

Discussion Paper 3 (DP3): Impact of Management Treatment Alternatives on Economic Activity

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Introduction

The links between forest management treatment alternatives and economic activity can be developed through engineering models of the direct and indirect economic inputs and outputs for each activity step in growing, harvesting and processing wood or by linking the treatments to an existing economic model. However, existing state economic models, while useful, when taken alone do not include the level of within-sector

detail desired to demonstrate the economic impacts of different forest management treatment alternatives. Updated estimates of the current direct and indirect inputs and outputs for each stage of processing and the differences across treatments have been developed by combining state employment data with surveys of logging companies, wood processing, and paper mills and secondary manufacturing facilities. Once calibrated to link to an interindustry economic model for the state, the additional detail available by combining survey and engineering estimates enables us to estimate the comparative impacts of different management treatments and policies on jobs, outputs and taxes.

Updated Surveys of Stage of Processing Activities

Surveys of labor intensity by activity sector when coupled with engineering estimates appropriate to specific management treatments can be used to develop treatment-specific economic impact models. For example, if thinning treatments require more labor and produce more chips but less secondary wood products than other activities, then adjustments can be applied to these specific sectors to reflect these differences. The Washington Projection and Simulation Model (WPSM): A Regional Interindustry Econometric Model (Conway 1990 and 1994 update) has been used in prior studies to analyze both direct and indirect downstream economic impacts of changes to the forest sector (Lippke et al 1996, Lippke and Conway 1994). However, this model has not been updated since 1994 as the classification system for statewide economic activity data collection has since been changed from collection of data by establishment to collection of data by job function. The new system is known as the North American Industrial Classification System (NAICS). Updated survey data for forest product sectors were collected in 2006, combined with sector employment data (NAICS) for Washington counties from the U.S. Census Bureau, and aligned with the current statewide database and the WASHINGTON INPUT-OUTPUT MODEL (NAICS). The Input-Output Model is a static model representing a snapshot of interindustry transactional relationships for the Washington State economy while the WPSM is a dynamic econometric model designed to more fully capture ripple effects. Both systems use a similar interindustry activity matrix to characterize the relationship between the forest sector and the rest of the state economy.

Economic Impact Model

The basic sector outputs from the model used for economic impact assessments in prior studies (WPSM) are provided in Table DP3.1. The model provides direct and total employment, direct output, gross output and state & local taxes for logging, and sawnwood as two components of primary wood; secondary wood, primary paper, and a total forest sector impact. Secondary paper is not included nor is wood construction as these are consumer driven activities that are independent of the origin of supply. Our focus is on the impact of supply changes within Washington State i.e. we do not want to infer changes in retailing activity that are not dependent upon local supply. Employment and economic outputs are presented as estimates of job-years and millions of 1992 dollars per one million board feet of state annual timber production in Washington State (MMBF/YR).

Table DP3.1: Employment, Economic Output, and Tax impacts generated by one million board feet of annual timber production in Washington State (employment in-person years, output in millions of 1992 dollars adapted from WPSM 1994).

	<u>Logging</u>	<u>Sawnwood</u>	<u>PrimW(sub)</u>	<u>SecW.</u>	<u>PrimP</u>	<u>Total</u>
Direct employment	1.18	3.47	4.65	2.01	1.03	7.69
Direct output	0.24	0.51	0.75	0.22	0.35	1.32
Total employment	5.17	17.30	22.47	6.93	7.42	36.82
Gross product	0.23	0.76	0.99	0.28	0.34	1.61
St&Loc Taxes	0.02	0.08	0.11	0.03	0.04	0.18

Updated employment impacts

For more current estimates of economic activity, we update the employment data to 2004 based on new surveys, census data, and revenue streams as presented in Table DP3.2. The logging sector shows a slightly

higher labor intensity consistent with harvest of more difficult locations and smaller diameter timber. Sawnwood, however, shows a decline in employment per unit input indicating productivity gains by fewer but much larger and efficient sawmills than in prior studies. Secondary wood processing is split out into two categories, other manufacturing (such as molding, millwork, doors, and windows) and wooden furniture manufacture, picking up some value-add manufacturing activity not included in earlier models. Primary paper direct employment per unit input is very close to the prior assessment indicating that, while gross levels of activity in this sector may have declined and per-unit-outputs may have increased, the per-unit-input productivity has remained relatively constant. The 2004 table is expanded to show the impact detail of the subset of indirect jobs within the forest sector i.e. some parts of the forest sector outsource to other parts of the sector and appear as within-sector transactions. For example, one logging company may purchase standing timber but contract with another company to undertake the harvest. This approach allows a direct comparison to the sector by sector jobs picked up in our survey which includes both the direct employment and other within-sector employment comprising a Total Forest Industry Employment estimated as job-years/MMBF/YR for logging and other forest industry sectors.

