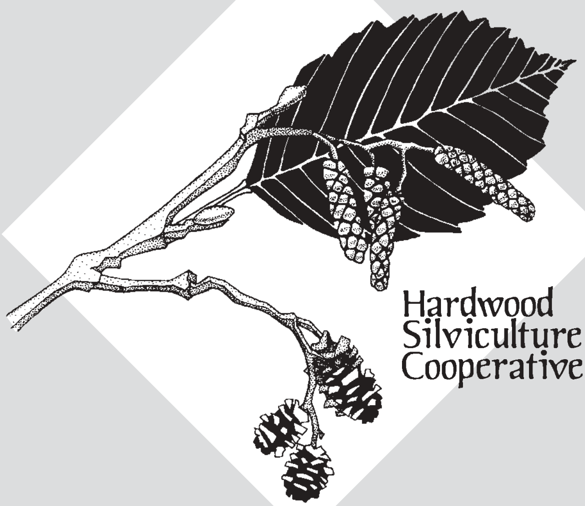
1994-1995

June 1995

HSC

Annual Report



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Highlights of 1994-1995

- Our long course toward establishment of the installations in the Alder Stand Management Study is nearing completion. This year, we established 4 new Type 2 variable-density alder plantations and 1 new Type 3 mixed alder/Douglas-fir installations.
- Permanent plot installation and third-year measurements were completed at five Type 2 and one Type 3 installations. In addition, sixth-year measurements were completed at one Type 1 and one Type 2 installation
- Following an interim guideline, trees at one site was pruned to 11 feet.
- Work on Phase II of the Wood Quality Study was completed. Bob Lewis, a Master's student, completed his thesis documenting the effects of stand spacing and respacing on young tree growth and form.
- An ad hoc technical committee reviewed our pruning goals and established a protocol for pruning in the 230 tree per acre plot designated for pruning. The committee also began discussions on a pruning study that would involve other initial densities and pruning to different heights-to-live crown.
- The Bigleaf Maple Regeneration Study almost did not get out of the starting blocks: much of the region had little seed last fall. However, with the help of several cooperators, we secured seedlings from 5 seedling lots, completed a series of preplanting measurements, and outplanted them at 5 locations.

Contents

Introduction

This report summarizes the activities of the Hardwood Silviculture Cooperative (HSC) during its eighth year. The current emphasis of the Cooperative continues to be on the management of red alder for timber production, biodiversity, nitrogen fixation, and as an alternative species to conifers in areas infected with laminated root rot. This year we also began a study of bigleaf maple regeneration.

The Red Alder Stand Management Study continues as our highest priority. Efforts over the last three years to complete the sampling matrix have really paid off. We have 23 of our target of 30 Type 2 installations (new variable density plantations) successfully in the ground and 3 of the 7 planting locations identified for next spring. Baring the unforeseen, the matrix should be completed in 1996. We have also made good progress with our Type 3 installations (mixed alder/Douglas-fir); 5 of the 9 plantations are in the ground.

The second research priority of the HSC is the project on the Effects of Management on Alder Wood Quality and Stem Form. The second and final phase has been completed in the Master's thesis project of Bob Lewis. This research has outlined the effects of initial spacing and thinning on height and diameter growth, on stem form, and on crown lift. Of particular importance to foresters, the tradeoffs among tree growth, wood quality, and stand density were quantified.

The HSC began work on a third research priority, regeneration of bigleaf maple. Initial plans for a study that covered both seedling quality issues and seed movement were hastily modified when a poor maple seed crop was reported over much of the region in the fall of 1994. We were able to move forward with a seedling quality study when seedlings grown under a variety of conditions were provided by the Oregon Department of Forestry, Weyerhaeuser Company, and the PNW Research Station.

The following report reviews in more detail our progress with these three major projects, as well as related research by HSC staff on alder and other hardwoods. The activities of our Management Committee are also summarized.

Organizational Activities

Policy Committee Meeting - June 1994

The Policy Committee met on June 8, 1994 at Oregon State University. A proposal introduced by Dave Hibbs to combine the Technical and Policy Committees into one body was unanimously approved. The combined committee is now called the Management Committee. Previously, proposals and new projects were suggested by the Policy Committee, developed by the Technical Committee, and finally returned to the Policy Committee for approval. This procedure resulted in at least a one year delay in implementation. Combining the two committee functions should cut the delay in half. Most membership in the two bodies overlapped, and all members present who sent different representatives to the two meetings agreed to the change.

Dave presented a design for a proposed study of the regeneration of bigleaf maple. This short term (4-year) study would test the effects of seedling size, seed transfer (between zones) and animal damage control on the establishment of bigleaf maple seedlings. HSC members participating in this study are:

- BC Ministry of Forests
- Bureau of Land Management
- Diamond Hardwood Lumber Co.
- Gifford Pinchot National Forest
- Oregon Department of Forestry
- PNW Experiment Station
- Siuslaw National Forest
- WA Department of Natural Resources

It was moved and unanimously approved that the interested paying members (all those listed above, with the exception of the PNW Station) would divide evenly the cost of the study, and all would serve on a subcommittee to direct the project. The study itself is described in a separate section of this report.

