C I N T R A F O R

Working Paper

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Economic Contribution of the Forestry & Wood Processing Sectors in the State of Washington

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Center for International Trade in Forest Products

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This material is based upon research supported by the USDA Cooperative State Research, Education and Extension Service, the State of Washington Department of Community, Trade and Economic Development and the Washington State Legislature. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the funding agencies.

Executive Summary

Investment by value-adding wood industries is critical to sustaining forestland ownership. An increasingly complex array of forest owners and investors suggests a business climate that views forests as a financial, rather than an industrial, asset. However, maintaining the ecological, environmental and economic health of the forests in Washington requires a vibrant and competitive forest products industry. The lack of a diversified and competitive forest products industry to process the logs, small diameter timber and thinnings removed from the forest undermines the ability to manage forests in Washington in a sustainable manner and reduces the range of management options available to forest managers in the state. The lack of competitive markets for intermediate forest products derived from forest management operations undermines the economic rationale of forest management, adversely affects forest health and ultimately results in increased fire risks. At the same time, the forestry and forest products industries make significant contributions to the economy of Washington State, particularly in rural, timber dependent communities.

The analysis of the economic data suggests that the forestry and wood products manufacturing sectors have played an increasingly important role in the economy of Washington State since 2001. Not only did this sector provide over 45,000 jobs in 2005 but it also generated approximately $16 billion in gross business revenue, paid out over $2 billion in wages and over $100 million in tax receipts. As a result, the forestry and wood products sector of the state economy employed 1.43% of the workers in the private sector in Washington, accounted for 1.8% of the total wages paid within the private sector and generated 3.2% of the gross business income within the private sector.

The sawmill industry in Washington state suffered through a tough period between 1987 and 1993, much of which can be attributed to the 1990-1991 recession and the loss of federal timber as a result of the listing of the spotted owl as an endangered species in 1989. Between 1987 and 1993 softwood lumber production in Washington decreased by 23.5% as 45 sawmills closed and almost 1,400 jobs were lost. Industry consolidation ensued throughout much of the past decade and by 2005 the number of sawmills had declined from 217 (in 1994) to 128. Much of this decline in sawmills can be attributed to the closure of older, inefficient sawmills that relied on the large, old-growth logs coming from the federal forests. Despite the huge drop in sawmills, employment in the sawmill sector actually increased from 7,721 to 8,565 between 1994 and 2005 as larger more efficient sawmills were built to replace the older mills being closed.

The plywood industry in Washington, previously one of the largest in the US, has been in decline since 1962. The number of plywood mills has dropped from 35 to 8 during this period although plywood production has only declined from 1.8 billion square feet (3/8 inch basis) to 1.1 billion square feet (3/8 inch basis). As seen in the sawmill industry, the closure of smaller, inefficient mills has been offset to a degree by the establishment of larger, more efficient plywood mills. Annual production per mill in 1962 was just 52 million square feet whereas this has jumped to 137 million square feet in 2005. It is important to note that as the end-use market transitions from plywood to oriented strand board (OSB), there are no OSB mills located in the state of Washington. The challenge for the structural panel industry is to successfully make the transition from plywood to OSB.

The Washington pulp and paper sector is the second largest following wood products manufacturing. In addition to its importance within the economy, this sector also plays an important demand role within the forest products industry. Pulp and paper companies are important consumers of lower quality pulp logs as well as providing a demand for by-products from other forest products industries such as sawdust and planer shavings from the sawmill industry. Given the cost structure of the sawmill industry, lumber manufacturers often break even at best with their lumber production and it is the sales of their by-products that provide them with an operating profit. Thus this industry segment is particularly important to the

health of the sawmill and logging sectors. From a strategic industry perspective, it is extremely important that this industry remain healthy and viable within the state of Washington.

The regional inter-industry econometric model called the Washington Projection and Simulation Model (WPSM) has been used to estimate that in 1992 there were 7.7 direct jobs and 32.3 indirect jobs linked to each million board feet of timber harvest in Washington. In 1994, it was further estimated that 29.7 Washington jobs would be lost for every $1 million in tax increases to replace lost trust revenue from reduction in timber harvests from the state forestlands. Further public benefits derived from DNR timber sales through the generation of state and local, and federal tax revenues were calculated to be 11% and 19% respectively, of the Gross State Product, in 1996.

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Introduction

The forest products industry in Washington State, while facing challenging times, is one of the most dynamic in the US, Figure 1. Production statistics from the softwood lumber and plywood industries show that Washington ranked second and fourth in terms of the volume of softwood lumber and plywood produced in 2005. The fact that Washington is the second largest softwood lumber producer yet employment in this sector is ranked 8th in the country suggests that the softwood lumber industry has an above average level of productivity.

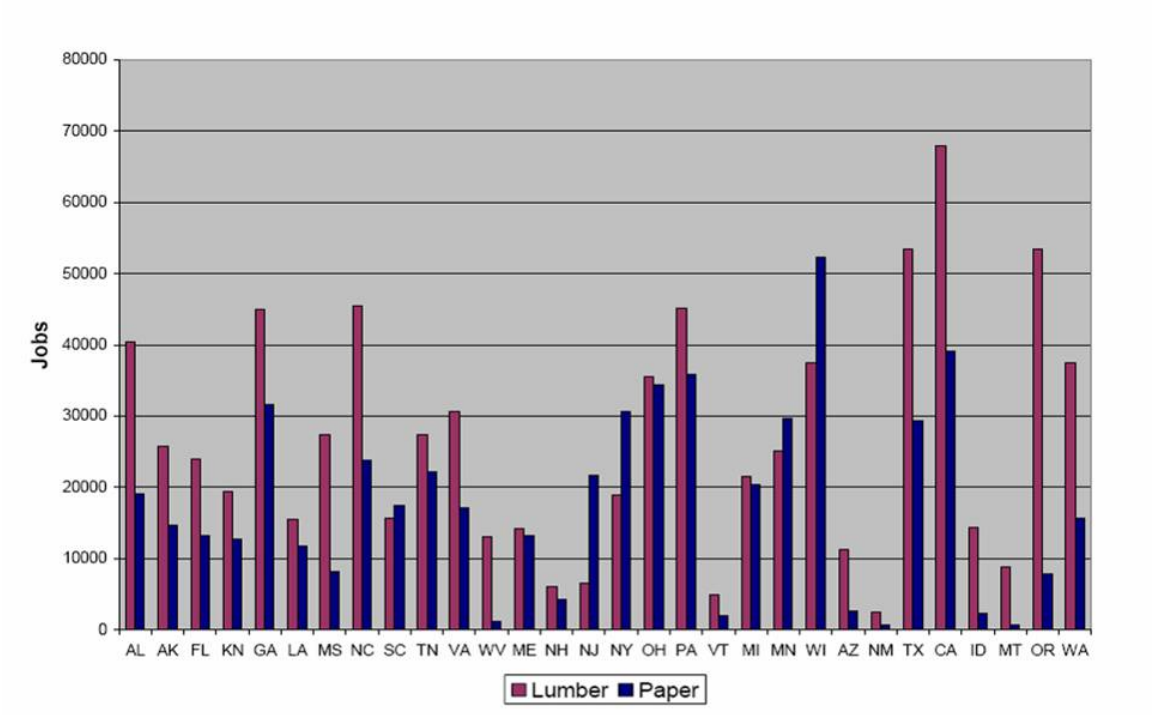

Figure 1: Employment in the forest and paper industries in the US.
Source: AF&PA 2005; Evans 2006.

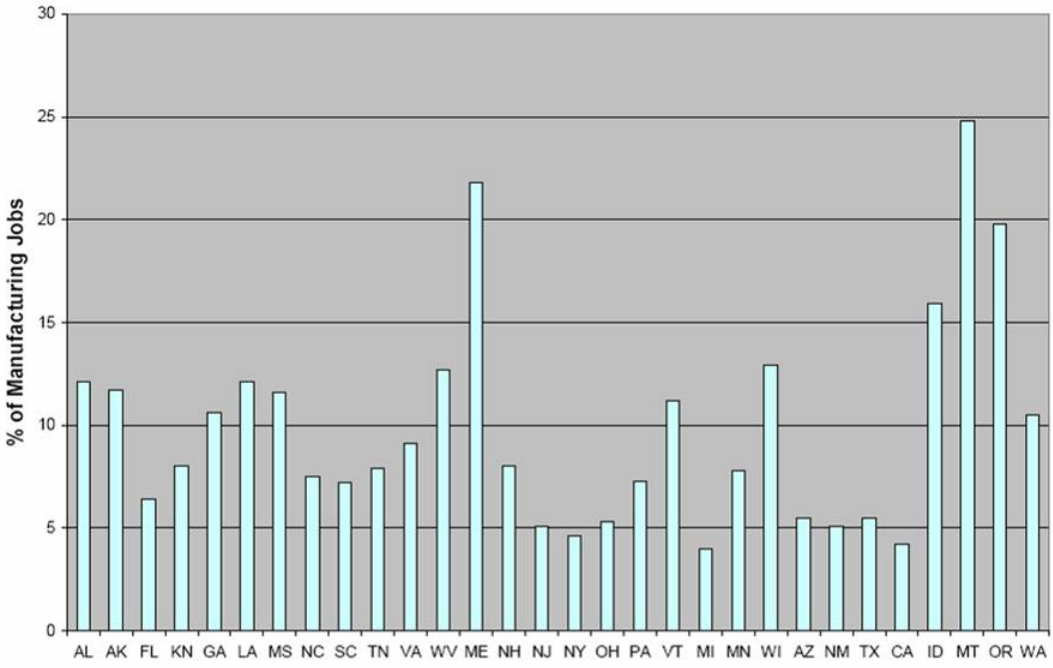

Figure 2: Employment in the forest and paper industries as a percentage of manufacturing jobs.
Source: AF&PA 2005; Evans 2006.

The employment data presented in Figure 2 show that employment in the forest and paper industries represents 11% of all manufacturing jobs in the state, suggesting that the forest products industry plays an important role within the diversified economy of the state. This is of particular relevance since many of these jobs are located in rural, timber dependent communities where family wage jobs are difficult to come by. For example, the 2005 employment and wage data show that jobs in the lumber manufacturing and paper manufacturing industries provide an annual average wage of $45,703 and $60,421, respectively. Indeed, even the logging industry provides an average annual wage of $40, 208. In addition, the indirect economic impacts of these jobs in the forest sector play an important role in the economies of rural timber dependent communities.

Figure 3 shows capital investment in wood products manufacturing as a function of value of wood products shipments. Forest products manufacturers in Washington have one of the highest levels of capital investment, trailing only Wisconsin. More important, the level of capital investment is well above the average of 3% of annual sales (as indicated by the slope of the line in Figure 3). Equally important, from an industry perspective, is the fact that Washington timber lands have the highest per acre yield of any state in the country, Figure 4. At the same time, a study by the Oak Ridge National Laboratory suggests that Washington also has a ready availability of cost competitive forest residues that could provide raw material inputs for a wide range of forest products including particleboard, medium density fiberboard and oriented strandboard as well as providing the raw material for biomass refinery or bioenergy facilities (Figure 5).

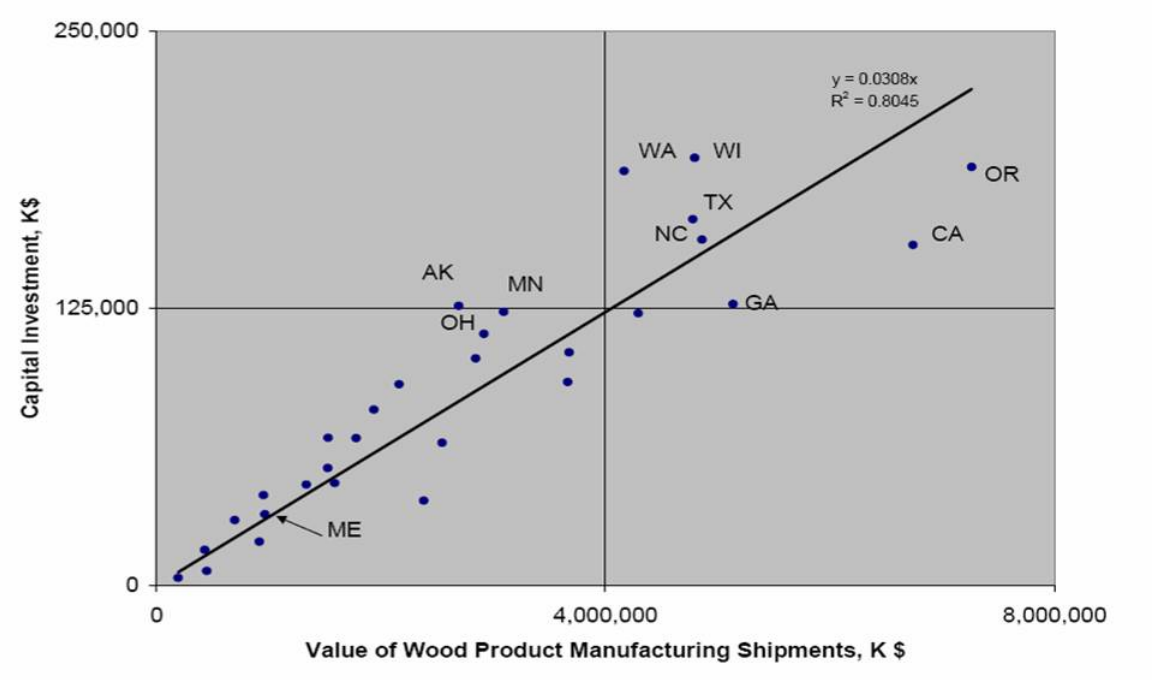

Figure 3: Capital investment versus the value of wood product shipments.
Source: AF&PA 2005; Evans 2006.

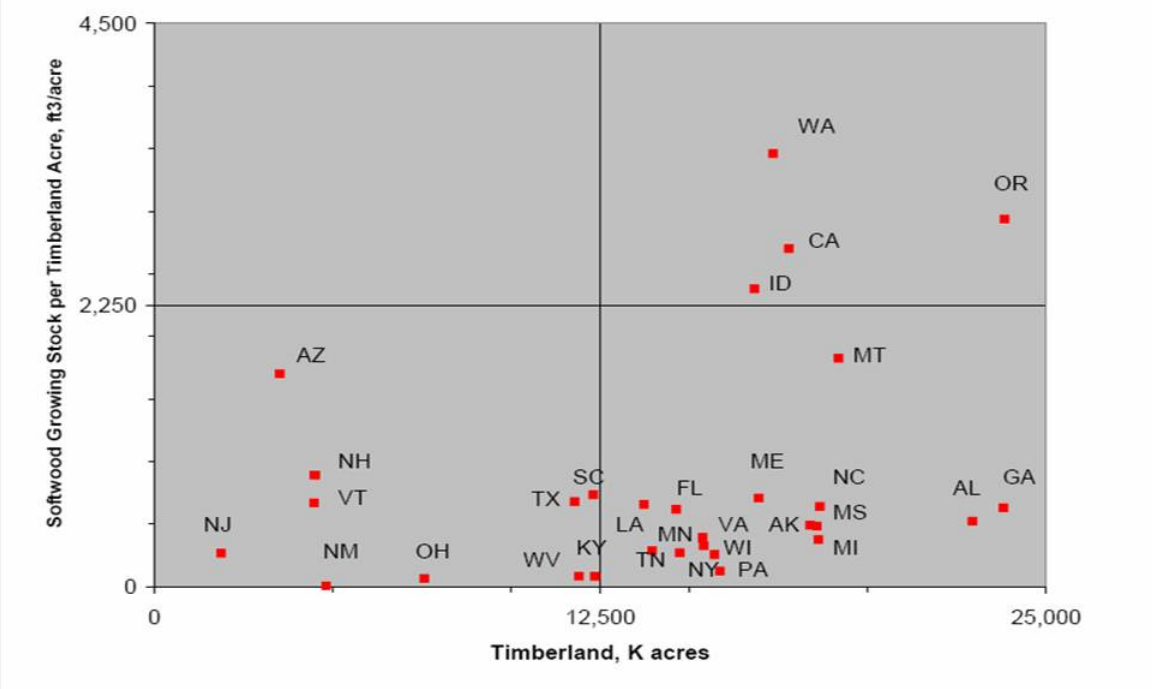

Figure 4: Intensity of softwood growing stock relative to timber area.
Source: AF&PA 2005; Evans 2006.

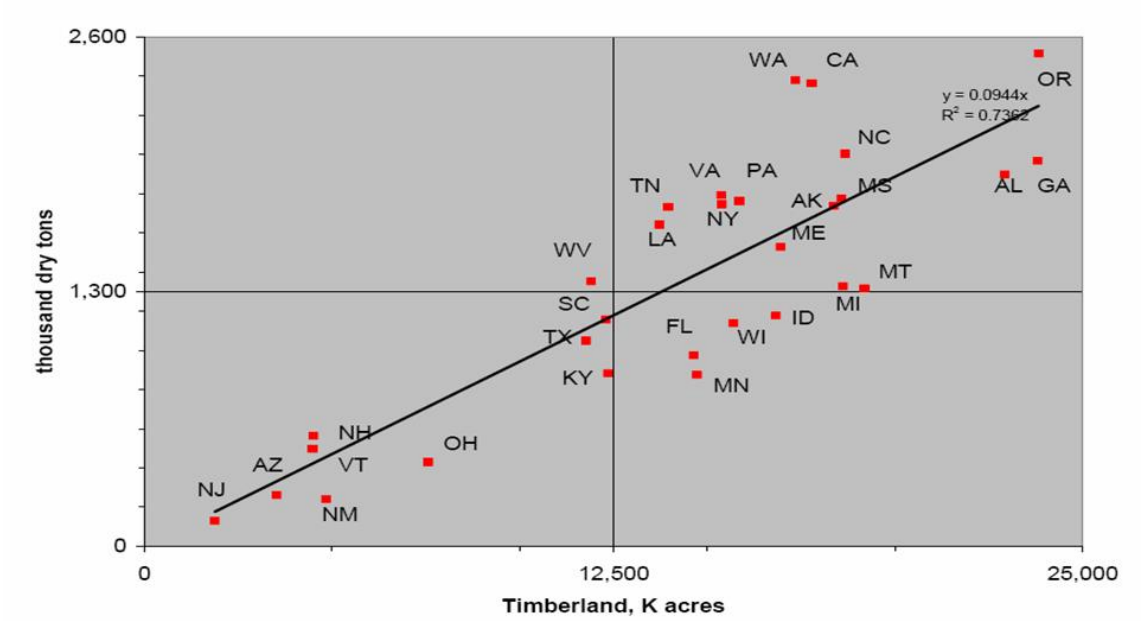

Figure 5: Estimates (1999) of forest residues available for less than $50/BDT.
Source: Oak Ridge National Laboratory 2000; Evans 2006.

Study Objectives

Given the critical role of a healthy and diversified forest products industry to the state economy, the Washington state Legislature commissioned a study to evaluate the contribution of the forestry and forest products industries to the economy of Washington State. The objectives of this study include:

- Describe the role of forestry ownerships and forest products industries in the economy of Washington.
- Analyze the economic contribution of the forest products industry on a regional basis (including timber-dependent communities).
- Describe changes over time in key drivers at both the state and regional level.
- Project the contribution of forestry and logging, primary manufacturing, and secondary manufacturing.
- Analyze regional economic and productivity trends across stages of processing.
- Assess economic impacts (gross business revenue, income, direct and indirect jobs, and taxes) related to forest sector activity.
- Identify factors and policies that constrain investment within the industry.

Results

Data Inconsistencies

The task of estimating the economic contribution of the forestry and forest products sectors to the economy of the State of Washington is complicated by the transition in the way that much of the industry census data are classified. Between 1997 and 2002, the methodology for classifying industries was changed from the Standard Industrial Classification System (SIC) to the North American Industry Classification System (NAICS). However, the transition between the two classification systems changed the way that industries are aggregated and classified and resulted in a discontinuity in the industry data (Figure 6). The data presented in Figure 6 clearly show that the change in classification systems can have a significant impact on the employment data. For example, whereas there is fairly good consistency in the logging employment data reported by each classification system, the sawmill employment data reported using the NAICS classification system consistently and significantly under-report employment levels within this industry. As a result, it was determined that the economic analysis for this study would be confined to the time period 1990-2005 using only the NAICS data. Further, limited data availability for taxes and gross business revenue at the state level restricted the analysis to the time period 1994-2005.

Of greater concern is the fact that there is much ambiguity in the way that specific industry groupings are assembled that limits the ability to gain a clear understanding of the economic performance and competitive situation of a specific industry group. For example, using the six digit level of definition within the NAICS system (the greatest detail provided), provides information on the sawmill industry (NAICS code: 321113). However, using this classification would suggest that there were 128 sawmills operating in Washington in 2005. Clearly this is a huge overestimate. A review of the industry definition for NAICS code soon demonstrates the problem of using the NAICS system to gain an understanding of a specific industry. The definition for the NAICS code 321113 (sawmills) provides the following:

> *This U.S. industry comprises establishments primarily engaged in sawing dimension lumber, boards, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips from logs or bolts. Sawmills may plane the rough lumber that they make with a planing machine to achieve smoothness and uniformity of size.*
> *Source: http://www.census.gov/epcd/naics02/def/ND321113.HTM#N321113*

Obviously this industry grouping includes much more than just sawmills and using the data provided for this industry sector would provide hugely misleading results. Given the importance of understanding the economic performance and competitiveness of the sawmill industry, it was determined that a census of Washington sawmills should be conducted to facilitate a better understanding of the factors that influence the business environment and competitiveness within this sector. The results of this survey will be presented in a separate section.

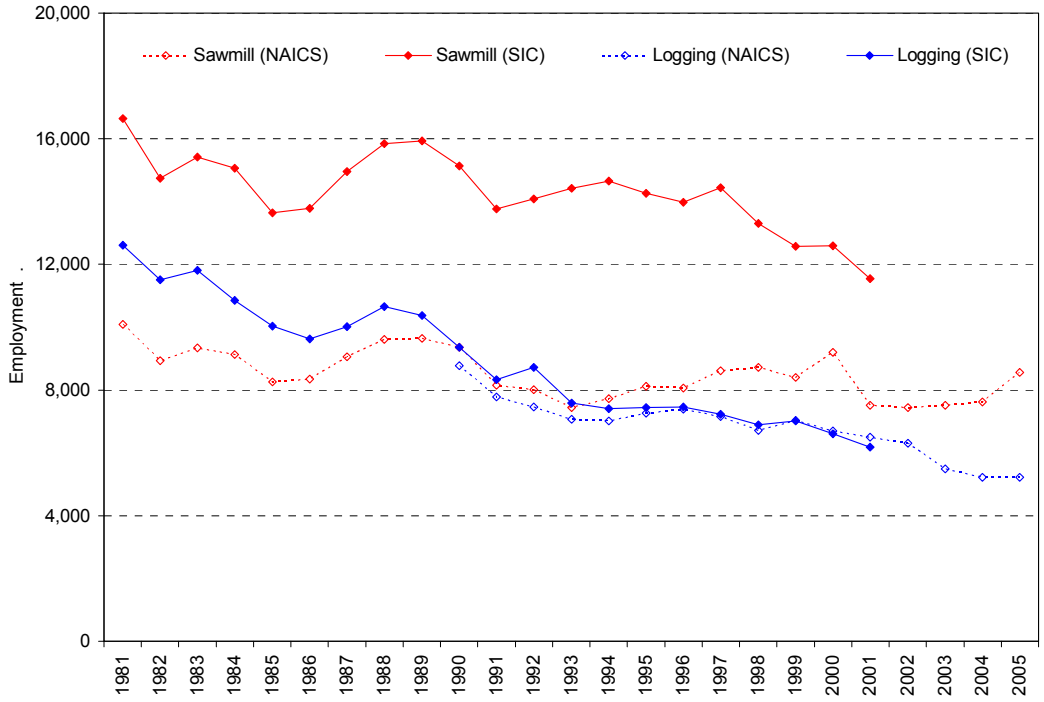

Figure 6: A comparison of the differences in the employment levels for the sawmill and logging industries as reported under the SIC and NAICS classification systems.

Source: WA State Employment Security Department website 2006.

Economic Contribution of the Forestry and Forest Products Sectors at the State Level

The preliminary analysis of the economic data suggests that the forestry and wood products manufacturing sectors have played an increasingly important role in the economy of Washington State since 2001 following several years of sub-par performance (Figure 7). Not only did this sector provide over 45,000 jobs in 2005 but it also generated almost $16 billion in gross business revenue, paid out over $2 billion in wages and over $100 million in tax receipts. As a result, the forestry and wood products sector of the state economy employed 1.43% of the workers in the private sector in Washington, accounted for 1.8% of the total wages paid within the private sector and generated 3.2% of the gross business income within the private sector (Table 1). While employment within the sector has declined since 1990, it increased by 6.1% between 2002 and 2005. In contrast, gross business income within the sector increased slightly over the 1994-2005 period. An important aspect of this sector is that many of the jobs are located in rural, timber dependent communities where job opportunities are often lacking.

In contrast to the modest performance of the forestry and forest products sector (GBI increased by just 4.2%) between 1994-2005, the overall state economy increased by an impressive 42.2% over the same period. As a result, the contribution of the forestry and forest product sector to the state economy declined from 4.3% in 1994 to 3.2% in 2005 (Table 2). Over the same period, employment in the forestry and forest products sector declined by 13.5%, while the state economy experienced a 29% increase in employment.

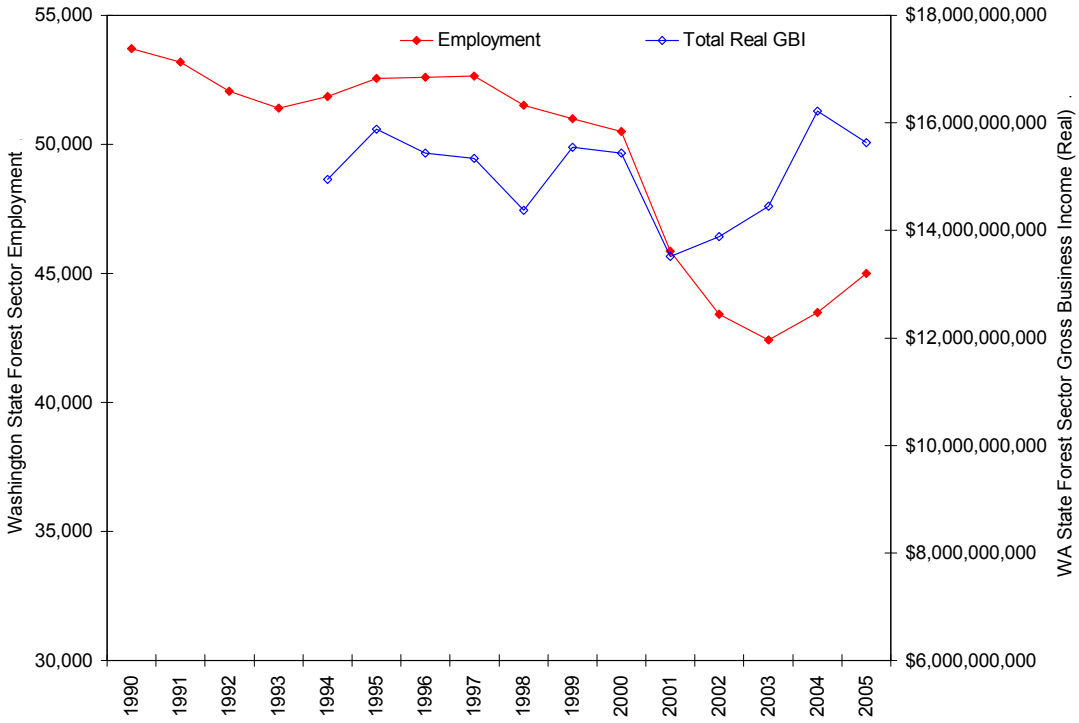

Figure 7: Employment and real gross business income (GBI) in the WA state forest sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

Table 1: Direct economic contributions of the forestry and wood products sector to WA state economy.

	Gross Business Income (Nominal)	Gross Business Income (Real)	Wages Paid (Nominal)	Wages Paid (Real)	TaxesPaid (Nominal)	TaxesPaid (Real)
1994	$12,030,699,633	$14,947,903,371	$1,675,753,809	$2,082,090,550	$89,223,231	$110,858,078
1995	$13,042,168,977	$15,879,682,539	$1,753,282,959	$2,134,735,169	$91,049,216	$110,858,297
1996	$12,922,764,764	$15,441,583,072	$1,799,483,153	$2,150,226,295	$87,818,767	$104,935,810
1997	$13,047,855,668	$15,335,818,369	$1,873,857,914	$2,202,441,945	$89,483,765	$105,174,889
1998	$12,363,538,918	$14,372,139,812	$1,895,060,605	$2,202,935,272	$87,422,495	$101,625,298
1999	$13,571,292,892	$15,551,075,340	$1,945,678,882	$2,229,514,839	$91,667,349	$105,039,797
2000	$13,769,266,067	$15,441,543,431	$1,959,602,334	$2,197,596,037	$94,165,788	$105,602,223
2001	$12,341,930,360	$13,516,594,695	$1,848,160,209	$2,024,062,019	$86,211,453	$94,416,776
2002	$12,896,262,652	$13,881,303,571	$1,791,346,125	$1,928,172,528	$83,017,405	$89,358,431
2003	$13,696,657,217	$14,449,100,452	$1,820,956,326	$1,920,992,871	$86,932,149	$91,707,877
2004	$15,783,200,083	$16,223,860,652	$1,918,991,078	$1,972,568,534	$97,973,692	$100,709,078
2005	$15,630,467,572	$15,630,467,572	$2,010,155,372	$2,010,155,372	$101,751,871	$101,751,871

Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

Table 2: Employment and number of firms in the forestry and wood products sector.

