FOREST PRODUCTS USE OF ROADWAYS AND TRANSLOAD FACILITIES IN WASHINGTON

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FINAL REPORT

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PROBLEM STATEMENT

Washington's forest products sector has changed dramatically over the past several decades and with it the movement of timber and forest products. The major input of wood manufacturing is logs, usually transported from forest sites by log trucks to mills or export facilities. The predominant products are lumber with some plywood; they are shipped locally, regionally, and less internationally. As an example, Washington lumber is primarily shipped to California and to other west and mid-west regions by using trucks and rail. Lumber mills are the major source of woodchips for pulp manufacturers, using trucks, barges, and rail to transport the chips to the pulp manufacturers. Integrated pulp and paper manufacturers produce market pulp transported by rail, and paper products ship by trucks and in containers overseas. Given the dynamic nature of Washington's timber base, it is likely that the movement of raw material resources and products will continue to adjust as timber resources change, and milling and processing facility investments respond to these changes. How will the forest products sector's use of roadways and transload facilities in Washington change?

BACKGROUND

Several studies recently completed by researchers at the College of Forest Resources suggest a forest sector that will continue to evolve as demands on forestlands respond to changes in various end-use markets, regulations increasingly control land uses, and environmental factors impact raw material availability (WADNR 2007, CFR 2007). Other studies have projected lumber manufacturing demand (Perez-Garcia 2003), future timber harvest levels (Perez-Garcia 2004, 2005) and log flows across western Washington (Perez-Garcia, Barr and Daniels 2005).

These findings have implications for the transportation sector, although no studies adequately addressed the use of the transportation system by the forest sector. The studies provide useful information to characterize forest products sector use of roadways and transload facilities in Washington. Using the information from the recent future of Washington forests study (WADNR 2007), data on roadways and transload facilities and consultations with transportation and forest sector representatives, we project current and future use of roadways and transload facilities by the forest products.

OBJECTIVES

The study provides the Washington State Department of Transportation (WSDOT) with an estimate of the current and future use of roadways and transload facilities in Washington by Washington's forest products sector. Estimates of current and

projected future use by wood product manufacturers will allow the WSDOT to better plan its infrastructural needs to move products across the state efficiently.

IMPLEMENTATION

A measure of roadway and transload use by the forest products sector was constructed using published survey data on log use by mills and wood products production by mills from the Washington State Department of Natural Resources (WADNR 2007) and other sources explained below. For log truck loads, milling clusters and county of harvest activity, when available, were located on a map. Roadway and transload facility locations were associated with these harvest and mill data. We inferred transportation activity to and from mill and harvest locations by mapping the county harvest data and mill survey consumption data. We calculated log truck loads using a load factor range between 5 thousand board feet (mbf) per truck and 3.5 mbf per truck to establish a credible range of truck log loads. We determined the truck loads for each county where the harvest was recorded. We added county past-through truck loads to each county's truck load harvest when there were counties in between the county where the end-using mill cluster was located and the counties where harvest occurred.

We calculated the measure for chip truck loads and road and rail use in a similar fashion. Due to confidentiality restrictions of the published survey data (WADNR 2007), however, there were less county-level data available to construct a more detailed picture of chip truck usage of the state's transportation systems. Chip loads were calculated at 70,000 lbs per load, a maximum load limit. Most chips are transported from lumber, veneer and plywood mills to pulp mills.

Products were transported by rail to markets outside of Washington and trucks to markets within and outside of Washington. A small percentage of lumber is also barged out of state. We used a weighted conversion factor of 100 mbf per rail car for dried lumber and 68 mbf per car for green lumber. We used data on housing markets from the Census Bureau and their location to link product flows heading out of state by truck and rail.

We utilized findings from the Washington forests future study (CFR 2007) and discussions with industry representatives to project roadway and transload facility future use. We validate our estimates by using phone calls to transloaders, mill managers, and other contacts.

RESULTS

Logging Sector

Figure 1 reports the number of log truck loads in thousands taking logs from the harvest sites and transporting them to mill clusters in western Washington. Table 1 reports these truck loads by state roads segments in each county.