Bob Lewis reported on the progress of the second phase of the Wood Quality Study, which is described later in this report.

Karl Buermeyer reviewed the progress of the Red Alder Stand Management Study. Problems with severe thinning treatments in natural and planted stands (trees falling over and breaking when opened up too suddenly) were discussed.

There was a discussion about what to do in plantations that have a significant incidence of forking due to earlier top dieback. This discussion was continued on the field trip the following day. It was decided that, since this will probably be a standard operational practice, forked trees will be pruned to a single stem after the third year measurement and plot installation (and thus pruned trees noted in the data set).

Progress in completing the matrices of Type 2 (variable density alder plantations) and Type 3 (alder/Douglas-fir replacement series) was, as always, an important topic. A discussion prior to the regular meeting (in the morning) determined that the Cooperative will continue planting Type 3 installations at the 300 tree per acre density, and will continue to use the 50/50 mix of alder and Douglas-fir. There was a legitimate concern that such a wide density may result in stems of poor quality, and would not reflect current operational planting densities. It was decided that, since four of the nine planned installations were already in, and that the remaining sites were planned for poorer sites, to change treatments at this time would introduce another confounding factor. An additional confounding factor would be introduced with the eventual need to thin from the greater planting densities. The 50/50 mix in plantations of other species has resulted in some surprisingly good growth of the slower growing species (in this case Douglas-fir), despite fears that the slower growing species would be shaded out, so this treatment will be continued.

A soil sampling procedure to obtain baseline soils data, should differences in tree performance be noted in the future, was finalized. It was decided, to minimize costs, that soils would be collected only in the pure alder and pure Douglas-fir portions of the Type 3 installations. In addition, soil scientists will determine what analyses are absolutely necessary now, and what could be performed on archived samples should it be needed in the future.

The budget for 1993-94 was reviewed, and the 1994-94 budget presented. The latter was unanimously approved.

The following day, ten of those present at the Policy Committee Meeting went on a field trip to visit sites relating to some of the indoor discussions. The first stop was a demonstration area for replanting non-susceptible species in *Phellinus* pockets. Bigleaf maple regeneration was discussed, and problems with animal damage viewed. This was followed by a visit to the site that prompted the discussion of pruning forked trees, and some possible criteria for selecting stems for crop trees were discussed. The trip wrapped up with a look at one of the new Type 2 plantations where there was significant nursery frost damage, and some herbicide damage in the seedlings planted that spring.

Management Committee Meeting, November 1994

The meeting was held at the PNW Station in Olympia on November 29 and 30. Following introductions (including our newest member, Coast Mountain Hardwoods of Delta, BC), Connie Harrington gave a preview of Tuesday's field activities. Karl Buermeyer then discussed 1994 progress on the Alder Stand Management Study.

Six new Type 2 installations (variable spacing alder plantations) were planted in the spring of 1994. One was a failure, another had some problems which will be discussed in the following section.

Three alder/Douglas-fir replacement series (Type 3) installations were planted in 1994; all appear at this time to be successful.

In the winter of 1994-95, plot installation and 3-year measurements were completed on five Type 2 installations and one Type 3 installation planted in 1992, as were 6-year measurements on one Type 1 (thinned natural stand) and one Type 2 installation.

A sub committee consisting of David Hibbs, Dean DeBell, Connie Harrington, Jerry Hoyer, and Bill Voelker was set up to deal with problems encountered in opening up stands in thinning treatments, pruning issues and a review of the Stand Management Study treatments in preparation for growth modeling.

Bob Lewis gave his final report on the second part of the red alder Wood Quality Study.

Tuesday's field trip began near the PNW Station, where a trial of browse protection for bigleaf maple seedlings had been conducted the previous summer. The primary conclusion reached was that solid translucent tubes are preferable to course meshes because deer and elk can pull leaves out through the holes. A recycled sandpaper tube was most resistant to being pulled out, but did not allow enough light to get to the seedling.

The group then travelled to the Meridian Seed Orchard where studies of spacing, thinning and pruning of red alder are being conducted. Rates of occlusion of pruned branches in thinned and unthinned stands were compared, and characteristics of multiple stemmed trees were examined.

Wednesday morning began with Karl finishing the review of the Stand Management Study by discussing plans for the next two years and completion of the Type

2 and Type 3 installation matrices.

Dave Hibbs discussed the Bigleaf Maple Study. 1994 was a very bad seed year for bigleaf maple; some cooperators were not able to find enough seed to proceed with the study as planned. He offered a plan for an interim study, mainly of the effects of seedling size and animal protection until enough seed can be collected to include seed source effects. The participating cooperators agreed to go ahead.