Table DP3.2: Employment, Economic Output, and Tax impacts generated by one million board feet of annual timber production in Washington State (employment in person-years, output in millions of 2004 dollars calibrated to the Washington State Input-Output Model NAICS).

	<u>Logging</u>	<u>Sawnwood</u>	<u>PrimW(sub)</u>	<u>SecW.</u>	<u>PrimP</u>	<u>Total</u>
Direct forest employment	1.30	2.97	4.27	3.26	1.13	8.67
Indirect forest employment	0.53	1.14	1.67	0.83	0.12	2.62
Total forest employment	1.83	4.81	5.94	4.09	1.25	11.28
Total forest income	0.07	0.16	0.23	0.14	0.08	0.45
Total all sector employment	5.19	11.96	17.15	10.27	5.38	32.80
All labor income	0.18	0.40	0.58	0.32	0.22	1.12
Gross product	0.30	0.69	0.99	0.54	0.38	1.90
St&Loc Taxes	0.03	0.08	0.11	0.06	0.04	0.21

The Direct Forest Industry employment appears higher than in prior studies with some gains resulting from including two secondary manufacturing sectors. Labor Income is computed from employment using average labor rates within the Input-Output Model adjusted to reflect 2004 dollars. Total Employment is estimated in the model including interindustry transactions and indirect purchases for a direct plus indirect job estimate in support of the Forest Sector economic activity. Similarly, Gross State Product is computed using the Washington State Input-Output Model driven by these estimates. State & Local taxes are estimated directly from the statewide economic activity and do not reflect extra taxes leveled on the industry such as the timber excise tax. It is important to note that not all activities generally perceived to be within the Forest Sector are actually defined as part of the Total Forest Industry in the economic models. For example, trucking is considered by the employment model as an indirect service provided by the Transportation Sector while forestry and reforestation services are considered as Agriculture Sector activities. These activities could add about 1.5 persons to the total Forest Industry employment estimate if the definition of employment was to include all forestry and logging related activities. However, these activities are captured as indirects in the Total Employment estimates generated by the Forest Sector activities.

While Table DP3.2 reflects updated estimates to current levels of productivity, further refinements can be developed to reflect the economic impacts of different management treatment alternatives that in turn can be linked to a timber and forest structure supply model. As noted in Lippke et al (1996) a first thinning treatment is much more labor intensive than a final regeneration harvest as a consequence of lower volume and smaller pieces, while a second and third treatment are just slightly more labor intensive than regeneration harvests. Similarly, thinnings with much smaller diameter trees are weighted more heavily to chips for pulp and paper and less heavily to secondary wood uses. Estimates of alternative treatment employment impacts were developed from relative harvest cost comparisons provided by the Washington Department of Natural Resources and a survey of Washington logging companies.

Impact of Treatment Differences

Different treatments produce different log outputs that serve different end uses. By noting how these treatment differences affect the sector level data in the model, a first-order estimate of the impact of different treatments can be obtained.

Table DP3.3 summarizes the sector impact responses to different treatments relative to the average base case and Table DP3.4 summarizes the sector responses to the different treatments.

Treatment Alternatives

Base (short rotation): Regeneration harvest at 50 years after full plantation stocking followed by a pre-commercial thin (PCT) for density and quality control (the dominant historic treatment for Western Washington).

First Thin: Commercial thin at or before about age 30, roughly half by ground processor equipment (low slopes) and half by skyline (steep slopes) with costs almost twice the Base.

Second Thin: Commercial thin at about age 50 with fewer small logs flowing to chips and more large logs.

Third Thin: Commercial thin at about age 70 with more uniform and larger logs.

