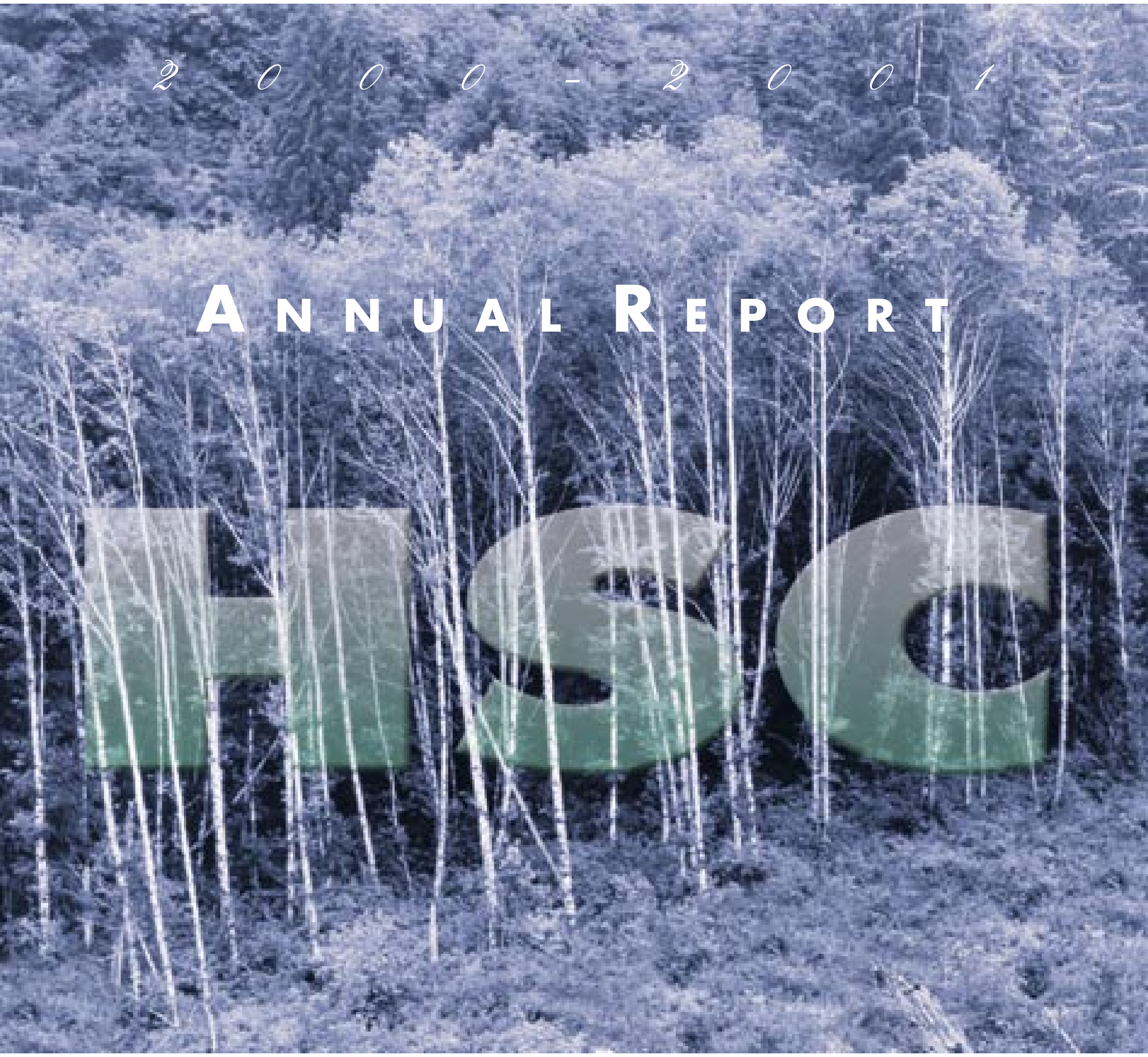
June 2001



Hardwood Silviculture Cooperative

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Hardwood
Silviculture
Cooperative

Annual Report

2001

Highlights of 2000-2001

- The 12th year growth measurement and all of the treatments have been completed on one of the Type 2 installations in the Red Alder Stand Management Study. After the twelfth year, the measurement cycle changes to once every five years.

- The first thinning treatment (3-5 year thin) and the 6th year growth measurement have been completed on twenty two of the twenty six Type 2 installations.

- The second thinning treatment (15-20' height to live crown thin) and the 9th year growth measurement have been completed on eleven Type 2 installations.

- Five of the seven Type 3 (mixed red alder/Douglas-fir) installations have had their 6th year growth measurement.

- Three of the four Type 1 (thinned natural red alder stands) installations have had their 9th year growth measurement. After nine years, the measurement cycle changes to once every five years.

Executive Summary

The HSC has entered an interesting transition period. We are presented with new opportunities and challenges. First, the research program of the HSC has been underway for long enough that we now have a data base of considerable (huge, really!) size and unusual duration in forestry research. This is making it valuable to others as well as to ourselves. Second, we have been underway long enough that personnel changes in cooperating organizations have changed almost all of the faces at the table.

The HSC has begun sharing data with B.C. Ministry of Forests modeling group in Victoria. They are the developers of the TASS modeling system and want to develop an alder version. Our young stand data is nearly unique in the alder world so is of particular value to them. Also, the HSC worked with a visiting French scientist, Catherine Cluzeau, a few years ago. She collected data on the relationships between alder crown dimensions and diameter growth rates. We have shared this data with the TASS modelers as well.

Two more of the original cooperative representatives have retired and will be sorely missed at HSC meetings. Both Bill Voelker of the Oregon Department of Forestry and Dean DeBell of the USFS PNW Research Station have provided critical insight into the design and conduct of the HSC. Both have been strong institutional advocates. We will adapt but their contributions cannot be replaced. Thanks, guys.

Alison Bower, our former Faculty Research Assistant, says hi. They have just bought a house in Walla Walla, Bob loves his job, Rowan keeps growing, and Alison has just started a job with the local watershed council.

Andy Bluhm, our new Faculty Research Assistant, came through his first field season in great form. Alison would point out that he had better weather than she ever did. One important measure of Andy's success is that he got me out twice thinning installations.

In the next and coming years, our challenge is maintaining the integrity of the HSC installations and data collection. Our opportunity is seeking out uses and users for our strong and growing data sets.

David Hibbs
Professor
Program Leader

Contents

History of the HSC

The Hardwood Silviculture Cooperative (HSC) is a multi-faceted research and education program focused on the silviculture of red alder (*Alnus rubra*) and species mixes of red alder and Douglas-fir (*Pseutotsuga menzeisii*) in the Pacific Northwest. The goal of the HSC is improving the understanding, management, and production of red alder. The activities of the HSC have already resulted in significant gains in understanding of regeneration and stand management, and have highlighted the potential of red alder to contribute to both economic and ecological forest management objectives.

The HSC, begun in 1988, is a combination of industry and both federal and state agency members, each with their own reasons for pursuing red alder management. For instance, some want to grow red alder for high-quality saw logs, while others want to manage red alder as a component of bio-diversity. What members have in common is that they all want to grow red alder to meet their specific objectives. Members invest in many ways to make the HSC a success. They provide direction and funds to administer the Cooperative. They provide the land for research sites and the field crews for planting, thinning, and taking growth measurements.

The HSC's highest priority is understanding the response of red alder to intensive management. To accomplish this, the HSC has installed 26 variable-density plantations extending from Coos Bay, Oregon to Vancouver Island, British Columbia. The majority of plantations are located in the Coast Range, with a few in the Cascade Range. The plantation distribution covers a wide range of geographic conditions and site qualities. At each site, cooperators planted large blocks of red alder at densities of 100, 230, 525, and 1200 trees per acre. Each block is subdivided into several treatment plots covering a range of thinning and pruning options (twelve total treatments per site).

In addition to the 26 variable-density plantations, the HSC has related studies in naturally regenerated stands. Twelve years ago, young stands (less than 15 years old) of naturally regenerated red alder, 5 to 10 acres in size, were pursued as a means of short-cutting some of the lag time before meaningful thinning results could be obtained from the variable-density plantations. It came as a surprise to find only four naturally regenerated stands of the right age and size in the entire Pacific Northwest.