Karl presented a draft protocol for identifying and removing multiple stems resulting from early seedling damage. Some modifications were made, and operations are proceeding based on this protocol.

Karl presented some changes to the Stand Management Study Field Manual, to better reflect our experience on the ground and to save unnecessary work. The same committee that will be reviewing the thinning protocol above will develop a pruning protocol to be added to the manual.

Wednesday's field trip was to the Centralia Mine site. Red alder was planted 12 years ago at spacings from one to six meters. Effects of spacing and site variation were noted, as were the results of a pruning study.

Cooperative Research

Alder Stand Management Study

Six new Type 2 installations (variable spacing alder plantations) were planted in the spring of 1994. One, near Sedro-Woolley, WA was a failure due to heavy grass competition, some stock quality problems, and the inability to properly prepare the site. Another, on the west coast of Vancouver Island, has some problems with heavy accumulations of rotten wood, fingers of talus, and stock problems (intermixing of Sitka alder and possible herbicide damage). This site was interplanted in the spring of 1995 and will be replaced if necessary.

The remaining four sites appear at this time to be successful, with a small amount of interplanting in the spring of 1995 to make up for some mortality. Most mortality in the successful plantings was due to soil heating the root collars and girdling the seedlings. An interesting development was heavy mortality in one installation which had appeared in the Fall of 1994 to have recovered from some nursery frost damage and planting site herbicide damage. Dead and damaged trees were replaced in the spring of 1995. In another installation, apparently healthy trees (some 6-7 feet tall) died back over the winter. These problems may be related to *Septoria* in nursery stock; this will be investigated.

Three alder/Douglas-fir replacement series (Type 3) installations were planted in 1994; all appear at this time to be successful. Soil sampling was conducted in the four existing Type 3 installations in the summer of 1994.

In 1994-1994, plot installation and 3-year measurements were completed on five Type 2 installations and one Type 3 installation planted in 1992, as were 6-year measurements for one Type 1 (thinned natural stand) and one Type 2 installation.

For an overview of 1995 planting season progress in filling the Type 2 and Type 3 installation matrices, see Tables 1 and 2. Of the six sites identified for Type 2 installations to be planted in 1995, two were moved to 1996. Logging on one has not been completed yet, and the stock for the other sustained heavy frost damage in the nursery.

For the 1996 planting season, a proposed site on the OSU College of Forestry Research Forest is in question due to spotted owl regulations. We will be looking for two sites with Coast Mountain Hardwoods and one or two with International Paper, our newest member. If these sites are found, the location of a site on Washington DNR lands on the Olympic Peninsula and replacement of the Goodyear Nelson site lost this summer would give us the 30 installations planned for, regardless of the outcome on the OSU School Forest site. With only four sites planted in 1995, this leaves seven sites to plant in 1996, four or five of which have yet to be found. If any additional members join the Coop, we could add more sites in the future.

One Type 3 installation was planted in 1995; two originally planned for 1995 were moved to 1996 because of incomplete site preparation. See Table 2 for a progress summary. Solicitations for the two additional sites needed will go out at the 1995 Summer Management Committee Meeting.

In Type 2 installations, problems have been encountered in the first thinning where trees have grown too fast (high quality sites) and become top heavy and spindly in the 1200 tree per acre planting density. It was proposed to change the trigger for this early thinning from the year after lower branch mortality to using a given tree height to assure that trees do not become too tall before thinning. A sub committee consisting of David Hibbs, Dean DeBell, Jerry Hoyer, and Bill Voelker will come up with a recommendation (This committee will also deal with pruning issues and a review of the Stand Management Study treatments in preparation for growth modeling. Other expertise will be called on as needed by this committee).

A protocol for identifying and removing multiple stems resulting from early seedling damage was developed and finalized at the fall Management Committee Meeting. It was decided that there would be no tolerance for multiple stems, as this

Table 1: Existing, committed and identified Type 2 installation sites, April, 1995. None to four installation sites are identified in each cell of the matrix. Number in upper left indicates number of installations originally planned in that block.

Region	Site Quality: Low SI_{50} :23-27 M SI_{20} :14-17 M	Site Quality: Medium SI_{50} :28-32 M SI_{20} :18-20 M	Site Quality: High SI_{50} :33+ M SI_{20} :21+ M
1) Sitka Spruce North	—	2 DNR 91 DNR 96 (?)	2 BCMin 94 (?)
2) Sitka Spruce South	2 SNF 91 SNF 95	2 Diam 92 SNF 94	2 WeyCo 90 Diam 94
3) Coast Range	2 SNF 92 BLM 95	3 WeyCo 90 ODF 92 BLM 94 ODF 96	3 Diam 92 WeyCo 93 OSU 96 (?) IP 96 (?)
4) North Cascades	2 BCMin 94 CMH 96 (?)	3 GYN 90 BCMin 93 DNR 95	3 GYN 89 CMH 96 (?)
5) South Cascades	2 GPNF 95	2 BLM 92 WeyCo 93 Diam 96	—

Sites with (?) are those that have been committed to but not identified, or success is questionable.

