MANAGEMENT PRACTICES ON PACIFIC NORTHWESTWEST-SIDE INDUSTRIAL FOREST LANDS, 1991-2000: WITH PROJECTIONS TO 2005

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JOHN TROBAUGH

STAND MANAGEMENT COOPERATIVE

SMC WORKING PAPER NUMBER 2

SEPTEMBER 2001

COLLEGE OF FOREST RESOURCES

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ACKNOWLEDGMENTS

This study was supported by the Stand Management Cooperative, College of Forest Resources, University of Washington, Seattle, WA. We wish to thank the following manuscript reviewers for helpful suggestions; Bruce Lippke, University of Washington; Robert Lowery, Weyerhaeuser Company; and Jeff Madsen, The Campbell Group. We also wish to thank the nine companies that responded to the survey for their time in completing it.

INTRODUCTION

This report summarizes the fifth survey of silvicultural practices of members of the Stand Management Cooperative (SMC) and its predecessor the Regional Forest Nutrition Research Program. Previous surveys were conducted in 1983, 1986, 1991, and 1996. Results of the first three surveys were summarized and distributed to members but no formal publications were developed. Results of the 1996 survey were summarized in the SMC Quarterly (Briggs and Turnblom 1997). While many of the questions contained in the series of surveys are the same, they have expanded in breadth and level of detail. Survey # 5, which was prepared and reviewed during the summer of 2000, discussed at the September 2000 meeting of the SMC Policy Committee, and mailed in October 2000, is presented in the Appendix.

The SMC membership includes federal (USFS, BLM), state (Oregon Dept. of Forestry, Washington Dept. Natural Resources), county (King County Dept. Natural Resources), and tribal (Quinault Dept. Natural Resources) agencies plus 17 industrial forest landowners. While surveys and a follow-up reminder were sent to all members, 9 usable surveys were returned and all were from the industrial forest landowners.

In this report data received from the 9 forest industry respondents were pooled hence the subsequent summaries are based on treating the data as if it is a profile of a single composite industrial entity with holdings west of the Cascades in Oregon and Washington. All of the time series data are presented by dividing the combined respondent total for a treatment by their total net timberland. This ratio is multiplied by 1000 to create an “intensity rate” in acres per thousand acres (A/1000A) of net timberland for the treatment. In several questions, respondents also provided data by species and intensity rates were also calculated by dividing the species total for a treatment by the acres of net timberland for that species. Each respondent’s acres of net timberland by species was calculated using the information from Questions 1 and 2. Occasionally a respondent provided an overall total for a treatment with no species detail. Consequently, the sum of the species-level intensities may not coincide with the intensity calculated for the overall total. For questions where means and standard errors are presented, the statistics were not weighted by respondent size.

Chapter 2 further describes the sampling frame, response rate, and general characteristics of the respondents. Chapters 3-8 respectively summarize site preparation; regeneration, planting stock, and stocking targets; vegetation management practices; pre-commercial and commercial thinning; fertilization; and pruning. Chapter 9 summarizes respondent issues with pest management and Chapter 10 summarizes responses to questions related to the current regulatory situation.

2.1 Acreage Totals

The 17 forest industry companies that are members of the SMC collectively own 5.317 million acres gross timberland west of the Cascades, hereafter referred to as the “west-side”. Gross acreage refers to forestland without deductions for unproductive areas, roads, etc. Forest inventory statistics indicate that industry owns approximately 4.035 million acres of timberland on the west-side in Oregon (MacLean 1990) and 3.732 million acres on the west-side in Washington (Bolsinger et al 1997); a combined total of 7.767 million acres (Figure 2.1). The 17 SMC forest industry members own 68% of the west-side industrial lands. Nine of these 17 members (53%) with 2.404 million gross acres responded to the survey; these represent 43% of the SMC industry acreage and 31% of the total industry west-side forestland (Figure 2.1). The average respondent size was 267,000 acres; three own less than 150,000 acres, three own between 150,000 and 300,000 acres, and three own more than 300,000 acres. Data from the respondents was pooled hence the summary results are presented as if the 9 respondents were merged to form a single entity managing 2.404 million acres in western Oregon and Washington.

One factor that may affect recent trends and interpretation of the results is the distribution of age classes on industrial forest lands. Figure 2.2 presents the age class distribution for west-side forest industry lands in Washington (Bolsinger et al 1997). The acres reported for a specific cultural practice depend on the number of acres on the landscape that have reached the stage of development when the practice is commonly applied. Figure 2.2 indicates that, in 1992, there was a large cohort of age 10-29 year old stands in Washington; prime candidates for commercial thinning during the decade. Therefore, one might predict increasing intensity of thinning operations during the 90’s and this indeed is the case as will be seen in Chapter 6. The effect of aging cohorts of stands on intensity of cultural practices is similar to the effect of the “baby-boom” segment of the US population on social trends. Both the movement of acres through stand development age classes and economic conditions during the survey period must be kept in mind when interpreting the results.

Question 1 asked respondents to indicate for the west-side holdings in each state their gross and net (capable of producing at least 20 cubic feet per acre per year) acreage. Figure 2.1 shows that the gross acreage of the respondents drops by 5.4% to 2.274 million net acres after deducting land occupied by roads, rock outcrops, wetlands and area lacking the potential to yield 20 cubic feet per acre per year. This net acreage figure is the basis upon which many of the subsequent management intensity statistics in later chapters are calculated.

Respondents were also asked to estimate the percentage of the net timberlands that was not managed due to environmental set-asides (unstable slope, habitat reserve, etc.). Approximately 9.5% (0.215 million acres) of net timberlands are presently in a “not managed” state (Figure 2.1).

Figure 2.3 shows some of the data from Figure 2.1 at the state level. While 52% of west-side forest industry lands occur in Oregon, there is relatively more respondent acreage (63%) in Oregon. To the extent that there are differences in management practices and forest practice regulations between the states, the survey may be somewhat biased toward Oregon conditions. Comparison of net and gross west side acreage indicates that 86% of respondent gross timberlands in Oregon and 93 % in Washington are capable of producing 20 cubic feet per acre. In western Washington, 14% of respondent net timberland has been set aside with no management in comparison to 8% in western Oregon.

2.2 Acreage by Species and Site Index

Questions 2 and 3 obtained the percentage breakdown of net timberlands by species cover type and by site index (50 year basis). The percentages reported by each respondent were applied to that respondents' total net acreage and the results were summed across respondents to obtain composite owner totals. Douglas-fir, hemlock, and a Douglas-fir/hemlock mix account for 88% of the net acreage of the combined respondents (Figure 2.4). Site classes I and II account for 58% of the net acreage (Figure 2.5).

2.3 Harvest unit size

Question 28 asked respondents to indicate the minimum, maximum, and average size harvest unit in 1990, 1995, and 2000. The mean and standard error of the reported values are presented in Figure 2.6. A trend toward smaller harvest units is clearly evident; the average unit has dropped by about 20 acres from 1990 to 2000. The maximum size unit has declined from 212 to 112 acres, or almost half, during the decade. The standard error has also decreased over time suggesting that differences between organizations have narrowed.

2.4 Harvest Practices

Question 31 asked respondents to indicate the average annual percentage of the area harvested in 1996-2000 that received the treatments or activities listed in Table 2.1 and to indicate their expectations for the next 5 years. About one-third of harvested lands have whole tree logging or removal of unmerchantable material, about 15% involves species conversion, 17% has varying amounts of green trees retained, and about half involves maintaining and creating down wood material and snags for habitat.

2.5 Rotation

Question 29 asked respondents to indicate current rotation age by species. The mean and standard error of the reported values are presented in Figure 2.7. Average rotation age for Douglas-fir and hemlock is approximately 50 years. Mixtures and other species tend to have somewhat longer rotations. The average rotation for hardwoods, primarily red alder, is approximately 40 years. Question 30 asked respondents to indicate if certain cultural treatments would increase, decrease or not change rotation length. Table 2.2 shows that planting at wide early spacing and pruning would not change their rotation but that fertilization and other (pre-commercial thinning and early weed control) would decrease their rotation.

Table 2.1 Treatments on annual harvested areas, percent				
		Mean	Std Error	No. Responses
1996-2000	Whole tree logging	21%	6.2	8
	Yard unmerchantable material	12%	10.5	9
	Maintain or create woody material & snags	50%	16.0	9
	Green tree retention	17%	12.0	8
	Species conversion	14%	4.2	8
2001-2005	Whole tree logging	24%	6.7	8
	Yard unmerchantable material	12%	10.5	9
	Maintain or create woody material & snags	55%	14.7	9
	Green tree retention	17%	12.0	8
	Species conversion	15%	6.7	8

Table 2.2 Effect of Treatments on Rotation				
Treatment	Number of Responses	No Change in Rotation	Increases Rotation	Decreases Rotation
Wide planting spacing	9	56%	22%	22%
Pruning	7	71%	14%	14%
Fertilization	9	22%	11%	67%
Other (pct, early weed control)	2	0	0	100%

References:

Bolsinger, Charles, L., Neil McKay, Donald R. Gedney, Carol Alerich. 1997. Washington’s public and private forests. Resource Bulletin PNW-RB-218. USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 144pp.

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MacLean, Colin D. 1990. Changes in area and ownership of timberland in western Oregon. Resource Bulletin PNW-RB-170. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

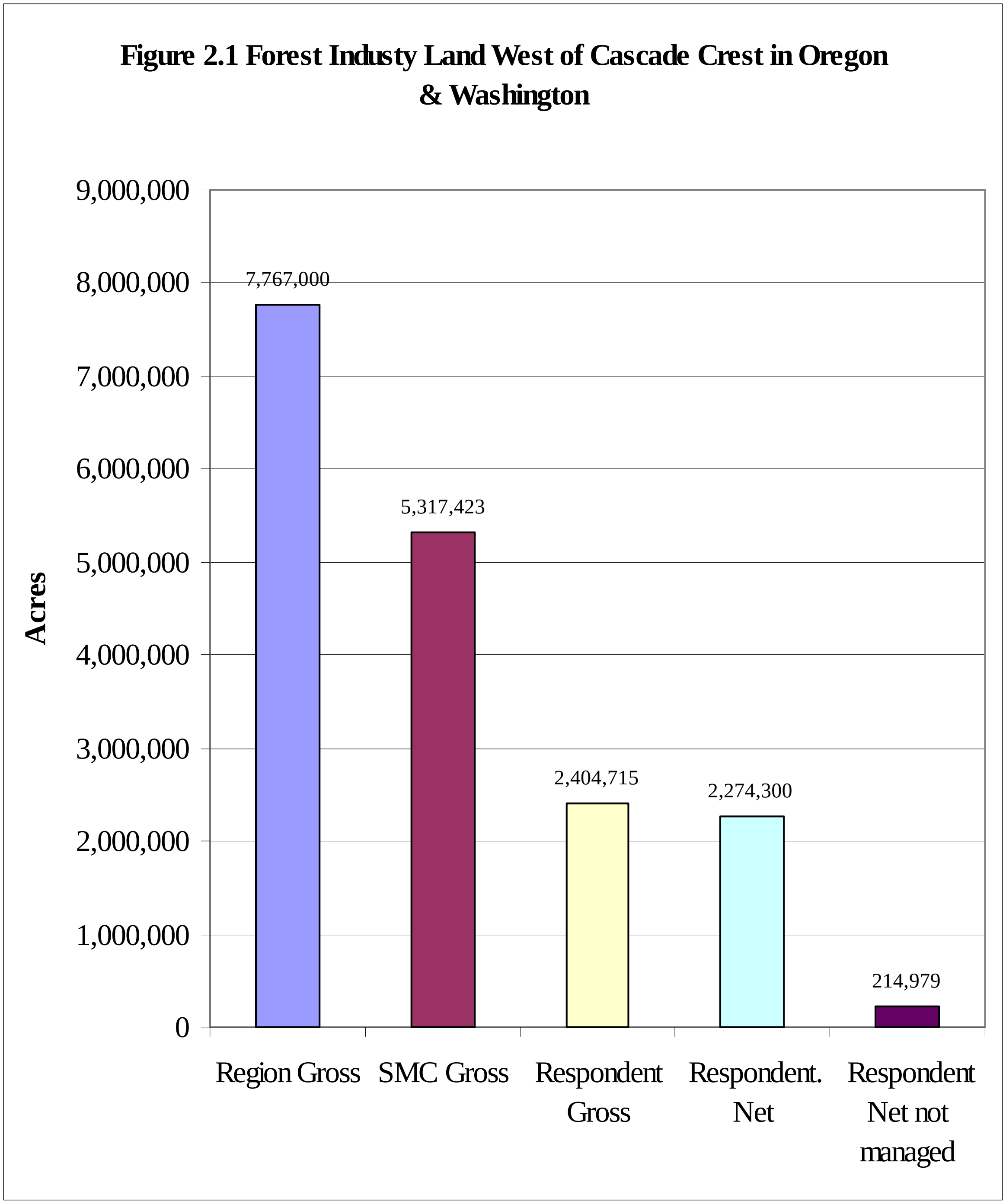


Figure 2.1 Forest Industy Land West of Cascade Crest in Oregon & Washington
Acres
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
7,767,000
5,317,423
2,404,715
2,274,300
214,979
Region Gross
SMC Gross
Respondent Gross
Respondent. Net
Respondent Net not managed

Figure 2.2 Age Class Distribution of Forest Industry Land in Western Washington (Bolsinger et al. 1997)

