Implications of Working Forest Impacts on Jobs and Local Economies

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Abstract

The sustainability of working forests and the infrastructure of mills and other forest uses are to a substantial degree interconnected. The impact of working forests on rural jobs has been of special interest given the dependence of timber dominant communities on forest-related jobs. We summarize what is known about the number of jobs supported by working forests in Washington, both direct and indirect, whether they are lost if a mill closes, where these jobs are located, what impact closures have on mill infrastructure and investments to remain competitive, and the probable impact of closures on timber harvest and forest management. We note that the decline in log exports over the last decade has more than offset the decline in Washington's harvest, resulting in a stable to increasing capacity for lumber production. We also characterize the impact of changes in forest management on the infrastructure. We assume a general theme that ensuring viability of working forests to provide integrated economic and ecological outputs is an important public priority.

I. Objective

This paper summarizes available information on the job and local economic impacts of management changes that affect working forests, forest industry infrastructure, and local economies. We assume a general theme that ensuring viability of working forests to provide integrated economic and ecological outputs is an important public priority.

II. Introduction

A number of economic impact questions arise when considering policies that might help sustain working forests. We will attempt to address how many jobs are supported by working forests, whether they are lost if a mill closes, where these jobs are located, what impact closures have on mill infrastructure and investments to remain competitive, and the probable impact of closures on timber harvest and forest management. We note that there are other potential uses of forestland, some of which can be complementary to timber production, but leave to others the discussion of how these uses can improve the sustainability of working forests.

III. Direct Forest Industry Employment

Timber harvest activities have always been associated with the jobs they create in rural communities. Warren (2004) estimated for 2002 that the direct forest industry employment in Washington and Oregon produced 13.2 workers per million board feet (MMBF) of annual timber harvest. Using Warren's jobs-to-harvest ratio with the total annual harvest level for Washington of 3.6 billion board feet (BBF) produces an estimate of 48,000 direct forest sector jobs in the state. Han et al. (2002) suggested that, depending on the availability of paper industry jobs, the number of direct jobs in Idaho may fluctuate from 9 to 11 forest products workers per MMBF annually. Keegan et al. (2004) found that harvesting and processing saw timber generates nine direct full-time jobs per MMBF annually in Montana. Keegan further indicated that some mill activity may depend on imported materials from other states and may not be directly linked to local harvests.

Estimates of jobs created generally depend on the type of harvest and the degree of primary and secondary manufacturing of the raw material. Jobs are also created in forestry operations, logging, hauling, processing for lumber and plywood, and for the many uses of the processing residuals, including pulp and paper, press boards, beauty bark, and renewable fuel for energy generation. Secondary manufacturing of products such as pallets, trusses, engineered wood products, prefab subassemblies, and furniture generally generates more jobs per unit volume consumed than primary processing. These primary and secondary jobs are summed to develop cumulative job estimates of direct forest industry employment.

Management alternatives that can address ecological service functions as well as product markets are of particular interest in the discussion of keeping working forests viable, as these generally involve more labor intensive activities that can be expected to increase jobs so long as economic viability is sustained.

1. Indirect Forest Industry Employment (Job Multipliers)

In addition to direct forest industry employment, many indirect jobs also result from timber harvesting. Conway (1994) developed a regional inter-industry econometric model called the Washington Projection and Simulation Model (WPSM) and estimated the total direct and indirect jobs per year created from one MMBF of timber harvest in Washington. Conway found that for every direct industry job another 4.2 indirect jobs were created. Using 1992 statistics, he estimated that there were 7.7 direct jobs and 32.3 indirect jobs linked to each MMBF of timber harvest. His direct job measures were actually lower than other regional estimates, in part because the definitions of "direct" and "indirect" jobs vary with the way data is recorded and the model is constructed. For example, while hauling logs is clearly a direct response to harvesting, in a modeling context, these jobs are often defined as indirect because they are considered in the transportation rather than in the forest industry sector. Similarly, administrative support can be classified as an outsourced service and not included in direct job estimates. As the income is recycled from direct jobs to indirect jobs and via consumption to other support services within the community the number of indirect jobs can be quite high except when many of the goods used in production or consumption are imported.