Table 2: Commitments for Douglas-fir/red alder mixture plantations

Region	Cooperator	
1) Sitka Spruce South	2	SNF 96 Diam 94
2) Coast Range	2	DNR 95 **Site Needed**
3) North Cascades	2	BCMin 92 BCMin 94 GYN 94
4) South Cascades	2	GPNF 96 **Site Needed**

Sites with (?) are those that have been committed to but not yet identified.

would effect growth of the primary stem in the clump. A removal operation will be conducted following the 3-year measurements on all Type 2 and Type 3 installations, before the 4th growing season. This operation is proceeding on all installations three years and older.

Some changes to the Stand Management Study Field Manual were discussed and agreed to at the fall Management Committee Meeting, to better reflect our experience on the ground and to save unnecessary work. A rewrite of the manual should be completed in the summer of 1995.

A pruning protocol is needed, as some installations are ready for pruning. The same committee that will be reviewing the thinning protocol above will develop a pruning protocol to be added to the Field Manual. In the interim, the first site that was ready was pruned to 11 feet.

Red Alder: Effects of Planting Density and Thinning on Growth, Stem Form, and Crown Lift

In 1990, the HSC initiated a two-phased study called the Alder Wood Quality and Stem Form Project. Phase 1 utilized natural stands to examine effects of stand characteristics and individual tree growth rates on red alder lumber recoverability. Phase 2 began in 1993. This part of the project included research done from 1993 to 1995 by Robert Lewis, who completed his M.S. degree at Oregon State University last February. His work and some of its major findings are outlined below.

Stem growth, stem form development, and the dynamics of crown lift in young red alder were studied by analyzing annual growth rings of stems and knots, annual height increments, projected crown areas, and branch diameters. Forty-one trees were sampled from three plantation spacing studies, representing ages 1 through 12 years and square spacings from 0.94 x 0.94 m to 8.6 x 8.6 m. These plantations are located at Cascade Head, Oregon, near Apiary, Oregon, and near Centralia, Washington. Data from the spacing studies were used to develop non-linear functions describing height-age and diameter-age relationships (Figure 1), and one-year stem diameter growth rates, in relation to spacing and site index. Linear functions were developed that describe the variation in responses to spacing of stem taper, live crown ratios, projected crown areas, stem diameters at live crown bases, and mean branch diameters.

Planting density strongly affected crown development of red alder; for example, 73 percent of the variation in live crown ratios was explained by spacing alone. Trees planted at high densities developed short, narrow crowns, and small branches, while trees planted at progressively wider spacings had progressively wider and longer crowns, and larger branches. Stem growth patterns were subsequently affected.

Rates of annual stem diameter growth increased faster and culminated earlier at intermediate (3 to 4 m) spacings than at wider spacings. Total diameter growth of trees planted at spacings closer than 3 x 3 m and wider than 6 x 6 m was markedly reduced throughout the first twelve years of growth. The greatest height growth was attained by trees planted at 2, 3, and 4 m spacings; significant long-term height growth reductions occurred in trees planted at the high and low ends of the density spectrum. Trees planted at high densities developed cylindrical form, and widely-spaced trees developed stems with significant taper. These differences in growth patterns among spacing treatments will undoubtedly affect wood yield and quality to