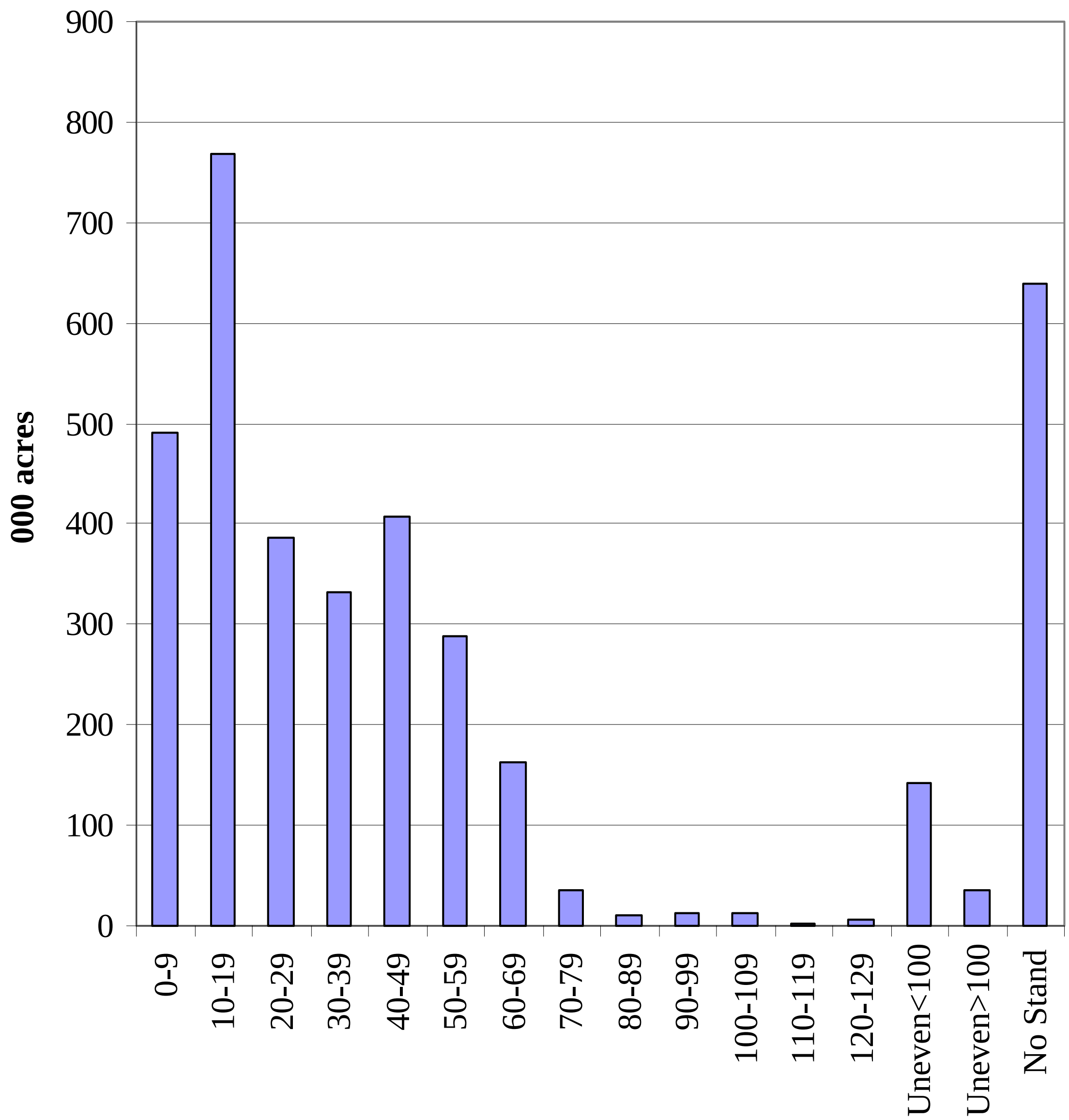


Figure 2.3 Total Industry & Responent Acres by State

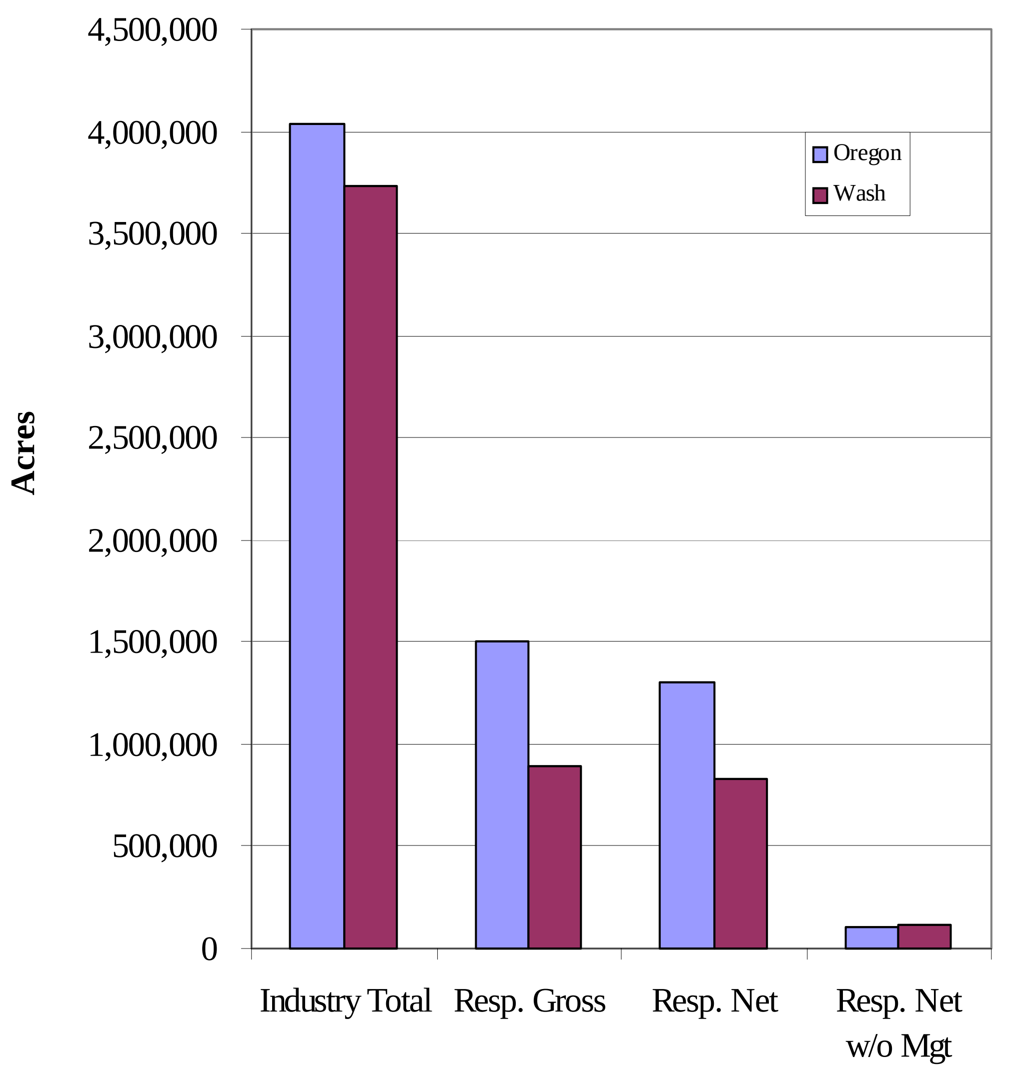


Figure 2.4 Net Timberland by Forest Type

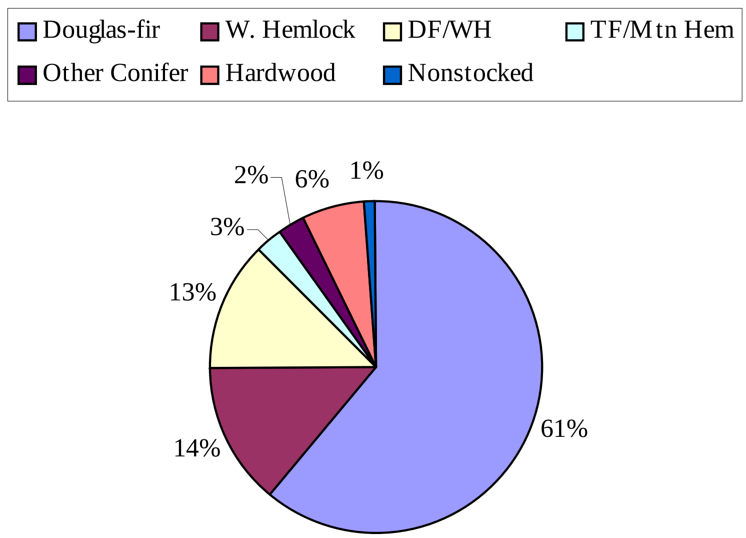
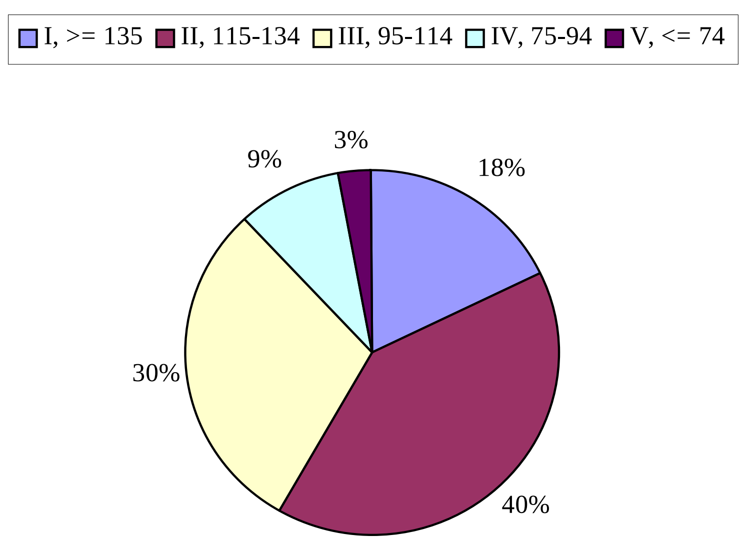
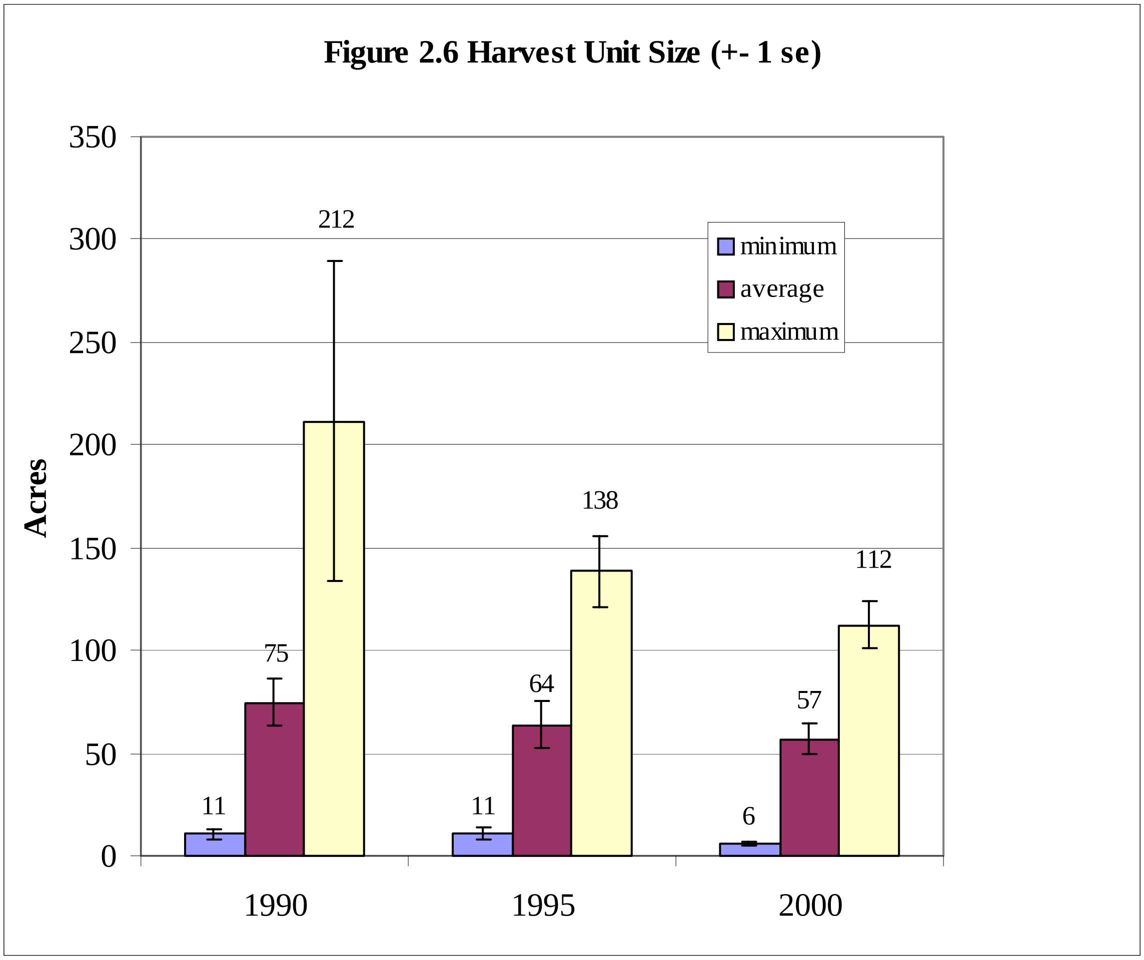
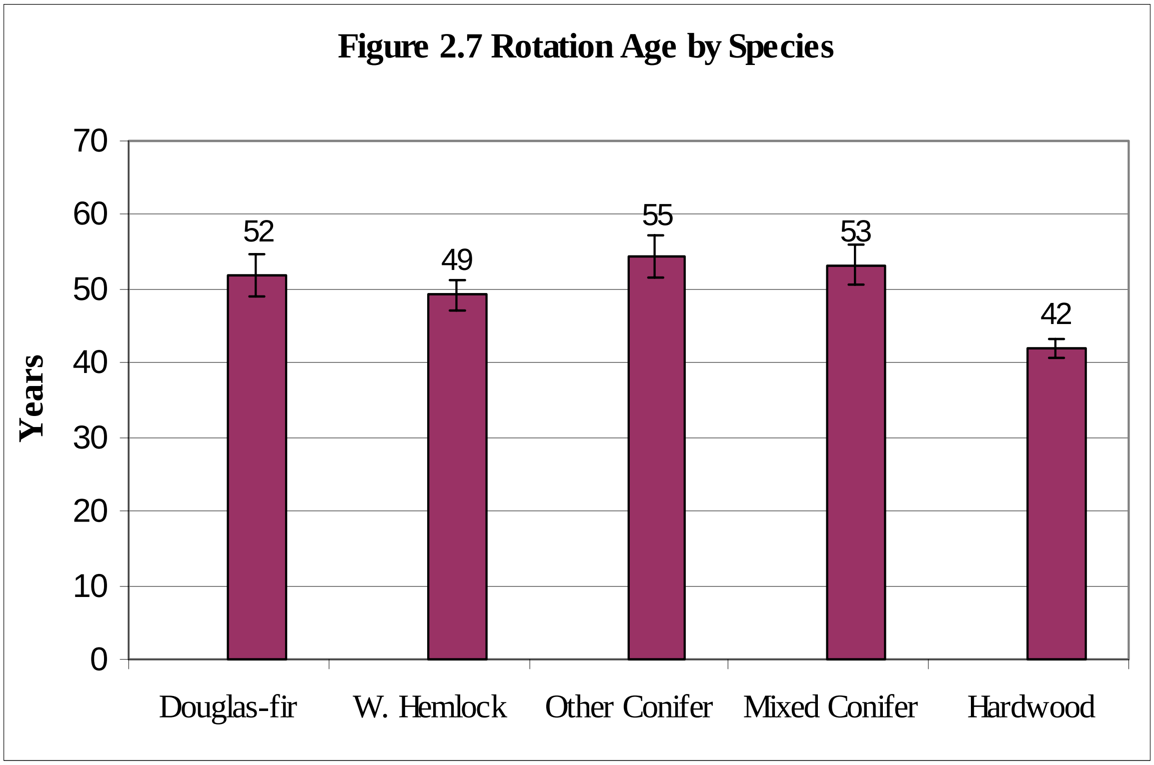


Figure 2.5 Net Timberland by Site Index





Data Table for Figure 2.6				
		Mean, Acres	Standard Error	N
1990	Minimum	11	2.6	6
	Average	75	11.6	7
	Maximum	212	78.3	6
1995	Minimum	11	3.0	6
	Average	64	11.2	7
	Maximum	138	17.3	7
2000	Minimum	6	1.3	7
	Average	57	7.5	8
	Maximum	112	11.4	7



Data Table for Figure 2.7			
	Mean, years	Standard Error	N
Douglas-fir	52	2.9	8
Western hemlock	49	2.1	6
Other conifers	55	2.8	5
Mixed conifers	53	2.7	7
Hardwood	42	1.2	5

CHAPTER 3: SITE PREPARATION (QUESTIONS 10-12)

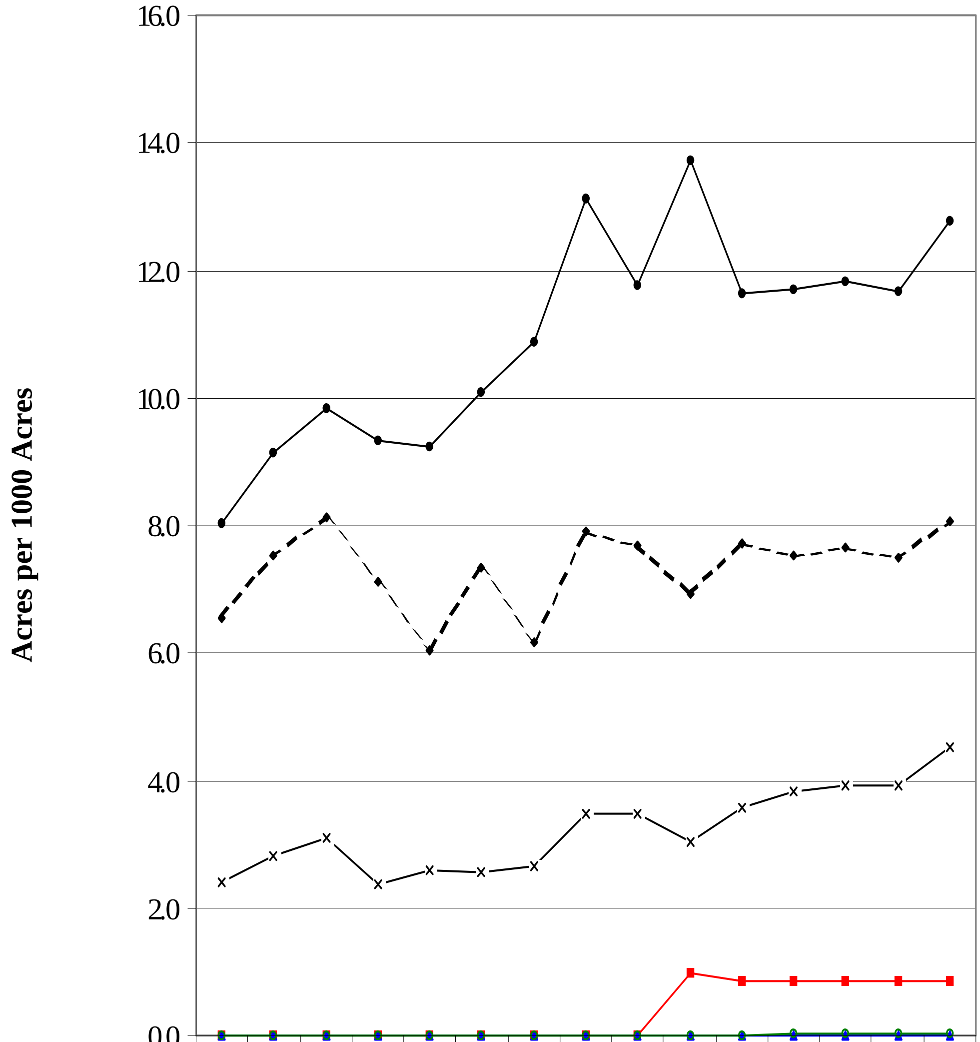
Figure 3.1 presents trends in site preparation activity per 1000 A of net timberland for the 9 respondents of which 6 provided detail by species. As a result, the species composition values may not sum exactly to the overall total. Site preparation has been rising since 1991, recently reaching 13-14 A/1000A net timberland with future plans at about 12 A/1000A. Site preparation of Douglas-fir has been approximately 7A/1000A throughout with little change expected in the future. Mixed conifer site preparation has increased to about 3A/1000A and is expected to continue to rise. Hemlock site preparation is a new addition (1A/1000A) and a small amount of hardwood site preparation is planned in the future.

Figure 3.2 provides a different perspective by expressing site preparation of each species in terms of 1000 acres of that species type. Site preparation on Douglas-fir land has been and will remain steady at about 12 A/1000A. In contrast, site preparation intensity on mixed conifer land has been steadily increasing and exceeds that of Douglas-fir. Site preparation is just beginning on hemlock and hardwood lands and intensities are expected to reach about 7 and 0.5 A/1000A respectively.

Figure 3.3 summarizes trends in methods of site preparation. The overall trend is increasing as the lands with no site preparation have declined from about 8 to 2.5A/1000A. Non-chemical methods have either remained constant (pile & burn) or declined (mechanical and broadcast burn). The largest increase has been chemical site preparation and within the chemical methods, use of pre-emergent herbicides has grown from less than 50% prior to 1996 to 70-90% recently and is expected to rise to 95% in the future (Figure 3.4).

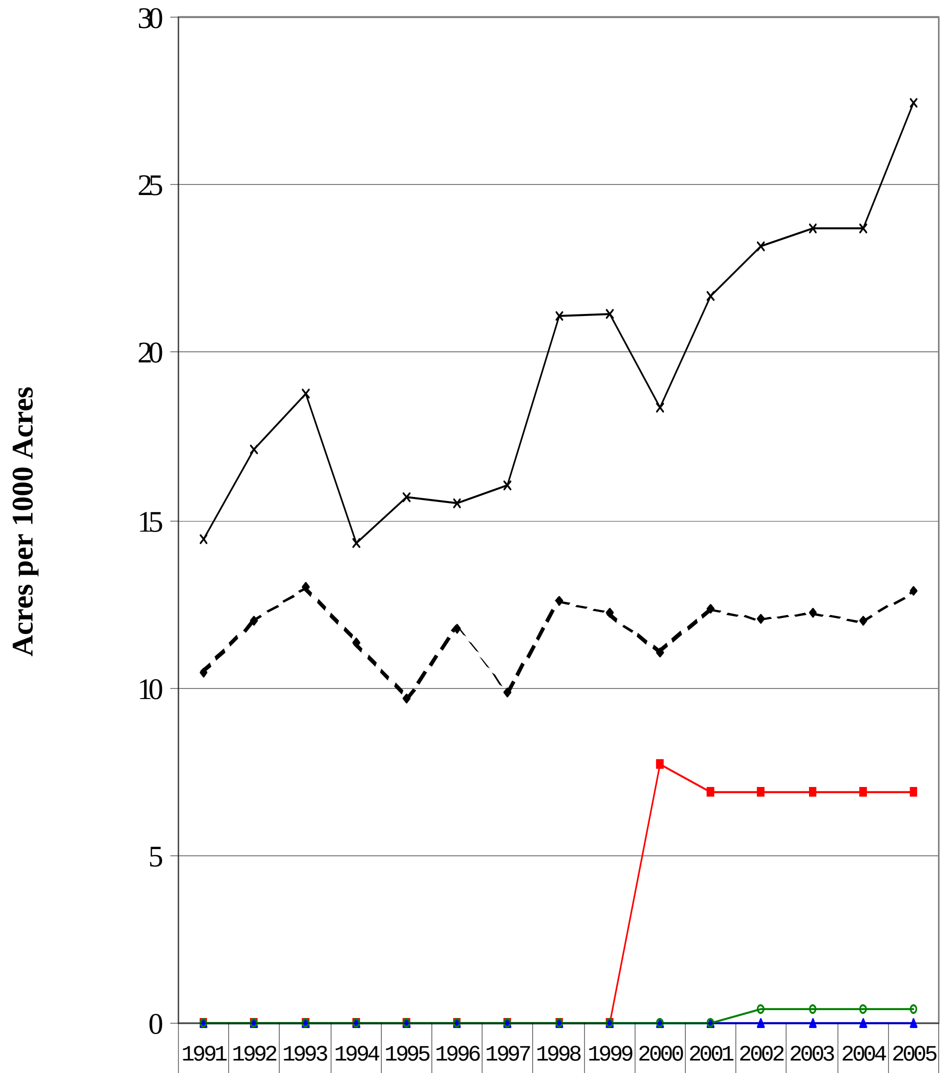
Each respondent provided the minimum, maximum, and average cost per acre for each site preparation method and the mean and standard error for each was calculated and presented in Figure 3.5. Broadcast burn and pile and burn methods tend to be more costly and have more variability than chemical treatments. Lower cost and lower variation would act as a powerful motivation underlying the shift to chemical methods shown in Figure 3.3.

Figure 3.1 Site Prep per 1000 A Net Timberland



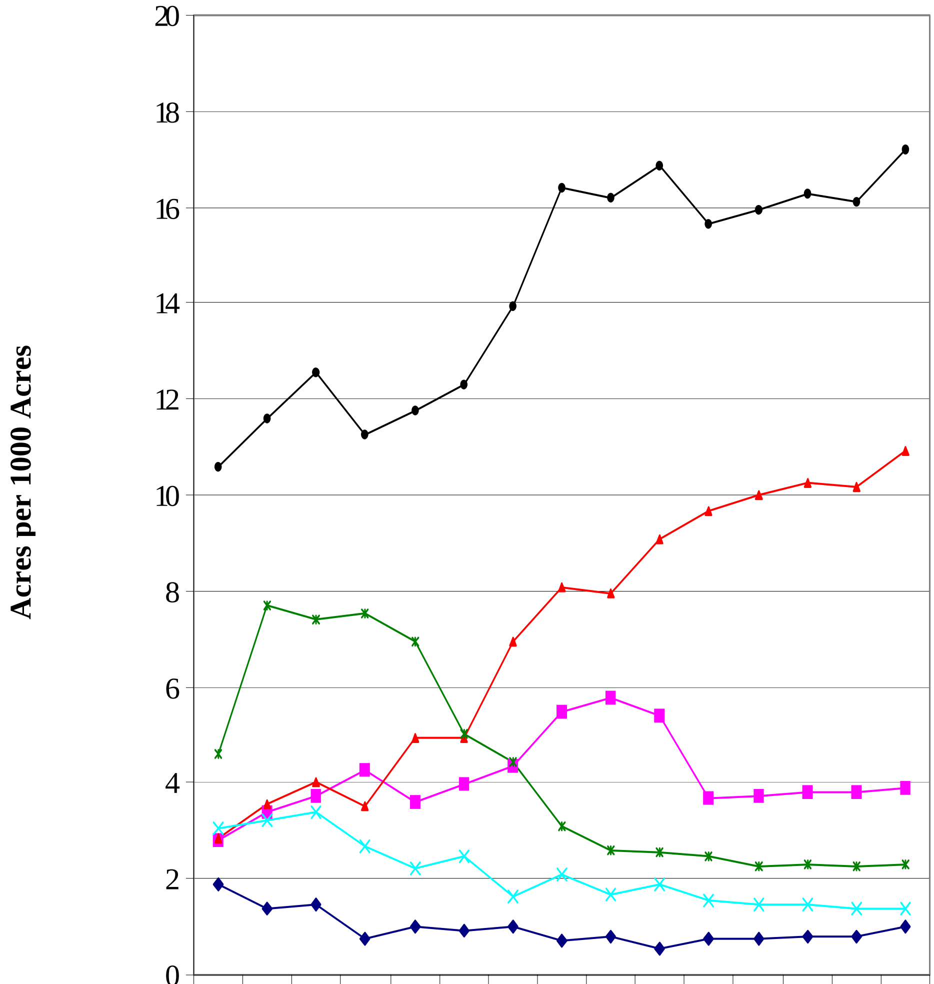
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	6.5	7.5	8.1	7.1	6.0	7.3	6.2	7.9	7.7	6.9	7.7	7.5	7.7	7.5	8.1
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.9	0.9	0.9	0.9	0.9
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	2.4	2.8	3.1	2.4	2.6	2.6	2.7	3.5	3.5	3.0	3.6	3.8	3.9	3.9	4.5
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	8.0	9.2	9.8	9.3	9.2	10.1	10.9	13.1	11.8	13.7	11.6	11.7	11.8	11.7	12.8

Figure 3.2 Site Prep per 1000 A of Species



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas fir	10.5	12.0	13.0	11.4	9.7	11.7	9.9	12.6	12.3	11.1	12.3	12.0	12.3	12.0	12.9
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	6.9	6.9	6.9	6.9	6.9
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	14.5	17.1	18.8	14.3	15.7	15.5	16.0	21.1	21.1	18.3	21.7	23.2	23.7	23.7	27.5
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4

Figure 3.3 Site Prep Methods per 1000 A Net Timberland



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Broadcast Burn	1.9	1.4	1.5	0.8	1.0	0.9	1.0	0.7	0.8	0.5	0.7	0.8	0.8	0.8	1.0
Pile & Burn	2.8	3.4	3.7	4.3	3.6	4.0	4.3	5.5	5.8	5.4	3.7	3.7	3.8	3.8	3.9
Chemical	2.8	3.6	4.0	3.5	4.9	4.9	6.9	8.1	8.0	9.1	9.7	10.0	10.2	10.2	10.9
Mechanical	3.1	3.2	3.4	2.7	2.2	2.5	1.7	2.1	1.7	1.9	1.5	1.5	1.5	1.4	1.4
None	4.6	7.7	7.4	7.5	7.0	5.0	4.5	3.1	2.6	2.6	2.5	2.3	2.3	2.3	2.3
Total	10.6	11.6	12.5	11.3	11.8	12.3	13.9	16.4	16.2	16.9	15.6	15.9	16.3	16.1	17.2