Additional jobs are also produced by profits from harvesting and from mills where profits are reinvested by forest landowners and timber companies. However, very few models capture such secondary impacts. For example, log exports have historically produced the highest profit for quality logs and therefore supported many more jobs from investment than domestic processing (Perez-Garcia et al. 1994). However, unlike the jobs connected to processing activities, the jobs created from investments may be free to flow out of the region, even out of the country. Capital tends to be invested where the financial returns are perceived to be most favorable. If profits (returns on investment) are low for forestry activities then capital will likely flow to other more attractive business alternatives that will result in changes to management, harvesting, and processing infrastructures affecting both direct and indirect jobs.

While indirect jobs may not be as immediately sensitive to harvest volume fluctuations as primary activities, direct jobs lost and not replaced with some new source of economic activity eventually result in reduced employment spread across many sectors.

Changes in efficiencies within various job sectors have altered some job multiplier relationships; some may have decreased and others increased. For example, the number of modern sawmill workers per unit product may be less, but the number of jobs in secondary manufacture or government services per unit product may be more. Furthermore, as a greater share of the available timber is derived from thinning or from difficult harvests with longer hauls, associated labor per unit harvest increases. The

practice of outsourcing more activities to local firms may decrease the direct jobs while increasing the jobs multiplier, offsetting what might otherwise appear to be productivity gains.

2. Substitution Uses

Non-timber forest products such as mushrooms and decorative boughs produce some jobs but impacts are generally small (Kingery and Schlosser 1992, Blatner and Alexander 1998) when compared to jobs from timber harvest activity. These activities are generally not constrained by timber harvests. Other forest uses such as recreation may also create jobs. Recreational jobs may be generated as a result of not harvesting potentially available timber; or, they may not if the unharvested timberland is not available for recreational use. Since recreation activity is largely constrained by discretionary income and there are many alternative recreational opportunities from which to choose (McConnell 1975), any increase in recreation in one area may be offset by a decrease elsewhere. A forest land use change that favors recreation may simply transfer recreation from another location and type of recreation and not actually increase jobs. Recreational activity purchased by local users will decline as their income declines and hence will decrease with declines in forest activity rather than offset these declines.

3. Log and Income Flows

Since logs are purchased by both in-state and out-of-state companies, not all of the jobs linked to the reinvestment of timber returns will reliably stay within Washington. This is not the case, however, for the trust revenue generated by the sale of Washington State Department of Natural Resources (DNR) timber. Revenue generated from DNR timber sales has a uniquely powerful impact on state wealth since all stumpage revenues are reinvested for the public good in government projects, including DNR administrative charges and the use of the funds by trust beneficiaries. Stumpage revenues are largely profits as they represent the accumulated unpaid dividends to the investors for the 50 or more years from the time of regeneration to harvest. Lippke and Conway (1994) developed an estimate of the economic impacts associated with incremental decreases in trust revenue from reductions in the DNR timber sales program. There are two ways to think about assessing such impacts. First, if trust revenues that fund school construction and government operations are reduced, as activities slow, jobs in these sectors as well as those impacted indirectly are lost. Second, if taxes for Washington residents are raised to replace trust revenue shortfalls, job losses result from subsequent reductions in disposable wealth. Lippke and Conway chose the second approach to simulate the jobs impacts associated with an increase in state and local taxes and estimated that 29.7 Washington jobs would be lost for every $1 million in tax increases to replace lost trust revenue.

4. Estimating the Expected Impact of a Change in Activity

With this introduction to the linkages between timber harvest and jobs, both direct and indirect, we can estimate the expected impact to local economies of the loss of timberland or other changes in timber management activities. Whether the changed use of timberland

potentially generates jobs or not is another study, and a difficult one given the many alternative uses of the land. However, if forests are converted to residences or other non-commercial uses, the job losses from reductions in timber activity are likely not replaced.