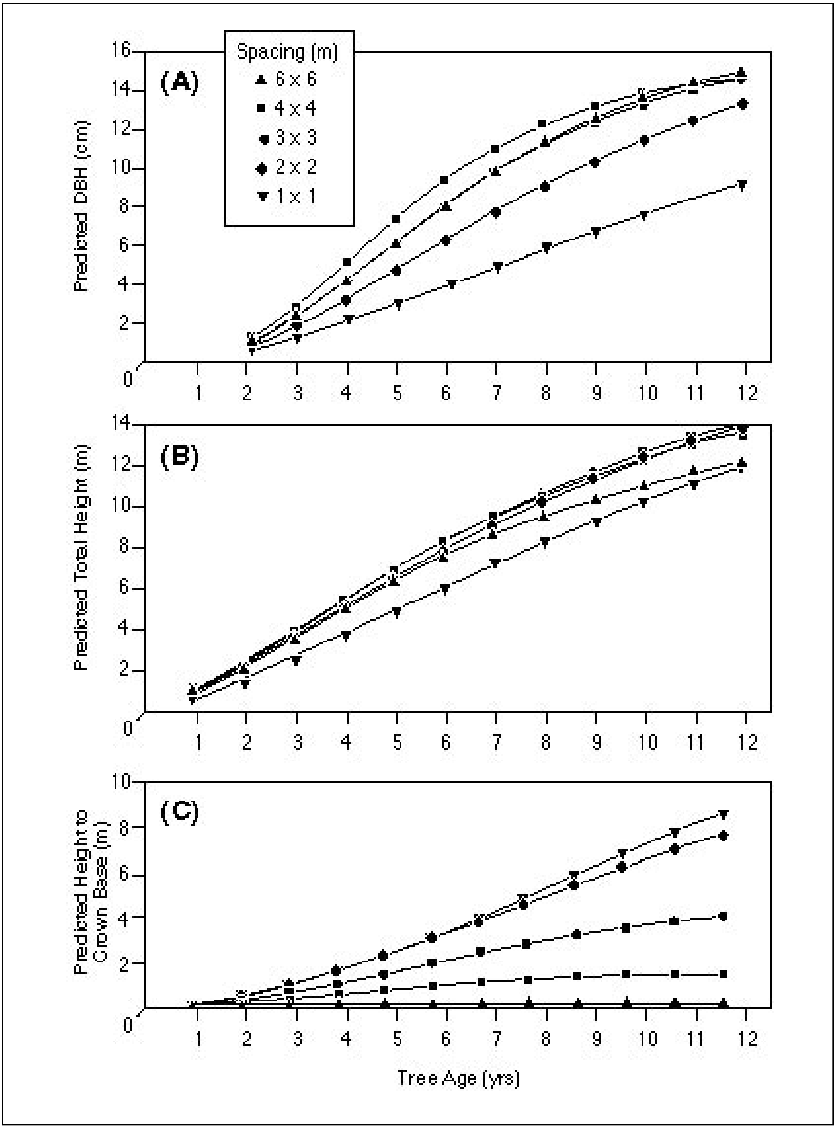


Figure 1. *Predicted DBH-age (A) and height-age (B) relationships, and predicted heights to crown bases (C), for five square spacings (m) using a site index of 21 m (base age 20 years). Values were predicted from models developed in the red alder study.*

the end of a rotation.

Spacing accounted for a relatively small proportion of the explained variation (from 0.9 to 16.4 percent) in the diameter-age and height-age relationships of plantation-grown alder shown in Figure 1. Results of Robert's study, however, were consistent with results of some previous studies, and show that a balance between the negative and positive effects of stand density on growth should guide approaches to managing red alder for production of clear lumber.

During at least the first decade after plantation establishment, optimal diameter and height growth occur at spacings of about 3 to 4 m. When size and spacing of knots, clear bole lengths, and stem taper are important management considerations, it becomes clear that red alder exhibits its best growth characteristics at moderate levels of competition (i.e., at spacings near 3 x 3 m). Due to initial spacing effects, red alder planted at 3 and 4 m spacings may exhibit significant differences in wood quality throughout a rotation. Trees planted at 4 x 4 m will have shorter branch-free boles (Figure 1), greater knotty core diameters, and larger knots encased within their lower boles. The choice of a silvicultural strategy will depend on a tradeoff between diminished wood quality at the wider spacing, and economic benefits associated with a lower intensity management regime.

At age 27 years, nine trees were sampled from a thinning study near Olney, Oregon. These naturally established red alder had been thinned at age 14 years to square spacings of 4.2 x 4.2 m and 5.8 x 5.8 m, or left unthinned as control. A non-linear function was developed, describing height-age relationships as affected by thinning intensity. Linear functions were developed that describe the variation in responses to thinning of stem taper, projected crown areas, stem diameters at live crown bases, heights to live crown bases, and mean branch diameters.

Results from the thinning study showed that in response to thinning, crown lift slowed, crown areas expanded, more branch wood was produced, and height growth was reduced (Figure 2).

These effects were more pronounced in trees thinned to the widest spacing. Although stem diameter growth increased after thinning, relative diameters decreased (i.e., stem taper increased). Because it appears that post-thinning allocation of growth to crown expansion occurs at the expense of stem height growth, production of large crowns with increased growing space has important implications for red alder silviculture. Because of their larger crowns, lower stem growth was much greater in thinned trees at the Olney site compared to unthinned trees. Thus, the volume of knot-free wood will be much greater in the butt logs of thinned trees, making them