The HSC has also established seven mixed species plantations of red alder and Douglas-fir. They are located on land designated as Douglas-fir site class III or below. Each plantation is planted with 300 trees per acre with five proportions of the two species. The site layout is designed to look at the interactions between the two species. We are finding that in low proportions and when soil nitrogen is limited, red alder can improve the growth of Douglas-fir. This improvement is due to the nitrogen fixing ability of red alder. The management challenge is to find the right proportion of the two species to maintain a beneficial relationship.

In the 12 years since the first plantation was established, we have learned a great deal about seed zone transfer, seedling propagation, stocking guidelines, identification of sites appropriate for red alder, and the effects of spacing on early tree growth (see the HSC web-page http://www.cof.orst.edu/coops/hsc). Furthermore, the data set is now complete enough to begin analyzing the growth response of red alder after thinning and/or pruning. Our ultimate goal is a better understanding of the effects of stand density on red alder growth and yield, and wood quality and to develop a red alder growth model.

The HSC 's red alder stand management studies are well designed and replicated on a scale rarely attempted in forestry. Over the next 20 years, we will harvest much from our investment. Our data set on growth of managed stands will make red alder one of the better understood forest trees of the Pacific Northwest.

Cooperative Research

Red Alder Stand Management Study

The Red Alder Stand Management Study is divided into three specific types of installations. Study installations are predominately located in the coastal mountain ranges of the Pacific Northwest from Coos Bay, Oregon to Vancouver Island, British Columbia (Figure 1). The three types of study installations are as follows:

1. Type 1 is a natural red alder stand thinned to 230 and 525 trees per acre. There are four Type 1 installations.

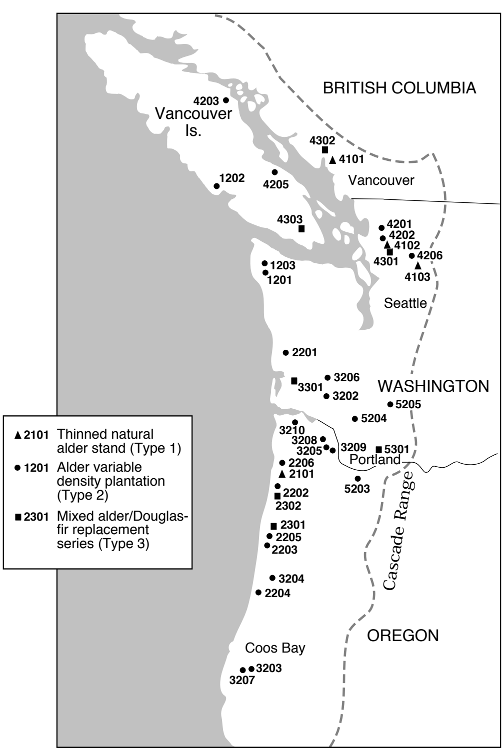

Figure 1. Location of installations for the Red Alder Stand Management Study.

2. Type 2 is a variable-density red alder plantation. At each site, red alder is planted in large blocks at densities of 100, 230, 525, and 1200 trees per acre. Each block is subdivided into several thinning and pruning treatments. There are twenty-six Type 2 installations.

3. Type 3 is a mixed species plantation of red alder and Douglas-fir. Each site is planted to 300 trees per acre with five proportions of the two species. There are seven Type 3 installations.

The primary focus of the Red Alder Stand Management study continues to be the Type 2 variable-density plantations. Type 2 installations are distributed across a matrix of five ecological regions and three site qualities (Table 1).

In winter 2001, field work was completed on fourteen installations:

- Type 1 installations had no field work.
- In the Type 2's, a total of twelve installations had field work. Specifically, one installation had 12 year measurements completed, the third thin (30-32′ height to live crown) and the final pruning lift (to 22′). Six installations were thinned; two for the first time

Table 1. Matrix of Type 2 installations. Each successful installation identified by number, ownership, and year planted.

Region	Site Quality Low	Site Quality Medium	Site Quality High
	SI_{50} :23-27 M SI_{20} :14-17 M	SI_{50} :28-32 M SI_{20} :18-20 M	SI_{50} :33+ M SI_{20} :21+ M
1) Sitka Spruce North	X	1201 DNR '91	1202 BCMin '94 1203 DNR '96
2) Sitka SpruceSouth	2202 SNF '91 2206 SNF '95	2203 NWH '92 2204 SNF '94	2201 WHC '90 2205 NWH '94
3) Coast Range	3204 SNF '92 3209 BLM '95	3202 WHC '90 3205 ODF '92 3207 BLM '94 3208 ODF '97	3203 NWH '92 3206 WHC '93 3210 OSU '97
4) North Cascades	4205 BCMin '94	4202 GYN '90	4201 GYN '89 4203 BCMin '93 4206 DNR '95
5) South Cascades	5205 GPNF '97	5203 BLM '92 5204 WHC '93	X

Definition of Acronyms

BCMin	British Columbia Ministry of Forests.
BLM	Bureau of Land Management.
DNR	Washington Department of Natural Resources.
GYN	Goodyear-Nelson.
GPNF	Gifford Pinchot National Forest.
MBSNF	Mt. Baker Snoqualmie National Forest.
NWH	Northwest Hardwoods.
ODF	Oregon Department of Forestry.
OSU	Oregon State University Forest Research Laboratory.
SNF	Siuslaw National Forest.
WHC	Washington Hardwood Commission.

(3-5 year thin) and four for the second time (15'-20' height to live crown). One installation had the third pruning lift (to 18'). The 6 year measurement was completed on three installations and the 9 year measurement was completed on five installations.

- In the Type 3 installations, one had the 6 year measurement and one had the 9 year measurement.

With each passing year, more and more treatments are applied and data collected. See Tables 2, 3, and 4 for the data collection schedules. These tables illustrate the tremendous accomplishments of the HSC.

Table 2. Data Collection Schedule for Type 1 Installations.

Cooperator	**BCmin**	**SNF**	**WA DNR**	**MBSNF**
Site Name	**Sechelt**	**Battle Saddle**	**Janicki**	**Sauk River**
Site Number	**4101**	**2101**	**4102**	**4103**
Plot Installation	1989	1990	1991	1993
1st yr Measurement	1989	1990	1991	1994
3rd yr Measurement	1992	1993	1994	1997
6th yr Measurement	1995	1996	1997	2000
9th yr Measurement	1998	1999	2000	2003
14th yr Measurement	2003	2004	2005	2008
19th yr Measurement	2008	2009	2010	2013
24th yr Measurement	2013	2014	2015	2018

Table 3. Data Collection Schedule for Type 3 Installations.

Cooperator	**BCmin**	**NWH**	**GYN**	**BCmin**	**DNR**	**SNF**	**GPNF**
Site Name	**East Wilson**	**Monroe-Indian**	**Turner Creek**	**Holt Creek**	**Menlo**	**Cedar Hebo**	**Puget**
Site Number	**4302**	**2301**	**4301**	**4303**	**3301**	**2302**	**5301**
Year Planted	1992	1994	1994	1994	1995	1996	1997
1st yr Regen Survey	1993	1995	1995	1995	1996	1997	1998
2nd yr Regen Survey	1994	1996	1996	1996	1997	1998	1999
Plot Installation	1993	1996	1997	1995	1998	1999	2000
3rd yr Measurement	1995	1997	1997	1997	1998	1999	2000
6th yr Measurement	1998	2000	2000	2000	2001	2002	2003
9th yr Measurement	2001	2003	2003	2003	2004	2005	2006
12th yr Measurement	2004	2006	2006	2006	2007	2008	2009
17th yr Measurement	2009	2011	2011	2011	2012	2013	2014
22nd yr Measurement	2014	2016	2016	2016	2017	2018	2019

Table 4. Data Collection Schedule for Type 2 Installations.