The usual way to characterize job impacts is to estimate the direct jobs needed for every stage of processing activity from forest management, logging, hauling, primary wood processing, secondary wood processing, and paper making. Using models to track how these activities affect other sectors we can derive estimates for indirect impacts.

Table 1 provides estimates of the direct and total employment for each forest products activity based on the Conway model as it was developed in the1996 report, "Economic Analysis of Forest Landscape Management Alternatives: Final Report of the Working Group on the Economic Analysis of Forest Landscape Management Alternatives for the Washington Forest Landscape Management Project" (Lippke et al. 1996).

Table 1: Economic Impact of One MMBF Harvest (employment in person years, economic activities in $ millions)

Impact	Logging	Sawn Wood	Primary Wood	Secondary Wood	Primary Paper	Total
	(1)	(2)	(3)=(1)+(2)	(4)	(5)	(6)*
Direct Employment	1.18	3.47	4.65	2.01	1.03	7.69
Direct Output ($millions)	0.24	0.51	0.75	0.22	0.35	1.32
Total Employment	5.17	17.3	22.47	6.93	7.42	36.82
Gross Product ($millions)	0.23	0.76	0.99	0.28	0.34	1.61
State & Local tax receipts ($millions)	0.02	0.09	0.11	0.03	0.04	0.18

*(6) = (1)+(2)+(4)+(5)

Several explanations are necessary to better understand these estimated job multipliers. Secondary manufacturing serving local purchasers, such as box plants that would import their paperboard if not available from the harvest, are not included in the job estimates because only those jobs dependent on or contributing to local harvest activities are relevant. Job estimates for logging based on field surveys are closer to two persons per MMBF of harvest, considerably higher than that in Table I (Lippke et al. 1996). One reason is that the hauling contracted out to the transportation sector becomes an indirect impact in the model. Also, export logs require extra handling, and thus additional labor, in ports. Forest management jobs are not separated out in Table I. All of these jobs are largely captured as indirect impacts and are based on the purchases made by the logging sector. In addition, sawn wood employment is at least 15% higher than estimates of mill inputs and outputs, possibly reflecting the secondary processing that take place in primary mills while lowering the mills' apparent volume productivity. While a typical estimate of secondary wood processing might be 6-8 persons per MMBF of that mill's material input, if only 25% of the harvest receives secondary processing, there can be

only two persons employed in secondary manufacturing for every MMBF total raw log harvest (as suggested by Table I).

Another important caveat is that when tracking jobs on a regional basis, Conway's model found only about half of the total direct and indirect employment related to forestry to be in the rural area close to primary processing. The rest of the jobs were located in the higher population corridors. A final caveat is that there has been productivity gains since the model was last estimated suggesting that employment estimates may be overstated by the amount of productivity improvement. However, since wage increases and wage-dependent costs have increased generally faster than productivity and are quoted in 1992 dollars in Table 1, the dollar value measures will be understated. Input output coefficients for the Washington economy were updated in 1997 but have yet to be incorporated into a time dynamic econometric model like the Conway model. A comprehensive updating of state economic models is an enormous task that must be left to others, but existing models are sufficient for understanding relative jobs-to-harvest relationships.

5. Scaling the Impacts per Acre of Commercial Forestland

More useful in understanding community impacts is to note that the current harvest rate on private land in Western Washington is about 500 BF/acre/yr averaged across all commercial acres after factoring in harvest restrictions on some of the acres. The economic impacts developed above are approximately consistent with the harvest activity annually for 2,000 acres of forest under a 50-year rotation, harvesting about 40 acres per year. In effect, if you have 40 acres of timber in your backyard that is harvested at 50 years old with 25,000 BF/acre, Table I provides the person/year assessment of economic impacts.

