Analysis of the Wild Olympics Wilderness and Wild and Scenic Rivers Act of 2012: economic impacts and opportunities.

November 26, 2012

Report to:

Port of Port Angeles | **Clallam County** | **City of Forks**

Prepared by:

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Port Angeles, WA
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Sequim, WA
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Executive summary

Economic impacts of proposed legislation

The Wild Olympics Wilderness and Wild and Scenic Rivers Act of 2012 (Act) proposes, "to designate and expand wilderness areas in Olympic National Forest in the State of Washington, and to designate certain rivers in Olympic National Forest and Olympic National Park as wild and scenic rivers…" In the language of the (governing) Northwest Forest Plan, the Act would transfer the Land Use Allocation of approximately 120,900 acres from Late-Successional Reserve to Congressional Reserve (i.e. wilderness), and approximately 5,200 acres from Adaptive Management Area to Congressional Reserve.

The impact of the wilderness designation would be a reduction in harvest capacity on Olympic National Forest that, at current harvest rates and intensities, would annually yield 439,200 board-feet. This yield supports a total of 4.9 jobs within the Olympic Regional Economy: 2.3 direct (i.e. logging, milling, paper), 1.5 indirect, and 1.1 induced; with total labor incomes of $136,100, $62,500 and $27,100 respectively. The impact of designating proposed rivers as wild or scenic would be a reduction in harvest capacity on Olympic National Forest that (at current harvest rates and intensities) would annually yield 641,000 board-feet. This yield supports a total of 7.0 jobs within the Olympic Regional Economy: 3.3 direct, 3.3 indirect and 1.5 induced; with total labor incomes of $193,900, $40,400 and $38,900, respectively. The economic impacts are summarized in ES Table 1. Not contained are the economic impacts from reductions in harvests on Washington State Trust Lands that will result from recreational river designations. The upper limit for harvest reductions is 1.12 MMBF annually, with an economic impact of an additional 12.8 direct, indirect and induced jobs, $595,800 in total labor income, $70,800 in state and local business taxes, and $10,400 in excise taxes.

ES Table 1. Employment, wage, and tax impacts of Wild Olympics and Wild Scenic Rivers Act of 2012.

Proposal element	Jobs	Annual wages + benefits [a] [d]				Annual taxes [d]		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Wilderness	4.9	$136,100	$62,500	$27,100	$225,700	$23,200	$3,700	$23,500
Wild & Scenic	7.0	$193,900	$90,400	$38,900	$323,200	$33,300	$5,600	$35,100
Total	11.9	$330,000	$102,900	$66,000	$548,900	$56,500	$9,300	$58,600

[a] Wages, state and local taxes paid by businesses resulting from changes in employment; source: IMPLAN.

[b] Portion of state timber excise tax returned to counties (4%) based stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on stumpage of $230 / MBF.

[d] Monetary values rounded to nearest one hundred.

Economic impacts of inter-sector closures

The Port of Port Angeles, Clallam County, and City of Forks expressed concern that any reduction in available fiber may have an adverse effect on the Forest Products Industry and requested an analysis of potential economic impacts. The Forest Products Industry of the Olympic Peninsula is tightly integrated among firms and across sectors, explained by the fiber supply-production chain: products and by-products from logging and milling are inputs for other manufacturing processes, such as paper production and bioenergy generation. Sales of by-products are significant sources of revenue for milling operations. In the absence of local markets for those by-products the probability of a mill closure increases; similarly, the absence of local supplies of mill by-products increases the probability of closure of paper production and bioenergy generation. The economic impacts of a cross-sector closure scenario are summarized in ES Table 2, where closure of a local saw mill causes the closure of a paper mill and its bioenergy generation in Clallam County. The direct loss would be 431 jobs paying an average annual wage, including salary and benefits, of $72,900 with an economic output valued at $210,147,400, a significant source of income to Clallam County. State and local business tax revenues associated with the direct employment would decline by $2,550,900. The direct effect would cause further economic impacts in the fiber supply-production chain through indirect effects, and ultimately induced effects from reduced labor expenditures.

ES Table 2. Aggregate economic impact of a cross-sector shutdown[a].

Impact type	Employment	Labor income	Average wage	Value output	Business taxes
Direct Effect	431.0	$31,411,900	$72,900	$210,147,400	$2,550,900
Indirect Effect	408.7	$21,129,100	$51,700	$63,209,000	$2,027,900
Induced Effect	332.2	$9,235,300	$27,800	$34,622,200	$2,181,300
Total Effect	1,171.8	$70,360,400	$60,000	$307,978,600	$6,760,100

[a] Labor income include benefits; state and local taxes paid by businesses resulting from changes in employment; Source: IMPLAN. Monetary values rounded to one hundred; thus, totals may not sum.

Alternative management scenarios

The Northwest Forest Plan (Plan) originally envisioned an annual yield of 900 MMBF; with half expected to come from stands older than 200 years. The sale of timber from older stands has not been realized and in the past decade, sale volumes have averaged only 54 percent of Plan goals. Reduced harvest levels have been met with reduced budgets: the impact on Region 6 (that includes Olympic National Forest) in terms of budget and employment (measured in job-years) has been a decline of about 50 percent since the Plan was adopted.

During the Plan's first decade, thinning operations in Late Successional Reserves were implemented on fewer than 300,000 out of 2.2 million eligible acres. At this rate, many stands

will surpass 80 years before being thinned. This is problematic as the benefits of silvicultural manipulation for ecologic objectives are not in dispute, as the Plan's Standards and Guidelines clearly acknowledge. Thus, to the degree the Act reserves lands where owl recovery could benefit from active management by accelerating development of a complex forest, the probability of owl survival is reduced, an outcome contradictory to the Plan's objectives.

The Plan's original vision coupled with the 10- and 15-year updates make clear that Olympic National Forest could support an annual yield of 30 MMBF within current upland Adaptive Management Areas and young (< 80) Late Successional Reserves. This would add an additional 110 job-years to direct employment (i.e. logging, sawmilling, and paper) to the Olympic Regional Economy. However, given reduced budgets and staffing, activity in LSRs falls short of potential total thinning, thus reducing the capability of active management to increase habitat and thus recover of the northern spotted owl, the ostensible goal of the Northwest Forest Plan in accordance with the Endangered Species Act.

An alternative management scenario – A Third Way – that yields 49,400,000 board-feet annually is explored. This would be accomplished by transferring approximately 168,200 acres of both Adaptive Management Area and Late Successional Reserve - all located outside of Key Watersheds identified in the Plan - into Matrix status, and imposing a limit on harvest intensity of 18,500 BF/acre; re-entry cannot occur until the harvested volume is recovered by growth, a duration of approximately 25-30 years, depending on the quantity removed. The resulting harvest rate from the Third Way scenario would be 0.83% on the acres included. This, or similarly constructed alternatives, can take advantage of the robust growth rates across the forest (600 board-feet per acre per year): harvesting timber to increase light, water and nutrients to accelerate development of late-successional and old-growth structures (i.e. big trees) while leaving a continuous forest cover. In the scenario explored, only 1 of every 2 board-feet grown is harvested. Yields and economic impacts are summarized below.

