table>
<thead>
<tr>
<th>Trees</th>
<th>Basal area</th>
<th>Volume Scribner</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Sq Ft</td>
<td>Fbm</td>
</tr>
<tr>
<td>Original (1960)</td>
<td>204</td>
<td>268</td>
</tr>
<tr>
<td>Mortality</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Removed (1964)</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Removed (1968)</td>
<td>91*</td>
<td>75</td>
</tr>
<tr>
<td>Marked (1969)</td>
<td>33</td>
<td>43</td>
</tr>
<tr>
<td>Remaining (1970)</td>
<td>80</td>
<td>207</td>
</tr>
<tr>
<td>(unmarked)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Includes 1964 and 1968 trees were growing about 0.20 inch in diameter per year and the growth of codominants and intermediates actually was slowing down slightly.

The growth increment was based on the last 10 years' growth divided into 5-year segments. For the first 5 years, we calculated a growth of 0.19 inch in diameter per year and in the last 5 years about 0.21 inch. So we are getting a little response. As Tom Makey said on the BLM thinning, I think that in time we probably will see more response in this stand.

Audience. What rotation are you on?

Speisschaert. A 90-year rotation. We may not clearcut this stand when it is exactly 90 years old. If the stand is still growing well, we may hold it until it reaches 100 or 110 years.

Audience. Will you thin again?

Speisschaert. In 10 years, we may thin this stand again.

You might wonder why we made three thinnings so close together in time. When we first started our thinning program, we were conservative in our approach and marked lightly to prevent sunscald and shock. With what we know now, we should have thinned the stand in two operations, probably one in 1964 and another in 1968 or 1969.
Audience. How fast are the trees in the open growing?

Speisschaert. I haven’t measured any of them. We ran our sample through the center of this 10-acre stand to stay away from any edge influence.

Audience. How much area is in this sale?

Speisschaert. This type stand is about 10 acres. It is combined with other timber to make a 200-acre sale.

Audience. Is the rotation age 90 years for the State Forestry Department?

Speisschaert. As of now, but the Salem office is reviewing it and I think they will lower it.¹

Audience. Is it based on economic or silvicultural criteria?

Speisschaert. It is a balance between the economic approach and an attempt to produce maximum total volumes for sustained yield. Our Salem staff are making economic studies and, as a result, I believe they will lower the rotation age.

Audience. Do you always blaze the stump of the marked tree?

Speisschaert. This has been standard procedure, but we may not continue. We did this because the lower part of the tree is covered with moss and loose bark and the paint could be removed easily. If we blaze the stump with a machete or cruiser axe and then apply the paint, the mark would last longer.

Audience. Marking a ring completely around the tree takes extra time and is costly, I would think.

Speisschaert. We used 16-ounce Nelspot aerosol spray cans to apply the ring around the tree. This winter we purchased regular pump cans with quart containers. Now we will place only a spot on each tree marked for removal.

Audience. That method of marking must be time consuming.

Speisschaert. It is time consuming, because the marker must walk around every tree he marks.

The stand that we will see next has been marked for the first time.

Audience. Why are trees marked inside the posted right-of-way boundary?

Speisschaert. In this management unit, we mark the stand first and then locate the roads. This eliminates road reconnaissance and, by the time we have marked the entire stand, we have a better feel for the ground and where the roads should be.

¹As of March 1972, the rotation age has not been changed and is still 90 years.
Audience. Then the right-of-way is not separated from the thinning volume?

Speisschaert. The purchaser is permitted to cut all the trees inside the right-of-way boundary. In the sale area itself, he is permitted to cut only trees with orange paint spots.

**YOUNG DOUGLAS-FIR STAND MARKED FOR THINNING**

The overall thinning goal of the State Forestry Department is to reduce young-growth stands to 60 percent of normal stocking (basal area) according to Bulletin 201. This level can be reached in one or more thinnings, depending upon the condition of the stand, and is maintained through the rotation.

This stand is type D38.1920. The stand was marked for a first thinning in 1969 but has not been logged (Table 2). It was marked on a “forester’s choice” basis. Thinning was primarily from below with emphasis on spacing and release of crop trees. Intermediate, suppressed, unhealthy, and damaged trees were marked whenever merchantable. Additional thinnings in this stand will be made periodically to maintain the stocking at 60 percent of normal.

Speisschaert. This stand is about 50 years old. Before marking we had 130 trees, 206 square feet of basal area and about 38,000 fbm per acre. We marked 53 trees, 60 square feet of basal area, and about 7,600

<table>
<thead>
<tr>
<th>Table 2. Data per Acre.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees</td>
</tr>
<tr>
<td>No.</td>
</tr>
<tr>
<td>Before Marking</td>
</tr>
<tr>
<td>Marked</td>
</tr>
<tr>
<td>Unmarked</td>
</tr>
<tr>
<td>Volume marked, %</td>
</tr>
</tbody>
</table>
fbm per acre. After thinning the stand, we will have 77 trees, 146 square feet of basal area, and 30,000 fbm per acre. So, we removed 41 percent of the trees, 30 percent of the basal area, and 20 percent of the volume.

The thinning guideline that we used here and in nearly all of our thinning sales we call the "forester's choice" method. The trees to cut and the trees to leave are selected by the marker with no set basal area or volume established beforehand.

Audience. All these fellows learned how to mark yesterday so they'll tell you whether it's right or wrong.

Speisschaert. I would appreciate that.

Basically, we marked this sale for spacing, because this is the first thinning in a young stand. All merchantable intermediates and suppressed trees were marked, and then enough dominants and codominants for good spacing also were marked. We marked many small trees. We even marked a few unmerchantable trees when the trees were competing with a leave tree close by. The logger is only required to fell the unmerchantable trees.

Audience. How about hardwoods?

Speisschaert. We do not have a good hardwood market in this area. So, if the hardwood tree is competing with a leave tree we mark it for removal. If the hardwood is not competing in the stand we leave it.

CLEARCUT AREA

This area was part of the old Rock Creek burn that occurred about 1890. The stand was mixed conifer and hardwood, with a few scattered old-growth trees. The old-growth was logged in 1950, which left a poorly stocked, brushy area, type D321900 M.

The merchantable hardwood and conifer were logged in 1967 and 1968 (Table 3).

In the spring of 1969, after logging the conifers, the area was scarified by a D8 tractor. Slash was burned on September 16, 1969, after 0.12 inch of rain. The area was planted during the 1969-70 planting season with 2-0 Douglas-fir seedlings from seed collected in the Rock Creek area.

This stop illustrates that clearcutting may be necessary in young-growth management if stands are poorly stocked or stocked with a species not suitable for the site.
### Table 3. Data on Clearcut Area.

<table>
<thead>
<tr>
<th></th>
<th>Hardwood</th>
<th>Conifer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Sold</td>
<td>1967</td>
<td>1968</td>
</tr>
<tr>
<td>Year Logged</td>
<td>1967</td>
<td>1969</td>
</tr>
<tr>
<td>Acres</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Volume,</td>
<td>139</td>
<td>430</td>
</tr>
<tr>
<td>Volume/Acre, Mfbdm</td>
<td>4.6</td>
<td>14.3</td>
</tr>
</tbody>
</table>
Field Trip  
FRERES LUMBER COMPANY, INC.  
Lyons, Oregon  

*Hosts*  
Bob Richardson, Contract Supervisor  
Dick Schuetz, Forester

The logs used in the veneer mill are mostly from 8 to 18 inches in diameter. Logs under 8 inches and the cores from the veneer mill are processed in the Adco West core mill. The cores average between 5 and 6 inches. The largest log that the mill will handle is 8½ inches.

Studs are cut to exact length rather than 8 feet. The lumber averages more than 90 percent standard and better.

Chips from the side cut are sold to Western Kraft Corporation; shavings and sawdust to Duraflake Company, Albany; and the bark and millends to Crown Zellerbach Corporation as hogged fuel.

Mill production ranges from 20,000 to 25,000 board feet per shift depending on core or log size.
Banquet Discussion
THE FORESTER AND THE PUBLIC

Alan B. Berg, Moderator

Note. On Wednesday evening, the participants and instructors met for dinner. The discussion after dinner concerned the influence that the public will have on the forester and the practice of his profession. Although the instructors were seated at a head table and are designated as "panel," in reality the discussion was free with all taking part. The discussion was taped by the Self Learning Center, School of Forestry, and edited for publication by the moderator.

Moderator. The School of Forestry is indebted to foresters who have been willing to expose themselves and their ideas to other foresters in this short course. On the field trips, you have all realized that forestry organizations, both public and private, have different problems and are trying to answer them in their way.

My spies tell me that today and yesterday much discussion took place among foresters riding on the bus about the different management programs they saw. So, if my spies tell me right, you do have a lot to talk about.

Tomorrow, in the "Sound-Off" Session, we would like your comments on the course.

For the discussion this evening, however, a question that kept coming up during this course is: "How will the public influence the management of forests in the Pacific Northwest?"

First, I want to ask a question. I don't know that I will get answers. If you wish to respond, fine; if you don't, that's fine too. Are there foresters here who are members of the Sierra Club? None. Are there foresters here who are members of the Wilderness Society? One. Are there any participants who are members of the American Forestry Association? A few. I do know foresters who are members of the Sierra Club, for instance, but they are very few indeed. I believe foresters should be members of conservation organizations. We have a program to sell and we might be able to do it better if we were members of such organizations.

I would also suggest that we have had a very bad press in the past. We have not told the story that we should to the public. I do not believe the public understands what foresters can do in managing the forest and what we hope to do. This was emphasized strongly last week in The Society of American Foresters annual tour to which we invited the public on Saturday. Several Sierra Club members were there, and the story that
we told them did have an impact on their viewpoint in regard to foresters. I have friends who are members of the Sierra Club and my contact with them, I'm sure, has influenced the way they feel about forestry and about the forest industry. So by joining conservation organizations we, as foresters, probably can do much to influence the thinking of these people. They are, by the way, not stupid people. They want to see this country a good country. They want to protect, maintain, and improve the environment. We are all on the same side.

Audience. The Eugene Register-Guard had a full-page spread on the SAF tour.

Panel. I know several ideas were expressed in this short course as to the recreationist-timber management conflict. For instance, Schallau commented that some people have advanced the idea that the recreationists should have the high-elevation areas and the poor timber-growing areas and the foresters should manage the better timber-growing areas intensively. Is this practical? Also, rights the public might have on private forest land are not clear. Many problems arise in allowing the public access to company lands. What should the policy be? Would anyone on the panel like to comment before George Schoppert gives the address of the evening?

Audience. Won't young-growth management be more acceptable to the public because of partial cutting? It is not as drastic as clearcutting. We should have more success because of that.

Audience. If foresters can demonstrate expertise in the management of young timber, then this can be used as an example of what will occur on old-growth areas as we remove the mature timber and create a new stand.

Audience. I don't believe we can convince the public that we should clearcut along roads such as the Santiam Highway.

Audience. Not as long as we scallop!

Panel. In the June 1970 issue of American Forests, an article entitled “To Regenerate Eastern Hardwoods—Clearcut,” by William E. McQuilkin, presents one of the best cases for clearcutting that I know. McQuilkin is a retired forest researcher from the Northeastern Forest Experiment Station. He argues that clearcutting prescribed by foresters today is different than the cut-and-get-out slashings of the past. He also compares a clearcutting with a burn by wildfire and points out that many intolerant forest species can be perpetuated only by such catastrophes. He does not try to excuse misuse of the system but to recognize the value when it is used properly.

Audience. Shelterwood as a management tool in Douglas-fir is a possibility that should not be overlooked by foresters in the Pacific Northwest.
Audience. Our main opposition will not come from the educated membership of organizations such as the Sierra Club, but from the urban masses. You must admit that we are out-voted there. They hold the power through numbers of votes and they tend to follow rabble-rousers.

Audience. Well, the educated people of the conservation organizations write the rabble-rousing articles.

Audience. True. But the only way to influence policy is by votes. Legislatures understand this. We are preserving a hell of a lot of expensive ground for the wealthy. Once you can establish this fact you are in good shape.