Long Rotation Harvest: Regeneration final harvest of large mostly uniform trees producing more quality wood and less chips.

Sector Impacts

Logging (Prim W.): More costly thinnings with more jobs based on lower volume operations and handling of smaller diameter material.

Sawnwood (Prim W.): Sawnwood plus plywood with more quality volume from longer rotations.

Other MFG and Furniture (Sec W.): Half sensitive to higher quality wood (doors, windows, cut stock, mill work) but including pallets (low quality), trusses (above average structural quality), and furniture. Excludes building construction.

Primary Paper: Paper mills receive chip volumes primarily from mill processing residuals and smaller diameter logs.

Table DP3.3: Key employment impact changes to characterize treatment differences based on comparative processing costs relative to the base for Western Washington.

Jobs and Outputs/MMBF/YR 2004	TREATMENT JOBS RATIOS				
	Logging	Sawnwood	Other MFG	Furniture	PrimP
1st thin	2.32	1.00	0.50	0.50	1.60
2nd thin	1.89	1.00	1.00	1.00	1.00
3rd thin	1.89	1.20	1.75	1.50	0.81
base short rotation	1.00	1.00	1.00	1.00	1.00
long rotation	1.00	1.40	2.50	1.50	0.75

Table DP3.4: Adjusted employment impacts for different treatments for Western Washington.

Jobs and Outputs/MMBF/YR 2004	Total Forest Industry Jobs/MMBF/Year by Treatment Type				
	Logging	Sawnwood	Other MFG	Furniture	PrimP
1st thin	4.57	4.46	1.03	1.27	2.47
2nd thin	3.73	4.46	2.07	2.55	1.54
3rd thin	3.73	5.36	3.62	3.82	1.25
base short rotation	1.97	4.46	2.07	2.55	1.54
long rotation	1.97	6.25	5.16	3.82	1.16

Table DP3.5: Key employment impact changes to characterize treatment differences based on comparative processing costs relative to the base for Eastern Washington.

Jobs and Outputs/MMBF/YR 2004	TREATMENT JOBS RATIOS				
	Logging	Sawnwood	Other MFG	Furniture	PrimP
1st thin	2.32	1.00	0.50	0.50	1.60
2nd thin	1.89	1.00	1.00	1.00	1.00
3rd thin	1.89	1.20	1.75	1.50	0.81
base short rotation	1.00	1.00	1.00	1.00	1.00
long rotation	1.00	1.40	2.50	1.50	0.75

Table DP3.6: Adjusted employment impacts for different treatments for Eastern Washington.

Jobs and Outputs/MMBF/YR 2004	Total Forest Industry Jobs/MMBF/Year by Treatment Type				
	Logging	Sawnwood	Other MFG	Furniture	PrimP
1st thin	3.14	3.12	0.82	0.52	0.75
2nd thin	2.56	3.12	1.65	1.05	0.47
3rd thin	2.56	3.74	2.88	1.57	0.38
base short rotation	1.35	3.12	1.65	1.05	0.47
long rotation	1.35	4.37	4.12	1.57	0.35

Employment and Productivity Change

We have chosen not to include future productivity gains in the labor projections since it is easier to evaluate impacts on a current productivity or constant labor productivity basis. We prefer to display the impact of different treatments directly for a policy perspective rather than to confound the impact with unreliable estimates of productivity in the future. Since these impacts are sensitive to site productivity they are directly linked to volume outputs not acres and not directly to the log mix, which by itself does not include the labor sensitivity involved in treatments. Labor income is generally the more stable measure of employment over a projection period as productivity gains are generally passed on to wage gains so the labor wages are not compromised by productivity changes.

Job and Other Economic Outputs per unit of volume for different treatments

Final Impact tables are provided below for the Westside and Eastside based on survey differences, sector employment data (NAICS) for Washington counties from the U.S. Census Bureau, and treatment differences.

Table DP3.7: Total Employment, Economic Output, and Tax impacts for treatment alternatives as generated by one million board feet of annual timber production for Western Washington (employment in person-years, output in millions of 2004 dollars calibrated to the Washington State Input-Output Model NAICS).