Cooperator Site Name Site Number	GYN Humphrey Hill 4201	WHC John's River 2201	WHC Ryderwood 3202	GYN Clear Lake Hill 4202	WA DNR LaPush 1201	SNF Pollard Alder 2202	NWH Pioneer Trail 2203	NWH Sitkum 3203	SNF Keller- Grass 3204	ODF Shamu 3205	BLM Thompson Cat 5203	WHC Blue Mtn. 3206	BCmin Mohun Ck. 4203	WHC Hemlock Ck. 5204
Year Planted	1989	1990	1990	1990	1991	1991	1992	1992	1992	1992	1992	1993	1993	1993
1st yr Regen Survey	1990	1991	1991	1991	1992	1992	1993	1993	1993	1993	1993	1994	1994	1994
2nd yr Regen Survey	1991	1992	1992	1992	1993	1993	1994	1994	1994	1994	1994	1995	1995	1995
Plot Installation	1992	1993	1993	1993	1994	1994	1995	1995	1995	1995	1995	1996	1996	1996
3rd yr Meas	1992	1993	1993	1993	1994	1994	1995	1995	1995	1995	1995	1996	1996	1996
3-5 yr Thin	1993	1996	1996	1994	1996	1996	1997	1998	1997	1997	1996	1998	1998	1998
Prune Lift 1 6ft	1995	1996	1996	1996	1996	1996	1997	1998	1997	1997	1996	1998	1998	NA
6th yr Meas	1995	1996	1996	1996	1997	1997	1998	1998	1998	1998	1998	1999	1999	1999
Prune Lift 2 12ft	1995	2002	1999	1996	2000	2002	2000	2001	1999	2000	2000	2002	2002	NA
15-20' HLC Thin	1995	1999/2002	1999	1996	1999	1999	2000	2001	2001	2000	2000/01	2002	2001/02	2002
9th yr Measure	1998	1999	1999	1999	2000	2000	2001	2001	2001	2001	2001	2002	2002	2002
Prune Lift 3 18ft	1998	?	2002	1999	2003	2004/05?	2004?	2001	2004?	2004?	2003/04	?	?	NA
12th yr Measure	2001	2002	2002	2002	2003	2003	2004	2004	2004	2004	2004	2005	2005	2005
Prune Lift 4 24 ft	2001	2002/03?	?	2002	?	?	?	2004?	?	?	?	?	?	NA
30-32' HLC Thin	2001	?	?	2002	?	?	2007	?	NA	?	?	?	?	?
17th yr Measure	2006	2007	2007	2007	2008	2008	2009	2009	2009	2009	2009	2010	2010	2010
22nd yr Measure	2011	2012	2012	2012	2013	2013	2014	2014	2014	2014	2014	2015	2015	2015

(Table 4 continued)

Cooperator Site Name Mtn.	BCmin Lucky Ck.	SNF Cape Mtn.	NWH Siletz	BLM Dora	BCmin French Ck.	SNF Mt. Gauldy	BLM Scappoose	DNR Darrington	DNR Maxfield Ck.	ODF Weebe Packin	OSU Wrongway Ck.	GPNF Tongue
Site Number	**1202**	**2204**	**2205**	**3207**	**4205**	**2206**	**3209**	**4206**	**1203**	**3208**	**3210**	**5205**
Year Planted	1994	1994	1994	1994	1994	1995	1995	1995	1996	1997	1997	1997
1st yr Regen Survey	1995	1995	1995	1995	1995	1996	1996	1996	1997	1998	1998	1998
2nd yr Regen Survey	1996	1996	1996	1996	1996	1997	1997	1997	1998	1999	1999	1999
Plot Installation	1997	1997	1997	1997	1997	1998	1998	1998	1998	2000	2000	2000
3rd yr Meas	1997	1997	1997	1997	1997	1998	1998	1998	1999	2000	2000	2000
3-5 yr Thin	1999	1999	1999/01	1999	1999	2001	2000	2000/01	2002	2003	2002	2003?
Prune Lift 1 6ft	1999	1999	1999	1999	1999	2001	2000	2000	2002	2003	2002	2003?
6th yr Meas	2000	2000	2000	2000	2000	2001	2001	2001	2002	2003	2003	2003
Prune Lift 2 12ft	2002?	2003	2002	2003	2002	2004?	2003/04?	2002	?	?	?	?
15-20' HLC Thin	2002?	2003?	?	2003	2003?	?	?	2002/03	?	?	?	?
9th yr Measure	2003	2003	2003	2003	2003	2004	2004	2004	2005	2006	2006	2006
Prune Lift 3 18ft	?	?	?	?	2004?	?	?	2004?	?	?	?	?
12th yr Measure	2006	2006	2006	2006	2006	2007	2007	2007	2008	2009	2009	2009
Prune Lift 4 24 ft	?	?	?	?	?	?	?	?	?	?	?	?
30-32' HLC Thin	?	?	?	?	?	?	?	?	?	?	?	?
17th yr Measure	2011	2011	2011	2011	2011	2012	2012	2012	2013	2014	2014	2014
22nd yr Measure	2016	2016	2016	2016	2016	2017	2017	2017	2018	2019	2019	2019

Current Research

The data gathered thus far enables us to investigate specific aspects of red alder stand dynamics. Last year, Alison Bower conducted a preliminary analysis on the diameter and height growth responses of one installation to the first thinning treatment. The following is a preliminary investigation of Height/Diameter ratios in the Type 2 installations.

What is the height/diameter ratio? Why is it important?

Mathematically, the height/diameter ratio (hereafter H:D) is simply a unitless ratio of total tree height divided by DBH. But biologically it can be an indication of much more. According to Smith, et. al (1997), in 'The Practice of Silviculture', the H:D is an indication of how well the crown has been able to nourish the stem. The Dictionary of Forestry calls it an indirect measurement of past stand management, density and stand stability (Helms 1998).

It is generally known that tree spacing (density) and canopy position affect H:D. Wider-spaced trees have a lower HT/DBH than closely spaced trees. Dominant trees would have a low ratio because of a large diameter. Suppressed trees would have a higher ratio because diameter is more sensitive than height to loss of live crown vigor.

Therefore, because H:D is an indication of vigor, this ratio is often used as a thinning guide. When trees become crowded and competition is intensified (as with canopy closure), the H:D will increase, often indicating/coinciding with a need to thin. Furthermore, if a forest manager waits too long to thin and the H:D is high after thinning, more windthrow could occur. Generally, if the H:D of the main canopy trees become 100 or more, they become susceptible to windthrow (Smith, et. al, 1997; M. Newton, personal communication). However, most, if not all of the work on H:D has been done on conifers.

The H:D ratio has recently become an area of interest for the Hardwood Silviculture Cooperative for two main reasons. First, it has been observed that the H:D differs both across and within installations. What is causing these differences? Second, it seems, at least anecdotally, that H:D is greater as you move farther north. Is this true?

Methods

Specifically, three sets of questions were asked:

1) **Does site index, slope, elevation, or latitude effect the H:D?**

2) **Does the initial planting density affect the H:D?**

3) **Does the H:D change with time?**

Data was used from the following treatments (the number of installations used in the analyses are indicated in the parentheses).

Treatments used in the analyses:

Treatment 5 - 525 TPA thin to 230 TPA in year 3 to 5 (n=17).

Treatment 6 - 525 TPA thin to 230 TPA when height to live crown (HLC) is 15 to 20 feet (n=7).

Treatment 9 - 1200 TPA thin to 230 TPA in year 3 to 5 (n=17).

Treatment 10 - 1200 TPA thin to 230 TPA when HLC is 15 to 20 feet (n=10).

All data used in this analysis was taken before thinning. Thus, it describes the conditions of the stands to be thinned. Treatments 5 and 9 were 4 – 6 years old. Treatments 6 and 10 were 6 – 10 years old. We used prethinning data here for two reasons. First, of interest to the cooperators is the effect of H:D on the likelihood of windthrow following thinning. Although the HSC does not currently have sufficient data to perform this analysis, these pre-treatment data will be coupled with the post-treatment damage data. Second, later data from thinned plots will enable the HSC to follow short- and long-term H:D response following thinning

The mean site index, slope, elevation, and latitude for each installation used in the analysis was calculated as well as the H:D for every tree by installation and treatment. Significant differences in the means were calculated using ANOVA and tested with least squared means. Subsequently, a regression analysis was performed, by treatment, to look for trends (slopes) within the variables.

Results

1) Does site index, slope, elevation, or latitude effect the H:D?

Site index (m) - No significant rela-tionship detected for any treatment.

Slope (%) - No significant relationship, but all treatments have a negative slope (i.e. as percent slope increases, H:D decreases).

Elevation (m) - No significant relationship detected for any treatment.

Latitude (degrees, minutes) - No significant relationship, but positive slopes for treatments #5 and #10 (i.e. as you move north, H:D increases in these treatments only).

2) Does the initial planting density affect the H:D?

Comparisons of planting density by site and by the thinning treatments are seen in Table 5. As expected, the H:D ratio was significantly greater for the 1200tpa plot than the 525tpa plot both at the time of the 3 to 5 year thin (122.6 vs. 111.8) and the 15-20' HLC thin (113.8 vs. 98.4).