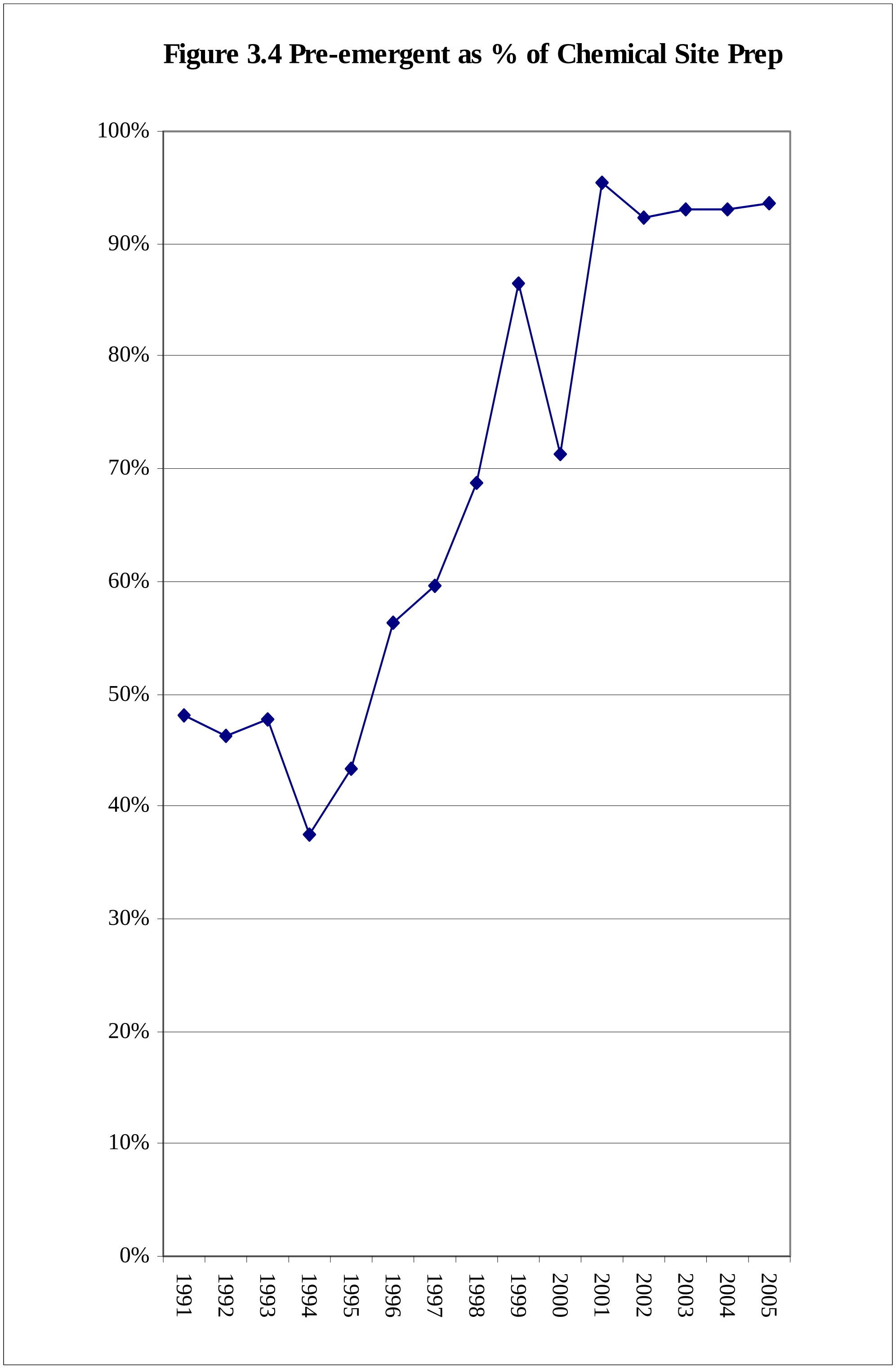


Figure 3.4 Pre-emergent as % of Chemical Site Prep
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
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1991
1992
1993
1994
1995
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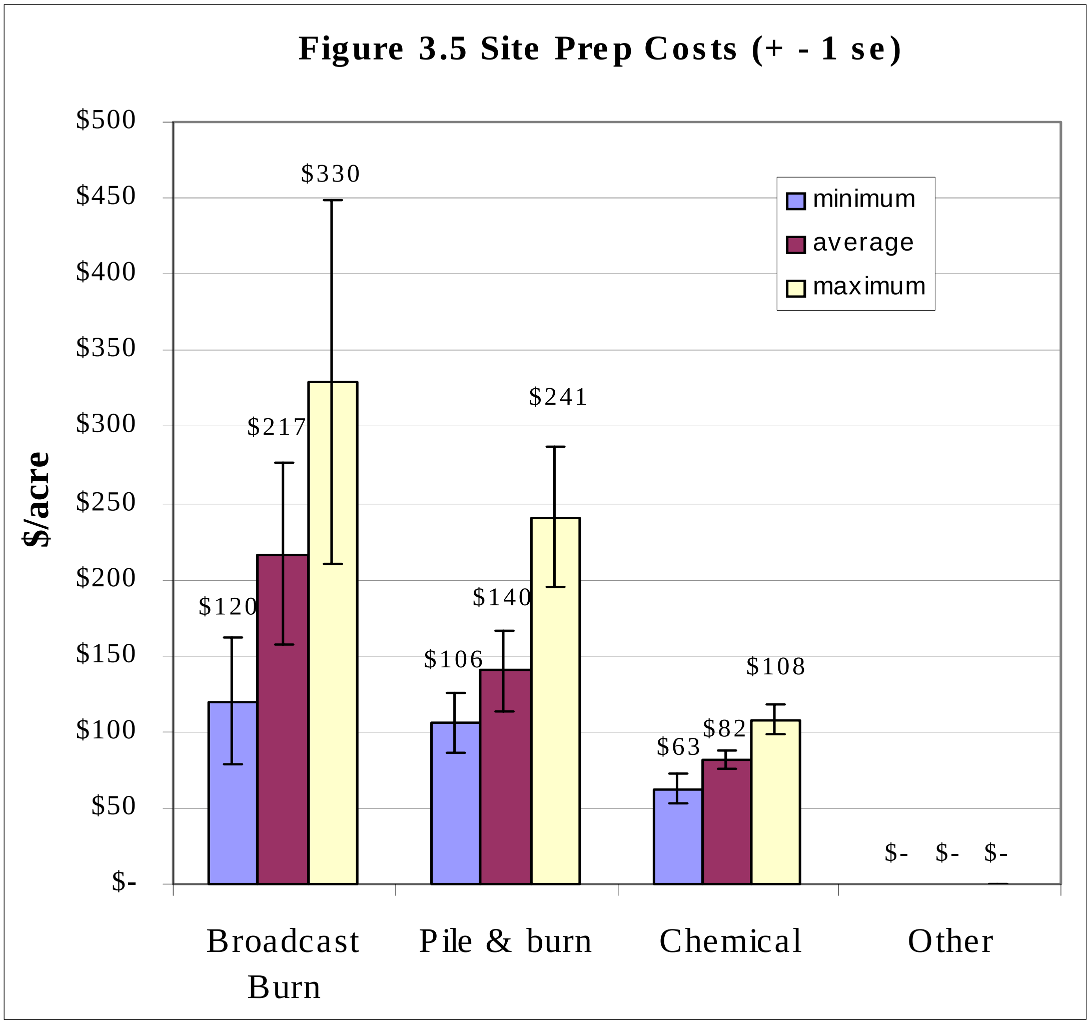
2001
2002
2003
2004
2005



Data Table for Figure 3.5				
		Mean, $/A	Standard Error	N
Broadcast burn	Minimum	120.00	41.63	3
	Average	216.67	60.09	3
	Maximum	330.00	119.30	3
Pile & burn	Minimum	105.83	20.06	6
	Average	140.29	26.27	7
	Maximum	240.83	45.47	6
Chemical	Minimum	62.50	9.58	8
	Average	81.89	6.13	9
	Maximum	107.50	9.82	8
Other	Minimum	NA	NA	0
	Average	NA	NA	0
	Maximum	NA	NA	0

CHAPTER 4. REGENERATION (QUESTIONS 4-9)

The typical regeneration unit of respondents in 2000 was 51 acres (se 6.7A, n = 9) which is in close agreement with the average harvest unit size (57A, se 7.5) in Figure 2.6. Virtually all (98.1%) of regeneration was accomplished by planting seedlings; artificial or natural seeding of the site occurs on the remainder (1.9%).

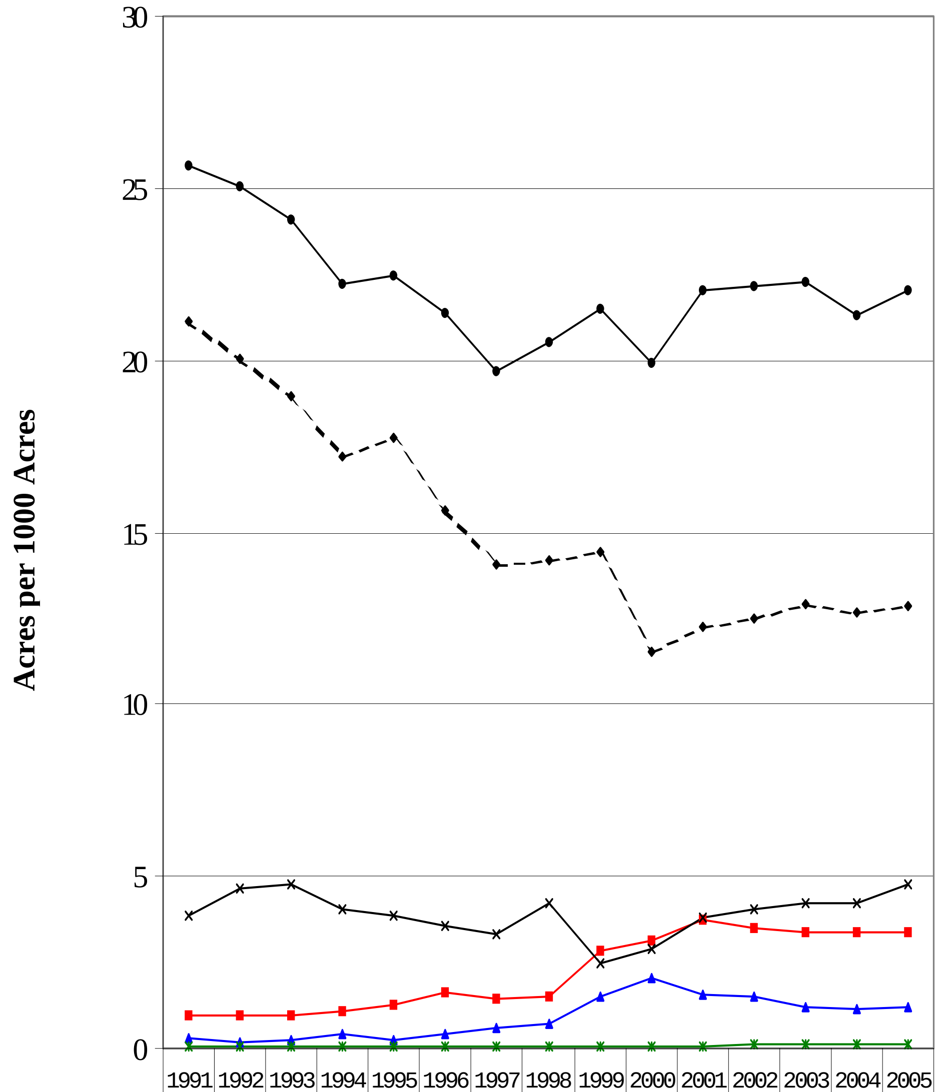
Figure 4.1 presents trends in regeneration activity per 1000 acres of net timberland for the 9 respondents of which 8 provided species level detail. As a result, species composition values may not sum exactly to the overall total. There was a slight decrease in regeneration intensity from about 25 A/1000A in 91-93 to about 20 A/1000A of net timberland in 1997-2000. This may be a result of a period of more intense thinning and selective/partial cuts to supply the harvest which could temporarily reduce the overall rate of required regeneration. Figure 2.2 indicates a large inventory of 10-30 year old stands at the start of the decade that would be prime candidates for commercial thinning and this survey found increased rates of commercial thinning (Figures 6.4 and 6.5). Planned levels for 2001-05 indicate an increase in regeneration intensity. Douglas-fir actually declined at a slightly greater rate than the total but this was partly offset by increasing regeneration activity in all other species groups.

Figure 4.2 provides a different perspective by expressing the regeneration of each species in terms of 1000 acres of that species type. Regeneration on Douglas-fir timberlands has decreased from more than 30 to about 20 A /1000 A while the intensity of regeneration of other species types has increased. This may reflect a shift from final harvest to more thinning in Douglas-fir as well as a shift in harvest among these timber types, a reduction in attempts to plant Douglas-fir on lands previously occupied by other species, and a shift away from Douglas-fir because of problems with Swiss needle cast.

Figure 4.3 indicates desired stand densities in trees per acre at planting and at age 10. Douglas-fir and western hemlock targets are very similar. Target densities for other conifer species, such as true firs and cedar, are slightly higher. Only 2 respondents indicated that they are planting hardwoods (red alder) and no error bar could be calculated for the 10 year hardwood density target.

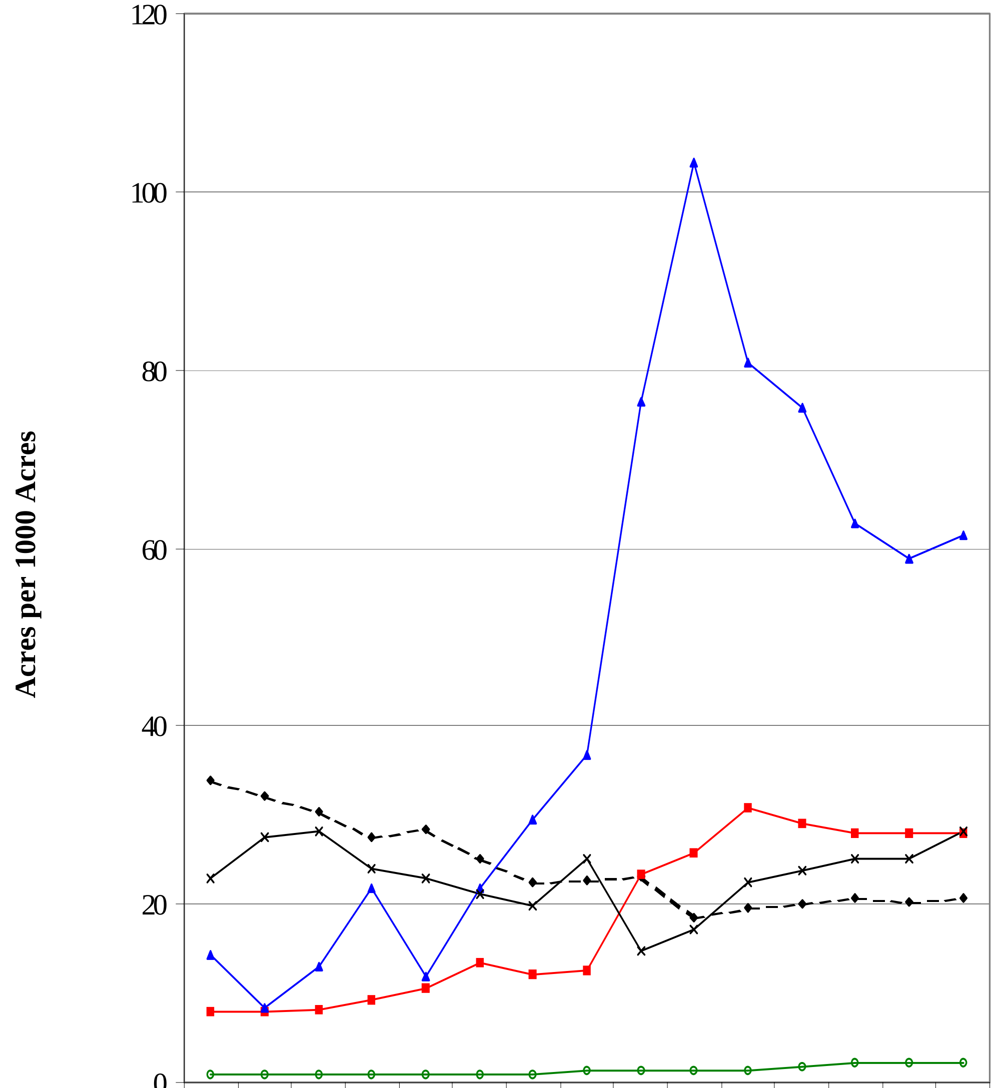
Figures 4.4 and 4.5 present trends in mix of planted seedling types for Douglas-fir and western hemlock. P+1 seedlings have grown to about 60% of Douglas-fir plantings followed by 1+1 seedlings that have grown to nearly 25%. Most of the remainder is large plug seedlings (> S8 or equivalent). These have displaced small plug (<= S8 or equivalent) and other (mostly 2-0) seedling types. In the early 90's, 2+1 seedlings accounted for 100% of western hemlock planted by respondents. By the end of the decade, planting 2+1 hemlock had dropped to 30% and this is expected to decline to 20% by 2005. Initially, the 2+1 hemlock seedlings were being replaced by small plug seedlings but more recently this has shifted to large plug seedlings. Improvements in nursery technology undoubtedly underlie some of these shifts.

Figure 4.1 Regeneration per 1000 A Net Timberland

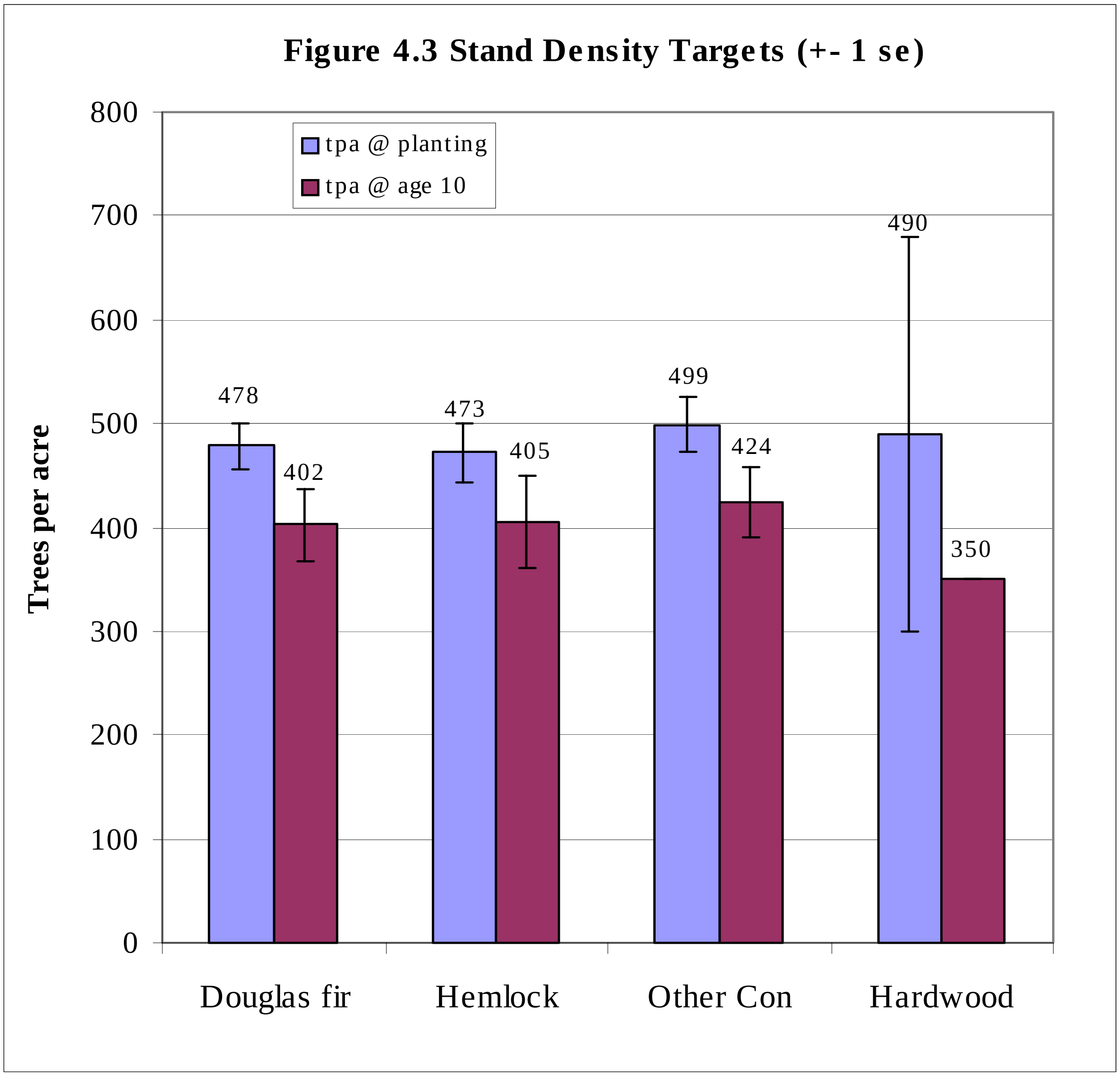


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	21.1	20.0	19.0	17.2	17.8	15.6	14.0	14.2	14.4	11.5	12.2	12.5	12.9	12.7	12.9
W. Hemlock	0.9	1.0	1.0	1.1	1.3	1.6	1.5	1.5	2.8	3.1	3.7	3.5	3.4	3.4	3.4
Other Conifer	0.3	0.2	0.3	0.4	0.2	0.4	0.6	0.7	1.5	2.0	1.6	1.5	1.2	1.2	1.2
Mixed Conifer	3.9	4.6	4.8	4.1	3.9	3.6	3.3	4.3	2.5	2.9	3.8	4.0	4.2	4.2	4.8
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
All Species	25.6	25.1	24.1	22.2	22.5	21.4	19.7	20.5	21.5	19.9	22.0	22.1	22.3	21.3	22.0