FIRST THIN									
Jobs and Outputs/MMBF/YR 2004		1ST THIN							
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total	
Dir Forest Industry Employment Jobs/MMBF/Year	3.86	2.64	6.50	0.61	0.89	1.50	2.26	10.27	
Indir Forest Industry Employment Jobs/MMBF/Year	0.71	1.82	2.54	0.42	0.38	0.80	0.21	3.55	
Total Forest Industry Employment Jobs/MMBF/Year	4.57	4.47	9.04	1.03	1.27	2.30	2.47	13.81	
Total Forest Industry Labor Income Million (2004 \$)/Year	0.17	0.18	0.34	0.04	0.04	0.08	0.15	0.57	
Total EmpJobs/MMBF/Year(Forest & All Other Indir)	15.42	10.65	26.06	2.46	2.20	4.66	10.76	41.48	
Total all Sector Labor Income Million (2004 \$)/Year	0.51	0.35	0.86	0.08	0.06	0.14	0.43	1.43	
GSP Million (2004 \$)/Year	0.87	0.60	1.47	0.14	0.10	0.24	0.74	2.45	
St&Loc Taxes Million (2004 \$)/Year	0.10	0.07	0.17	0.02	0.01	0.03	0.08	0.28	

2ND THIN									
Jobs and Outputs/MMBF/YR 2004		2ND THIN							
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total	
Dir Forest Industry Employment Jobs/MMBF/Year	3.05	2.99	6.04	1.39	2.18	3.57	1.39	11.00	
Indir Forest Industry Employment Jobs/MMBF/Year	0.68	1.47	2.15	0.68	0.37	1.05	0.15	3.35	
Total Forest Industry Employment Jobs/MMBF/Year	3.73	4.46	8.19	2.07	2.55	4.61	1.54	14.35	
Total Forest Industry Labor Income Million (2004 \$)/Year	0.13	0.18	0.31	0.08	0.08	0.16	0.09	0.56	
Total EmpJobs/MMBF/Year(Forest & All Other Indir)	12.18	12.06	24.24	5.38	5.38	10.96	6.62	41.82	
Total all Sector Labor Income Million (2004 \$)/Year	0.41	0.40	0.81	0.19	0.15	0.33	0.27	1.42	
GSP Million (2004 \$)/Year	0.70	0.69	1.39	0.32	0.25	0.57	0.46	2.42	
St&Loc Taxes Million (2004 \$)/Year	0.08	0.08	0.16	0.04	0.03	0.06	0.05	0.27	

3RD THIN									
Jobs and Outputs/MMBF/YR 2004		3RD THIN							
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total	
Dir Forest Industry Employment Jobs/MMBF/Year	2.92	3.83	6.75	2.58	3.38	5.96	1.11	13.82	
Indir Forest Industry Employment Jobs/MMBF/Year	0.81	1.53	2.34	1.03	0.44	1.47	0.14	3.95	
Total Forest Industry Employment Jobs/MMBF/Year	3.73	5.35	9.09	3.61	3.82	7.43	1.25	17.77	
Total Forest Industry Labor Income Million (2004 \$)/Year	0.13	0.21	0.35	0.14	0.11	0.26	0.08	0.68	
Total EmpJobs/MMBF/Year(Forest & All Other Indir)	11.66	15.41	27.08	10.41	8.34	18.74	5.28	51.10	
Total all Sector Labor Income Million (2004 \$)/Year	0.39	0.52	0.92	0.35	0.23	0.58	0.22	1.72	
GSP Million (2004 \$)/Year	0.67	0.89	1.56	0.60	0.39	0.99	0.37	2.92	
St&Loc Taxes Million (2004 \$)/Year	0.08	0.10	0.18	0.07	0.04	0.11	0.04	0.33	

SHORT ROTATION									
Jobs and Outputs/MMBF/YR 2004		SHORT ROTATION							
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total	
Dir Forest Industry Employment Jobs/MMBF/Year	1.38	3.19	4.57	1.48	2.23	3.71	1.40	9.68	
Indir Forest Industry Employment Jobs/MMBF/Year	0.59	1.27	1.86	0.59	0.32	0.91	0.14	2.91	
Total Forest Industry Employment Jobs/MMBF/Year	1.97	4.46	6.43	2.07	2.55	4.62	1.54	12.59	
Total Forest Industry Labor Income Million (2004 \$)/Year	0.07	0.18	0.25	0.08	0.08	0.16	0.09	0.50	
Total EmpJobs/MMBF/Year(Forest & All Other Indir)	5.51	12.86	18.37	5.95	5.50	11.45	6.66	36.49	
Total all Sector Labor Income Million (2004 \$)/Year	0.19	0.43	0.62	0.20	0.15	0.35	0.27	1.24	
GSP Million (2004 \$)/Year	0.32	0.74	1.05	0.34	0.26	0.60	0.47	2.12	
St&Loc Taxes Million (2004 \$)/Year	0.04	0.08	0.12	0.04	0.03	0.07	0.05	0.24	