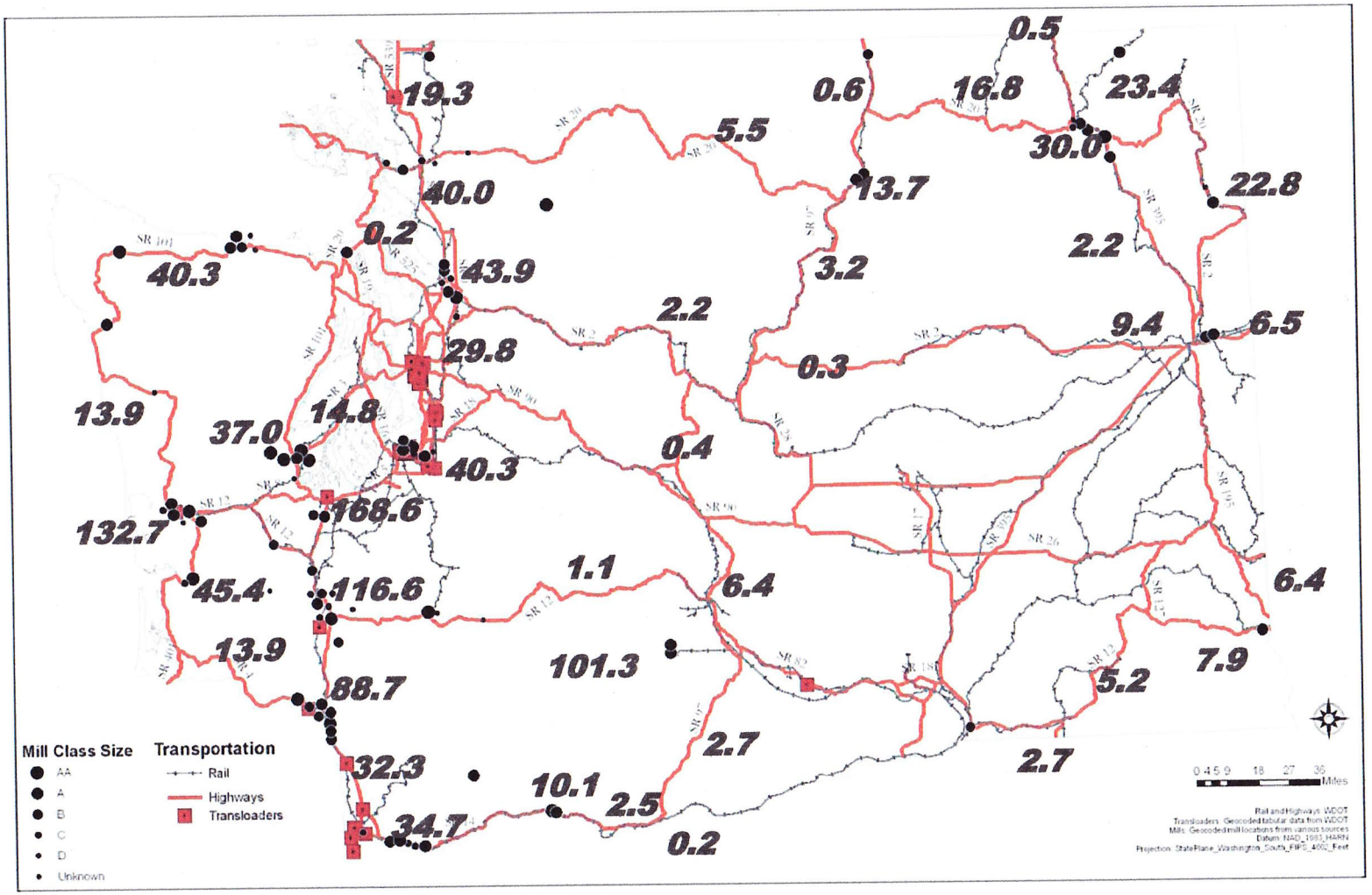

Figure 1. Estimated log truck loads in 1,000s servicing mill clusters in Washington State

Table 1. Estimated log truck loads servicing forest product mills in Washington state.

Log Truck Loads (1000)		Road Segment/ Comments
@ 5.0 mbf/load	@ 3.5 mbf/load	
40.3	57.6	SR 101 Clallam county
13.9	19.9	SR 101 Jefferson, Grays Harbor counties
132.7	189.6	SR 101, SR 12 Mill cluster area Grays Harbor county
45.4	64.9	SR 101, Pacific county
13.9	19.9	SR 4, Wahkiakum and Cowlitz counties
37.0	52.9	SR 101, SR 8 Mill cluster area, Mason, Kitsap and Pierce counties
19.3	27.6	SR 5, SR 539 Whatcom county
40.0	57.1	SR 5,SR 20 Skagit county
0.2	0.3	SR 525 Island county
43.9	62.7	SR 5, SR 9 SR 2 Snohomish county mill cluster
29.8	42.6	SR 5, SR 90, SR 405, SR 18 and others King county
14.8	21.1	SR 3 Kitsap county
40.3	57.6	SR 5, 18, 16 and others Pierce county
168.6	240.9	SR 5, SR 101 Thurston county
116.6	166.6	SR 5, SR 12 Mill cluster area Lewis county
88.7	126.7	SR 5, SR 4 Mill cluster area Cowlitz county
32.3	46.1	SR 5 Clark county
34.7	49.6	SR 14 Mill cluster area Skamania county
1.1	1.6	SR 12 Yakima county
101.3	144.7	Yakima Tribal lands
10.1	14.4	SR 14 Klickitat county
2.5	3.6	SR 14 Klickitat county
5.5	7.9	SR 20 Okanogan county
2.2	3.1	SR 2 Chelan county
0.4	0.6	SR 97 Kittitas county
6.4	9.1	SR 82 Yakima county
2.7	3.9	SR 97 Yakima, Klickitat counties
0.2	0.3	From Oregon
0.6	0.9	SR 97 Okanogan County
13.7	19.6	SR 97 Okanogan county
3.2	4.6	SR 97 Okanogan county
0.3	0.4	SR 2 Douglas, Lincoln counties
0.5	0.7	SR 395 Ferry, Stevens counties
16.8	24.0	SR 20 Ferry county
23.4	33.4	SR 20 Stevens, Pend Oreille counties
30.0	42.9	SR 20 SR 395 Mill cluster area Stevens county
2.2	3.1	SR 395 Stevens, Spokane counties
22.8	32.6	SR 20 SR 2 Pend Oreille, Spokane counties
9.4	13.4	SR 2 SR 90 SR 195 mill cluster area Spokane county
6.5	9.3	SR 90 Spokane county from Idaho, Montana
6.4	9.1	SR 195 Whitman county from Idaho
7.9	11.3	SR 12 Asotin, Garfield counties
5.2	7.4	SR 12 Columbia Walla Walla counties
2.7	3.9	SR 12 Walla Walla county from Oregon