The areas the conservationists are trying to preserve are those that the poor can’t visit—it is too expensive. Many of these people don’t own a car even. They can’t make it there. You are not going to beat the conservationists by arguing with them. You must go to the legislature and convince them that the people in the metropolitan areas can’t reach these areas and really use them. Then sell your program of forest management. You are knocking your head against the wall if you start arguing against the conservationists without facts that the legislators can back you up with.

Panel. Then you would suggest fighting the conservationists rather than joining them?

Audience. We can’t fight the conservationists! We convince the legislators.

Audience. The conservationists have a point in many instances. I would suggest that foresters emphasize that we have become better land managers. We are doing a better job as time goes on. A boot in the pants by criticism can force you to do something you should have done already. All of the criticism isn’t negative, much of it has been positive. We gained from it. It may not fit our original scheme, but we all must give and take a little. This kick in the pants has been good for us.

Panel. Let me make a comment here. When the Cascades Wilderness Area in Washington was being discussed, we held several meetings for local members of Congress concerning the North Cascades. And, believe me, the professionals—the engineers and the teachers—were the ones advocating wilderness. Not the rank and file of people off the street. These are well-spoken, well-educated people. And they are good people; they are people that I associate with in other ways—for instance, Scouting.

Our chapter of the Society of American Foresters has initiated a speakers bureau. With prepared speeches and slides we canvass service and hiking clubs to show them what we think forestry does for the nation. We have had good success with this program. I recommend you use it in your local areas. We give the program without charge to tell the forestry story.
Panel. We gave five or six presentations to service clubs such as Rotary, Lions, and Kiwanis. We talked to several PTA groups. We have also talked to the St. Helens Hiking Club, which is our local Sierra Club.

Audience. What response are you getting? Do the people show interest and ask questions?

Panel. Yes, very much so. We find that teachers are most interested. Businessmen seem to understand what we are trying to say. But it is groups that are not really interested in the business life of the community that respond most vigorously. Although they question us strongly, they do accept what we say. They don’t fight the professional approach that we make.

Audience. The best way to get to groups that have influence is by a damn good movie with a professional telling the forestry story that could be used in schools and service clubs! I work for the BLM and a movie was used to spank us.

Even though the scenes showed BLM, private, and Forest Service land, the finger was put on BLM. We benefited from it. But we should now produce a film to show people what we are doing that is good. We should propagandize our actions as foresters if we believe we are right.

Audience. That’s right, but if you preach, you must also practice what you preach.

Audience. The movie did a marvelous job of ax-grinding and presenting a personal viewpoint. I think what Bruce is suggesting is that we ought to use professional help to make the same kind of presentation.

Audience. I agree. But then we must follow that with good sound forest practices.

Audience. Correct!

Audience. If you were at the recent SAF meeting in Eugene and saw the slide talk that Don Hunter presented in the evening, I think you will agree with me that it was rather one-sided and emotional. I wrote to him and pointed out that he had made a one-sided presentation. I also pointed out to him that, while he showed fresh clearcuttings, he never showed a regenerated area or young trees. I reminded him that an old-growth forest is relatively static, whereas a young forest is dynamic, growing and interesting. I invited him to my tree farm to discuss this and to show him a forest under management. He phoned and accepted my invitation so I’m looking forward to meeting with him. Hunter is effective in presenting his message. He presents this to PTA’s and to organizations of all kinds very effectively.

Audience. Our agency is being criticized openly, and we must be very careful not to run scared. In the past 6 months to a year, a lot of
criticism has been directed at us for practices that, as professionals, we know are good. Certainly we all know that some bad practices occur, but also many good forest practices are carried out. The results may not look good this year, but we know that in 5 years, when the reproduction comes in, the results will look good. I don’t think that we can eliminate clearcuttings and I don’t think that we can eliminate good management practices because someone has blown a whistle. I feel strongly on this point. We tend to jump at shadows. A public-relations program to refute unfair criticism definitely is warranted. But it is not the only step. A search of our own consciences to establish that we know we are responding as professionals is the first step.

Audience. So how do you get the message across?

Audience. Through public relations.

Audience. I agree with you. We tend to be too defensive, however, and make too great an attempt to preserve present practices. A more objective way to approach the problem is to establish a platform for negotiations with conservationists. We should all recognize that we have to negotiate. As professional foresters, I believe we must accept the responsibility. During negotiations we may discover no conflicts in land use actually exist. If, in fact, conflicts occur in land use, then I think we will have to negotiate. One way may be to suggest some form of zoning, although I don’t think that zoning necessarily answers the questions of the adversaries.

Audience. I’d like to toss the ball to the academic community. Many of the present forest practices were taught us in forestry school. And academic people pack a lot of weight with the public. Many conservationists come from the academic community. I think that you should support both public and private agencies if we are doing a good job. It might help if you would say so and put your weight behind us.

Panel. In what way?

Audience. Well, the public is opposed to clearcutting. In forestry school, I learned that clearcutting is the only way to regenerate Douglas-fir because it is an intolerant species and doesn’t perpetuate itself well by selective cutting. Topography also is a problem in selective cutting. If we say this, the public says, “Well this guy is shot full of politics or thinks only of the dollar, so what he says must be taken with a grain of salt.” Whether what we say is right or wrong. A professor of forestry from the academic community can say, “I’m Doctor So-and-so and this is damn well the truth.”

Audience. The other day Professor Davies told me that he made a 30-acre clearcutting on McDonald Forest. The School brought people to the clearcutting and explained why they did it. The response was good.
Davies overheard several ladies say, “Maybe there is something to clearcutting.” This is a very direct and positive step in the right direction.  

Panel. On the other hand, several of my friends have seen the same clearcutting. I am continually reminded that the clearcutting is there. I try to explain to them why it was done and they reply, “Yes, but it was a beautiful area before you cut it.” It is difficult sometimes to explain acts that destroy beauty.  

Panel. Do we, as foresters, believe in wilderness areas? Do we believe areas should be set aside without management, such as we think of management? Should we maintain natural areas? Should we leave some old-growth?  

Audience. Yes, but a limit must be put on it.  

Audience. I have never found a forester or a logger who didn’t believe we should have natural or wilderness areas. I have never found someone that felt they were not necessary. I don’t believe that is the question at all. The question is how many, and how large the reserved areas should be. Maybe someone here believes we don’t need them, but I doubt it.  

Audience. Well, I don’t! The conservationists are demanding large areas and damn few people in the U.S. have the cash to get into these areas. It takes hard cold cash to travel from the East Coast and pay a packer to transport you all the way back in the wilderness. A common description of a wilderness area is 50 feet beyond the last beer can. Very few of these areas are left.  

Audience. The public tends to concentrate on the same spot within the wilderness area. All the other land, then, is absolutely being wasted because no one is utilizing it. The wilderness area is not one main trail, a fishing area, a camping area, or a rock climbing area—it is the whole area.  

Panel. If land is not used by man, is it wasted?  

Audience. Well, a few animals and birds use it.  

Audience. How much commercial timberland is in wilderness area? Probably about 99 acres out of 100 of the remaining areas that qualify as wilderness are not productive commercial forests anyway.  

Audience. The comment that was made a while ago that the high-elevation and low-site land should be delegated to recreation sites is valid.  

Audience. Yes, but conservationists want French Pete valley because it is low elevation.  

Audience. That’s right.  

Audience. Alan, you made the statement yesterday that much of our forest theory concerning young-growth management came from European countries. European countries do not reserve vast areas in a natural state.
Forestry, there, is compatible with recreation. They don't keep forest areas untouched forever because people have to see how the forest once was. Will anyone argue with that? The Europeans make forest land available for people to use. Foresters made a horrible mistake in the North Cascades Park controversy. We came out and said "No!" to the change of administration because we believed the area was well cared for. Why should we change agencies? Or policies? And as a consequence of our stand, the conservationists are asking for a larger area than they would have if we had not bucked them so hard. We should have agreed that the area belongs in recreation. Does anybody here disagree that the North Cascades belong to recreation? The conservationists compare the North Cascades to the Swiss Alps—so they want no road or other structures there. Yet the Swiss Alps have roads through them, tunnels under them, and power lines over them.

We fought them, and we shouldn't have. And now they are asking for larger areas beyond what they have already taken in the North Cascades. The conservationists say that in the year 2000, about 50,000 people will visit the area. When they closed the North Cascades to hunting they prevented 50,000 people from using it!

Audience. Has the Society of American Foresters ever made a public stand for or against something in a full-page newspaper ad?

Audience. Yes.

Audience. The SAF takes a long time to move.

Audience. We don't blow our whistles for things we stand for. We don't use the communication media that are available. We have our meetings with foresters to discuss what is bad and what is good. That is the end of it. We pat ourselves on the back and that's it. And no one else even knows about it. A bunch of elves talking in the forest.

Panel. I personally believe that the Society of American Foresters as a society should be talking to foresters and not the public. This is a personal feeling. I believe that I should express my opinion as a citizen. A number of organizations that I belong to are promoting ideas and opinions I don't believe in. I don't like that, because I want to express my own opinions. I believe the SAF should urge every forester who is a member to express his opinion no matter what it is. If the forester advocates the entire Pacific Northwest as a wilderness area then he should express that opinion.

Audience. Doesn't the argument carry more weight if it comes from a society, though?

Panel. It might. But suppose that 51 percent of the Society believes what is being advocated, but 49 percent don't. Also, personal judgment is important. It's the basis for a democratic society.
Audience. I'm not getting at that. It is possible to tell both sides of a story from a professional viewpoint. Let's face it, we have been slipshod in the past in getting our message across.

Panel. I wonder what the message is. On our field trip, what was the message from the foresters that we talked to? I think it's highly variable.

Audience. Depends on who you work for.

Panel. That has a great deal to do with it. Also, public policy in Europe, Australia, or Africa should not dictate our policy. This is a different and unique society.

Audience. We must remember that Europe has a large population now and that we will soon. To survive, the United States must think in terms of total development and use of its natural resources. That is the only way we will survive.

Audience. I go along with that. I am a member of the BLM. We will be discussing a problem in the office and someone will say, "Oh, I was talking to a Forest Service man the other day and they solved this problem this way." But, we are BLM, not Forest Service. We don't try anything of theirs.

This goes on day after day. And the Forest Service has told me that they have had problems that they know the BLM had solved but they wouldn't take our results. They run their own study. We do this all the time. We can't even agree among ourselves many times.

Panel. I believe very strongly that the forest has a good many values other than economic.

Panel. What?

Panel. That's an economist!

Audience. If I can use the words with small letters there is a far-right and a far-left. Usually the majority is in the center. Foresters are far-right or far-left and the Sierra Club is on the other side. The public is where we should be, in the middle.

Audience. The question was asked, what should the message be? Well, we should be telling people that point to a picture of a deer standing in a clearcutting and say, "Look—they cut all his food!" that this isn't right. We know it isn't right. Deer don't climb 300 feet in the air.

Audience. Are you sure of that?

Audience. I disagree with the idea that we should sit down and negotiate, because we would lose. No question about it. The conservationists are so far ahead of us it isn't even funny. What we must do, and I feel this strongly, is educate the people that the conservationists propagandize. Two factions exist, with the public in between. We should at least give the public both sides of the controversy and not just the one-sided story of the conservationists.
Panel. Many comments tonight advocate that we should educate other people. I have silvicultural or good forestry answers to many questions, but I don't have answers that are palatable to the public. For instance, the clearcutting that was beautiful before the logger cut it. I don't have a good answer for that, so I try to avoid that question. We need to educate ourselves before we try to educate the general public. And not necessarily silvicultural or economic answers, but answers that the public will find palatable.

Audience. I ask you, then, “Do you have cull peelers?”

Audience. What's the point of the question?

Audience. The fact that an old-growth stand is usually decadent. We harvest old-growth because it is ready to harvest. People can understand that. I have never had any problem with that concept.

Audience. Well, have you taken someone to a clearcutting, and told them that? They say: “It was beautiful before you cut it!” They don't care whether it was decadent or not, or whether it had to be cut. They care that it was esthetically pretty. You told them why you removed that esthetic value. Was it necessary to remove it?

Audience. How do we find ourselves, as foresters, at this point in time, in an adversary situation with conservationists? Once upon a time, everyone in this room was motivated by the same feelings as those of the conservationist. Isn't this the idealism that brought most of us to the field of forestry? I think it is. And now today, the Sierra Club and other organizations consider foresters to be their adversaries. And we consider them our adversaries. I don't believe this is the way it should be at all.