LONG ROTATION									
Jobs and Outputs/MMBF/YR 2004		LONG ROTATION							
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total	
Dir Forest Industry Employment Jobs/MMBF/Year	1.12	4.79	5.91	3.96	3.36	7.32	1.02	14.25	
Indir Forest Industry Employment Jobs/MMBF/Year	0.85	1.45	2.30	1.20	0.46	1.66	0.14	4.10	
Total Forest Industry Employment Jobs/MMBF/Year	1.97	6.24	8.21	5.16	3.82	8.98	1.16	18.35	
Total Forest Industry Labor Income Million (2004 \$)/Year	0.07	0.25	0.32	0.20	0.11	0.32	0.07	0.71	
Total EmpJobs/MMBF/Year(Forest & All Other Indir)	4.47	19.30	23.77	15.95	8.29	24.24	4.85	52.86	
Total all Sector Labor Income Million (2004 \$)/Year	0.15	0.66	0.81	0.54	0.23	0.77	0.20	1.78	
GSP Million (2004 \$)/Year	0.26	1.12	1.38	0.92	0.39	1.31	0.34	3.03	
St&Loc Taxes Million (2004 \$)/Year	0.03	0.13	0.15	0.10	0.04	0.15	0.04	0.34	

Table DP3.8: Total Employment, Economic Output, and Tax impacts for treatment alternatives as generated by one million board feet of annual timber production for Eastern Washington (employment in person-years, output in millions of 2004 dollars calibrated to the Washington State Input-Output Model NAICS).