There is a concentration of truck loads in the Grays Harbor, Thruston, Lewis and Cowlitz counties utilizing State Routes (SR) 5, 101, 8 and 12. There is a transloading station in Grays Harbor for logs. About 4.2 million board feet (or 650 car loads @100 ton per car) were sent via rail to Pend Oreille county in 2004. About 350 million board feet of logs entered from Oregon in 2004 and mostly travel up SR 5 or was barged to the Port of Longview for export markets. An estimated 30,000 truck loads use SR 5. Logs coming down from British Columbia are generally barged and then trucked to mills.

Figure 2 converts the annual numbers in Figure 1 to an average hourly basis. It assumes 340 days a year and 14 hours in a day. Slightly over 35 trucks an hour operated in Thurston County in 2004. This is an intersection for log trucks servicing mills up and down SR 5, as well as trucks from Grays Harbor using SR 12 and 8. It is centrally located connecting the resource rich counties of the Olympus Peninsula and lower Columbia to the milling infrastructure along the SR 5 corridor adjacent to Puget Sound. At the same time, the number of log truck loads associated with the volume transported to mills in Thurston County is likely over estimated by some undetermined amount since there is some unknown percentage of logs that are barged and rafted into the area. Grays Harbor, Lewis and Cowlitz counties were also found to have high hourly truck loads and it is supported by the concentration of mills in these counties.

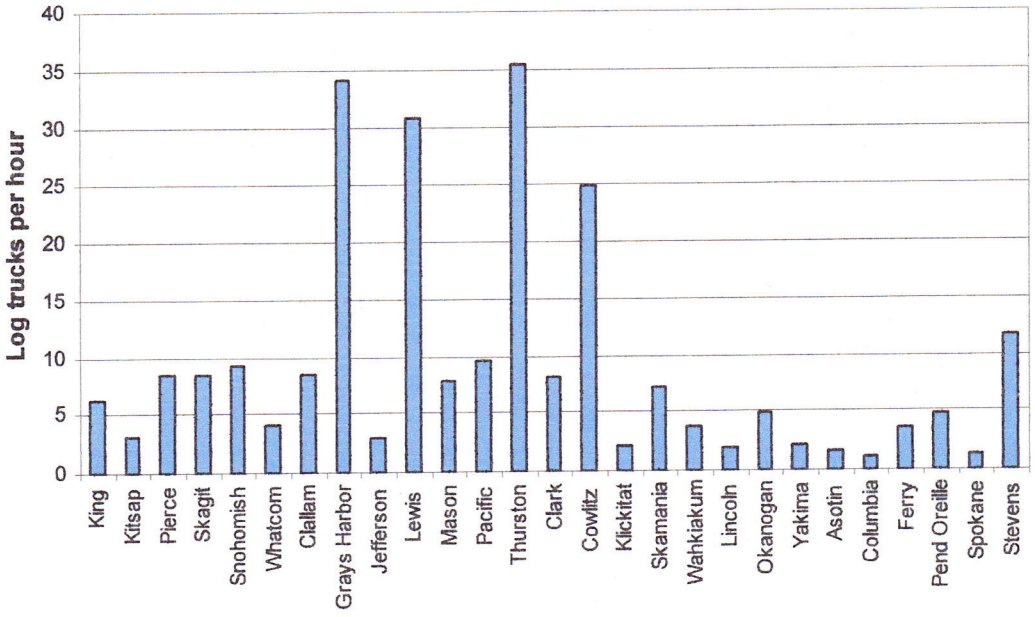

Figure 2. The average number of log trucks per hour. The numbers assume all harvested volume was transported to mills on logging trucks using an average log truck load of 5 thousand board feet (mbf).