ES Table 3. Acres, yield, and annual economic impacts of an alternative Third Way scenario.

County	Total Acres	Yield [a]	Harvested acres [a]	Direct employment [b]	Direct wages [b]	Excise tax & remit [c]
Clallam	32,219	11.523	698	62.2	$5.488	$768.6
Grays Harbor	52,990	15.569	944	84.0	$5.402	$1,038.4
Jefferson	55,873	16.417	995	88.7	$3.956	$1,095.0
Mason	20,099	5.905	358	31.9	$2.189	$393.9
Total	168,181	49.415	2,995	266.8	$17.036	$3,296.0

[a] Yield in millions of board-feet (MMBF); yield distributed among counties according to proportion of total acres; yield and acres based on a harvest rate of 0.83%; harvest intensity of 18,500 board-feet per acre.

[b] Wages, in millions, include benefits. Source, IMPLAN. Employment in job-years. Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf

[c] Tax revenues, in thousands, are the sum of state timber excise tax returned to counties (4% of revenue) and federal remittance to county of timber harvest (25% revenue) from annual yield and stumpage of $230 / MBF.

Contents

Introduction

The Wild Olympics Wilderness and Wild and Scenic Rivers Act of 2012[1] (hereafter, the Act) was introduced on 21 June, 2012, by Congressman Norm Dicks. The bill's purpose, "to designate and expand wilderness areas in Olympic National Forest in the State of Washington, and to designate certain rivers in Olympic National Forest and Olympic National Park as wild and scenic rivers…" Specifically, the Act would transfer the Land Use Allocation (LUA, defined below) of approximately 120,900 acres from Late-Successional Reserve (LSR) to Congressional Reserve (i.e. wilderness), and approximately 5,200 acres from Adaptive Management Area to Congressional Reserve. Additionally, the bill would designate as wild, scenic, or recreational segments of the following rivers: -Elwha River; -Dungeness River; -Big Quilcene River; -Dosewallips River; -Duckabush River; -Hamma Hamma River; -South Fork Skokomish River; -Middle Fork Satsop River; -West Fork Satsop River; -Wynoochee River; -East Fork Humptulips River; -West Fork Humptulips River; -Quinault River; -Queets River; -Hoh River; -Bogachiel River; -South Fork Calawah River; -Sol Duc River; and -Lyre River. Designation as wild, scenic, or recreational would establish quarter-mile wide corridors (on each side of the river) that would enjoin approximately 143,300 acres from certain actions and activities.

Scope of work

The Port of Port Angeles, Clallam County, and the City of Forks have asked Olympus Consulting of Port Angeles and Malus Partners of Sequim to analyze and quantify the bill's impact (if any) on the economies of Clallam, Grays Harbor, Jefferson, and Mason counties. In the event the Act would have a negative economic impact, Olympus Consulting and Malus Partners have been asked to explore alternative management scenarios that result in positive economic development.

Background

The Act proposes to change the distribution of LUA in Olympic National Forest, which were established in the Northwest Forest Plan. A brief recital of the events leading up to, and some of the specific provisions of the Plan is warranted to understand what elements need to be measured when evaluating economic impacts.

The northern spotted owl was listed as a threatened species in 1990; shortly thereafter, lawsuits over federal timber sales and injunctions halted timber harvest within the range of the owl. On July 1, 1993, President Clinton announced his proposed "Forest Plan for a Sustainable Economy and a Sustainable Environment". The Record of Decision (ROD) was signed in 1994, legally adopting a new management direction and ending the impasse over management of these lands. The ROD amended existing management plans for 19 national forests and 7 BLM

[1] House bill text (as introduced): http://www.opencongress.org/bill/112-h5995/text

districts in California, Oregon, and Washington (24 million acres of federal land within the 57-million-acre range of the northern spotted owl). The term "Northwest Forest Plan" (hereafter, the Plan) is really a catch-all for the implementation of the ROD and monitoring of 26 separate plans. Within the Plan, seven land use designations were established and allocated; below are brief descriptions of each (listed in order of precedence where overlap occurs):

Congressionally reserved areas. Includes national parks and monuments, wilderness, wild and scenic rivers, national wildlife refuges, Department of Defense lands, and other Congressional designations.

Late-successional reserves (LSRs). Management actions are allowed to benefit late-successional forest characteristics or reduce the risk of catastrophic loss.

Adaptive management areas. Areas designated as places to test new ideas and management approaches. Portions of AMAs are available for regularly scheduled timber harvest.

Managed late-successional areas. Management actions are allowed to help prevent catastrophic loss to fire, insects, etc. around known spotted owl activity centers in the Washington Eastern Cascades and the California Cascades Provinces.

Administratively withdrawn areas. Lands excluded from scheduled timber harvest (e.g., recreation sites; areas that are visually sensitive, unstable, or have special habitat or sensitive species; or areas where reforestation cannot be ensured.)

Riparian reserves. Areas along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas managed for aquatic and riparian values.

Matrix. All remaining lands outside reserves and withdrawn areas. Available for regularly scheduled timber harvests.

Methodology

If the transfer between LUAs and declarations of wild, scenic, and recreational proposed by the Act result in a loss of timber that may otherwise be harvested in a given year, the economic impact can be measured. Timber sales generate local and state tax revenues; harvest operations support direct and indirect employment, with associated income, and support other forms of employment across the broader local economy. The general equation below will be used to establish employment impacts as a function of timber harvest. The sources and methods for each component are discussed in the following sections.

Equation 1. Employment as a function of timber harvest.

$$\text{Harvestable acres}\ \frac{(\text{acre})}{} \times \text{Harvest rate}\ \frac{(\%)}{} \times \text{Harvest intensity}\ \frac{(\text{MBF})}{(\text{acre})} \times \text{Employment multiplier}\ \frac{(\text{Job-years})}{(\text{MMBF})}$$

Data for this analysis was furnished by Olympic National Forest through a Freedom of Information Act request[2]. Footnotes direct the reader to other sources, documents, or online locations of materials. September 19, 2012 and fulfilled on October 9th, 2012.

Harvestable acres

Wilderness

The distribution of LUA across Olympic National Forest and the counties of the Olympic Peninsula are detailed in Exhibit 1. The specific focus here is on the current and proposed quantities of wilderness: there are currently 87,250 acres of wilderness within the boundaries of Olympic National Forest; the Act would create and additional 126,014 acres of wilderness from 120,797 acres of LSR and 5,217 acres of AMA. The table below summarizes Wilderness by county.

Table 1. Current and proposed wilderness acres by Land Use Allocation and county.