FIRST THIN									
Jobs and Outputs/MMBF/YR 2004		1ST THIN							
		Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/MMBF/Year		2.71	2.04	4.75	0.54	0.29	0.83	0.67	6.25
Indir Forest Industry Employment Jobs/MMBF/Year		0.43	1.07	1.50	0.28	0.23	0.51	0.08	2.09
Total Forest Industry Employment Jobs/MMBF/Year		3.14	3.11	6.26	0.82	0.52	1.34	0.75	8.34
Total Forest Industry Labor Income Million (2004 \$)/Year		0.11	0.12	0.24	0.03	0.02	0.05	0.04	0.33
Total EmpJobs/MMBF/Year(Forest &All Other Indir)		10.82	7.04	17.86	3.36	0.72	4.07	3.19	25.12
Total all Sector Labor Income Million (2004 \$)/Year		0.36	0.27	0.63	0.07	0.02	0.09	0.13	0.85
GSP Million (2004 \$)/Year		0.61	0.46	1.08	0.12	0.03	0.16	0.22	1.45
St&Loc Taxes Million (2004 \$)/Year		0.07	0.05	0.12	0.01	0.00	0.02	0.02	0.16
2ND THIN									
Jobs and Outputs/MMBF/YR 2004		2ND THIN							
		Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/MMBF/Year		2.12	2.23	4.35	1.17	0.82	1.99	0.41	6.75
Indir Forest Industry Employment Jobs/MMBF/Year		0.44	0.89	1.33	0.47	0.23	0.70	0.06	2.10
Total Forest Industry Employment Jobs/MMBF/Year		2.56	3.12	5.67	1.65	1.05	2.70	0.47	8.85
Total Forest Industry Labor Income Million (2004 \$)/Year		0.09	0.12	0.22	0.07	0.03	0.10	0.03	0.34
Total EmpJobs/MMBF/Year(Forest &All Other Indir)		8.47	9.27	17.74	4.42	2.02	6.45	1.95	26.14
Total all Sector Labor Income Million (2004 \$)/Year		0.28	0.30	0.58	0.16	0.06	0.21	0.08	0.88
GSP Million (2004 \$)/Year		0.48	0.51	1.00	0.27	0.09	0.36	0.14	1.50
St&Loc Taxes Million (2004 \$)/Year		0.05	0.06	0.11	0.03	0.01	0.04	0.02	0.17
3RD THIN									
Jobs and Outputs/MMBF/YR 2004		3RD THIN							
		Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/MMBF/Year		2.02	2.79	4.81	2.15	1.28	3.43	0.32	8.56
Indir Forest Industry Employment Jobs/MMBF/Year		0.54	0.95	1.49	0.73	0.29	1.02	0.06	2.57
Total Forest Industry Employment Jobs/MMBF/Year		2.56	3.75	6.30	2.88	1.57	4.45	0.38	11.13
Total Forest Industry Labor Income Million (2004 \$)/Year		0.09	0.15	0.24	0.11	0.05	0.16	0.02	0.43
Total EmpJobs/MMBF/Year(Forest &All Other Indir)		8.07	13.48	21.55	6.43	3.16	9.59	1.50	32.64
Total all Sector Labor Income Million (2004 \$)/Year		0.27	0.38	0.65	0.29	0.09	0.38	0.06	1.09
GSP Million (2004 \$)/Year		0.46	0.65	1.11	0.50	0.15	0.65	0.11	1.86
St&Loc Taxes Million (2004 \$)/Year		0.05	0.07	0.12	0.06	0.02	0.07	0.01	0.21
SHORT ROTATION									
Jobs and Outputs/MMBF/YR 2004		SHORT ROTATION							
		Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/MMBF/Year		0.95	2.29	3.24	1.21	0.26	1.47	0.96	5.68
Indir Forest Industry Employment Jobs/MMBF/Year		0.40	0.83	1.23	0.44	0.21	0.65	0.09	1.97
Total Forest Industry Employment Jobs/MMBF/Year		1.35	3.12	4.47	1.65	0.47	2.12	1.05	7.65
Total Forest Industry Labor Income Million (2004 \$)/Year		0.05	0.12	0.17	0.07	0.01	0.08	0.06	0.32
Total EmpJobs/MMBF/Year(Forest &All Other Indir)		3.79	9.56	13.35	4.56	0.64	5.20	4.57	23.12
Total all Sector Labor Income Million (2004 \$)/Year		0.13	0.31	0.43	0.16	0.02	0.18	0.19	0.80
GSP Million (2004 \$)/Year		0.21	0.52	0.74	0.28	0.03	0.31	0.32	1.36
St&Loc Taxes Million (2004 \$)/Year		0.02	0.06	0.08	0.03	0.00	0.03	0.04	0.15
LONG ROTATION									
Jobs and Outputs/MMBF/YR 2004		LONG ROTATION							
		Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/MMBF/Year		0.78	3.45	4.23	3.25	1.26	4.51	0.29	9.03
Indir Forest Industry Employment Jobs/MMBF/Year		0.57	0.92	1.49	0.87	0.31	1.18	0.06	2.73
Total Forest Industry Employment Jobs/MMBF/Year		1.35	4.37	5.72	4.12	1.57	5.69	0.35	11.76
Total Forest Industry Labor Income Million (2004 \$)/Year		0.05	0.17	0.22	0.16	0.05	0.21	0.02	0.45
Total EmpJobs/MMBF/Year(Forest &All Other Indir)		3.12	18.27	21.39	8.72	3.11	11.83	1.36	34.57
Total all Sector Labor Income Million (2004 \$)/Year		0.11	0.47	0.58	0.44	0.09	0.53	0.06	1.16
GSP Million (2004 \$)/Year		0.18	0.80	0.98	0.76	0.15	0.90	0.10	1.98
St&Loc Taxes Million (2004 \$)/Year		0.02	0.09	0.11	0.09	0.02	0.10	0.01	0.22

Economic impact estimators are provided above to characterize the comparative effects of different management treatments for both the Westside and Eastside that reflect regional infrastructure differences in harvesting and processing. In Western Washington, current industrial forestland management favors short rotation regeneration harvests for maximum economic return (base case) which provide 12.59 direct jobs/MMBF/YR while other private and public forestland owners are likely to include more thinning treatments that increase jobs benefits. Determining a base case scenario for the Eastside is somewhat more complicated as multiple cohort and repeated thinning harvests are more common than the single cohort management regimes of the Westside (Oliver et al. 1994). However, the significance of the lower job multipliers on the Eastside should not go unnoticed as compared to the Westside. Lower multipliers

combined with much smaller harvest volumes on the Eastside result in Westside timber activities dominating the State Forest Sector contribution to the state economy.