	Forest Sector GBI (Real)	Total WA GBI (Real)	Forest Sector GBI Ratio	Employment	Number of Firms
1994	$14,947,903,371	$349,601,389,919	4.28%	51,857	4,622
1995	$15,879,682,539	$360,464,968,619	4.41%	52,553	4,599
1996	$15,441,583,072	$381,592,784,453	4.05%	52,609	4,219
1997	$15,335,818,369	$413,590,868,751	3.71%	52,644	3,974
1998	$14,372,139,812	$419,184,411,238	3.43%	51,517	3,798
1999	$15,551,075,340	$442,146,067,234	3.52%	50,990	3,692
2000	$15,441,543,431	$463,747,739,788	3.33%	50,488	3,583
2001	$13,516,594,695	$449,723,973,211	3.01%	45,867	3,452
2002	$13,881,303,571	$426,219,152,407	3.26%	43,411	3,585
2003	$14,449,100,452	$434,108,062,031	3.33%	42,413	3,458
2004	$16,223,860,652	$469,551,457,414	3.46%	43,477	3,636
2005	$15,630,467,572	$497,169,968,927	3.14%	45,010	3,673

Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

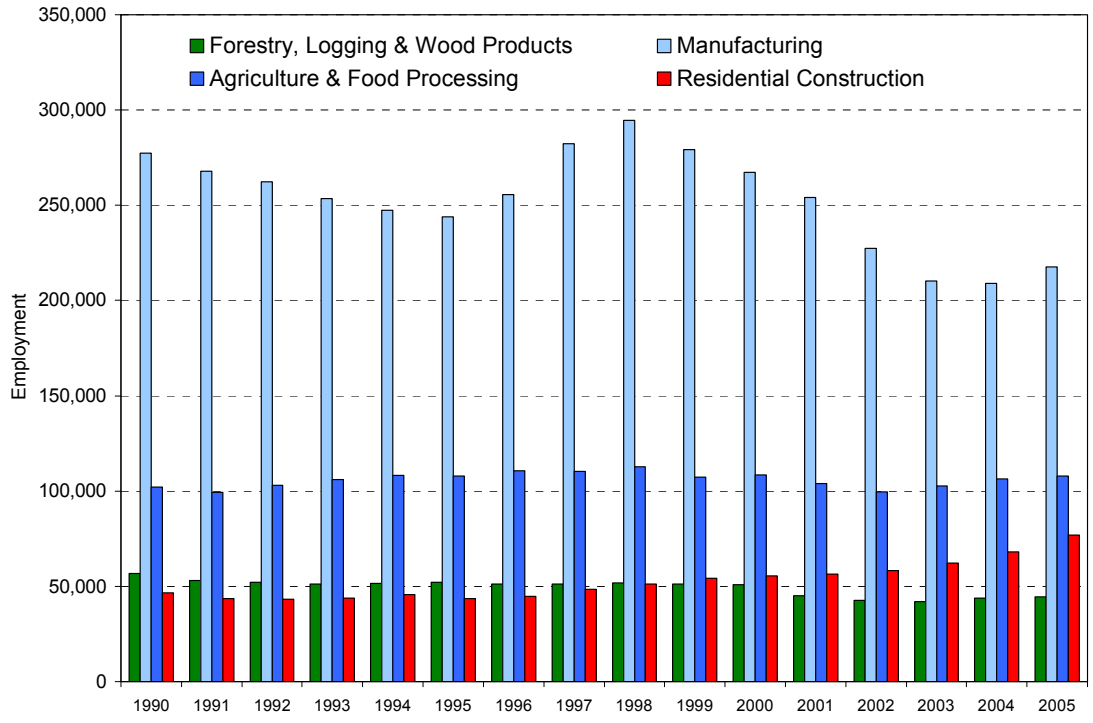

Figure 8: Comparative employment between major industries (see appendix for industry classifications).
Source: WA State Employment Security Department website 2006.

Compared to other industry sectors, the forestry and forest products sector has been relatively stable (Figure 8). For example, employment in the manufacturing sector declined by 12% between 1994 and 2005 while it dropped by 13.5% in the forestry and forest products sector. Employment in the agricultural sector remained relatively stable over the period while employment in residential construction sector jumped by 69%. Thus the forestry and forest products sector has remained a stable component of the State's economy, although there have been important changes within specific sub-sectors.

The forestry and forest products industry is composed of four main sectors: forestry and logging, wood manufacturing, paper manufacturing and furniture manufacturing. The largest sector by employment is wood manufacturing with 42% of the industry employment followed by paper manufacturing (27%), furniture manufacturing (17%) and forestry and logging (13%). Evaluating the industry sectors on the basis of gross business income, the largest sectors remain wood manufacturing with a 50% share, followed by paper manufacturing (30%), forestry and logging (13%) and furniture manufacturing (6%).

Despite a 15 year decline in employment, the forestry and logging sector saw a dramatic increase in gross business revenue between 2001 and 2004 before declining in 2005 (Figure 9). Employment has followed harvest levels to a surprising degree as illustrated in Figure 10, suggesting a close linkage between the two. Productivity within the logging sector has continued declining over the past decade.

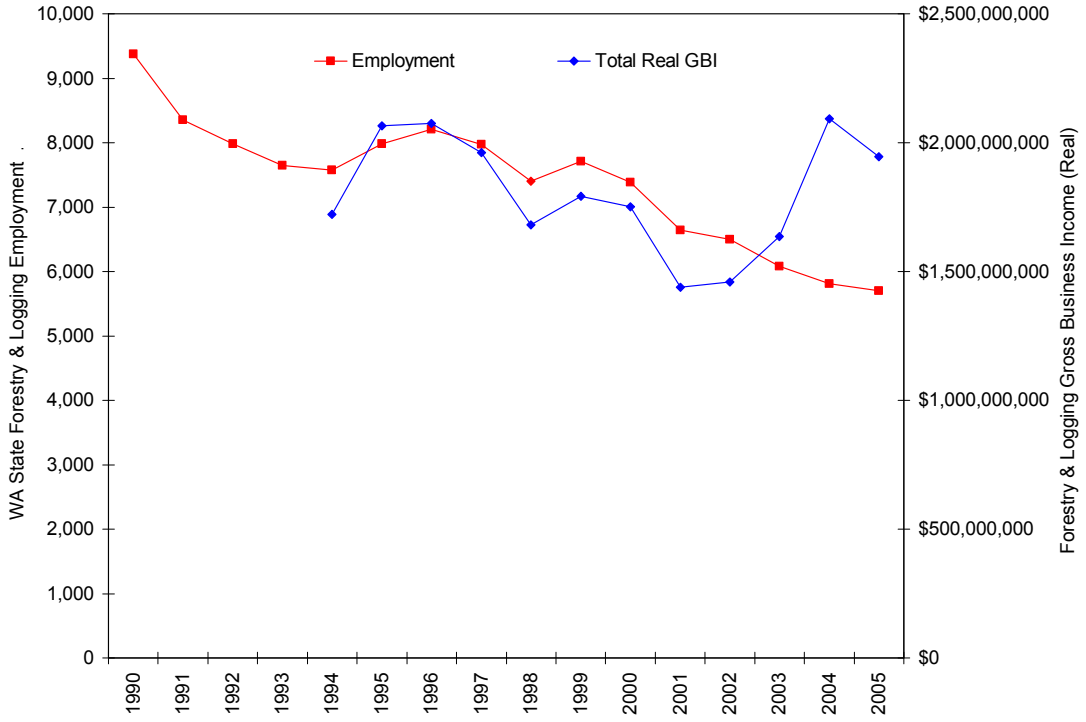

Figure 9: Employment and real GBI in the forestry and logging sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

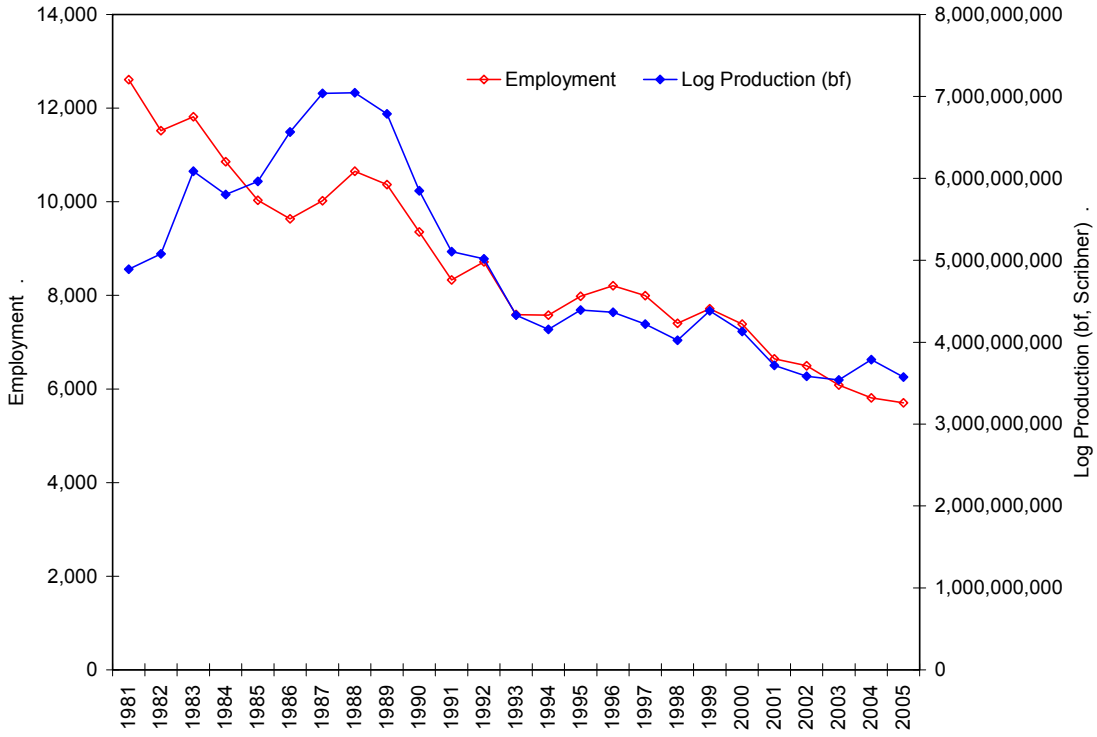

Figure 10: Employment and timber harvest in the logging sector, 1981-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

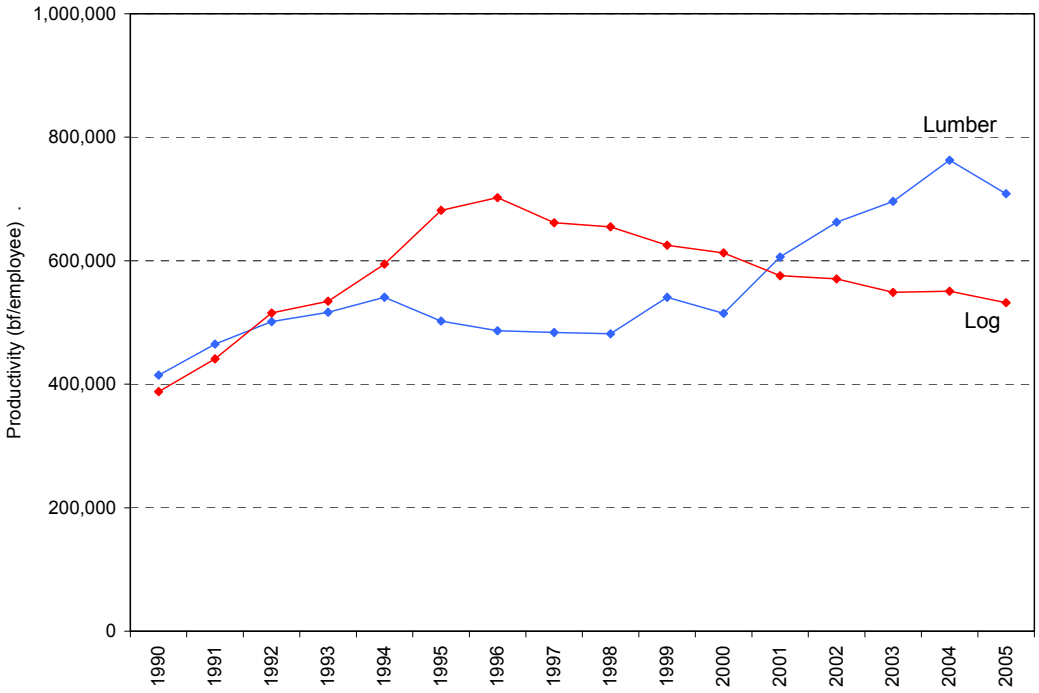

Figure 11: Worker productivity in the logging and sawmills sectors, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

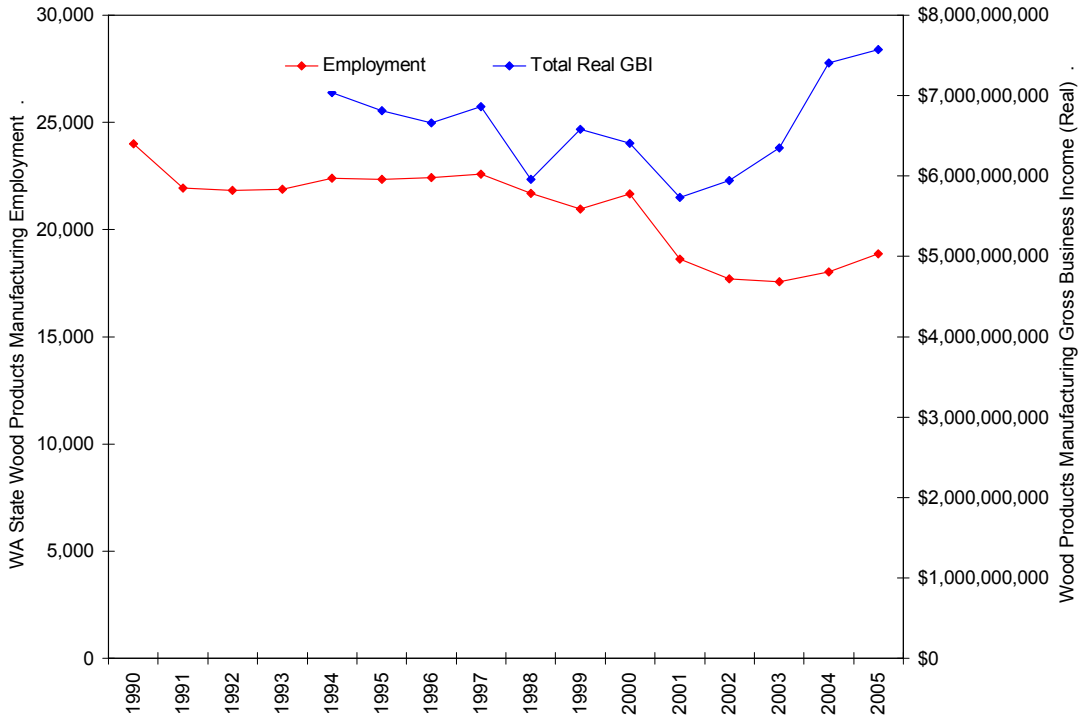

Figure 12: Employment and real GBI in the wood manufacturing sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

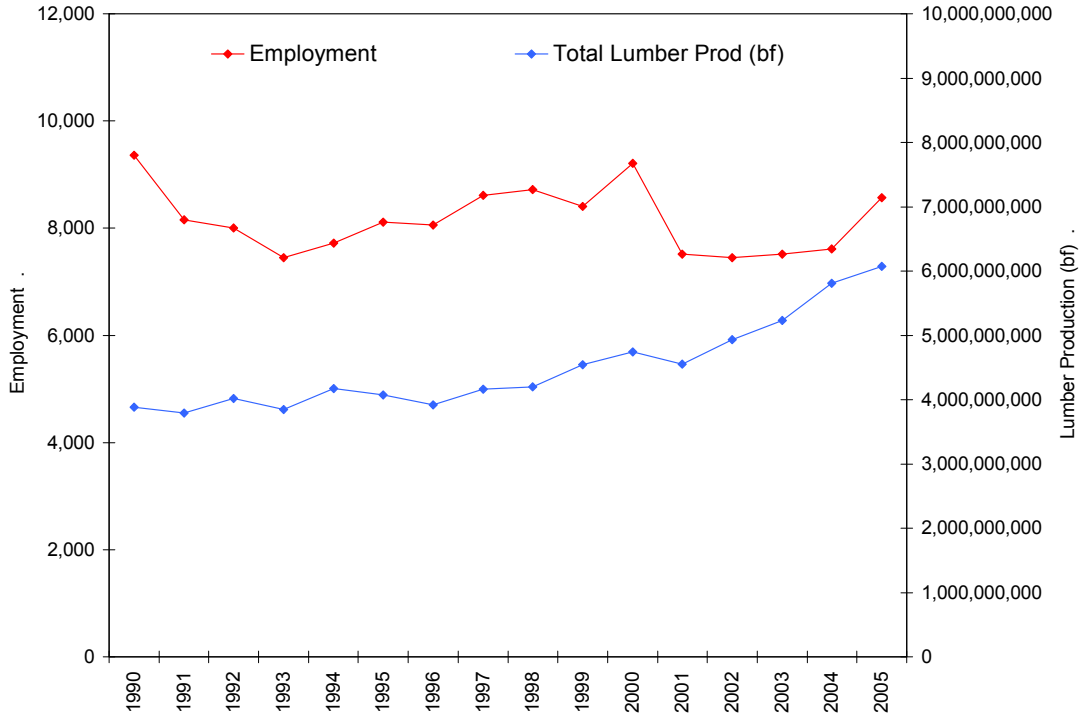

Figure 13: Employment and lumber production in the sawmill sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WWPA Yearbook various years.

The largest sector within the forestry and forest products industry is the wood manufacturing sector, both in terms of employment and gross business income. While employment has declined substantially (15.8%) over the period 1994-2005, GBI has increased, particularly during the period 2001-2005 when it increased by 32%, Figure 12. Much of this increase can be attributed to the strong performance of the lumber manufacturing sub-sector, Figure 13. Strong housing starts over the period 2000-2005 as well as record demand for softwood lumber provided high lumber prices and helped to increase gross business income for sawmills. A combination of lower housing starts and increased lumber imports from Canada (as a result of the new Softwood Lumber Agreement) has weakened softwood lumber prices throughout much of 2006 and will adversely affect the financial performance of the industry in 2006 (Figure 14). More important, a flood of Canadian lumber arrived into the US between the signing of the new softwood lumber agreement and its implementation a month later. This short-term lumber glut had a chilling effect on lumber prices.

The softwood lumber industry in the western US has increased production since the mid 1990's and represents approximately 50% of domestic softwood lumber production, Figure 15. However, with US production increasing by approximately .8% annually, and domestic consumption of softwood lumber increasing by 2.7% annually, the US will increasingly rely on imports to fill the supply gap (Figure 16).

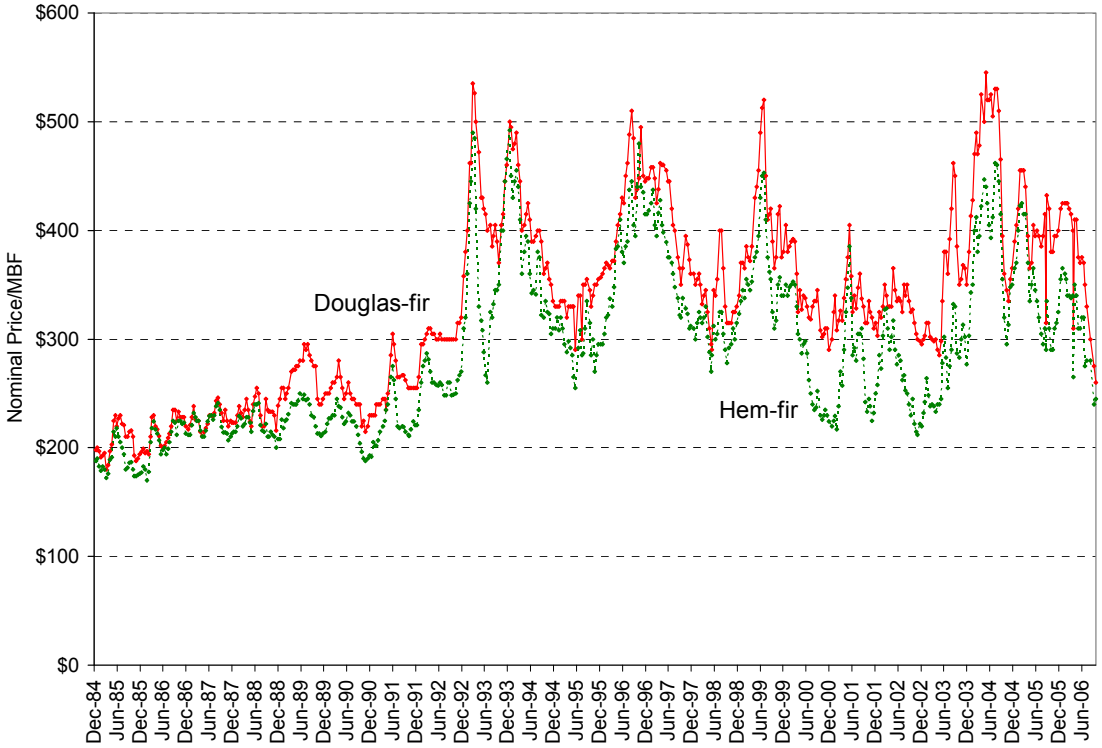

Figure 14: Nominal prices for Douglas-fir and hemlock dimension lumber (2x4, Std&Btr, KD, RL).
Source: Random Lengths, various.

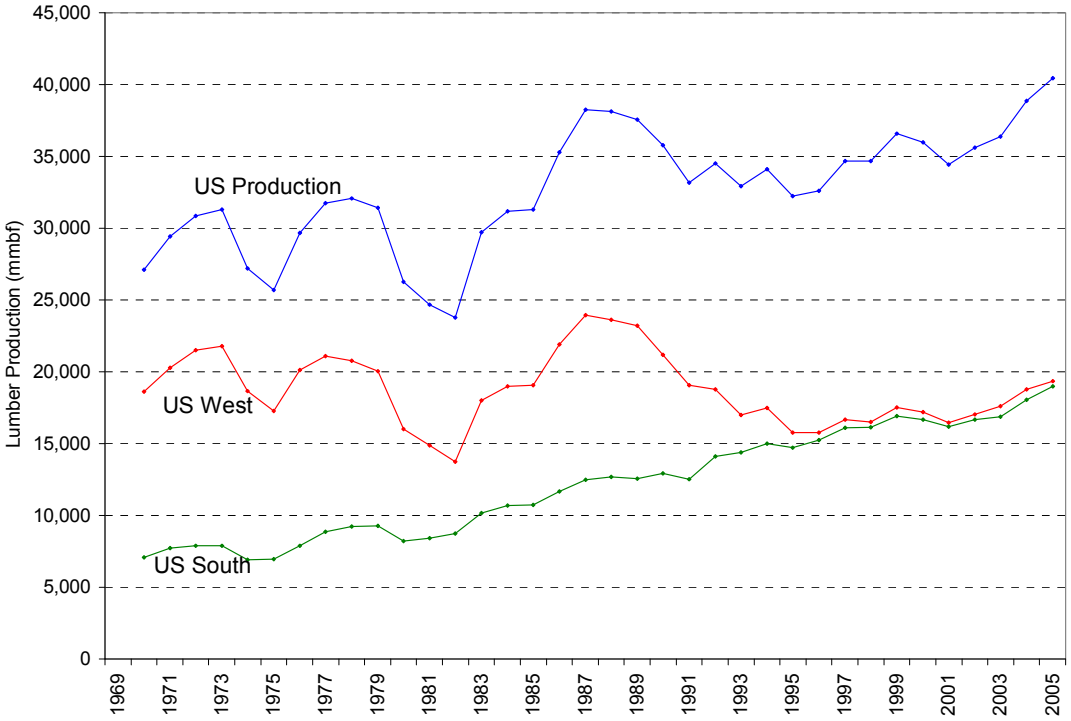

Figure 15: Softwood lumber production by geographic region.
Source: WWPA Yearbook various years.

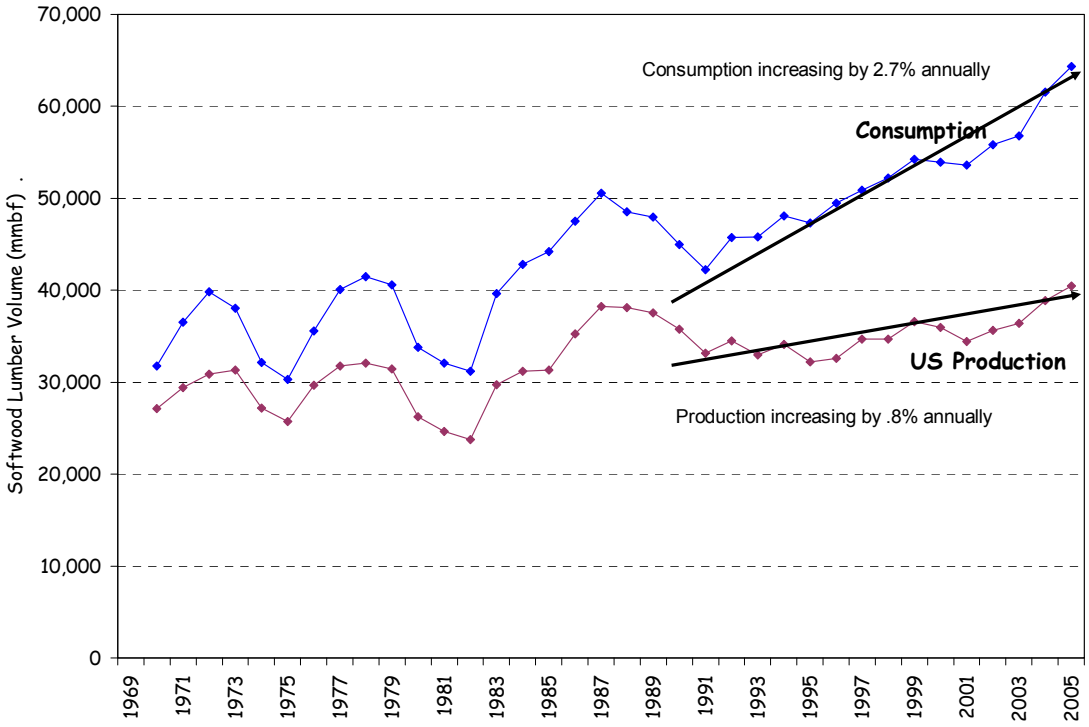

Figure 16: Consumption is increasing faster than domestic production
Source: WWPA Yearbook various years.

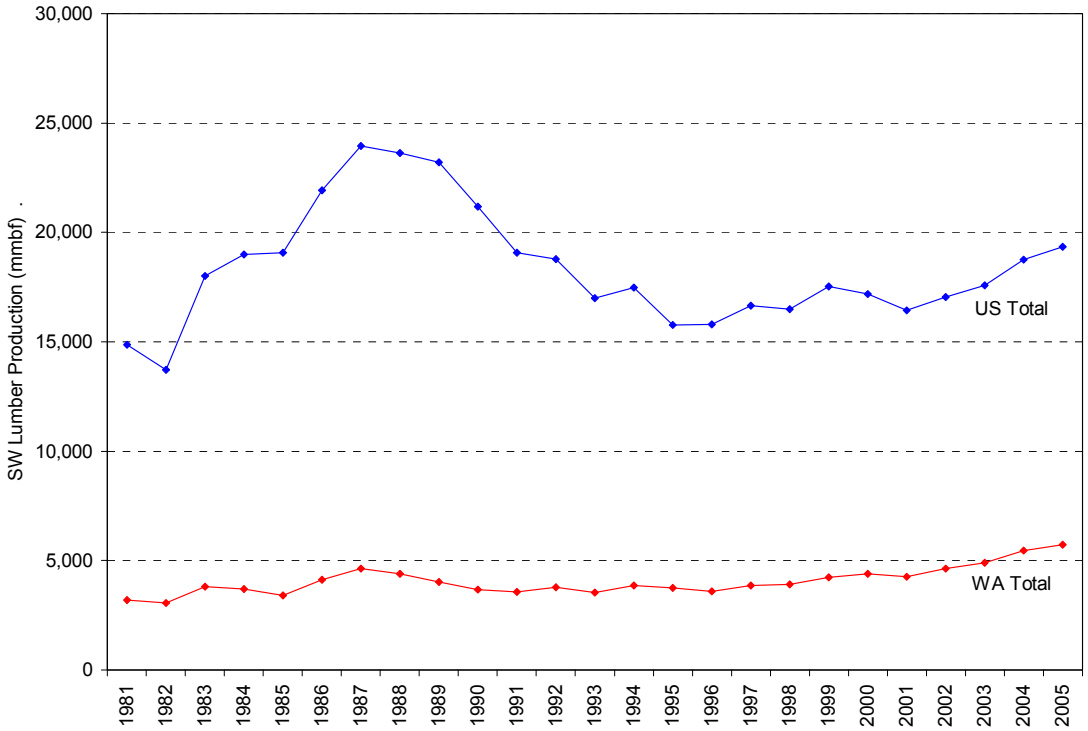

Figure 17: Softwood lumber production in Washington State, 1981-2005.
Source: WWPA Yearbook various years.

The sawmill industry in Washington state suffered through a tough period between 1987 and 1993, much of which can be attributed to a drop in demand caused by a recession during 1990-1991 and the loss of federal timber as a result of the decision to list the spotted owl as an endangered species in 1989. Between 1987 and 1993 softwood lumber production in Washington decreased by 23.5% as 45 sawmills closed and almost 1,400 jobs were lost (Figure 17 and Table 3). Industry consolidation continued throughout the next decade and by 2005 the number of sawmills had declined from 217 (in 1994) to 128. Much of this decline in sawmills can be attributed to the closure of older, inefficient sawmills that relied on the large, old-growth logs coming from the federal forests. Despite the huge drop in sawmills, employment in the sawmill sector actually increased from 7,721 to 8,565 between 1994 and 2005 as larger more efficient sawmills were built to replace the older mills being closed.

This can be clearly seen in the productivity numbers presented in Table 3. During the period 1994-2005, the number of workers per sawmill increased from 35.6 to 66.9 (an 88% increase). During the same period, the volume of lumber produced per sawmill increased from 18 million board feet to 45 million board feet (a 150% increase) and lumber production per employee increased from 500,000 board feet to 670,000 board feet (a 33% increase). These numbers suggest that not only were mills getting bigger but the industry was also investing in new processing technologies that improved lumber yields and increased production efficiency. This investment is clearly reflected in the information presented in Figure 3 and Figure 18.

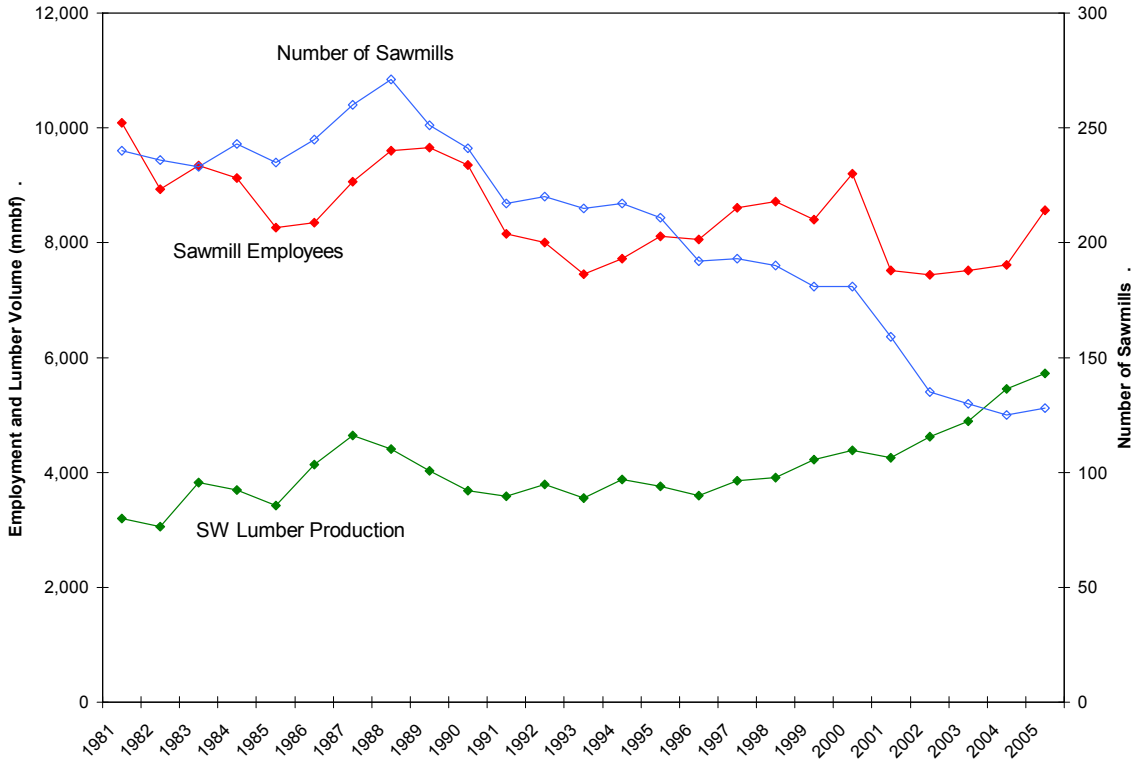

Figure 18: Demographic changes within the Washington sawmill industry, 1981-2005.
Source: WA State Employment Security Department website 2006; WWPA Yearbook various years.