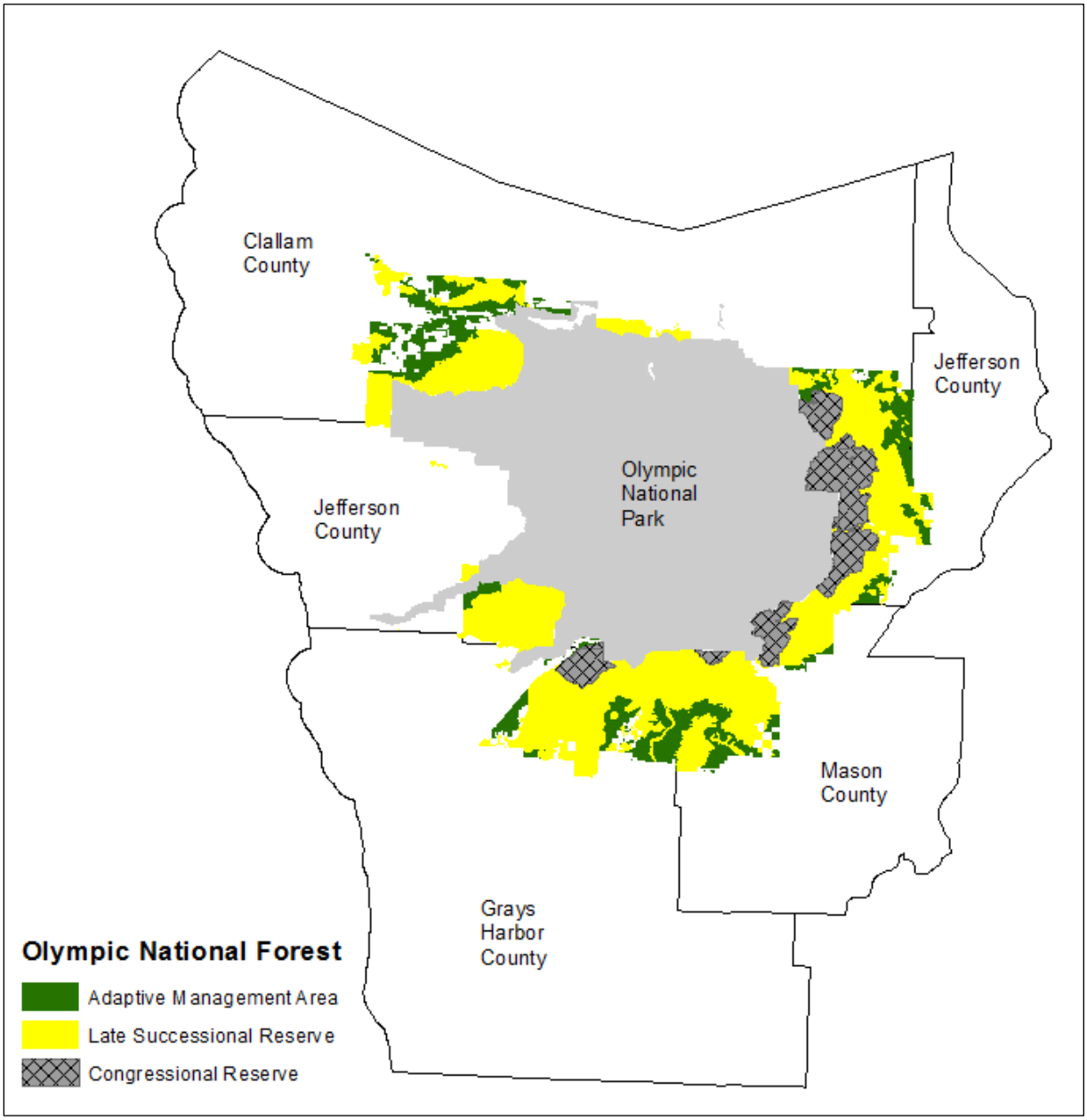
Designation / LUA	County				Total
	Clallam	Grays Harbor	Jefferson	Mason	
Current Wilderness [a]	13,059	11,142	47,641	15,408	87,250
Proposed LSR Wilderness [b]	31,674	25,330	32,896	30,897	120,797
Proposed AMA Wilderness [b]	2,403	0	2,735	0	5,138
Total	44,733	38,883	83,308	46,305	213,185

[a] Data source: Olympic National Forest GIS.

[b] Data source: GIS layers Wilderness_v21 and WSR_v13 provided by Sen. Murray via Port of Port Angeles.

[2] FOIA Xpress reference number FX12-2393-R; submitted 9/19/12, fulfilled 10/9/12. Request processed by Robin Shoal, Environmental Coordinator, Olympic National Forest, 1835 Black Lake Blvd SW, Olympia, WA 98512.

Exhibit 1. Olympic National Forest land use allocation with acreage distribution by county.



Land Use Allocation	County				Total [a]
	Clallam	Grays Harbor	Jefferson	Mason	
Adaptive Management Area	62,225	27,154	17,944	22,266	129,589
Late Successional Reserve	122,557	99,587	101,158	90,423	413,725
Congressional Reserve	13,059	11,142	47,641	15,408	87,250
Total [a]	197,841	137,883	166,743	128,097	630,564

[a] Does not include 217 acres of land with unspecified land use allocation.

The Standards and Guidelines[3] developed for implementing and monitoring the Plan state that the primary silvicultural objective within LSRs is to develop old-growth forest characteristics (which includes prevention of large-scale disturbances that would destroy or limit the ability of the reserves to sustain viable forest species populations). To that end, timber harvest may occur within LSRs younger than 80 years old. Where timber harvest itself is not an objective within LSRs, AMAs are available for regularly scheduled timber harvest and are not restricted by age for entry.

The spatial and age class distribution of the approximately 120,800 acres of current LSR proposed for wilderness is detailed in Exhibit 2. After accounting for riparian buffers[4], upland acres are distributed by county and age class according to table 2. Similarly, Exhibit 3 illustrates the spatial and age class distribution of AMA acres proposed for wilderness; table 3 summarizes the age class distribution of upland AMA acres by county.

Table 2. Proposed wilderness acres from LSR uplands by county and age class.

County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	723	852	84	4,513	2,018	1,478	17,641	27,309
Grays Harbor	25	276	449	31	133	44	0	22,062	23,020
Jefferson	14	1,023	1,546	671	3,873	208	755	21,107	29,197
Mason	0	343	302	730	2,009	633	856	20,694	25,567
Total	39	2,365	3,149	1,516	10,528	2,903	3,089	81,504	105,093

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not include value null age class values: Clallam County (552 ac), Grays Harbor County (350 ac), Jefferson County (284 ac), Mason County (2,340 ac).

Table 3. Proposed wilderness acres from AMA uplands by county and age class.

County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	38	129	466	1,259	30	255	18	2,195
Jefferson	0	0	253	1,369	655	10	51	19	2,357
Total	0	38	382	1,835	1,914	40	306	37	4,552