Commercial thinning (CT) at or before age 30 results in almost twice the direct labor per MMBF of volume removed as compared to a final harvest, thereby contributing additional jobs from a more intensively managed forest (Lippke et al. 1996). CT also produces more residuals for paper processing but substantially less volume for secondary wood processing. Overall, utilizing commercial thinning treatments on intensively managed acres adds 25% more jobs to the total provided by the final harvest per acre of forestland.

6. Impacts for a Scale Mill

If a sawmill becomes non-competitive and shuts down, what happens? Direct mill and processing jobs are eliminated quickly and the indirect jobs will be squeezed out over a period of time unless the timber is purchased locally by others. Mill surveys (DNR 2005) show that the capacity of operating mills has increased. New mills using expensive high-production equipment to lower per-unit output costs generally consume 100 MMBF or more per year. Mills that are labor intensive and short on technology are more likely to be in economic trouble unless they serve niche markets. As older mills close down or modernize there is some shift to higher quality, higher paying jobs as automation replaces low technology jobs and high technology skills are needed to support advanced

equipment. Some of the highest technology mills employ the fewest employees per unit of output.

The closure of a 100 MMBF scale mill is estimated from Table I to result in the loss of 769 direct jobs. This number is much higher than the jobs actually located in the sawmill because it includes loggers, haulers, pulp and paper producers, and other processors in the material chain. Over a little longer period, total job losses associated with such a mill closure are expected to reach 3,682 total jobs, of which only 1,840 are likely to be in the rural community. State and local tax receipts would eventually fall by $180 million statewide but the flow to the local community is obviously much less. If logs were flowing out of the region for lack of infrastructure to process all of the log grades, initially the local impacts would be significantly lower as the multiplier effect for local jobs would be reduced.

The number of lumber mills required to process the current 2.8 billion BF harvest rate for the Westside of Washington has been declining and would only take 28 of these 100 MMBF/yr scale mills. The 2002 mill survey (DNR 2005) shows 34 nearly scale mills on the Westside out of a total of 58. Perez-Garcia (2005), in a recent assessment of the lumber manufacturing industry in Washington, used data from DNR mill surveys to characterize changes in milling infrastructure from 1968 to 1998. The sector has been experiencing a consolidation of mill capacity, as evidenced by the size of mills in operation (see Figure 1). Class D mills equal less than 40 MBF of lumber tally output capacity per 8-hour shift. Class C mill capacity is 40 to 79.9 MBF. Class B mill capacity is 80 to 119.9 MBF, and Class A mill capacity is 120 MBF and greater per shift. While the total number of sawmills has dramatically declined, the number of large production facilities has increased along with total processing capacity. About ¾ of the processing capacity is now provided by the largest mill class.

Economic logic would explain the substantial decline in small mills in the early 1980's as a shake-out period after the WWII baby boom-induced housing boom ended. Only the lower-cost mills or those serving niche markets survived. The decline in 1988-98 is probably more related to the decline in the harvest on federal forests and the greater dependence of smaller mills on public timber.