While the long rotation treatment alternative increases the jobs per unit of removals by as much as 45% it should be noted that jobs benefits occur very far in the future and may be subject to unforeseeable changes including productivity gains and policy changes prior to the activity. Thinnings, such as the first thin, increase the job impact a modest 10% since added logging labor is largely offset by secondary (value-add manufacturing) labor declines, however, unlike the long rotation, the impact is near-term and can increase economic activity early in the projection period. Since different management treatments are practiced in different timbersheds with different infrastructure and employment bases, we can logically expect somewhat different job impacts in each local region. Tables presented above for West versus East reflect such differences.

Total state economic impacts from annual timber harvest

Table DP3.9, presented below, summarizes the average annual employment and revenue impacts for state timber harvest from 1998 through 2004. Economic results are presented in 2004 dollars. Total jobs and economic benefits for the logging sector have been calculated based upon an average annual harvest of about 3.9 billion board feet. Processing jobs are based upon the total harvest net of log exports which averaged approximately 660 million board feet per year. While the trucking jobs connected to log exports are likely captured by logging indirects, previous studies suggest that the magnitude of other export log handling employment, such as stevedore jobs, is understated by the Input-Output Model (Conway 1994). Paper employment, as a consequence of timber harvest, is considered to be fifty percent of total state paper employment since approximately half of the state paper production is from chip supplies imported from out-of-state suppliers or from recycled material. Total direct and indirect employment was found to be 109,253 jobs with total labor income of \$3.7 billion and an average annual wage of \$34,000. The average annual Gross State Product, which includes labor income, business taxes, and capital income, resulting from timber harvest was found to be \$6.3 billion with State and Local Taxes equal to \$713 million per year.

Table DP3.9: Total Jobs and Outputs/Ave Total Harvest MMBF/YR 1998-2004

Harvest Volume (MMBF/YR)	3,886.52 Total Harvest Volume					3,226.79 Total minus Exports		
	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/Year	5,052	9,591	14,643	4,559	5,970	10,528	3,646	28,818
Indir Forest Industry Employment Jobs/Year	2,076	3,670	5,746	1,744	928	2,673	385	8,804
Total Forest Industry Employment Jobs/Year	7,129	13,261	20,390	6,303	6,898	13,201	4,031	37,622
Total Forest Industry Labor Income Million (2004 \$)/Year	258	526	784	250	206	456	242	1,482
Total EmpJobs/Year(Forest & All Other Indir)	20,180	38,585	58,765	18,409	14,727	33,136	17,353	109,253
Total all Sector Labor Income Million (2004 \$)/Year	679	1,301	1,981	619	404	1,022	713	3,716
GSP Million (2004 \$)/Year	1,158	2,218	3,376	1,054	688	1,742	1,215	6,334
St&Loc Taxes Million (2004 \$)/Year	130	250	380	119	77	196	137	713

Increased employment and tax benefits from timber revenues re-invested in the state economy

Employment and revenue figures above reflect direct and indirect economic activity resulting from timber harvest but do not reflect all additional benefits that accrue from re-investment of timber revenues in the state economy. Timber revenues are largely accumulated dividends that have been deferred since the investment in regenerating the forest. Dividends are either paid back to shareholders or reinvested. While levels of re-investment from the private sector logically may flow as shareholder dividends to other regions depending upon the attractiveness of the instate re-investment and will fluctuate over time depending upon markets, policy changes, and other factors, this is not the case for the Washington Department of Natural Resources (DNR). Stumpage revenue generated from DNR timber sales has a uniquely powerful impact on state wealth as it is reinvested within the state; approximately seventy-five percent of stumpage revenues are reinvested for the public good (as returns to trust beneficiaries) in government projects and services in Washington. The remaining twenty-five percent funds DNR operations. There are two ways to think about assessing such impacts. First, if trust revenue that funds school construction and government operations is reduced then, 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 then job losses result from subsequent reductions in disposable wealth. An estimate of the added benefits provided by DNR stumpage revenues was calculated based upon the latter assumption; DNR revenues provide public service that otherwise would require tax increases therefore these revenues function as additional state labor income. The average annual timber volume harvested from state forests for the years 1998 through 2004 was 562 MMBF. The average stumpage return was \$329/MBF (DNR 2007). Total average annual revenue exceeded \$185 million with seventy-five percent returned to the trust beneficiaries and the state economy equal to \$134 million. A comparison of the difference in state economic activity without and with re-investment of trust revenues generated from a harvest volume of 562 MMBF is shown below in Tables DP3.10 and DP3.11. Results are presented in 2004 dollars. Note that the total benefits of re-investment of trust returns in the state economy, as shown in Table DP3.12, include 2,537 additional jobs with an increase to the gross state product of \$365 million, which is almost double the total value of DNR stumpage returns.