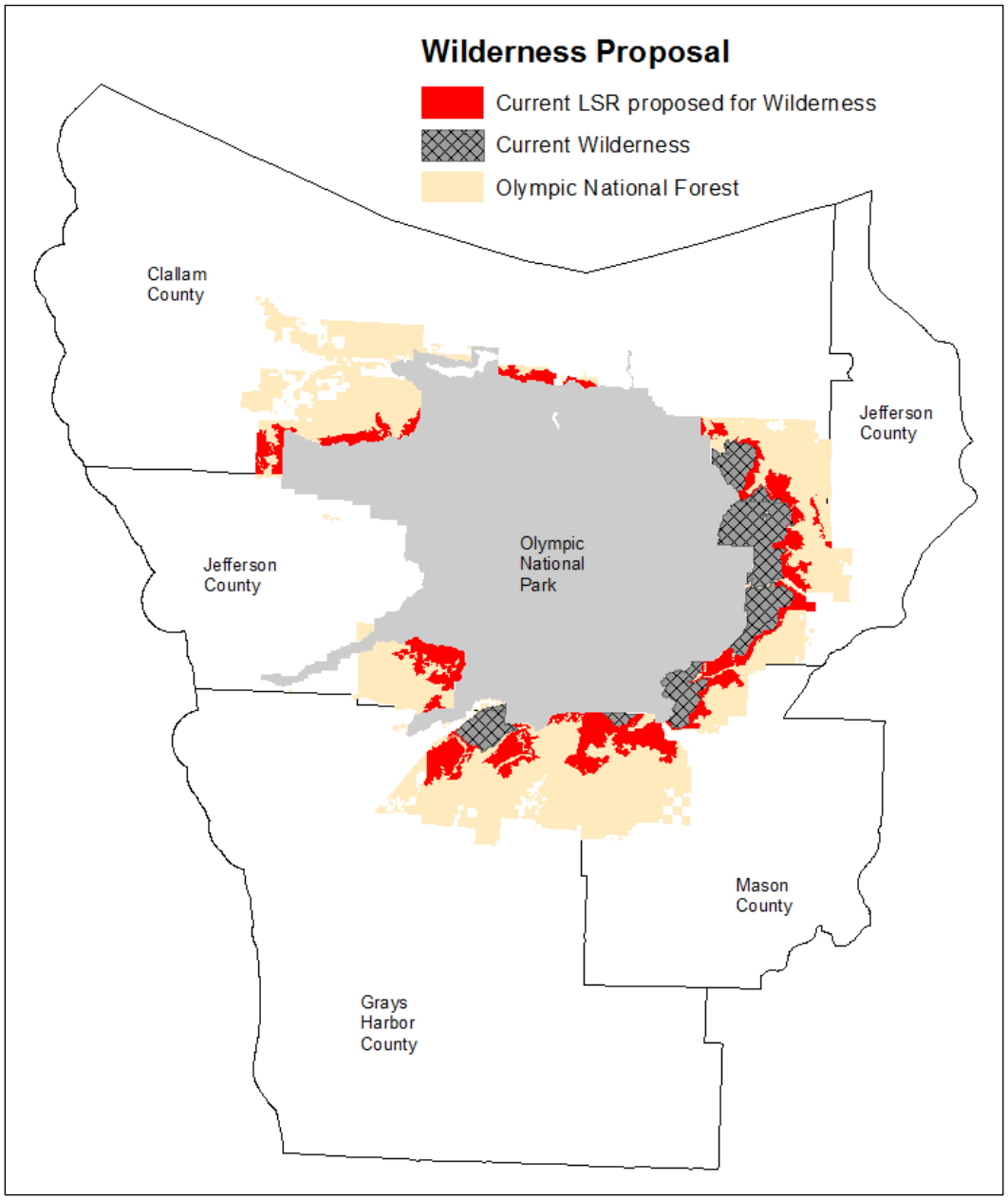
[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Clallam County (3 ac), Jefferson County (31 ac).

[3] Source: http://www.reo.gov/library/reports/newsandga.pdf; relevant passage on page D-8

[4] Riparian Reserves account for 213,983 acres of LSR and 63,365 acres of AMA; but are not entirely removed from management. No-cut buffers were applied as described in Derek Churchill's 2012 report, "Analysis of Impacts to Olympic National Forest Timber Base from the Wild Olympics Wild and Scenic Rivers Act (H.R. 5995; S. 3329)." Online: http://www.wildolympics.org/docs/report_OlympicNationalForest_TimberBaseAnalysis.pdf

Exhibit 2. Current Late-Successional Reserve proposed for wilderness with age class distribution by county.

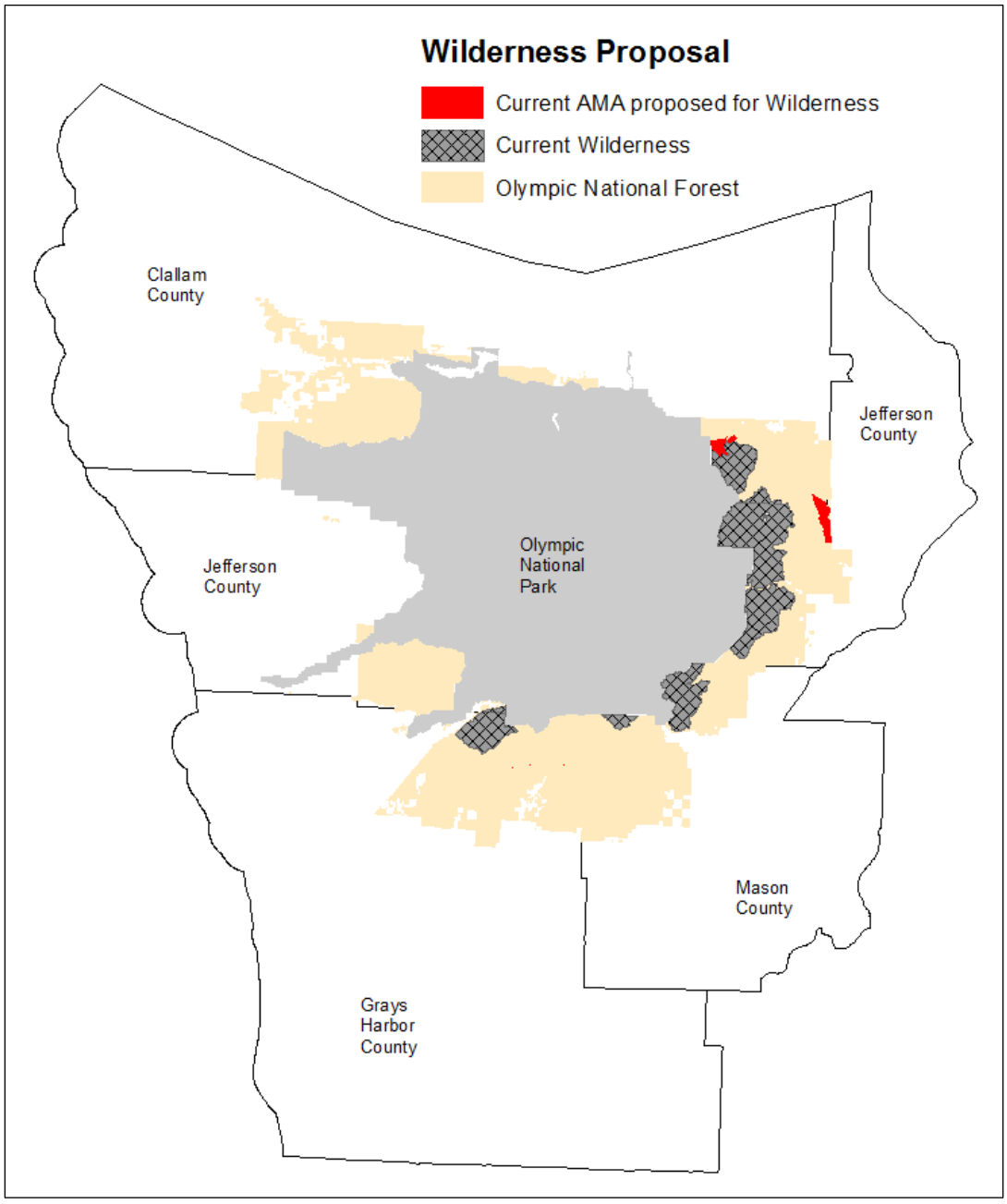


County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	766	945	87	5,030	2,146	1,542	20,574	31,090
Grays Harbor	25	313	507	34	150	45	0	24,172	25,246
Jefferson	14	1,179	1,814	759	4,075	233	773	23,665	32,512
Mason	0	365	311	810	2,252	774	935	22,446	27,893
Total	39	2,623	3,577	1,690	11,507	3,198	3,250	90,857	116,741

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Clallam County (578 ac), Grays Harbor County (389 ac), Jefferson County (371 ac), Mason County (2,800 ac).