Table 3: Summary statistics for Washington sawmills, 1981-2005.

	Lumber Production (bf)	Number of Sawmills	Sawmill Employment	Lumber Production bf per Sawmill	Employment/Mill	Lumber Production bf per Employee
1981	3,400,000,000	240	10,083	14,166,667	42.01	337,189
1982	3,259,000,000	236	8,928	13,809,322	37.83	365,032
1983	4,021,000,000	233	9,346	17,257,511	40.11	430,236
1984	3,897,000,000	243	9,122	16,037,037	37.54	427,215
1985	3,619,000,000	235	8,268	15,400,000	35.18	437,701
1986	4,332,000,000	245	8,352	17,681,633	34.09	518,652
1987	4,865,000,000	260	9,059	18,711,538	34.84	537,044
1988	4,633,000,000	271	9,604	17,095,941	35.44	482,397
1989	4,274,000,000	251	9,651	17,027,888	38.45	442,866
1990	3,918,000,000	241	9,356	16,257,261	38.82	418,769
1991	3,816,000,000	217	8,152	17,585,253	37.57	468,106
1992	4,054,000,000	220	8,006	18,427,273	36.39	506,370
1993	3,848,666,000	215	7,451	17,900,772	34.66	516,530
1994	4,174,515,000	217	7,721	19,237,396	35.58	540,670
1995	4,072,454,000	211	8,109	19,300,730	38.43	502,214
1996	3,921,792,000	192	8,061	20,426,000	41.98	486,514
1997	4,165,039,000	193	8,612	21,580,513	44.62	483,632
1998	4,197,976,000	190	8,718	22,094,611	45.88	481,530
1999	4,544,831,000	181	8,403	25,109,564	46.43	540,858
2000	4,739,324,000	181	9,206	26,184,110	50.86	514,808
2001	4,553,264,000	159	7,515	28,636,881	47.26	605,890
2002	4,931,309,000	135	7,446	36,528,215	55.16	662,276
2003	5,233,391,000	130	7,519	40,256,854	57.84	696,022
2004	5,808,212,000	125	7,613	46,465,696	60.90	762,933
2005	6,068,082,000	128	8,565	47,406,891	66.91	708,474
2006	5,450,000,000e					

Source: WWPA Yearbook and Washington Hardwood Commission various years.

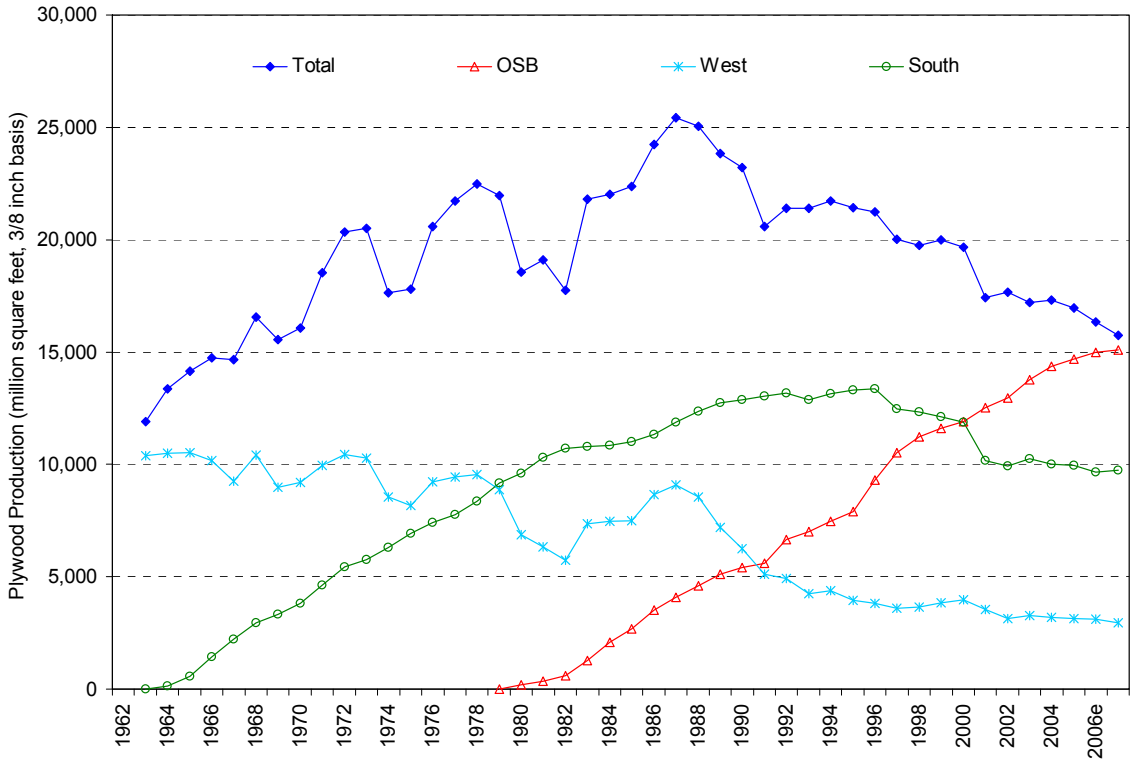

Figure 19: Production of plywood and oriented strand board in the US, by region.
Source: APA Annual Yearbook, various years.

Under the NAICS classification system, the softwood plywood industry includes both plywood manufacturers and veneer manufacturers. The commercial softwood plywood industry really began in Washington and Oregon at the turn of the 20th century as manufacturers took advantage of the large high quality Douglas-fir and white pine logs. However, following the introduction of lower cost southern pine plywood in the early 1960's, the demand for western plywood began a decline that continues to today, Figures 19 and 20. In fact, to a large degree both western and southern plywood are being replaced by lower cost oriented strand board (OSB). It is important to note that as the end-use market transitions from plywood to OSB, there are no OSB mills located in the state of Washington.

The plywood industry in Washington, previously one of the largest in the US, has been in decline since 1962, Figure 20. The number of plywood mills has dropped from 35 to 8 during this period although plywood production has only declined from 1.8 billion square feet (3/8 inch basis) to 1.1 billion square feet (3/8 inch basis). As seen in the sawmill industry, the closure of smaller, inefficient mills has been offset to a degree by the establishment of larger, more efficient plywood mills. Annual production per mill in 1962 was just 52 million square feet whereas this has jumped to 137 million square feet in 2005 (Figure 21). The challenge for the structural panel industry is to successfully make the transition from plywood to OSB.

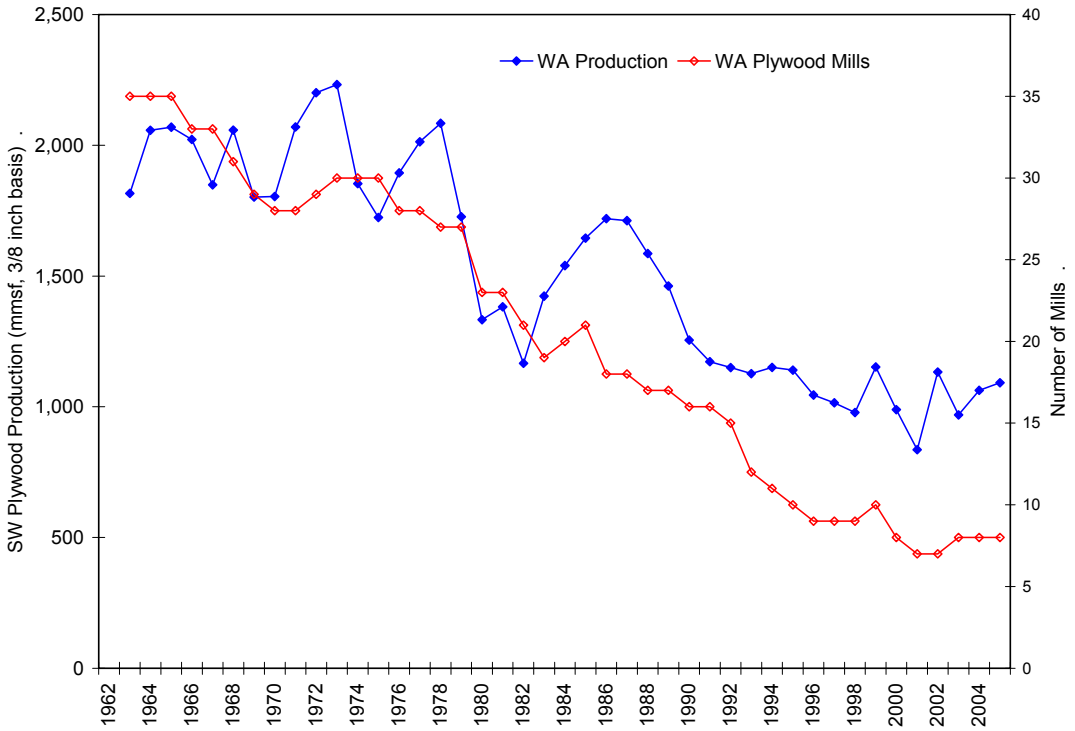

Figure 20: Demographic changes within the Washington plywood industry, 1962-2005.
Source: APA Annual Yearbook, various years.

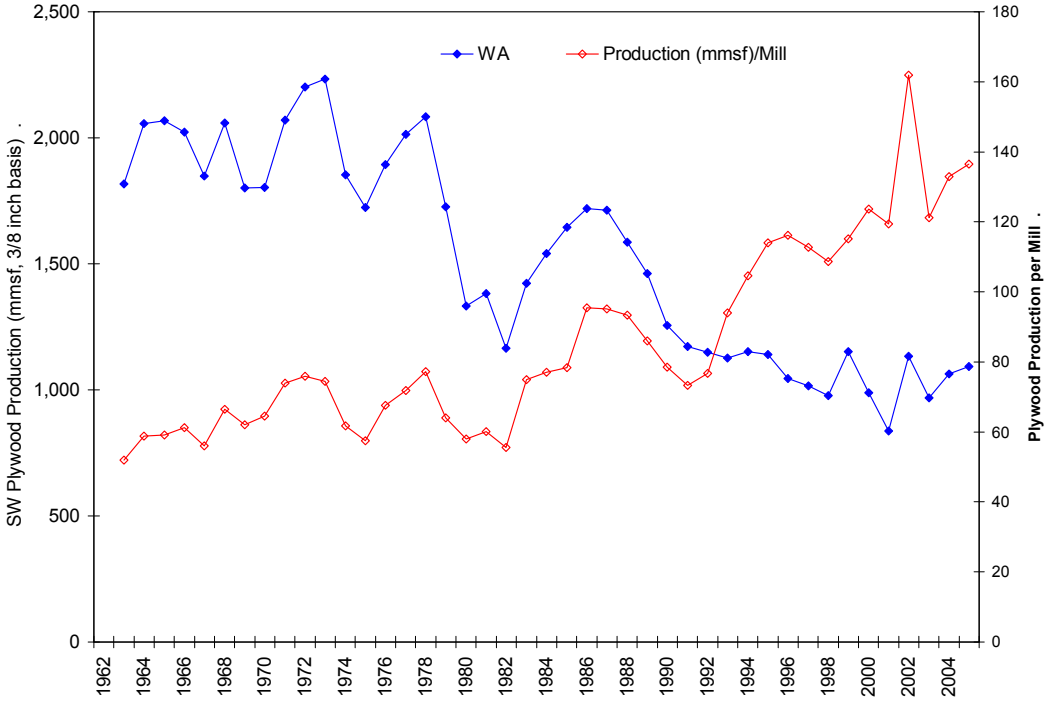

Figure 21: Plywood production and production per mill, 1962-2005.
Source: APA Annual Yearbook, various years.

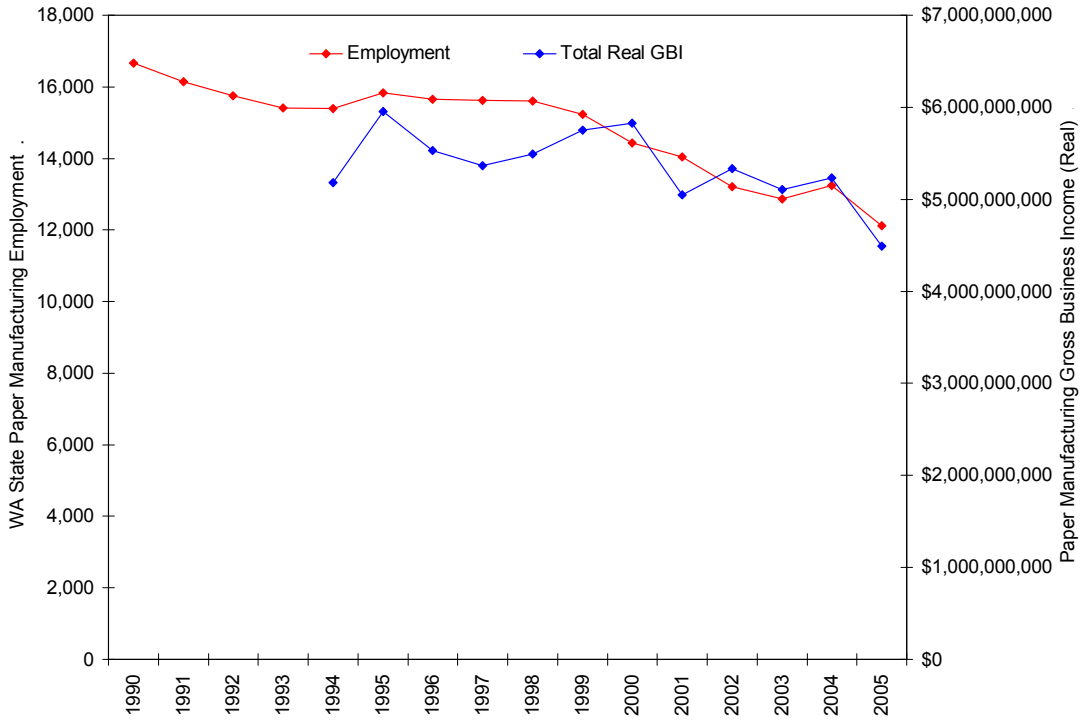

Figure 22: Employment and real GBI in the pulp and paper manufacturing sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

The Washington pulp and paper sector is the second largest following wood products manufacturing. In addition to its importance within the economy, this sector also plays an important demand role within the forest products industry. Pulp and paper companies are important consumers of lower quality pulp logs as well as providing a demand for by-products from other forest products industries such as sawdust and planer shavings from the sawmill industry. Given the cost structure of the sawmill industry, lumber manufacturers often break even at best with their lumber production and it is the sales of their by-products that provide them with an operating profit. Thus this industry segment is particularly important to the health of the sawmill and logging sectors. From a strategic industry perspective, it is extremely important that this industry remain healthy and viable within the state of Washington.

Since 1990 there has been a contraction in the number of pulp and paper mills (NAICS: 322) and employment within the sector. Between 1990 and 2005, the number of pulp and paper mills has declined from 106 to 93, although specific numbers for pulp mills and paperboard mills are not available due to confidentiality concerns. Across the entire pulp and paper sector employment has declined from 16,663 in 190 to 12,117 in 2005. Similarly, the real gross business income for the sector has declined slightly from $5.2 billion to $4.5 billion over the same time period.

In contrast to the trends observed in many industry sectors, the wood furniture industry is doing well. Being primarily a consumer oriented industry, it competes in a different market than do most of the other forest products sectors in Washington. Between 1994 and 2005, the industry has experienced solid growth in employment, gross business income and the number of firms operating in the industry. Gross business income increased from $516 million to $899 million during this period while employment jumped from 5,400 to 7,600 although the number of wood furniture manufacturers decreased slightly from 536 to 531.

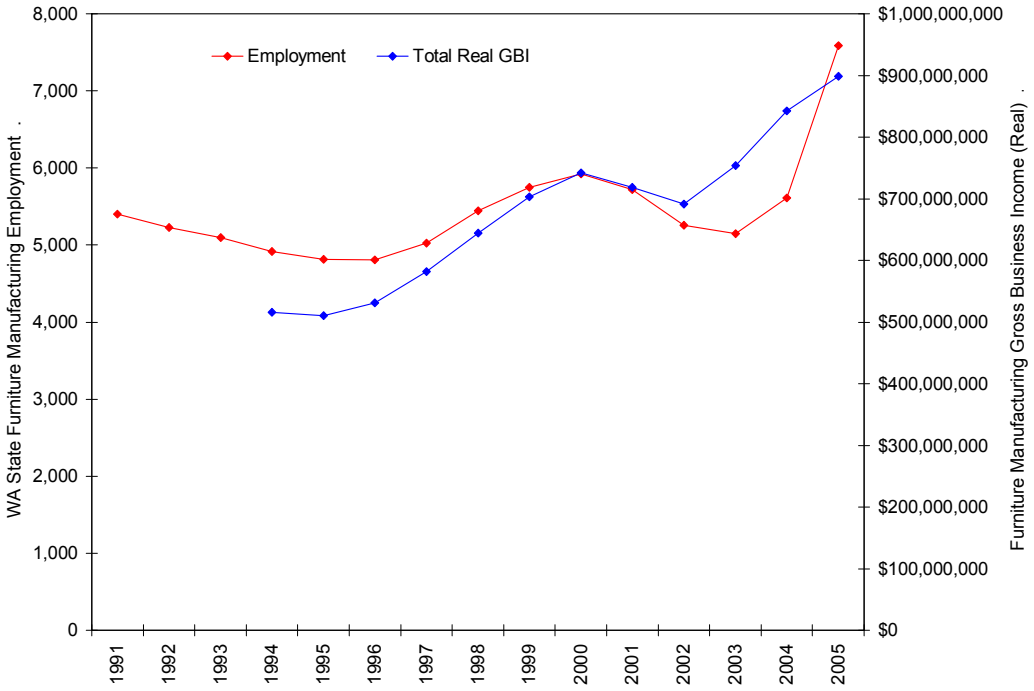

Figure 23: Employment and real GBI in the wood furniture manufacturing sector, 1990-2005.
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

Economic Contribution of the Forestry and Forest Products Sector at the Timbershed Level

Another important consideration regarding the economic importance of the forestry and forest products industries in Washington is their contribution to local economies. Whereas business data are theoretically available at the county level, oftentimes confidentiality concerns preclude the reporting of these data. In addition, the effort to link the economic analysis with the timber supply analysis suggests that it would be useful for the economic data to be aggregated in such a way that the results can be reported to coincide with the timbersheds developed for use in the timber supply study. As a result, the second phase of the economic analysis will look at the economic contribution of the forestry and forest products industries within the timbersheds defined by the timber supply study.

Table 4: Regional groupings of counties employed in this study.

North Coast	***North Puget Sound***
Clallam and Jefferson	King, Snohomish, Island, San Juan, Skagit and Whatcom
South Coast	***East Cascade***
Grays Harbor and Pacific	Okanogan, Chelan, Douglas, Kittitas, Yakima and Klickitat
Southwest	***Inland Empire***
Lewis, Wahkiakum, Cowlitz, Clark and Skamania	Ferry, Stevens, Pend Oreille, Lincoln, Spokane, Grant, Adams, Whitman, Benton, Franklin, Walla Walla, Columbia, Garfield and Asotin
South Puget Sound	
Kitsap, Pierce, Thurston and Mason	

Methodology for Estimating Gross Business Income Within the Timbersheds

In order to develop the economic information for this component of the economic analysis, it required aggregating the county level economic data for the counties included in each timbershed. However, the WA State Department of Revenue does not collect gross business information for specific industries at the county level, only at the state level. While there are a number of reasons for this, it required that we develop a methodology to estimate gross business income within each timbershed. Two proxies that are correlated with gross business income are total wages and total employment within the industry sectors of interest. However, since both measures are high correlated, we employed both measures in a regression to determine which provided the best estimate. The regression methodology and results are provided in the appendix. Ultimately it was determined that total wages provided a better estimate of gross business income.

Direct and Indirect Impact of Jobs in the Forestry and Forest Products Sectors

Increases in the timber harvest activities on state forests can reasonably be expected to result in direct economic benefits for rural communities. Multiplier benefits derived from increased employment ripple through the entire state economy as well. Existing economic models to estimate the full impact of changes in the forest sector on the economy are dated. Recent estimates of direct employment impacts are incomplete and cannot be directly linked to models that characterize the full direct and indirect impacts. Warren (2004) estimated direct forest industry employment in Washington and Oregon at 13.2 workers per million board feet of annual timber harvest for the year 2002. Han et al. (2002) suggests that the number of direct jobs in Idaho may fluctuate from 9 to 11 workers per million board feet of timber harvest per year. In addition to direct forest industry employment, there are many more indirect jobs from timber harvest that provide benefits throughout the state. Conway (1994) developed a regional inter-industry econometric model called the Washington Projection and Simulation Model (WPSM). His model has been used to evaluate many policy and economic development changes in the state. He estimated the total direct and indirect jobs per year created from a million board foot of timber harvest in Washington State in 1992. He estimates that for every direct industry job per million board feet of timber harvest per year, an additional 4.2 indirect jobs were created within the state. For example, he estimated that in 1992 there were 7.7 direct jobs and 32.3 indirect jobs linked to each million board feet of timber harvest in Washington. In addition, revenue generated from DNR timber sales has a uniquely powerful impact on state wealth since one hundred percent of stumpage revenues are reinvested for the public good in government programs and services in Washington.

In 1994, Lippke and Conway developed an estimate of the economic costs associated with incremental decreases in trust revenue from reductions in the DNR timber sales program. Evidence at that time indicated that 29.7 Washington jobs would be lost for every $1 million in tax increases to replace lost trust revenue. Further public benefits are derived from DNR timber sales through the generation of state and local, and federal tax revenues. In 1996 these were calculated to be 11% and 19% of the Gross State Product, respectively (Lippke et al. 1996).

The original WPSM study on the forest sector provided information on seven direct forest products sectors, ten indirect sectors, associated sector incomes and product values, the Gross State Product, state and local taxes, federal taxes, and other downstream economic metrics of interest. The WPSM was used with a regional analysis methodology to produce regional economic impacts and multipliers. Unfortunately 1992 was the last time that the forest sector was updated in WSPM. Much has changed since then in both the processing stages and technology for wood products while the changing location of manufacturing facilities will affect the regional economic impacts.

In order to better understand the broad social and economic implications of adjustments in state harvest volumes and revenues, as well as changes in the production processes, we suggest that the old models be

updated using the most recent data and develop updated survey-based estimates for different processing technologies (e.g., short vs. long rotation thinning regimes, biofuel removals, and new wood processing technologies) that will allow for the recalculation of the direct and indirect economic impacts from these activities for use with the most recent statewide economic model data. Developing updated multiplier models would be helpful to the Board of Natural Resources, the DNR, state and local economic development people, educators, and others interested in the unique contribution that state timber harvests make to Washington's economy, especially its timber rural communities.

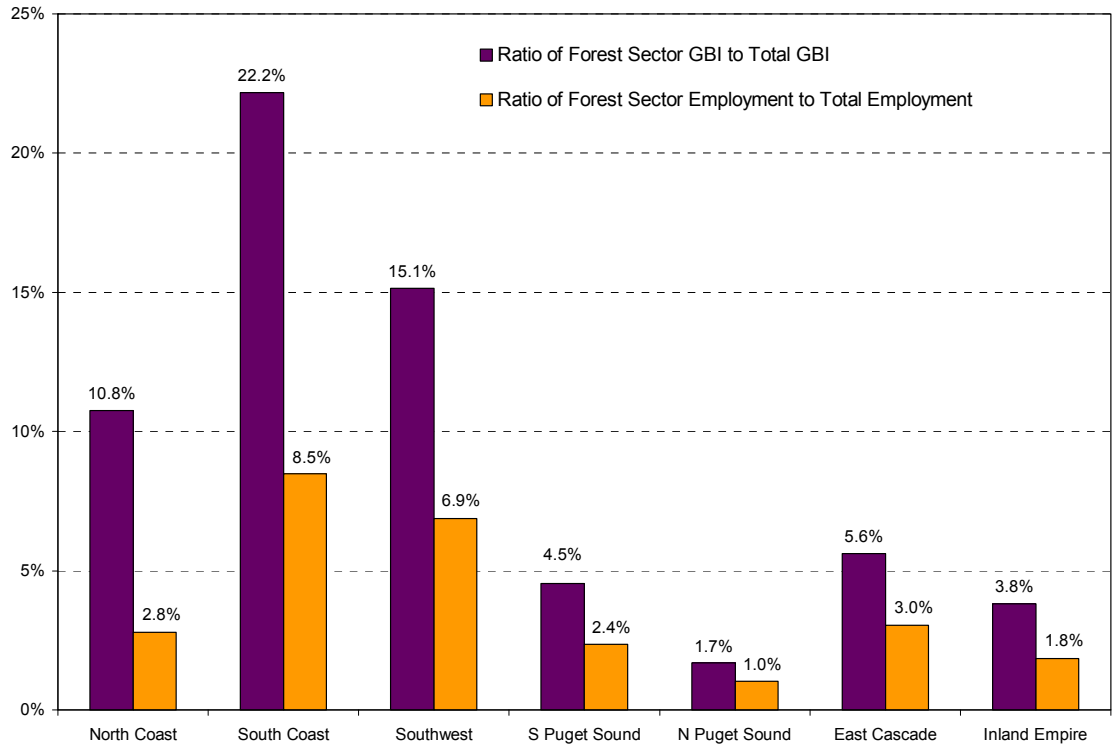

Figure 24: Forest sector GBI and employment with the timbersheds (2005).
Source: WA State Employment Security Department website 2006; WA State Department of Revenue website 2006.

The forestry and forest products sectors included in this study play a different role within the economies of the seven timbersheds included in the study. Gross business income from the forestry and forest products sectors is much more important in the north coast, south coast and southwest timbersheds than in the others. On the other hand, employment in this sector is most important in the south coast and southwest timbersheds. However, it is important to remember that this sector makes an important contribution to the economies of all timbersheds. It should also be remembered that there is an interconnectedness between the forestry and forest products industries in each timbershed, with logs from the coastal timbersheds providing raw material inputs to processors in other timbersheds while waste by-products from sawmills are shipped to paper manufacturers in other timbersheds. The following figures (Figures 25 thru 38) provide a summary of the trends in employment and gross business income for specific industry sectors within each timbershed.

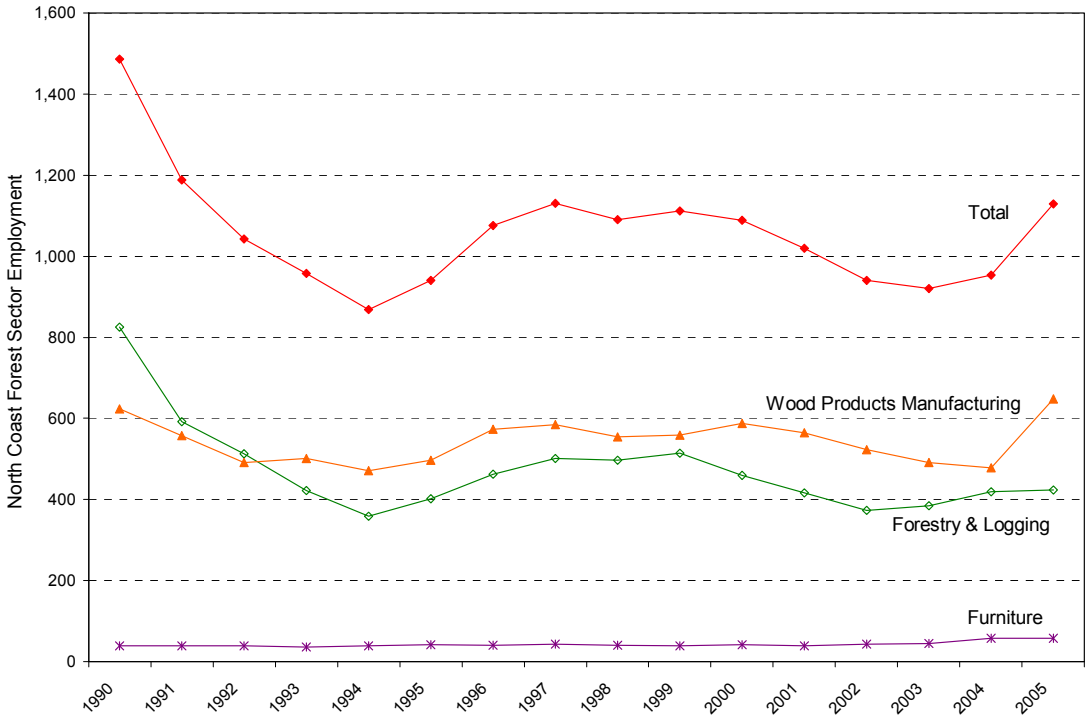

Figure 25: Employment within the North Coast forest sector.
Source: WA State Employment Security Department website 2006.

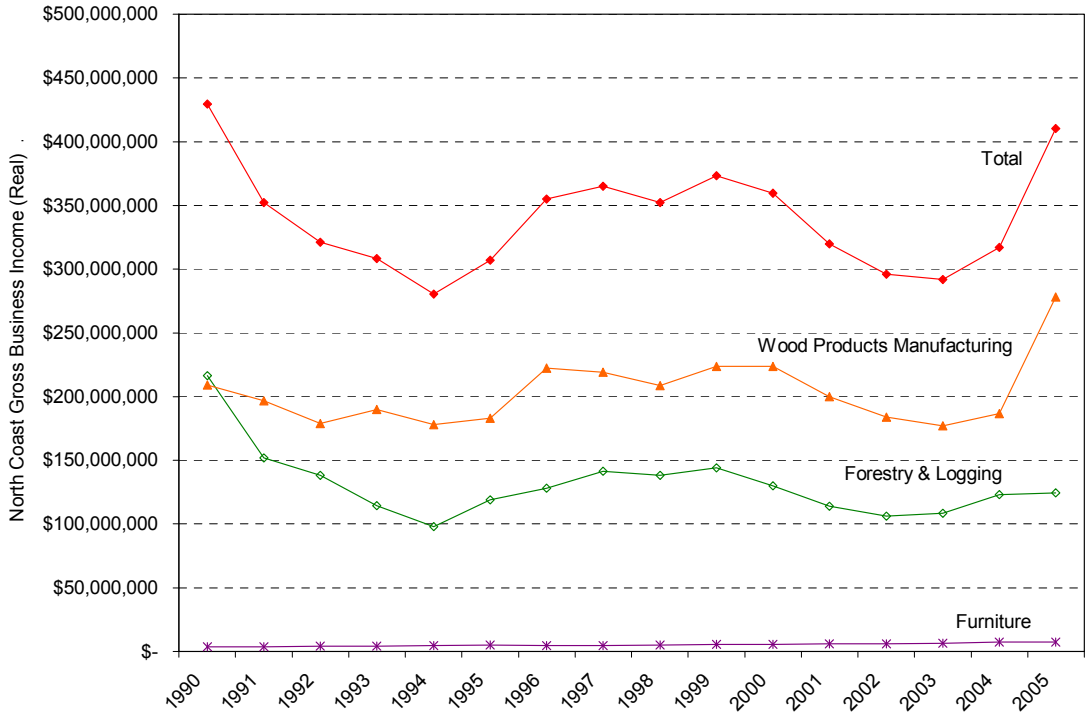

Figure 26: Gross business income within the North Coast forest sector.
Source: WA State Department of Revenue website 2006.