The Mill Residue and Pulp Sectors

The majority of the mill residues from shake and shingle operators, veneer and plywood plants and lumber mills go towards the production of pulp, fiber board or fuel. Pulp manufacturers consume the majority of the residues; residues from within-state mills and those imported from surrounding states provide about 70 percent of their raw material input. Wastepaper and chips from roundwood operators make up the remaining 30 percent.

Chip loads from roundwood operators and mill sources consumed by the pulp sector amounted to 4.4 million bone dry tons. The majority of the chips, 52 percent, came from lumber mills; followed by chipping mills with 40 percent. Table 2 reports the county in which either the mill residues or chips were produced and the volume consumed. The data detail was not sufficient to allocate residues from veneer and plywood plants, shake and single operations and roundwood chippers at the county level. The "others" listing in the table is distributed among the counties in the larger grouping (hence the second column in the table). Numbers in the table represent truck loads in thousands for 2004, and assume maximum payloads per truck. Hence, it is likely to be a conservative number.

The table contains the amount consumed in each broader county grouping as well as the apparent consumption and excess in consumption. The apparent consumption is the volume produced plus net trade in and out of the area. The excess in consumption is the amount in excess of consumption needs. For the Puget Sound area, consumption volumes were equal to production volumes, hence there is a reported excess of zero truck loads. Nevertheless chips from other areas were transported to the Puget Sound area mills. A study of Clallam County indicates that about 20 percent is shipped to Puget Sound pulp mills (Perez-Garcia 2005). This volume creates an excess amount that is then shipped to the Lower Columbia counties.

We infer road usage using the location of pulp mills and sawmills. The truck flows indicated in Figure 3 represent annual numbers estimated using production figures from WADNR 2004 survey (WADNR 2007). About 64 thousand chip truck loads were produced and utilize primarily SR 101, 12, 8, 5, and 4. About 42 thousand truck loads traveled to the Longview complex annually, some coming from Grays Harbor and Mason counties. The majority of chip trucks servicing the Longview complex were likely from Lewis county. Another 11 thousand truck loads from Clallam county crossed the Puget Sound to service the Everett and Tacoma mills primarily using SR 101. However, an unknown quantity of chips was barged rather than trucked. About 11 thousand trucks traveled down SR 5 from the Puget Sound counties and serviced Longview. Within the lower Columbian counties there are an estimated 79,000 trucks that utilized SR 5 and 14. The majority, 53,000 truck loads servicing the Camas area, originate in other counties.

It is more difficult to discern chip movements in eastern Washington since numbers are aggregated to provide confidentially. A pulp mill is located in the Northeast

portion of the state, one in the Spokane region and the third in Wallula, near the Oregon border. Counties of Okanagan and Yakima and others in Central Washington produced 5,400 chip truck loads and used SR 80 to service the Wallula mill and SR 20 (or alternate routes) to service the Usk mill. The inland portion of Washington state produced 15,000 truckloads; the majority is assumed to have been consumed locally in Usk mill utilizing SR 20.

Table 2. Chip truck loads in 1000s.

County	*Produced in*		*Consumed in*	*Out of State Imports*	*Apparent Consumption*	*Excess in Consumption*
King, Whatcom	0.8					
Pierce	11.4					
Skagit	0.2					
Snohomish	6.8					
Others		11.6				
Puget Sound	**30.7**		**30.7**		**30.7**	**0.0**
Clallam	3.3					
Grays Harbor	4.9					
Mason, Pacific, Thurston	11.6					
Lewis	9.1					
Others		34.4				
Olympic Peninsula	**63.3**		**10.2**		**63.3**	**53.1**
Clark, Klickitat, Skamania	3.3					
Cowlitz	5.5					
Others		1.3				
Lower Columbia	**10.0**		**78.8**	**11.8**	**21.8**	**-56.9**
Chelan, Okanogan	1.2					
Yakima	1.5					
Others		2.7				
Central Washington	**5.4**					
Ferry, Pend Oreille, Whitman	2.1					
Stevens	3.4					
Others		9.5				
Inland Empire	**15.0**		**31.1**	**0.5**	**15.5**	**-15.6**
State	**124.4**		**150.7**	**12.3**		