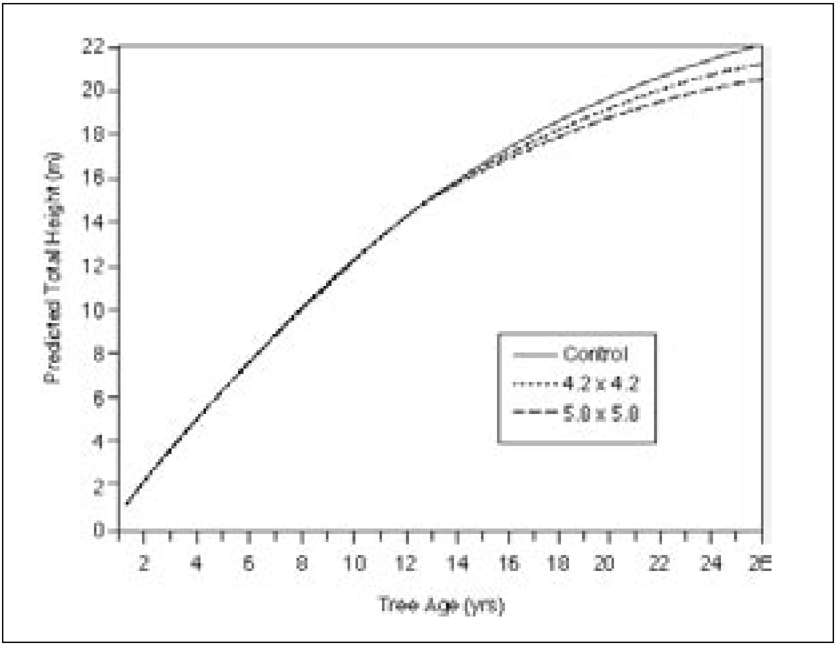


Figure 2. Predicted height-age relationships for trees from the Olney thinning study. Values were predicted from a model developed in the red alder study. Trees were thinned to spacings of 4.2 x 4.2 and 5.8 x 5.8 m, or left unthinned as a control.

much more valuable than unthinned trees. Because of this, thinning should be a viable economic and silvicultural strategy.

Increased taper following thinning, however, will reduce the amount of recoverable lumber per unit volume of wood for a tree of given DBH. Thus, an increase in stem-volume growth after thinning will be greater than the growth in recoverable volume. Among the two thinning treatments at the Olney site, no significant differences in stem taper developed after stand treatment. However, smaller, more widely-spaced knots, and greater clear bole lengths impart superior wood quality attributes to the more narrowly-respaced red alder. By age 26 years, trees respaced to an average distance of 4.2 m were clearly superior to trees thinned to 5.8 m.

From an economic perspective, the choice between these two spacings is evident. At a respacing distance of 5.8 m, there are about 295 stems ha^{-1} in the residual stand after thinning, compared to about 560 stems ha^{-1} in a stand thinned to 4.2 x 4.2 m. Thus, in a comparison of these two treatments, by age 26 years stands thinned to 4.2 m will yield the greatest volume of clear, knot-free wood.

More rigorous analyses are needed to determine the degree to which increased post-thinning taper affects lumber recovery. Additionally, future studies should investigate economic effects of post-thinning changes in growth allocation patterns. Because of the small sample size taken from the Olney site, one cannot make statistically valid inferences to other sites. However, properly timed and spaced thinnings will undoubtedly increase the value of a stand.

Bigleaf Maple Study Update

Bigleaf maple is the second most common hardwood tree species in the Pacific Northwest. In Oregon and Washington combined, there are about 2 billion cubic feet of bigleaf maple. In British Columbia, there are about 175 million cubic feet. Recent attempts to manage bigleaf maple in B.C. and Oregon have shown good survival but poor growth during the first two years after planting.

Cooperators of the HSC expressed interest in finding ways to improve early performance of bigleaf maple and to ensure successful regeneration. There is minimal information available on bigleaf maple propagation. Yet the utilization of bigleaf maple is considered advantageous in a number of areas of forest management. For example there is interest in planting maple in laminated root rot areas on sites not appropriate for red alder, as monoculture plantations for fiber production and landscape biodiversity, and as interplantings into conifer thinning for stand-level biodiversity.

The bigleaf maple regeneration project proposed in August of 1994 was intended to answer some of the fundamental questions about propagation and growth. Under this broad objective came subsidiary questions to be addressed such as:

1. What are desirable seedling characteristics?
2. What is the comparative success of various seeding techniques?
3. Does animal control contribute significantly to seedling survival?

However, the breadth of this study had to be reduced for 1995 because of inadequate seed supply for all cooperators. The seed transfer aspects of the original project would have been severely compromised by this shortage. Thus, this aspect of the original project has been postponed until substantial seed can be procured.

Since that time, an interim study has been implemented to address the seedling quality questions put forth in the original project proposal. The goal for the interim is to identify morphological attributes of bigleaf maple seedlings that will predict vigorous, fast growth following outplanting. We hope to develop a guide of easily identifiable characteristics that will be generally applicable regardless of seedling source. It is believed that the establishment of a seedling quality criteria will contribute to the likelihood of success for the large scale seed transfer study in the future.

The approach taken for analysis of seedling morphology was determined by the level of cooperation and availability of resources. Seedling from five different seedling lots were donated from Weyerhaeuser Company, ODF-Forest Grove and PNW-Forest Sciences Laboratory. Samples were taken from each lot and morphological characteristics were documented. Seedling source is considered the treatment for this study. The following is a list of the five treatments:

1. ODF seed source Turnridge; seed zone 452 (OR). Spring sown and grown at D.L. Phipps State Forest Nursery 1994. Lifted bare root in February of 1995.
2. ODF seed source Wildcat; seed zone 251 (OR). Fall sown and grown at Weyerhaeuser Aurora Nursery 1993. Lifted bare root in February of 1995.
3. PNW-Forest Sciences Laboratory seed source; zone 241 (WA). Transplants from peat pots to Aurora Nursery beds in spring 1994. Lifted bareroot in February of 1995.
4. Weyerhaeuser seed source; zone 241 (WA). Fall sown and grown at Aurora Nursery in 1993. Lifted bare root in February of 1995.