Table DP3.10: Annual economic outputs from DNR timber sales less re-investment of trust revenues.

	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/Year	731	1,670	2,401	794	1,040	1,834	635	4,870
Indir Forest Industry Employment Jobs/Year	300	639	939	304	162	466	67	1,472
Total Forest Industry Employment Jobs/Year	1,031	2,309	3,340	1,098	1,201	2,300	702	6,342
Total Forest Industry Labor Income Million (2004 \$)/Year	37	92	129	44	36	79	42	251
Total EmpJobs/Year(Forest & All Other Indir)	2,887	6,661	9,547	3,168	2,066	5,234	3,650	18,432
Total all Sector Labor Income Million (2004 \$)/Year	98	227	325	108	70	178	124	627
GSP Million (2004 \$)/Year	167	386	554	184	120	304	212	1069
St&Loc Taxes Million (2004 \$)/Year	19	43	62	21	13	34	24	120

Table DP3.11: Annual economic outputs from DNR timber sales with re-investment of trust revenues.

	Logging	Sawnwood	PrimW (sub)	Other MFG	Furniture	SecW (sub)	PrimP	Total
Dir Forest Industry Employment Jobs/Year	731	1,672	2,403	795	1,040	1,835	635	4,873
Indir Forest Industry Employment Jobs/Year	302	642	944	305	166	472	70	1,486
Total Forest Industry Employment Jobs/Year	1,032	2,314	3,346	1,101	1,206	2,307	705	6,358
Total Forest Industry Labor Income Million (2004 \$)/Year	37	92	129	44	36	80	42	251
Total EmpJobs/Year(Forest & All Other Indir)	3,282	7,581	10,864	3,606	2,349	5,955	4,150	20,969
Total all Sector Labor Income Million (2004 \$)/Year	132	304	436	145	94	239	167	842
GSP Million (2004 \$)/Year	225	519	743	247	161	407	284	1434
St&Loc Taxes Million (2004 \$)/Year	25	58	84	28	18	46	32	161

Table DP3.12: Difference in annual economic outputs from DNR timber sales with re-investment of trust revenues.

	Difference/MMBF	Difference/Total
Total Employment/Year (Forest & All Other Indir)	4.51	2537
GSP Million (2004 \$)/Year	0.65	365
St&Loc Taxes Million (2004 \$)/Year	0.07	41

Conclusions

Economic impact estimates derived from linking forest treatments to processing can provide economic measures of importance to a local region that go beyond the analysis of sustainable economics for the individual landowner. While such economic activity depends upon sustainable forest management, sustainability is also sensitive to policy impacts that can affect management treatments by making either shorter or longer rotations more economically attractive. As demonstrated by the magnitude of economic contribution to the state economy from re-investment of trust returns, forest policy that encourages private sector investment in the Washington economy can have significant multiplier benefits.

The economic multipliers used in the analysis are best current estimates grounded by surveys, census data, and engineering estimates of treatment differences as developed with the State Input-Output Model. The Forest Industry jobs estimate, alone, is not substantially different from estimates provided in earlier studies when adjusted for declines in harvest activities. Total direct and indirect jobs estimates derived from the Input-Output Model based on static interindustry relationships can be considered as conservative with lower

total estimates than econometric projection models such as WSPM that are designed to more fully capture dynamic downstream indirect effects of re-investment, government services, and other activities.

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