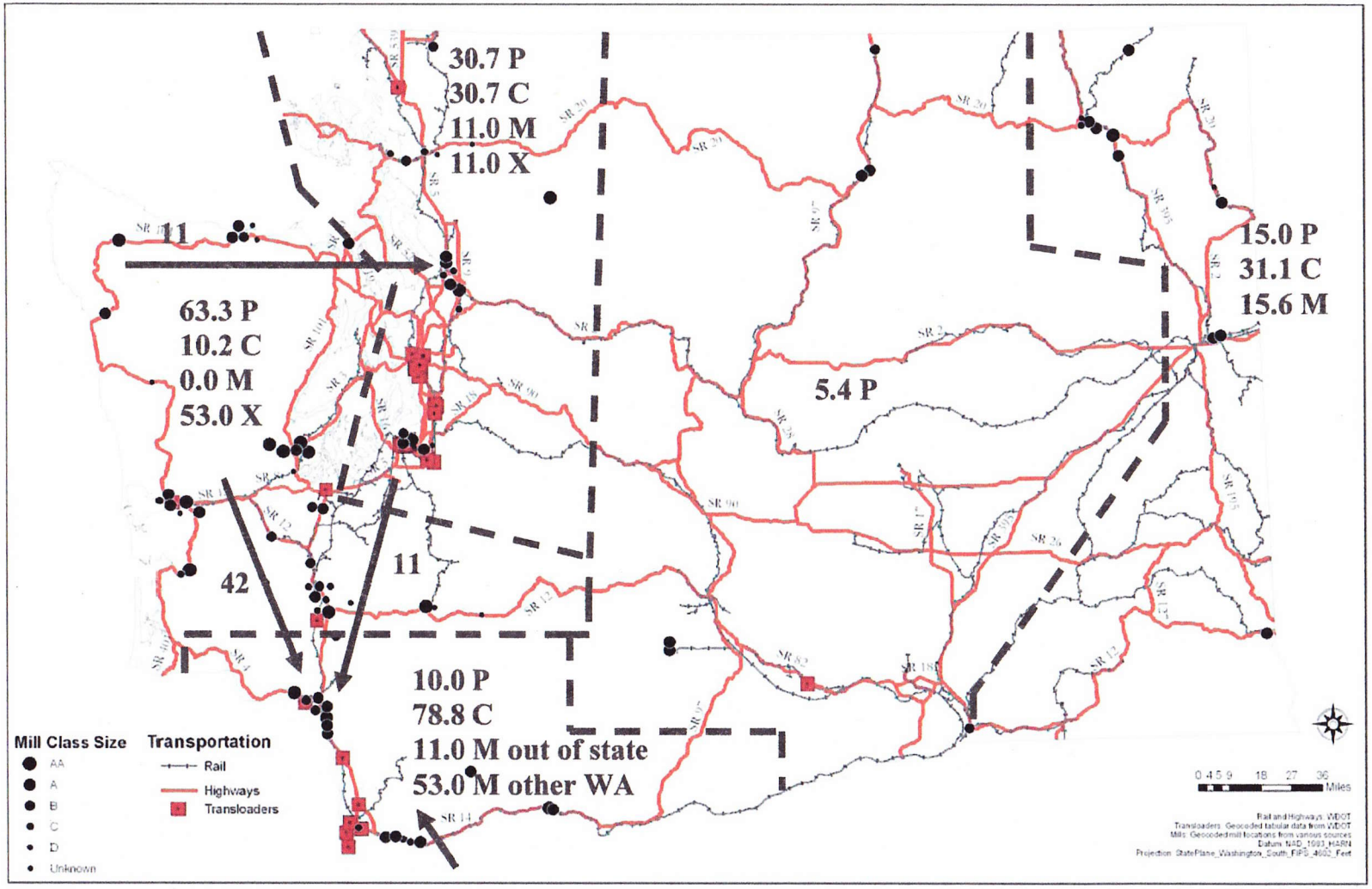

Figure 3. The origin and number of chip trucks in 1000s servicing Washington pulp mills, 2004. (P = produced in economic area; C = consumed in economic area; M = imported into the economic area; X = exported from the economic area).

The Lumber, Veneer and Plywood Sectors

Lumber production is primarily exported to other states. Of the 4.9 million board feet production level, we estimated 3.2 million was exported to other U.S. regions. We believe our calculations for transportation estimates are conservative. According to WWPA the principal markets for Washington lumber in 2004 include California (17%), Other West including Washington State (45%), Northeast (10.3%), South Central (6.7%), Southeast (6%) and export (1.2%) (WWPA 2005). WWPA also calculates 53.2 percent of the lumber production was shipped by rail, 41.1 percent by truck and 5.7 percent by water.

We assigned production destinations based on the percent of production share going to the markets outlined above. Of the Other West market share we estimated nearly 1.5 million board feet of lumber (30% of production) was consumed in Washington leaving about 0.7 million board feet (14%) for other west destinations. We further assumed that all lumber consumed in Washington is trucked.

We calculated the truck loads in Washington under several different assumptions. We used information on maxi trailers, winter and summer loads and dry and green lumber to construct a weighted average thousand board foot trailer load. We compared this weighted average factor with a factor based on 46,000 net weight, double axle using an average 1,772 lbs per thousand board feet. The maxi trailer factor was calculated at 28.7 mbf per load, while the net weight double axle was calculated at 26 mbf per load.