When I graduated from the University of Washington, I was an idealist about conservation. The University of Washington didn't expel these ideals. Even if you graduated from Oregon State you probably were an idealist about conservation. But I believe all of us then went through a process known as “knocking some of that nonsense out of their heads.” I did. Well, I submit that some of this nonsense that got knocked out of our heads wasn't all nonsense. Perhaps we should reexamine some of our youthful ideals and we'll not find ourselves as greatly in conflict with the conservation people as we are now.

Audience. I don't think we're in conflict with conservation people. They are in conflict with us.

Audience. Conservation is planned use. Preservation is no use.

Audience. I think our message is that preservation is not a live use and is not good conservation.

Audience. I think that people in the wilderness organizations, such as the Sierra Club, are not concerned only with preservation. I know foresters who have been active in these groups for years and I must say it
has been a very good influence on them. These foresters find little conflict
with their support of wilderness ideals and their activities as professional
foresters. At least one of them is an industrial forester. I'll let him speak
for himself.

Audience. If we're broadminded, the preservation of certain areas is
the best use of those areas.

Audience. Why should foresters be excluded as a conservation
group? I don't think it is right. I think things got turned around somehow.
We are conservationists. Perhaps everyone doesn't agree with our manage-
ment of the resources, but I think we are conservationists. We are
interested in sustained yield and perpetuation of the forest resource.

Audience. I'll echo that. It certainly wasn't because of money that I
became a forester. Many conservation types are Johnny-come-latelies and
advocating programs that I was concerned about in the seventh grade. I
believe that, if we could get together and tell our story to the public, we
would pack a hell of a lot of weight. The Sierra Club is a well-financed
pressure group, but I think that we can come up with more. "United we
stand, divided we fall."

Panel. Today we saw only a small part of the management program
that Longview Fibre company has initiated on the Silver Falls Unit. If a
Sierra Club member visited this area and was given the same information
that we were given, do you believe he would have objected to the
management program?

Audience. My most recent experience with Sierra Club members was
when Archie Craft and Merle Storms came to explain the new BLM
allowable-cut declaration, which called for an overall decrease in the State
but an increase in the Eugene district. Most people there asked questions
that might have sounded silly or uninformed to a forester, but they were
damn serious questions. And when Stormy explained it to them most of
them accepted it. And I don't see a problem, if we can communicate. And
a forester from Willamette Industries invited all those at the meeting to the
SAF field trip. He even gave them a copy of the program. A young girl
there urged the audience to put the information on the bulletin board at
their place of employment, and to visit Black Rock to see what foresters
are doing.

Panel. Some of them came.

Audience. To tell our story, we need more of that.

Audience. We have no problem selling our program locally.

Audience. The conservation controversy is a product of the
adversary situation in which we find ourselves. I agree wholeheartedly with
what you say—tell them our story and listen to theirs.
Audience. Right!

Audience. I don't think we are as far apart as we think. Conservationists are, by and large, an intelligent, articulate group of people who are able to reason as well as read. But you back us up.

Panel. Did I back you up?

Audience. If we are right. As I said before, the academic community should speak up. I am Professor So-and-so and I believe so-and-so. They will listen.

Panel. We have been battered by students, and the legislature will probably take a whack at us too. We are not as influential right now as you might think.

Audience. On the Longview Fibre area, the view is into a basin carpeted with a beautiful stand of 35-year-old young-growth. If you don't get too close to the trees you can't tell whether they are big or little. But this is a natural stand. If you want to manage it you must put roads through it and cut it up.

Audience. We do have a forester here who is also a mountaineer and a member of the Audubon Society. He may be a spy.

Panel. He never raised his hand.

Audience. I'm sure you have a comment.

Panel. I think, judging from the comments, that foresters must feel like the fellow tugging on a rock. All at once the rock came loose and fell on top of him. The forester has been trying to sell conservation for a long time, and now, to his surprise, it has fallen on him. The idea that we must educate the public immediately is an exercise in futility. For instance, buying an ad in a newspaper to tell our story might accomplish a little but only a little. I think we must anticipate the future. The future will say, "Certainly we need more houses, but we will build them out of wood substitutes." We have been deluding ourselves into thinking that people really need wood. I believe we will see an about-face. I suggest we will need less wood in the future than we did in the past. And I don't think it will do us much good to try to sell people the idea that what we are doing is for their good. I think we should tell them what the impact will be—that so many jobs are affected by change. I think that this will get to them. But the public will judge whether or not this impact is something they will tolerate.

An article this spring commented on environmental quality and the inequities in the Environmental Quality Program. The author pointed out that the people who profit most from the money spent for environmental quality measures are the wealthy people. His cry was for more equity in environmental quality. Until now, survival has received the most emphasis.
He feels that we should balance it out by the question of equity. The man in the ghetto is more concerned about the environmental quality around him than the environment on top of the mountain. But we had better address ourselves to the question “What does the public really want?” And we had better listen to them. Let’s go to meetings and let’s listen, and let’s not be too concerned about educating the public.

Audience. The public doesn’t know what it wants.

Panel. Well, if we can document the link between what we do in the woods and the man on the street, let’s do that, and let’s show them the consequences of various alternative programs. But it is they who will decide what is best. Not us.

Audience. Isn’t that educating? Guiding?

Panel. Well, I think that too much of what passes as education of the people is coercion rather than education.

Audience. Unless both sides are presented, how can the public make a good judgment? They are continually bombarded with one side of the question and not the other. We should present our point of view without pressure so that they hear both sides. You are right, the public will tell us what to do. Most of us are, in a sense, working for the public. They will tell us what to do on public lands, and this will influence private forestry. The public has a big influence on us now, and they may have even more in the future. Unless we show them both sides of the story, we will have a tough time getting an answer that is acceptable to us.

Panel. Let me qualify what I said about education. Many of you are advocating the same kind of “educational” pamphlet that the Sierra Club develops, and that is coercion. It is subtle, but it is coercion.

Audience. Isn’t the Sierra Club, though, based on emotion rather than sound reason?

Panel. Well, who do they hire? Who are their professionals? Lawyers. And lawyers take the adversary approach. They feel that someone else will present the other side. They are not responsible for telling the whole story. Now, as professionals, are we going to use that approach, or are we going to tell it as it is? Ethically, we are supposed to tell it as it is, aren’t we?

Audience. Well, why isn’t a lawyer supposed to?

Panel. I don’t know. I’m not a lawyer. But the legal system is based upon the adversary principle, and forestry is not.

Audience. The lawyer does what the client wants him to.

Panel. That’s right.

Audience. All the lawyer does is put what the client wants to say in words, and he knows how to twist meaning.

Panel. Now, let’s take the other side. I propose we charge for the use of wilderness areas. Let the market do more allocating of the recreation
resource. I believe, as Marion Clausen said about 10 or 12 years ago, that if people are given something as a free good they will treat it as a free good. They will abuse it. So, if the public use a wilderness area without charge they will abuse it. The time will come when the Sierra Club will be held as responsible for ecological abuse as the timber industry is now. We know that the high alpine meadow country will not tolerate as much use and abuse as the lower elevation forest areas. I think this is a story that hasn’t been told. And economics should be brought to bear in this area. Why is it any less logical to charge for a symphony concert than it is to charge for a recreational opportunity out in the mountains? Why should industry pay for stumpage and the public enjoy recreation for nothing on a wilderness area?

*Audience.* Do you think that the Sierra Club would be willing to pay for what they advocate?

*Panel.* I don’t know.

*Audience.* Industry isn’t going to pay for it. They will pass the cost on.

*Panel.* The people proposing a charge for wilderness use are also members of the Sierra Club. They can afford it. Although it never comes out in the forefront, what the conservationists are really concerned about now is the *de facto* wilderness. Most of the true wilderness areas have been set aside. The *de facto* wilderness areas are what we are fighting about now. For instance, the French Pete Creek area. They want a buffer zone around wilderness to make it as difficult as possible for people to have access to these areas. Well, that is all right, but let’s make the user pay.

*Audience.* Do you think they will pay for it?

*Panel.* I don’t know.

*Audience.* Let’s put the issue on a dollar and cents basis.

*Panel.* Members of the Sierra Club would pay for wilderness use. They are wealthy enough to pay for it.

*Audience.* I question that.

*Panel.* Unfortunately, if you charge the Sierra Club member you also must charge a Boy Scout Troop from Portland. I am not sure that is a good idea.

*Audience.* The Scouts can’t afford that.

*Panel.* That is an inequity, but our capitalistic system has a way of dealing with this. After all, we do have the progressive income tax, and it seems to me that we could work out a system that would be based on ability to pay, such as a progressive tax.

*Audience.* Why be concerned about a few dollars?

*Audience.* The public is paying for scalloping and landscape management because of the decrease in stumpage and the increase in
management cost—for instance, the cost of providing a staff in landscape management.

Audience. I don’t think they realize how much they are paying.

Audience. The industry doesn’t pay for management, either. The people who buy the forest products pay for it.

Audience. Right. I didn’t mean we as industry, but we as the public.

Audience. I wanted to make the point clear.

Audience. Everybody pays for it. They just don’t know what they are paying for.

Panel. Much enjoyment of wilderness is vicarious. For instance, the little old ladies in tennis shoes don’t have to pack into the wilderness area to derive satisfaction. They are satisfied with the knowledge that wilderness areas exist. This fact seems to escape a lot of people. When it gets right down to voting for wilderness areas or voting for timber cutting, people are going to vote on the basis of a “gut feeling,” and maybe concern for their grandchildren. They are thinking, using the economists’ jargon, in terms of option goods. They want to reserve this option for future generations. This means a lot to them. And isn’t this why we went into conservation? Isn’t this why we went into forestry? Why are we fighting these things? As Bill mentioned, many of us were attracted to forestry school because of the feeling that maybe something worthwhile is to be gained by maintaining these options.

Audience. In other words, you are saying that all these things have a place.

Panel. Not one of us doesn’t enjoy walking through an old-growth stand that hasn’t been cut. The feeling you get as you walk through the stand is indescribable.

Audience. Everyone has a different feeling when he walks through an old-growth stand. To me this is perfect enjoyment. Many times, when I lay out a new setting in a stand that hasn’t been cut before, I feel that harvesting that particular piece is right. In other stands, I am not sure. I feel uncomfortable in preparing the stand for cutting. I have a feeling that perhaps it should not be cut.

Audience. How much ground do you need to get that feeling?

Audience. What do you mean?

Audience. We have Mt. Rainier National Park and the Olympia National Park of 800,000 acres, both in Washington. And much more in wilderness areas. How much area do we need set aside to experience this feeling?

Panel. Well, a place exists for all uses. We have set aside some areas and they should be set aside. We should not be against all of them.
Audience. But the conservationists want more. They want the de facto wilderness.

Panel. The conservationists have turned that around and said, “The more the forester gets, the more he wants.”

Audience. It’s about time we heard from Schoppert isn’t it?

Panel. He’s ready. Would you like to give a speech, George?

Schoppert. My speech tonight is, “Goodnight, everyone.”
We have problems in presenting a short course like this. Yesterday, the skyline system that we wanted to see in operation was down for repairs. Although seeing the excellent thinning in that forest is worthwhile, travel time was long. Planning trips to operations several months ahead of time is also difficult.

You might have noticed that we had a TV camera along with us. We hope to experiment with visiting an operation and producing a television record that can be presented on campus. We will ask the forester in charge of the operation to be here during the showing so that future classes may ask questions of him. This will not eliminate all field trips, but will allow us to visit, by camera, distant operations that are pertinent. We also can
save a tremendous amount of travel time and avoid missing observations because of breakdowns.

On Monday, Dave Bruce offered guides in the management of Douglas-fir obtained from experience in Europe. The lack of information on management of Douglas-fir in the Pacific Northwest was evident. I believe we will have sound information on management from research in the Pacific Northwest within a few years. What we know about the management of Douglas-fir has been based, to a large extent, upon data from Europe.