Exhibit 3. Current Adaptive Management Area proposed for wilderness with age class distribution by county.



County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	43	139	525	1,343	36	288	29	2,403
Jefferson	0	0	299	1,591	762	10	54	19	2,735
Total	0	43	438	2,116	2,105	46	342	48	5,138

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Clallam County (4 ac), Jefferson County (44ac).

There are 11,621 acres of Olympic National Forest that are available[5] for harvest under the Plan that would be impacted by the proposed legislation: 7,069 acres of upland LSR younger than 80 years (Table 3); and 4,552 acres of upland AMA[6]. Table 4 summarizes acres proposed for wilderness that may otherwise be available[7] for harvest by current LUA and county.

Table 4. Proposed wilderness acres from uplands by LUA and county.

Designation / LUA	County				Total
	Clallam	Grays Harbor	Jefferson	Mason	
Late Successional Reserves	1,659	781	3,254	1,375	7,069
Adaptive Management Areas	2,195	0	2,357	0	4,552
Total	3,854	781	5,611	1,375	11,621

Wild & Scenic Rivers

The effect of a Congressional designation of a river as wild, scenic, or recreational[8] is to establish a corridor of 320 acres of land per river mile (160 acres per side), or 1,320 feet from each side of the ordinary high water mark. Exhibit 4 details the extent of the proposed designations on 19 rivers running through Olympic National Park, Olympic National Forest, and Washington State Trust Lands in all four counties on the Olympic Peninsula. Timber harvest would be restricted[9] in the portions of proposed wild, scenic, and recreational river corridors that overlap AMAs and young LSRs and thus have an economic impact. Exhibit 5 details the age class distribution of corridors within federals lands. Tables 5 and 6 detail the age class distributions by county for LSR uplands and AMA uplands, respectively.

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[5] Over 99% of lands in Olympic National Forest produce at least 20 ft3/ac/yr, which is enough to be considered a timber-producing stand; no lands are removed from the analysis due to elevation or subjective assessments of operability so as not to discount future improvements in harvest technology, utilization, or price support.

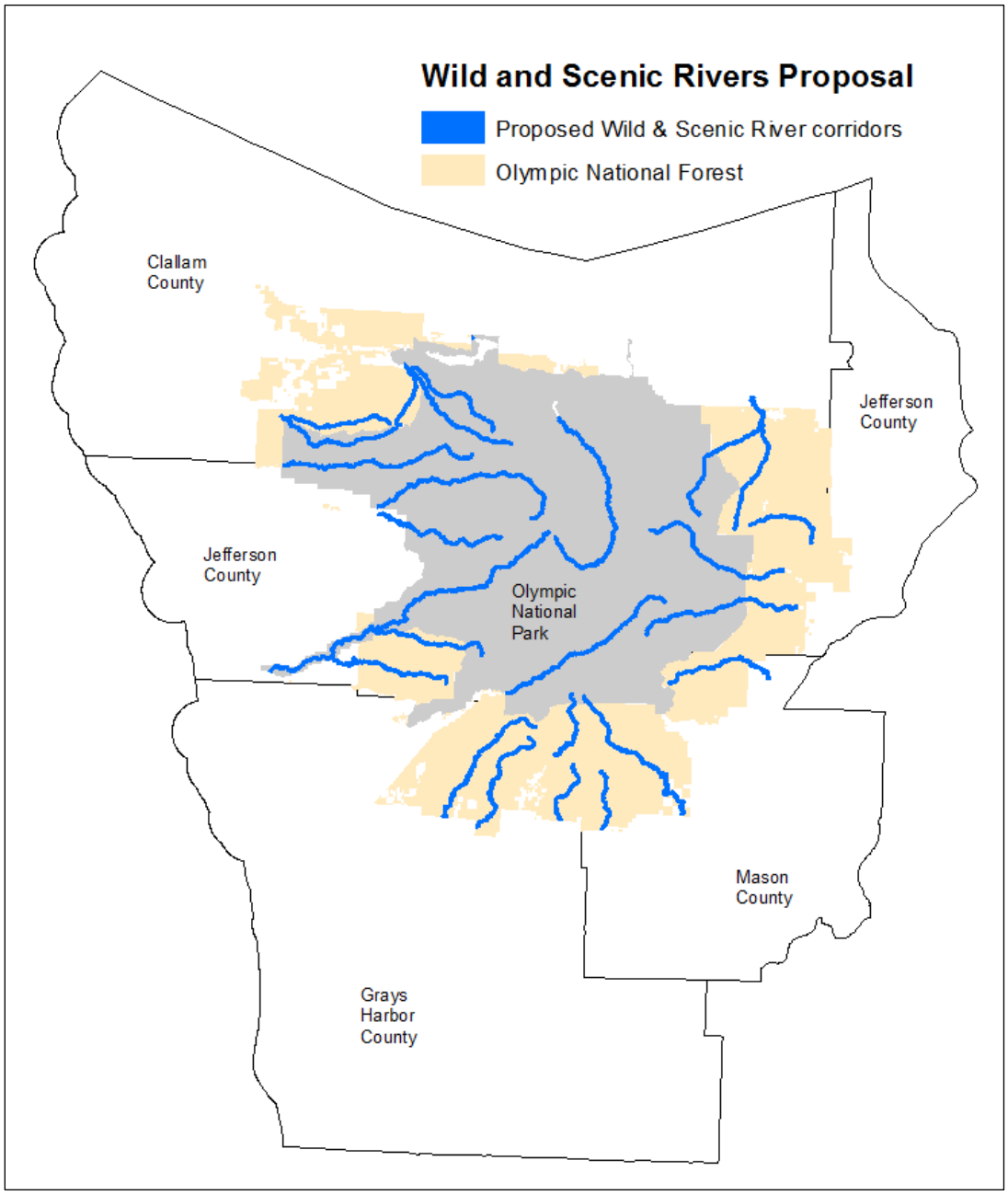
[6] In its FOIA response, Olympic National Forest stated that there is no policy to remove stands in AMAs from consideration for silvicultural activities based on age (i.e. 140 years and older).