For the 3 to 5 year thin, the 1200tpa plot has a greater H:D than the 525tpa in 12 of the 14 paired sets, with the difference for 8 pairs being statistically significant ($p<0.05$).

For the 15-20' HLC thin, the 1200tpa plot has a greater H:D than the 525tpa in all 7 of the paired sets, with the differences for 6 pairs being statistically significant ($p<0.05$).

However, contrary to common knowledge of H:D with other species, the H:D actually decreased with stand age. This does fit with our casual observation that dominance is established in alder stands within this age range.

3) Does the H:D change with time?

Table 6 shows a variable H:D response, with time, for both planting densities. The general pattern is one of a decreasing H:D with time. Caution, however, must be taken in drawing any firm conclusions

Table 5. H:D by thinning treatment (i.e. age), planting density, and site for HSC Type 2 Installations.

			3 to 5 year Thin[1]			15 to 20' HLC Thin[2]		
Site	**Owner**	**Name**	**525 tpa**	**1200 tpa**	**p-value**	**525 tpa**	**1200 tpa**	**p-value**
4203	BC Min	Mohun Creek	135.2	135.8	0.86			
4205	BC Min	French Creek	117.8	136.7	0.0009			
1202	BC Min	Lucky Creek	134.5	122.3	0.08			
4202	GYN	Clear Lake Hill	131.6					
4206	WA DNR	Darrington	93.2	117.4	0.0001			
1201	WA DNR	LaPush	106.1	131.5				
2201	WHC	Johns River	106.2	120.8	0.0001	93.9	105.2	0.0001
3206	WHC	Blue Mtn.	105.8					
3202	WHC	Ryderwood	96.9	121.9	0.0001	107.5	117.7	0.0006
5204	WHC	Hemlock Creek		110.2				
3205	ODF	Shamu	99.3	100.9	0.67	98.6	114.5	0.0001
3209	BLM	Scapoose	122.0	128.6	0.05			
5203	BLM	Thompson Cat	102.5			92.1	120.7	0.0001
2202	SNF	Pollard Alder	109.8	113.3	0.22		110.2	
2206	SNF	Mt. Gauldy	105.4	115.2	0.0014			
2205	NWH	Siletz	122.4	121.9	0.89			
2203	NWH	Toledo		109.1		104.0	108.8	0.06
3204	SNF	Keller Grass	96.0			84.8	97.3	0.0001
2204	SNF	Cape Mtn.	137.0	144.1	0.13			
3203	NWH	Sitkum	93.3	137.7	0.008	108.4	118.1	0.04
3207	BLM	Dora	123.5	129.4	0.06			

[1] 3 to 5 year thin completed at age 4-6 years (76% at age 5)

[2] 15-20'HLC thin completed at age 6-10 years (33% at age 8 and 9)

Table 6. H:D by planting density, thinning treatment(i.e. age), and site for HSC Type 2 Installations.

Site	Owner	Name	525 tpa 3 to 5 year[1]	525 tpa 15-20' HLC[2]	525 tpa p-value	1200 tpa 3 to 5 year[1]	1200 tpa 15-20' HLC[2]	1200 tpa p-value
4203	BC Min	Mohun Creek	135.2			135.8		
4205	BC Min	French Creek	117.8			136.7		
1202	BC Min	Lucky Creek	134.5			122.3		
4202	GYN	Clear Lake Hill					131.6	
4206	WA DNR	Darrington	93.2			117.4		
1201	WA DNR	LaPush	106.1				131.5	
2201	WHC	Johns River	106.1	93.9	0.0001	120.8	105.2	0.0001
3206	WHC	Blue Mtn.				105.8		
3202	WHC	Ryderwood	96.9	107.5	0.0001	121.9	117.7	0.15
5204	WHC	Hemlock Creek				110.2		
3205	ODF	Shamu	99.3	98.6	0.72	100.9	114.5	0.0004
3209	BLM	Scapoose	122.0			128.6		
5203	BLM	Thompson Cat	102.5	92.1	0.0001		120.7	
2202	SNF	Pollard Alder	109.8			113.3	110.2	0.19
2206	SNF	Mt. Gauldy	105.4			115.2		
2205	NWH	Siletz	122.4			121.9		
2203	NWH	Toledo		104.0		109.1	108.8	0.88
3204	SNF	Keller Grass	96.0	84.8	0.0001		97.3	
2204	SNF	Cape Mtn.	137.0			144.1		
3203	NWH	Sitkum	93.3	108.4	0.001	137.7	118.1	0.23
3207	BLM	Dora	123.5			129.4		

[1] 3 to 5 year thin completed at age 4-6 years (76% at age 5)

[2] 15-20'HLC thin completed at age 6-10 years (33% at age 8 and 9)

because of the limited sample size in this analysis.

Summary

This analysis contains some expected and some unexpected results. As expected, denser stands have a higher H:D. Somewhat unexpectedly, the H:D dropped with age and we found no relationship with any ecological variable including latitude. We have observed a somewhat higher incidence of windthrow following thinning in the more northerly HSC installations and this led to the hypothesis that the H:D must increase with latitude. This does not appear to be the case.

The range of H:D ratio values found in this analysis is high by the standards of most foresters. This indicates that standards for red alder need to be increased. Alder stands appear to be quite wind-firm at H:D ratios well above 100.

People Behind Our Success

Featured Cooperative Member - Oregon Department of Forestry (ODF)

HSC members invest in many ways to make the Cooperative a success. Members provide direction for the HSC, land for plantations, crews for field-work, and funds for administration. Our ability to establish 37 research installations and manage these installations for more than a decade is a strong testament to our members' dedication and commitment to red alder research. We would like to introduce you to one of our member organizations, the people and the sites they own and manage.

This year's featured member is the Oregon Department of Forestry (ODF). ODF was originally formed to reforest lands burned in the Tillamook fire and now manages 790,000 acres divided into three areas: Eastern, Southern, and Northwest. The Northwest area is further divided into five districts; the West Oregon, Santiam, Astoria, Tillamook, and Forest Grove.

These state lands are managed primarily on the principle of 'greatest permanent value' defined as achieving "healthy, productive and sustainable forest ecosystems that over time and across the landscape to provide a full range of social, economic and environmental benefits to the people of Oregon" (Oregon Forests report, 2001). Management strategies have changed over the years, recently shifting from more of an industrial forest model to one based on structure-based management. This approach calls for actively managing the forest to mimic natural disturbances which maintain a mosaic pattern across the landscape. Stand types and the proportion of the landscape desired are as follows: regeneration (5-15%), closed single canopy (10-20%), understory (15-35%), layered (20-30%), and older forest structure (20-30%). This blend of stand structures is "designed to provide steady timber revenue, healthy wildlife habitat and quality recreationaal opportunities- all on a sustainable basis" (Oregon Forests report, 2001).

Dale Anders, out of the Forest Grove office, is the new ODF representative since the long time committee member Bill Voelker is now retired. Dale has been working with ODF for 22 years and on the Forest Grove District for the last 15 years. Most of his career has been in reforestation/silviculture. Dale has plenty of experience in managing red alder, in fact he probably plants more red alder than any ODF employee. Approximately 20% (75-100 acres) of the annual reforested land on the Forest Grove District is currently planted with red alder. He would like to plant more, however, obtaining enough quality planting stock has been an issue. Red alder provides diversity by adding another stand type and more wildlife habitat, and is the species of choice when reforesting areas infected with Phellinus.

Folks at the Forest Grove Office have taken an active role in the success of the HSC. Under the direction of Dale, with labor provided by the South Fork Inmate Camp and various ODF personnel, they planted and continue to manage two HSC installations:

1. Shamu-Type 2 variable-density plantation established in 1992 (Figure 1, 3205)
2. Weebe Packin'- Type 2 variable-density plantation established in 1997 (Figure 1, 3208).

The Shamu site was a Douglas-fir stand (average age of 88 years) with a high degree of laminated root rot. It was primarily tractor logged in the summer of 1991 and site preparation consisted of aerial spraying of glyphosate and velpar. Seed was collected from local sources, grown in the Elkton nursery and 1-0 bare root seedlings were planted in the spring of 1992. First year survival was excellent (98%). In fact, it was the only site established in that year that did not need to be interplanted. The site has had two thinning treatments and two pruning lifts. The 9 year measure was conducted last year.