Table 3. Lumber truck loads shipped within Washington in 2004

Counties	Production (mbf)	1000 trucks per year	trucks per day	SR involved
King, Whatcom	16,398	0.6	2	SR 5, 9, 542
Pierce	195,783	6.8	20	SR 5 and roads located in the Tacoma area
Skagit	6,116	0.2	1	SR 5, 20
Snohomish	225,351	7.8	23	SR 2, 5, 9
Clallam	88,795	3.1	9	SR 101
Grays Harbor	117,916	4.1	12	SR 8, 12 101
Mason, Pacific and Thurston	202,490	7.0	21	SR 5, 8, 101, 12, 507
Lewis	192,761	6.7	20	SR 5, 6, 12
Clark, Klickitat and Skamania	77,059	2.7	8	SR 5, 205, 503, 14
Cowlitz	115,317	4.0	12	SR 4, 5
Chelan, Okanogan	23,372	0.8	2	SR 97, 20, 215, 155, 2
Yakima	64,517	2.2	7	SR 82, 22, 97
Ferry, Pend Orielle and Whitman	92,194	3.2	9	SR 20, 25, 395, 2, 195
Stevens	81,931	2.9	8	SR 20, 395
State	**1,500,000**	**52.2**	**154**	

Table 3 presents the county production levels for lumber and their respective truck loads in thousand units and trucks per day. Major markets in Washington include the Seattle metro area, the Vancouver metro area; these two areas were estimated to consume about 63 percent of the lumber consumed in Washington. Spokane and the Tri-cities are the other two major housing areas in Washington. The loads were assumed to be carried on a maxi trailer. Table 3 also reports the state routes that link the mills to markets in Washington.

Table 4 presents lumber shipments by truck to other states. About 11 percent of Washington's total production level was estimated to be shipped by trucks to other states. Since other states do not allow maxi trailers, the load coefficient to convert volume to weight was estimated to be 20.5 mbf per load. Table 4 also reports the SR involved in shipping lumber out of states. Only those SR that lead out of state are listed in the table.

Table 4. Lumber production and truck loads estimated to be truck to other states

Counties	Production (mbf)	1000 trucks per year	trucks per day	Major outbound SR involved
King, Whatcom	6,174	0.3	1	SR 5
Pierce	73,716	3.6	11	SR 5
Skagit	2,303	0.1	0	SR 5
Snohomish	84,850	4.1	12	SR 5, 2
Clallam	33,433	1.6	5	SR 101, 5
Grays Harbor	44,398	2.2	6	SR 101, 5
Mason, Pacific and Thurston	76,242	3.7	11	SR 5
Lewis	72,579	3.5	10	SR 5
Clark, Klickitat and Skamania	29,015	1.4	4	SR 5
Cowlitz	43,419	2.1	6	SR 5
Chelan, Okanogan	8,800	0.4	1	SR 2
Yakima	24,292	1.2	3	SR 82, 97
Ferry, Pend Orielle and Whitman	34,713	1.7	5	SR 25, 2, 195, 90
Stevens	30,849	1.5	4	SR 395, 90
State	**564,782**	27.5	**81**	

The remainder of the volume of lumber production is estimated to be shipped by rail, with only a small portion (6%) shipped by barge out of the Port of Longview.

Table 5 reports lumber shipments by rail out of state. Rail cars are estimated using the weighted average of dry to green lumber production and 100 mbf dry to 68 mbf green rail car capacities respectively. The table also includes rail reload information. The rail reload information was taken from Random Lengths 2007 Big Book (Random Lengths 2007). Although the publication does not indicate which facility is utilized by the mill, we report the closest reload facility to the mill. Also, not all mills report they use a reload facility. That is, several mills report rail shipments without the use of a reload facility.

Table 5. Lumber production shipped by rail and the use of transload stations

Counties	Production (mbf)	Annual Rail Cars	Cars per 5 day week	Is rail reload facility used?[1]
King, Whatcom	31,171	370	5	Reload, Bellingham
Pierce	372,166	4,422	65	Rail
Skagit	11,626	138	2	Reload, Bellingham
Snohomish	428,372	5,090	75	Rail
Clallam	168,790	2,006	29	Reload, Grays Harbor
Grays Harbor	224,148	2,663	39	Reload, Grays Harbor
Mason, Pacific and Thurston	384,916	4,574	67	Reload, Port of Olympia
Lewis	366,421	4,354	64	Reload, Winlock
Clark, Klickitat and Skamania	146,483	1,741	26	Reload, Vancouver
Cowlitz	219,207	2,605	38	Reload, Longview, Woodland
Chelan, Okanogan	44,428	528	8	Rail
Yakima	122,640	1,457	21	Rail
Ferry, Pend Orielle and Whitman	175,253	2,082	31	Rail
Stevens	155,744	1,851	27	Rail
State	**2,851,366**	**33,881**	**498**	

[1] All counties have mills that use rail. When rail is indicated, no reload activity was noted in that county.

Plywood and veneer production numbers were unavailable by county or economic area due to confidentiality rules in the WA DNR survey publication. We estimated the production on a weight basis and then converted these weights to a truck load basis. Only a small unknown percentage of the plywood production is shipped by rail.