The problem of *Poria weirii* in Douglas-fir stands was pointed out, and the possible relation of alder to this problem was explored. That red alder can be both a biological and an economic asset in Douglas-fir stands was discussed. Also, the soil-building properties of alder, especially the addition of nitrogen, are ecologically important. In addition, the wood of red alder is becoming more important for furniture. Alder is, therefore, a valuable addition, economically.

In the administration of thinning, new problems not faced with clearcutting are present. Both speakers pointed out that the logging operator is the key to successful thinning. We must have skilled operators who understand the management of young forests. Schallau pointed out that we need more study in economics as a basis for management. We do not have the economic knowledge that we need.

On Tuesday at the George T. Gerlinger Experimental Forest, I should have emphasized that the area is a research forest and not an operational forest; therefore, we are limited as to what we can do. For instance, once we have set up a thinning regime we must follow that regime; otherwise, our research results are confounded. This is not true on an operational forest. There, we can change the cutting practice as often as is necessary or desirable from economic and biological considerations. Although we have no conclusive evidence as to specific kinds of regimes we should initiate in our forests, I believe now that heavy thinning is more advantageous for both silvicultural and economic reasons than light thinnings. In thinning, we must open the canopy of the stand before we can get the release and subsequent volume increase that we are after. If heavy thinnings and, therefore, an open forest present a danger to the forest environment, we need not manage the whole forest on one single thinning regime. We can vary the thinning regime from light to heavy cutting by dividing the forest into blocks, or strips, or by topographical features. I also believe that the individual tree is the key to young-growth management. If this is true, some of our silvicultural guides might be somewhat simple, such as number of trees per acre, or spacing. It seems now as though basal area might not be the guide to use in management.
Different opinions have been expressed on who should mark trees for removal; a forester, a technician, or the faller himself. I believe a trained faller can select trees to remove in the first, second, and even the third thinning, depending upon the stand. The trees then are easy to mark. But even so, a forester must be involved. I think this is critical. I believe we can all agree that the trees we leave are most important, not the trees we remove. The trees we leave determine whether our management program is successful or not.

I believe that foresters will become more interested in shelterwood as a technique to regenerate the forest. In the Pacific Northwest, offsite planting has failed on several areas. Shelterwood will insure the regeneration of the local seed source of Douglas-fir on the area.

Wednesday, we examined several problems that exist in young-growth management. Problems differ with the agency or company. The agencies or companies differ in attempts to solve these problems. The U.S. Forest Service, of course, is concerned with the public and maintenance of scenic vistas along road sides. Road systems are dictated by present equipment. In some instances, after the road system is built, a new type of equipment is developed that makes the system far from perfect. I do not know what the answer is, but we must face its necessity. Also, in several instances the road system was developed to exploit the present forest and not the forest of 25 or 50 years from now.

The field trip on Wednesday also demonstrated knowledge of young-growth management is incomplete. All foresters know this. They are feeling their way into a management program. For instance, foresters are not sure what the rotation age should be. Many stated that they were deliberately being cautious.

As a last item, I will comment on equipment in general. I believe strongly that we should keep an open mind as to the kinds of equipment we use in the forests. It is important that we manage the forest. We should use any equipment that will do the job, whether this be with horses or skyline thinning. In the woods, each kind of equipment has a place. When we see an opportunity, we ought to take it. Sometime soon, we—as foresters—must train specialized operators to do different kinds of work in the woods. One kind of operator and one kind of equipment will not serve the many operational situations in management nor the different terrain. We should plan now for the systems, equipment, and operators that we need to accomplish the job of management.

I know the other instructors also have comments. Dave?

Bruce. Some illustrations taken from my recent PNW Research Paper on Douglas-fir plantation yields show differences between the natural stands summarized in Bulletin 201 (4) and the plantations described in
foreign production tables. Figure 6, on page 14 of these proceedings, shows the total production in cubic feet per acre per year for eight Douglas-fir stands in Europe, one in New Zealand, and three schedules from the United States. The bottom line represents the data in Bulletin 201, which are net yields. The next line is Staebler's yield, calculated by adding mortality to the yields in Bulletin 201. The yields calculated by Bob Curtis were derived in part from temporary plot data and used a new method of estimating growth. Notice that all the lines tend to converge on the lower sites, but diverge on the higher sites. Also notice the band of lines, representing the data from Europe. The important point is that these lines lie in a band and are headed in the same direction. As I pointed out previously, the width of that band is about 50 cubic feet per year total production. For estimating in a moist climate, data near the top edge of the band are suitable, but in a dry climate, data near the bottom edge of the band would be more suitable. Notice the asterisk in the upper right of the figure. That is the highest yield reported, from a widely spaced plantation in New Zealand in an area of mild maritime climate. The site is better than 170 and the mean average production at 50 years is nearly 400 cubic feet.

Figure 1 presents the age at culmination of mean production. The bottom set of lines that slant upward to the left are for total cubic feet or

![Figure 1. Age at culmination of mean production. Numbers indicate top diameter outside bark (2).](image-url)
3-inch top diameter. I put them all together because they plotted that way, and, actually, the culmination to a 3-inch top is very close to a culmination for total cubic feet. You will note that the lines are all headed in the same general direction, so the culmination in total cubic feet for site II is less than 50 years, site III is about 50 years, and site IV is close to 60 years. For the lines in the upper part of the graph, I regard the 7-inch top cubic feet, which is based upon the British Management Tables, as the most important. You will notice that it suggests a delay of about 10 years over the line below it, which is for total cubic foot yield. So culmination, in terms of merchantable volume, is delayed over total cubic foot. The topmost line represents culmination based upon normal yield tables from Bulletin 201 which can be compared with much younger ages for managed stands.

Figure 2 represents relative density figures that are directly proportional to the Reineke Stand Density Index based on Table 25 in Bulletin 201, which gives the number of stems per acre for the average tree of mean basal area. Notice that none of them is much over one, and the lowest are around 60 percent of what Table 25 (Bulletin 201) shows. Using basal area data from Bulletin 201 gives quite different relative densities.

Yesterday, a forester said that he was using 60 percent of basal areas in Bulletin 201 as a control for thinning. In the stand we were observing at that time, this may be low. In Bulletin 201, a normal stand is much more

![Graph](image-url)
Managing Young Forests in the Douglas-Fir Region

open, relatively, than a normal stand in most other normal yield tables. Most of them are at 90 to 95 percent of the maximum possible volume per acre. The authors of Bulletin 201 used larger plots and took plots as they came, and, if you remember, studies of the approach to normality showed that the approach was about 120 percent of normal, rather than normal. This is just another indication that normal stands in Bulletin 201 are more open than stands in other normal yield tables. So I believe that, if you use a single basal area control, 70 percent would be a safer limit. If you drop to 60 percent of normal, except in young stands and those with deep crowns, you are likely to open the stand so much that a free-growing condition that wastes growing space for several years occurs.

Figure 3 compares basal area midway between thinnings. Data from Bulletin 201 are represented by the round, large, solid black dots running through the middle of the curves. Note that nearly all the basal area figures begin at 20 years and all of them are higher than in Bulletin 201. Plantations and natural stands in the Northwest often exceed the basal areas in Bulletin 201 at 20 years. So Bulletin 201 is not a good guide to basal area for young stands.

![Figure 3. Average basal area midway between thinnings—site index range, 130-147 (2).](image-url)
Figure 4 shows the basal areas in relation to site index at age 50 and, as you would expect, basal areas are lower on low sites and higher on high sites.

Figure 5 is the number of stems per acre midway between thinnings. It doesn't tell you much, because the average diameter is not given.

Figure 6 shows the mean dbh immediately after thinning. According to my ratings, the British and Swedish thinnings were the heaviest in intensity and, as you would expect, had the largest average diameters.

One other comment about Bulletin 201. It was prepared many years ago, and the techniques for developing yield tables, height curves, and so forth have changed in the interim. Considerable question has been raised about the site index curves in Bulletin 201. Recently, Bob Curtis looked at the basic data used to develop these curves and discovered that certain plots had been rejected. The author of Bulletin 201 decided that he had collected more plots with high site index in these younger ages than he needed, so discarded part of them. When we added them to the data, we found that the site curves were very similar to Jim King's curves, if you translate total age to age at breast height. So, if you use Bulletin 201 curves as they are, the indicated site is lower than it should be. For instance, site index measured on a plot at age 50 years will be lower than site index measured at 70 years. But we thought that Jim King's curves were adequate, and he does give a conversion to 201 curves so there was no need to construct another set of site curves for Douglas-fir. We suggest that you use Jim King's curves and convert to 201 if you need to.
Managing Young Forests in the Douglas-Fir Region

Figure 5. Number of trees per acre midway between thinnings-site index range, 130-147 (2).

Figure 6. Mean dbh of residual stand immediately after thinning-site index range, 130-147 (2).
On thinning, I disagree that heavy thinning is necessary in middle-age stands. I agree with European thought that thinning is a process that should continue over an extended time if you are going to realize its advantages. The first entry into the stand doesn't have to be as drastic as some suggestions made on Tuesday. You can begin with a light cut and within 5 years follow with another light cut to realize benefits. I don't believe the first thinning need be from below. The first thinning should be for spacing control and release. In many species—Berg didn't mention this—if you measure the effect of thinning release on the individual trees, you will find that bigger trees don't benefit much from release. They don't need it. It's the codominants usually that have the best chance to benefit from release.

A generality in thinning is that the big trees that are growing vigorously now will continue to grow whether you thin or not. It's the next size down that you need to think about, whether you use crown class or diameters as a measure.

**Audience.** Might you forestall the slowing down of growth in many instances?

**Bruce.** This is a possibility. But I am referring to observations on unthinned stands where a fall-off in growth in the dominants was not realized. They continued to grow quite well. The trees that suffered and slowed down in growth were the codominants. When the stand tightens up they quickly drop down to intermediates.

**Audience.** At what age is thinning from below for the first thinning unnecessary?

**Bruce.** Well, I don't believe thinning from below is necessary at any age. This is just a thinning philosophy. I was speaking in particular of first entries in older stands such as the 55-year-old stand at Black Rock. It is a spacing thinning, or whatever you want to call it, where the thinned trees were nearly the same diameter as the leave trees. Unless the dominants occupy too much space or are poorly formed, they are seldom removed.

**Audience.** Then you would advocate removing dominants on the theory that you get more growth in cubic volume in the codominants over time than if you took out the codominants and left the dominants?

**Bruce.** I believe that, generally, the only time you can justify removing dominants is in a young stand with adequate crown on the codominants. They will develop and fill in the spaces. I think that in older stands you are throwing money away if you cut dominants. They will grow better no matter what the circumstances. Unless you have a good reason to remove dominants, leave them for crop trees.

**Berg.** It depends upon the age of the stand?

**Bruce.** Yes.
Berg. But in younger stands you could make perhaps one or two selection thinnings?

Bruce. Yes. On the field trips, we saw stands in which commercial thinnings were easy because of the large number of merchantable trees. Even the intermediates were merchantable. But there are stands that need thinning, because of the number of stems per acre, in which only the larger trees are of commercial size. In such stands, I don’t think you will hurt the stand with one crown thinning. I don’t think you can continue crown thinnings in most of these young stands and come out very well. But for a first entry to open the stand and also earn as much income as possible, nothing prevents crown thinning.

Audience. In the last 2 days, we have observed good sites. The further south, however, the more severe the sites become. We are forced to work on sites IV and V—severe rocky, hot, dry sites in the Roseburg and Medford area. Even the north slopes sometimes aren’t good as far as workability.

Bruce. Well, I think these are the last places you would thin.

Audience. But we have a lot of acreage of this type.

Bruce. Economists tell us to spend money on the best sites first. You realize more economic return and the country will realize more gain in wood produced if the money is spent on the better sites. I don’t know about site V, but I think possibilities exist for managing timber and thinning on site IV. I’ve seen areas that could be managed.

Audience. We ought to put the effort where the most good will be derived first.

Audience. Will a site tend to increase with age of the stand? For instance between 40 and 80 years?

Bruce. Only if site index is calculated using Bulletin 201 curves. This has nothing to do with increasing the fertility of the soil. If you are referring to site as the fertility of the soil, then no.

Audience. You are talking about the site index?