The Weebe Packin' site was a mixed conifer forest also heavily infected with laminated root rot. It was primarily tractor logged in the summer of 1995 and site preparation consisted of spraying of glyphosate, triclopyr, and sulfo-meturon. Seed was collected from local sources, grown by Weyer-haeuser Company, lifted early and frozen, and 1-0 bare root seedlings were the planted in the spring of 1997. First year survival was acceptable. The site has had the 3 year measure. The first thin and prune is expected at age 5 or 6. Red alder stocking and growth rates are currently impeded by the heavy salal cover.

Bill Voelker, working with ODF since 1973, and representing ODF in the HSC since 1990, has been a key member of the HSC management committee. He has been a major driving force behind the success of the HSC. Being quick of mind (and wit) and understanding both forest management and research design, he has always offered valuable insights. He would sit quietly through the early parts of a discussion and then offer an insightful observation or conclusion that was critical to moving the discussion to a successful conclusion.

And, of course, Bill was not bashful about expressing his opinion.

Alison Bower, the HSC research assistant who worked with Bill for many years shared these thoughts:

"During my 5 years with the Hardwood Silviculture Cooperative I came to know and appreciate the various facets of Bill Voelker. I first got to know him as the "Well, ya know Dave…Guy". He was always the one at the meeting to offer up a different perspective on an issue. Bill was always thinking, thinking how we can do things better, faster, cheaper. He was kind of the Bionic Man of the HSC.

I did not fully appreciate Bills' Bionic capabilities until we worked in the field together. The guy was fast! He must have some sort of leaping device installed in his legs because he was able to move through a thinned plot like no one I have ever seen. No lollygagging when Bill was on the job!

It comes as a surprise to me that Bill is retiring. I had this image of him out in the field long into his silver years, raising heck and teaching us youngsters a thing or two. He will be greatly missed.

Bill, I feel fortunate to have worked with you.

Farewell,
Alison Bower"

The dedication of Bill, Dale, and the rest of the ODF personnel is one of the reasons the HSC has been successful in red alder research for more than ten years. Thanks to them (and all of the HSC members), red alder is fast becoming one of the better understood forest trees in the Pacific Northwest.

Direction for 2002

The specific goals for 2002 are a continuation of our long-term objectives:

- Continue treatment and measurement of Red Alder Stand Management Study installations.
- Continue support of the alder modeling program of the BC Ministry of Forests.
- Work with the Washington Hardwood Commission and Northwest Hardwoods to organize support for additional alder growth modeling efforts.
- Continue efforts to recruit new members.
- Archive data and maintain the data base.
- Recruit a new graduate student to explore a detailed aspect of red alder using the HSC database.

Appendix 1

Summary of Red Alder Stand Management Study Treatments

Type 1- Thinned Natural Red Alder Stands

1. Control- measure only, stand left at existing density
2. 230 trees/acre (tpa) re-spacing density in year 3 to 5
3. 525 tpa re-spacing density in year 3 to 5
4. 230 tpa re-spacing density when height to live crown (HLC) is 15 to 20 feet
5. 525 tpa re-spacing density when HLC is 15 to 20 feet
6. Control- measure only, stand left at existing density
7. 100 tpa re-spacing density when HLC is 30 feet
8. 230 tpa re-spacing density when HLC is 30 feet
9. Control- measure only, stand left at existing density

Type 2- Red Alder Variable Density Plantations

1. 100 tpa control- measure only
2. 230 tpa control-measure only
3. 230 tpa pruned to 6 ft. lift, 12 ft lift, 18 ft lift, 24 ft lift
4. 525 tpa control -measure only
5. 525 tpa thin to 230 tpa in year 3 to 5
6. 525 tpa thin to 230 tpa when HLC is 15 to 20 feet
7. 525 tpa thin to 230 tpa when HLC is 30 to 32 feet
8. 1200 tpa control- measure only
9. 1200 tpa thin to 230 tpa in year 3 to 5
10. 1200 tpa thin to 230 tpa when HLC is 15 to 20 feet
12. 1200 tpa thin to 100 tpa when HLC is 15 to 20 feet
13. 525 tpa thin to 100 tpa when HLC is 15 to 20 feet

Type 3- Mixed Red Alder Douglas-fir Plantations

1. 100% red alder planted at 300 tpa density
2. 50% red alder and 50% Douglas-fir planted at 300 tpa density
3. 25% red alder and 75% Douglas-fir planted at 300 tpa density
4. 11% red alder and 89% Douglas-fir planted at 300 tpa density
5. 100% Douglas-fir planted at 300 tpa density

Appendix 2

HSC Management Committee Meeting Minutes

Summer Management Committee Meeting, June 20-21, 2000, Chehalis, WA

Tuesday June 20, 2000

Meeting held at the Howard Johnson Inn- Chehalis, Washington

Attendees:

Dave Hibbs, Alison Bower and Andy Bluhm- OSU; Bill Voelker- ODF; Norm Anderson, Dennis Carlson and Doug Belz- WA DNR; Larry Larsen and Floyd Freeman- BLM; Dean Debell and Connie Harrington- PNW, Olympia, WA; Keith Thomas, Paul Courtin and George Harper- BC Ministry of Forests; John Trobaugh- The Timber Company; Jim Murphy- Pac4 Tec (Goodyear Nelson); Alex Dobkowski and Rod Meade- Weyerhaeuser.

The meeting began at 8:00 am with welcome and introductions. Dave Hibbs introduced Andrew Bluhm who will be replacing Alison Bower starting August 1, 2000. Next, Alison gave a summary of the winter 2000 field season. We completed all scheduled field work on 22 sites. Seven of these sites did not have a field crew and we had to hire one.

The list of field activities for winter 2001 and the estimate for crew days to complete these activities were handed out. There are only 18 sites requiring field work this coming winter, however, we may have to hire a field crew for 50% of these sites. The continued increase of orphaned sites is problematic. We will work to reverse this trend by bringing in new members and possibly creating new membership categories. The proposal of a new membership category in which field crew is contributed in lieu of dues was received cooly by the Management Committee.

Next, Alison summarized her lessons learned from the HSC over the last 5 years. We work in a dynamic environment in which new challenges and new approaches to problem solving are required. The unity of this group has enabled us to overcome many challenges in the past and this unity will see you through the current budget difficulties. We have worked hard to clarify the HSC goals and the methodology for achieving these goals in the form of new, more efficient field protocol. Your challenge for the next 5 years will be to maintain the integrity of the study in this dynamic environment, as well as take the first steps towards the growth and yield model. In times of frustration, keep in mind the power of your vision to change perception. The public no longer thinks of red alder as a trash species and is beginning to see the value of red alder management. This shifting paradigm is what research is all about. Good luck, and thank you for the opportunity to be a part of the HSC.

Dave Hibbs opened the topic of modeling by summarizing our discussion from the January 2000 meeting in which the group agreed to pursue various modeling options and approaches. One option that appears to have a lot of potential is with the BC Ministry of Forests Tree and Stand Simulator (TASS) model. George Harper of BC Ministry of Forest presented the basics on the TASS modeling approach to the group.

TASS is a three-dimensional growth simulator that generates growth and yield information for even-aged stands of pure coniferous species of commercial importance in coastal and interior forests of British Columbia. TASS is a biologically oriented, spatially explicit individual tree model. It is calibrated for four coastal and four interior tree species in British Columbia.

The processes that drive the development of individual trees in TASS include height growth, branch extension, accumulation of foliage and crown expansion of competing trees, production and distribution of bole increment, suppression of height growth, and mortality.

The model grows trees and simulates crown competition in a three-dimensional growing space within a computer. The crowns of individual trees add a shell of foliage each year and either expand or contract asymmetrically in response to internal growth processes, competition, environmental factors, cultural practices, and genetic variation among trees. The volume increment produced by the foliage is distributed over the bole annually, and is accumulated to provide tree and stand statistics.

Output from TASS comes in the form of several tables:

- Stand Table- Shows the number of trees by diameter class for each stand age requested.
- Stock Table- Shows merchantable volume by diameter class for each stand age requested.
- Mortality Summary Table- Shows the number of trees that die due to non-competitive juvenile mortality, and due to suppression between age steps by 10-cm diameter size classes.
- Height Profile Table- Shows the interception of tree crowns at given heights. Includes number of trees, basal area, percent crown cover, and percent crown interception.

TASS custom report command lets you choose from dozens of stand-level statistics, and format them in any length and number of decimal places. Even DBH and height classes can be specified, for stand and stock tables.