Table 6. Production in 2004 for Washington State

	Production in msf	weight basis: lbs	Truck loads
Veneer	558,459	553,432,869	12,031
Plywood	890,316	882,303,156	19,181
Total	**1,448,775**	**1,435,736,025**	**31,212**

The Future Outlook

There are several factors that influence the future estimates of truck and rail usage in Washington. The first factor that we considered is the projection for harvests levels. The Future of Washington Forests and Forest Industry study (CFR 2007) provides estimates of future harvest levels. Other studies completed at the University of Washington also provide estimates of harvests levels (Perez-Garcia and Barr 2006). Both of these analyses indicate the potential for an increase in the harvest level in western

Washington. Figure 4 illustrates the decadal increases projected for industrial ownerships.

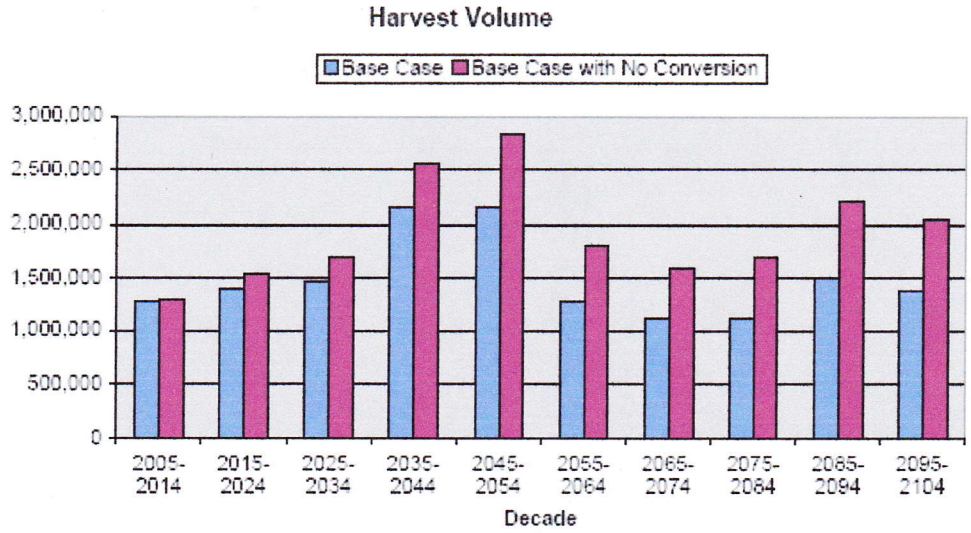

Figure 4. Harvest level projections for industrial ownerships in western Washington (CFR 2007).

The harvest levels are predicted to remain largely flat in all counties with exception to those located in southwestern Washington. The potential for an increase in volume from these counties is the greatest. By 2020 there is likely to be an additional 0.5 billion board feet of harvest from this area, with other areas maintaining their harvest levels. The additional 0.5 billion board feet translates into 143,000 log truck loads, largely coming from the Grays Harbor, Pacific, Lewis and Cowlitz county area.

The second factor that is important to consider is the changing nature of the log resources. Log harvested have smaller diameters today than a decade ago, and this trend is projected to continue. The significance of the smaller diameter log lies in the conversion factor from volume to truck load. A truck load of smaller material holds about 3.5 mbf rather than the 5 mbf used to estimate truck loads in 2004. This trend is already evident with many of the larger mills in the state receiving smaller log diameter sizes and likely reducing the volume of logs carried by each load. The difference between using a 5 versus 3.5 mbf conversion factor is over 500,000 log truck loads.

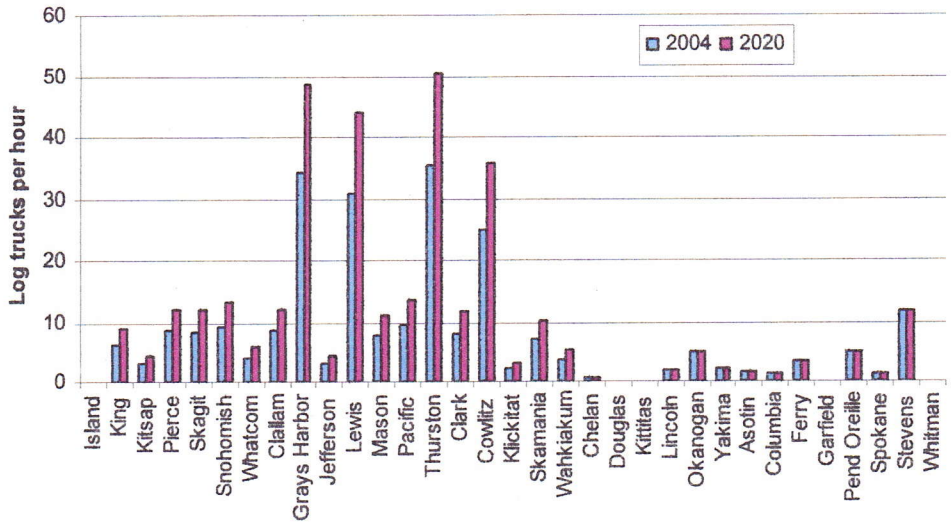

Figure 5. The average number of log trucks per hour for 2004 and 2020

Figure 5 illustrate the increase in number of log trucks due to smaller diameter trees and growth in harvest levels in Gray Harbor, Lewis Pacific, Cowlitz and Skamania counties.