Bruce. Yes, site index. Not the fertility or productivity of the land. The height growth curves in Bulletin 201, unfortunately, do not follow actual height growth in most stands. The site index increases with age. Therefore, if you remeasure plots at 10-year intervals you will find that each time the site index is slightly higher. Once the amount of change is known, adjustments can be made.

Audience. In our area, we can’t find a normal stand if we use basal area as a base.

Bruce. In dry country?

Audience. Yes. The basal area is below normal unless the stand is stagnated.
Bruce. This is typical. In coastal regions with plenty of rainfall, height growth occurs in the early part of the season but diameter growth continues until late in the summer, so relatively more diameter growth occurs with respect to height growth. Other things being equal, more diameter growth and therefore more volume production for the same height growth should take place.

Audience. We still have trouble with basal area even in areas with 60 inches of rain.

Bruce. Rainfall, by itself, doesn't indicate the availability of moisture in the soil. The soil type is also important. In the southwest, 4 or 5 inches of rain will occur in August, but because the sandy soil has dried out, physiological drought exists and growth stops. The sandy soil dried immediately so growth stopped. It is soil moisture that is important—not necessarily rainfall.

Audience. You indicated that you lean toward European thinning—removing small volumes frequently. With the economic conditions in the Northwest—high wages, equipment costs, interest rates, and so on—if you were managing the forest of a private company with the objective of receiving the greatest return for the invested dollar, would this theory still hold?

Bruce. If you can thin a stand early, I believe you can justify thinning on a 5-year cycle on the sites we have seen in the last 2 days. I believe that in later thinnings when the stand is older and the number of trees per acre is low, regular thinnings may not be so essential. The number of stems per acre is important. Below 80 stems per acre, a commercial cut removing five trees will create five holes in the stand.

Audience. I believe that reluctance to reduce growing stock radically in 30-year-old stands is one of our biggest barriers to initiating thinning.

Bruce. This could be. I have nothing against reducing growing stock in young stands, particularly to make a commercial entry into the stand. If this is the only way to initiate management, it is probably good business to do it.

George Warrack has an unusual Douglas-fir plot near Lake Cowichan in British Columbia (5). I have seen the plot twice and it always amazes me. The age today is about 60 years. Warrack started thinning relatively early. Mean annual growth culminated on a nearby checkplot just about when you would expect—about 50 years. But the periodic annual growth on the thinned plot still exceeds its mean annual growth. If managed Douglas-fir performs in this manner, then the economist must determine harvest age. Mean annual production has not been reduced. I believe we will find more stands like that.

Berg. How many trees per acre in the stand?
Bruce. Still quite a few. About 70 or 80 at least.

Berg. The reason I asked is that after we reduced plot 13 at Black Rock to 100 trees per acre, most foresters either believed we had reduced growth seriously or that we were going to lose this stand. In 1955, however, George Warrack and Alan Frazier from the B. C. Forest Service liked the regime better than lighter thinnings at Black Rock. The years have proved them right.

In Figure 7, which is data from Black Rock (1), notice where the greatest diameter growth occurs. Although the increase in the trees of larger diameter (the large dominants) is satisfactory, the greatest increase in diameter is on the smaller dominants and the codominants.

Audience. Does more volume growth occur on the larger stems?

Berg. Yes. But the choice of whether you take dominants or codominants can change with time; perhaps 5 years can make the difference, for instance, with a large, rather limby dominant tree with two

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Figure 7. Increment in diameter breast high for three thinned plots and an unthinned plot at Black Rock. Site is high III. Stand was 45 years old in 1955. Average number of trees per acre: unthinned 250; thinned 124. Heavy lines are average increment. Numbers represent the numbers of trees in each diameter class in 1955. Broken vertical lines give the range of increment for thinned plots; dots give the range for unthinned plots (1).
well-formed codominants nearby. At age 30 or 35 years, the dominant may be removed to benefit the two codominants, but by age 40 years or perhaps a few years older, the dominant has so affected the codominants by competition that the only choice is to remove the codominants and leave the dominant. Timing is important.

**Audience.** You mentioned that on the drier sites, root competition is more important than crown competition. What effect does this have on spacing?

**Bruce.** I was speaking specifically of ponderosa pine, not Douglas-fir, but I presume the relations are somewhat similar. Where soils are dry in the summer, lack of available moisture to the roots limits growth more than crown competition. I don’t have data to back that up for Douglas-fir.

**Audience.** Is anyone in the Northwest working on soil as an indication of site instead of the present tree-height method?

**Bruce.** Some work has been done in the past, and the Forest Service is now mapping the soils in all national forests. In the correlation of soil factors with growth of trees, however, the limit of error in the estimate is still fairly broad, so that even though it does improve the estimate over no information, it hasn’t proved as accurate as using height growth of trees. The tree is a sensitive indicator of the site. Now, at least, measurements of the environment will not substitute for the height measurement of trees. The height growth of trees demonstrates the potential of the whole environment. Indicator vegetation has proved to be most useful as an indicator of forest site near the limits of tree growth, for instance, north latitudes, high altitudes, or near deserts. In these places, vegetative types are of greatest value as indicators.

**Berg.** Homer Hildenbrand, do you have anything you would like to say?

**Hildenbrand.** Very briefly. The talks by Bob Tarrant and Jim Trappe were certainly thought provoking. We certainly must consider alder in Douglas-fir and western hemlock management, primarily because the species can be utilized as a tool in the management program. I think this is going to be the future of alder. I don’t know anyone in the hardwood industry that advocates using the coastal forests for hardwood production only. Foresters must not be prejudiced against alder. I believe alder has a place in the environment. We must learn what this is and use it to the advantage of the forest. The use of herbicides to remove alder from stands has actually compounded the problem rather than solved it.

**Audience.** In your talk, you indicated that the alder market was primarily furniture. Have you explored the market for panels? In my home, I have a room paneled in maple, another in alder, another in ash,
and one in chinkapin. Everyone is impressed with the paneling. I had a
great deal of difficulty in obtaining paneling in these species, however.
Have you explored this market?

Hildenbrand. Yes, we have. Basically this is the problem. To make
paneling from alder and maple requires a select board. The defects in alder
generally are serious. They aren’t attractive like defects in eastern
hardwoods because usually the knots are rotten. The knots will loosen,
split, and quite often fall out. So we must have a select board for paneling,
which is about 5 percent of our production. If we remove 5 percent of the
select to make paneling we are robbing the furniture customer, which
makes him unhappy. So it’s a marketing problem, but we can sell paneling.
One major line in furniture—kitchen cabinets—I also regard as furniture
business. Our sales to manufacturers of kitchen cabinets are increasing
considerably. A company in Hoquiam, Washington, manufactures kitchen
cabinets using alder lumber exclusively. The doors are all edge glued and
are very stable with no warping or twisting. They are really a worthwhile
addition to a kitchen.

Audience. Are the cabinets marketed as alder or as western birch?

Hildenbrand. They are marketed as red alder. And we are very proud
of it. The aversion to red alder is fading except in the Northwest. Local
furniture salesmen will extol eastern maple, for instance, and run down the
“western junk”.

Berg. Several years ago, farm foresters with the Oregon State
Forestry Department tried to promote an interest in Oregon white oak. It
makes beautiful flooring. Several small operators started cutting oak, but
they all failed for lack of a market. One operator begged home builders to
put his oak flooring in the houses. They refused to do it. He said, “Put it
in and if you don’t like it, I’ll rip it out at my expense and put in eastern
oak.” And they answered “No, we don’t want to bother with it.”
Consequently, some foresters in the State Forestry Department have
beautiful Oregon white oak floors in their homes.

Audience. We surveyed furniture manufacturers concerning the use
of Oregon white oak and they expressed a great deal of interest. Their
main complaint, however, was that they could not obtain it in the
dimensions that they needed.

Berg. This is a technical problem that should be fairly easy to solve.
Howard Hopkins, do you have comments?

Hopkins. Alan said that we should watch equipment. I am very
interested in equipment because my job is getting the thinnings out. Some
rather interesting developments have occurred recently. For instance,
Katrak manufactures a logging machine that is driven from above. The
tracks are around the bogies on both sides. Apparently, the Katrak is doomed because loggers were not interested. Mountain Logger, which has a relatively well established skidder, has entered in with Katrak to make a logging machine (Figure 8). The experimental machine is now operating on the Capitol Forest, Washington Department of Natural Resources, near Olympia. The machine was developed by modifying the regular mountain logger, if I recall, to direct drive. It exerts 2½ pounds per square inch ground pressure, which is, as you can well imagine, considerably less than for a wheel skidder. Meanwhile, Shetky Equipment Company in Portland has developed a machine (Figure 9) that is hydrostatically driven. It has a diesel engine that powers a hydraulic pump to drive both the tracks and the winch. A unique feature is the placement of the blade in the rear for piling logs only. The operator's seat and control system both swivel, but I don't remember how it is controlled. The machine can be driven backward and forward with equal ease. The operator releases a latch on the seat,
turns the seat and controls around to go either backward or forward. Changing the hydrostatic drive is just a matter of switching valving from one place to another. With this system, the machine theoretically can be driven into the brush with the blade and arch pointing forward and hook up a turn without ever turning around. The operator can then drive to the landing area, unhook the logs, back up and pile the logs, and then go back to the woods. Several companies that are thinning young growth have this machine operating on their property experimentally. The machine is not yet being produced commercially.

**Audience.** Does the machine have two control panels?

**Hopkins.** No. The control panel turns with the seat. When you turn the seat the controls are always in front of you.

**Audience.** What is the ground speed compared to a rubber-tired tractor?

**Hopkins.** It is comparable, although probably somewhat slower. But this machine exerts only 4 pounds per square inch ground pressure. The tracks are about 20 inches wide and 4 feet long on the ground. It is built by a reliable company and seems to be well built.

**Berg.** With tracks only 4 feet long, is it a small machine?

**Hopkins.** Actually, the machine is quite long. Its turning radius is fairly wide, but the backing feature compensates for that. But equipment people are working on suitable thinning machines now and this particular machine is really promising for us.

**Berg.** Sounds almost as good as a horse!

**Hopkins.** Probably more expensive. But this machine actually pulled logs across an area that was growing skunk cabbage.

**Berg.** It seems to be comparable to the Bombardier with 1½ pounds per square inch ground pressure. Apparently, it is a little light for work in stands in the Pacific Northwest. During rainy weather it could operate in the woods when no other equipment could, however.

**Everett,** do you have a comment?

**Hunt.** I would like to make a comment on the statement that Berg made earlier about shelterwood cuttings. We have had some experience in shelterwood cuttings on the Elliott State Forest. A word of caution. I would recommend that we not go into a shelterwood cutting system until we have more of the answers we need from this type of system. We have had poor results from the shelterwood cuts we have made so far. Timing seems to be a critical factor. If you can time a shelterwood cut to seed production, and know that you are going to have a good seed crop right after the shelterwood cut, I think the method will be successful. But good seed years are difficult to predict. Our poor experience results from a lack
of seed and from brush competition developing before adequate re-
stocking. We have actually planted our shelterwood areas because we
didn’t want to take the chance that the area would not restock. It is
critical from an economic standpoint. How long can we allow an area to
remain unstocked?

_Audience._ In what area was your experience with shelterwood?

_Hunt._ In the coastal area near Coos Bay. We do have a real brush
problem, as you know. The results wouldn’t be the same everywhere. I’m
just relating my experience on the coast.

_Berg._ Bill Rouse¹, would you like to comment on that?

_Rouse._ We have had good luck with our shelterwood cuts. On two
areas we were quite fortunate in getting about 1,700 trees per acre. On
another area, we had as severe a brush situation as you can imagine. Vine
maple was so thick you couldn’t throw a handful of gravel into it, but we
were really pleased the way that turned out. We burned the area hot to
remove logging debris. We haven’t a good cone crop on the area yet, but
we did set the brush back enough so that we were not too concerned
about it. As a subjective observation, I believe the shelterwood method
offers good possibilities if you cut back to 12 to 18 seed trees per acre. We
are convinced that we are increasing seed production on these areas. We
find that we have cones on the leave trees when no other trees have cones.
I don’t think we know all the answers. Some economic problems occur.

_Audience._ Where are these areas?

_Rouse._ In the Meadowlake-Nestucca River area.