[7] 76,365 acres proposed for Wilderness are within the boundaries of Inventoried Roadless Areas. With respect to management of these lands, 36 CFR §294.13(a) [p.3273] indeed states, "Timber may not be cut, sold, or removed in inventoried roadless areas of the National Forest System, except as provided in paragraph (b) of this section." §294.13(b)(i) allows for infrequent sale of timber in these areas, "To improve threatened, endangered, proposed, or sensitive species habitat". As these acres are currently designated as either LSR or AMA, the Standards and Guidelines require all silvicultural activities to conform to a standard no less rigorous than §294.13(b)(i). Therefore, it is reasonable to include these lands for management action.

[8] The Wild and Scenic Rivers Act (16 U.S.C. 1271-1287): http://www.rivers.gov/rivers/documents/wsr-act.pdf

[9] Harvest limitations detailed: http://www.law.cornell.edu/cfr/text/36/292.46
The Olympic Forest Plan also studied the issue and concluded that management practices (circa 1990) within the would-be corridors disqualified rivers from consideration/inclusion; regularly scheduled timber harvest within corridors is incompatible with the purposes of the Wild and Scenic Rivers Act.
The Wild Olympics' website noted that the East Fork Humptulips River, "… it is already being managed as it would after designation with respect to the sale." Implies a different in management due to designation

Exhibit 4. Proposed Wild and Scenic River corridors with acreage distribution by ownership and county.

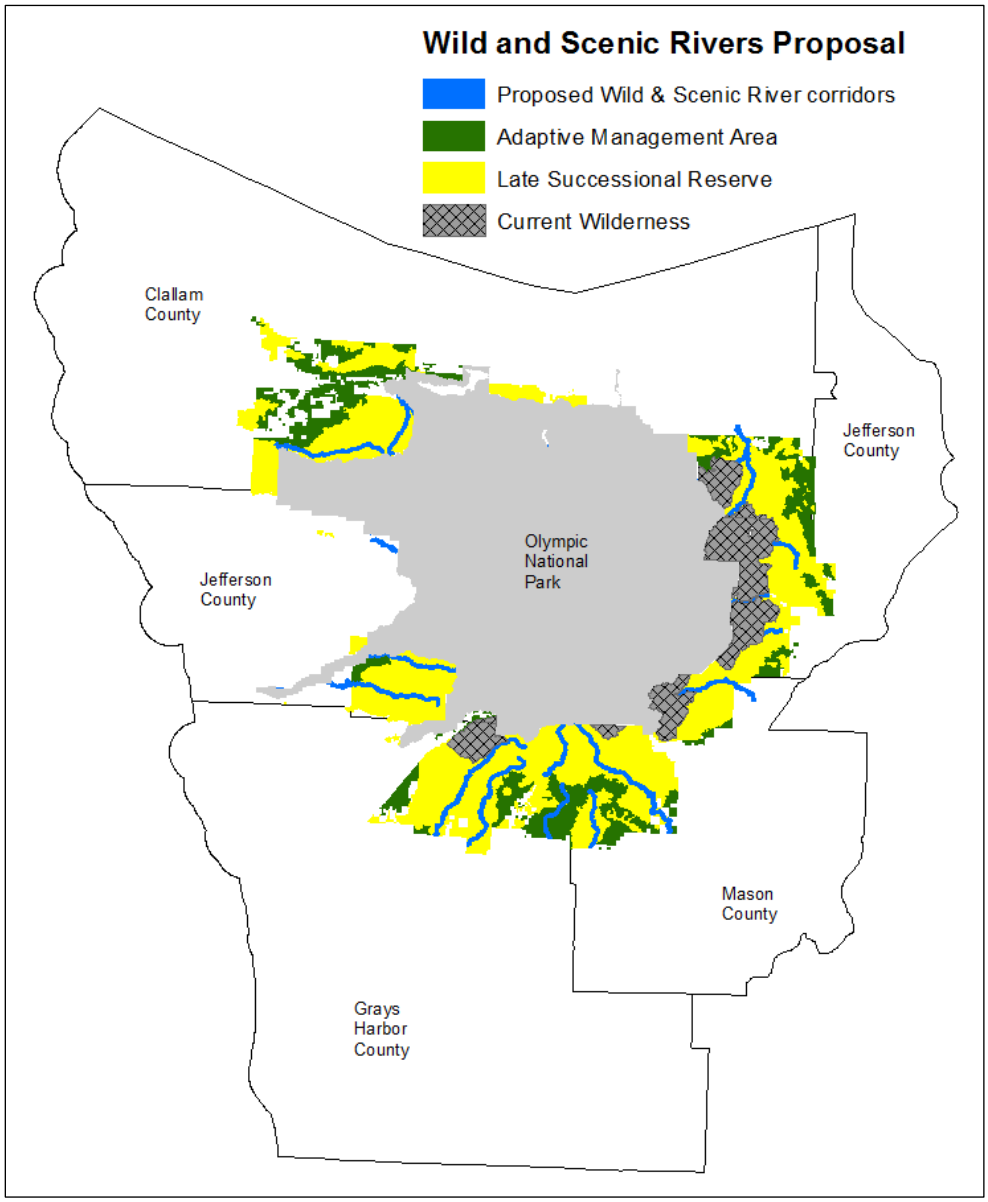


Ownership	County				Total
	Clallam	Grays Harbor	Jefferson	Mason	
Olympic National Park	28,290	0	53,570	359	80,219
Olympic National Forest	13,365	16,771	15,439	12,395	57,970
non-ONP / ONF [a]	674	0	2,642	1,837	5,153
Total [b]	40,329	16,771	71,651	14,591	143,342

[a] State forest transfer lands (DNR) in Clallam; Common School and University Trust Lands (DNR) in Jefferson; state forest transfer (DNR) and private lands in Mason. These lands would be designated recreational.

[b] Total acreages may differ slightly from legislation due to different GIS source data.

Exhibit 5. Proposed Wild & Scenic River corridors within Late-Successional Reserves, Adaptive Management Areas, and non-federal lands with acreage distribution by age class.



County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	1,362	1,993	585	594	182	1,198	5,428	11,342
Grays Harbor	33	2,005	4,079	574	401	145	0	8,424	15,661
Jefferson	0	1,553	2,146	355	758	52	2	5,200	10,066
Mason	0	1,219	1,465	1,601	1,663	39	0	4,765	10,752
Total	33	6,139	9,683	3,115	3,416	418	1,200	23,817	47,821

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Clallam County (62 ac), Grays Harbor County (1,016 ac), Jefferson County (355 ac), Mason County (526 ac), and non-federal lands (5,153 ac).

Table 5. Proposed wild and scenic river corridor acreage from LSR uplands by county and age class.

County	Age Classes [a]								Total [b]
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	1,170	1,503	497	526	145	991	4,206	9,038
Grays Harbor	33	1,669	3,129	390	286	118	0	6,911	12,536
Jefferson	0	1,132	1,751	263	643	28	2	3,939	7,758
Mason	0	974	1,261	1,326	1,351	31	0	4,000	8,943
Total	33	4,945	7,644	2,476	2,806	322	993	19,056	38,275

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Clallam County (53 ac), Grays Harbor County (526 ac), Jefferson County (126 ac), Mason County (271 ac).

Table 6. Proposed wild and scenic river corridor acreage from AMA uplands by county and age class.