The expectation of an increase in harvest levels in Washington State is likely to produce interest in expanding sawmilling capacity in the state. We envision an additional large scale mill to be in place in Washington State, likely in the Southwest region. This capacity is likely to increase the average number of trucks per day by 36.

It is also instructive to note potential changes due to market cycles in the housing sector. Figure 6 illustrate the decline in year to year changes in new residential housing markets across the U.S. The numbers represented in the charts have been converted to a mbf measure. The changes in the housing sectors in the West and Midwest (MW) regions amount to over 0.5 billion board feet. Converting this number using an average 26 mbf per truck load equals nearly 60 truck loads a day (~ 19,000 loads a year). If all the volume is shipped by rail, the reduction in rail cars is equivalent to nearly 6,000 rail cars annually.

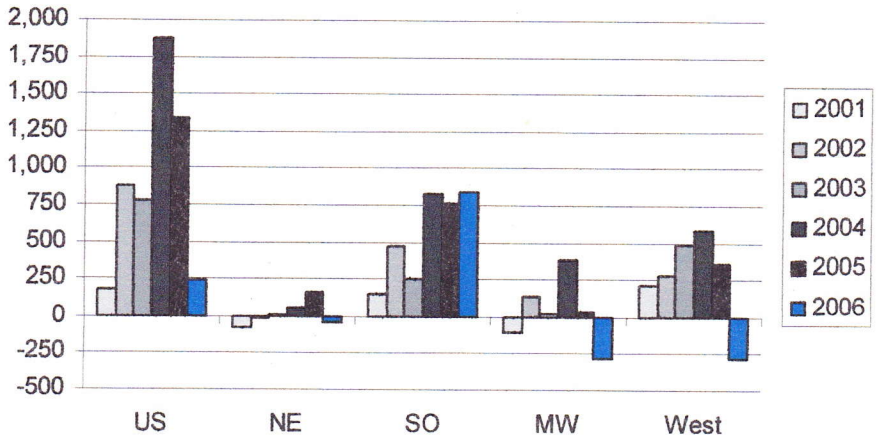

Figure 6. Year to year changes in new residential construction expressed in million board feet. Data Source: US. Census Bureau and CINTRAFOR

SUMMARY

The study calculates road and rail use by the forest products sector in Washington. It uses existing survey data on harvest levels and mill productions, as well as recent analyses on the future of Washington forests. It maps the location of harvest activity, roads, rails, transloaders, and milling capacity. It considers demand end users.

It estimates the number of log truck loads and expects the number to increase over time due to a projected increase in the harvest levels in southwestern Washington and the changing diameter and volume capacity of log trucks. The concentration of log trucks is in Thurston, Grays Harbor, Lewis and Cowlitz counties. Logs traveling by rail are not common in Washington. Currently nearly 800,000 truck loads move logs from harvest sites to log users. This number will grow to over 1 million by 2020.

Statewide there is over 124,000 trucks annually carrying chips from lumber mills, veneer and plywood plants, chippers and shake and shingle operations. The Lower Columbia counties have the highest concentration.

Lumber products employ over 52,000 trailers to deliver products within Washington borders. An additional 27,000 trailers take lumber products out of state. Nearly 34,000 rail cars transport lumber shipments to western markets. Many sawmills use transload facilites in western Washington. An estimated 31,000 truck loads distribute plywood and veneers products statewide.

Conversation with several industry representations indicate that the use of rails is not likely to increase over time. In fact, since the time of the survey (2004) and recent conversations, industry has faced logistical problems that raise their cost in using rail. Most Washington lumber to California is moved by trucks according to one representative. Rail cars moving through Washington carrying lumber are mostly from Canada. There is a significant amount of lumber shipped to other markets in the U.S. In 2004 this amounted to 47% and is likely all rail shipments.

The study projects an increase in harvest levels and with it an increase in road use by log trucks. The smaller diameter also has implications on how truck loads are calculated, indicating an increase in truck loads with smaller diameter logs to carry the same harvest volume. The combined effect is to increase the number of log truck loads by 643,000 in western Washington.

Additional capacity in lumber production is also projected to increase. The increase implies an additional 20,000 trailer loads annually or an equivalent 6,000 rail cars.

All numbers and estimates presented here area first attempt to document rail and road use by the forest sector in Washington. Estimates presented in the study were calculated using imprecise methods due to time and budget constraints. Nevertheless, we find the numbers to be within expectations. Further work is needed to develop a more precise estimate of the demand for road and rail services by the forest sector in Washington.

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