Figure 4.2 Regeneration per 1000 A of Species

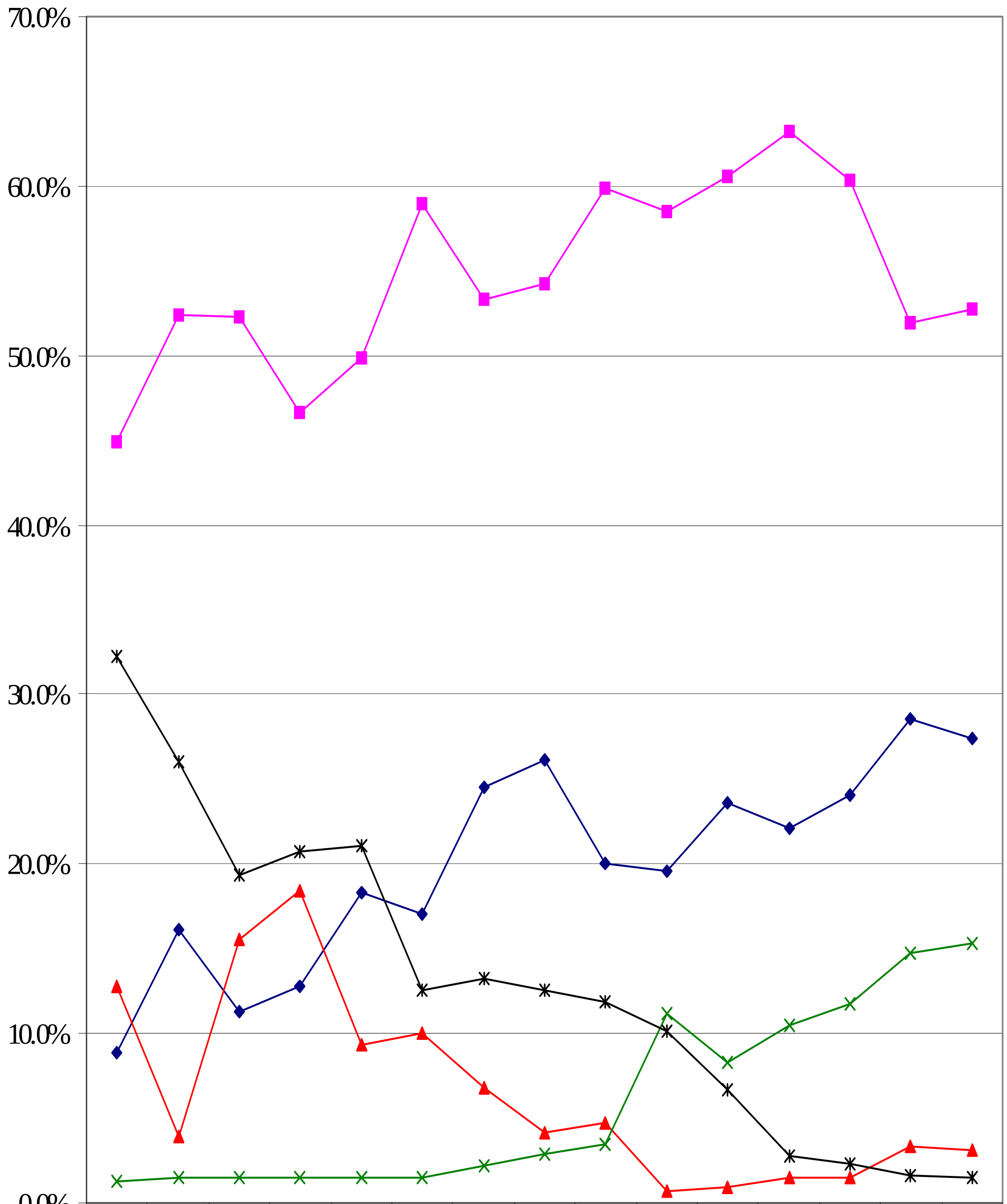


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	33.9	32.1	30.4	27.6	28.5	25.1	22.5	22.7	23.1	18.4	19.6	20.0	20.7	20.4	20.6
W. Hemlock	7.9	8.0	8.2	9.1	10.5	13.4	12.1	12.5	23.3	25.9	30.7	29.2	28.0	28.0	28.0
Other Conifer	14.2	8.3	12.9	21.9	11.8	21.7	29.5	36.8	76.5	103.	80.8	75.8	62.7	58.9	61.4
Mixed Conifer	22.9	27.5	28.3	24.1	22.8	21.2	19.8	25.2	14.7	17.1	22.4	23.8	25.1	25.1	28.3
hardwood	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.3	1.3	1.3	1.3	1.7	2.2	2.2	2.2



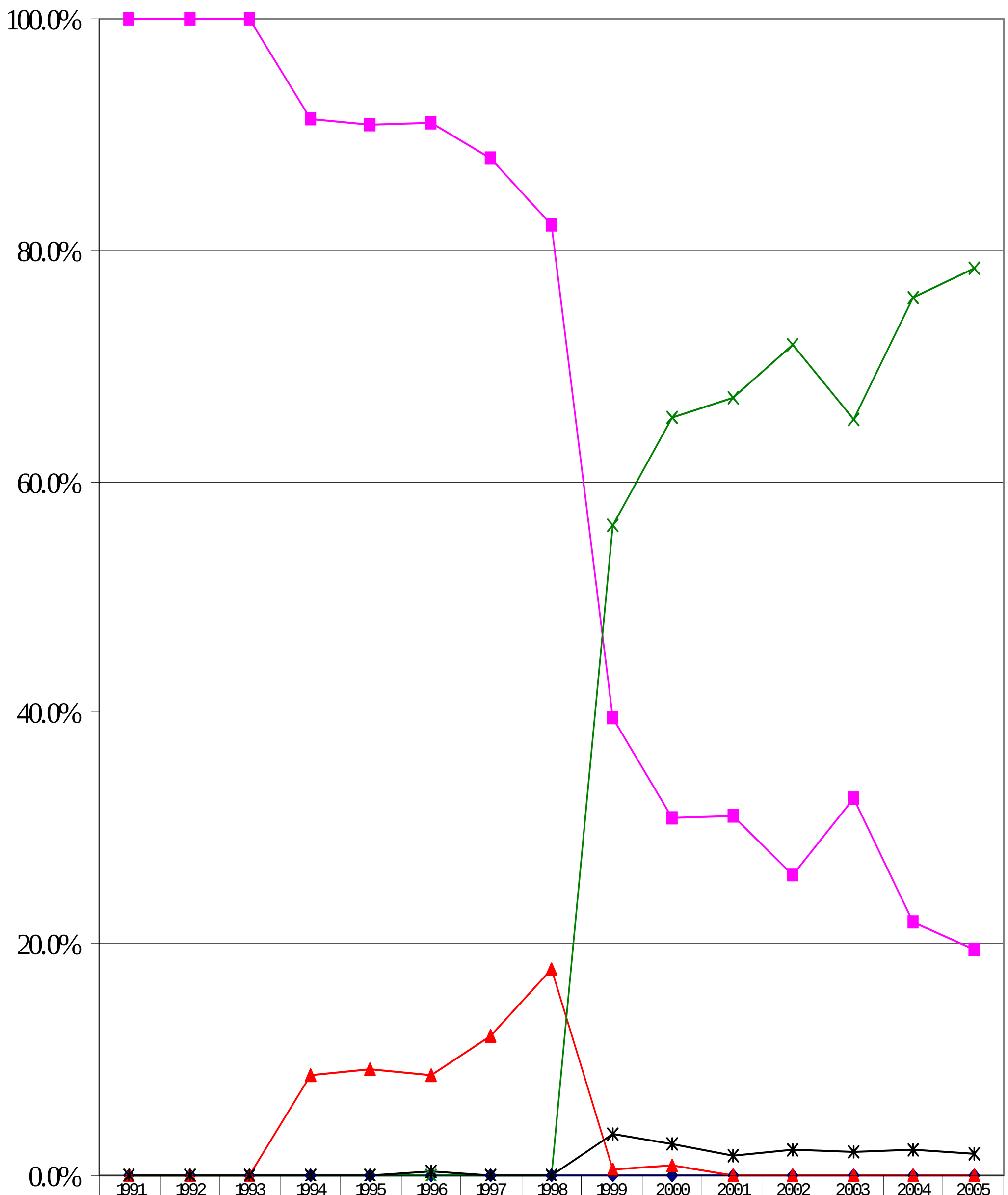
Data Table for Figure 4.3				
		Mean, TPA	**Standard Error**	**N**
Douglas-fir	Age 0	478	23	9
	Age 10	402	34	9
W. hemlock	Age 0	473	29	7
	Age 10	405	45	7
Other conifers	Age 0	499	26	7
	Age 10	424	34	7
Hardwood	Age 0	490	190	2
	Age 10	350	NA	1

Figure 4.4 Douglas-fir Seedling Types



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1+1	8.9%	16.1%	11.3%	12.8%	18.3%	17.0%	24.5%	26.1%	20.1%	19.5%	23.6%	22.1%	24.1%	28.5%	27.4%
P+1	44.9%	52.4%	52.3%	46.6%	49.9%	59.0%	53.3%	54.2%	59.8%	58.5%	60.5%	63.3%	60.4%	51.9%	52.7%
Small Plug	12.8%	3.9%	15.6%	18.4%	9.3%	10.0%	6.7%	4.2%	4.8%	0.7%	0.9%	1.5%	1.5%	3.3%	3.2%
Large Plug	1.3%	1.5%	1.5%	1.5%	1.4%	1.5%	2.2%	2.9%	3.4%	11.1%	8.3%	10.5%	11.8%	14.7%	15.3%
Other	32.2%	26.1%	19.3%	20.7%	21.1%	12.6%	13.3%	12.6%	11.9%	10.1%	6.6%	2.7%	2.3%	1.6%	1.5%

Figure 4.5 W. Hemlock Seedling Types



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1+1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2+1	100.0%	100.0%	100.0%	91.3%	90.9%	91.0%	87.9%	82.1%	39.6%	30.9%	31.1%	25.9%	32.6%	21.9%	19.6%
Small Plug	0.0%	0.0%	0.0%	8.7%	9.1%	8.7%	12.1%	17.9%	0.6%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Large Plug	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	56.2%	65.5%	67.3%	71.9%	65.4%	76.0%	78.5%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	3.6%	2.7%	1.7%	2.2%	2.1%	2.2%	2.0%

CHAPTER 5. VEGETATION MANAGEMENT PRACTICES (QUESTIONS 13-15)

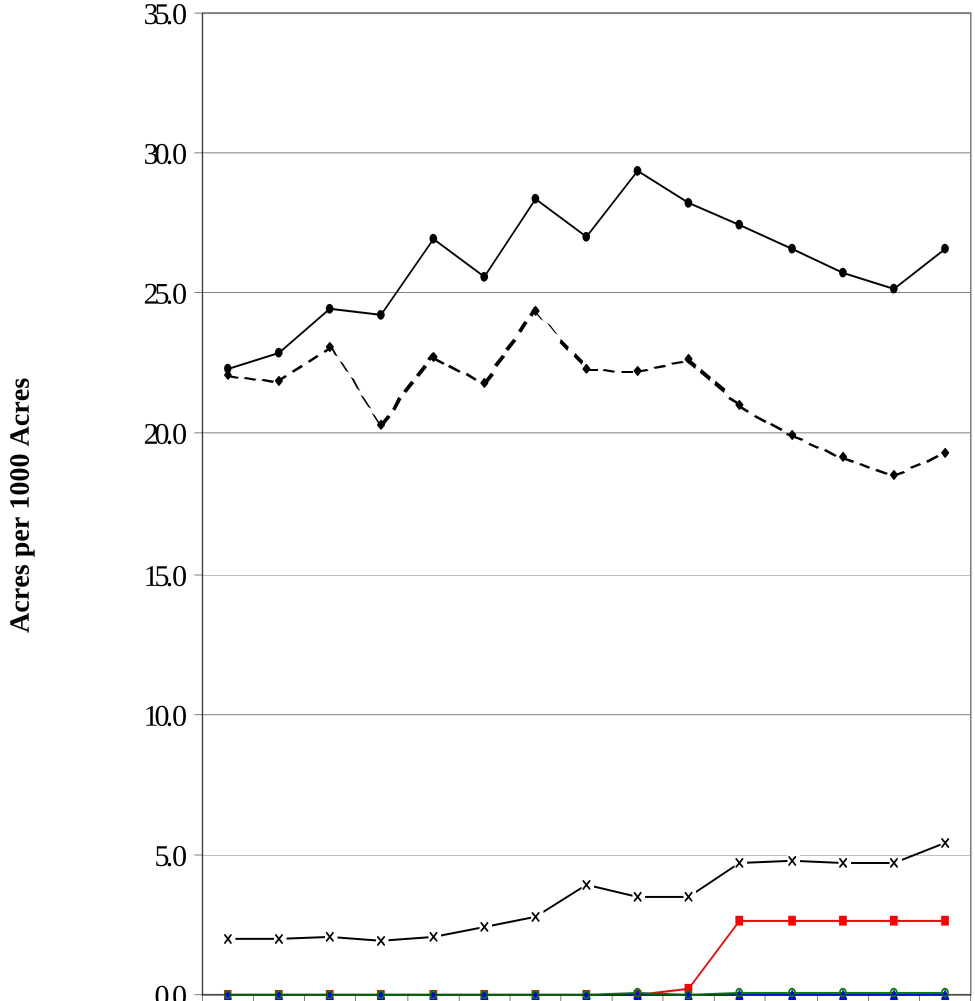
Figure 5.1 presents trends in vegetation management activity per 1000 acres of net timberland for the 9 respondents of which 8 provided species level detail. As a result, species composition values may not sum exactly to the overall total. There was an increase in vegetation management intensity from about 22 A/1000A in 91-92 to 29 A/1000A in 2000 but this is expected to decline to 25 A/1000A in 2001-05. Douglas-fir has accounted for most of the activity but has been relatively constant and is expected to decline slightly. There has been a low but steadily increasing trend in mixed conifers and activity has begun or is planned in hemlock and hardwoods.

Figure 5.2 provides a different perspective by expressing the vegetation management associated with each species in terms of 1000 acres of that species type. Vegetation management on Douglas-fir timberlands has been about 35A /1000 A but is expected to decline to about 30 A/1000 A. Vegetation management in mixed conifer stands doubled from 12 to 25 A/1000 A and is expected to rise to 30 A/1000. Vegetation management in hemlock and hardwood stands, while negligible in the past, is expected to rise to about 20 and 1 A/1000A respectively. Some of these trends may reflect movement of the cohorts of young stands in need of vegetation management into older age classes as well as increased emphasis on alternatives to pure Douglas-fir stands.

Figure 5.3 indicates that methods of vegetation management are shifting from release from woody (hardwood) competition, often several years after planting, to control of herbaceous vegetation in the first and/or second years following planting. Herbaceous control chemicals have a secondary benefit in suppressing germination and development of hardwood seedlings, thereby reducing the need for release from woody competitors.

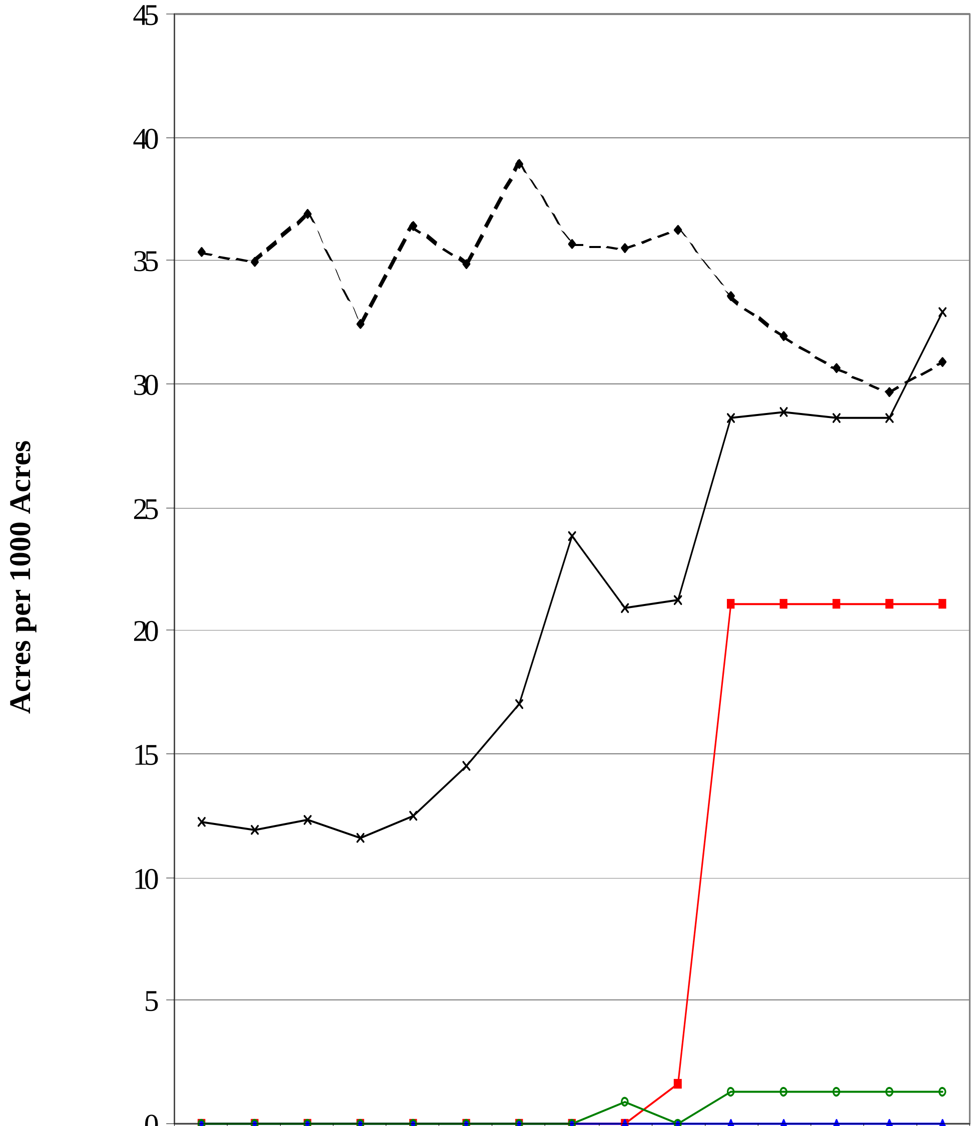
Each respondent provided the minimum, maximum, and average cost per acre for each vegetation management method and the mean and standard error for each was calculated and presented in Figure 5.4. Although traditional woody release tends to be similar to herbaceous controls in average cost, woody release is more variable and this along with more rapid seedling growth associated with early control of herbaceous competition act as a powerful motivation to shift to early herbaceous controls.

Figure 5.1 Vegetation Management per 1000 A Net Timberland



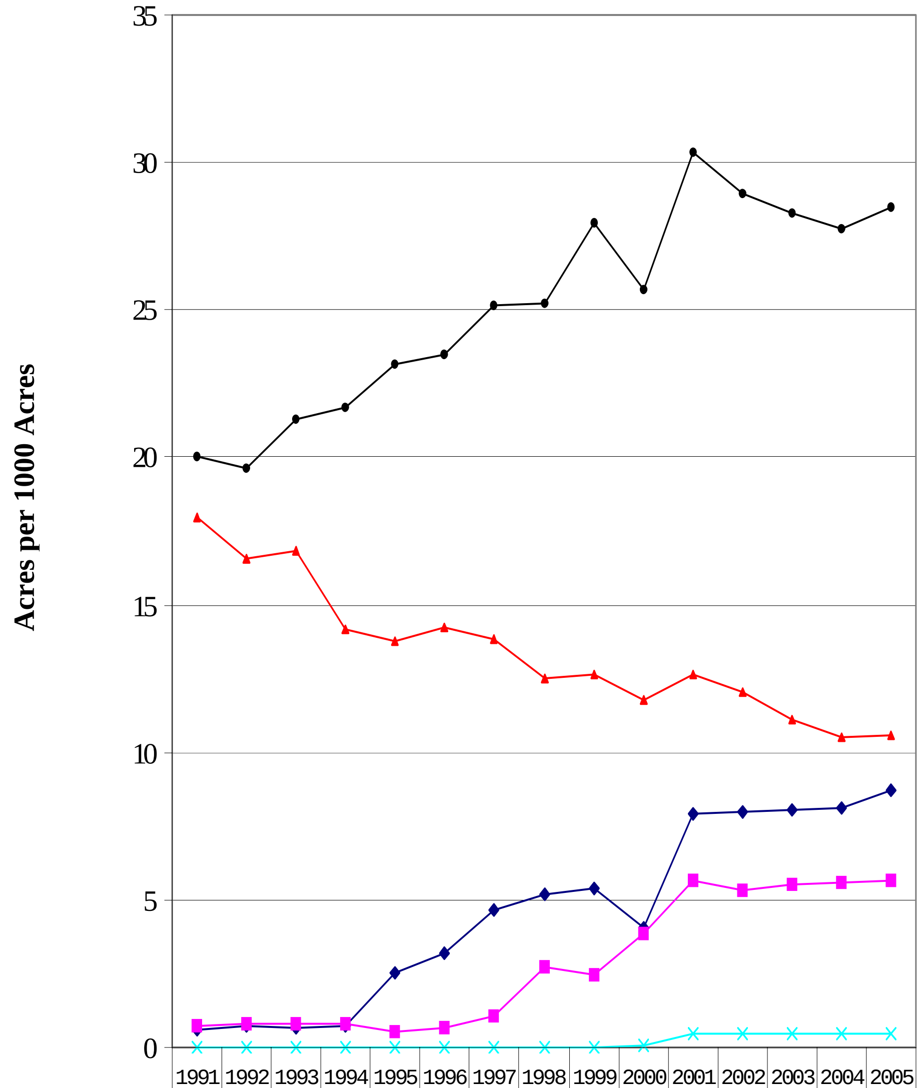
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	22.1	21.9	23.1	20.3	22.8	21.8	24.3	22.3	22.2	22.7	21.0	20.0	19.2	18.6	19.3
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.7	2.7	2.7	2.7	2.7
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	2.0	2.0	2.0	1.9	2.1	2.4	2.8	3.9	3.5	3.5	4.7	4.8	4.7	4.7	5.4
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Total	22.3	22.9	24.5	24.2	27.0	25.6	28.3	27.0	29.3	28.2	27.5	26.6	25.8	25.2	26.6