_Audience._ How did you burn it?

_Rouse._ As a matter of fact, in the heavy brush area we burned a few
of the reserve trees, which got us all pretty excited.

_Audience._ That’s the way to distress cones, isn’t it?

_Audience._ We logged one of Bill’s shelterwood sales. It has been our
experience that the increased cost of logging, the increased cost of
burning, and the further increased cost of logging residual trees is many
times what it cost to log clearcuttings and then plant them.

_Rouse._ No doubt at all that costs increase.

_Audience._ The BLM does argue, though, that they are leaving
superior trees. But I believe that the cost of the shelterwood will even
exceed the cost of participation in a superior seed tree program.

_Rouse._ Don’t bet on it, we’re in one.

_Audience._ Well, the way it looks so far, this is true.

¹William R. Rouse, now Assistant District Manager, Bureau of Land
Management, Roseburg, Oregon.
Audience. What is the effect of a shelterwood cut on the rotation age in sustained yield? Will it increase or decrease over a clearcut system?

Audience. I believe it will lengthen the rotation. It will take longer to get regeneration. We have a shelterwood in our area that regenerated. The trees were from 1 to 3 years old last fall. We then cut it back to seed trees, piled slash, and burned it, but now we will have to wait again until we get more regeneration and then take out the seed trees. In this particular instance, we could have clearcut the area and planted it the same year.

Rouse. Disadvantages do exist, however. Cost is one disadvantage. I think you must also consider what the advantages are.

The advantage of shelterwood is to get regeneration when you have a difficult time by any other means. That is the true value of a shelterwood. Audience. In the past, no one knew where the planting stock came from. High-elevation seed came from the top of the barrel. Low elevation came from the bottom of the barrel, but we didn't know whether it came from Montana, California, Washington, or British Columbia. We had good reasons for shelterwood. But now, with everyone active in a superior tree seed-source program, that problem is solved.

Berg. I understand the geneticists are not as hopeful of the superior tree program as they were in the beginning.

Audience. Starker Forests removed a shelterwood last summer after the reproduction had reached a height of several feet. Stocking was excellent. They will wait a year or two until the trees color up and then make a precommercial thinning.

Hildenbrand. Shelterwood is a valuable tool for the forester, particularly in the eastern or southern part of the state. We have a shelterwood program on some of our lands in southern Oregon, particularly in the South Umpqua. I think it is unfortunate that clearcutting is used in these areas. Any regeneration after a clearcutting in southern Oregon is a miracle.

Berg. Schallau, do you have comments?

Schallau. Last night, someone referred to "foresters on the left" and "foresters on the right" or something to that effect. I prefer different terminology. At one extreme are what I call "silvan fundamentalists" (floral arrangers). At the other extreme are "capital management foresters" (economic men).

I would judge that foresters, in general, are more concerned about capital management, as constrained by floral arrangement specifications, than they are about floral arrangement as constrained by economic realities. So let's look at the booklet entitled, "Volume Percent Tables"
(3). And not because this booklet provides a technique you can apply to managed stands. As a matter of fact, you can’t, because the data are based on “normal” yields.

Let’s say you are an entrepreneur with investments in a number of banks. Furthermore, let’s assume all accounts are paying 6 percent interest except one, which pays 5.8 percent. Why don’t you transfer your money from the account earning 5.8 percent to another bank that pays 6 percent? Well, it just happens a cute little blonde works at the reception desk!

Well, let’s say one bank increases interest from 6 to 6½ percent. So you transfer most of your money to the bank paying 6½ percent. Capital management, isn’t it? But you still might want to keep some money in the bank where the little blonde works.

What I’ve tried to build up to is the concept of financial maturity. The banks could be the trees we were marking at Black Rock. Now let’s refer to Table 1 and proceed with a more realistic financial maturity exercise. The growth percent figures are for site index 200, age 49. We can measure diameter at breast height with a diameter tape and rings per inch with an increment hammer. Which trees should be harvested? We need more information. First, we need to know the rate of return your Board of Directors require on new investments. Let’s assume we must earn 8 percent. The growth percents in the handbook allow you to relate physical growth response to value growth in the stand. If we adhere to this, we would harvest all trees that earn less than 8 percent. So, in Figure 10, we would cut four trees: 9-, 10-, 12-, and 14-inch trees. I used this hypothetical example to demonstrate how one might apply economics to marking timber. An interesting exercise would be to go back to the stands

Table 1. Example of Volume Growth Percent Table (3, p. 116).
Figure 10. Concept of financial maturity using growth percent table. Guiding rate of return is 8 percent.

you examined at Black Rock and see how economic guidelines compare with silvicultural “prescriptions.”

Audience. If we set up a guideline system based on growth percent, I believe it will lead to a marking system that will tend to take the bigger trees first.

Schallau. I hesitate to generalize, because growth percent depends on the age of the stand. In a young, vigorous stand the slow growers would probably be the smaller suppressed trees. As a stand matures, the opposite might be true.

Audience. The data are based on physical, not economic growth.

Schallau. That’s right. But if you will look at Figure 11, the relation between value and volume growth, at least in the higher age classes, is almost linear. However, discontinuities might exist for some market
Figure 11. Five-year periodic volume and value growth percents for sample tree (3).

situations. A pole and piling market, for instance, might change the relation between value and volume growth percent. Furthermore, as with the example of the banks and the blonde, esthetic reasons might preclude harvesting certain trees despite their having reached financial maturity.

Berg. One comment on this. We place red ribbons on the most rapidly growing trees on the thinned plot and on a control plot (unthinned) at Black Rock. The most rapidly growing trees on the unthinned plots occurred in clumps, but on the thinned plot they were spread evenly over the plot. So management had changed the growth pattern of the trees in stand. In other words, we must look at the potential of the tree as well as present growth rate when we select trees to leave.

Also, it seems to me, two factors must be considered: percent of interest or the money we are earning on our stand and the total volume that we are growing. For instance, I heard foresters from one company say, “Look what I am earning, I am earning 10 percent on these trees.” Two years later they had changed and were saying, “Yes, I am getting 10 percent on my stand, but look what is happening to my volume growth per acre—it’s way down. It is now 1,000 board feet per acre per year, when it should be 2,000 board feet per acre. I need that wood for my mill so I want the 2,000 board feet per acre rather than 10 percent interest rate.” It depends upon your goals as a landowner or a mill owner.

Schallau. I would like to add to this. In some situations you might have to decide whether money should be shifted from one’s growing stock to alternative investment opportunities outside the forestry sector. For
example, an integrated firm may decide it’s better to upgrade mill capacity than to fertilize forest land.

**Audience.** I speak purely as an economic man. You indicated on Monday that the greatest return on the dollars spent for management occurs in spruce and hemlock. And I haven’t heard a word about spruce and hemlock. I’d like to know, if we are going to invest our money for the greatest possible return why haven’t we considered hemlock and spruce here? Those of us working in the private sector must make a profit.

**Schallau.** The report concerns an existing spruce stand and a unique combination of intensified forestry practices. All the report says is that you should consider these intensified forestry practices and put your money into hemlock and spruce first, if you have this alternative. If this does not exhaust all of your capital, then manage Douglas-fir sites I and II.

**Audience.** But there are tremendous areas of young-growth hemlock and spruce stands. According to the title of this course, some information on management of these stands was to have been included.

**Schallau.** Well, maybe next year we might have more information on hemlock.

**Audience.** I brought this up because we haven’t looked at hemlock and Sitka spruce as closely as we should.

**Audience.** Yesterday, a statement was made that, in the future, species would be less important than the volume of wood fiber. Con, do you think we are headed this way?

**Schallau.** I am biased in that direction. I believe the differential in stumpage prices between major species is not as great as it used to be.

**Audience.** We are all here because we are concerned about young-growth management. Now, some of you are saying we don’t care what species comes back. It’s all wood. It seems to me we should start management with the kind of species we want rather than wait until some species regenerate and then try to determine what to do with it.

**Schallau.** According to Say’s Law, supply will create its own demand. I’d judge this to imply we should be less concerned about species than your comment suggests.

**Berg.** I personally believe that hemlock is a much overlooked species in the Pacific Northwest. In the past, many foresters advocated eliminating hemlock from the forest in favor of Douglas-fir. We have discussed hemlock in this short course in past years but not to the extent that we have Douglas-fir, because we have less information about hemlock. But we are concerned, and next year we should have more information on hemlock, particularly management of precommercial hemlock. Rudy Kangur is now completing the first stage of his work on hemlock and
mixed stands of hemlock and Douglas-fir. Last year, we visited Crown Zellerbach's Clatsop Managed Forest and discussed hemlock with Don Malmberg and his staff. The year before that, we discussed management of precommercial hemlock. Hemlock was not discussed this year and I am sorry about that. We will remedy that in the next course.

Audience. Mistletoe has become a problem in hemlock on the west slopes of the Cascades.

Berg. It is on the coast, also.

Audience. This should have a long-term effect on management of hemlock.

Berg. Next year, perhaps we can ask Lew Roth to talk about mistletoe. Jim, do you have a comment on Poria?

Trappe. Precious few man-hours are available in research. We want to use these man-hours as efficiently as we can to help foresters solve problems. You may recall I mentioned our survey comparing pure Douglas-fir stands with mixed Douglas-fir—alder stands for incidence of Poria weirii. To locate these stands, we circulated letters with specifications to most of the major landowners in Oregon and Washington, and we got a very good response. The State of Oregon, the State of Washington, Weyerhaeuser, International Paper, the Forest Service—some of the national forests, anyhow—wrote back and proposed candidate stands. About 2 man-weeks were required to reduce this information to six pairs of stands that would fit our criteria. To find these stands on my own would probably have taken all summer and we wouldn't have the data yet.

After all, if alder is indeed a worthwhile silvicultural tool for reducing losses from root rots, we will not convince you foresters unless we have sufficient field data to demonstrate this. So if the land that you are managing has Poria scattered about, and if you know a good mixed alder-conifer stand, we would really like to know of it. Then we can test our hypothesis with the circumstances prevailing on your lands. Is alder really helping in that particular area?

Secondly, you may recall that Poria is attacking young stands. In some plantations of Douglas-fir from 10 to 25 years of age, Poria is serious, in some areas, to a degree that I question whether a stand will ever reach merchantability because of Poria mortality. Again, we have looked mostly in northwestern Oregon at this. We would like to know whether plantations in these younger age classes in other areas are attacked by Poria. So, if you have a young stand in which you notice trees here and there turning red in summer or fall, or if you have noticed mortality in past years or a fair number of trees that are a bit off color, not the healthy green color that a sapling ought to have, we would like to know about it.
and investigate the area. Please keep this in mind; with your help we might
be able to come to grips with Poria a little faster than if we researchers rely
exclusively on our own travel time.

Audience. How does borax sprinkled on a fresh stump prevent the
spread of Poria? Is this a chemical reaction or is it physical?

Trappe. I am not involved in these studies but, primarily, the
chemical is toxic to Fomes spores.

Audience. Does it control Poria?

Trappe. It has not been tried with Poria because we are not sure at
this point that Poria spores will infect freshly cut stumps. We hope to
know this before long.

Audience. Is there any indication that the Poria problem is increased
by thinning?

Trappe. Not that we know. If Poria is spread by spores—and we have
some indication that it is—scars around the stump or root collar of leave
trees are courts for new infection. Thinning probably will not have any
impact on Poria already in woody material in the ground. The Poria will
not spread along dead roots of a cut tree as it does along live roots, but
roots of the adjacent leave trees will grow to Poria in the dead roots. The
major consideration, with our limited understanding of the biology of
Poria, is not that thinning will increase mortality over what you might
have without thinning, but that you run the severe risk of losing prime
leave trees from Poria before you are ready to cut them. From a risk
standpoint, therefore, areas heavily infested with Poria may not be very
good places to invest in thinning. In a few years, a thinned stand may
become severely understocked because of mortality from Poria.

Audience. How large an area will be infected with Poria?

Trappe. From what can be observed above ground, infection will
range from a single tree to 30 or 40 acres in some cases. Typically, in
young stands, areas are from 1 to 10 acres with a scattering of live trees
remaining. But in older stands, all the trees in the pocket generally have
died and brush or hemlock has become established. In many old stands,
brush-filled openings are old Poria sites.