There are limitations to the current version of TASS. For example, it does not predict the yield of complex stands (i.e., mixed-species and/or uneven-aged stands); nor does it include any hardwood species, and the stand size is currently limited to roughly 5 hectares with a maximum of 32,000 trees individually simulated within each run. Improvements are currently being made to remove these limitations. For example, TASS will soon include light and moisture components needed to simulate the development of complex stands. Light is necessary to model the variable crown structure found in mixed-species and uneven-aged stands. The dynamics of moisture within a complex stand is uncertain and is currently under investigation. Future development plans include a red alder calibration, which is where the HSC data may be of use. See the BC Ministry of Forests web-page for more details about TASS:

http://www.for.gov.bc.ca/research/gymodels/TASS.

Next, Ivan Eastin from The Center for International Trade in Forest Products (CINTRAFOR) talked to the group about a survey of ten hardwood producers from which CINTRAFOR developed a competitive assessment of the hardwood lumber industry in the Pacific Northwest. Managers of hardwood firms were surveyed on a variety of issues ranging from factors affecting firm competitiveness to challenges and threats specific to industry stability.

The hardwood firms that participated in the survey produce approximately 450 MBF of lumber, accounting for over 95% of the annual hardwood lumber production in the PNW. Exports totaled approximately 126 MBF, or 28% of total production. Both large and small producers sell a substantial percentage of their lumber directly to the end-user.

In the survey, problems and threats confronting producers were grouped into three categories: domestic regulatory issues, domestic resource issues, and international regulatory issues:

1. Domestic Regulatory Issues- Respondents indicated that state taxes, federal regulations, and state forest practice regulations all had a negative impact on their firm 's competitiveness.

2. Domestic Resource Factors- Respondents rated raw material procurement as important and they perceived increasing raw material price and price volatility to have an extremely negative impact on competitiveness. Quality of labor and resource quality were each generally perceived to have relatively little

impact, while resource availability had a slightly positive impact on their firm's competitiveness.

3. International Regulatory Factors- Environmental certification of wood products and tariff barriers were perceived to have a more negative impact on the competitiveness than non-tariff barriers and regional trade agreements, although the difference in score was small.

Hardwood lumber production in the Pacific Northwest increased over 200% between 1983 and 1997, with annual exports of red alder surpassing $160 million. Yet, less than 1% of private and industrial timberlands are being managed for hardwood production. Experts predict that the supply of red alder will decline 25% by 2003. There are two primary factors driving this decline in supply. First, there are very few intermediate-age alder stands to replace the mature stands that are currently being harvested. Second, restrictions to logging in riparian zones may put much of the mature alder off limits. In spite of these factors, respondents did not consider resource ownership to have an important impact on competitiveness.

Respondents also identified factors that influence a firm 's reputation, such as maintaining high quality control standards and communicating regularly with customers, as very important to a firm 's competitiveness. Efficient manufacturing was also rated as being important. Product differentiation and distribution were perceived to be somewhat important, while marketing activities did not have an important impact on their firm 's competitiveness.

John Trobaugh presented The Timber Company 's Financial Analysis of Red Alder to the group. The Timber Company owns forested land in the Oregon Coast Range that is well suited for growing red alder. John set out to determine if it would be profitable to do so on their land. John developed two production scenarios for his Base Line Value (BLV) calculation, then compared the return on alder to the return on hemlock. The following are his results:

1. Red Alder BLV Calculation: assumes 15 mbf/acre at 25 years (600 bf/ac/yr).

Establishment	Stumpage Price*		
Cost	$150/mbf	$200/mbf	$350/mbf
$400/acre	-BLV	7%	109%
$500/acre	-BLV	-BLV	82%

2. Red Alder BLV Calculation: assumes 20 mbf/acre at 25 years (800 bf/ac/yr).

Establishment Cost	Stumpage Price*		
$150/mbf	$200/mbf	$350/mbf	
$400/acre	7%	52%	188%
$500/acre	-BLV	25%	161%

* Stumpage Price; $150/mbf is 10 year average, $200/mbf is 5 year average, and $350/mbf is current seasonal high.

Based on John 's analysis there is potential to make a good return on red alder plantation investment if:

- We capture the seasonal high stumpage price
- We can grow 20 mbf/acre in 25 years
- Establishment costs are $500/ acre or less
  - Intensive site preparation.
  - Plant at high density.
  - PCT to maintain good growth on straight stems.

The big question John put to the group was "Are we able to grow 20 mbf/acre at 25 years?" The group was divided in its response. It should be noted that The Timber Company does not own any mills and therefore quality value add was not included in assessment.

Field Tour- Tuesday June 20, 2000

Alex Dobkowski and Rod Meade of Weyerhaeuser Company lead the group through the Ryderwood alder plantation. This Type 2 installation is in the Washington Coast Range and is of medium site quality. The site was broadcast burned and sprayed prior to planting in 1990. The first thinning treatment was completed in 1996, and the second was in Winter 1999. The group commented on the difference in understory density and composition between the various plots. Much of the discussion centered on site preparation alternatives.

Height and diameter comparison between densities was similar to our observations at other sites. Trees in the denser plots are taller than trees in wider spaced plots. But, trees in the wider spacings are maintaining their diameter growth better than trees in the tightly spaced plots (1200 and 680 tpa). We are not seeing much differentiation between thinned and control plots at this point in time, at least among the 100 largest trees per acre. The crowns are much fuller in the thinned plot. This may indicate an increased growth rate, compared to the controls, in the next few years.

Wednesday June 21, 2000

The meeting opened at 8:00 am with a continuation of the previous day's discussion on modeling. The group wanted to know if there are any other modeling options beside TASS. Currently, we are only pursuing the TASS option with BC Ministry of Forests because other options, such as OREGONON, are cost prohibitive at this point in time.

Dave handed out the 2000-01 budget with some troublesome news. We may loose Siuslaw National Forest as a cooperator next year. This, combined with some debt means a budget that is $17,512 less than was spent in 1999-2000. The cut will come in the form of time that Andy spends on HSC duties. Siuslaw National Forest will make its decision this fall and we can discuss it further at the Winter 2001 meeting. Fortunately 2001 is a light field season, with fewer than normal sites requiring work.

One cost cutting measure that will be implemented at the next Management Committee Meeting is that all participants will pay a fee to cover food and meeting associated expenses.

Dave will continue to pursue new members in both the public and private sectors.

Field Tour- Wednesday June 21, 2000

Alex Dobkowski and Rod Meade of Weyerhaeuser Company lead the group through the Hemlock Creek alder plantation. This Type 2 installation is in the South Cascades region and is of medium site quality. It is 7 years old, and had its first thinning in Winter 1998. This site was similar to the Ryderwood site in that there were differences in tree size between the densities, but not between control and thinned plots. There was a heavy understory of sword fern and bracken fern in the thinned plots, as well as in the wide spaced control plots. Currently, we do not collect vegetation data past the establishment phase (year 2), however it may be useful to start recording vegetation cover, height, and dominant species to help ascertain site quality and site preparation efficacy. Andy will determine when is the best time in the measurement cycle to do this and report back to the group.

Next, Alex Dobkowski and Rod Meade provided an overview of the Weyerhaeuser alder program. Weyerhaeuser currently has 10% of their land planted with red alder. The best alder growing land is also the best Douglas-fir land. They operationally plant at 680 trees per acre (tpa), and site prep with herbicides. No form pruning is done, they remove poor form trees when they thin.

We toured two Weyerhaeuser operational plantings of red alder. The first one was planted in 1998. Its growth rate is behind by one year and according to Weyerhaeuser, this is due to poor weed control resulting in greater than 30 percent weed cover. The second site was an 8 year old stand of lovely, straight trees that are going to be thinned this next winter down to 300-350 tpa. They do not like to take the density lower than this due to increased incidence of sun-scald and epicormic branching. The stand will be commercial thinned to 150 tpa in an additional 5 or more years.

The summer 2000 meeting ended under the shade of the lush alder canopy. We said our good-byes and wished each other well. We will meet again when the rains come, and the shades of summer are a mere memory.

Winter Management Committee Meeting, January 10-11, 2000, Corvallis, OR

Wednesday January 10, 2001

Meeting held in Room 313, Richardson Hall, OSU Campus

Attendees:

Dave Hibbs and Andrew Bluhm- OSU; Bill Voelker- ODF; Norm Anderson and Doug Belz- WA DNR; Floyd Freeman and Bill Caldwell- BLM; Karl Buermeyer and David Peter- PNW, Olympia, WA; Paul Courtin- BC Ministry of Forests.