5. Weyerhaeuser seed source; zone 241 (WA). Spring sown and grown at Aurora Nursery in 1994. Lifted bareroot in February 1995.

After lifting but prior to outplant, seedlings from each of the above sources were sorted into small, medium, and large size classes. Then 320 trees of each lot were randomly selected from among the size classes to represent that seedling lot. Morphological characteristics were then documented for each of these seedlings. The measurements taken are as follows:

I. Stem and Bud Measurements:

a. Height - root collar to terminal bud.

b. Caliper - stem diameter at 1 cm above root collar.

c. Stem color.

d. Terminal bud length and condition.

e. Bud count on forked tops.

II. Root Measurements:

a. Root volume.

b. Root form:

1. First-order root morphology.
2. Number of second order roots ($\geq$ 1mm) at 5 cm below the root collar.
3. Amount of fine root network.

Amount of fine roots was an ocular estimation that was fairly subjective. One represented the least and five the most intact network. The same two people did the grading for all five seedling lots. Initially, they calibrated for consistency and then conferred with one another on seedlings considered on the borderline between two categories. Thanks to the help of Tom Turpin and crew, Doug Belz and crew, Connie Harrington, and the entire staff of the Weyerhaeuser Nursery at Aurora, the measurement of 1500 seedlings was completed in four day.

The seedling lots were then divided into five groups of 64 for outplanting at five study sites. Each study installation has 64 seedlings from each seed lot, of which, 60 are protected with Vexar tubing. There is a total of 20 seedling without tubing for a total of 320 trees at each installation.

Each installation is 1/4 acre in size. Installation sites were chosen based on environmental gradient as well as land owner commitment to plant and provide site management. Three installations are located on Weyerhaeuser property in southern Washington, interior Coastal Range, and Cascade Foothills . The fourth installation is located in the northern Oregon Coastal Range on ODF- Forest Grove District property. The fifth installation is on Diamond Wood property at Pioneer Mountain in the western-central Oregon Coastal Range. At all five installations the bigleaf maple seedlings were planted and tubed during March 1995.

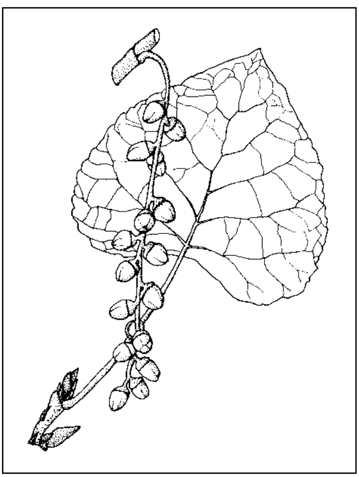
Initial mortality will be tabulated after bud break this spring. There after, seedling performance will be documented through the 1997 growing season. The data will then be analyzed to determine any correlation between morphological characteristics prior to outplant and seedling performance in the experimental installations.

Other Applied Research

Other applied research includes projects conducted by or in association with HSC staff and of likely interest to HSC Cooperators, but not funded by the HSC.

Hybrid Poplar Production in the Willamette Valley

Last year's HSC Annual Report provided an introduction to project designed to provide better information to aid Willamette River valley farmers who were examining the possibility of converting some acreage to hybrid poplar culture. While much work has been conducted in other parts of the Pacific Northwest on the practice and production of hybrid poplar, little work had been done in the Willamette Valley. This one-year project has done a lot to correct this deficiency.



Twenty eight existing plantations of hybrid poplar were located and found to be in adequate condition for growth and yield measurements. From this survey, site index curves were developed that allowed classification of Valley soils into four site or production classes. The survey results were also used to develop a yield model for these site classes through age 10 (figure 3).

The growth and yield information was combined with production cost estimates to develop economic models for poplar production. These models considered a range of production and harvesting costs as well as future prices for pulp chips. The comparison of the results of these models with similar economic models for rye grass production showed a favorable result for poplar on some soils (some that were poor agricultural soils).

The results of this study have been presented in a number of workshops and are presented in a new publication, Hybrid Poplar Production on Willamette Valley Ryegrass Sites (see Appendix 1).

Educational Activities

Books

Niemiec, S., G. Ahrens, S. Willits, and D. Hibbs. 1995. Hardwoods of the Pacific Northwest. OSU Forest Research Laboratory Research Contribution 8.