County	Age Classes								Total
	1-20	21-40	41-60	61-80	81-100	101-120	121-140	140+	
Clallam	0	5	111	0	0	0	0	10	126
Grays Harbor	0	136	453	94	0	6	0	73	762
Jefferson	0	223	16	45	0	0	0	114	398
Mason	0	129	17	70	0	0	0	14	230
Total	0	493	597	209	0	6	0	212	1,516

[a] Data source: Olympic National Forest GIS.

[b] Total acreage does not null age class values: Grays Harbor County (16 ac), Jefferson County (79 ac).

There are 17,043 acres of Olympic National Forest within proposed wild and scenic river corridors that might otherwise be available for timber harvest 15,527 acres of upland LSR younger than 80 years; 1,516 acres of upland AMA. Table 7 summarizes the 17,043 total available acres by LUA and county.

Table 7. Proposed wild and scenic river corridor acreage from uplands by land type and county.

Designation / LUA	County				Total
	Clallam	Grays Harbor	Jefferson	Mason	
Proposed LSR Wild & Scenic	2,268	5,458	4,094	3,707	15,527
Proposed AMA Wild & Scenic	126	762	398	230	1,516
Total	2,394	6,220	4,492	3,937	17,043

[a] State forest transfer lands (DNR) in Clallam; Common School and University Trust Lands (DNR) in Jefferson; state forest transfer (DNR) and private lands in mason. These 4,133 upland acres would be designated recreational. The harvest restrictions under this designation would bar current harvest practices on these lands.

Harvest rate

Harvest rate is the ratio of annual yield to total yield. For the period beginning with fiscal year 2000 and ending with fiscal year 2012, the cumulative volume of timber sold on Olympic National Forest was 132.5 MMBF. This figure is reduced to 118.9 MMBF when considering those sales that contribute to employment in a measurable way; an average annual yield of 9.15 MMBF. Sale attributes are summarized by size class in the table below. There are 243,902 acres upland AMA and LSR younger than 80 years within Olympic National Forest; if the average harvest intensity is 12.5 MBF/acre[10], the total yield from the Forest is 3.05 MMMBF. This represents a harvest rate of 0.003 (0.3%) and implies a rotation length of 333 years.

Table 8. Cumulative timber sales on Olympic National Forest by size class, FY 2000 - FY 2012. [a].

Size class [b]	Sold sales	Sold volume (MBF)	Sold Volume (CCF)	Sold value
$301 - $10,000	17	2,103	3,971	58,021
$10,001 - $100,000	21	91,243	173,866	3,576,519
$100,001 - $1,000,000	5	25,597	48,347	1,765,203
$1,000,001 - $5,000,000	0	0	0	0
> $5,000,000	0	0	0	0
Total	43	118,943	226,184	5,399,743

[a] Data source: Olympic National Forest [Cut and Sold (new) – CUTS203F].

[b] Excluded Size classes (MMBF sold): 0 (0), Non-convertible (0), < $300 (12.1), ADDVOL (1.56), NONTIM (0), PRETIM (0), RPLCMT (.01).

Harvest volume

Given that the average annual yield of 9.15 MMBF from Olympic National Forest is distributed evenly across AMAs and LSRs less than 80 years old, approximately 4.8% (439.2 MBF) would be expected to originate within the proposed Wilderness[11]; similarly, 7.0% of the volume (640.5 MBF) would be expected to originate within proposed Wild & Scenic River corridors[12]. There are 1,601 upland acres that are within both proposed wilderness areas and wild and scenic river corridors: 168 acres of LSR in Clallam County; 303 acres of LSR in Grays Harbor County; 885 acres of LSR in Jefferson County; and 245 acres of LSR in Mason County. Adding the expected annual wilderness and wild & scenic yields would count overlapping acres twice; these acres

[10] Source: Churchill, D. (2012) "Analysis of Impacts to Olympic National Forest Timber Base of draft Congressional Watershed Conservation Proposal." Online: http://wildolympics.org/docs/report_ONFTimberBaseAnalysis.pdf
In a previous analysis, data provided by Olympic National Forest indicated an average harvest intensity of 18.5 MBF/acre. In this analysis, 12.5 MBF/acre is used to make analyses as comparable as possible. This creates a downward bias in employment impact estimates.

[11] 11,621 is 4.8% of 243,902.

[12] 17,043 is 7.0% of 243,902.

account for approximately 60 MBF of harvest annually[13]. Harvest can be distributed by the proportion of a county's acreage within an LUA. Tables 9 and 10 summarize expected annual yield by county for proposed wilderness and wild & scenic river corridors, respectively. Recreational corridors through Washington State Trust Lands are not included, though restrictions will reduce harvests from current levels, because the precise reductions in volume are not known at this time.[14]

Table 9. Percent and total harvest volume from proposed Wilderness areas by land designation and county.

Designation	County								Total
	Clallam		Grays Harbor		Jefferson		Mason		
	%	MBF	%	MBF	%	MBF	%	MBF	
LSR	24	64.1	11	29.4	46	122.9	19	50.8	267.2
AMA	48	82.6	0	0	52	89.4	0	0	172.0
Total [a]		146.7		29.4		212.3		50.8	439.2

[a] Percentages are within a designation; therefore, it is not appropriate to sum percentages within a column.

Table 10. Percent and total harvest volume from proposed Wild & Scenic river corridors by land designation and county.

Designation	County								Total
	Clallam		Grays Harbor		Jefferson		Mason		
	%	MBF	%	MBF	%	MBF	%	MBF	
LSR	33	192.6	6	35.0	49	285.9	12	70.0	583.5
AMA	14	8.0	37	21.1	26	14.8	23	13.1	57.0
Total [a]		200.6		56.1		300.7		83.1	640.5

[a] Percentages are within a designation; therefore, it is not appropriate to sum percentages within a column.

Employment

A model of economic multipliers linked to annual timber harvest activity was developed by the Rural Technology Initiative at the University of Washington[15]. The work included review of the literature, surveys of industry sectors, and collection of census employment data. Input from loggers, mill managers, timber merchandisers, consultants, scientists, other forestry professionals, and agency representatives provided inside information and professional insights in regards to current harvesting, manufacturing, and employment developments within the

[13] 1,601 is 0.7% of 243902; 0.7% of 9.15 MMBF is 60 MBF.

[14] House bill text appears to designate river miles running through Washington State Trust Lands as recreational. Resulting restrictions would reduce current harvest levels. http://www.law.cornell.edu/cfr/text/36/292.46

[15] Mason, C.L.; Lippke, B.R. (2007) "Jobs , revenues, and taxes from timber harvest; an examination of the forest industry contribution to the Washington State economy." Working Paper 9. Seattle: University of Washington, Rural Technology Initiative. 58p. online: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf

region. For each million board-feet harvested, the model's estimates for direct and indirect employment by forest sector are presented in Table 11.

Table 11. Annual employment multipliers per MMBF harvested by type and sector [a].

Employment	Forest sector			Total
	Logging	Sawmilling	Paper & Pulp	
Direct	1.30	2.97	1.13	5.40
Indirect	0.53	1.14	0.12	1.79
Total	1.83	4.11	1.25	7.19

[a] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf

By comparison to the figures used in this analysis, the Forest Service's own multipliers for direct logging jobs averaged more than 2.5 per million board-feet for the period 2001 – 2007[16]. Thus, the methodology we employ results in a relative downward bias in estimates.