The meeting began at 8:00 am with welcome and introductions. Dave Hibbs first commented on how far the cooperative has come since its' establishment and introduced the agenda for the meeting. He then gave an update on all of the former HSC research assistants. Barbara Bond; faculty member of the Department of Forest Science, OSU. Klaus Puettmann; faculty member of the Department of Forest Science, OSU. Glenn Ahrens; new Extension forestry agent in Astoria. Karl Buermeyer; research forester with the PNW Research Station, Olympia. Alison Bower; proud mother of a beautiful baby boy and her husband working with the Milton-Freewater Watershed Council.

Andy started off by giving a summary of the winter 2001 field season. We are in the middle of completing all of the scheduled fieldwork on 16 sites, and the remaining sites are all scheduled. Compared to other years. The workload this year is lower. Next year will be a very busy year (with approximately 25 sites to do). Four of the sites done last year were not completely finished and required further work by either Dave, myself, or other cooperators. Three of the sites did not have a field crew and we had to hire one (2 prison crews, 1 student crew). As always, the continued increase of orphaned sites is problematic. In terms of the amount of time required for the field measurements, Doug Belz said that the maintenance of replacing tags during remeasure-ments was a major time user. It was good practice to get the tags anchored with bar straps as early as possible, even if the stem was only a thumb's width at DBH.

Andy then presented the full treatment calendar for the Type II installations. What was impressive about the calendar was how far we as a coop have gotten in data collection and treatment application. For instance, 11 of the 26 installations have had their 9th year measure, and 22 of the 26 have had their 6th year measure. By the year 2006 (just 5 years from now) 19 sites should have all of the treatments applied.

Next, other topics in regard to fieldwork procedures were discussed. The main issue that came up was when to time the thinning treatments. According to the manual, the decision to thin should be based on what the 1200 tpa plot looks like. However, we often find that the 1200 tpa and the 525 tpa plots differ in stand development (and thus, the timing of the thin). We all agreed that in a perfect world we would treat the two plots separately, and thin each of them when they are ready. However, this is often not practical. The next favored approach was to tie the thinning treatments to a measurement year and therefore save work. This strategy then brought up the question of which would be more favorable; thinning a plot too early (shocking the stand) or too late (stagnation). The general consensus of the group was that it is preferable to delay the treatment. Lastly, the idea of each cooperator using their knowledge, experience, and intuition to decide when to thin, instead of a rigid schedule, was proposed.

Another issue which came up in regard to fieldwork procedures was how long should we measure the Type I stands and what should the measurement interval be. A few members (including Doug Belz and Norm Anderson) proposed that we should carry these plots as long as possible due to the interest in long-term ecosystem planning and multiple use issues (conservation, wildlife, riparian, etc.). So, if we were to carry these plots long into the future, what should we measure, and what should the interval be? It was suggested that a five year measurement interval would be too long to catch the dynamics of suppression, especially as the stand reaches maturity. It was also proposed that because height growth rapidly slows as these stand reach maturity, we would only measure diameter and status (live/dead). Dave then brought up the Cascade Head experiment, an example of a long-term study. This study was established between 1911-13 and is looking at the dynamics of red alder, Douglas fir, and red alder/Douglas fir mix. The measurement interval is every 10 to 15 years. It was agreed that the final desired results should dictate what and when we measure. For instance, do we want a smooth curve or episodic self-thinning line?

Dave and I will look at the data and the literature and recommend/report any changes in the protocol at our next meeting.

Damage codes were discussed next. Andy proposed a numerically coded damage list since non-numerical comments can not be used for analysis. Doug Belz favored adding more damage codes to the current list to cover damage types not found (i.e. 'sinuosity', sapsuckers, etc.). Doug also proposed and presented a procedure that the SMC uses to quantify damage based on the timing, agent, and severity of the damage. However, other members raised two questions; 1) whether the modelers will actually use the damage data and 2) the problems of bias/subjective ness in recording damage. All in all, most of the group favored the less common damages to be covered in the comments section rather than be coded because they were not pertinent to the study. It was proposed that Andy should supply the measurement crews with the last DBH, height, damage, etc. because it would help the crews better determine the timing and severity of the damage. Finally, Doug Belz mentioned logging damage by skyline cable yarding adjacent conifer stands as a problem in some sites. Dave Hibbs said that these should be stand characteristics that would be kept in the project/site folders instead of for individual trees.

There was discussion on the maximum height for pruning. The group felt that 22 ft. was operationally the best that could be achieved even with ladders. A 22 ft. lift would yield two 10 ft. logs.

Doug Maguire of the Forest Resources department at OSU and the head of the Swiss Needle Cast Cooperative (SNCC) gave a presentation on three of the SNCC projects; 1) Growth Impact Studies, 2) Effects of pre-commercial thinning, and 3) the severity of Swiss needle cast across gradients in foliage and soil nutrients.

The Growth Impact Study is a retrospective study focusing on the area between Newport and Astoria within 18 miles of the coast (187,000 acres). The study has three main objectives. Listed below are these objectives and some of the key findings.

1) What are the growth losses across the intensity (severity) of the Swiss needle cast (SNC) infections.

On the average the number of years a needle is retained on Douglas-fir (retention) is 3.65 years. However, they found the average retention on 1990 was 1.43. Furthermore, starting in 1990 and factoring out stand variables, needle retention is a significant predictor of relative growth rate (RGR) and basal area (BA).

As of 1996 growth impacts were as follows:

- 15% average loss in BA growth (maximum 35%) since 1990
- 10% average height growth loss (maximum 25%) since 1992
- 23% average volume growth loss in 1996 alone

This amounts to a loss of 230 board feet/acre/year or 43 million board feet over the whole study area. Furthermore, SNC is widely distributed throughout the entire study area; 50% of the area suffers 30% or more volume growth loss.

Is needle retention the best indicator? What are the best foliage/tree indicators to use?

To answer this question the SNCC used 0.2 acre permanent plots (n=77) to relate initial conditions with growth losses. They found a positive relationship between the periodic annual increment (PAI) and needle retention (i.e. PAI increases with increasing retention). They also found that with a retention of 1.0 there is a 50% decline in volume growth. However, the problem with only using needle retention is that it assumes retention is only affected by SNC that no other factors contribute to the length of needle retention. Because the above statement is not true, the SNCC persued other indicators and found that the ratio of crown length to sapwood area is a more objective substitute for either retention or leaf area index (LAI) in predictive models for growth effects.

2) What is the effect of pre-commercial thinning on SNC infections? Or, more specifically, does thinning affect the degree of infection? What is the response of volume growth to thinning?

Alan Kanaski and Doug determined that the data is not conclusive, it is hard to interpret, and that another measurement year is needed. However, they showed that if a stand is heavily infected, thinning appears to make the stand look worse. Therefore, do not thin if retention is less than 3.0.

3) Does SNC severity differ across gradients in foliage and soil nutrients?

Findings from this study include:

- negative relationship between sulfur and nitrogen foliar and soil percent with SNC severity
- positive relationship between calcium foliar and soil percent with SNC severity
- negative relationship between nitrogen and needle retention

Dave Peter of PNW Research Station, Olympia, WA gave a presentation on Oregon white oak acorn production. The reasons behind this study include; 1) oak savannas are rapidly disappearing, 2) oak savannas are rapidly changing, 3) oak acorns are a food source of the western gray squirrel which has a protected status in WA state, and 4) Oregon white oak has the greatest north/south distribution of the western oaks but is perhaps the least studied. Specifically, this study addresses two main topics; 1) how common are good and bad acorn crop years and 2) what are the local/regional climatic factors and the biological factors that affect acorn production?

The months of August, September, and October are the only time to study acorn production (September being the best) because once the acorns turn brown, they fall off the tree extremely fast. Therefore, because the window of opportunity is so short, sample sizes are small and depend largely on volunteer work. Between Longview, WA and Oak Harbor, WA 159 trees were sampled. Between the Columbia Gorge and Roseburg, OR 131 trees were sampled.