Audience. Does Poria travel through soil as well as through the
roots?

Trappe. As far as we know, along live roots only. The Poria in the
soil is waiting for a live root to come in contact with it.

Audience. Then shouldn’t thinning tend to slow the spread by
creating a buffer zone?

Trappe. That depends on how large the buffer zone is. The buffer
zone needs to be big enough that the roots of leave trees will not grow into
the infected area. In a 30- or 40-year-old Douglas-fir stand this may be 100
yards. If competition is eliminated, the roots from adjacent trees will really push out. The old rule of thumb that roots go out to about the edge of the tree crown is hogwash.

Berg. Bob, do you have a comment?

Tarrant. I suggest that those of you who know T. J. or Bruce Starker talk to them about their experience with *Poria*. They have a real problem in their holdings in the Coast Range. About 15 years ago, a team of foresters from MacMillan-Bloedel on Vancouver Island visited the Wind River *Poria* research area to determine whether indeed they could afford to manage young-growth Douglas-fir on Vancouver Island in view of the serious *Poria* problem there. The problem is not new.

As researchers, we have become interested in alder, the principal hardwood in this part of the country, in an attempt to unravel some of the ecological influences. We need no more research to determine the amounts of nitrogen this fast-growing species supplies the soil. Also, it is a fast-growing tree species. We need to understand the ecological base and solve the management problems of alder, because the species will be important under a different economy than we now have. We hold no illusion that we can profitably grow alder at this time, but I think that in time, the benefits from alder, including its very rapid early growth, might be of great interest to us here.

We have preliminary evidence now that, for instance, the *Poria* problem is less in stands that required a long time to regenerate. We are concerned about the possible ecological blunder of logging old-growth Douglas-fir, burning slash immediately, and planting Douglas-fir. We may be short-circuiting a process that, in the long run, nature will not allow.

As far as I know, only one deliberately created red alder stand exists in the whole country, and that's at Wind River Experimental Forest. After the last Yacolt burn in 1929, the people who lived in the valley and planted trees for a living assumed that this was certainly not the last burn for they had seen fire occur often in the past. While they were planting Douglas-fir in the burn in 1930, they argued around a campfire whether or not a strip of planted alder would serve as a firebreak for the next fire. Some argued that the alder would overtop the Douglas-fir to create a firebreak.

The alder seed was collected at sea level near Puget Sound, and the seedlings were grown in the nursery at Wind River and interplanted in the 4-year-old Douglas-fir plantation as a 100-foot-wide, mile-long firebreak. A lack of knowledge about the adaptability of seed source resulted in winter kill of the alder the first 4 or 5 years, so that Douglas-fir and the alder developed together. But at age 27, the mixed plantation of Douglas-fir was producing more than twice the wood fiber of the pure Douglas-fir
plantation. The first indication that alder may reduce the incidence of *Poria* was discovered on these mixed plantations.

**Audience.** Does immediate Douglas-fir reproduction help the *Poria* problem or make it worse?

**Tarrant.** Makes it worse. We now hypothesize that many Douglas-fir stands did not regenerate to Douglas-fir immediately, but went through a period of brush and perhaps alder for a long enough time for the pathogens to die, and perhaps for restoration of soil fertility after fire. In the Black Rock area on the Capital Chapter of the SAF field trip this spring, one stand we observed was logged in 1915 and the area regenerated about 1940. I asked about the incidence of *Poria* in that stand and was told that no *Poria* had been observed. Trappe postulated the other day that the reason *Poria* hasn’t wiped out Douglas-fir was delay in regeneration. Many times this pathogen has died out. If you have any doubts as to the seriousness of *Poria*, T. J. and Bruce Starker have observed it frequently in their thinnings and I think are deeply concerned about it.

**Audience.** The other day Dr. Trappe said that *Poria* would live in the ground for maybe 50 years or more. This morning he said that *Poria* lived in the live roots.

**Berg.** *Poria* will live in dead material in the ground, but it travels in the live roots.

**Berg.** Dick, do you have a statement?

**Stonex.** I should have mentioned yesterday—this was brought to mind by Tom Mackey who said their roads system was designed for a 600-foot maximum skidding distance—that at Longview Fibre we have discussed yarding distances at length. In the Silver Falls tract, the maximum yarding distance is roughly 1,000 feet, with some long corners with yarding distance to 1,500 feet on favorable ground. Because of the low-value timber there, we can’t justify more expense in the road system. But if we are able to yard small material this far, we feel that we will be able to yard larger material just as easily. Howard, I don’t know whether you have a final answer on other areas.

**Hopkins.** The discussion goes on.

**Stonex.** When we changed from cats to rubbertired skidders the problem of yarding distance wasn’t eliminated, but travel time was reduced greatly. I believe that new equipment now in the developmental stage will move logs more rapidly and roads then will be spaced more widely with, of course, more land devoted to production of trees. In the last 8 years, company roads are getting narrower all the time to keep more land in production.
Audience. If you had a more valuable stand, would you construct roads closer together?

Stonex. Probably not.

Hopkins. Our calculations are based on log size, current volumes, and time of skidding.

Audience. Present time?

Hopkins. No, present stands.

Stonex. Basically, our road system is old railroad grades from which we develop spur roads. Most of these railroad grades are not over ½ mile apart. Occasionally we need a long spur. We have few places where we must build over a mile of new road without using the railroad grade.

Hopkins. In the future, when the trees are larger and therefore more valuable, we will have more efficient equipment capable of moving the logs longer distances.

Stonex. This winter, we were yarding on a 15-percent adverse grade for distances up to 1,500 feet with good production. So it can be done.

Audience. Con, I wonder how a public resource manager can practice financial or economic management with so many resource values with no established dollar value?

Schallau. I was afraid somebody would ask that question! Allow me to illustrate briefly how we might use existing models for maximum financial returns, subject to environmental quality constraints.

Let's assume we want maximum timber production or dollars. We have inventoried all stands and find 10 units can be produced from stand number one, maybe 12 units from stand number two, and so on. These are the opportunities. But we also determine that certain levels of sedimentation cannot be tolerated. So, for each one of the stands we have a "coefficient of sedimentation." For example, let's say for stand 1 we would generate three units of sedimentation for each unit timber; two units of sedimentation for one unit of timber production in stand 2, and so on. We determine also that sedimentation cannot exceed a specified amount. We can do the same for other nonmarketed goods. For example, perhaps we can develop an additive measure of esthetics.

Presently, linear programming allows us to determine how to get maximum financial returns, subject to environmental quality constraints.

Audience. Isn't it important what values you place upon your "not greater than or not less than?"

Schallau. That is most important. Many people, including me, are intrigued by linear programming. I contend, however, that the most important challenge with respect to this technique is the determination of constraint values—the "not greater than or not less than" values.
Audience. Foresters have used the guideline, never cut over 30 percent of the basal area. This was true in the stands we observed yesterday. Several plots at Black Rock were reduced by more than 30 percent, however, without adverse affect. Would you comment on this?

Berg. Well, this is caution on the part of the foresters. So much is not known about managing young stands—how they will react—that we all tend to be somewhat cautious. Black Rock is a research forest, and we have established a series of growing-stock levels to determine tree and stand response under these conditions. We must be bold in our approach to get the answers. A forester managing forests for a company or an agency on an operational basis, however, must protect that investment. We know that a reduction of 30 percent of the maximum level is safe. We also believe now that much greater reductions are safe—in fact, necessary. As soon as the data have been analyzed carefully, this information will be released. But for the present, I would recommend that foresters err on the safe side.

Bruce. This may be related to the idea that, if you know the maximum density to which stands will grow at any age, then you have a top limit guide for reducing the stand; for instance, 60 percent of the top limit would be a good growing condition for trees. This is the basis of Reineke’s stand density index, the Japanese competition density, and so on. Well, if you determine that the stand you have entered is somewhere near the maximum density, then, if you cut 30 percent of the growing stock, you are down to a 70-percent level, which is good and safe. If you go below a lower percent of maximum density in many species, they you may have opened your stand up so much that you are losing growing space efficiency for too long a period. This is the argument.

Berg. Do you have a comment, Darrel?

Speisschaert. Several foresters, last night and today, asked why we were thinning in the older age classes when we had so much timber in the younger age class. Until about 2 years ago we had no market for small logs in the North Santiam canyon. Now that we have a market, we are thinning younger stands. I personally believe the priority should be in the younger stands. In the older age stands of 70 to 90 years, management is strictly the salvaging of mortality before we make the final harvest cut.

Stonex. We probably invested $150,000 in road development before we started logging. A public agency can’t do this.

Speisschaert. That’s true. We can’t preroad our areas ahead of our sales, so we must build the road with the timber sale. This slows development of some areas.

Bruce. We have not discussed the measurement of small material removed in thinning sales.
Audience. Is a local volume table important or necessary?

Bruce. How do you define a local volume table?

Audience. One that is developed for the individual stand.

Bruce. The value depends on the units of measure used to develop the volume table. The estimation of board-foot volume depends on the taper of individual trees. This results in some wild estimates, occasionally, so that for trees in small size classes it is reasonable to measure them in cubic foot volume. Even if you make a small error in taper estimate you will come very close to the cubic foot content of a tree. Also, using Scribner board foot volume scale, logs with 5- or 6-inch diameters can result in high overruns, whether it is a long log or a short log. You end up rather confused about what your product potential is.

Cubic volume is a way out of this. I know this is a nasty term among some foresters. For inventorying young stands and updating tree growth, cubic foot volume is much more meaningful than board foot volume. Figure 12 shows the percentage of lumber, chips, and sawdust recovered from logs by diameter size.

Figure 12. Percentage of cubic foot volume recovered in lumber and chips from logs by diameter size.
by log size (solid lines). With sound logs about 18 inches or more in
diameter, about 65-80 percent of the cubic foot volume will be converted
into lumber. Of course, this is influenced to some extent by the sawing
process itself. But for logs less than 18 inches in diameter, a progressive
decline in lumber recovery occurs until at about 6 inches in diameter only
about 30 percent of the cubic foot volume is recovered. So, only in small
logs are you concerned about recovery ratios.

On the other hand, if you use board foot volume to determine
recovery ratio, the curves go down to practically nothing and the overrun
curves go up. I calculated once that if you scaled a 40-foot log that was 5½
inches at the top end and then rescaled it in short segments you get about
300 percent overrun. I don’t know how you can handle overrun in small
material. It seems so much easier to use the gradual curves for cubic
volume and go directly from the raw material to the volume of product.
And incidentally, if you do this for veneer logs, you get a curve that is
somewhat similar, except that the veneer curve drops a little more sharply
(Figure 12). The broken line shows the shape of the veneer recovery curve.
Its level depends on core size and log quality. I am also interested in using
weight to determine product recovery. For instance, butt logs will give
more weight per given board foot volume. This is not a problem, however,
in weight-cubic foot volume relation, which is nearly constant. The
percentage of sapwood affects the weight-cubic volume relation, however.

Audience. What about using cords to measure small material?

Bruce. The reason for using cords as a measure is the ease of scaling
on the truck. You measure the average height, width, and length of the
stack, convert to cubic feet at about 93 cubic feet per cord, and you have
an estimate of solid wood content. You can develop just as good an
estimate with sampling and weighing.

Audience. Would you comment on the use of tariff tables?

Bruce. Well, I have not had much experience with them. Once, I
compared tariff tables with actual tree measurements from an 80-year-old
Douglas-fir stand at Mt. Hood. I discovered something that was not
supposed to happen. The trees with small diameters actually had higher
tarif numbers than the trees with large diameters. I asked Ken Turnbull
about this. He said he had looked for this in the stands he used as a basis
for the tariff tables and had not found it. I believe tariff is adequate for
stand average volumes. If you sample the trees properly for tariff number,
you will have good reliable figures. I would question it as a system for
getting volumes of components of a stand, because of what I have
experienced.

Audience. Our firm scales 25 percent of the load when we use
weight and are scaling on the ground. The information is placed on a card.
Bruce. In weighing logs and converting to volume and then to dollars, you are using a process that may not be absolutely necessary for small uniform material. To scale by weight, you use either an experience weight conversion or a sample. First, develop the conversion factor using the first 20 or 40 loads. Then, every tenth load or so you check the reliability of the conversion factor. It probably would be easier if you can reach agreement with the buyer to sell on the weight alone. This would be much more sensible for small, uniform-value material.