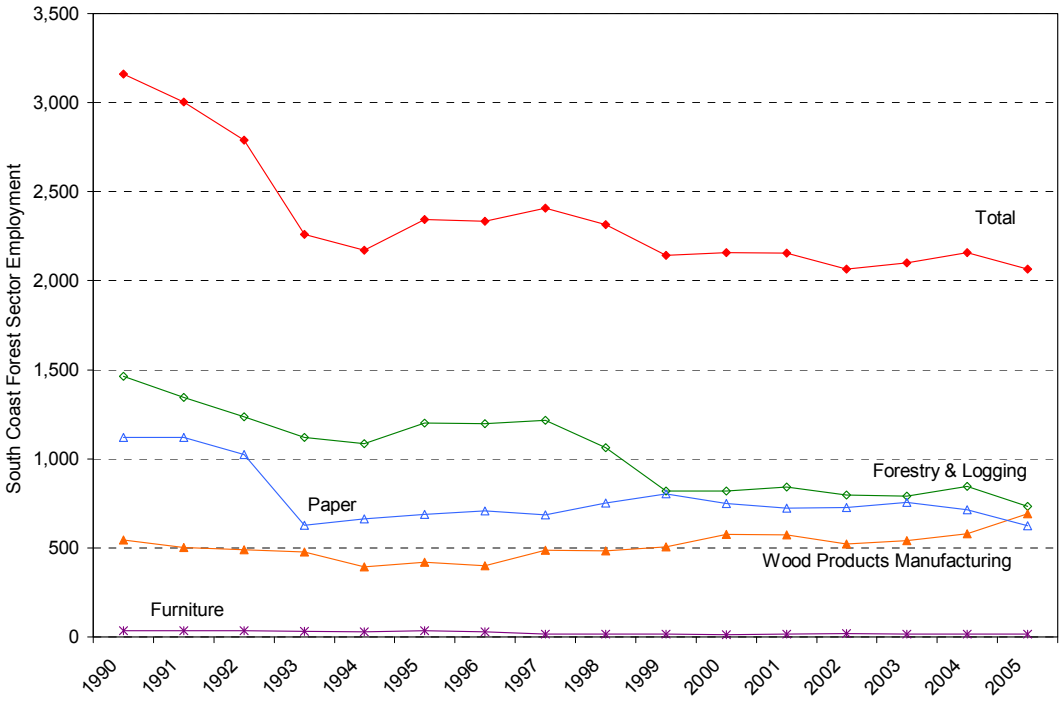

Figure 27: Employment within the South Coast forest sector.
Source: WA State Employment Security Department website 2006.

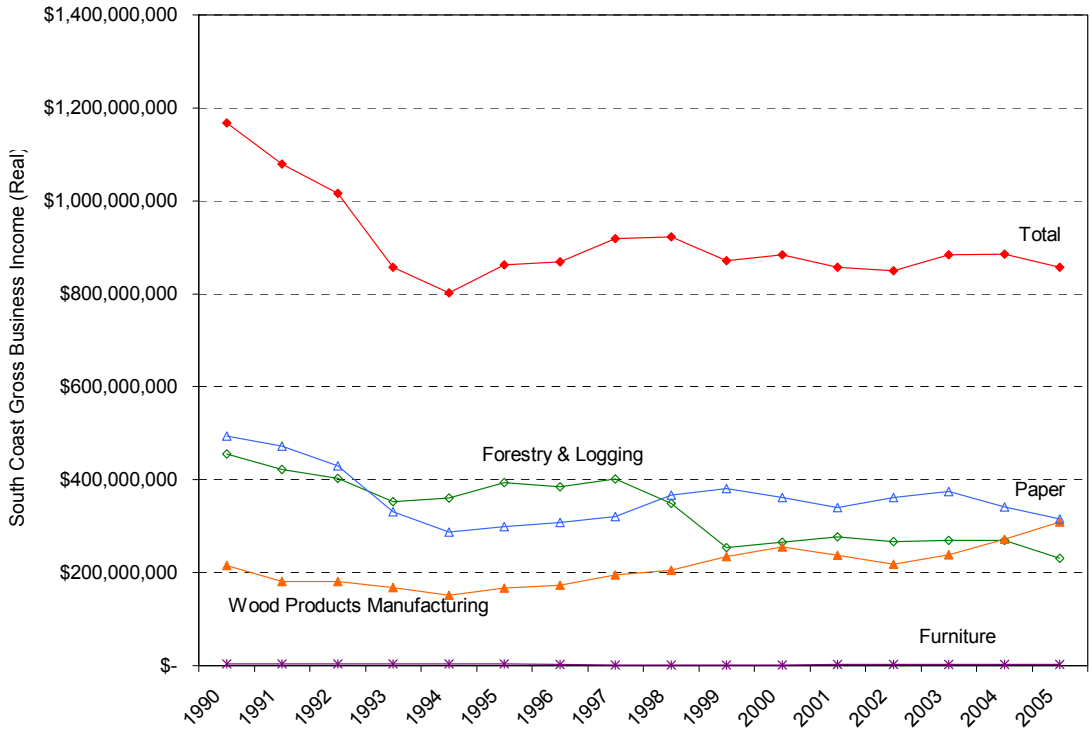

Figure 28: Gross business income within the South Coast forest sector.
Source: WA State Department of Revenue website 2006.

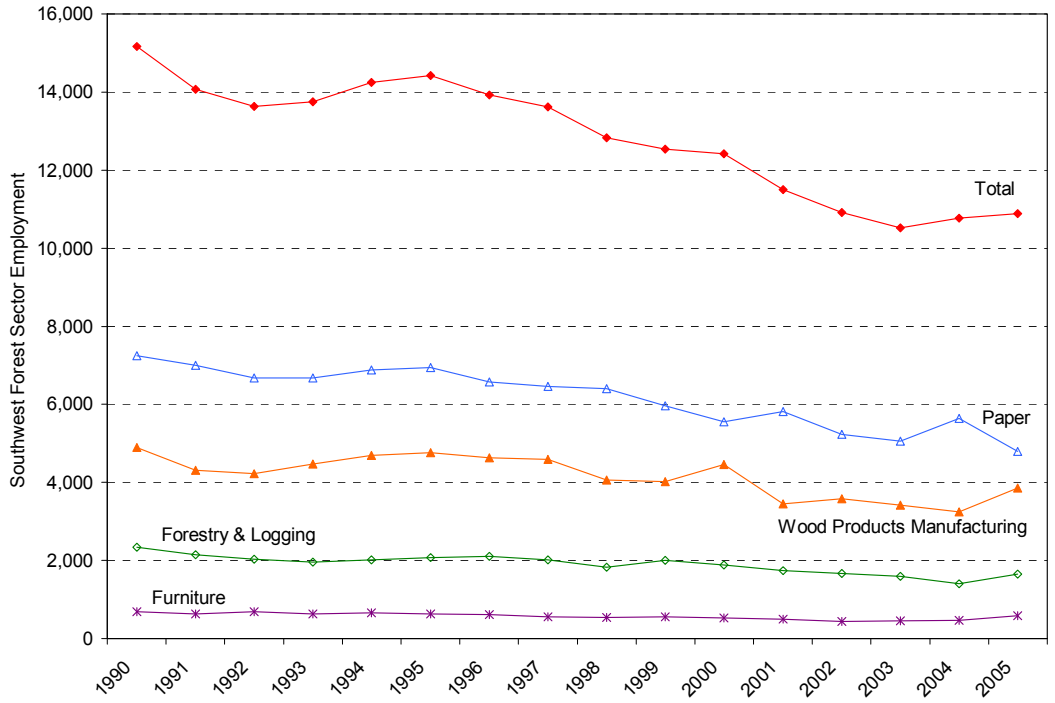

Figure 29: Employment within the Southwest forest sector.
Source: WA State Employment Security Department website 2006.

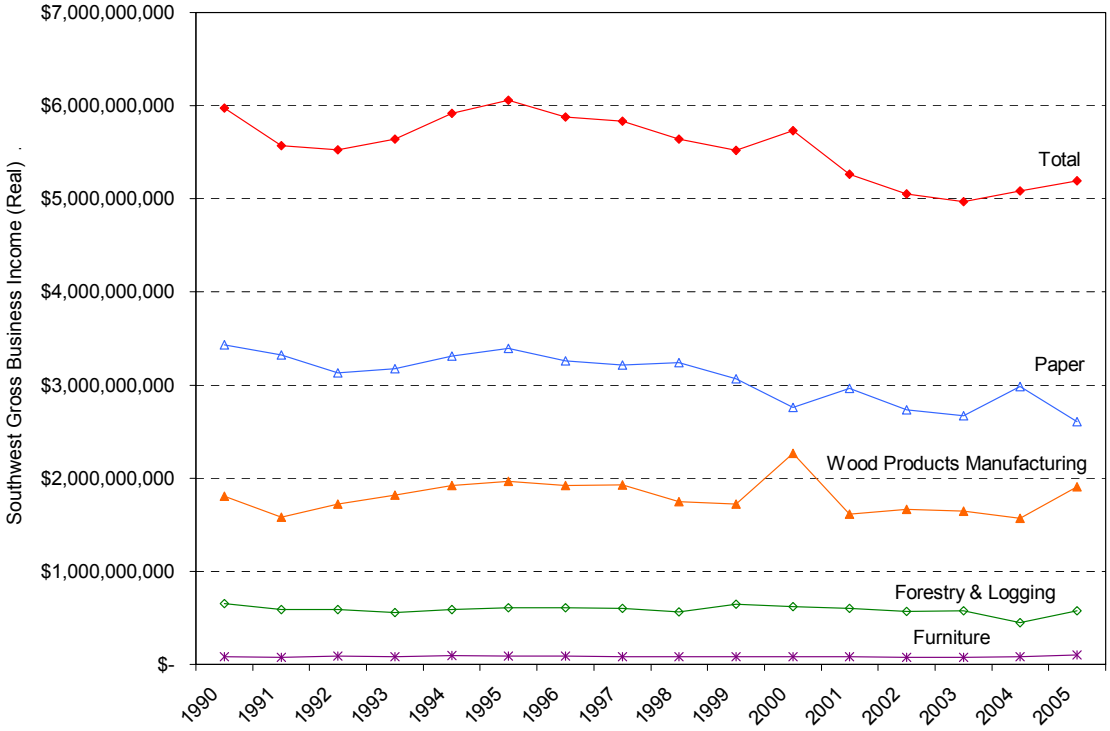

Figure 30: Gross business income within the Southwest forest sector.
Source: WA State Department of Revenue website 2006.

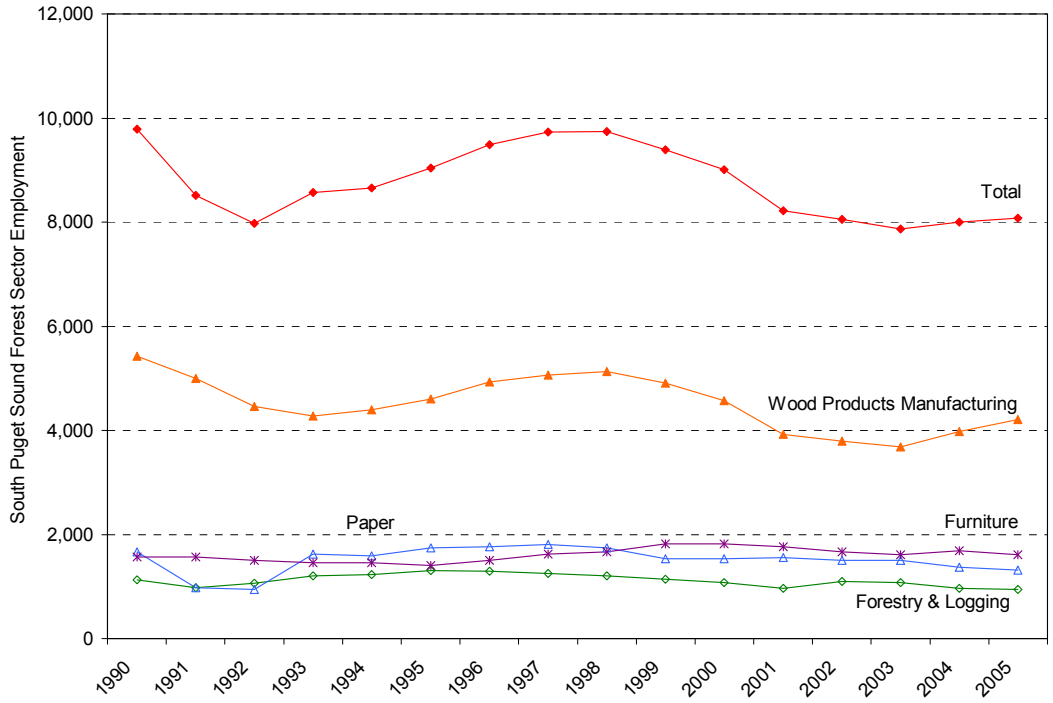

Figure 31: Employment within the South Puget Sound forest sector.
Source: WA State Employment Security Department website 2006.

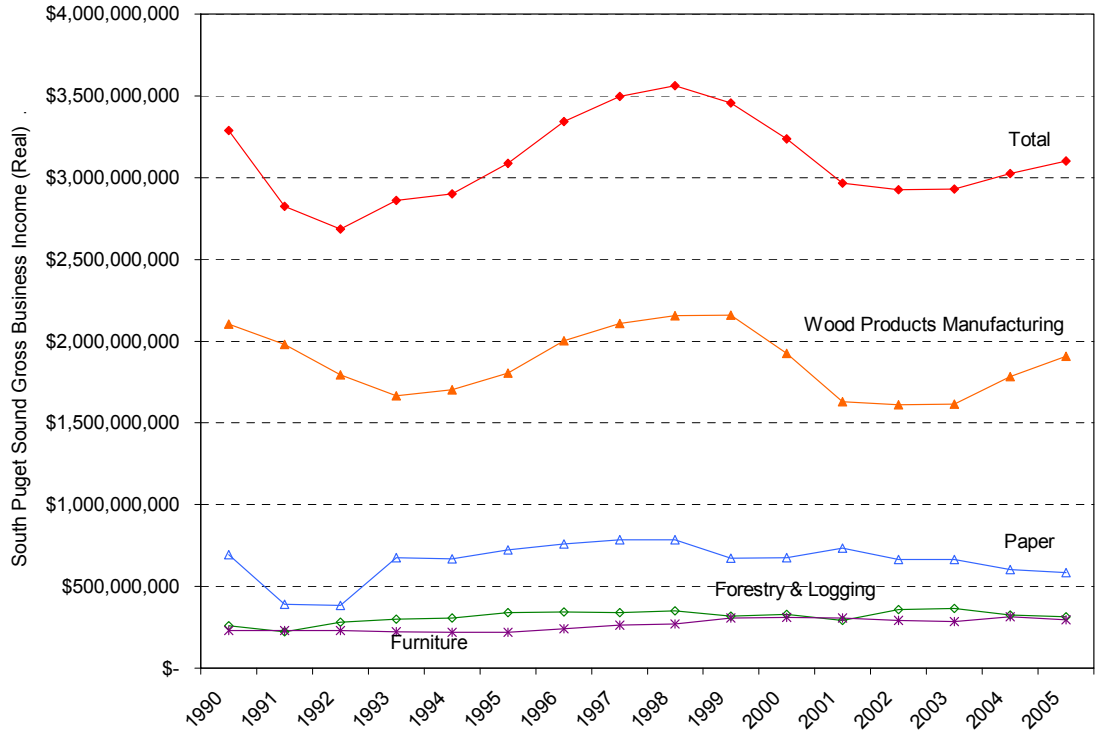

Figure 32: Gross business income within the South Puget Sound forest sector.
Source: WA State Department of Revenue website 2006.

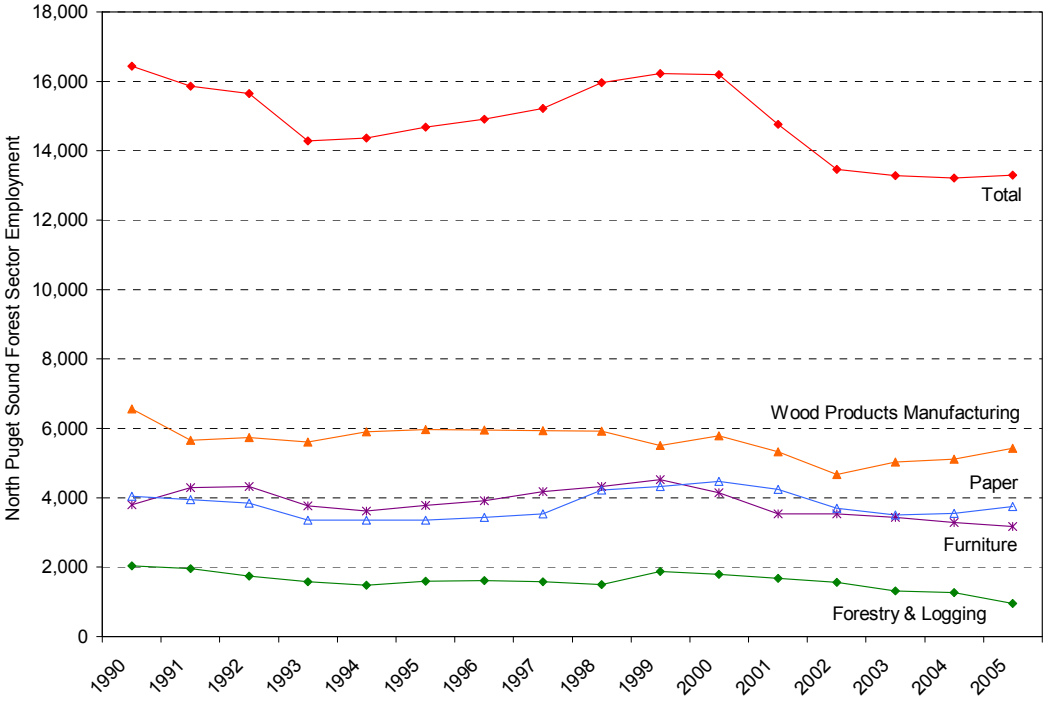

Figure 33: Employment within the North Puget Sound forest sector.
Source: WA State Employment Security Department website 2006.

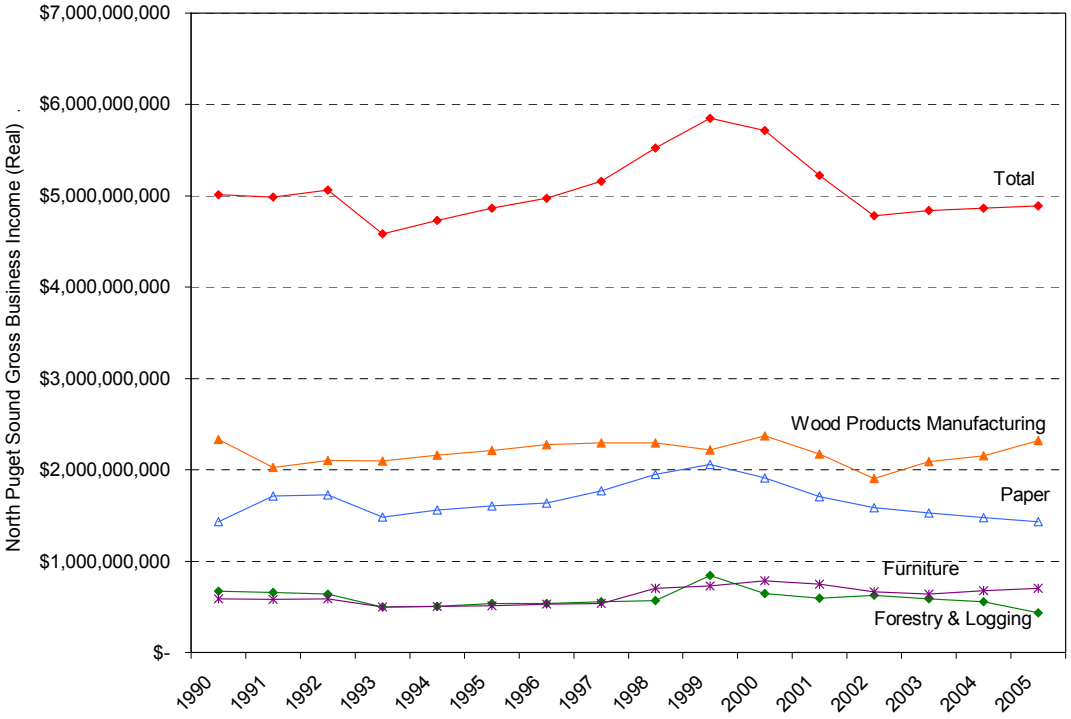

Figure 34: Gross business income within the North Puget Sound forest sector.
Source: WA State Department of Revenue website 2006.

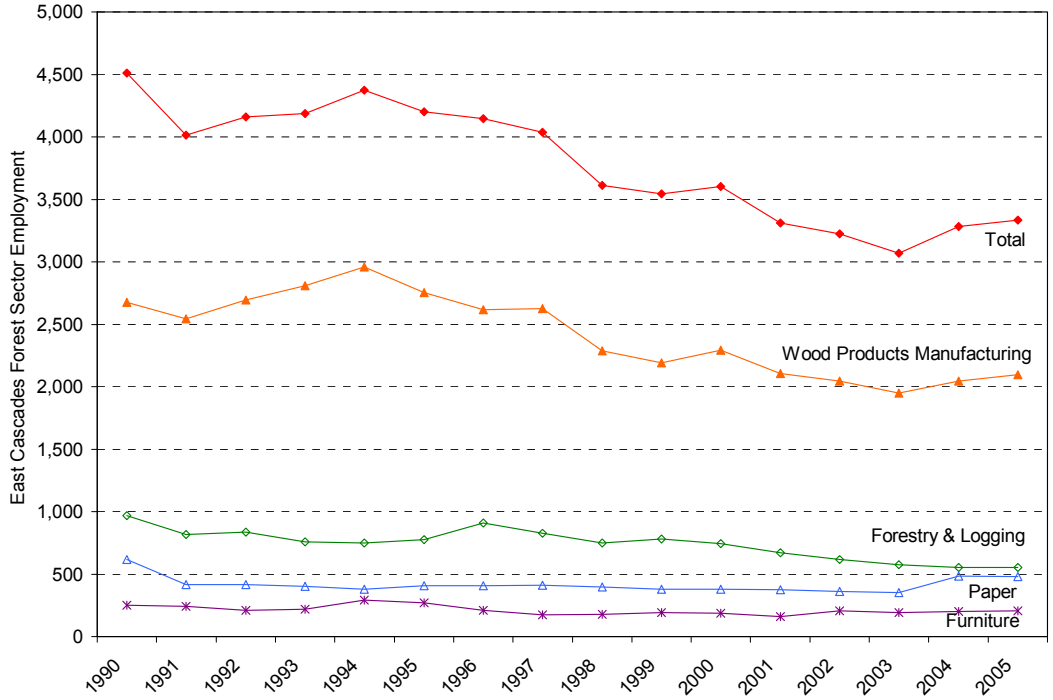

Figure 35: Employment within the East Cascades forest sector.
Source: WA State Employment Security Department website 2006.

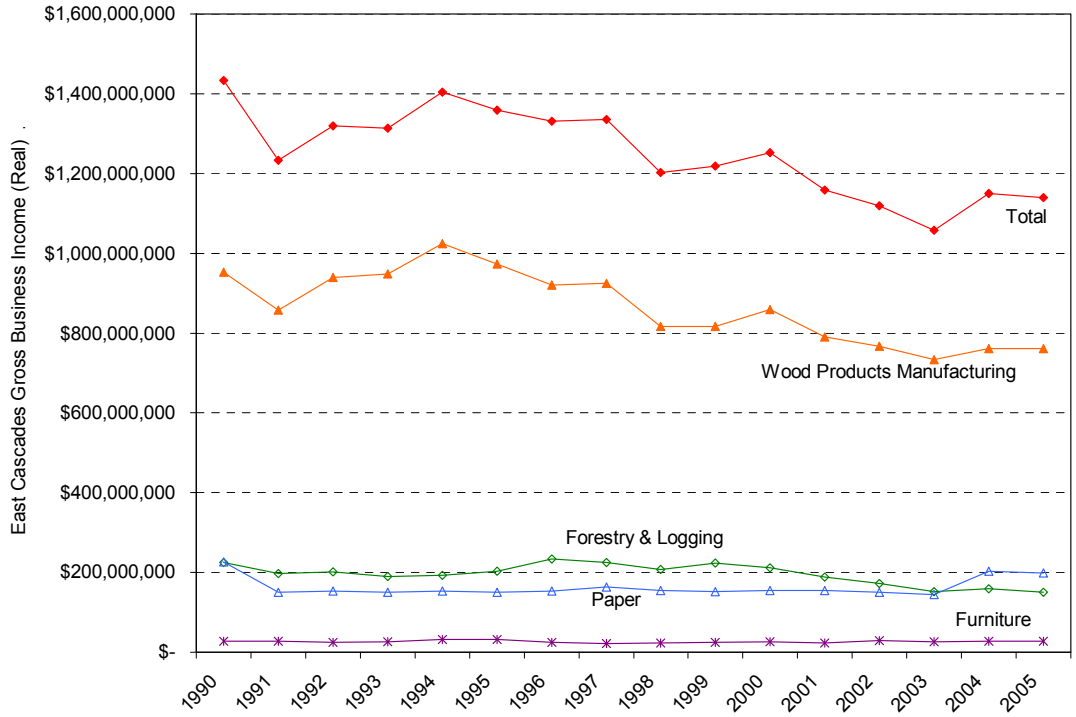

Figure 36: Gross business income within the East Cascades forest sector.
Source: WA State Department of Revenue website 2006.

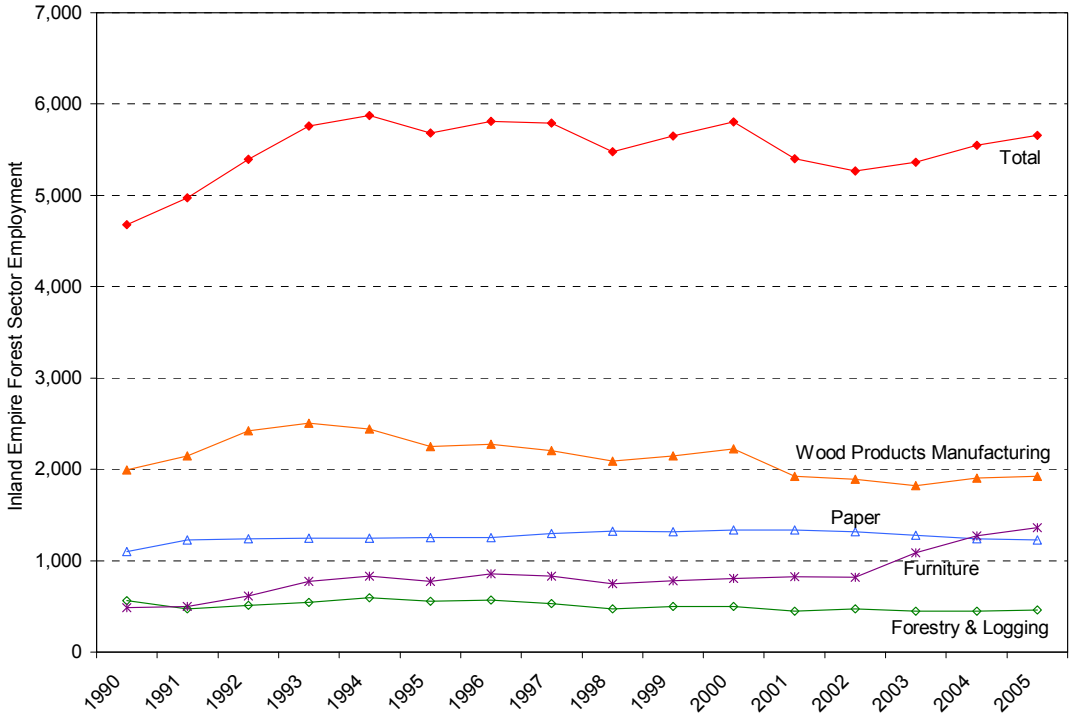

Figure 37: Employment within the Inland Empire forest sector.

Source: WA State Employment Security Department website 2006.

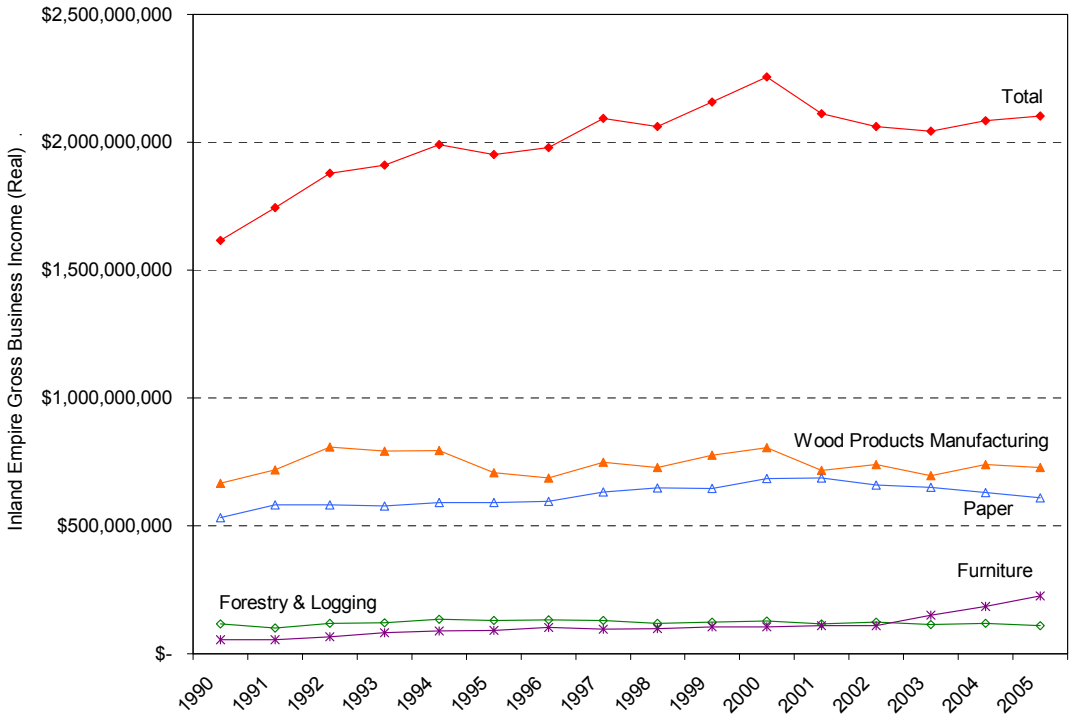

Figure 38: Gross business income within the Inland Empire forest sector.

Source: WA State Department of Revenue website 2006.