Figure 5.2 Vegetation Management per 1000 A of Species

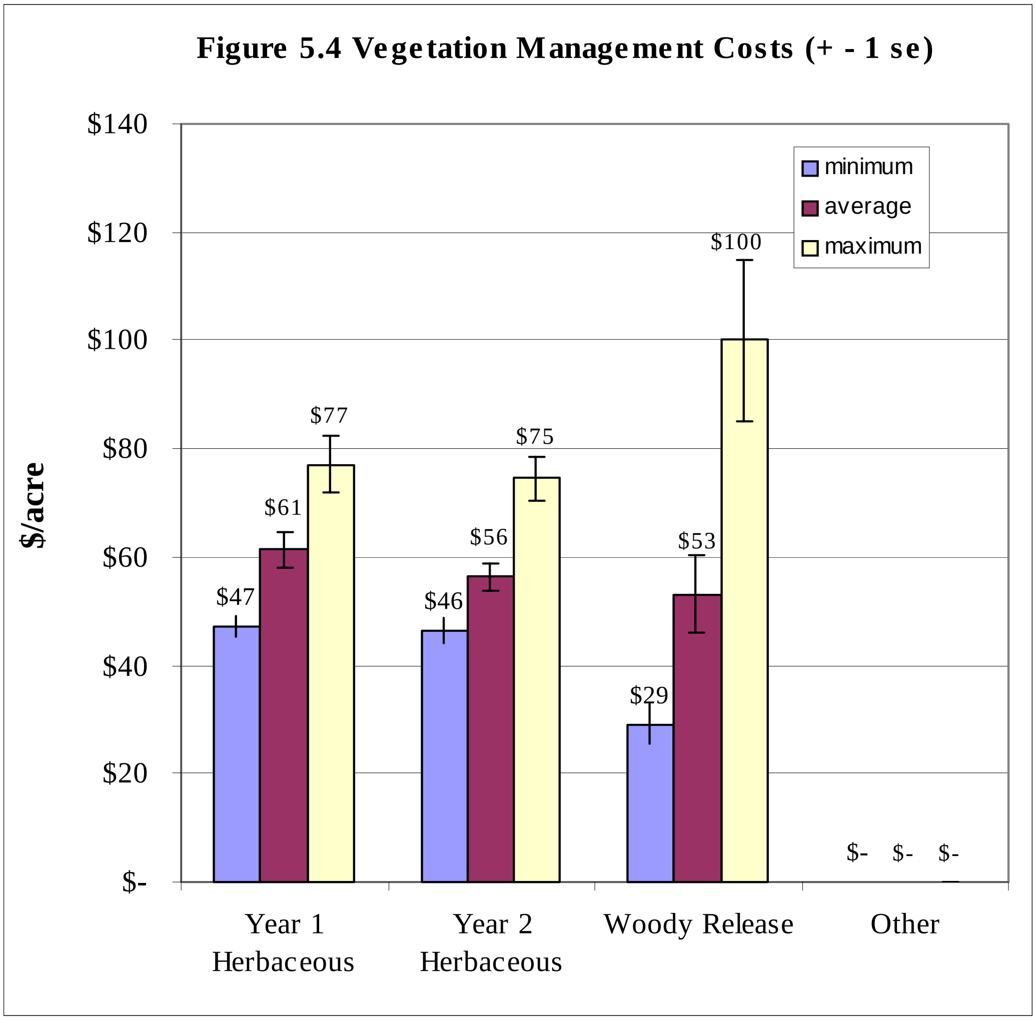


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas fir	35.3	35.0	36.9	32.5	36.4	34.9	38.9	35.7	35.6	36.2	33.6	31.9	30.6	29.7	30.9
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	21.1	21.1	21.1	21.1	21.1
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	12.2	11.9	12.3	11.6	12.5	14.5	17.0	23.8	21.0	21.3	28.7	28.9	28.6	28.6	32.9
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	1.3	1.3	1.3	1.3	1.3

Figure 5.3 Vegetation Management Methods per 1000 A Net Timberland



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Year 1 Herbaceous	0.6	0.7	0.6	0.7	2.6	3.2	4.7	5.2	5.4	4.0	7.9	8.0	8.1	8.1	8.7
Year 2 Herbaceous	0.7	0.8	0.8	0.8	0.5	0.7	1.1	2.7	2.5	3.8	5.7	5.3	5.5	5.6	5.7
Woody Release	18.0	16.6	16.8	14.2	13.8	14.3	13.8	12.5	12.6	11.8	12.6	12.0	11.1	10.5	10.6
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5
Total	20.0	19.6	21.3	21.7	23.2	23.5	25.1	25.2	28.0	25.7	30.4	28.9	28.3	27.7	28.5



Data Table for Figure 5.4				
		Mean, $/A	**Standard Error**	**N**
Herb. Yr 1	Minimum	47.19	2.00	8
	Average	61.42	3.27	9
	Maximum	77.13	5.06	8
Herb. Yr 2	Minimum	46.44	2.33	8
	Average	56.34	2.41	8
	Maximum	74.50	4.01	8
Woody release	Minimum	29.06	3.64	8
	Average	53.14	7.10	9
	Maximum	100.06	14.99	8
Other	Minimum	NA	NA	0
	Average	NA	NA	0
	Maximum	NA	NA	0

CHAPTER 6: THINNING (QUESTIONS 16-19)

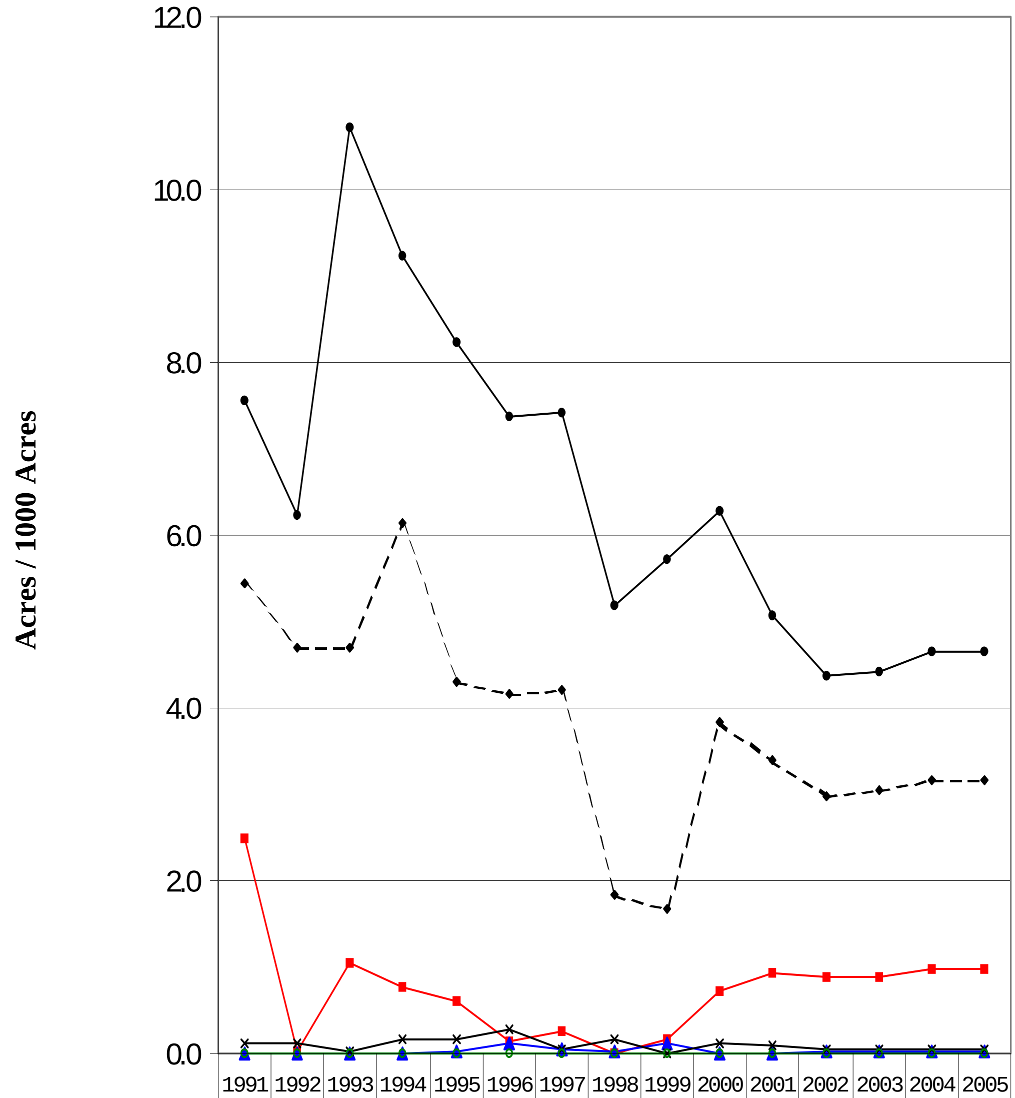
6.1 Pre-commercial Thinning (PCT)

Figure 6.1 presents trends in PCT activity per 1000 acres of net timberland for the 9 respondents. Generally, PCT activity declined during the 1990's from 8-10 A/1000A to about 6 A/ 1000A. PCT plans for 2001-2005 is expected to drop further to about 5 acres per 1000 A net timberland; roughly half the level of the early 90's. The species composition values may not sum exactly to the overall total since 2 respondents provided total PCT without any species breakdown. The majority of PCT activity is conducted in Douglas-fir with western hemlock a distant second.

A different perspective of each species is shown in Figure 6.2 by expressing PCT intensity per 1000 acres of timberland of that species type. These intensities are based on information provided by 6 of the 9 respondents. The intensity of PCT Douglas-fir land was 7-10 A/1000A until a sharp drop in 1998/99. Douglas-fir is projected to be about 5 A/1000A in 2001-2005. The PCT intensity on hemlock land was very high in 1991, 20 A per 1000 A, but dropped to about 1 A/1000A in 1999. Since then PCT on hemlock lands rose sharply and is projected to be about 7 A/1000 A in 2001-2005. PCT on land occupied by other conifers rose from zero to 1-2 A per 1000 A and PCT on mixed conifer land has been about half as great. No PCT has been conducted on hardwood timberlands.

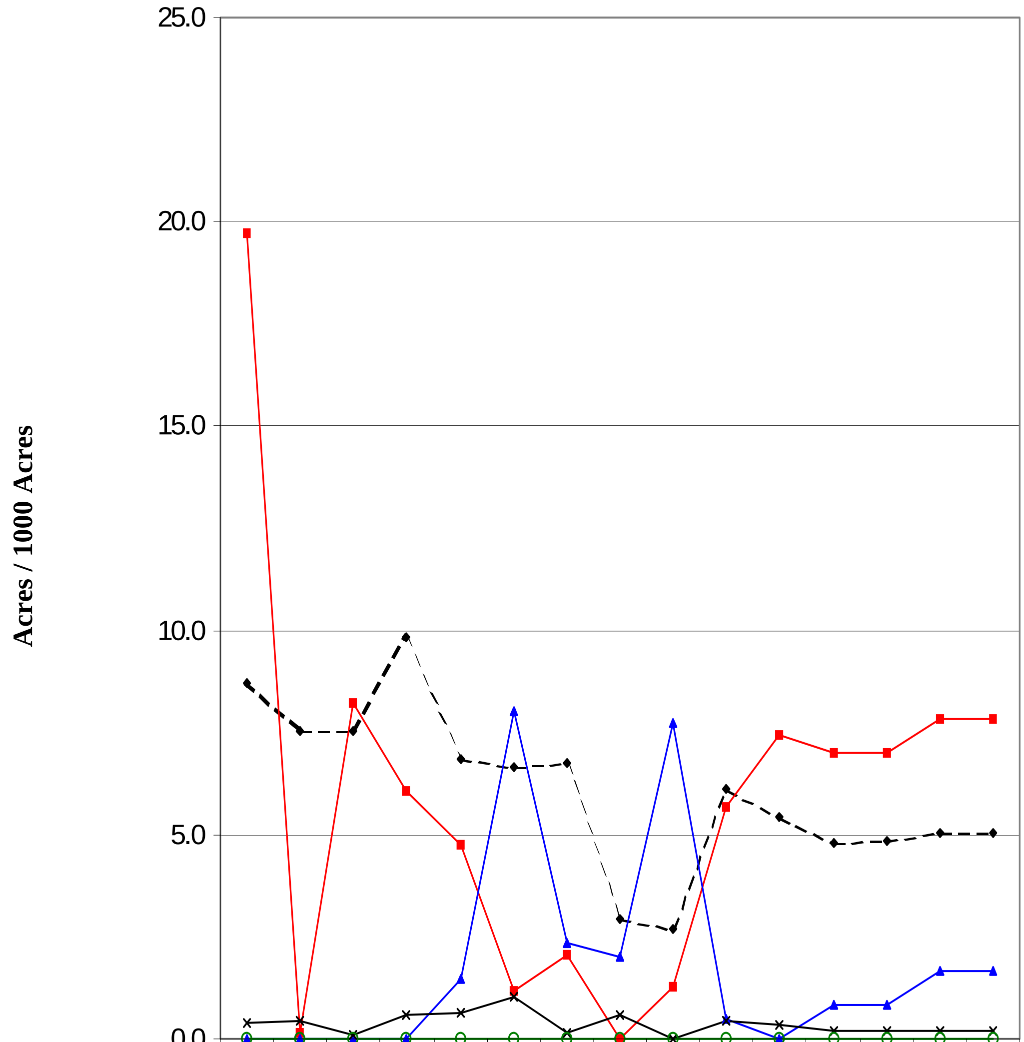
The minimum, average, and maximum PCT cost per acre (Figure 6.3) was $62, $96, and $167 respectively. The wide range and large standard errors are reflective of the variety of terrain and other operational factors affecting the conduct of PCT operations.

Figure 6.1 PCT per 1000 A Net Timberland

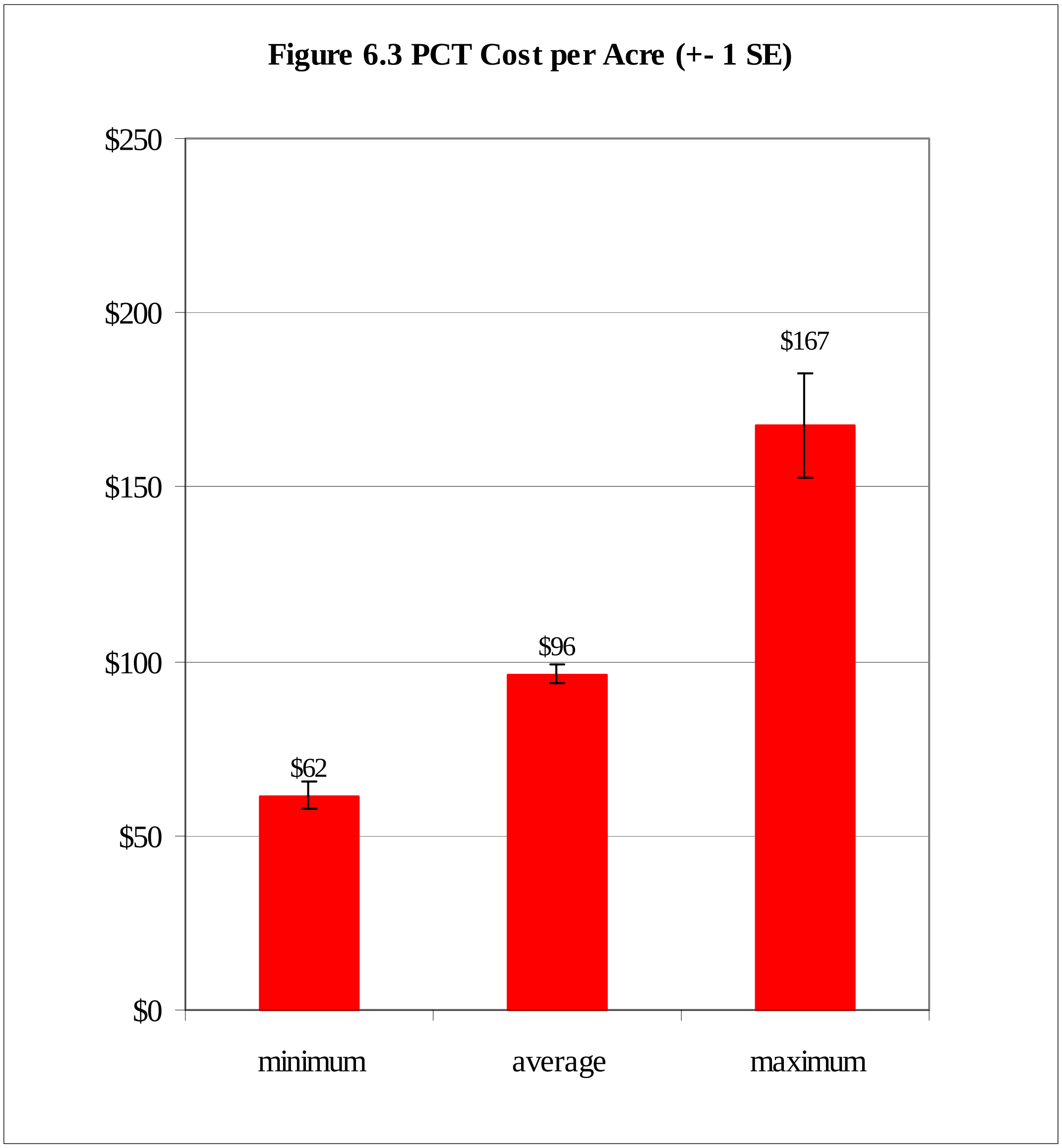


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	5.4	4.7	4.7	6.1	4.3	4.2	4.2	1.8	1.7	3.8	3.4	3.0	3.0	3.2	3.2
W. Hemlock	2.5	0.0	1.0	0.8	0.6	0.1	0.3	0.0	0.2	0.7	0.9	0.9	0.9	1.0	1.0
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	0.1	0.1	0.0	0.2	0.2	0.3	0.0	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	7.5	6.2	10.7	9.2	8.2	7.4	7.4	5.2	5.7	6.3	5.1	4.4	4.4	4.6	4.6

Figure 6.2 PCT per 1000 A of Species



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	8.7	7.5	7.5	9.8	6.9	6.7	6.7	2.9	2.7	6.1	5.4	4.8	4.9	5.0	5.0
W. Hemlock	19.7	0.2	8.2	6.1	4.8	1.2	2.1	0.0	1.3	5.7	7.4	7.0	7.0	7.8	7.8
Other Conifer	0.0	0.0	0.0	0.0	1.5	8.0	2.3	2.0	7.7	0.5	0.0	0.8	0.8	1.7	1.7
Mixed Conifer	0.4	0.4	0.1	0.6	0.6	1.0	0.1	0.6	0.0	0.4	0.4	0.2	0.2	0.2	0.2
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Data Table for Figure 6.3				
		Mean, $/A	Standard Error	N
Precomm. Thin	Minimum	61.57	3.70	7
	Average	96.44	2.96	8
	Maximum	167.43	15.04	7

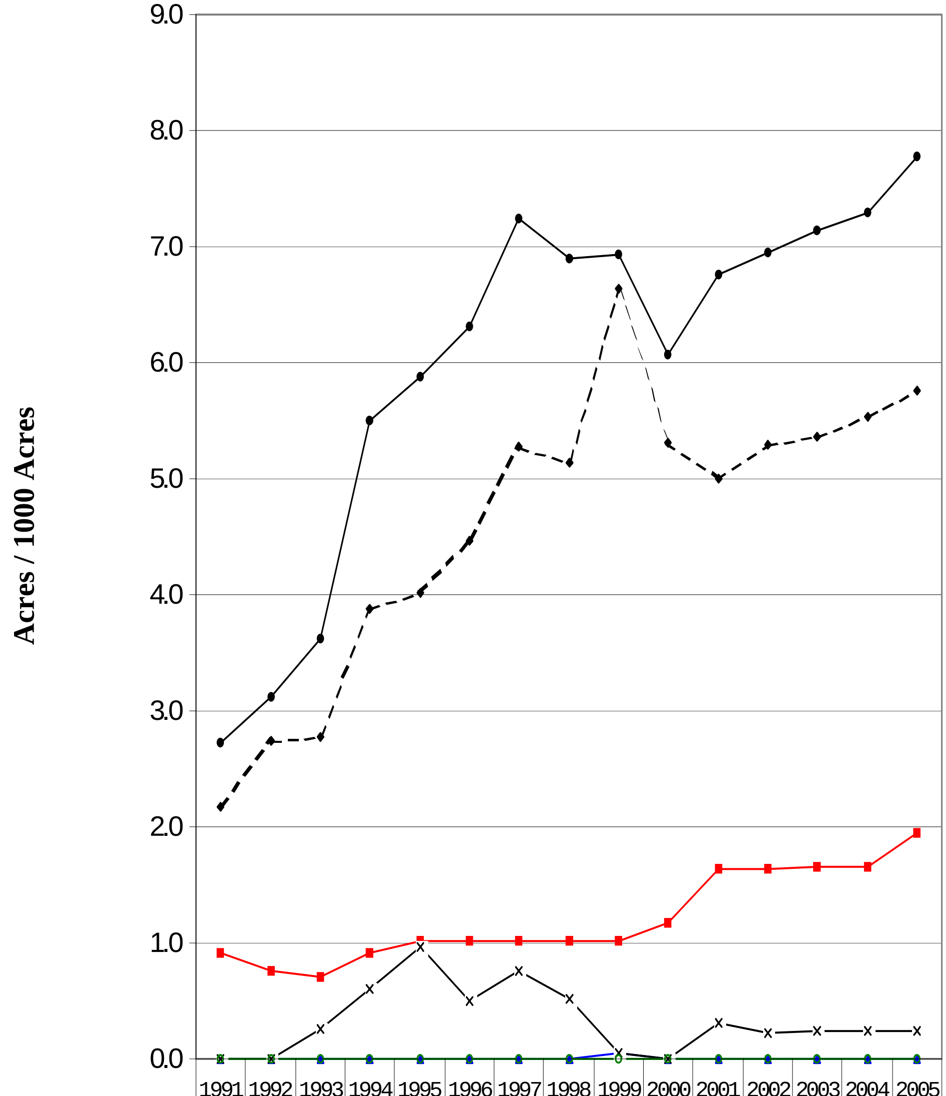
6.2 Commercial Thinning

Commercial thinning supplied from 1% to 7% of the total timber harvest volume with an average of 3.5% (se 1.1%). Figure 6.4 presents trends in commercial thinning per 1000 acres of net timberland for the 9 respondents. Generally, commercial thinning more than doubled during the 1990's rising from about 3 to about 7 A/1000A and is expected to rise to 8 A/1000A by 2005. This trend should not be too surprising given the large acreages of 10-19 and 20-30 year old stands present at the start of the decade (Figure 2.2). The species composition values may not sum exactly to the overall total since 2 respondents provided total commercial thinning without any species breakdown. The majority of commercial thinning activity and most of the growth during the 1990's occurred in Douglas-fir. Western hemlock was a distant second but is planned to double by 2005. Lesser activity has also occurred in mixed conifers and other conifers.