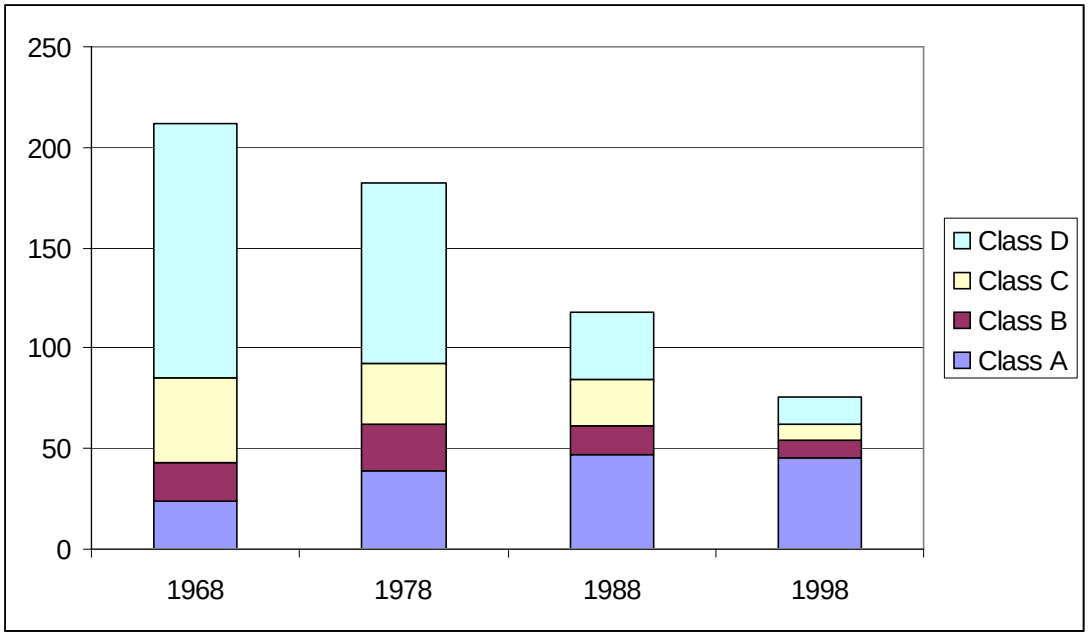

Figure 1. Number of Sawmills by Class in Four WADNR Mill Surveys

7. If a Mill Shuts Down is the Timber Really Not Harvested?

It depends. If there were many bidders for local timber, there would still be a buyer but the price of the timber going to the second bidder on the list is lower. There may be a job offset to the region where the winning bidder operates. It is likely that the mill winning the bid is more efficient since it is a surviving mill, but will haul the logs farther since the fewer the number of mills, the longer the haul. Thus, transportation costs may go up even as the cost of mill operations goes down. Evidence presented in a recent report on the Washington State timber sale program suggests such a trend (Mason 2005).

If there were only one bidder, the timber price would logically be low with a lack of competition. In addition, to get that timber sold could require extra marketing efforts by the seller that could result in an even lower net return. If there are only two bidding mills, the highest priced timber should be expected to be located midway between them where they both compete equally. If the timber is located much closer to one mill than to the other, the price of the timber will fall by the increased transportation cost of the farthest mill, since that is all that the closer mill has to pay for the timber to be equally competitive. Since mills are somewhat customized to process special log sorts, having three or more bids does not guarantee competitive pricing; only a subset of the mills may be well situated to process competitively the largest part of the log mix in the sale.

8. As Mills Become Economically Marginal Will There Be a Structural Shift towards Higher Technology Mills with Lower Cost Structures? Can They Keep a Regional Forest Products Industry Competitive?

Only after enough mills have closed to reduce the demand for local timber with consequent reductions in timber prices will there be an adequate mill profit to motivate

any general investment in better technology. When mill owners are confident that their mills will survive and that there is no longer too much capacity for available log supplies, the opportunity to invest in technology and increase profit margins becomes attractive. This will likely follow a period with lower timber prices. The market response can be expected to maintain enough mill capacity to consume the available timber but not to produce competitively high timber prices. With lower prices for both timber and products, however, less re-investment (fewer jobs) in forest management might be a logical outcome. So, while the jobs are not all eliminated by a mill closure, they may be relocated to another location and the returns to timber reduced as the economic signal is to produce less. It is this reduced return to timber production coupled with increased demand for residential and commercial real estate that motivates land conversions, the greatest threat to working forests and the economic/ecological benefits they provide.

9. Impact on Forest Management

With the lower timber sale prices that result from fewer bidders, reductions in investment in intensive forest management can be anticipated. Thinning would be reduced or eliminated, especially by the smaller forest landowners who are more at risk. Rotation lengths are shortened in absence of thinning with resultant loss of ecological diversity. Reduced investment in activities that increase forest productivity will have long term implications for yields and related economic contributions (Mason 2001). The small forest landowner will also be more sensitive to deferring sales than the large timber owner since a steady stream of volume to maintain mill operations and cash flow is not as urgent. However, raising revenue on family-owned forests for life stage events such as college costs or financial emergencies will assure that harvests are undertaken. Reductions in available pulp logs and mill residuals, however, result in permanent adjustments to essential processing infrastructure such as pulp and paper mills which in turn may reduce the motivation for thinning activities.