Results of a CINTRAFOR Survey of Washington Sawmills

The sawmill industry in Washington state suffered through a difficult period between 1987 and 1993, much of which can be attributed to the 1990-1991 recession and the loss of federal timber harvests that resulted from the listing of the spotted owl as an endangered species in 1989 (Figure 39). Between 1987 and 1993 softwood lumber production in Washington decreased by 23.5% as 45 sawmills closed and almost 1,400 jobs were lost. Industry consolidation ensued throughout much of the subsequent decade and by 2005 the number of sawmills in Washington had dropped from 217 (in 1994) to 128. Much of this decline in sawmills can be attributed to the closure of smaller, inefficient sawmills that had relied on the large, old-growth logs harvested from the federal forests. Despite the huge drop in sawmills, employment in the sawmill sector actually increased from 7,721 to 8,565 between 1994 and 2005 as larger, more efficient sawmills were built to replace the older mills being closed. Similarly, Washington's role within the US sawmill industry has increased over the past decade and Washington is now the second largest manufacturer of lumber in the US, producing over 14% of total US lumber production in 2006.

The analysis of the economic data suggests that the forestry and wood products manufacturing sectors have played an increasingly important role in the economy of Washington State since 2001 (Figure 40). Not only did this sector provide over 45,000 jobs in 2005 but it also generated approximately $16 billion in gross business revenue, paid out over $2 billion in wages and over $100 million in tax receipts. In addition, the forestry and wood products sector of the state economy employed 1.43% of the workers in the private sector in Washington, accounted for 1.8% of the total wages paid within the private sector and generated 3.2% of the gross business income within the private sector.

The shift towards larger, more efficient sawmills can be clearly seen in the productivity data presented in Figures 41 and 42 and Table 4. During the period 1994-2005, the average number of workers per sawmill increased from 35.6 to 66.9 (an 88% increase). During the same period, the average volume of lumber produced per sawmill increased from 18 million board feet to 45 million board feet and lumber production per employee increased from 500,000 board feet to 670,000 board feet. These numbers suggest that not only have sawmills been getting bigger but that the industry has also been investing in new processing technologies to improve lumber yields and increase production efficiencies.

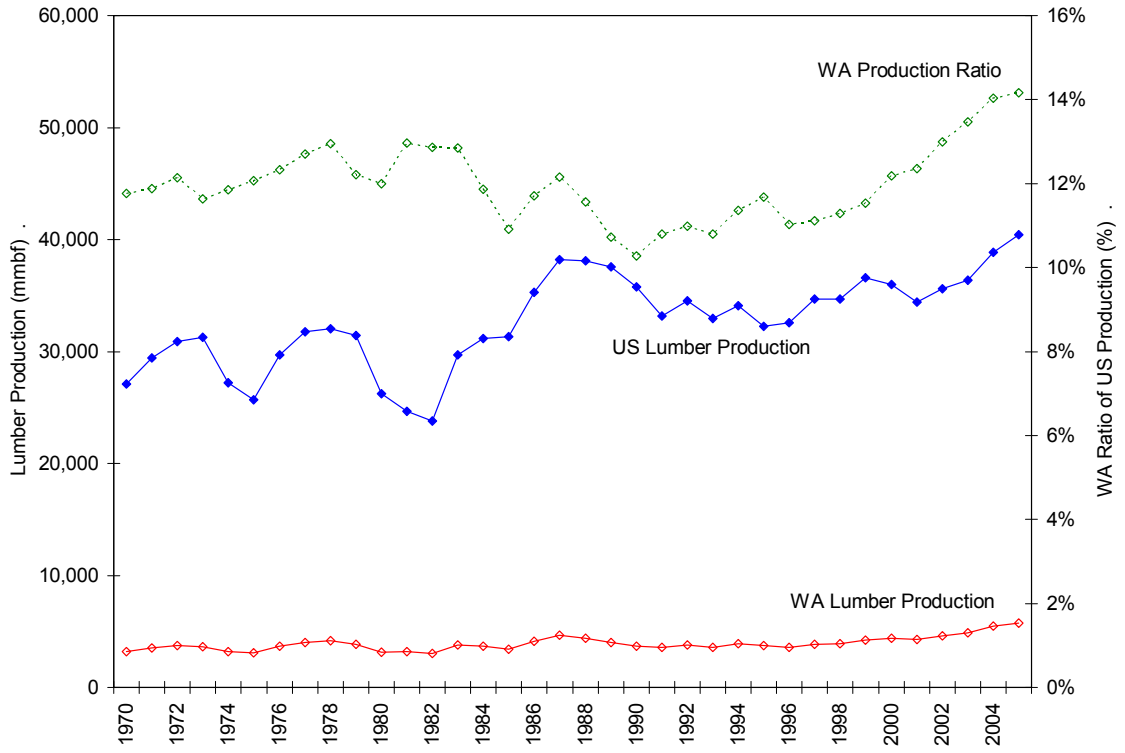

Figure 39: Washington state softwood lumber production relative to US production.

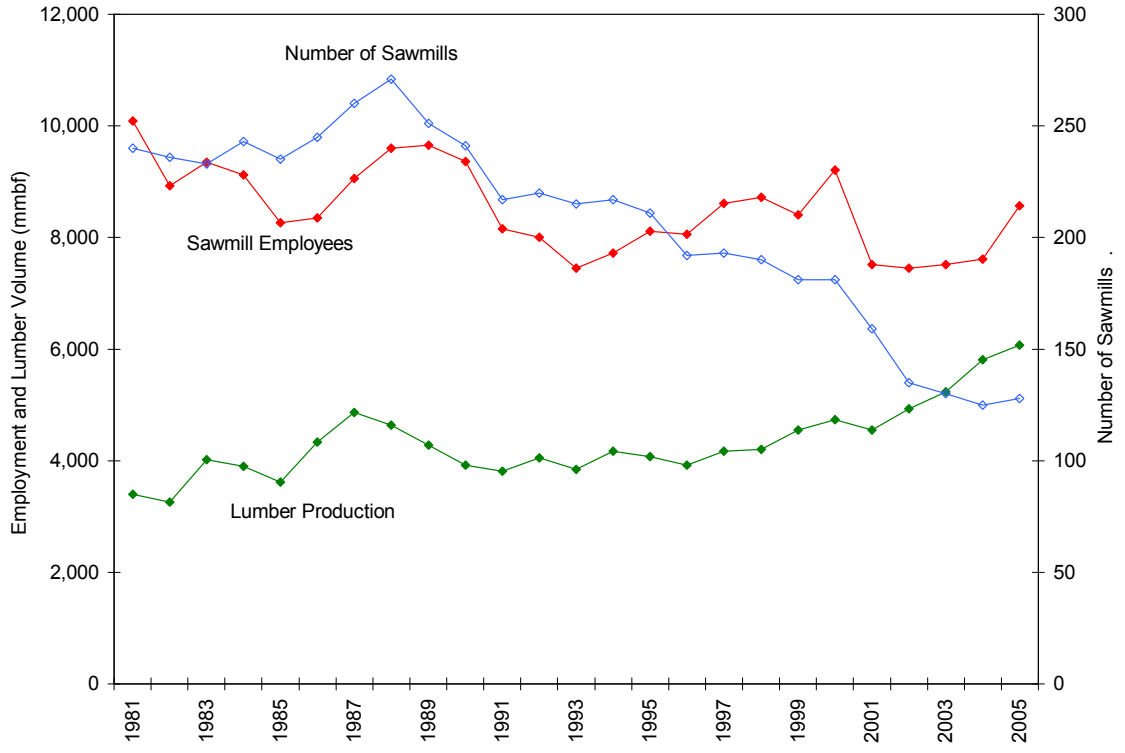

Figure 40: Characteristics of the Washington sawmill industry.

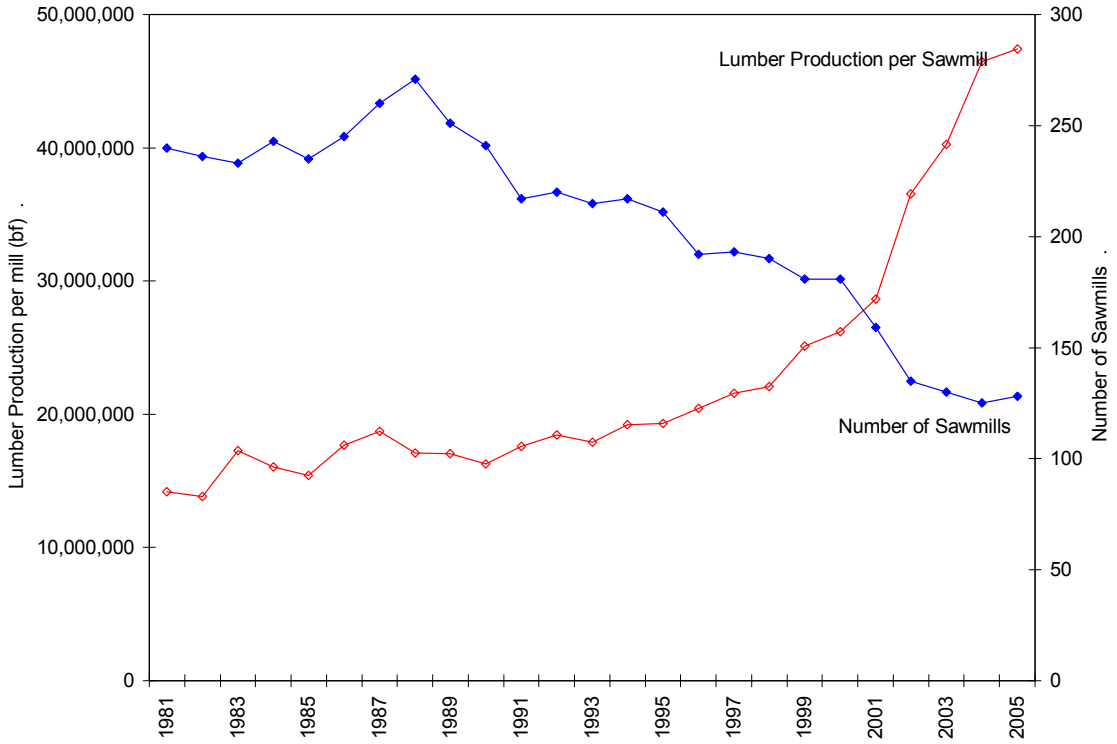

Figure 41: Trends in average lumber production and the number of Washington sawmills.

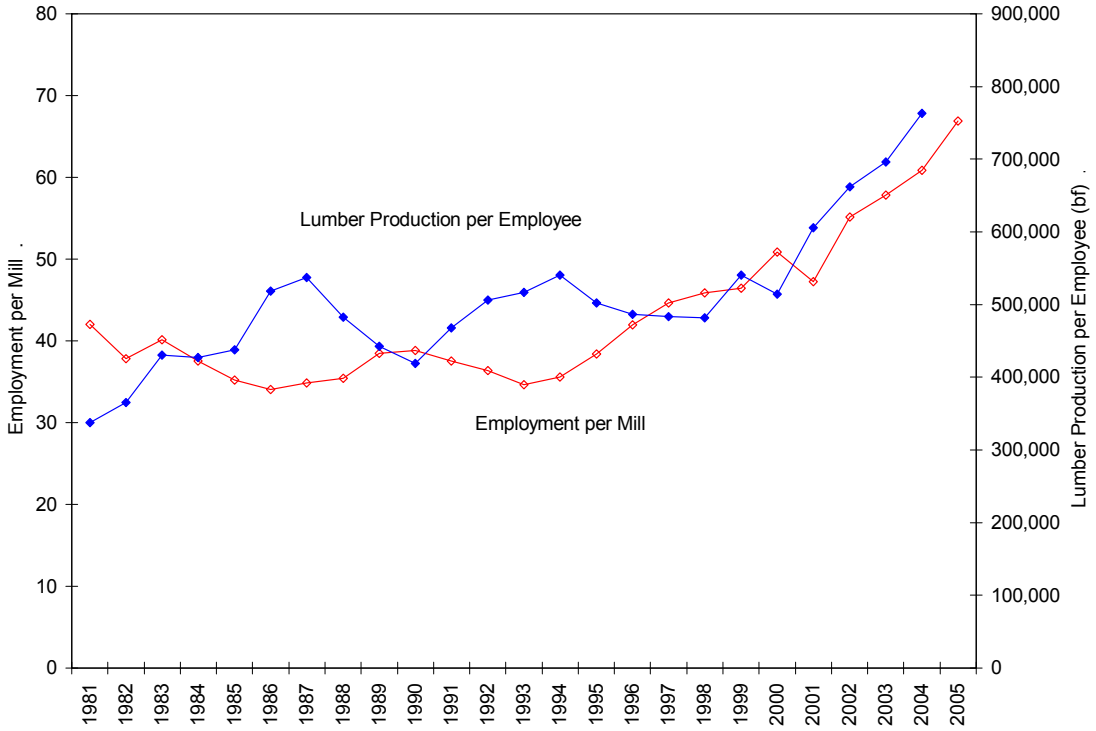

Figure 42: Trends in employment and employee productivity for Washington sawmills.

A review of the survey data compiled by the Washington State Department of Natural Resources at the start of this project found that the most recent Mill Survey was 2002 (although the results of the 2004 Mill Survey were subsequently released in mid-2007 following the completion of the CINTRAFOR sawmill survey). The Mill Survey data corroborated the main trends observed within the sawmill industry: that the number of sawmills has been declining and that average sawmill size has been increasing (Figure 43). It also helped to illustrate how the timber supply for the sawmill industry has changed over the past 35 years as the supply of federal timber has declined (Figure 44).

Research Objectives

Looking more closely at the sawmill industry in Washington for this project, it became apparent that we had little up-to-date information on the sawmill industry at the regional and mill level. While the Washington State Department of Natural Resources publishes the Washington Mill Survey in even numbered years, the most recent data available at the beginning of this study was from 2002. In order to obtain current information on the Washington sawmill industry, additional funding was made available to conduct a survey of the sawmills in Washington. The objectives of the sawmill survey were to: 1) obtain updated production and employment information, 2) determine where sawmills source their logs, 3) determine the importance of out-of-state logs in supplying Washington mills, 4) develop an understanding of transportation modes within the sawmill industry and 5) identify the factors that affect competitiveness within the sawmill industry.

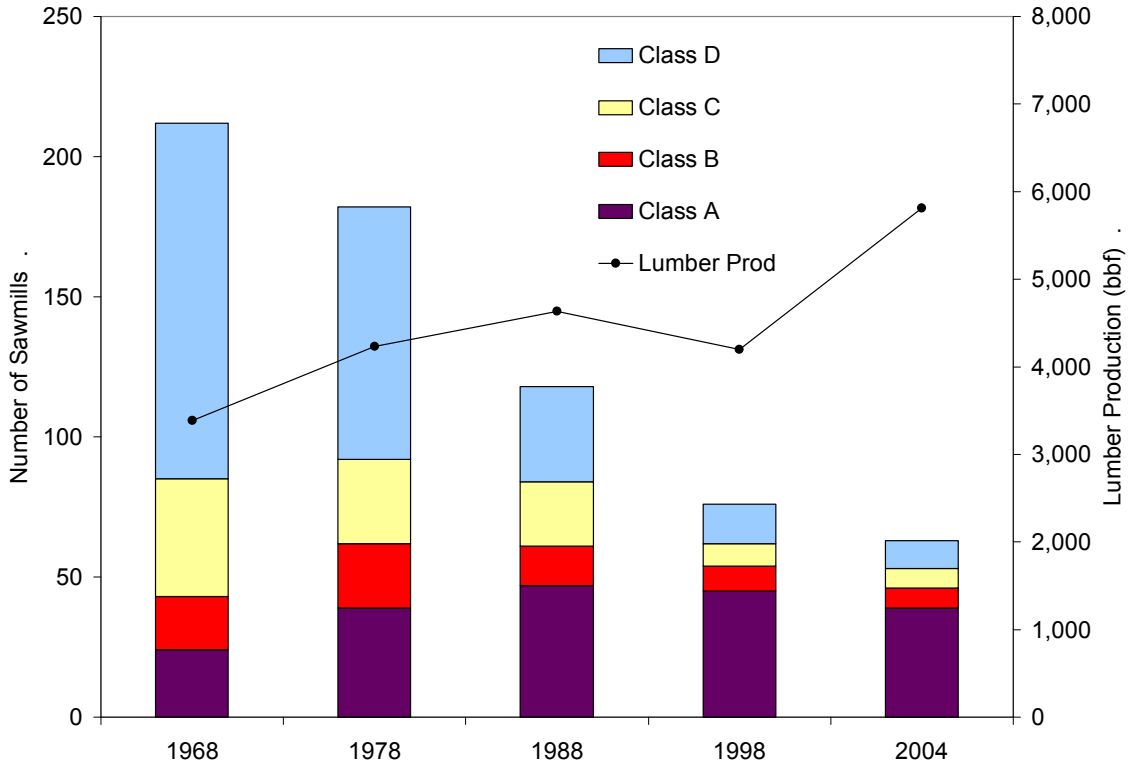

Figure 43: Number and size class distribution of Washington sawmills as compared to total annual state lumber production.

Source: Washington Mill Surveys, various years.

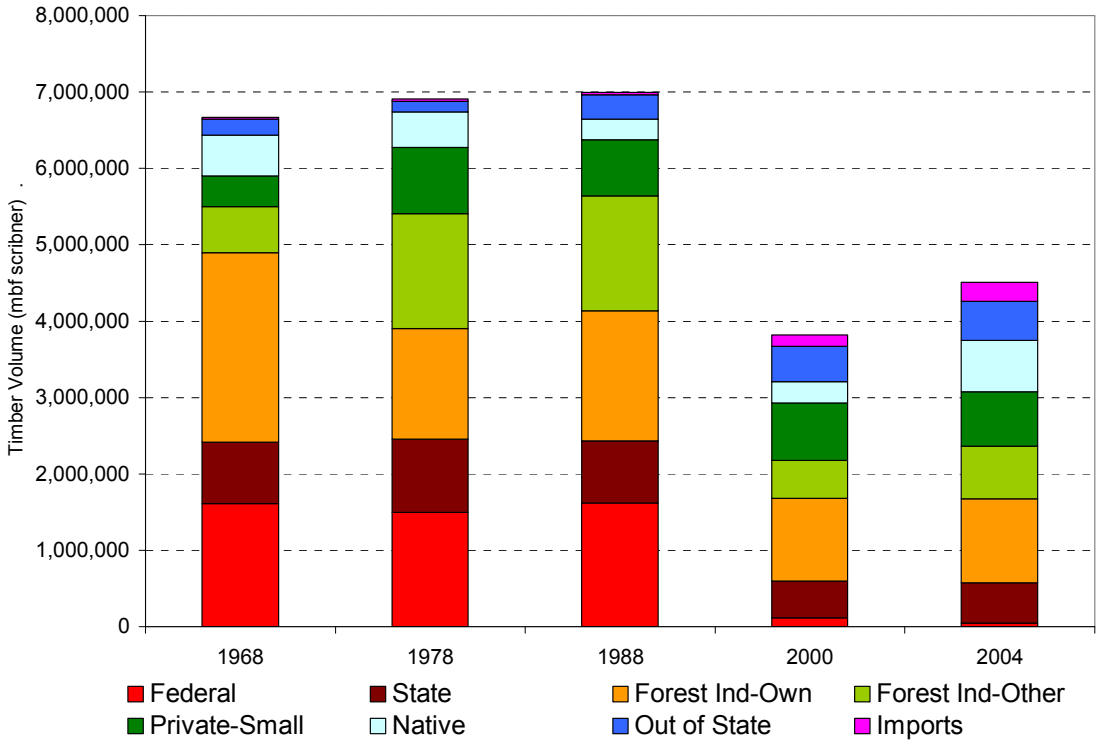

Figure 44: Sources of timber for Washington sawmills.

Source: Washington Mill Surveys, various years

Survey Methodology

A database of all sawmills located in Washington was generated using a variety of public sources, including the Random Lengths Big Book (2006). The preliminary database was screened to remove those sawmills that were no longer in business or were very small mobile sawmills. The remaining sawmills totaled 70 and were comprised of 45 Westside sawmills, 14 Eastside sawmills and 11 hardwood sawmills (all located on the Westside of the Cascades). The initial surveys were mailed to the general manager of each sawmill in the fall of 2006 and follow-up surveys were mailed three weeks and six weeks following the initial mailing. A total of 36 responses were received by the end of 2006, although two of the respondents that reported log inputs of less than 10 thousand board feet (mbf) were removed from the sample along with four hardwood sawmills due to on-going litigation concerns. The final response rate for the survey was 56.2%, with the response rate for Westside mills being 51.9%, for Eastside mills being 50% and for hardwood mills being 42.9%. The total lumber production for the respondent sawmills in 2005 was 4.1 billion board feet (bbf) whereas the total lumber production for the state of Washington in 2005 totaled 5.7 bbf. As a result, the survey respondents represented 71.7% of the total state lumber production in 2005 suggesting that the survey responses provide a representative picture of the Washington sawmill industry.

Survey Results

The characteristics of Washington sawmill survey respondents are summarized in Tables 5-7. The average sawmill processes about 60 million board feet of logs per year, producing about 116 million board feet (mmbf) of lumber and employs about 128 workers. Five mills reported fewer than 10 employees and 7 mills reported over 200 employees. The largest mill reported having 403 employees. The average log sizes being processed range between 6 inches on the small end of the spectrum to over 40

inches on the large end although the individual diameters reported range from 3 inches up to 120 inches. The average overrun ratio was calculated to be 1.9 with a range of 0.17 to 5.78.

Lumber Overrun

The survey results present some interesting differences between sawmills located in Western Washington and Eastern Washington. While the average log input and minimum log diameter are similar between the two regions, there are substantial differences in other characteristics. For example, despite the fact that Eastside mills tend to have more workers, they produce less lumber per mill and have much lower overrun ratios. Many factors including log taper, shifts from old growth, and scaling differences contribute to overrun differences between the two regions. In addition, differences in the shape of the logs being processed within the two regions have an important impact on the lumber overrun ratio. The dominant log species processed on the Westside (Douglas-fir and hemlock) tend to be larger and have more taper than do the pines (primarily lodgepole and ponderosa pine) being processed in Eastern Washington.

Table 5: Characteristics of sawmills located in Washington state in 2006.

	Total Washington (n = 34)	Western WA (n = 27)	Eastern WA (n = 7)
Overrun	1.90	2.02	1.45
Number of Employees	128	117	171
Log Input in mmbf	59.73	59.76	59.60
Lumber output in mmbf	116.40	126.23	79.88
Minimum log diameter (inches)	6.04	6.04	6.07
Maximum log diameter (inches)	40.35	42.19	33.50

Table 6: Log input and lumber output ratios (overrun) of sawmills relative to log consumption.

Annual Log Input	East (n = 7)			West (n = 27)		
	No. of Firms	Overrun		No. of Firms	Overrun	
		Average	Range (min – max)		Average	Range (min – max)
< 3 mmbf	0	--	--	5	1.25	1.00 - 2.00
3 - 10 mmbf	1	1.80	1.80 – 1.80	4	1.69	0.17 - 3.50
10 - 30 mmbf	0	--	--	4	1.72	1.33 - 2.07
30 - 60 mmbf	4	1.45	1.32 – 1.57	4	2.89	1.50 - 5.78
60 - 120 mmbf	1	1.56	1.56 – 1.56	5	2.48	2.22 - 2.85
> 120 mmbf	1	1.00	1.00 – 1.00	5	2.12	1.56 - 2.36

Table 7: Surveyed saw mills by firm size and geographic location

	≤ 3 mmbf	4 - 10 mmbf	11 - 30 mmbf	31 - 60 mmbf	61 - 120 mmbf	> 120 mmbf	Total
E. Washington	0	1	0	4	1	1	7
W. Washington	5	4	4	4	5	5	27
Total	5	5	4	8	6	6	34

In Washington, log volume is generally estimated using the Scribner log scale method, which assumes that the log is a uniform cylinder with a diameter equal to the small end diameter of the log. Therefore, logs that are long and have a large amount of taper will provide greater opportunity for increases in overrun. Improved sawing technologies such as kerf sawing, lasers and scanners have also allowed some sawmills to improve their lumber recovery. Figure 45 shows that, as the sawmill industry in Western Washington adjusted to the smaller logs with greater taper and less defect that were available from private lands following curtailment of federal harvests in the early 1990's, large gains in average overrun resulted. Additions to the increase in average overrun also resulted as smaller, less efficient mills dropped out of production and investments in new technologies were made by surviving mills shifting to high production of commodity lumber products. On the Eastside, however, while similar reductions in federal harvest were also experienced, shifts to greater reliance on private logs did not result in dramatic changes to log sizes, product streams, or mill types. By 2005, the lumber overrun ratios for Western and Eastern Washington sawmills were 2.02 and 1.45, respectively.

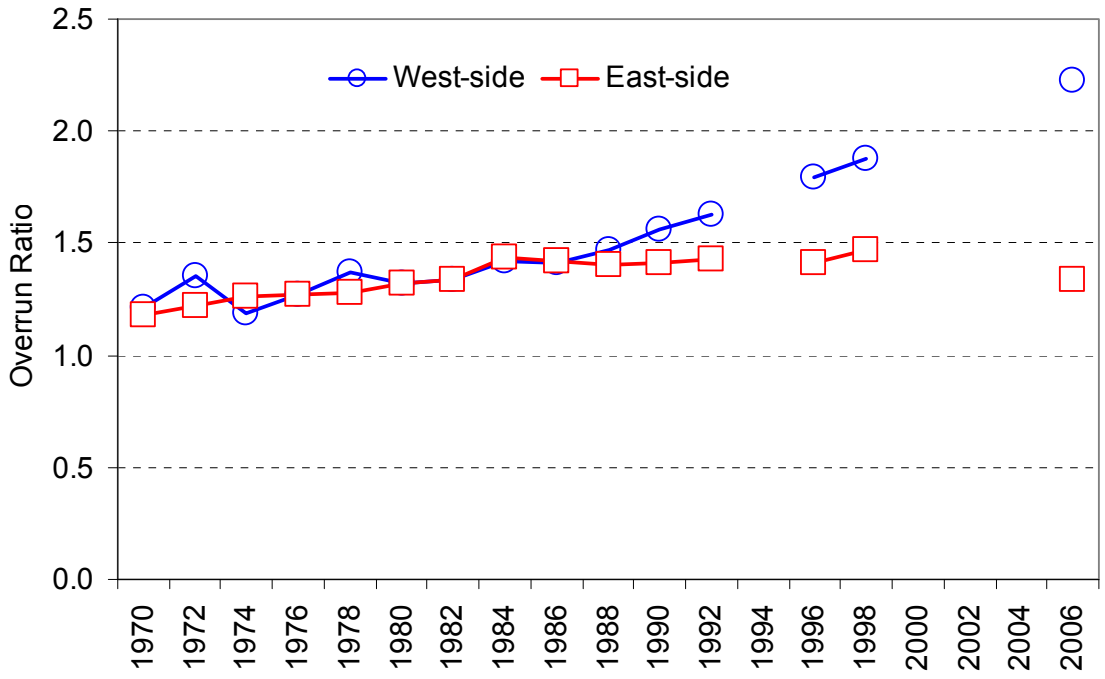

Figure 45: Historical lumber-to-log overrun ratios for Western and Eastern Washington sawmills.

Table 8: Age of Washington sawmills by region.

	< 10 years	10-19 years	20-39 years	40-59 years	60-79 years	80-99 years	> 100 years
Eastern Washington	3	0	0	2	2	0	0
Western Washington	3	2	5	4	6	1	6

Table 9: Age of Washington mills by annual log input.

Annual Volume of Log Inputs	Less than 20 years	20 years or more
< 3 mmbf	2	3
3 - 10 mmbf	3	2
10 - 30 mmbf	0	4
30 - 60 mmbf	1	7
60 - 120 mmbf	2	4
> 120 mmbf	0	6

Table 8 shows the average age of sawmills operating within Eastern and Western Washington. The average sawmill age in Western Washington is 53 years whereas in Eastern Washington it is 35 years.

Figure 46 shows that there is a significant relationship between sawmill age and sawmill size, with sawmill size tending to be positively correlated with sawmill age. This suggests that newer sawmills being built in Washington tend to be fewer and smaller than existing sawmills.

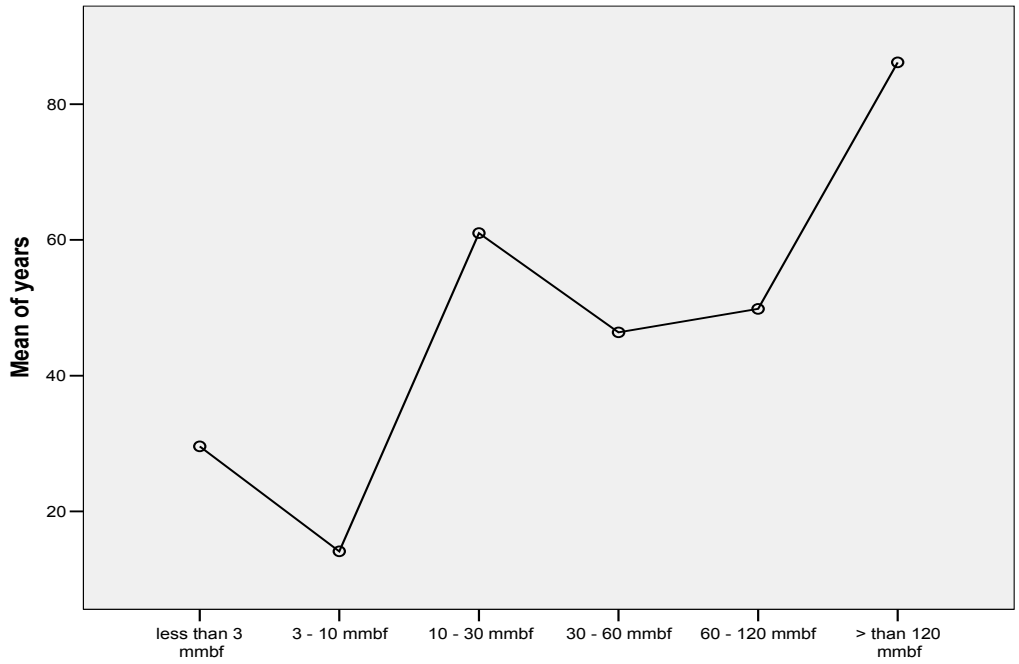

Figure 46: Relationship between average number of years in business and annual volume of log input per sawmill.

Table 10: Number of employees in Washington sawmills, by region and firm size.

Region	Region	Number of Sawmills	Average Number of Employees
	East	0	--
≤ 3 mmbf	West	5	7
	East	1	100
4 - 10 mmbf	West	4	35
	East	0	--
11 - 30 mmbf	West	4	60
	East	4	201
31 - 60 mmbf	West	4	130
	East	1	160
61 - 120 mmbf	West	5	169
	East	1	135
> 120 mmbf	West	5	276

Table 10 summarizes the average number of employees working in each sawmill based on annual volume of log input. The survey data show that in Western Washington there is a direct relationship between sawmill size and the number of jobs generated. This relationship is less clear for Eastern Washington sawmills. If we look at the average number of jobs generated per million board feet of logs processed, the relationship becomes clearer. The data presented in Table 11 and Figure 47 show that while the total number of jobs increase as sawmill size increases, the average number of jobs actually declines as the sawmill size increases (measured as jobs per log volume input). The data in Figure 47 also suggest that for similar size sawmills, there are more jobs generated in Eastern Washington than is the case in Western Washington. It is also interesting to note that the variation in jobs generated is much higher for smaller firms than it is for larger firms, suggesting that smaller firms have more flexibility in switching between capital and labor than do larger mills. This flexibility may be related to the differences in the types of processing technologies and market strategies employed by these sawmills.