A different perspective of each species is shown in Figure 6.5 by expressing commercial thinning intensity per 1000 acres of timberland of that species type. These intensities are based on information provided by 6 of the 9 respondents. The intensity of commercial thinning on Douglas-fir land more than doubled from 3 to 8-10 A/1000A and is projected be about 8 A/1000A in 2001-2005. Commercial thinning intensity on hemlock land, 6-8 A/1000A, has generally been higher than that on Douglas-fir, and is expected to rise further to 13-15 A/1000A in 2001-2005. Commercial thinning intensity on timberlands occupied by mixed conifers rose to 3-6A/ 1000A in 1994-98, dropped sharply in 1999-2000, and is expected to be between 1-2 A/1000 A in 2001-2005. Commercial thinning of timberlands occupied by other conifers has occurred just once during the decade and no commercial thinning has been conducted on hardwood timberlands.

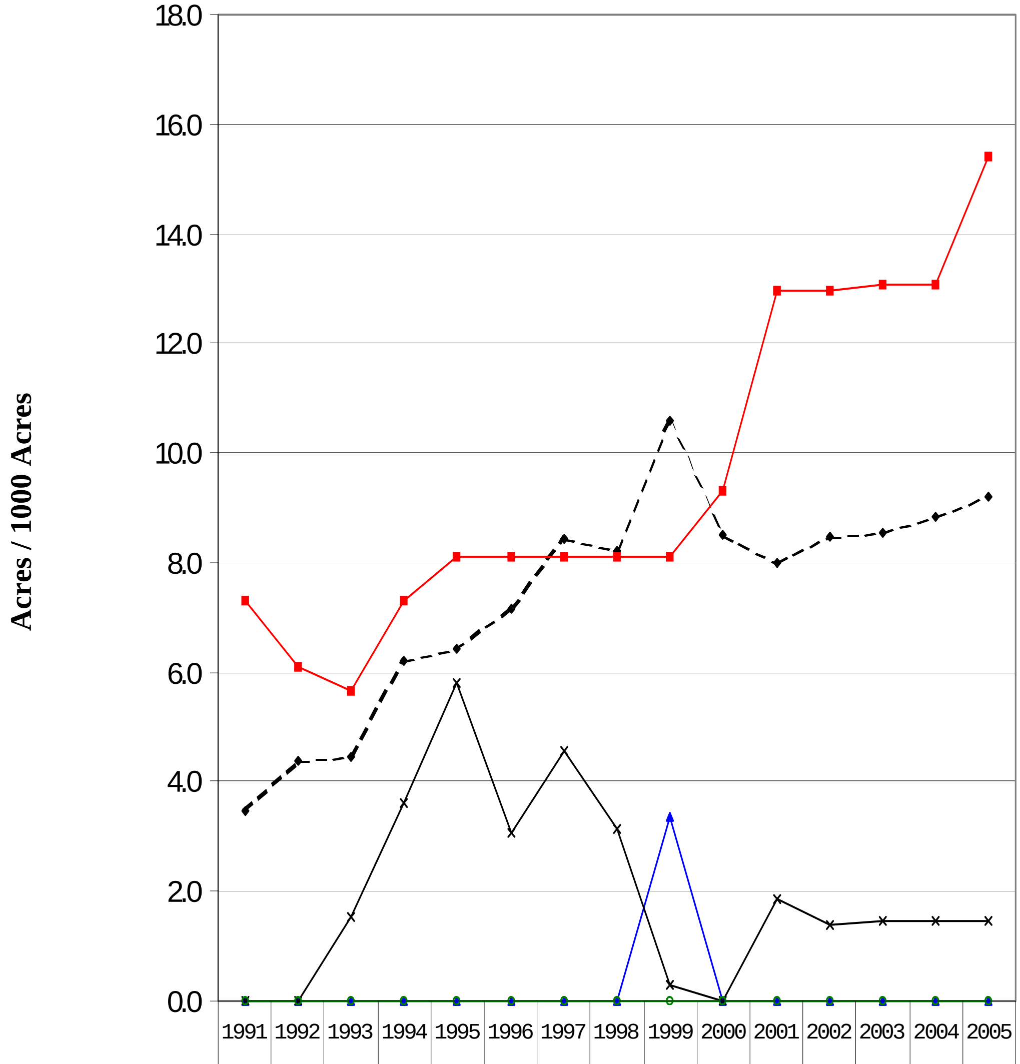
The minimum, average, and maximum commercial thinning cost per acre (Figure 6.6) was $793, $950, and $1100 respectively. These costs are exclusive of hauling costs.

Figure 6.4 Commercial Thin / 1000 A Net Timberland

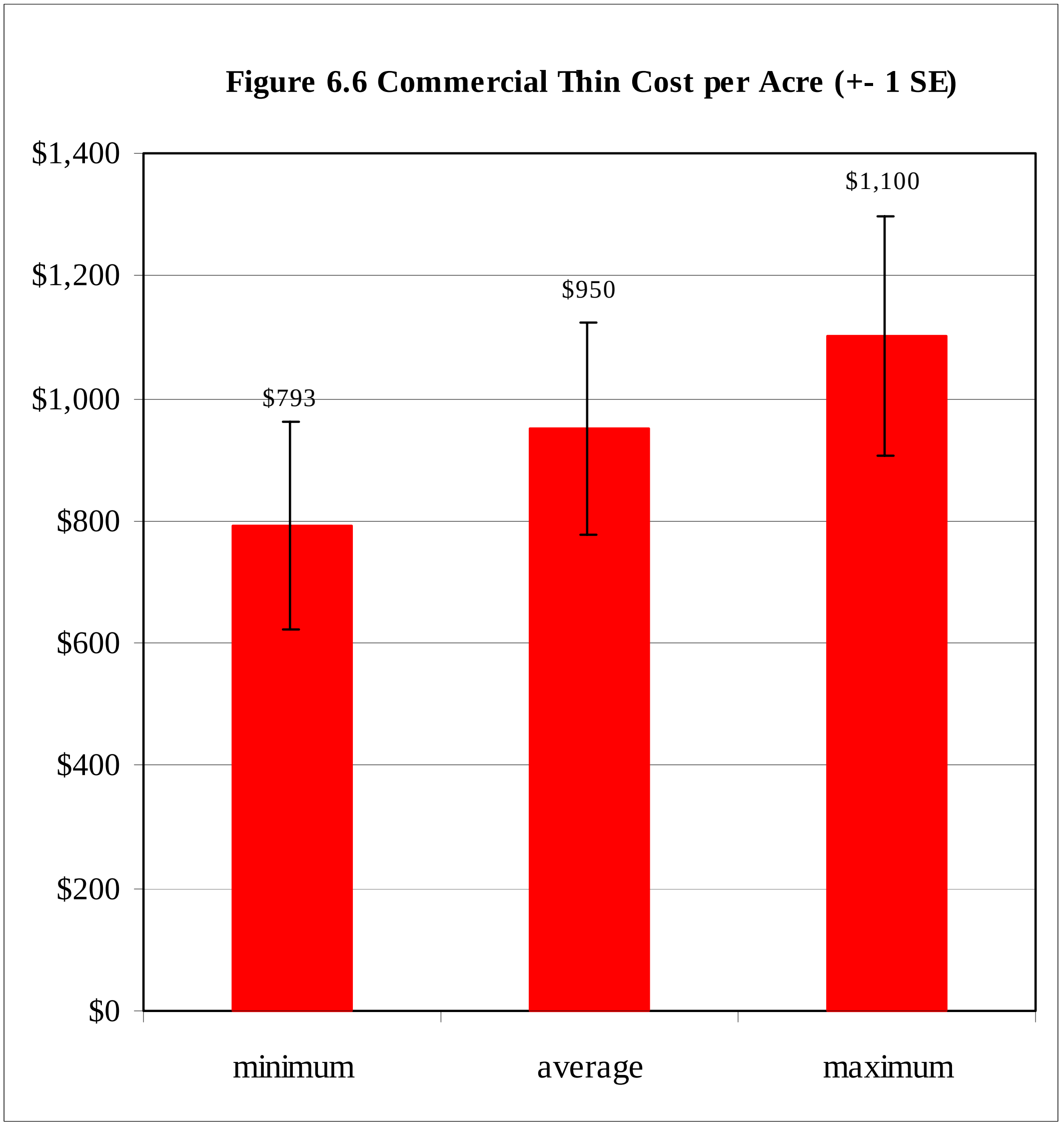


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	2.2	2.7	2.8	3.9	4.0	4.5	5.3	5.1	6.6	5.3	5.0	5.3	5.4	5.5	5.8
W. Hemlock	0.9	0.8	0.7	0.9	1.0	1.0	1.0	1.0	1.0	1.2	1.6	1.6	1.6	1.6	1.9
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	0.0	0.0	0.3	0.6	1.0	0.5	0.8	0.5	0.1	0.0	0.3	0.2	0.2	0.2	0.2
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	2.7	3.1	3.6	5.5	5.9	6.3	7.2	6.9	6.9	6.1	6.8	7.0	7.1	7.3	7.8

Figure 6.5 Commercial Thin / 1000 A of Species



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	3.5	4.4	4.4	6.2	6.4	7.1	8.4	8.2	10.6	8.5	8.0	8.5	8.6	8.8	9.2
W. Hemlock	7.3	6.1	5.7	7.3	8.1	8.1	8.1	8.1	8.1	9.3	13.0	13.0	13.1	13.1	15.4
Other Conifer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Mixed Conifer	0.0	0.0	1.5	3.6	5.8	3.1	4.6	3.1	0.3	0.0	1.9	1.4	1.5	1.5	1.5
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Data Table for Figure 6.6				
		Mean, $/A	Standard Error	N
Comm. Thin	Minimum	793.00	169.09	7
	Average	950.29	172.05	7
	Maximum	1100.04	195.34	7

CHAPTER 7: FERTILIZATION (QUESTIONS 23-26)

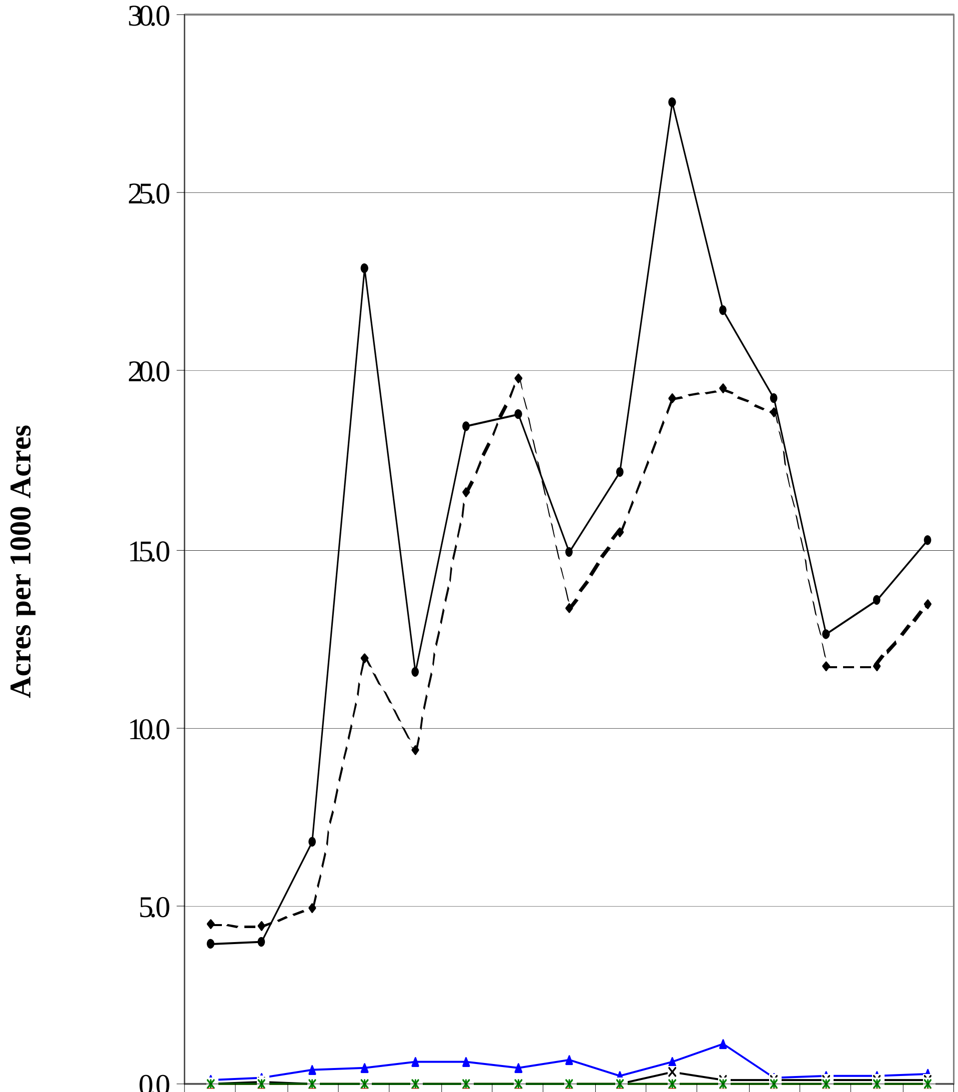
Figure 7.1 presents trends in fertilization per 1000 acres of net timberland for the 9 respondents. Fertilization increased in the early 1990's to about 20 A/1000 A and then fluctuated around this level for the remainder of the decade. However, planned fertilization activity for 2001-2005 is expected to drop to between 10 and 15 A/1000A. The species composition values may not sum exactly to the overall total since 2 respondents provided total fertilization without any species breakdown. The majority of fertilization was conducted in Douglas-fir with other conifers a distant second. All respondents apply 200 lb N as urea.

A different perspective of each species is shown in Figure 7.2 by expressing fertilization intensity per 1000 acres of timberland of that species type. These intensities are based on information provided by 7 of the 9 respondents. The intensity of fertilization for Douglas-fir rose to about 30 acres per 1000 acres of Douglas-fir timberland but is projected to drop back to about 20 A/1000A by 2005. The fertilization intensity in other conifers has, on average, been similar to that for Douglas-fir but with wider fluctuations. However, respondents indicate that the intensity of fertilizing other conifers will drop to half the Douglas-fir intensity in the future. Very low activity has occurred, and is planned, in mixed conifers. None of the respondents fertilize hemlock or hardwood timberlands.

The minimum, average, and maximum fertilization cost per acre (Figure 7.3) was $59, $64, and $69 respectively.

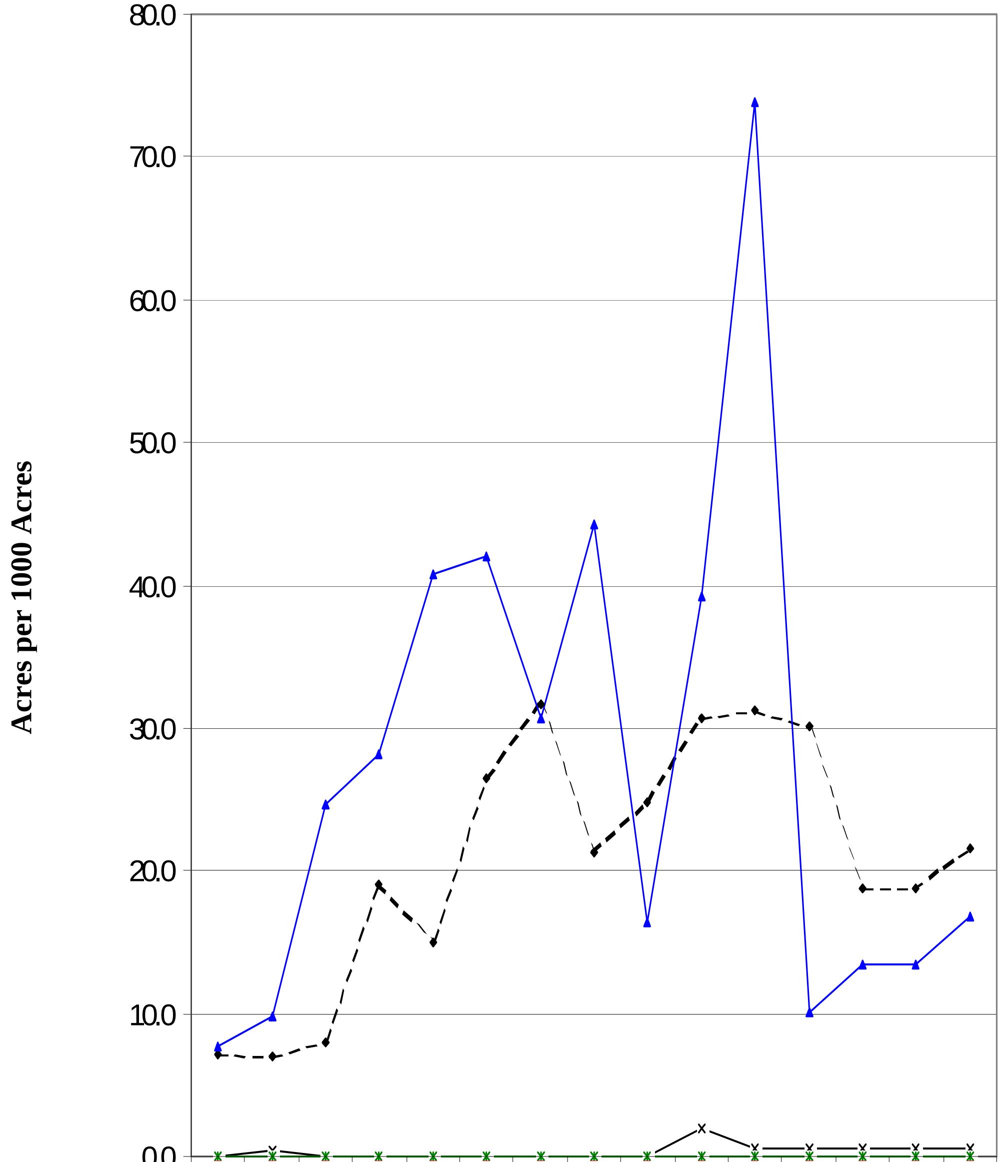
Respondents were also asked to indicate their priorities for fertilizing combinations of age and site class for the different species categories. Table 7.1 summarizes the frequency with which respondents indicated that the age/site combination was of high, medium, of low priority for fertilization or that the combination was not considered. The last possibility may have been checked by a respondent either because such a combination is deemed to never be a viable fertilization opportunity or possibly because the responded did not have any lands that fell into this age/site combination. Hardwoods are excluded from the table since they always received the "not considered" rating. In general, the middle age class (21-50) and sites II-IV tend to have more incidence of higher priorities. Hemlock has few situations when it is considered.