Results include:

- Insect predation is the primary cause of premature acorn dropping. Normally about 20 to 80% of acorns are infected with filbert moth and filbert weevil. These acorns turn brown early and drop off a few days later never reaching maturity.
- Acorns are larger and more numerous from moist, well-drained sites and poorer from dry sites, wet sites, and rocky hilltops.
- Finer textured soils tended to produce less acorns than coarser soils.
- Hot underburns create a temporary reduction in acorn production (first year) but may increase long-term productivity, after only five years.
- Since acorns are produced only on the tips of the branches, oaks growing in crowded conditions produced acorns only at the top of the tree. Acorn production is low per tree but high per area. Open-grown trees produce the best acorn crops on a per tree basis.
- Young or old trees produce less acorns than a mid-aged tree. Best acorn production occurs from 40-80 years.
- To quantify acorn production, every acorn on 18 trees was counted and grouped according to 4 classes, 1-4 with 1 having no acorns to 4 having so many acorns to bow the branches.

Code	n	acorns/ sq.m	mean tree surface area (sq.m)
1	9	0.03	211.8
2	5	0.19	233.4
3	4	1.60	465.4
4	0	—	—

These results correlated to tree form where the open-grown trees (mushroom-shaped) produced more acorns than closed-grown trees (columnar or inverted vase).

Data from 2000 also seems to indicate that there is some type of regional, synchronous masting. In Eastern WA the average class was 2.7; the Puget-Willamette trough had an average class of 1.4-1.7; and in Southern OR/Northern CA the average class was 1.9. However, the reasons behind this are not known. For instance, genetics do not seem to affect production since a previous study found very little genetic variation across the range.

Weather-related damage was discussed as the session returned to alder. It has been suggested by members of the HSC that tree tipping (stem breakage or uprooting) sometimes happens in recently thinned areas. Breakage occurs in alder when there is wet snow or freezing rain. Some thought that more breakage occurred at upper elevations further north. However, the evidence seems to be anecdotal; there doesn't seem to be any documented evidence of this.

The following examples of damage were brought up by the members.

- Doug Belz suggested that the greatest damage to alder in Washington occurs in a 1200 to 1800 ft. elevation zone due mainly to two storms within the last 30 years which freezing rain in a swath about 20 miles wide stretching from Aberdeen to Enumclaw.
- David peter reported that an ice storm (from freezing fog) four years ago in Washington stripped off all of the branches of alder but they have now recovered by re-sprouting branches, and seem to be doing fine.
- A Type I installation near Clear Lake, WA had a lot of breakage in the low density plots.
- Paul Courtin reported that a Type II installation (French Creek) suffered damage in the 1200 tpa plots after thinning as well as a seventeen year old Type 1 stand (#4101?).
- The WeyCo site near Abernathy, WA lost two of the three 1200 tpa plots due to a spring storm.

Andy then reported on a preliminary analysis of Height-to-Diameter (H:D) ratio, especially as it related to latitude.

In short, the following results were found:

- Type II alder H:Ds ranged from 93 to 144.
- Alder H:Ds seem to be much greater than what is expected for Douglas-fir. In Douglas-fir there is high probability of windthrow if the H:D is 100 or greater. Red alder seems to be different. Because alder is a deciduous tree, dropping its leave before the winter storms, its' crown is less of a sail than conifers.

- Planting density affects the H:D. Trees in the 1200tpa plots had a significantly greater H:D than trees in the 525tpa, both at the time of the first thinning (4-6 years) and the second thinning (6-10 years).
- H:D decreases with time for most 525 tpa plots and all 1200 tpa plots.
- As percent slope increases, H:D generally decreases.
- As latitude increases, H:D generally increases.

The discussion then turned to scheduling the next HSC meeting. It was decided that the meeting will be in the first week of June in British Columbia. Paul Courtin, Dave, and Andy will work together in preparing an agenda for the meeting.

Field Tour Wednesday January 10, 2001

After lunch, Randy Johnson, geneticist with the Corvallis PNW lab, took us to a site located a few miles southwest of Monmouth on land administered by the Siuslaw National Forest. There is a test plot of about 2 acres that is one of 3 sites to study genetic variation in alder. Three hundred families collected from Oregon and Washington are included in this study. The other 2 sites are on Weyerhaeuser land in WA. This Monmouth site is a very poor site for red alder growth but is all that PNW thought was available for this study. Red alder is not found in the Willamette Valley. White alder (*Alnus rhombifolia*) is found in riparian areas.

It is a real challenge to keep red alder alive in this kind of environment for a number of reasons. 1) The site is quite dry; precipitation is about 40" annually. 2) The site is surrounded by grass farms and there is a great abundance of windblown seed as a result. 3) Due to herbicide restrictions cultivation has been done for grass control with limited success. 4) Because of the grass, there is a huge population of mice and voles plus a few gophers. These rodents are eating the alder roots and are trying to be controlled by mousetraps baited with peanut butter.

These trees are 2 years old yet only about 2 feet tall, much shorter than they should be. Dave Hibbs pointed out that the seedlings (containerized stock) appeared to be of poor quality nursery stock because the buds did not go to ground level. This was probably because the bed density in the nursery was too high. Conifers can be sown at 30 trees per square foot. Alder should be sown at about 10 to 15 trees per square foot. There was significant mortality in the nursery because the alder leaves acted as umbrellas causing erratic water distribution from overhead irrigation.

Another nursery practice required for good alder growth, is to inoculate with *Frankia* spp. Because the soil and potting mediums are sterile, *Frankia* spp. Is required to 'jump start' the nitrogen fixing bacteria. Dave said that there are only a couple of nurseries in the PNW that practice good alder horticultural practices. Brooks Nursery is one of these, ODF's Phipps nursery does not inoculate with *Frankia* spp.

Despite the multitude of problems inherent to this site, Randy considers he still has a valid study because he planted many more trees and can accept some losses. The 2 year height measurements show strong family variation and that some of this variation is associated with parent tree location.

We also looked at several other planted species. We saw a western redcedar seed orchard that Salem BLM and Willamette Industries harvested seed by bagging branches and later dumping out the seed. We also looked at Noble fir, Douglas-fir and Ponderosa Pine seed orchards.

One key bit of discussion was on the red alder growth model. Dave Hibbs described a regional effort to develop an alder data base that brings together all alder data sets. This mega-data set is seen as providing an opportunity and incentive to the development of an alder growth and yield model. Weyerhaeuser has been playing point in this effort. Weyerhaeuser said they would not do this themselves. There was a general consent that it is unlikely that Weyerhaeuser would contribute to a public model.

In terms of models in general, Bill Voelker brought up the thought that the HSC would be premature to start modeling right away. Because our oldest plots are 12 years old, it might be better to wait another year or two to get a broader age span and have more plot data. Also, because a lot of resources are required to develop a model, there might be only one chance. If after a few years we discovered some unexpected results it would be much harder to correct the model than to wait a few years until we had more data.

Thursday January 11, 2001

Nine people from the coop (plus Klaus Puettmann) went to the orphaned Type II installation, Pioneer Trail (#2203), just to the east of Toledo. This site was owned by Northwest Hardwoods and is now managed by AME. The Siuslaw National Forest has graciously been assisting in data collection since then.

The weather was markedly different this year than what our group experienced last year when we worked on the Siletz site. This year it was almost 60 degrees and sunny; last year gates were frozen shut and about 6 inches of wet snow fell while we were measuring and maintaining plots.

At this installation, Himalayan blackberry has a strong presence in the 100 and 230 TPA planted plots. We had to chop through the blackberry canes to get to almost half the trees with our machetes on these lightly stocked plots. Often the canes were an inch thick. On the 525 and 1200 TPA plots, there was almost no blackberry problem. The blackberry invasion could also be initiated by too early a thinning. Some of the largest alder were approaching 8 inches in diameter.

Doug Belz pointed out alder that were being girdled by flagging. It is not a good idea to tie flagging around the boles of young alder because of their thin bark and rapid growth. Flagging restricts the downward flow of nutrients through the phloem. Even some trees that previously had flagging removed, still had a distinct band impressed into the trunk.

We completed just over 6 plots of the 9th year measurements. Thank you all.

Hope to see everyone in BC this summer.

Appendix 3

Financial Support Received in 1999-2000

Cooperator	Support
BC Ministry of Forests	$8,500
Bureau of Land Management	$8,500
Goodyear-Nelson Hardwood Lumber Company	$4,500
Oregon Department of Forestry	$8,500
Siuslaw National Forest	$8,500
USDA Forest Service PNW Station	In kind
Washington Department of Natural Resources	$8,500
Washington Hardwood Commission	$8,500
Subtotal	$55,500
Forestry Research Laboratory	$51,483
Total	**$106,983**

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