Table 11: Number of employees –regions and firm sizes

	Log Input	Number of Firms	Average Number of Jobs per mmbf of Log Input
East	3 - 10 mmbf	1	10.0
	31 - 60 mmbf	4	3.6
	61 - 120 mmbf	1	2.4
	> 120 mmbf	1	1.2
West	≤ 3 mmbf	5	8.3
	4 - 10 mmbf	4	3.9
	11 - 30 mmbf	4	4.0
	31 - 60 mmbf	4	2.7
	61 - 120 mmbf	5	2.0
	> 120 mmbf	5	1.6

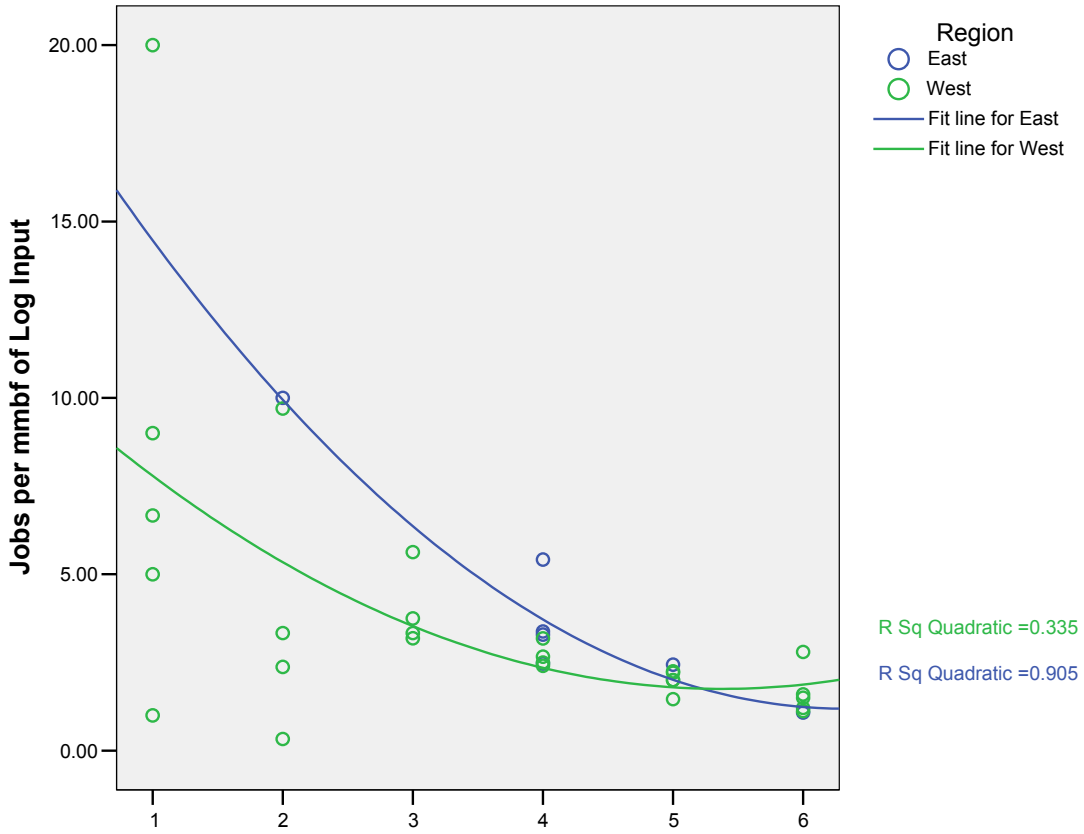

Figure 47. The relationship between employment and sawmill size.
(Note that the values on the x-axis correspond to the log input categories for Western WA sawmills in Table 11.

The sawmill industry, especially on the Westside, relies heavily on timber sourced from private forests, Table 12 and Figure 48. Survey respondents indicated that private forests (including those owned by Native American groups) provided 86.7% of the timber processed in Washington sawmills. The single largest source of timber was private industrial forests (63.7%) followed by state forests (10.1%), private non-industrial forests (8.4%) and Native American forests (7.2%).

Table 12: Sources of logs used in sawmills, by region.

Log Source:	Log Volume (mmbf)			Percentage (%)	
	East	West	Total	East	West
Federal Land	26.35	6.25	32.6	6.3%	0.4%
State Land	36.96	170.56	207.52	8.9%	10.5%
Other Public Land	6.25	26.19	32.44	1.5%	1.6%
Industrial Land	138.10	1,167.41	1,305.51	33.1%	71.5%
Non-industrial Land	56.17	115.20	171.37	13.5%	7.1%
Tribal Land	135.54	11.61	147.15	32.5%	0.7%
Out of State	17.84	134.65	152.49	4.3%	8.3%
Total	**417.2**	**1,631.9**	**2,049.1**	**100%**	**100%**

Figure 48. Sources of logs for the sawmill industry in Washington State.

The survey data suggest that there are important differences in the sourcing of timber between Westside and Eastside sawmills. Westside sawmills are heavily reliant on private forests from both industrial forests (71.5%) and non-industrial forests (7.1%) for their log supplies. In contrast, the sources of timber supply for Eastside sawmills are more evenly distributed across private non-industrial forests (33.1%), Native American forests (32.5%), private non-industrial forests (13.5%) and state forests (8.9%). Federal forests represent a minor component of the timber supply for all Washington sawmills, although it is more important for sawmills on the Eastside of the state.

The mix of sources of timber supply vary between sawmills within different size classifications, Tables 13 and 11. For example, small sawmills rely much more heavily on private non-industrial forests than do large sawmills while large sawmills rely more on private industrial forests and medium-sized sawmills display the greatest reliance on logs harvested from state forests.

Table 13: Sources of logs by sawmill size (mmbf)

Log Source	< 3 mmbf	3-10 mmbf	10-30 mmbf	30-60 mmbf	60-120 mmbf	> 120 mmbf
Federal Land	0.0	0.3	0.0	4.1	3.3	25.0
State Land	0.0	2.7	18.1	66.1	86.1	34.6
Other public Land	0.2	2.4	15.3	1.9	0.8	11.8
Industrial Land	0.9	11.7	12.4	178.8	286.9	814.9
Non-industrial Land	2.6	19.3	6.4	57.8	30.2	55.1
Tribal Land	0.0	0.4	3.9	57.4	66.5	18.9
Out of State	0.6	6.2	6.2	63.7	11.6	64.2
Total	**4.3**	**43.0**	**62.3**	**429.8**	**485.3**	**1,024.5**

Table 14: Sources of logs by sawmill size (percentage)

Log Source	< 3 mmbf	3-10 mmbf	10-30 mmbf	30-60 mmbf	60-120 mmbf	> 120 mmbf
Federal Land	0.0%	0.7%	0.0%	0.9%	0.7%	2.4%
State Land	0.0%	6.3%	29.0%	15.4%	17.7%	3.4%
Other public Land	4.7%	5.6%	24.6%	0.4%	0.2%	1.2%
Industrial Land	20.9%	27.2%	20.0%	41.6%	59.1%	79.5%
Non-industrial Land	60.5%	44.9%	10.3%	13.5%	6.2%	5.4%
Tribal Land	0.0%	0.9%	6.3%	13.4%	13.7%	1.8%
Out of State	14.0%	14.4%	9.9%	14.8%	2.4%	6.3%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Washington sawmills purchase a substantial volume of logs from out of state sources, with out of state logs representing 7.4% of the total log supply, Table 14. The largest volume of out of state logs is used by large mills (64.2 mmbf) and medium-sized mills (63.7 mmbf) although this represents a much higher component of the log mix for medium-sized mills. The largest supplier of logs from outside Washington is British Columbia (76.5%) followed by Oregon (17.1%) and Idaho (5.9%) while a small volume of logs is also supplied from Montana (Table 15). The vast majority of these logs are used by sawmills on the Westside of Washington (88%) although the mix of out of state logs differs between the Eastside and Westside (Table 13 and Figure 49.) Logs from Oregon and Idaho represent almost 84% of the out of state logs used in Eastside sawmills while 84% of the out of state logs used by Westside sawmills are sourced from British Columbia. Logs from Idaho are only used by Eastside sawmills.

Table 15: Sources for out of State logs used by Washington sawmills

Logs from	Volume (mmbf)	Percentage
Oregon	26.03	17.07%
Idaho	8.95	5.87%
British Columbia	116.7	76.52%
Other out of state	0.82	0.54%
Total	**152.5**	**100%**

Table 16: Sources for out of State logs used by Washington sawmills, east vs. west

Logs from	East		West	
	mmbf	%	mmbf	%
Oregon	6.00	33.6%	20.03	14.9%
Idaho	8.95	50.2%	0.00	0.0%
British Columbia	2.62	14.7%	114.08	84.7%
Other out of state	0.28	1.6%	0.54	0.4%
Total	**17.8**	**100%**	**134.6**	**100%**

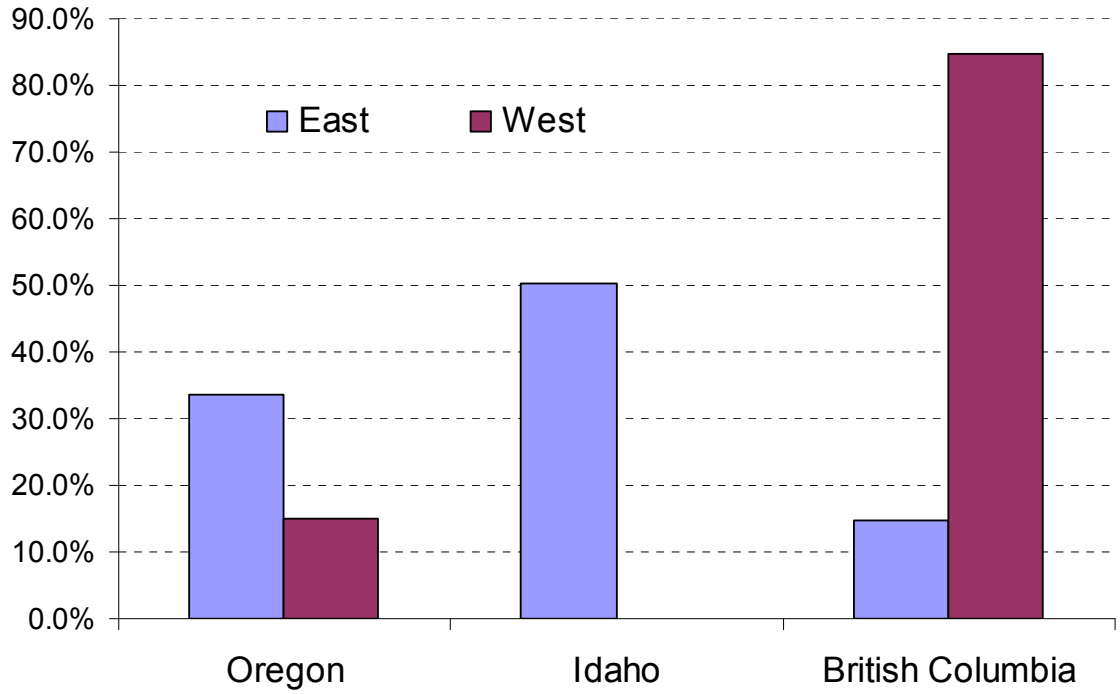

Figure 49: Reliance of sawmills on out of state sources of logs, east vs. west.

The types of timber species processed by Washington sawmills varies considerably between the east side of the state and the west side (Tables 17 and 18). While Douglas-fir represents a major component of the raw material mix for both Westside and Eastside sawmills, over half of the raw material mix for Westside mills is composed of hemlock, white fir and spruce logs while these species represent just 20% of the log mix in Eastside mills (Figure 50). In contrast, ponderosa pine and lodgepole pine, which represent almost 40% of the log mix for Eastside sawmills, are not processed at all in Westside sawmills. In addition, all of the hardwood sawmills, which predominantly process western red alder, are located on the west side of the state.

Table 17: Species of logs used by Washington sawmills (mmbf)

Species	Total Washington	East	West
Douglas-fir or Western larch	796.69	145.34	651.35
Western hemlock, White Fir and Spruce	919.82	87.14	832.68
Ponderosa pine	117.50	117.50	.00
Lodgepole pine	48.13	43.13	5.00
Western white pine	.02	.00	.02
Red cedar	137.83	24.10	113.73
Red alder	10.02	.00	10.02
Other species	.82	.00	.82
Total	**2,030.8**	**417.2**	**1,613.6**

Table 18: Species of logs used by Washington sawmills (percentage)

Species	Total Washington	East	West
Douglas-fir or Western larch	39.2%	34.8%	40.4%
Western hemlock, White Fir and Spruce	45.3%	20.9%	51.6%
Ponderosa pine	5.8%	28.2%	0.0%
Lodgepole pine	2.4%	10.3%	0.3%
Western white pine	0.0%	0.0%	0.0%
Red cedar	6.8%	5.8%	7.0%
Red alder	0.5%	0.0%	0.6%
Other species	0.0%	0.0%	0.1%
	100%	**100%**	**100%**

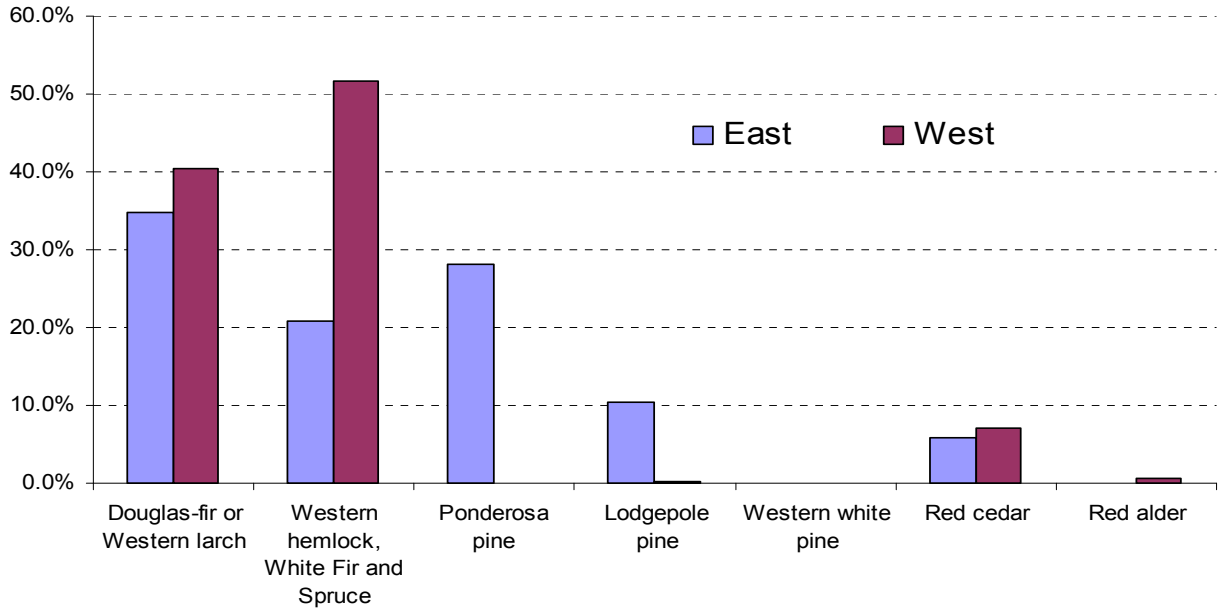

Figure 50: Species of logs processed by Washington sawmills, Eastside versus Westside.

Table 19: Log sizes used by Washington sawmills.

Log Diameter	Total Washington		East		West	
	mmbf	%	mmbf	%	mmbf	%
less than 5 inches	66.2	3.3%	61.1	14.6%	5.1	0.3%
5 to 7 nches	473.5	23.8%	94.5	22.6%	379.1	24.2%
8 to 11 inches	714.9	36.0%	94.5	22.6%	620.4	39.6%
12 to 24 inches	674.4	34.0%	150.0	35.9%	524.4	33.4%
over 24 inches	56.8	2.9%	17.2	4.1%	39.6	2.5%

Westside sawmills tend to process a larger log than do sawmills located on the Eastside of the state (Table19 and Figure 51). Small diameter logs (those less than 5 inches in diameter) make up 14.6% of the raw material input for Eastside mills whereas they are hardly processed at all in Westside sawmills. In contrast, medium-sized logs (those with diameters between 8 and 11 inches) represent almost 40% of

the log mix for Westside sawmills but just 23% for Eastside mills. Large size logs (those with a diameter over 12 inches) represent 40% of the log input for Eastside sawmills and 36% for Westside sawmills.

The vast majority of small diameter logs are processed by large sawmills, although the data show that these logs are only processed by a small number of large sawmills (Tables 10, 11 and Figure 52). In general, large sawmills tend to process a fairly uniform log that ranges between 6 and 24 inches in diameter (which represents 94% of their raw material input), excluding both the smaller logs and the large diameter logs. This focus on a specific range log sizes allows them to improve their production efficiency and reduce the number of log sorts required in the log yard. The survey results show that medium size sawmills process three-quarters of the large diameter logs (those over 24 inches in diameter) processed within the industry and they tend to process a larger log than the larger sawmills.

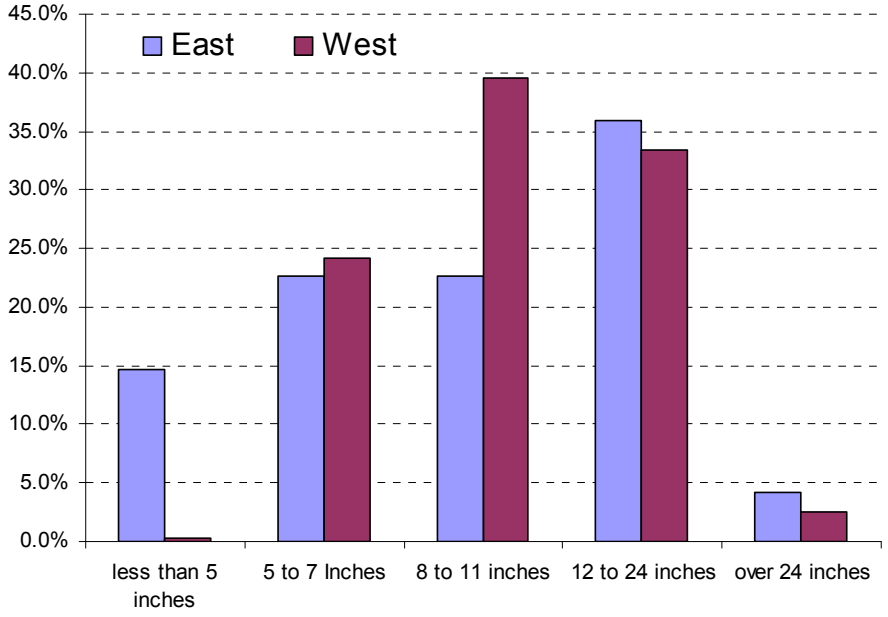

Figure 51: Breakdown of log sizes processed by Washington sawmills (percentage).

Table 20: Log diameters used by Washington sawmills, by firm size (mmbf)

Log Diameter	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
< 5”	0.0	0.0	0.9	4.9	0.0	60.4
5” to 7”	0.3	10.7	8.7	35.7	125.5	292.5
8” to 11”	0.8	16.2	18.2	91.2	164.3	424.3
12” to 24”	2.9	12.8	25.4	203.5	185.6	244.2
> 24”	1.3	3.3	9.1	33.4	9.8	0.0
Total	**5.3**	**43.0**	**62.3**	**368.6**	**485.3**	**1,021.4**

Table 21: Log diameters used by Washington sawmills, by firm size (%)

Log Diameter	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
< 5”	0.0%	0.0%	1.4%	1.3%	0.0%	5.9%
5” to 7”	5.8%	24.9%	14.1%	9.7%	25.9%	28.6%
8” to 11”	15.4%	37.7%	29.2%	24.7%	33.9%	41.5%
12” to 24”	55.2%	29.8%	40.7%	55.2%	38.2%	23.9%
> 24”	23.6%	7.7%	14.6%	9.1%	2.0%	0.0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

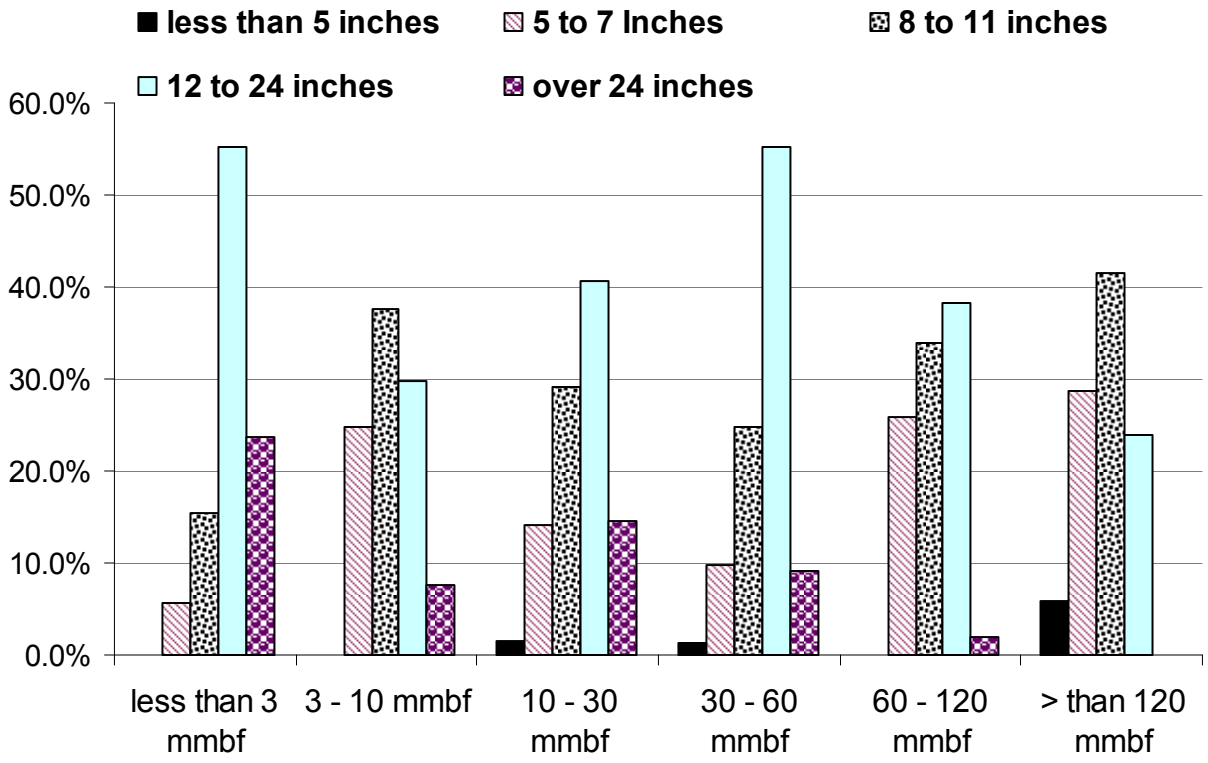

Figure 52: Breakdown of log sizes used by Washington sawmills (%).

Table 22: Log quality distribution for Washington sawmills, by region.

Log Grade	Total Washington		East		West	
	mmbf	%	mmbf	%	mmbf	%
Pulp Grade	28.2	1.4%	25.0	6.0%	3.2	0.2%
Low Grade Saw logs	1,176.3	59.2%	210.3	50.4%	966.0	61.6%
High Grade Saw logs	781.2	39.3%	181.9	43.6%	599.3	38.2%

Table 23: Log quality distribution for Washington sawmills, by sawmill size.

	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Pulp Grade	.03	.4	1.6	1.20	.00	25.00
Low Grade Saw logs	3.4	13.4	27.2	172.3	135.2	824.8
High Grade Saw logs	1.8	29.2	33.5	195.1	350.1	171.6
Total	**5.2**	**43.0**	**63.3**	**368.6**	**485.3**	**1,021.4**

Approximately 60% of the logs processed within the sawmill industry are low grade sawlogs while the remaining 40% are high quality sawlogs. While a very small volume of pulp grade logs are processed by Washington sawmills, pulp grade logs are almost all used by the large sawmills located in Eastern Washington (Table 22 and Figure 53). Western Washington sawmills tend to favor a mix of logs that is heavy to the low grade while Eastern Washington sawmills purchase a more balanced mix of high grade and low grade sawlogs. The largest sawmills process a lower quality sawlog while other sawmills favor a log mix that is weighted more towards the high quality sawlogs. The focus of the largest sawmills on a lower quality sawlog is indicative of log volume availability and commodity market production.

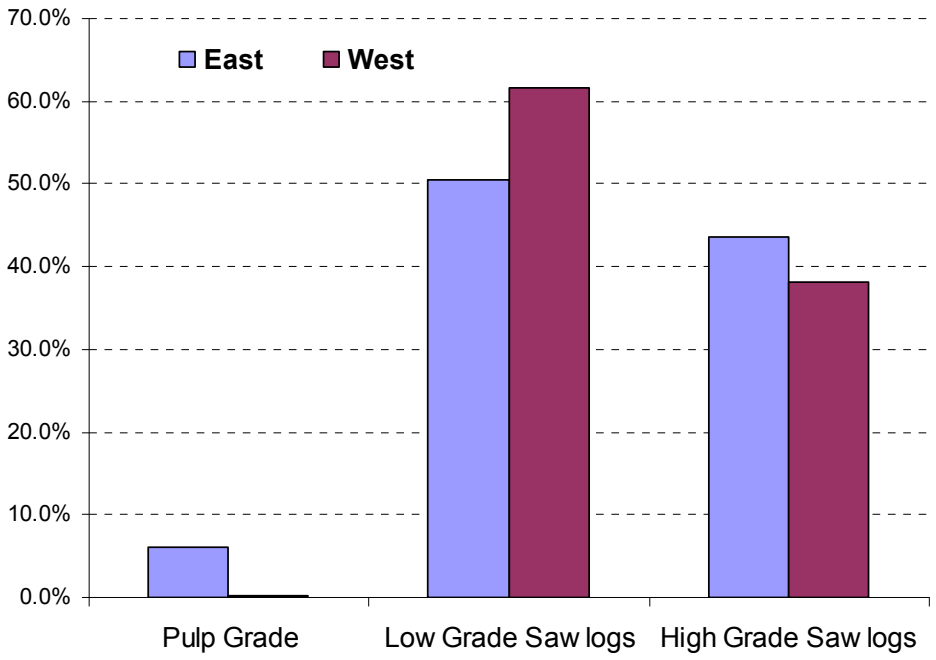

Figure 53: Grades of logs processed by Washington sawmills.

Table 24: Respondents perceptions of the availability of sawlogs, by region

Perception of Log Availability	Eastside		Westside	
	Number	%	Number	%
Always Scarce	0	0.0%	2	7.4%
Sometimes Scarce	4	57.1%	18	66.7%
Adequate	3	42.9%	5	18.5%
Sometimes Oversupplied	0	0.0%	1	3.7%
Regularly Oversupplied	0	0.0%	1	3.7%

Survey respondents were asked to give their opinion regarding the general availability of sawlogs for their sawmills (Table 24 and Figure 54). Two-thirds of the respondents indicated that sawlogs are sometimes scarce while just 7.4% indicated that they were always scarce. In contrast, 18.5% of respondents felt that sawlog supplies were adequate and 7.4% felt that there was an oversupply of sawlogs. The breakdown of survey responses by sawmill size suggests that perception of the availability of sawlogs is relatively consistent across the industry (Table 25).

Survey respondents were also asked to give their opinion regarding the future availability of timber harvested from federal forest lands, Tables 26 and 27. In general, managers within the sawmill industry consider any increase in federal timber to be unlikely and the uncertainty regarding the federal timber supply will likely constrain investment within the wood processing industry in specific timbersheds (e.g., the East Cascades timbershed).

Table 25: Respondents perceptions of the availability of sawlogs, by firm size

Log Availability	Firm Size						
	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf	Total
Always Scarce	1	0	0	1	0	0	2
Sometimes Scarce	0	4	4	6	4	4	22
Adequate	3	1	0	1	1	2	8
Sometimes Oversupplied	0	0	0	0	1	0	1
Regularly Oversupplied	1	0	0	0	0	0	1

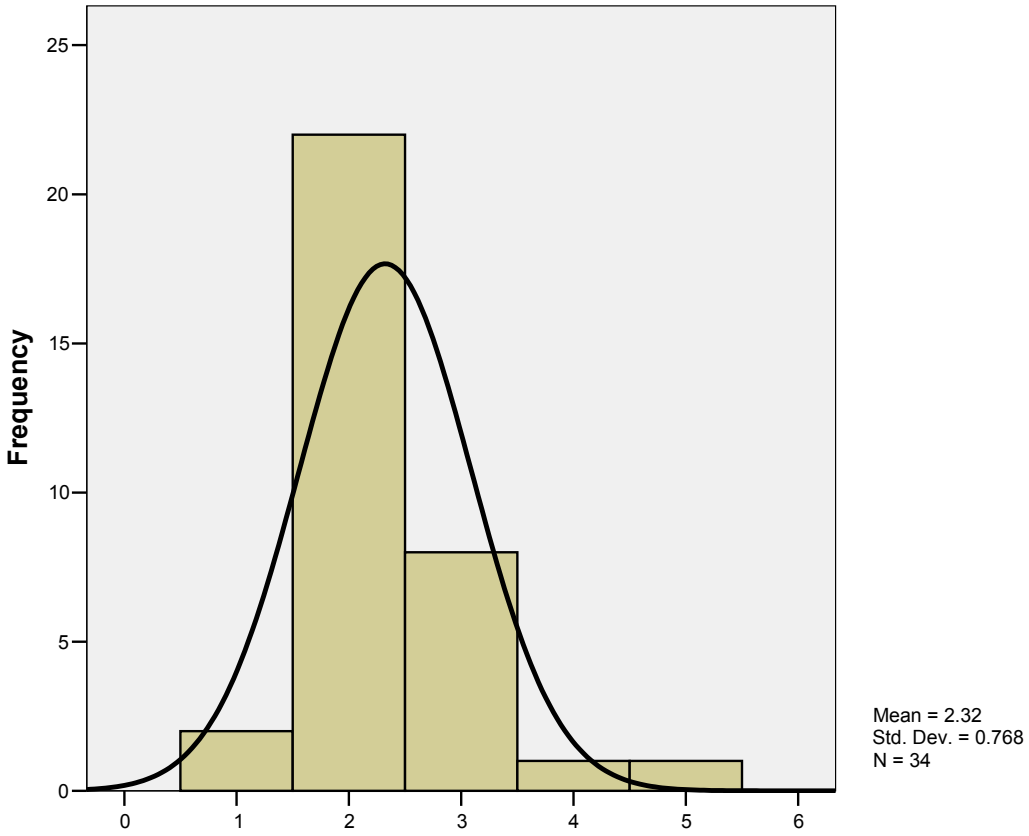

Figure 54: Respondents perceptions of the availability of sawlogs.

Table 26: Respondents' perception regarding the future availability of timber from federal forests.

	Total	Eastside	Westside
Impossible	3	1	2
Not Likely	20	4	16
Uncertain	4	0	4
Somewhat Likely	3	2	1
Very Likely	1	0	1

Table 27: Respondents' perception regarding the future availability of timber from federal forests, by firm size.