Figure 7.1 Fertilization per 1000 A Net Timberland

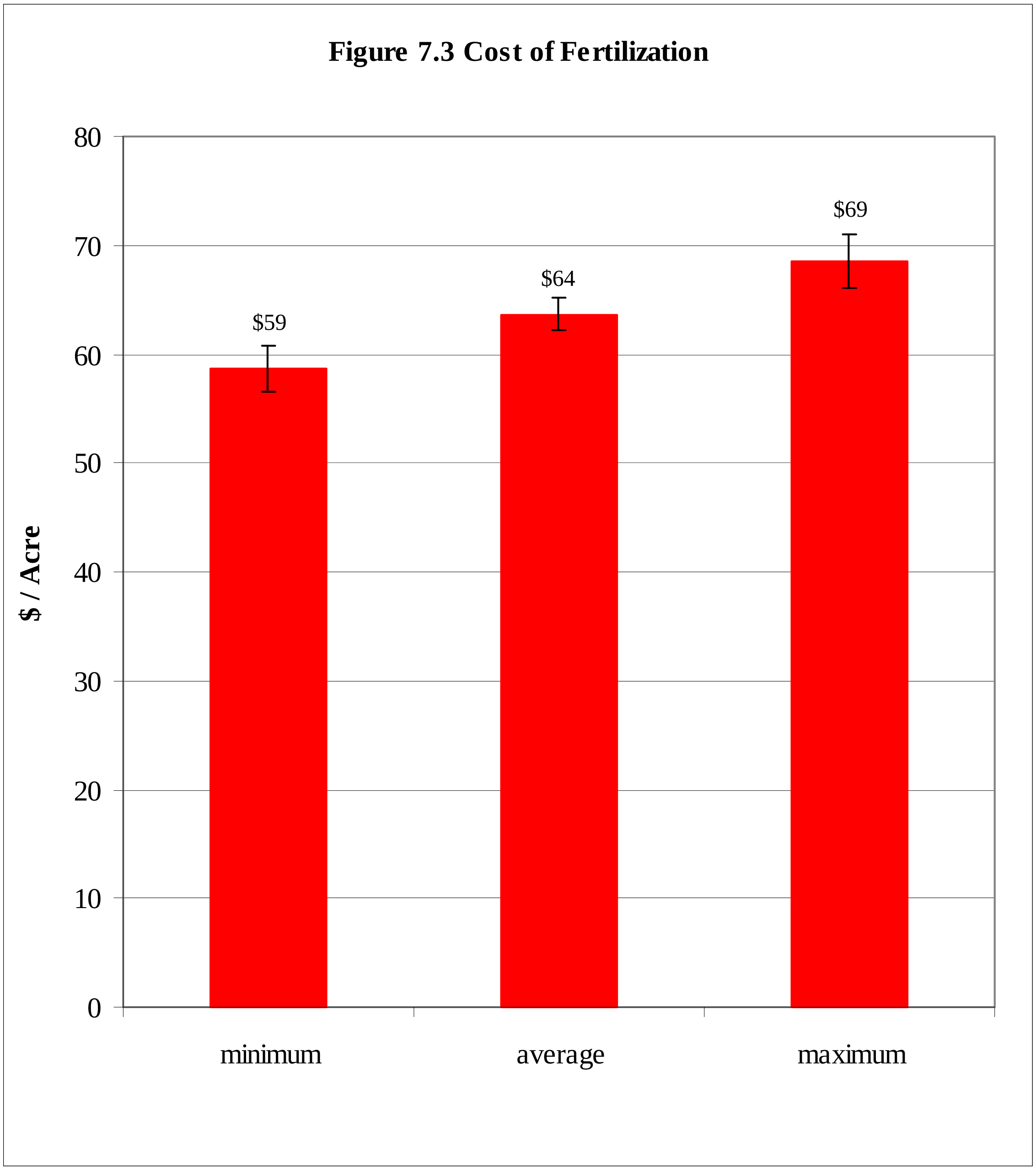


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	4.5	4.4	5.0	11.9	9.3	16.6	19.8	13.4	15.5	19.2	19.5	18.8	11.7	11.7	13.5
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Conifer	0.1	0.2	0.4	0.4	0.6	0.6	0.5	0.7	0.3	0.6	1.1	0.2	0.2	0.2	0.3
Mixed Conifer	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.1	0.1
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	3.9	4.0	6.8	22.9	11.6	18.5	18.8	14.9	17.2	27.5	21.7	19.2	12.6	13.6	15.3

Figure 7.2 Fertilization per 1000 A of Species



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas-fir	7.1	7.0	7.9	19.1	14.9	26.5	31.6	21.4	24.8	30.7	31.2	30.1	18.8	18.8	21.5
W. Hemlock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Conifer	7.7	9.9	24.6	28.2	40.8	42.0	30.6	44.3	16.4	39.2	73.8	10.1	13.4	13.4	16.8
Mixed Conifer	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.6	0.6	0.6	0.6	0.6
Hardwood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Data Table for Figure 7.3				
		Mean, $/A	Standard Error	**N**
Fertilization	Minimum	58.63	2.12	7
	Average	63.68	1.50	8
	Maximum	68.56	2.51	7

TABLE 7.1 Frequency of Responses to Priority Ranking of Stands by Site and Age for Fertilization[1]

Site	Priority	Age <=20				Age 21-50				Age > 50			
		DF	WH	OC	MC	DF	WH	OC	MC	DF	WH	OC	MC
I	High					3	1		1	1	1		1
	Medium	3			1	1			1	1			
	Low	2	1	1	2	2		1	2	2		1	2
	Not Considered	3	7	7	5	2	7	7	4	4	7	7	5
II	High					6	1		2	1	1		1
	Medium	5		1	2	2	1	1	3	2			1
	Low	1	1	1	2			1		1		1	
	Not Considered	2	7	6	4		6	6	3	4	7	7	6
III	High	1			1	8	2	1	3	2	1		2
	Medium	5		1	2				2	1			
	Low		1	1	1			1		2		2	1
	Not Considered	2	7	6	4		6	6	3	3	7	6	5
IV	High	1			1	6	1	1	3	2	1		2
	Medium	5		1	2	2	1		1				
	Low		1	1	1			1	1	3		2	1
	Not Considered	2	7	6	4		6	6	3	3	7	6	5
V	High								2				
	Medium	1			1	1		1	1				
	Low	3		2	1	4		1		3		2	1
	Not Considered	4	8	6	6	3	8	6	5	5	8	6	7

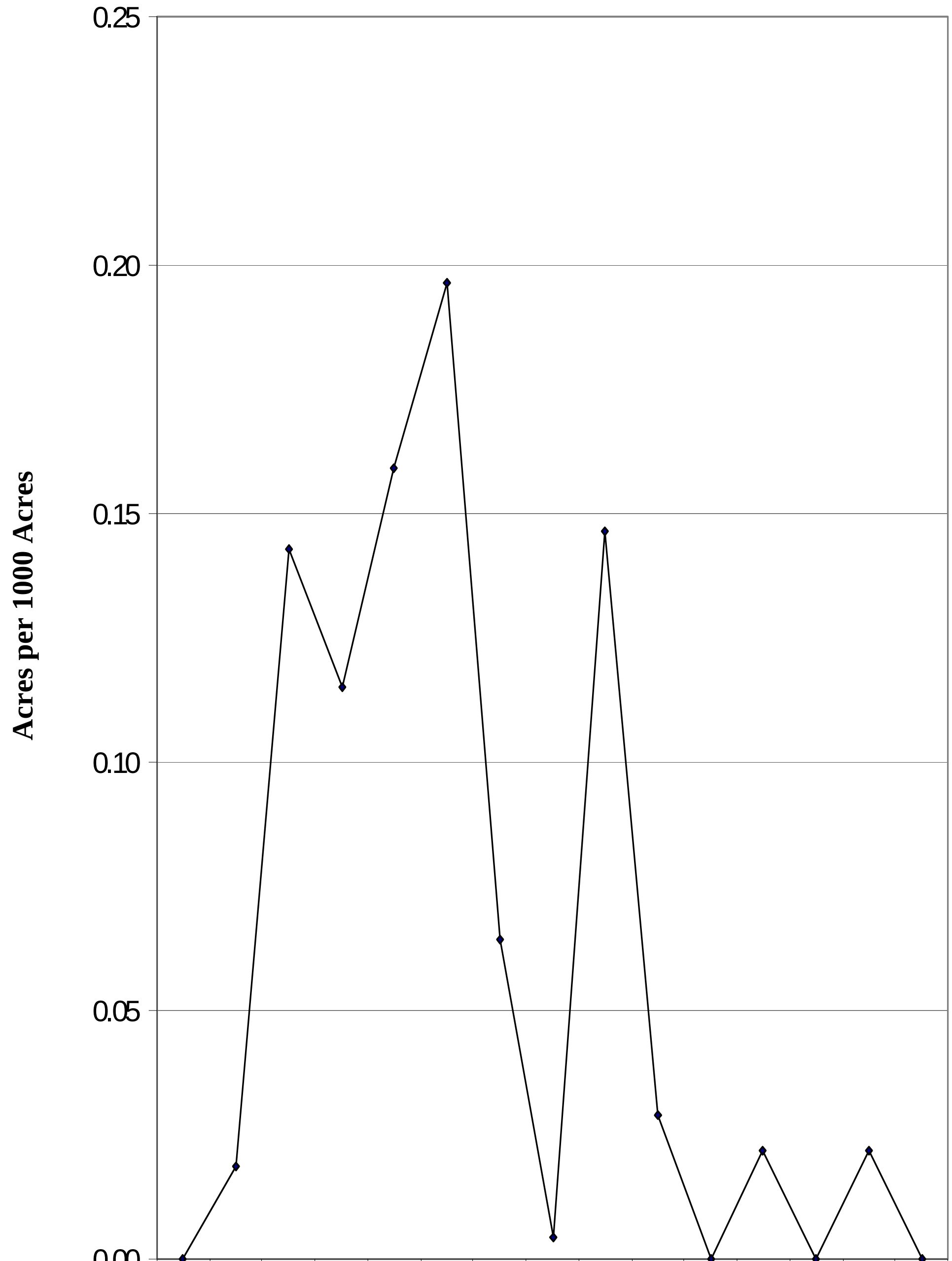
[1] DF = Douglas-fir, WH = western hemlock, OC = other conifer, MC = mixed conifer

CHAPTER 8: PRUNING (QUESTIONS 20-22)

Only 3 of the 9 respondents conducted pruning and all pruning conducted since 1991 and planned for 2001-2005 involves just Douglas-fir. Figures 8.1 and 8.2 present trends in pruning intensities per 1000A of total net timberland and per 1000A of Douglas-fir timberland. Activity rose from zero in 1991 to a high in 1996 and has dropped sharply since then. All pruning was done in a single lift to either 18 or 20 feet and the pruning trigger was total stand height between 30 and 40 teet.

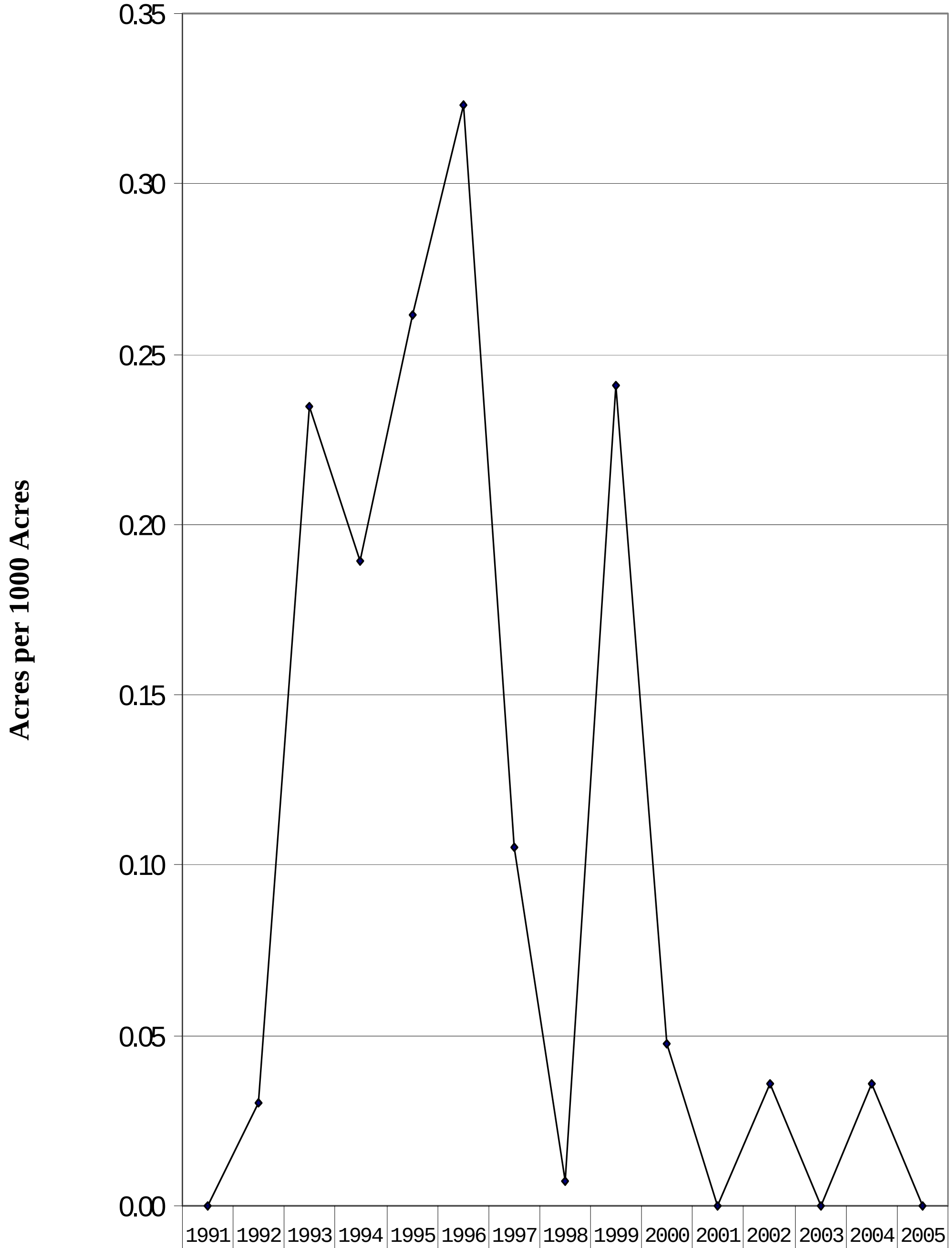
The minimum, average, and maximum pruning cost per acre and per tree are presented in Figure 8.3 and Figure 8.4 respectively. Dividing average cost per acre by average cost per tree implies an average of 150 pruned trees per acre.

Figure 8.1 Pruning per 1000 A Net Timberland

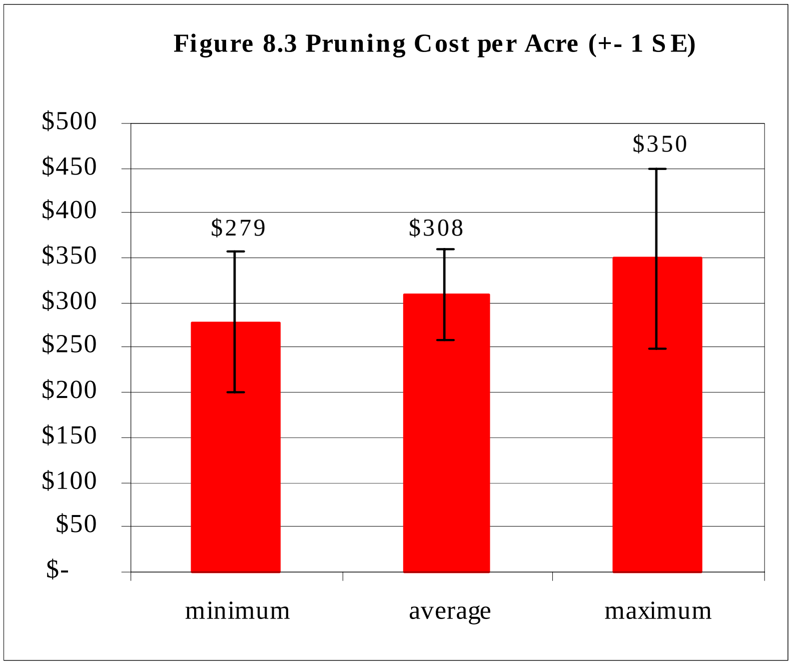


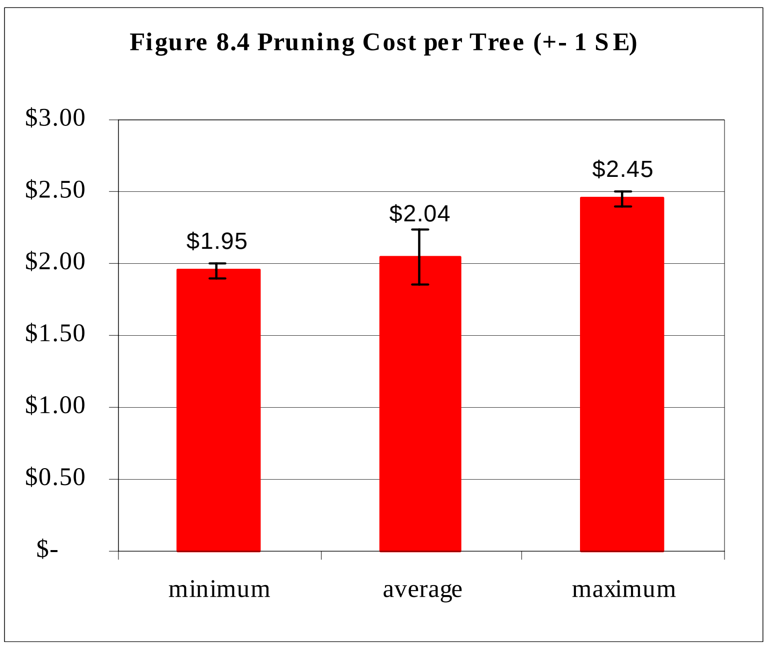
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas fir	0.00	0.02	0.14	0.12	0.16	0.20	0.06	0.00	0.15	0.03	0.00	0.02	0.00	0.02	0.00

Figure 8.2 Pruning per 1000 A Species



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Douglas fir	0.00	0.03	0.23	0.19	0.26	0.32	0.11	0.01	0.24	0.05	0.00	0.04	0.00	0.04	0.00





Data Table for Figures 8.3 and 8.4				
		Mean, $	Standard Error	**N**
Prune per acre	Minimum	278.50	78.50	2
	Average	308.00	50.72	3
	Maximum	350.00	100.00	2
Prune per tree	Minimum	1.95	0.05	2
	Average	2.04	0.19	3
	Maximum	2.45	0.05	2

CHAPTER 9: PEST ISSUES (QUESTION 27)

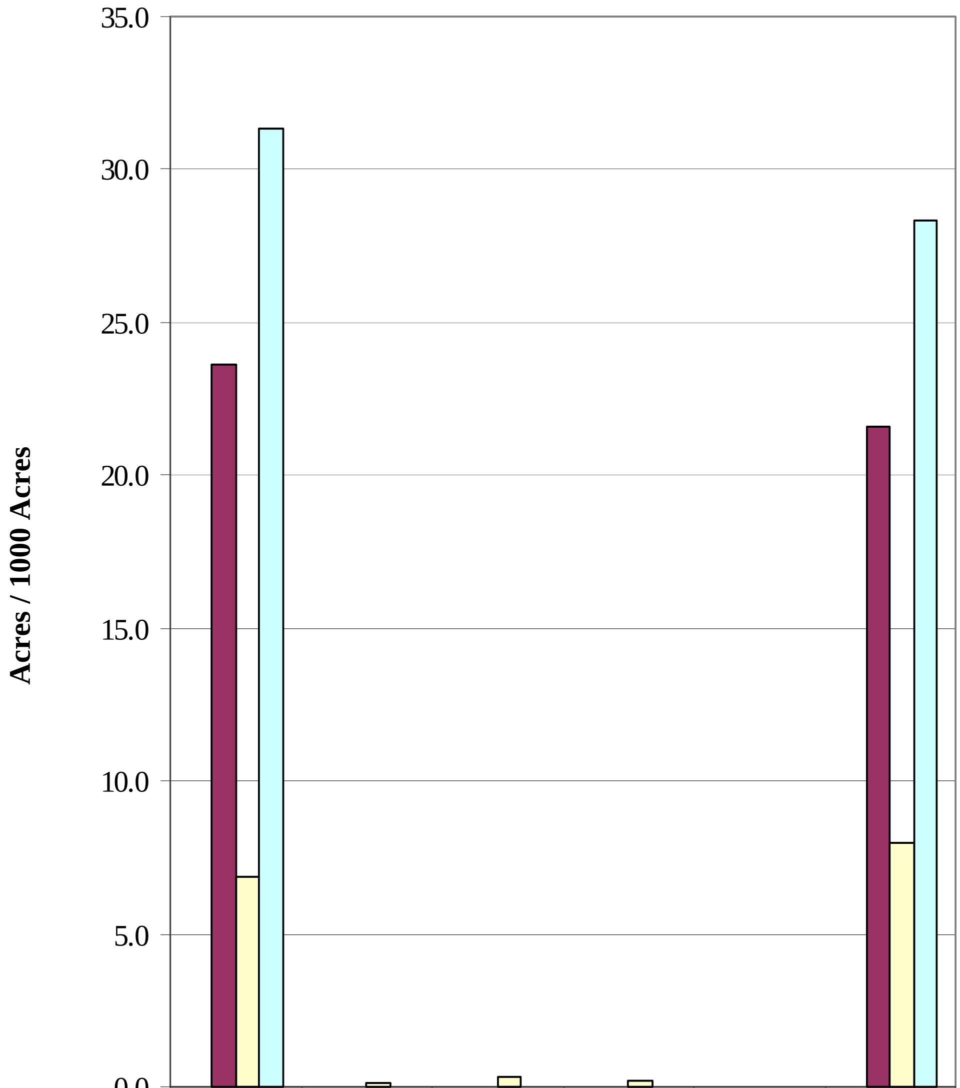
Respondents were asked to indicate the recent annual acres affected by various pests on timberland. 8 of 9 respondents provided data with 7 providing detail by timberland type. Figure 9.1 summarizes results per 1000 A of net timberlands and Figure 9.2 re-casts the information per 1000 A of the species type. Respondents were asked to list the principal organisms involved and Table 9.1 summarizes the frequency counts. Clearly the overwhelming majority of pest problems indicated were associated with Douglas fir.

Key disease issues were Swiss needlecast and root rots and the main browse problems were with elk and deer. No acreages associated with insect problems were given but the Douglas-fir bark beetle and seed eaters were mentioned as problems. The "other" category of issues was predominantly mountain beaver and bear damage.