Foresters argue that the variation in moisture content of logs will make weight as a measure impractical. Foresters over the world have argued about this, but those using the method have found it practical. In the southeastern United States, loads of mixed oak and pine are measured and sold by weight. The proportion of each species is calculated and the value calculated. In thinning sales, selling wood by the pound should be efficient and accurate. If weight differs at different times of the year because of sapwood, this can be adjusted. Even though 100 cubic feet of wood can vary in weight 10 percent up or down, over a course of a sale, it will average out. Games can be played with any system of measurement such as, an empty truck coming in with water tanks empty and then not applying brakes downhill with a full load so that water isn’t used before weighing.

Audience. We considered using weight for scale but you must be set up to use weight and we weren’t.

Bruce. That’s true. You could use a highway scale or something similar. Some full-length truck scales are in use in the Douglas-fir region now.

Audience. One Forest Service sale at Oak Ridge is specifically set up to sell logs by weight. The contracts are written to allow the use of weight at the discretion of the purchaser. He can use either weight or the conventional Bureau scale.

Bruce. It is legal to sell by weight in the Forest Service.

Audience. So far the Forest Service hasn’t convinced a purchaser to change.

Bruce. This is a matter of education. I thought that talking to this group might stir up some interest in this.

Audience. If we continue to use log rule, wouldn’t the International 1/8-inch be more accurate than Scribner?

Bruce. Why must you use a log rule?

Audience. But if we do use board feet instead of weight or cubic feet, wouldn’t International be more accurate than Scribner?

Bruce. International usually gives a closer estimate of the potential yield of boards for small material, yes—depending on kerf width, mill
objectives, efficiencies, deficiencies, and so forth. I have seen studies where the mills actually underran International ¼-inch, and I've seen others where recovery is close to scale. But actually using cubic feet is better because you can estimate all your products. The ratio of lumber to chip production changes with log size, so if you measure in cubic feet you estimate both of them from log dimension.

Well, this is a sales pitch only. I didn't really believe that anyone would change on the next sale. If scales are available, this method should be considered because of efficiency. The trucks are not delayed—they stop on the scale and the weight ticket is produced automatically. It is a certified weight. Everybody is happy. The material has been measured. Logs are sold in Georgia that way. They first tried weight conversion and then suddenly realized they were wasting time. Once both the buyer and seller were familiar with the conversions, logs were sold by the pound.

Audience. Yes, but selling small logs by Scribner rule, both the buyer and seller understand. This is a conventional method.

Bruce. I believe both are equally confused by Scribner log rule.

Audience. Alan, what were you referring to when you questioned the genetic program?

Berg. Well, after I said that I began to wonder whether I should have. But it comes to mind that Helge Irgens-Moller said geneticists do not now expect the results from this program that they originally had believed possible.

Audience. I’ve heard Helge say that.

Audience. What they said was that the foresters should not try to develop forests of super trees. They only should try to raise the quality of the overall forest stand.

Audience. For the program we are discussing, only one parent is known. Is that right?

Audience. That’s right. One parent is known and the tree is designated as a super tree, but maybe that is the wrong term—perhaps “superior tree” would be better.

Audience. They pick an average tree and it is not necessarily a super tree.

Audience. Right. The method is designed to test the progeny, not the tree itself.

Audience. I have a comment and a question. At the banquet, someone suggested a movie to demonstrate what foresters do as professionals. My comment is that if a movie is produced it should be concerned with what we are doing in the forest. Don’t just show somebody talking.
Secondly, how long will it be before skyline logging is as practical in thinning as on clearcutting? Tom Shipler in Eugene claims that the only limit to yarding distance is the time that it takes the falling crew to get out and back. On clearcuttings, we use 4,000-foot yarding distances. Can we do this in thinning? Any ideas?

Audience. We yard a mile or so.

Berg. Everett, how far do you reach with the Baco?

Hunt. Our longest yarding skyline road is 3,000 feet, but the reach from the skyline road is 150 feet on either side. This was limited by the ability of the choker setter to pull the choker out only 150 feet from the skyline cable. Sometimes a two-man crew was necessary.

Audience. How wide was the road itself?

Hunt. Thirty feet from the bole of one tree to the bole of the tree on the other side. The roads were 300 feet apart.

Berg. In the course last year, several foresters argued strongly that we should convert to high-lead or skyline systems entirely—even on level ground. They claimed it would be the least expensive method as well as cause less disturbance to the soil because the log is lifted off the ground. I believe Weyerhaeuser Company has worked with cable systems rather extensively and that the cost is low. But certainly the cable system does less damage than tracked vehicles, particularly on steeper ground.

Audience. I might point out that about 90 percent of one unit was a selective cut. The logs were yarded above the canopy of the standing trees, which are about 70 years old. The system didn’t work.

Audience. Why not?

Audience. The method removed the tops of the trees. I believe that they tried to get so much volume per turn that the line was weighed down.

Audience. That problem happened to us in clearcutting, too. The line was overloaded constantly.

Hopkins. I can visualize problems in cable yarding the more favorable ground that we have. Getting enough deflection to reach far is difficult. In the Longview area, Weyerhaeuser Company found that, as their cost in logging with the high-lead system dropped, their damage factor skyrocketed.

Hunt. I saw this operation and it was bad.

Berg. Last year, we looked at a skyline thinning by Crown Zellerbach using the Washington 98 Yarder. Little damage occurred either to the trees or to the ground.

Hunt. This was tree damage at Weyerhaeuser.

Berg. With the proper skyroad, practically no damage to the stand should occur.
Hunt. The point is that as logging costs went down, the damage went up. Too much speed.

Berg. I still believe strongly that we should not sell any method of logging short. I believe we are going to have to use all of them.

Audience. What is the minimum volume in small logs that you can afford to log with cable systems?

Hunt. A skyline system?

Audience. A system that lifts one end of the log off the ground.

Hunt. For thinning, one of our operators said he needed at least 100,000 board feet for each skyline road.

Audience. What was the cost per thousand board feet?

Hunt. We never knew for sure. We heard from 60 to 75 dollars a thousand.

Audience. Did he rig a tail tree?

Hunt. Yes. He used a gravity system with the tower and yarder on a ridge. First he used the Baco, and then he invented what he called a "weaver retriever." Volumes removed are about 5,000 board feet per acre.

Remember that, in a thinning of this type, a large part of the volume is in the skyline road itself which is actually a clearcutting. On a 2½ million board foot sale that we made, 750 thousand board feet were on the skyline roads themselves. So we had a thinning and a clearcutting.

Audience. On the high-lead cable logging at Fisher Point, the operation was removing 12,000 board feet per acre from the area. The Forest Service believes that that is about as small as volume recovery should be for high-lead outfits on a show like that. It should not be much less than 12,000 board feet per acre.

Audience. On that operation, at first they used small equipment for thinning young timber with small logs. It was not efficient for the larger logs removed at Fisher Point. We want to thin in the younger stands, but we don’t have a cable system that is efficient and economical. This is a problem on management of steeper land. Has anyone had experience with this?

Audience. In this short course, I hoped we would see more logging operations. I understand, of course, that the day of the visit is quite often the day the equipment breaks down or the operator moves his equipment so that arranging tours is difficult. So I believe, Alan, as you were discussing this morning, that either movies or a TV tape of various thinning methods presented to a group shows promise. I think that would be great.

Hopkins. In answer to questions about high-lead thinning in small timber, John O’Leary has been working with Crown Zellerbach in their Vernonia department on such a program.
Berg. John is in Europe now; otherwise, we would have him here to discuss this subject with us.

Audience. We have not discussed high-lead strip thinning today. We had a sale like this on our district this past year, and the loggers seemed to do quite well with it. I don’t know what his costs were. At least, he did a very good silvicultural job. The strips were 25-foot clearcuttings with a 55-foot reserve with no logging between strips. Yarding was straight up and down the hill.

Berg. Last year we visited Crown Zellerbach in Clatsop County and saw strip thinning in hemlock. It is still in the experimental stage. They were trying various widths of clearcut strips and various widths of leave between strips. Then, in the next cutting, they made another strip clearcut in the uncut reserve. Eventually, they would thin the reserve strips to proper tree spacing. The purpose was to produce wood, generate income, and lower the costs of logging. They also believed that they would get release in the hemlock stand. This hasn’t been demonstrated yet, of course. Logging costs are lower, no question about that.

Audience. Do they want regeneration in those strips?

Berg. No, the strips are to provide access to the stand, to make logging in young stands profitable, and, they hope, to increase growth on the residual stands. They are trying this system with both cable systems on steep ground and tractors on gentle ground.

Audience. How old is the stand?

Berg. About 40 years old.

Audience. This is called a Carter thinning. It is actually an adaptation of a European practice that was used initially to provide access. The basic roads and thinning strips are developed so that they can reach out between the strips for selective thinning. The method serves two functions—access to the stand and a reduction in logging costs—and, we hope, release to the residual stand. But again, it still is experimental.

Berg. Does anyone have a comment or a question? Then I will ask which was the easiest stand to mark at Black Rock—the thinned or the unthinned?

Audience. From the standpoint of which tree to take and which to leave?

Berg. Yes.

Audience. The unthinned. It had enough trees so that your decision did not affect the stand as much.

Audience. The marker didn’t have to correct the other marker’s mistakes!

Audience. Marking in the thinned stand required more skill in selecting the right tree to leave as a crop tree.
Berg. I believe this is true.

Audience. Dick Stonex said that he was going to let the logging contractor do some of the marking because of the time consumed in marking. This would lead you to believe that the initial choice isn’t that critical.

Berg. This is true. Two factors are involved in what Dick is trying to do. In the first thinning, the trees mark themselves and he has an operator that he can trust.

Audience. If we had had records of individual tree growth in the field at Black Rock, we could have observed how the tree was growing over the years to learn whether our theory is correct that the better growing tree has the better crown. Perhaps we could estimate growth percent by the tree characteristic.

Berg. A good idea.

Hopkins. You can select fast-growing trees after you have used the increment hammer for a while in marking trees. We started our thinning program cautiously. We wanted to keep the fast-growing trees as residuals. For about 2 years, I carried a hammer. After a while, it was quite obvious that I was carrying the hammer for only the occasional tree that was doubtful. I had developed a knack for identifying the leave trees most of the time.

Audience. I’d like to see work done in 80- to 100-year-old stands as to possible release by thinning. Thinning some of these stands would produce wood from other than just mortality. But can we increase growth?

Bruce. Dick Williamson and Frank Price of the Experiment Station worked up data on thinning plots in this approximate age class scattered in the Coast Range. They concluded that thinning did improve growth rates.

Berg. The Station has a publication on release in 100-year-old Douglas-fir.

Bruce. Yes, but this is another report on several thinnings 15 or 20 years after treatment. Some beneficial effect showed up.

Audience. Was it worthwhile economically?

Bruce. I can’t answer this.

Audience. If you remove competition you can expect added growth. But does it pay to do this? Or should the stand have been clearcut instead?

Audience. If you enter a stand of this age at all, you should harvest mortality only. The question of response is purely academic. Soon we will not have stands of this age to manage, so why should we bother to determine whether they respond or not.

Audience. We have unmanaged stands of this age now.
Audience. All right. Take the mortality only. Don't expect release.

Audience. What if they could respond?

Audience. It doesn't matter whether they respond or not. You still have the stand. All you can do is harvest the dead and dying trees. An improvement thinning in this age class is ridiculous. When the average rotation age is 50 or 70 years, considering these stands for intensive management is pointless. You are only fooling around.

Audience. In old-growth management, we are not harvesting at rotation age. We have a rotation age of about 90 years. That doesn't mean we are going to cut this stand when it reaches 90 years. We may hold it for another 30 years.

Audience. That's true. But eventually, rotation age will be less than 70 years. Silvicultural response of older stands cannot be determined before that time.

Berg. Are there any more comments or questions? I want to thank the instructors again; without foresters willing to share experiences we could not offer these short courses. I hope the course and discussion have been profitable to you.

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