	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf	Total
Impossible	0	0	0	2	1	0	3
Not Likely	2	3	2	6	4	3	20
Uncertain	2	1	1	0	0	0	4
Somewhat Likely	0	1	1	0	0	1	3
Very Likely	1	0	0	0	0	0	1

Table 28: Incidence of timber harvest operation by respondent companies, by region.

	Region	
	East	West
Company does not harvest timber	0	16
Company does harvest timber	7	11

Survey respondents were asked to indicate whether or not their company conducted its own timber harvest operations or whether they purchased logs from outside the company (Tables 28 and 29). The survey results presented in Table 28 show that all of the sawmills in the Eastern side of the state conducted their own timber harvest operations whereas more than half of the sawmills in the west purchased their logs from external suppliers. An analysis of the survey data found that sawmills in Eastern Washington are significantly more likely to harvest their own timber whereas there was no significant difference in the likelihood of sawmills to harvest their own timber based on sawmill size.

The respondents who do conduct timber harvest operations were then asked to indicate whether they used their own loggers to harvest timber or whether they used contract loggers to conduct their timber harvest. The results of the survey responses are presented in Tables 29 –32. The results show that sawmills harvested approximately 1,200 mmbf of timber, approximately 59% of the total volume of the sawmill raw material input. However, few sawmills harvest the majority of their timber using their own loggers. In most cases, the majority of logs are obtained by using contract loggers or purchasing logs on the open market, although mills do engage in log swaps to balance their raw material supply.

Table 29: Incidence of timber harvest operation by respondent companies, by firm size.

	Firm_Size					
	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Company does not harvest timber	3	3	3	4	1	2
Company does harvest timber	2	2	1	4	5	4

Table 30: Summary of timber harvests conducted by company loggers and contract loggers, by region

Harvest conducted by:	Volume (mmbf)			Percentage (%)		
	East	West	Total	East	West	Total
Company Loggers	63.5	275.0	338.5	17.2%	33.5%	28.4%
Contract Loggers	306.4	545.8	852.2	82.8%	66.5%	71.6%

Table 31: Summary of timber harvests conducted by company loggers and contract loggers, by firm size.

Harvest conducted by:	MMBF					
	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Company Loggers	1.1	0.0	0.0	51.0	61.8	224.6
Contract Loggers	0.0	18.0	15.7	118.3	358.5	341.8

Table 32: Summary of timber harvests conducted by company loggers and contract loggers, by firm size.

Harvest conducted by:	Percentage					
	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Company Loggers	100.0%	0.0%	0.0%	30.1%	14.7%	39.7%
Contract Loggers	0.0%	100.0%	100.0%	69.9%	85.3%	60.3%

Table 33: Summary of the average distance from which sawmills obtain sawlogs, by region

Radial distance	Total Washington	East	West
0 to 50 miles	57.4%	56.6%	57.7%
51 to 100 miles	27.4%	16.3%	20.0%
101 to 150 miles	16.0%	9.9%	17.7%
150 to 200 miles	2.7%	1.1%	3.1%
More than 200 miles	4.6%	16.1%	1.5%

Table 34: Summary of the average distance from which sawmills obtain sawlogs, by firm size

Radial distance	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
0 to 50 miles	80.0%	67.0%	42.5%	30.8%	70.8%	66.7%
51 to 100 miles	11.2%	20.0%	32.5%	13.0%	18.3%	24.2%
101 to 150 miles	3.8%	9.0%	16.2%	38.6%	10.0%	5.8%
150 to 200 miles	0%	4.0%	8.8%	2.9%	0%	1.7%
More than 200 miles	5.0%	0%	0%	14.8%	0.8%	1.7%

Tables 33 - 38 refer to sawmills use of various transportation options to obtain logs. Tables 33 and 34 summarize the average percentage of logs that sawmills source from within specific radial distances from the sawmill facility. Table 33 indicates that sawmills on both the east side and west side of Washington source more than half of their logs from within a 50 mile radius of the sawmill. In contrast, sawmills in Eastern Washington source 16.1% of their logs from more than 200 miles from their processing facility whereas sawmills in Western Washington obtain just 1.5% from more than 200 miles. The results also show that the largest sawmills obtain 90% or more of their logs from within 100 miles of the mill whereas medium-sized mills obtain a significant percentage of their logs from more than 100 miles away from the mill location. A parallel survey of Washington loggers indicated that the average delivery distance of logs from in-state landings to sawmills is 67 miles.

While most sawmills haul some of their logs on company trucks, between 80-90% of logs are transported by contract truckers (Tables 35 and 36). This result remains constant both for geographic location firm size classes, with the single exception of very small sawmills. The survey results also show that larger sawmills are significantly more likely to use rail and/or water transportation to provide logs for their processing facility (Tables 37 and 38).

Table 35: Volume and percentage of logs transported by company trucker, by region

	East		West	
	mmbf	%	mmbf	%
Company Trucks and Drivers	46.6	11.16%	208.10	12.90%
Contract Truckers	370.6	88.84%	1,405.62	87.10%

Table 36: Percentage of logs transported by company trucker, by firm size

	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Company Trucks and Drivers	62.00	.00	.00	9.75	9.17	19.5
Contract Truckers	58.00	100.00	100.00	90.25	90.83	80.5

Table 37: Sawmill use of rail or water transportation for logs, by region (number of firms)

	East	West
Do NOT use rail or water transport	2	16
DO use rail or water transport	5	11

Table 38: Sawmill use of rail or water transportation for logs, by firm size (number of firms)

	Firm Size					
	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Do NOT use rail or water transport	4	4	3	3	4	0
DO use rail or water transport	1	1	1	5	2	6

Survey respondents were asked about their familiarity regarding certification programs for forests and wood products, (Tables 39 and 40). All of the survey respondents from Eastern Washington indicated that they were very familiar with forest certification and certified wood products whereas only 65% of respondents from Western Washington indicated that they were very familiar with these programs. An additional 31% of respondents from Western Washington indicated that they were somewhat familiar with certification. An analysis of the survey data found a significant relationship between firm size and familiarity with certification programs, with respondents from the larger sawmills being more likely to be familiar with certification than were those from smaller sawmills. The survey respondents were also asked if they would be willing to pay a premium to obtain logs that were independently certified as having been harvested from sustainable managed forests. While no specific price premium was indicated, only one respondent indicated a willingness to pay a premium for certified logs.

Table 39: Survey respondents familiarity with certified logs, by region.

Familiarity with Certification	East	West	Total
Not Familiar	0	1	1
Vaguely Familiar	0	8	8
Very Familiar	7	17	24

Table 40: Survey respondents familiarity with certified logs, by firm size.

Familiarity with Certification	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Not Familiar	0	1	0	0	0	0
Vaguely Familiar	4	0	3	1	0	0
Very Familiar	1	4	1	7	5	6

The survey results show that only 13 of the responding sawmills are independent single companies with most of these being located in Western Washington (Table 41). There is also a high correlation between firm size and number of sawmills owned (Table 42). The majority of the multiple mill ownership respondents represent larger mills while the independent, singly-owned sawmills tend to be smaller in size.

Given declines in lumber demand and market prices that occurred in 2006, it is not surprising that 70% of the respondents indicated that their sawmill was not operating at capacity (Table 43). This result was consistent between Eastern and Western Washington as well as across the different size of sawmills represented in the survey (Table 44).

Table 41: Number of sawmills owned by each respondents' company, by region.

Number of Sawmills Owned	East	West	Total
1 Sawmill	2	11	13
2 Sawmills	4	7	11
3 Sawmills	0	2	2
4 Sawmills	1	7	8

Table 42: Number of sawmills owned by each respondents' company, by firm size.

Number of Sawmills Owned	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
1 Sawmill	3	3	4	3	0	0
2 Sawmills	2	1	0	3	2	3
3 Sawmills	0	1	0	1	0	0
4 Sawmills	0	0	0	1	4	3

Table 43: Number of sawmills operating at capacity, by region.

	East	West	Total
No	5	18	23
Yes	2	8	10

Table 44: Number of sawmills operating at capacity, by firm size.

	Firm Size					
	< 3 mmbf	**3 - 10 mmbf**	**10 - 30 mmbf**	**30 - 60 mmbf**	**60 - 120 mmbf**	**> 120 mmbf**
No	4	3	3	5	4	4
Yes	0	2	1	3	2	2

The mix of lumber products manufactured by sawmills in Washington are summarized in Figures 55 and 56. The main differences in product mix between sawmills in Western and Eastern Washington are that western sawmills produce a substantially higher proportion of timbers whereas sawmills in Eastern Washington produce a higher proportion of boards (Table 45 and Figure 55). This difference can be attributed to the timber species being processed. Douglas-fir, which is mainly processed in western mills, has high structural strength and good dimensional stability and therefore is well suited to the production of large diameter timbers. In Eastern Washington, small diameter pines species are better suited to the production of boards. Half on the lumber production on both sides of the state is dedicated to studs and dimension lumber. Less than six percent of lumber currently produced is either clear or industrial stock indicating limited potential for value-added secondary manufacture from Washington lumber production.

There are several differences in product mix based on sawmill size (Figure56). The most noticeable is the fact that the largest sawmills focus exclusively on the production of dimension lumber while half of the sawmills in the second largest production category specialize in producing just studs. The small and medium-sized sawmills tend to produce a range of lumber products with eastern sawmills tending to favor board production and western sawmills favoring a mix of dimension lumber and timbers. The exception to this is that smallest size sawmills appear to focus on boards production.

Table 45: Mix of lumber products manufactured by Washington sawmills, by region.

	East	**West**	**Total**
Dimension lumber	37.8%	38.3%	38.2%
Studs	14.8%	13.8%	14.0%
Boards	43.3%	29.5%	32.5%
Timbers	.6%	12.1%	9.6%
Cross arms	.1%	.3%	.3%
Clears	.1%	2.5%	2.0%
Industrial Lumber	3.3%	3.4%	3.4%

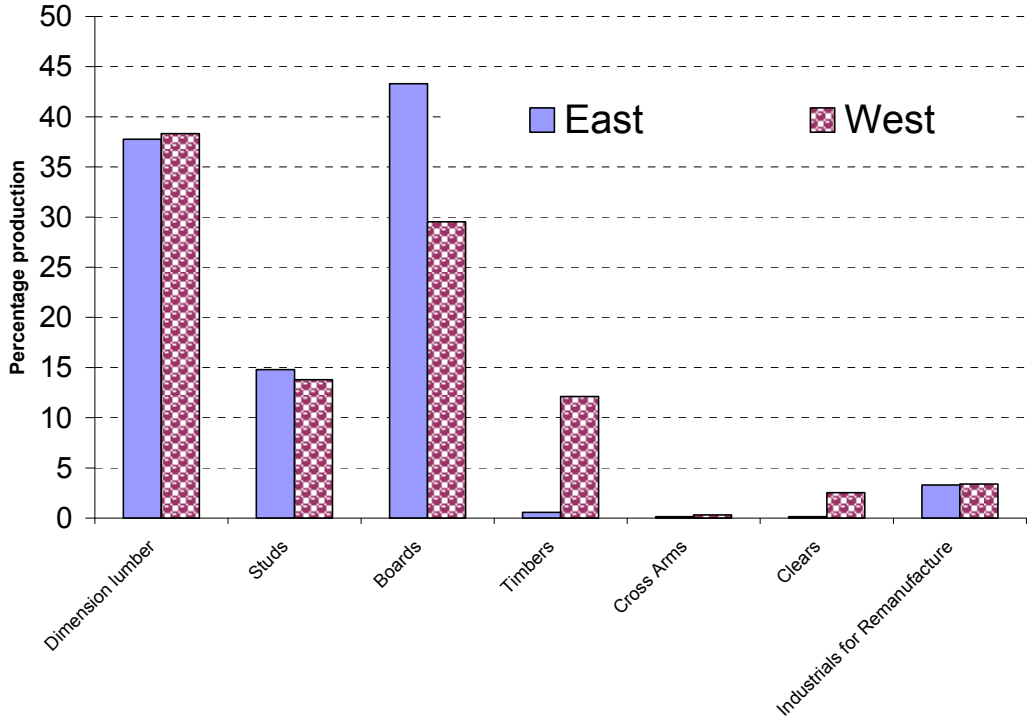

Figure 55: Distribution of products manufactured by sawmills, by region.

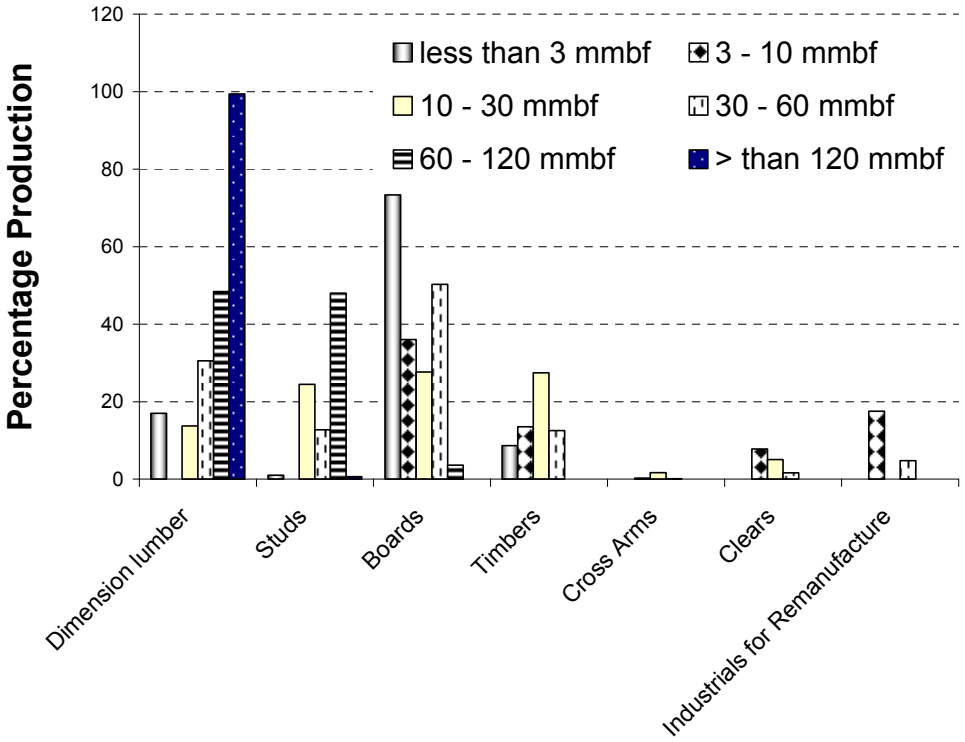

Figure 56: Distribution of products manufactured by sawmills, by firm size.

Sawmills in Washington sell about a third of lumber production within state, Table 46. Approximately two-thirds of lumber sales are to domestic customers outside the state and less than 4% of lumber sales are to export markets. However, this varies considerably on the geographic location of the firm. For example, while lumber manufacturers in Western Washington sell about 60% of their lumber to customers outside of the state, almost 90% of lumber sales by Eastern Washington sawmills are to outside customers. Sawmills on the west side of the state export about 4.2% of their lumber production while Eastern Washington sawmills export just 1%. The largest sawmills tend to sell more of their lumber outside of the state, although there is some variability across firm size and the differences are not significant (Table 47). The smallest sawmills report that they export 10% of their sawn lumber sales while the largest sawmills export almost none of their lumber.

For sawmills in Western Washington, labor tends to represent the largest production cost followed by operations (Table 48). The situation is opposite in Eastern Washington sawmills where operations represent a substantially higher proportion of production costs. An analysis of the survey data shows that labor costs are a significantly higher proportion of production costs for Western Washington sawmills. Analysis of the survey data indicates that sales and administration costs are significantly higher for Eastern Washington sawmills.

Table 46: Percentage of lumber sales in various markets, by region

	East	West	Total
Washington	9.3	35.7	30.2
Other US states	89.7*	60.1*	66.2
Exports	1.0	4.2	3.6

* *significant difference at the .05 level*

Table 47: Percentage of lumber sales in various markets, by firm size

	< 3 mmbf	3 - 10 mmbf	10 - 30 mmbf	30 - 60 mmbf	60 - 120 mmbf	> 120 mmbf
Washington	64.0	26.2	45.0	14.4	37.3	9.7
Other US states	26.0	73.2	51.3	79.3	62.5	90.2
Exports	10.0	0.6	3.8	6.4	0.2	0.2

Table 48: Production costs as a percentage of gross annual sales, by region

	East	West	Total
Labor	29.6%*	45.5%*	40.7%
Operations	36.0%	29.7%	31.6%
Maintenance	12.1%	13.1%	12.8%
Sales and Administration	11.7%*	4.4%*	6.6%
Fixed Assets	10.7%	7.3%	8.3%

* *significant difference at the .05 level*

Figures 56 and 57 are presented to illustrate declines in profitability for Western Washington sawmills as a result of lumber prices falling faster than log prices. Over the past two years log prices have remained strong despite the fact that lumber production and lumber prices have fallen significantly. Between 2004 and 2006 lumber log prices rose from $516/mbf to $568/mbf while softwood lumber prices dropped from

an average of $376/mbf to $298/mbf. As a result, margins for lumber producers, net of log costs but before reductions for production costs, have dropped significantly from an average of $323/mbf in 2004 to just over $100/mbf in 2006. Note that the "net of log" margin in this case is estimated as the lumber price per thousand board feet times the overrun ratio (gross return-to-log) less the log cost per thousand board feet. The steep decline in lumber margins has resulted in curtailment in production and could well lead to mill closures in 2007 if log prices remain high.

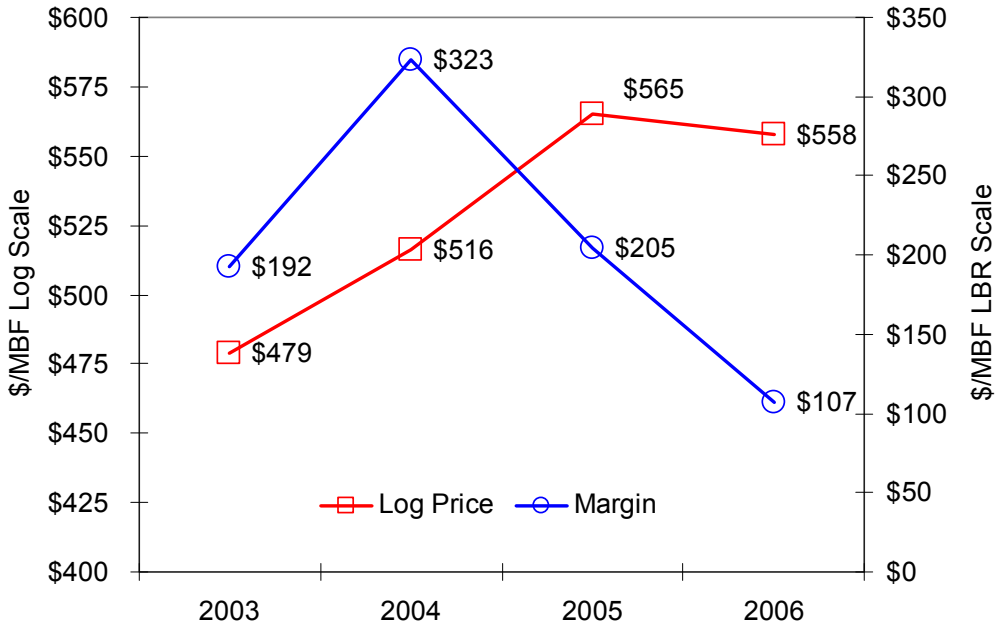

Figure 57: Western Washington log price and sales margin (net log price)

Sources: Log prices from LogLines.

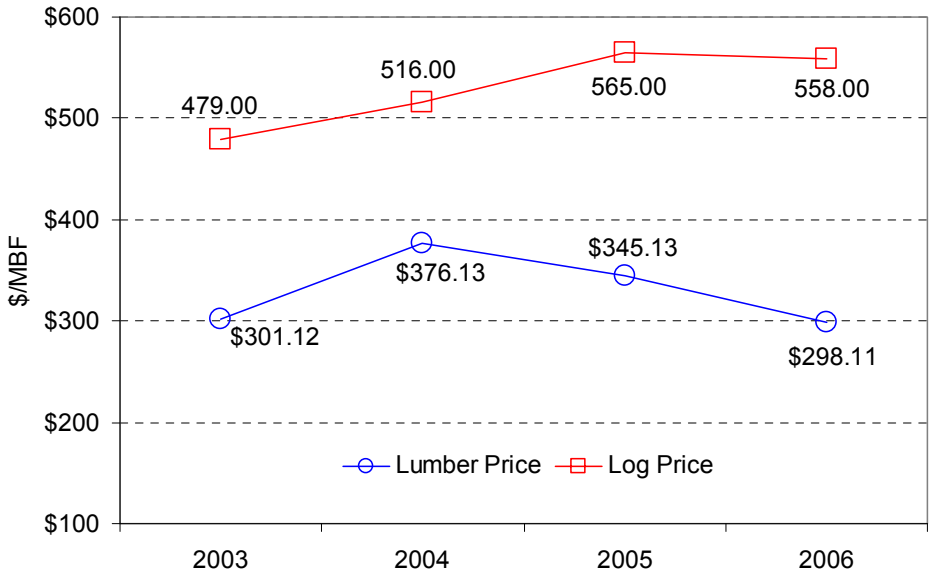

Figure 58: Lumber and log price comparison

Sources: Log prices from LogLines and lumber prices from Random Lengths, various years.

Tables 49 and 50 provide a summary of respondents' perceptions of the difficulty in keeping and recruiting qualified workers in operations and trades positions within the sawmill industry in Washington. A couple of trends are noticeable in Table 49. First, it appears that finding qualified workers, both in operations and the skilled trades, is more difficult for sawmills in Western Washington than in the eastern part of the state. This is likely due to a broader range of employment alternatives for workers in Western Washington. Second, sawmills in both regions of the state report that it is much more difficult to hire workers in the skilled trades than workers for general mill operations. Again, the fact that trades workers have specialized skills makes them employable across a broad range of industries and leads to a tighter labor market for these workers, particularly in Western Washington. Further analysis of the survey data found that large sawmills were significantly more likely to report difficulties in finding workers than were small- and medium-sized firms. Sawmills on both sides of the state perceive that the availability of qualified workers has worsened in recent years, with large sawmills significantly more likely to report this trend (Table 50).

Table 49: Respondents' perception of the difficulty in keeping and recruiting qualified operations and trades workers, by region.

	Operations Workers		Trades Workers	
	East	**West**	**East**	**West**
Very difficult	14.3%	36.0%	42.9%	68.0%
Somewhat difficult	71.4%	56.0%	57.1%	24.0%
Workers are readily available	14.3%	8.0%	0.0%	8.0%

Operations Workers include saw filers, sawyers, and other positions unique to the sawmill industry
Trades Personnel include millwrights, electricians, and other positions <u>not</u> unique to the sawmill industry

Table 50: Respondents' perception of the availability of workers, by firm size.

	Region			
	East	**West**	**East**	**West**
More Scarce	5	19	71.4%	76.0%
The Same	2	6	28.6%	24.0%
Less Scarce	0	0	0.0%	0.0%

Table 51: Respondents' perception of the business environment in Washington relative to other states, by region.

	Region	
	East	**West**
Substantially More Difficult	4	5
Somewhat More Difficult	0	8
Neutral	3	7
Somewhat Less Difficult	0	2
Substantially Less Difficult	0	0

Survey respondents reported that they felt that the business environment in Washington was somewhat more difficult than that faced by competitors in neighboring states (Table 51). While there were

differences observed in the responses between Eastside and Westside sawmills, these differences were not significant.

Survey respondents were also asked a series of open-ended questions related to the business environment in Washington and how it affects the competitiveness of the sawmill industry. Specifically, these questions asked the respondent to: 1) indicate how the productivity of their sawmill had changed between 2000 and 2005, 2) identify the factors that caused this change in productivity, 3) identify those factors that adversely affected the competitiveness of the sawmill industry in Washington and 4) provide suggestions that could help to improve the competitiveness of the sawmill industry in Washington.

Survey respondents indicated that the productivity of their sawmills had changed anywhere from a decline of 10% to an increase of 100%. While three firms indicated that their productivity had not changed between 2000 and 2005, only one firm indicated that it had declined. The remaining 20 firms reported a productivity increase. The average change in productivity over the 2000-2005 time period was calculated to be 33%. The most commonly cited reasons for increased productivity were: 1) investment in new processing technology and 2) investment in worker training.

There were a variety of factors that were identified as having an adverse affect on the competitiveness of the sawmill industry in Washington. However, there were several factors that were cited by a large number of respondents. The most frequently cited factors are listed below with the number of times that each was mentioned appearing in parentheses. The most frequently cited factors were:

- overly complex environmental regulations that restrict logging en private forests (cited 14 times)
- burdensome and biased (towards workers) workman's compensation program (11)
- slow and complicated land-use permitting process (8)
- high Business and Occupation tax (5)
- burdensome Labor and Industries (L&I) program (6)
- taking of private land through streamside set-asides and riparian management zones (7)
- WA DNR has not been responsive to small sawmills and forest owners (enforcers not facilitators) (7)
- high volume of Canadian lumber exports into the US (5)

Respondents were also asked to provide suggestions for ways to improve the competitiveness of the sawmill industry in Washington. The most commonly cited factor was related to increasing the timber supply on federal, state and private lands, although the specific suggestions differed somewhat by ownership. A total of 19 respondents responded that timber harvests on federal forests should be increased to improve both the timber supply and forest health. In addition, ten respondents recommended increasing the timber harvest in state forests. With respect to public forests in general (both federal and state), three respondents requested that some small timber sales be made available exclusively for bidding by small sawmills. A total of 13 respondents indicated that land use planning requirements should be less restrictive and the permitting process streamlined and sped up for sawmill expansion projects that occur on the original sawmill site (or an adjacent piece of property). Finally, nine respondents indicated that road improvements, both the expansion of all weather logging roads (5 citations) and the widening and up-grading of I-5 (4 citations), would help improve their company's competitiveness.

Survey Summary Observations

The sawmill industry in Washington state suffered through a difficult period between 1987 and 1993, much of which can be attributed to the 1990-1991 recession and the loss of federal timber as a result of the listing of the spotted owl as an endangered species in 1989. Between 1987 and 1993 softwood lumber production in Washington decreased by 23.5% as 45 sawmills closed and almost 1,400 jobs were lost. Industry consolidation ensued throughout much of the past decade and by 2005 the number of sawmills

had declined from 217 (in 1994) to 128. Much of this decline in sawmills can be attributed to the closure of smaller, inefficient sawmills that relied on the large, old-growth logs coming from the federal forests. Despite the huge drop in sawmills, employment in the sawmill sector actually increased from 7,721 to 8,565 between 1994 and 2005 as larger more efficient sawmills were built to replace the older mills being closed. Similarly, Washington's role within the US sawmill industry has increased over the past decade and Washington is now the second largest producer of lumber in the US, producing over 14% of total US lumber production in 2006.

The analysis of the economic data suggests that the forestry and wood products manufacturing sectors have played an increasingly important role in the economy of Washington State since 2001. Not only did this sector provide over 45,000 jobs in 2005 but it also generated approximately $16 billion in gross business revenue, paid out over $2 billion in wages and over $100 million in tax receipts. However, beyond these broader economic measures of the sawmill sector, little up-to-date information is available on the sawmill industry and the factors that affect the competitiveness of this important sector of Washington's economy.

In order to obtain up-to-date information on the WA sawmill industry, a survey of the sawmill industry in Washington was performed in the fall of 2006. The objective of the Washington sawmill survey was to: 1) obtain updated production and employment information, 2) determine where sawmills source their logs, 3) determine the importance of out-of-state logs in supplying Washington mills, 4) develop an understanding of the product mix, markets and transportation modes within the sawmill industry and 5) identify those factors that affect competitiveness within the sawmill industry. The final response rate for the survey was 56.2%, with the response rate for Westside mills being 51.9%, for Eastside mills being 50% and for hardwood mills being 42.9%. The survey respondents represented 71.7% of the total state lumber production in 2005.

The survey results present some interesting differences between sawmills located in Western Washington and Eastern Washington. While the average log input and minimum log diameter are similar between the two regions, there are substantial differences in the other characteristics. For example, despite the fact that Eastside mills tend to have more workers they produce less lumber per mill and have much lower overrun ratios. Many factors including log taper, shifts from old growth, and scaling differences likely contribute to overrun differences. In Washington, log volume is generally estimated using the Scribner log scale method, which assumes that the log is a uniform cylinder with a diameter equal to the small end diameter of the log. Therefore, logs that are long and have a large amount of taper will provide greater opportunity for increases in overrun. As the sawmill industry in Western Washington adjusted to smaller logs with greater taper and less defect available from private lands following curtailment of federal harvests in the early 1990's, gains in average overrun resulted. Additions to the increase in average overrun also resulted as smaller less efficient mills dropped out of production and investments in new technologies were made by surviving mills shifting to high production of commodity lumber products. On the Eastside, however, while similar reductions in federal harvest were also experienced, shifts to greater reliance on private logs did not result in dramatic changes to log sizes, product streams, or mill types. As a result, by 2005 the lumber overrun ratios for Western and Eastern Washington were 2.02 and 1.45, respectively, whereas between 1970 and 1990, they had been roughly the same (averaging 1.30) in both regions.

The survey data show that in Western Washington there is a direct relationship between sawmill size and the number of jobs generated. This relationship is less clear for Eastern Washington sawmills. The survey data show that while total jobs increase as sawmill size increases, the average number of jobs actually declines as the sawmill size increases (measured as jobs per log volume input). The data also suggest that for similar size sawmills, there are more jobs generated in Eastern Washington than in Western Washington. It is interesting to note that the variation in jobs generated is much higher for

smaller firms than it is for larger firms, suggesting that smaller firms have more flexibility in switching between capital and labor than do larger mills. This flexibility may be related to the differences in the types of processing technology and market strategies employed by these sawmills.

The survey data suggest that there are differences in the sourcing of timber between Westside and Eastside sawmills. Westside sawmills are heavily reliant on private forests from both industrial forests and non-industrial forests. In contrast, the sources of timber supply for Eastside sawmills are more evenly distributed across private non-industrial forests, Native American forests, private non-industrial forests and state forests. Washington sawmills purchase a substantial volume of logs from out of state sources, with out of state logs representing 7.4% of the total log supply. The largest supplier of logs from outside Washington is British Columbia (76.5%) followed by Oregon (17.1%) and Idaho (5.9%).

Survey respondents were asked to give their opinion regarding the general availability of sawlogs and future availability of logs from federal forests. Two-thirds of the respondents indicated that sawlogs are sometimes scarce while just 7.4% indicated that they were always scarce. In general, managers within the sawmill industry consider any increase in federal timber to be unlikely and the uncertainty regarding the federal timber supply will likely constrain investment within the wood processing industry in specific timbersheds (e.g., the East Cascades timbershed).

Survey respondents from Eastern Washington indicated that they were very familiar with forest certification and certified wood products while only two-thirds of the respondents from Western Washington indicated that they were very familiar with these programs. When survey respondents were asked if they would be willing to pay a premium for certified logs, only a single respondent indicated a willingness to pay a premium for certified logs.