TABLE 9.1 Pest Type Frequencies

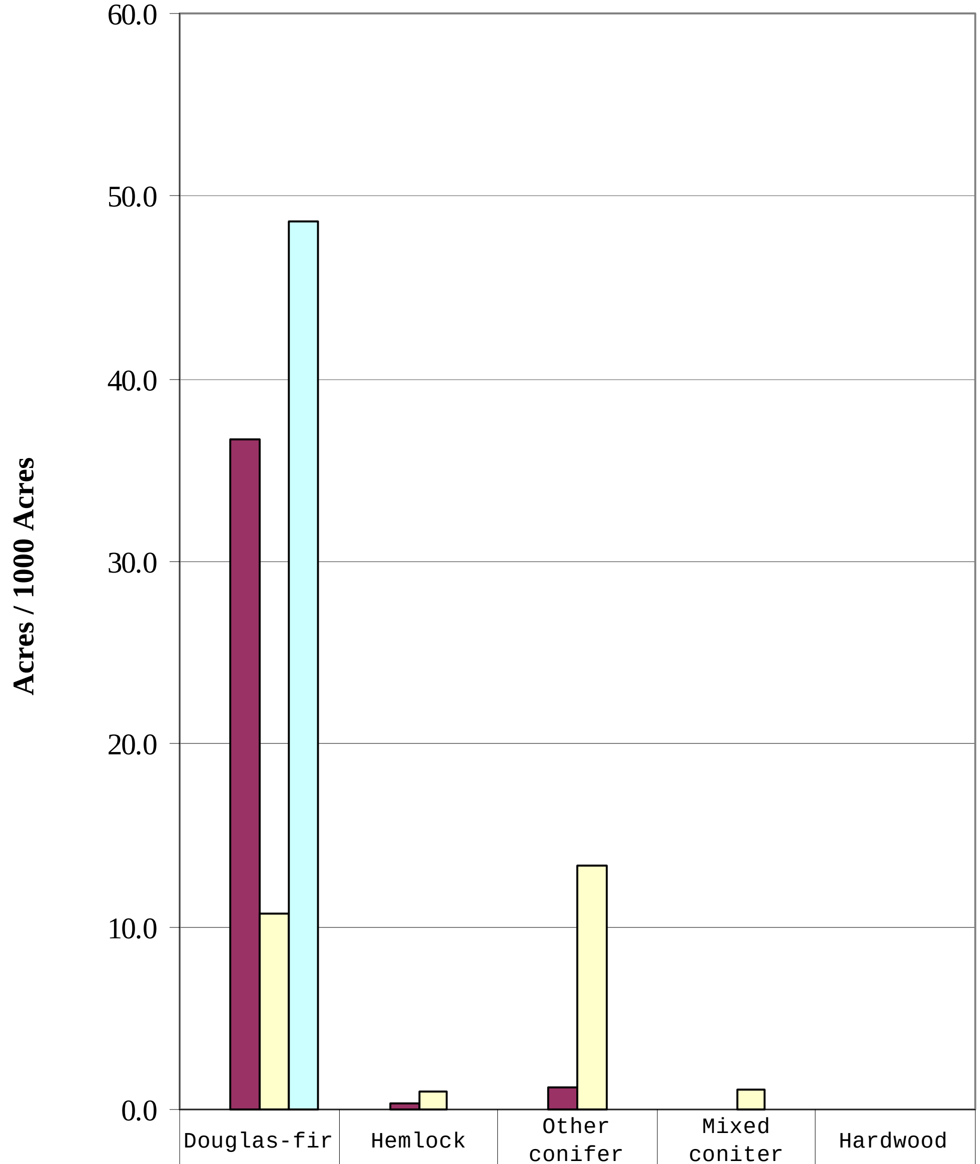
Pest Category	**Agent**	**Frequency**
Insect	Douglas-fir bark beetle	1
	Seed insects	1
Disease	Swiss needle cast	4
	Root rots	5
	Mistletoe	1
	Black stain	1
Browse	Elk	5
	Deer	4
	Cattle	1
Other	Mountain beaver	6
	Bear	6
	Other rodents	5

Figure 9.1 Pest Problems per 1000 A Net Timberlands



	Douglas-fir	Hemlock	Other conifer	Mixed coniter	Hardwood	Total
insect	0.0	0.0	0.0	0.0	0.0	0.0
disease	23.6	0.0	0.0	0.0	0.0	21.6
browse	6.9	0.1	0.3	0.2	0.0	8.0
other	31.3	0.0	0.0	0.0	0.0	28.3

Figure 9.2 Pest Problems per 1000 A of Species



	Douglas-fir	Hemlock	Other conifer	Mixed coniter	Hardwood
insect	0.0	0.0	0.0	0.0	0.0
disease	36.7	0.3	1.2	0.0	0.0
browse	10.7	1.0	13.4	1.0	0.0
other	48.6	0.0	0.0	0.0	0.0

CHAPTER 10: FOREST REGULATIONS (QUESTION 32, 33)

Respondents were asked to indicate if they presently have a process in place to identify areas harvested with ground-based systems that have had soil disturbance and compaction requiring tillage or other treatments. All 9 respondents answered this question and 4 (44%) indicated that they presently have such a process.

Respondents were asked to indicated the acreage affected by regulations for endangered species, stream protection and restoration, restoration associated with roads, and other environmental protections. They were also asked to indicate the effect of these regulations on rotation length and to indicate the additional cost per acre associated with planning and management associated with these regulations. Six of the 9 respondents provided data.

Figure 10.1 summarizes the acreage falling under various regulatory categories, expresses as acres per 1000 A of net timberland. Activities related to stream buffers and road work to minimize erosion and runoff dominate with 78 and 47 A/1000A net timberland. Northern spotted owl and marbled murrelet protection were 15 and 0.4 A/1000 A of net timberland and "other" (eagles, wetlands, unstable slopes, watershed analysis) accounted for 15A/1000 A net timberland.

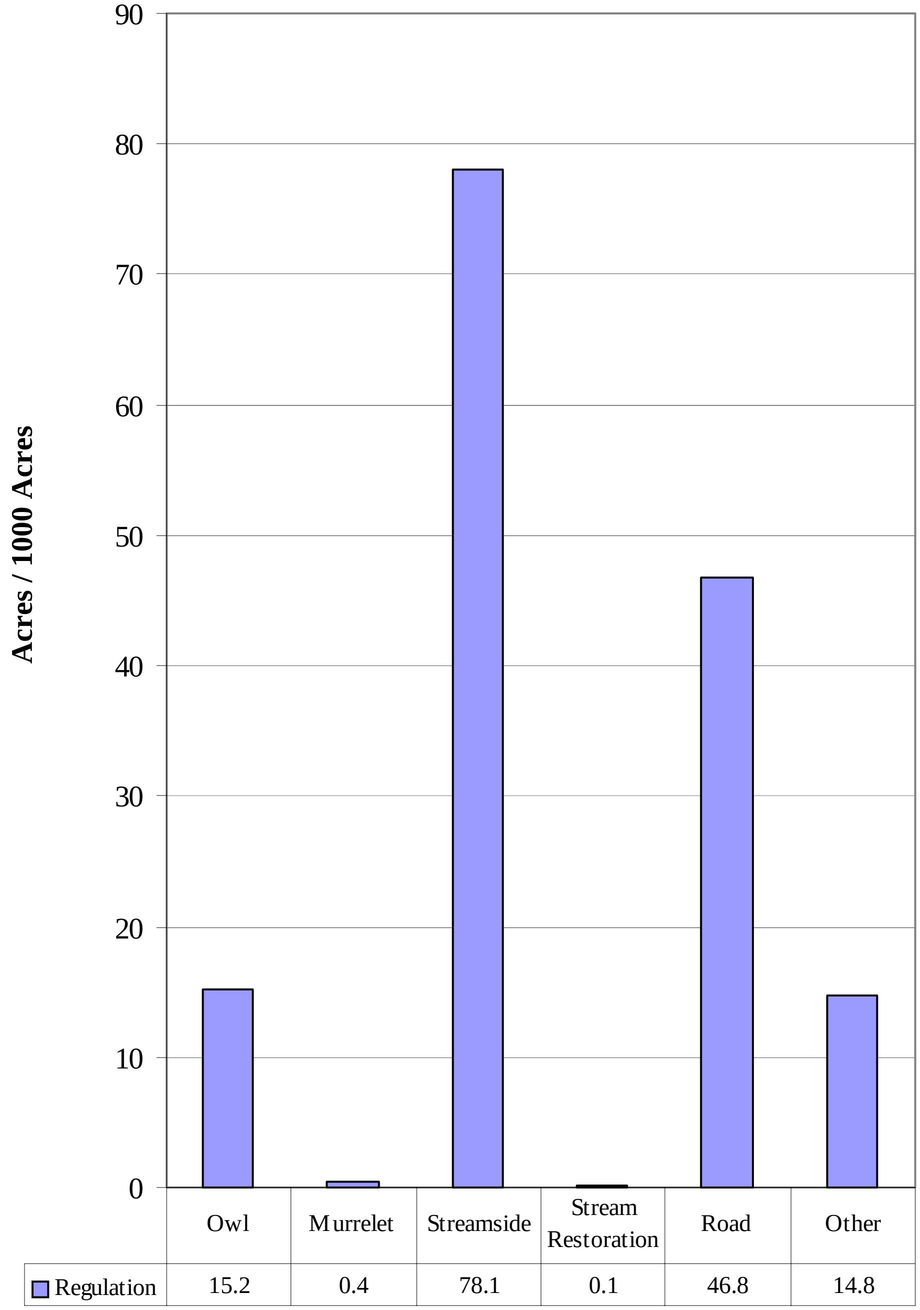
For spotted owl and murrelet protection and stream buffers, the effect on rotation was considered to be indeterminate in the sense that these protection zones often have restrictions on tree harvesting or a "no cut" requirement that renders the concept of a conventional rotation or harvest cycle meaningless. In cases where dispersal habitat is being created, rotation may increase in some stands and decrease in others to achieve desired effects. Collectively, the area associated with these protective regulations is 9.4% of net timberlands of the six respondents who provided data. This is consistent with information in Table 2.3 where respondents indicated that 9.5% of their net timberland was set-aside with no management. Road and stream restoration were not viewed as having any effect on rotation.

Only 1 to 3 respondents provided estimates of additional per acre costs associated with these protection and restoration activities. Table 10.1 summarizes the wide range of per acre costs from this small sample. Some respondents commented on the difficulty of separating these costs from "normal" costs. The wide cost range may be indicative of very different conditions on different ownerships and/or differences in cost accounting where some indicate direct costs and others indicate direct plus indirect costs. Then cost ranges in Table 10.1 should be treated with caution; this is an area that requires further investigation.

Table 10.1 Cost per Acre of Forest Regulation Practices

Regulatory Issue	**$ / Acre**
Spotted owl, marbled murrelet	$0.05 - $25.00
Streamside buffers	$1.00 – $10.00
Road restoration, drainage improvement	$0.70-$130.00

Figure 10.1 Area of Regulatory Impacts per 1000 A Net Timberland



APPENDIX

STAND MANAGEMENT COOPERATIVE OWNER SURVEY # 5

STATUS OF STAND MANAGEMENT IN PACIFIC NORTHWEST WEST-SIDE FORESTS

In 1983, 1986, 1991, and 1996, a survey has been conducted of RFNRP/SMC members concerning their timberland base and silvicultural practices. A summary of the last survey was published in the Spring 1997 issue of "The Co-op Correspondent".

Enclosed is a new survey to continue and update this series of important information. The current survey gathers the same information as the predecessors but also includes changes to gather more detail and to address issues and factors that may influence future operations. To facilitate completing this survey, a copy of your response to the last survey is included and we have indicated the corresponding question from the last survey beside each question herein. All survey information from individual companies will be kept strictly confidential; only aggregate summary results will be released or published.

In preparing and redesigning this survey, special thanks go to the following individuals who served as reviewers. Their suggestions for improvement are greatly appreciated.

John Trobaugh, The Timber Company
Bruce Lippke, Director, Rural Technology Initiative Program, UW College of Forest Resources
Eric Turnbom, SMC Silviculture Project Leader
Rob Harrison, SMC Nutrition Project Leader
Tom Terry, Weyerhaeuser Co.

Please return the completed survey by December 1, 2000. I wish to thank you for your participation.
Sincerely,
David Briggs
Director, Stand Management Cooperative
In case we have a question regarding your completed form, please supply the following information

ORGANIZATION ____

INFORMATION SUPPLIED BY ____

TELEPHONE___________________________ FAX_____________________

EMAIL ____

A. TIMBERLAND BASE

1. Ownership of timberland west of the Cascade Crest. (Question 1 of Survey # 4)

	Gross Timberlands, Acres	Net Timberland[1], Acres	% of Net Timberland area not managed for timber[2]
British Columbia			
Oregon			
Washington			
Total			

[1] capable of producing at least 20 ft^3 per acre per year

[2] Placed in roads, habitat reserves, nesting site buffers, riparian areas, etc.) (Question 4 of Survey # 4)

Note: Your Net Timberland acres is the basis for subsequent questions.

2. How would you characterize your Net Timberland in terms of forest type? Please ensure that the total equals 100%. (Question 2 of Survey # 4)

Douglas-fir	__________ %
Western hemlock	__________ %
Douglas-fir / western hemlock	__________ %
True fir / mountain hemlock	__________ %
Other conifer	__________ %
Hardwoods	__________ %
Non-stocked	__________ %
Total	100 %

3. How would you characterize your Net Timberland by generalized site classes (SI_{50}). Please indicate the Site Index range for each class and ensure that the total equals 100%. (Question 3 of Survey # 4)

Site Class	Site Index (SI_{50}) Range	% of Net Timberland
I	>= 135	
II	115-134	
III	95-114	
IV	75-94	
V	<= 74	
Total		100 %

B. REGENERATION PRACTICES

4. What is the average size of a regeneration unit? _________________ acres. (Question 7 of Survey # 4)

5. What percentage of timberland reforested in the past 5 years was (Question 5 of Survey # 4)

a. planted with seedling stock ? ___________ %
b. seeded or naturally regenerated? ___________ %

6. How many acres has your organization regenerated in the past 10 years and planned for the next 5 years? (Question 8 of Survey # 4)

Year	**Douglas-fir, acres**	**W. hemlock, acres**	**Other Conifer, acres**	**Mixed Conifer, acres**	**Hardwoods, acres**	**Total, Acres**
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

7. For each species indicated, what is the predominant stock type you are planting and what is the target stocking level? (Question 6 of Survey # 4)

Species	**Preferred Stock Type(s)**	**Desired Planting Density, trees per acre**	**Desired Density at age 10, trees per acre**
Douglas-fir			
Western hemlock			
Other conifer			
Hardwoods			

8. For Douglas-fir, please indicate the number of seedlings planted by year and planned for the next 5 years with the indicated stock types. (New Question**)**

Year	1 + 1 transplants	P + 1 transplants	Small plugs (<=S-8 or equivalent)	Large plugs (>S-8 or equivalent)	Other
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
Plan:					
2001					
2002					
2003					
2004					
2005					

9. For Western hemlock, please indicate the number of seedlings planted by year and planned for the next 5 years with the indicated stock types. (New Question**)**

Year	1 + 1 transplants	P + 1 transplants	Small plugs (<=S-8 or equivalent)	Large plugs (>S-8 or equivalent)	Other
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
Plan:					
2001					
2002					
2003					
2004					
2005					

C. SITE PREPARATION

10. Acres of Site Preparation west of the cascades in the last 10 years and planned for the next 5 years. (New Question).

Year	Douglas-fir, acres	W. hemlock, acres	Other conifer, acres	Mixed Conifer, acres	Hardwoods, acres	Total, Acres
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

11**. Acres of Site Preparation Treatments west of the cascades in the last 10 years and planned for the next 5 years. (Since an acre may get more than one treatment in a year, the acres in each year in this table may exceed the acres in the same year in Question 10) (**New Question**). For chemical site preparation indicate the total acres treated and the percentage of these acres treated with a pre-emergent herbicide to control herbaceous weeds in the first growing season after planting.**

Year	Broadcast Burn, acres	Pile and Burn, acres	Chemical Site Preparation		Mechanical Only, acres	No Treatment, acres
			Acres	% with pre-emergent		
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

12. Current cost information for site preparation treatments (New Question)

	Minimum, $/Acre	Maximum, $/Acre	Average, $/Acre
Broadcast burn			
Pile and burn			
Chemical site prep.			
Other			

D. VEGETATION CONTROL AFTER PLANTING

13. Post-planting vegetation management west of the cascades in the last 10 years and planned for the next 5 years. (Expands on Question 9 of Survey # 4)

Year	Douglas-fir, acres	W. hemlock, acres	Other conifer, acres	Mixed Conifer, acres	Hardwoods, acres	Total, Acres
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

14. Acreage of Post-Planting Vegetation Control Treatments west of the cascades in the last 10 years and planned for the next 5 years. (Since an acre may get more than one treatment in a year, the acres in each year in this table may exceed the acres in the same year in Question 13) (New Question)

Year	1st Year herbaceous Control, acres	2nd Year herbaceous Control, acres	Woody Release, acres	Other (please specify), acres	Total, acres
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					
Plan:					
2001					
2002					
2003					
2004					
2005					

15. Current cost information for vegetation control treatments (New Question)

	Minimum, $/Acre	Maximum, $/Acre	Average, $/Acre
1st year herbaceous			
2nd year herbaceous			
Woody release			

E. STAND DENSITY MANAGEMENT

16. Total acres precommercially thinned west of the cascades in the last 10 years and planned for the next 5 years. (Question 13 & 14 of Survey # 4, more detail)

Year	Douglas-fir, acres	W. hemlock, acres	Other conifer, acres	Mixed Conifer, acres	Hardwoods, acres	Total, Acres
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

17. Total acres commercially thinned west of the cascades in the last 10 years and planned for the next 5 years. (Question 13 & 14 of Survey # 4, more detail)

Year	Douglas-fir, acres	W. hemlock, acres	Other conifer, acres	Mixed Conifer, acres	Hardwoods, acres	Total, Acres
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

18. What percentage of total harvest volume is from commercial thinning operations?
(Question 15 of Survey # 4) __________ **%**

19. Current cost information for thinning operations (cost for commercial thinning should be to roadside) (Question 16 of Survey # 4, more detail)

	Minimum, $/Acre	**Maximum, $/Acre**	**Average, $/Acre**
Precommecial thin			
Commerial thin			

F. PRUNING

Year	**Douglas-fir, acres**	**W. hemlock, acres**	**Other conifer, acres**	**Mixed Conifer, acres**	**Hardwoods, acres**	**Total, Acres**
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

21. **Pruning Prescription** (Question 19 of Survey # 4, more detail)

	Douglas-fir	W. hemlock	Other conifer	Hardwoods
Single lift ?				
Multiple lift ?				
Final pruned height				
Trigger for initial prune is				

22. **Current or most recent cost for pruning to final height:** (Question 20 of Survey # 4, more detail)

	Minimum	Maximum	Average
Per acre			
Per tree			

G. FERTILIZATION

23. Total acres fertilized west of the cascades in the last 10 years and planned for the next 5 years. (Question 21 & 22 of Survey # 4, more detail)

Year	Douglas-fir, acres	W. hemlock, acres	Other conifer, acres	Mixed Conifer, acres	Hardwoods, acres	Total, Acres
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						
Plan:						
2001						
2002						
2003						
2004						
2005						

24. Fertilization Priorities. For each species, fill in each cell with one of the following codes to indicate which age and site classes have fertilization priority (Question 26 of Survey # 4, more detail)

H = high priority

M = medium priority

L = low priority

N = not considered for fertilization

a. Douglas-fir

	Age 0-20	Age 21-50	Age > 50
Site Class I			
Site Class II			
Site Class III			
Site Class IV			
Site Class V			

	Age 0-20	Age 21-50	Age > 50
Site Class I			
Site Class II			
Site Class III			
Site Class IV			
Site Class V			

	Age 0-20	Age 21-50	Age > 50
Site Class I			
Site Class II			
Site Class III			
Site Class IV			
Site Class V			

	Age 0-20	Age 21-50	Age > 50
Site Class I			
Site Class II			
Site Class III			
Site Class IV			
Site Class V			

	Age 0-20	Age 21-50	Age > 50
Site Class I			
Site Class II			
Site Class III			
Site Class IV			
Site Class V			

25. Fertilization Prescription(s) (Question 23 of Survey # 4)

	Douglas-fir	W. hemlock	Other conifer	Mixed conifer	Hardwoods
Nutrient					
Source					
Rate, lb/acre					

Example: Nutrient is N, source is urea, rate is 200 lb/acre

26. Current cost information for fertilization operations (Question 28 of Survey # 4, more detail)

	Minimum, $/Acre	**Maximum, $/Acre**	**Average, $/Acre**
Fertilization			

H. INSECT, DISEASE, & WILDLIFE (New Section)

27. How many acres are planned to include the following practices in the management regime planned for the stand?

Practice	**Douglas-fir, acres**	**Western hemlock, acres**	**Other Confer, acres**	**Mixed Conifer, acres**	**Hardwoods, acres**	**Total, acres**
Insect Control						
Disease control						
Browse						
Other, please specify						

a. What insect(s) are the main concerns in your control program?

b. What disease(s) are the main concerns in your control program?

c. What browsing problem(s) are the main concerns in your control program?

d. What other items are concerns in your control program?

I. HARVEST UNIT SIZE & ROTATION

Year	Minimum, acres	Maximum, acres	Average, acres
2000			
1995			
1990			

29. Under normal conditions, what is the expected rotation length for regenerated stands of (Question 11 of Survey # 4)

Douglas-fir	W. hemlock	Other conifer	Mixed Conifer	Hardwoods

30. What effect does each of the following cultural practices have on rotation length? (Question 12 of Survey # 4)

Practice	No change	Increases rotation	Decreases rotation
Wide planting density			
Pruning			
Fertilization			
Other, please specify			

31. What percentage of the area harvested/regenerated in the last 5 years and projected for the next 5 years have included or will include the following practices? (Question 10 of Survey # 4)

Practice, %	1996-2000	2001-2005
Whole tree logging		
Yarding unmerchantable material		
Woody material/snag creation or maintenance		
Variable retention thinning or harvests (green tree retention)		
Species conversion		
Other, please specify		

32. Do you have a process in place to identify ground-based harvest areas that have been compacted / disturbed so that areas in need of amelioration receive tillage of other treatments? (Check one)

Yes No

J. IMPACT OF REGULATIONS (new section)

33. For each following regulatory factors, please indicate the acreage affected on your lands, impact on rotation length on these specially managed acres, and the associated increase in planning and management costs on these acres ($ per acre)

Regulatory Issue	Additional Acres affected	New rotation length, years	Increase in Planning & Management Cost ($ / Acre)
Northern spotted owl			
Marbled murrelet			
Streamside buffers			
Stream restoration (add wood debris, special plantings, etc.)			
Road/drainage restoration			
Other, please specify			

Please make any additions, comments, or clarifications regarding any section of this survey.