IV. Impact Summary

In summary, if timber prices decline, less timber will be provided and subsequent local job losses will result that may not be offset in other communities. However, one might speculate that if the local economy is resilient and provides alternative job opportunities, then the likelihood for subsequent land conversion pressure, aggravated by poor potential for timber investment, increases the threat of losing private forest land to development with permanent loss of aesthetic and environmental benefits (DNR 1998). Uncertainty about future employment opportunities in forest industries may also result in reduced availability of skilled forestry workers (Rummer et al. 2003, Renewable Resources Foundation 2003-4, Pickell pers. comm.), further reducing long-term potential for sustainable management of working forests.

It should be noted that there is no data characterizing the differences between the behavior and impacts of mills that might be vertically integrated from owned timber to the marketplace vs. more independently owned mills. While we do have historical

information on forest management intentions that are differentiated by size of ownership and considerable case study information on small forest landowners, even here there is no data to identify differences that might apply to larger landowners.

1. The Current Trend

Since harvest levels have declined, did mill processing and jobs decline? Between 1992-2002 and averaging the first two and last two years to minimize yearly deviations, Washington harvest levels declined 1.4 billion BF while the reported forest sector employment declined by 7,600 jobs (Warren 2004). The increase of jobs per MMBF of harvest from 11.5 to 13.1 suggests negative productivity even though many older mills have been closed and some investments in processing technology should result in increased productivity. While the number of mills in Washington declined, the mill capacity remained fairly stable with fewer but larger production facilities (Perez-Garcia 2005). Coincidentally, due to political constraints and changes in international markets, log exports declined slightly more than reductions in timber harvest, resulting in a previously unavailable volume of logs to Washington mills with some increase in logs exported to Oregon.

Oregon experienced larger declines in harvest such that, even as log exports declined, more logs were sought from Washington. Oregon forest industries also experienced a decline in lumber production and jobs, but a near doubling in the jobs per harvest ratio. This was attributed to a number of factors including increased secondary manufacturing, reduced log exports and increased log imports, increased use of recycled fiber, the use of lower quality timber, and more labor intensive practices owing to environmental and aesthetic considerations (Gebert et al. 2002).

This evidence may simply suggest that it takes a long time for adjustments to take place and that the region has not yet stabilized after dramatic harvest and market events that characterized the 1990's. Lippke et al. (2000) provided a number of measures suggesting the region had not at the time regained the productivity levels that were evident prior to the harvest declines in the early 1990's.

2. Maintaining Competitiveness

For optimal community economics and forest management opportunities, a competitive and integrated mill infrastructure is needed to maintain investments in both forest management and mills. Any departure will reduce the amount of timber available, raise the unit cost of production, decrease local jobs, and increase the motivation for investment conversions to non-forestry uses.

Literature Cited

Blatner, Keith A. and Susan Alexander. 1998. Recent Price Trends for Non-Timber Forest Products in the Pacific Northwest. Forest Products Journal 48(10): 28-34.

Conway, Richard. 1994. The Forest Products Economic Impact Study Current Conditions and Issues. Prepared for WFPA, WADNR, WADTED by Dick Conway and Associates, Seattle, Washington.

Gebert, Krista M., Charles Keegan III, Sue Willits, and Al Chase. 2002. Utilization of Oregon's Timber Harvest and Associated Direct Economic Effects, 1998. USDA GTR 532. Pacific Northwest Research Station, Portland, Oregon.