For sawmills in Western Washington, labor tends to represent the largest production cost followed by operations while the situation is just the opposite in Eastern Washington. Over the past two years log prices have remained high despite the fact that lumber production and lumber prices have fallen significantly. Between 2004 and 2006 lumber log prices rose from $516/mbf to $568/mbf while softwood lumber prices dropped from an average of $376/mbf to $298/mbf. As a result, margins for lumber producers net of log costs but before reductions for production costs have dropped significantly from an average of $323/mbf in 2004 to just over $100/mbf in 2006. Note that the "net of log" margin in this case is estimated as the lumber price per thousand board feet times the overrun ratio (gross return-to-log) less the log cost per thousand board feet. The steep decline in lumber margins has resulted in curtailments in production and could well lead to mill closures in 2007 if log prices remain high.

Finding qualified workers, both in operations and the skilled trades, is more difficult for sawmills in Western Washington than in the eastern part of the state. This is likely due to a broader range of employment alternatives for workers in Western Washington. Second, sawmills in both regions of the state report that it is much more difficult to hire workers in the skilled trades than workers for general mills operations. Again, the fact that trades workers have specialized skills makes them employable across a broad range of industries and leads to a tighter labor market for these workers, particularly in Western Washington.

There were a variety of factors that were identified as having an adverse affect on the competitiveness of the sawmill industry in Washington. The most frequently cited factors included: an overly complex environmental regulations that restrict logging en private forests, burdensome and biased (towards workers) workman's compensation program, slow and complicated land-use permitting process, high Business and Occupation taxes, a burdensome L&I program, excessive taking of private land through streamside set-asides and riparian management zones, complaints that the WA DNR has not been

responsive to small sawmills and forest owners (enforcers not facilitators)and a high volume of Canadian lumber exports into the US.

Respondents were also asked to provide suggestions for ways to improve the competitiveness of the sawmill industry in Washington. The most commonly cited factor was related to increasing the timber supply on federal, state and private lands. With respect to public forests in general (both federal and state), three respondents requested that some small timber sales be made available exclusively for bidding by small sawmills. In addition, a substantial number of respondents indicated that land use planning requirements should be less restrictive and the permitting process streamlined and sped up for sawmill expansion projects that occur on the original sawmill site (or an adjacent piece of property). Finally, nine respondents indicated that road improvements, both the expansion of all weather logging roads and the widening and up-grading of I-5 would help improve their company's competitiveness.

Concluding Observations

The forestry and forest products industries have traditionally made a substantial contribution to the economy of Washington State, and this continues to be true today. Despite a substantial reduction in sawmills and plywood mills, production has increased due to investment in larger mills, mill expansion and new processing technology which has resulted in substantial productivity increases. In 2005 the forest products industry had the second largest level of capital investment in the US, and Washington was the second largest producer of softwood lumber and the fourth largest producer of plywood in the US. As a result, the forest products manufacturing sector represents almost 15% of total manufacturing jobs in WA (many of which are in rural locations) with an average annual wage of $49,329.

During the post recession period of 2002-2005, while total manufacturing employment in the state of Washington declined by 4.2% (over 10,000 jobs lost), employment in the forestry and forest products sectors increased by 3.7% (over 1,500 jobs added). Direct employment in the forestry and forest products sector was almost 45,000 in 2005 while indirect employment attributed to the forestry and forest products industry was estimated to be 106,000. Over this same period, the gross business income generated within the forestry and forest product sectors has been stable or increasing across all timbersheds (as has employment). While employment and production have been increasing, the number of mills has been declining. This trend illustrates the fact that the forest products sector is going through a period of transition and consolidation that is seeing processing facilities become larger and more efficient. For example, while the number of sawmills in Washington declined from 240 to 126 between 1991 and 2005, lumber production increased by 60% and Washington's share of US lumber production increased from 10.3% to 14.2%. One worrying trend is the decline in the number of pulp mills in Washington which undermines the market for sawmill residues and adversely impacts the economic viability of sawmills where the sale of residuals represents a substantial contribution to mill profitability. The inter-relationship between sawmills and pulp mills suggests that the industry must be viewed holistically and strategically (as the sum of its parts) rather than via a piecemeal approach.

The forestry and forest products industry is particularly important to the economies of rural counties in the S. Coast, N. Coast, Southwest and East Cascades timbersheds. While 65% of the timber harvest is from the N. Coast, S. Coast, Southwest and East Cascades timbersheds, only 39% of the forest sector jobs are located in these regions. In contrast, 48% of the forest sector jobs are located in N. and S. Puget Sound, while only 23% of the timber harvest occurs. At the same time, unemployment in the S. Coast, Southwest and East Cascades timbersheds is substantially higher than in the Puget Sound region, suggesting that jobs are flowing out of these timbersheds along with the logs. The biggest locational discrepancy between industry infrastructure and timber harvest is found in the S. Coast and East Cascades timbersheds. This lack of local infrastructure seriously undermines the management options available to forest managers and results in declining forest health and increasing fire risk.

As noted in the Timber Supply Study, increasing volumes of dead and dying timber in the East Cascades represent a significant fire risk and requires that substantial volumes of timber be removed to mitigate the fire risk and improve forest health. Years of fire suppression efforts have resulted in many Eastside forests having unnatural stand structures with large volumes of small diameter trees and shrubs that undermine forest health and represent a significant fire risk. The loss of processing mills across the state (but particularly within the East Cascades timbershed) undermines the ability to manage forests sustainably for health and reduction of fire risk.

The threat to forest health and fire risk posed to Eastside forests from mountain pine beetle and bark beetle infiltrations makes it incumbent upon the State to consider options to reduce this risk. If the economics do not support the establishment of wood manufacturing facilities to process the wood removed from unhealthy forests, then it may be necessary for the State to consider incentives that would

encourage the establishment of the required mills. The benefits from this strategy would be four-fold: forest health could be improved, fire risk could be reduced, social losses could be contained, and new employment options would be provided in a rural region. However, the success of this type of strategy would rest largely upon the state's success in gaining the Forest Service's commitment to include federal forests in the land base. An analytical framework to assess strategic options to improve forest health could incorporate the total avoided costs of fire suppression against the cost of incentives to establish wood manufacturing facilities to process the timber removed from unhealthy forests. Fundamentally, state planners must address the following question: Is it important to have some processing capacity (and jobs) close to the resource in order to expand forest management options, improve forest health and reduce fire risk? In other words, can economic development, improved forest health and reduced fire risk be achieved through long-term strategic planning?

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Appendix A: North American Industrial Classification System Codes

NAICS Industry Codes for Forestry and Wood Products Manufacturing Sectors

Forestry and Logging
113110 Timber Tract Operations
113210 Forest Nurseries and Gathering of Forest Products
113310 Logging

Wood Product Manufacturing
321113 Sawmills
321114 Wood Preservation
321211 Hardwood Veneer and Plywood Manufacturing
321212 Softwood Veneer and Plywood Manufacturing
321213 Engineered Wood Member (except Truss) Manufacturing
321214 Truss Manufacturing
321219 Reconstituted Wood Product Manufacturing
321911 Wood Window and Door Manufacturing
321912 Cut Stock, Resawing Lumber, and Planing
321918 Other Millwork (including Flooring)
321920 Wood Container and Pallet Manufacturing
321991 Manufactured Home (Mobile Home) Manufacturing
321992 Prefabricated Wood Building Manufacturing
321999 All Other Miscellaneous Wood Product Manufacturing

Paper Manufacturing
322110 Pulp Mills
322121 Paper (except Newsprint) Mills
322122 Newsprint Mills
322130 Paperboard Mills
3222 Converted Paper Product Manufacturing

333210 Sawmill and Woodworking Machinery Manufacturing

Furniture and Related Product Manufacturing
337110 Wood Kitchen Cabinet and Countertop Manufacturing
337122 Nonupholstered Wood Household Furniture Manufacturing
337129 Wood Television, Radio, and Sewing Machine Cabinet Manufacturing
337211 Wood Office Furniture Manufacturing
337212 Custom Architectural Woodwork and Millwork Manufacturing

NAICS Classification for Industry Comparisons used in Figure 8.

NAICS Code	*Manufacturing*
321	Wood Product Manufacturing
322	Paper Manufacturing
324	Petroleum & Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics & Rubber Products Manufacturing
327	Nonmetallic Mineral Product Mfg
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing
334	Computer and Electronic Product Mfg
335	Electrical Equipment and Appliances
336	Transportation Equipment Manufacturing
337	Furniture and Related Product Mfg
339	Miscellaneous Manufacturing
	Forestry & Wood Products
113	Forestry and Logging
11531	Support Activities for Forestry
321	Wood Product Manufacturing
322	Paper Manufacturing
33711	Wood Kitchen Cabinets and Countertops
337122	Nonupholstered Wood Household Furniture
337211	Wood Office Furniture Manufacturing
337212	Custom Architectural Woodwork & Millwork
	Agriculture and Food Processing
111	Crop Production
112	Animal Production
115111	Cotton Ginning
115112	Soil Preparation, Planting, Cultivating
115113	Crop Harvesting, Primarily by Machine
115114	Postharvest Crop Activities
115115	Farm Labor Contractors and Crew Leaders
115116	Farm Management Services
11521	Support Activities for Animal Production
311	Food Manufacturing
	Residential Construction and Remodeling
236115	New Single-Family Housing Construction
236118	Residential Remodelers
238111	Residential Poured Foundation Contractor
238121	Residential Structural Steel Contractors
238131	Residential Framing Contractors
238141	Residential Masonry Contractors
238151	Residential Glass/Glazing Contractors
238161	Residential Roofing Contractors
238171	Residential Siding Contractors
238191	Other Residential Exterior Contractors
238211	Residential Electrical Contractors
238221	Residential Plumbing/HVAC Contractors

238291	Other Residential Equipment Contractors
238311	Residential Drywall Contractors
238321	Residential Painting Contractors
238331	Residential Flooring Contractors
238341	Residential Tile/Terrazzo Contractors
238351	Residential Finish Carpentry Contractors
238391	Other Residential Finishing Contractors
238911	Residential Site Preparation Contractors
238991	All Other Residential Trade Contractors

Appendix B: Summary Tables for the WA State Forest Sector

Forestry and Logging Sector

	Firms	Employment	Total Real Wages	Total Real GBI	Taxes Paid
1990	1,142	9,374	$327,324,907		
1991	1,084	8,352	$295,852,749		
1992	1,148	7,981	$299,062,779		
1993	1,159	7,649	$269,999,507		
1994	1,145	7,576	$276,891,810	$1,722,016,367	$10,921,051
1995	1,132	7,979	$294,904,883	$2,066,083,907	$11,876,368
1996	1,129	8,207	$298,956,702	$2,075,777,002	$11,779,757
1997	1,114	7,970	$303,864,617	$1,961,588,881	$11,470,818
1998	1,078	7,400	$291,408,157	$1,681,106,440	$10,203,445
1999	1,039	7,711	$323,448,894	$1,790,872,850	$10,743,199
2000	966	7,386	$295,888,722	$1,751,688,916	$10,381,534
2001	913	6,645	$271,152,857	$1,439,885,015	$9,000,922
2002	854	6,497	$276,621,386	$1,459,148,161	$9,081,513
2003	725	6,082	$274,784,668	$1,635,873,128	$9,650,493
2004	698	5,810	$248,348,486	$2,092,037,699	$11,701,789
2005	680	5,704	$244,473,009	$1,946,381,867	$11,109,171

Sector includes the following industries (and NAICS codes):

Timber Tract Operations (113110), Forest Nurseries and Gathering of Forest Products (113210), Logging (113310), and Support Activities for Forestry (115310)

Wood Manufacturing Sector

	Firms	Employment	Total Real Wages	Total Real GBI	Taxes Paid
1990	708	23,998	$785,624,359		
1991	674	21,938	$716,758,867		
1992	679	21,826	$737,301,647		
1993	681	21,870	$732,530,432		
1994	692	22,390	$753,148,388	$7,034,564,266	$53,845,479
1995	699	22,339	$759,375,452	$6,814,094,928	$50,408,378
1996	655	22,423	$777,233,837	$6,659,060,540	$48,077,039
1997	659	22,581	$798,388,514	$6,859,893,047	$47,229,857
1998	648	21,679	$776,856,869	$5,961,055,853	$43,196,289
1999	636	20,958	$776,776,645	$6,580,542,099	$46,202,095
2000	635	21,670	$827,857,277	$6,405,577,767	$46,145,639
2001	593	18,636	$693,937,008	$5,733,381,962	$41,353,808
2002	536	17,700	$666,547,283	$5,943,297,721	$39,488,358
2003	510	17,561	$675,380,519	$6,346,716,312	$41,025,093
2004	490	18,037	$700,026,485	$7,409,677,099	$46,068,565
2005	518	18,857	$734,885,906	$7,571,154,185	$48,548,514

Sector includes the following industries (and NAICS codes):

Sawmills (321113), Wood Preservation (321114), Hardwood Veneer and Plywood Manufacturing (321211), Softwood Veneer and Plywood Manufacturing 321212), Engineered Wood Member (except truss) Manufacturing (321213), Truss Manufacturing (321214), Reconstituted Wood Product Manufacturing (321219), Wood Window and Door Manufacturing (321911), Cut Stock, Resawing Lumber and Planing (321912), Other Millwork (including Flooring) (321918), Wood Container and Pallet Manufacturing (321920), Manufactured Home (Mobile Home) Manufacturing (321991), Prefabricated Wood Building Manufacturing (321992), All Other Miscellaneous Wood Product Manufacturing (321999)

Pulp and Paper Manufacturing Sector GBI Subtotal

	Firms	Employment	Total Real Wages	Total Real GBI	Taxes Paid
1990	106	16,663	$890,210,498		
1991	112	16,148	$868,505,292		
1992	118	15,754	$836,534,815		
1993	118	15,415	$831,743,708		
1994	119	15,393	$853,714,407	$5,180,096,460	$24,703,081
1995	124	15,826	$879,896,301	$5,954,544,630	$28,039,570
1996	126	15,647	$873,625,017	$5,532,893,207	$24,869,468
1997	130	15,616	$891,478,668	$5,368,032,619	$26,128,322
1998	130	15,602	$913,042,884	$5,491,354,945	$26,988,255
1999	128	15,238	$891,071,541	$5,749,031,959	$26,046,639
2000	129	14,427	$840,936,157	$5,829,588,172	$26,078,474
2001	129	14,038	$842,651,822	$5,046,162,391	$22,613,531
2002	107	13,210	$783,784,789	$5,330,945,429	$21,640,421
2003	105	12,875	$768,345,018	$5,108,224,772	$21,346,943
2004	101	13,244	$792,619,653	$5,233,974,187	$21,936,407
2005	93	12,117		$4,494,476,936	$19,399,044

Sector includes the following industries (and NAICS codes):

Pulp Mills (322110), Paper (except Newsprint) Mills (322121), Newsprint Mills (322122), Paperboard Mills (322130), Converted Paper Product Manufacturing (3222)

Furniture Manufacturing Sector GBI Subtotal

	Firms	Employment	Total Real Wages	Total Real GBI	Taxes Paid
1990	196	2,144	$54,974,407		
1991	536	5,404	$137,831,418		
1992	538	5,230	$136,187,827		
1993	540	5,094	$134,473,760		
1994	536	4,914	$126,726,119	$515,878,107	$16,801,486
1995	531	4,811	$125,613,256	$510,818,214	$15,906,962
1996	519	4,805	$127,658,123	$531,562,968	$16,108,694
1997	502	5,028	$136,436,808	$581,592,893	$17,043,631
1998	513	5,441	$151,155,187	$644,445,677	$18,233,210
1999	507	5,747	$171,358,787	$703,376,304	$19,038,498
2000	500	5,923	$180,548,058	$742,291,685	$19,874,024
2001	491	5,723	$174,910,054	$718,407,092	$18,687,011
2002	474	5,259	$163,005,311	$691,768,258	$17,355,473
2003	455	5,146	$160,285,215	$753,592,388	$17,741,596
2004	418	5,614	$186,750,519	$842,973,626	$18,726,552
2005	521	7,584	$258,675,849	$898,953,747	$20,522,962

Sector includes the following industries (and NAICS codes):

Wood Kitchen Cabinet and Countertop Manufacturing (337110), Nonupholstered Wood Household Furniture Manufacturing (337122), Wood Television, Radio and Sewing Machine Cabinet Manufacturing (337129), Wood Office Furniture Manufacturing (337211), Custom Architectural Woodwork and Millwork Manufacturing (337212)

Appendix C: Regression Equations for Estimating GBI Within the Timbersheds

Regression Model to Estimate GBI

We utilized two data sets from different sources; one from the Employment Security Department and the other from the Department of Revenue. The Employment Security Department has historical employment and wage data for each county and in each of the industrial sectors included in the study (NAICS or SIC). Similarly, the Department of Revenue has historical GBI data for each industrial sector (NAICS or SIC). However, the Department of revenue GBI data is only available at the statewide level and no information is available for specific industry sectors at the county level. Since one of the objectives of this study was to estimate the economic contribution of the forestry and forest products sectors within each of the timbersheds, it was important that we develop simple regression models to estimate GBI for each timbershed using county level wage and employment data.

1. Total GBI (all sectors) in each timber shed

In order to estimate the total GBI of each timber shed, a linear regression model was developed. Sample data used for the regression included total wages, total employment and total aggregated GBI in Washington state from 1994 to 2004, where the dependent variable was Gross Business Income. GBI showed a much higher correlation with total wages (.951) than with employment (-.567). Furthermore, wages and employment showed a relatively high correlation (-.679). When two highly correlated independent variables are included in a regression model, multicolinearity produces unacceptable uncertainty in estimating regression coefficients. With these considerations in mind, it was determined that total wages would be used as the independent variable.

The simple linear regression using the Ordinary Least Square (OLS) method provided the following:

Total Real GBI for all sectors in timber shed = Total Wages * 4.229

T-value of coefficient is 53.4 (significant at .001 level).

This suggests that an increase in $1 in total wages in each timbershed leads to an increase of $4.229 in total real GBI (across all sectors) in each timbershed.

2. GBI of each forest industrial sector in each timber shed

The dependent variable is GBI for the five forest product industry sectors from 1994 to 2004 (n=54). The independent variable is either total wages or total number of workers in each forest industry. Employment shows higher correlation with GBI (.961) than wages (.949). Wages and employment show high correlation (.892), so only one variable can be used as independent variable in order to avoid multicolineality problem. Five sectors are regarded as dummy variables. It is natural to think that sector differences effect on the magnitude of trend rather than base level. Hence, dummy variables are used in terms of trend rather than constant.

2-1. Wages as an independent variable

The linear regression by using Ordinary Least Square (OLS) method for GBI estimates is

GBI = (7.936 * Total Wages * Dummy113) + (11.176 * Total Wages * Dummy321) + (8.194 * Total Wages * Dummy 322) + (12.866 * Total Wages * Dummy 3332) + (5.265 * Total Wages * Dummy 337)

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
wag113	7.936	0.644	0.203	12.321	0
wag321	11.176	0.248	0.743	45.076	0
wag322	8.194	0.218	0.619	37.57	0
wag3332	12.866	3.286	0.065	3.916	0
wag337	5.265	1.143	0.076	4.606	0

In conclusion:

- An increase of $1 in total wages for forestry and logging in each timbershed leads to an increase of $7.936 in real GBI for that industry sector in each timbershed.
- An increase of $1 in total wages for wood product manufacturing in each timbershed leads to an increase of $11.18 in real GBI for that industry sector in each timbershed.
- An increase of $1 in total wages for pulp and paper manufacturing in each timbershed leads to an increase of $8.194 in real GBI for that industry sector in each timbershed.
- An increase of $1 in total wages for wood machinery manufacturing in each timbershed leads to an increase of $12.87 in real GBI for that industry sector in each timbershed.
- An increase of $1 in total wages for wood furniture manufacturing in each timbershed leads to an increase of $5.265 in real GBI for that industry sector in each timbershed.

Appendix D: Summary Tables For Forest Sector Within Each Timbershed (2005)

North Coast	Firms	Employment	Total Wages	Average Wage
1131	5	32	$1,341,272	$41,915
1133	66	397	$14,352,691	$36,153
3211	17	416	$17,765,717	$42,706
3212	*	*	*	*
3219	6	26	$809,043	$31,117
3221	3	501	$31,093,270	$62,062
3371	13	54	$1,198,999	$22,204
3372	*	*	*	*

South Coast	Firms	Employment	Total Wages	Average Wage
1131	*	*	*	*
1132	*	*	*	*
1133	90	722	$28,837,322	$39,941
3211	35	1204	$54,069,953	$44,909
3212	*	*	*	*
3219	11	693	$27,663,641	$39,919
3221	3	614	$38,114,541	$62,076
3222	*	*	*	*
3371	4	6	$41,391	$6,899
3372	*	*	*	*

Southwest	Firms	Employment	Total Wages	Average Wage
1131	7	15	$345,201	$23,013
1132	3	71	$1,237,041	$17,423
1133	154	1565	$70,714,297	$45,185
3211	31	2603	$124,607,933	$47,871
3212	14	625	$26,008,855	$41,614
3219	35	629	$20,058,874	$31,890
3221	11	3939	$275,865,767	$70,034
3222	13	861	$42,529,273	$49,395
3332	*	*	*	*
3371	40	513	$17,279,008	$33,682
3372	*	*	*	*

South Puget Sound	Firms	Employment	Total Wages	Average Wage
1131	7	57	$4,487,926	$78,736
1132	9	66	$1,139,550	$17,266
1133	85	822	$34,147,782	$41,542
3211	32	1891	$89,343,373	$47,247
3212	14	800	$30,205,907	$37,757
3219	70	1551	$52,209,410	$33,662
3221	6	608	$37,332,857	$61,403
3222	15	711	$33,846,407	$47,604
3371	78	736	$22,407,123	$30,444
3372	9	393	$15,243,877	$38,788

** Screened due to confidentiality (either 3 or fewer firms, or one firm was more than 80% of employment)*

North Puget Sound	Firms	Employment	Total Wages	Average Wage
1131	13	85	$21,982,323	$258,616
1132	*	*	*	*
1133	122	833	$32,204,669	$38,661
3211	35	1,551	$75,104,038	$48,423
3212	15	766	$28,855,240	$37,670
3219	143	3,116	$103,755,007	$33,297
3221	9	503	$26,412,005	$52,509
3222	32	2,668	$148,152,987	$55,530
3332	*	*	*	*
3371	205	2,271	$78,484,683	$34,560
3372	28	709	$27,130,135	$38,265

East Cascade	Firms	Employment	Total Wages	Average Wage
1132	*	*	*	*
1133	71	559	$18,983,343	$33,959
3211	16	1151	$41,908,776	$36,411
3212	6	201	$5,804,008	$28,876
3219	27	747	$20,386,420	$27,291
3221	4	232	$11,253,451	$48,506
3222	3	248	$13,058,833	$52,657
3332	*	*	*	*
3371	27	148	$3,713,809	$25,093
3372	*	*	*	*

Inland Empire	Firms	Employment	Total Wages	Average Wage
1131	*	*	*	*
1133	97	461	$13,683,031	$29,681
3211	20	832	$33,169,491	$39,867
3212	10	475	$17,571,295	$36,992
3219	41	623	$14,390,433	$23,099
3221	7	784	$53,711,633	$68,510
3222	8	443	$20,627,081	$46,562
3332	3	45	$1,371,709	$30,482
3371	54	1009	$28,373,949	$28,121
3372	5	59	$1,570,423	$26,617

** Screened due to confidentiality (either 3 or fewer firms, or one firm was more than 80% of employment)*

Appendix E: Sawmill Survey

If you have an interest in the future productivity of the Washington forest products industry, please fill out this UW/College of Forest Resources survey.

Sawmill Survey for the Future of Washington Forests and Forest Industries

September 2006

Dear Sawmill Manager,

The WA State Legislature has asked the College of Forest Resources to conduct an objective study of the Washington Forest Products Industry to assess the economic and environmental trends influencing the forest products industry and secondary manufacturing sectors in Washington State. This study will conduct an independent assessment of the economic contribution of the forest products industry and secondary manufacturing sectors to the WA state economy. In addition, an analysis of the competitive position of Washington's forest products industry, both domestically and internationally, will be developed. The final report will provide a rich array of information from which the Washington Department of Natural Resources, the College of Forest Resources and an advisory board comprised of industry managers will collaboratively develop policy recommendations for the State Legislature intended to enhance the competitive position of Washington's forest products industry and ensure a productive forest land base that can be managed for a sustainable flow of forest products, recreation, and environmental benefits into the future.

The results of this survey will allow us to more accurately estimate the economic contribution of the sawmill industry to the WA state economy. In particular, the results will help us to highlight the key contribution of the sawmill industry in the economies of rural communities. To ensure that information from the forest products industry is current and that adequate opportunity is provided for industry recommendations to the Legislature, we have prepared surveys for the logging, sawmill, plywood and paper industries.

Please take a few minutes to fill out and return this important questionnaire. If your company operates more than one sawmill, please fill out a separate survey for each sawmill facility. Your participation in this survey will ensure that future policies or regulations considered by the Legislature will be informed by a current understanding of forest industry operations and manager expectations. ***PLEASE BE ASSURED THAT YOUR RESPONSES WILL BE KEPT COMPLETELY CONFIDENTIAL.*** To ensure respondent anonymity in the final report, all survey data will be summarized to reflect industry activities occurring either West or East of the Cascade Mountains. All information collected from this survey will be analyzed and aggregated at the College of Forest Resources prior to presentation to DNR and the State Legislature.

If you have any questions, please contact the Ivan Eastin, Director of the Center for International Trade in Forest Products (CINTRAFOR) at Tel: (206)543-8684, Fax: (206) 685-0790, or email: eastin@u.washington.edu or Larry Mason, Project Coordinator for the Rural Technology Initiative (RTI), at Tel: (206) 543-0827 or email: larrym@u.washington.edu. A report on project progress through July 2006 can be viewed at: http://www.ruraltech.org/pubs/pubs_list/2006/pdfs/DNR_report_July2006.pdf.

Thank you for taking the time to share your information and recommendations.

Please check the box that best indicates your answer to each question.

1) **In which county(s) is your sawmill located?** _____

2) **Approximately how many years has your company been in business?** _____

3) **Approximately how many people did you employ in 2005?** _____

4) **Approximately what volume of logs did your sawmill process in 2005 (Please report volume in either million board feet Scribner or tons)?** _____

5) **Approximately what percentage of your logs originated from the following ownerships in 2005?** *(Total should equal 100%).*

Federal	State	Other Public	Industrial	Non-industrial	Tribal	Out-of-state

6) **Approximately what percentage of your out-of-state logs came from the following in 2005:** *(Total should equal 100%).*

Oregon	Idaho	British Columbia	Other

7) **Approximately what percentage of your log input in 2005 was from the flowing species?** *(Total should equal 100%)*

DF/WL	WH/WF/SPR	PP	LP	WP	RC	RA	Other

DF = Douglas-fir, WL = western larch, WH = western hemlock, WF = white fir and other true firs, SPR = spruce, PP = ponderosa pine, LP = lodgepole pine, WP = western white pine, RC = red cedar, RA = red alder

8) **Approximately what percentage of your logs in 2005 were the following diameters** *(Total should equal 100%).*

Less than 5 "	5 to 7"	8 to 11"	12 to 24"	More than 24"

What is the minimum and maximum diameter that you process?

Minimum Diameter _____ Maximum Diameter _____

9) **Approximately what percentage of your logs in 2005 were the following log quality** *(Total should equal 100%)*

Pulp	Low Grade Saw logs	High Grade Saw logs

10) **How would you describe the current availability of logs for your sawmill?**

Always Scarce	Sometimes Scarce	Adequate	Sometimes Oversupplied	Regularly Oversupplied

11) Do you think that the volume of timber harvested by the US Forest Service will increase appreciably in the future?

Impossible	Not Likely	Uncertain	Somewhat Likely	Very Likely

12) Are timber harvest operations conducted by your company? □ **Yes** □ **No**
If yes, please enter the percentage of your timber harvest conducted by the following *(Total should equal 100%).*

Company Loggers	Contract Loggers

13) What is the range (radial distance from your mill) from which you purchase log supplies? *(Total should equal 100%).*

0 to 50	51 to 100	101 to 150	150 to 200	More than 200

14) Approximately what percentage of your logs are transported by the following? *(Total should equal 100%).*

Company Trucks and Drivers	Contract Truckers

15) Does your company use rail or water services to transport logs long distances? □ **Yes** □ **No**

16) Are you familiar with forest certification programs such as those offered by the Forest Stewardship Council and the Sustainable Forestry Initiative?

Not Familiar	Vaguely Familiar	Very Familiar

17) Would your company pay a premium for certified logs? □ **Yes** □ **No**

18) How many sawmills does your company own?

0	1	2	3	More than 3

19) Is your company operating at production capacity? □ **Yes** □ **No**

20) Approximately what volume of lumber did your sawmill produce in 2005 (Please report volume in million board feet Scribner)? _____

21) Approximately what percentage of your production in 2005 was of the following lumber products *(Total should equal 100%)*

Dimension lumber	
Studs	
Boards	
Timbers	
Cross Arms	
Clears	
Industrials for Remanufacture	
Engineered Wood Products	
Poles	
Chips	
Hog Fuel	
Other	

22) Approximately what percentages of your lumber sales were to the following markets? *(Total should equal 100%)*

Washington	Other US	Export

23) What was your average annual gross value of product sales in 2005?

_____

24) Please estimate the following production costs as a percentage of gross annual sales.

Labor	
Operations	
Maintenance	
Sales and Administration	
Fixed Assets	

25) Please estimate the number of employees and their wages by job type.

Job type	Hourly or Salaried (Please Mark H or S)	Number of Employees	Average Wage
Production			
Maintenance			
Sales			
Purchasing			
Administration			
Other			

26) How difficult is it for you to keep or recruit qualified workers in the following categories?

a. Operations Workers (filers, sawyers, and other positions unique to the sawmill industry)

Very difficult	Somewhat difficult	Workers are readily available

b. Trades Personnel (millwrights, electricians, and other positions not unique to the sawmill industry)

Very difficult	Somewhat difficult	Workers are readily available

Please estimate the average age of current Operations Workers _____Trades Personnel_____

27) How would you characterize the availability of workers compared to 10 years ago?

More scarce	The same	Less scarce

28) By what method of transportation does your lumber travel to market? *(Total should equal 100%).*

Company Trucks	Contract Trucks	Rail	Ship

29) How would you rate the business environment in WA State for your company as compared to other states where your competitors operate?

Substantially More Difficult	Somewhat More Difficult	Neutral	Somewhat Less Difficult	Substantially Less Difficult

Please use Additional Pages as Necessary

Why?

_____

_____

_____

30) What regulatory factors do you feel most negatively affect your business?

_____

_____

_____

31) What do you feel could be done at the federal level to improve your business competitiveness?

_____

_____

_____

32) What do you feel could be done at the state level to improve your business competitiveness?

_____

_____

_____

33) What do you feel could be done at the local level to improve your business competitiveness?

_____
_____
_____

34) How much has your productivity changed between 2000 and 2005? *(Indicate the approximate percentage)*

_____
_____
_____

35) What factors have contributed to your productivity change?

_____
_____
_____

36) Has your company considered expanding its production capacity in the next five years? □ **Yes** □ **No**
If Yes, *Please explain which factors would be important to your investment decision.*

_____
_____
_____

ADDITIONAL COMMENTS (*Please use the back of the sheet for additional space)*

_____
_____
_____
_____
_____

THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY. If you would like a copy of the summary results, please include your name and email address and we will send you the summary report.

Name: _____

Address: _____

_____