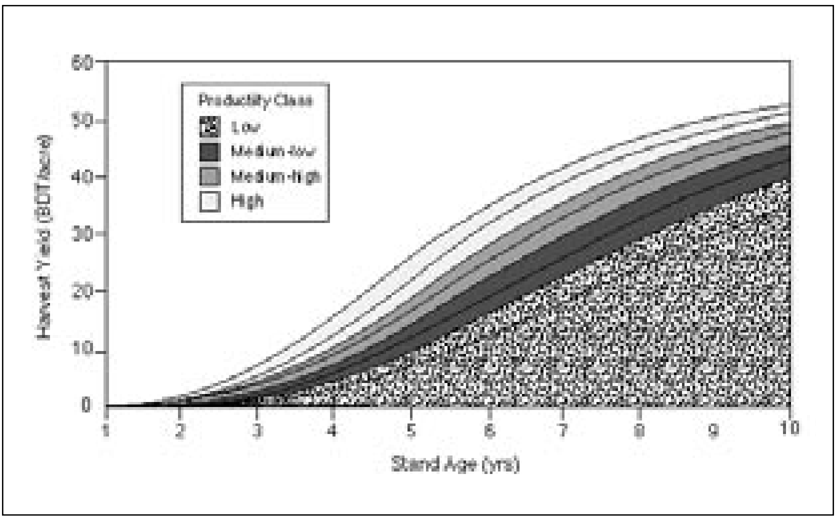


Figure 3. *Predicted harvest yields by site class for hybreid poplar in the Willamette Valley.*

Presentations

Western Hardwoods: Policy, Products and the Future. Dave Hibbs and Glenn Ahrens organized and presented at this workshop.

Master Woodland Managers. Dave Hibbs led sessions on hardwoods and silvicultural alternatives for an advanced group of woodland owners in this Extension program in Coos Bay (April 1995).

Hybrid Poplar Management. Dave Hibbs led presentations to farmers and small woodland owners, including the annual meeting of the Oregon Seed Growers League, in Toledo, Corvallis (two), and Portland.

Riparian Zone Management. Dave Hibbs led three day-long programs on the management of riparian forests.

Silviculture Institute. Dave Hibbs presented programs on hardwood management and riparian zone management to participants in this year's SI course.

Directions for 1995-1996

At the beginning of the Alder Stand Management Study, we set the goal of completing the Type 2 matrix in 1996. With a little luck and a lot of hard work, this will be accomplished.

We will explore the possibilities of expanding our pruning research to include more initial densities and different pruning heights.

It is exciting to be working with a new species - bigleaf maple. We will get our first results from our new maple study in the winter of 1995-6.

Results from our Type 1 and Type 2 installations are beginning to come in. In the next year, we will begin working with forest growth modelers to develop the foundations for our alder models.

A possible opportunity to work with the Pacific Northwest Tree Improvement Research Cooperative on red alder genetics has come up. We will explore this opportunity with both cooperatives.

Appendix 1. Publications

Hibbs, D.E., W.H. Emmingham, and M.C. Bondi. 1995. Response of red alder to thinning. Western J. Applied Forestry 10:17-23.

Hibbs, D.E. 1995. Silviculture of red alder stands. In P.G. Comeau, G.J. Harper, M.E. Blanche and J.O. Beateng (editors). Ecology and Management of B.C.

Hardwoods. Workshop Proc. Dec 1-2, 1993 Richmond B.C. B.C. Min. For. FRDA Rep. (in press).

Hibbs, D.E., S.S. Chan, M Castellano, and C. Niu. 1995. Response of red alder seedlings to CO_2 enrichment and water availability. New Phytologist (in press).

Niemiec, S., G. Ahrens, S. Willits and D. Hibbs. 1995. Hardwoods of the Pacific Northwest. OSU Forest Research Laboratory, Research Contribution 8.

Withrow-Robinson, B. and D.E. Hibbs. 1995. Hybrid poplar production for Willamette Valley ryegrass sites. OSU Forest Research Laboratory, Research Contribution (in press).

In preparation:

Ahrens, G.R., M. Plank and D.E. Hibbs. Effects of growth rate and stand characteristics on lumber recovery from red alder. (in review).

Giordano, P.A. and D.E. Hibbs. Vegetation characteristics of alder-dominated riparian buffer strips in the Oregon Coast Range. (in review).

Hibbs, D.E. and G. Carlton. Succession in red alder stands in the Oregon Coast Range. (in review).

Hibbs, D.E. and K. Puettman. Developing models and management guides for mixed-species stands.

Appendix 2. Financial Support Received in 1994-1995

Cooperator	Support
B.C. Ministry of Forests	$7,500
Bureau of Land Management	7,500
Coast Mountain Hardwoods, Inc.	2,250
Diamond Wood Products	5,500
Gifford Pinchot National Forest	7,500
Goodyear-Nelson Hardwood Lumber Company	4,500
Oregon Department of Forestry	7,500
Siuslaw National Forest	7,500
USDA Forest Service PNW Station[1]	-
Washington Department of Natural Resources	7,500
Weyerhaeuser Company	6,500
	$63,750
Subtotal	
Forestry Research Laboratory, OSU	$51,678
Total	$115,428

[1]In-kind contributions