Han, H., H. Lee, L. Johnson, R. Folk, T. Gorman, J. Hinson, and G. Jackson. 2002. Economic Feasibility of Small Wood Harvesting and Utilization on the Boise National Forest: Cascade, Idaho City, Emmett Ranger Districts. Department of Forest Products, College of Natural Resources, University of Idaho. Moscow, Idaho.

Keegan III, C., C. Fiedler, and T. Morgan. 2004. Wildfire in Montana: Potential Hazard Reduction and Economic Effects of a Strategic Treatment Program. Forest Products Journal. 54 (7/8): 21-25.

Kingery, Peggy and William Schlosser. 1992. Special Forests Products: Growing in the Pacific Northwest. Western Forester. 37 (5): 1,4.

Lippke, Bruce and R. S. Conway. 1994. Economic Impact of Alternative Forest Practices Rules to Protect Northern Spotted Owl Sites. Washington State Forest Practices Board, State of Washington, Olympia, Washington. 240 pp.

Lippke, Bruce R., J. Sessions, and A. B. Carey. 1996. Economic Analysis of Forest Landscape Management Alternatives: Final Report of the Working Group on the Economic Analysis of Forest Landscape Management Alternatives for the Washington Forest Landscape Management Project. CINTRAFOR Special Paper 21, College of Forest Resources, University of Washington, Seattle, Washington. 157 pp.

Lippke, Bruce, Rose Braden, and Scott Marshall. 2000. Changing Export Trends and the Health of the Pacific Northwest Forest Sector. CINTRAFOR Working Paper 75, College of Forest Resources, University of Washington, Seattle, Washington. 86pp

Mason, C. L. 2001. Will Low Prices for Large Logs Mean Shorter Rotations on Private Forestlands? RTI Fact Sheet No. 7. College of Forest Resources, University of Washington, Seattle, Washington.

Mason, C. L. 2005. An Examination of the WADNR Timber Sales Program Against a Backdrop of Changing Regional Infrastructure and a Growing Forest Health Crisis. RTI

Working Paper No. 2. College of Forest Resources, University of Washington, Seattle, Washington. 96 pp.

McConnell, K.E. 1975. Some Problems in Estimating the Demand for Outdoor Recreation. American Journal of Agricultural Economics, 57 (2): 330-334.

Perez-Garcia, J. M., H. L. Lippke, B.R. Lippke, and X. Yu. 1994. The Impact on Domestic and Global Markets of a Pacific Northwest Log Export Ban or Tax. CINTRAFOR Working Paper 47, University of Washington, Seattle, Washington. 31 pp.

Perez-Garcia, J. M. 2005. A Preliminary Assessment of the Lumber Manufacturing Sector in Washington State. In: Understanding Key Issues of Sustainable Wood Production in the Pacific Northwest. Gen. Tech. Rep. PNW-GTR-626. USDA Forest Service. Pacific Northwest Research Station, Portland, Oregon.

Pickell, B. 2004. Personal communication. Mr. Pickell is the Director of the Washington Contract Loggers Association. http://www.loggers.com/

Renewable Natural Resources Foundation. 2003-4. Federal Natural Resource Agencies Confront an Aging Workforce and Challenges to their Future Roles. Renewable Resources Journal. 2 (14): 31pp. http://www.rnrf.org

Rummer, R., D. May, W. Sheppard, et al. 2003. A Strategic Assessment of Forest Biomass and Fuel Reduction Treatments in Western States. USDA Forest Service and the Western Forestry Leadership Coalition. http://www.fs.fed.us/research/infocenter.html

WADNR. 1998. Our Changing Nature: Natural Resource Trends in Washington State. Olympia, Washington.

WADNR. 2005. Washington Mill Surveys 2002, Series Report #16, May 2005. www.dnr.gov/htdocs/obe/millsurvesy/2002ms.html.

Warren, D. 2004. Production, Price, Employment, and trade in Northwest Forest Industries, All Quarters 2002. Resource Bulletin. PNW-RB-241. USDA Forest Service. Pacific Northwest Research Station Portland, Oregon.

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