Economic Impact Analysis

IMPLAN

The objective of economic impact analysis is to trace how changes in employment and income in one economic sector spillover to other sectors. The *direct effect* is the impact on employment and income resulting from a specified change in a sector or group of sectors. There are two types of spillovers. First, are *indirect effects*, consisting of sectors integrated through the supply-production chain and ancillary services. This set of relationships exhibits interstices between multiple economic sectors, some which may, in the absence of impact analysis, otherwise appear quite distinct or unrelated. Second are *induced effects*. Employees in any economic sector where the direct and indirect effects occur spend income, some in the local economy and some outside. Local expenditures are sales for local businesses, across multiple sectors, the result of which is to support additional employment and labor income. Some of this income creates additional rounds of local spending, further stimulating the economy. Expenditures also leak from the economy, to import products, or in the form of income, interest payments, internet purchases, etc. These leakages ultimately lead to an end in this multiplier process.

Input output models are the standard methodology utilized for economic impact analysis. The impact of changes in timber harvest on the Olympic Regional Economy was estimated using the IMPLAN system, which includes data and software (IMPLAN).[17] IMPLAN is a regional input output model that constructs multipliers derived from expenditure flows between economic

[16] Grinspoon, E.; Phillips, R. (2011) Northwest Forest Plan the first 15 years (1994-2008); Socioeconomic Status and Trends. Tech. Paper R6-RPM-TP-02-2011. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. Online: http://reo.gov/monitoring/reports/15yr-report/NWFP%20Socioeconomic%20Status%20and%20Trends%20-%20WEB.pdf

[17] http://implan.com/V4/Index.php

sectors within specified regions. These multipliers make it possible to estimate indirect and induced changes in employment, labor income, value of economic output, and tax revenues caused by a direct effect. The IMPLAN dataset includes hourly, salary and proprietor employment and income by sector, including benefits.[18] IMPLAN data for Clallam, Grays Harbor, Jefferson, and Mason counties for the year 2010 was used.[19] While IMPLAN deflators adjust all value to the year 2012, the underlying economic relationships are for the year 2010. Economic impacts were estimated at the county level and summed for total impact.[20] Call these geographically juxtaposed counties the Olympic Regional Economy. IMPLAN data values can be modified when more accurate information is available. One method to obtain precise values for employment and labor income is to interview local employers and solicit employment and payroll values. Employment and labor income data, including benefits, was thusly obtained from a variety of employers in the Forest Products Industry and integrated into the IMPLAN dataset to produce more accurate estimates of impacts on employment, labor income, value of economic output, and state and local business taxes.[21] Where requested, income results presented in this report are averages for the entire Olympic Regional Economy. This protects the proprietary nature of payroll values without compromising estimated economic impacts – the focus of this study – except for the labor income reported.

Modeling the forest products industry

Clallam, Grays Harbor, Jefferson and Mason counties constitute the Olympic Regional Economy. Washington State's Olympic Peninsula spans an area of 6,432 square miles. The central region is comprised of Olympic National Park, which is circumscribed by Olympic National Forest, Washington State Trust Lands, tribal, and private Lands. The steep topography of the interior confines the primary transportation network to the Peninsula's periphery. Harvests move laterally to Highway 101 and then to processors and distributors of fiber products, located primarily in Aberdeen, Grays Harbor, Shelton, Port Townsend, Port Angeles, and Forks. Transport between the Grays Harbor and Mason county region runs east-west, as it does between Clallam and Jefferson counties. North-south hauling distances between processors

[18] IMPLAN data provides a broad description of a region's economy with inclusion of proprietors, which can be a significant component in some sectors. However, this broader description comes at the cost of higher degrees of data aggregation and less precise values for employment and income as they are estimated based on expenditure flows, not actual employment and wage counts, and can over or underestimate employment and income. Thus, when direct and precise comparisons of sectors is desired, use of actual reported values for employment and wages by Washington's Employment and Security Departments ES202data can be preferred. Ultimately the appropriate choice of a dataset depends on the questions being investigated.

[19] 2010 is the most recent year for which data is available. IMPLAN data is derived from databases created by the Bureau of Labor Statistics, Bureau of Economic Analysis, and the Census

[20] Combining all four counties into a single regional model increases the total rounds of spending and thus spillover effects. Thus, the values reported understate true impacts on the Olympic Regional Economy, except where otherwise noted.

[21] State and local business taxes take the form of sales taxes, property taxes, motor vehicle licenses, severance taxes, and other taxes and fees.

generally exceed east-west distances, resulting in relatively greater hauling costs. As a result, integration between firms in the Forest Products Industry greatly follows the east-west transportation network. This is especially true for Clallam County, and least true for Grays Harbor and Mason counties that can also make use of markets to the east and south.

To model the organizational structure of the Forest Products Industry, interviews were conducted with managers of firms in sectors spanning harvesting of timber, transport, milling, paper production, and bioenergy generation.[22] The objective was three-fold. First, model the flow of fiber throughout this supply-production chain. Second, identify interdependencies between operations as a function of the fiber supply-production chain. Third, establish, using the professional judgment of decisions-makers, the probable impact of changes in timber harvest on the scale of their operations, and how changes in one firm's operations would likely impact the operations of other firms in the fiber supply-production chain.

A model of the fiber supply-production chain is illustrated in diagram 1. Relationships within the fiber supply-production chain are presented using solid directional arrows. Saw mills and veneer-plywood mills serve as an organizational and distributional focal point as a majority of harvested timber passes though these firms, exiting as finished products for market, or as inputs for finished wood products. By-products – hog fuel, wood chips and saw dust – continue in the fiber supply-production chain serving as primary inputs for paper and pulp mills and bioenergy. Similarly, small diameter logs and slash move through the fiber supply-production chain as inputs for paper and pulp production and bioenergy generation. This entire movement is supported by ancillary services, including truck transport, wholesale trade businesses, and management of companies.[23] Sectors with induced effects include food services and drinking places, offices of physicians and dentists, and nondepository credit intermediation.

The model reveals the high degree of interdependence between firms and sectors in the Forest Products Industry. Reductions in production by any single firm in the fiber supply-production chain causes indirect and induced effects on employment and income in other sectors. The array of potential adaptations to flow reductions in the fiber supply-production chain depends on the nature of a firm's operations. This has two implications for the size and continuity of employment changes by sector. In some sectors it is reasonable to assume employment changes as a near "smooth and continuous" function of timber harvest. For instance, reduced harvests decrease the demand for hauling services. Trucking firms respond by reducing hauls one load at a time. Depending on haul distance, decreases in hauls/day translate into idling a single truck and the loss of a job. For this sector, assumptions of a "continuous" relationship

[22] Harold Norlund and Edward Tolan, Nippon Paper Industries; Bill Hermann, Hermann Brothers; Stevel Kroll, Interfor; Randy Johnson, Green Crow; Terry Smith, Mary's River Lumber.

[23] Food services and drinking places also experience indirect effects, in addition to induced effects, when expenditures made at those establishments occur during the fiber supply-production process,.

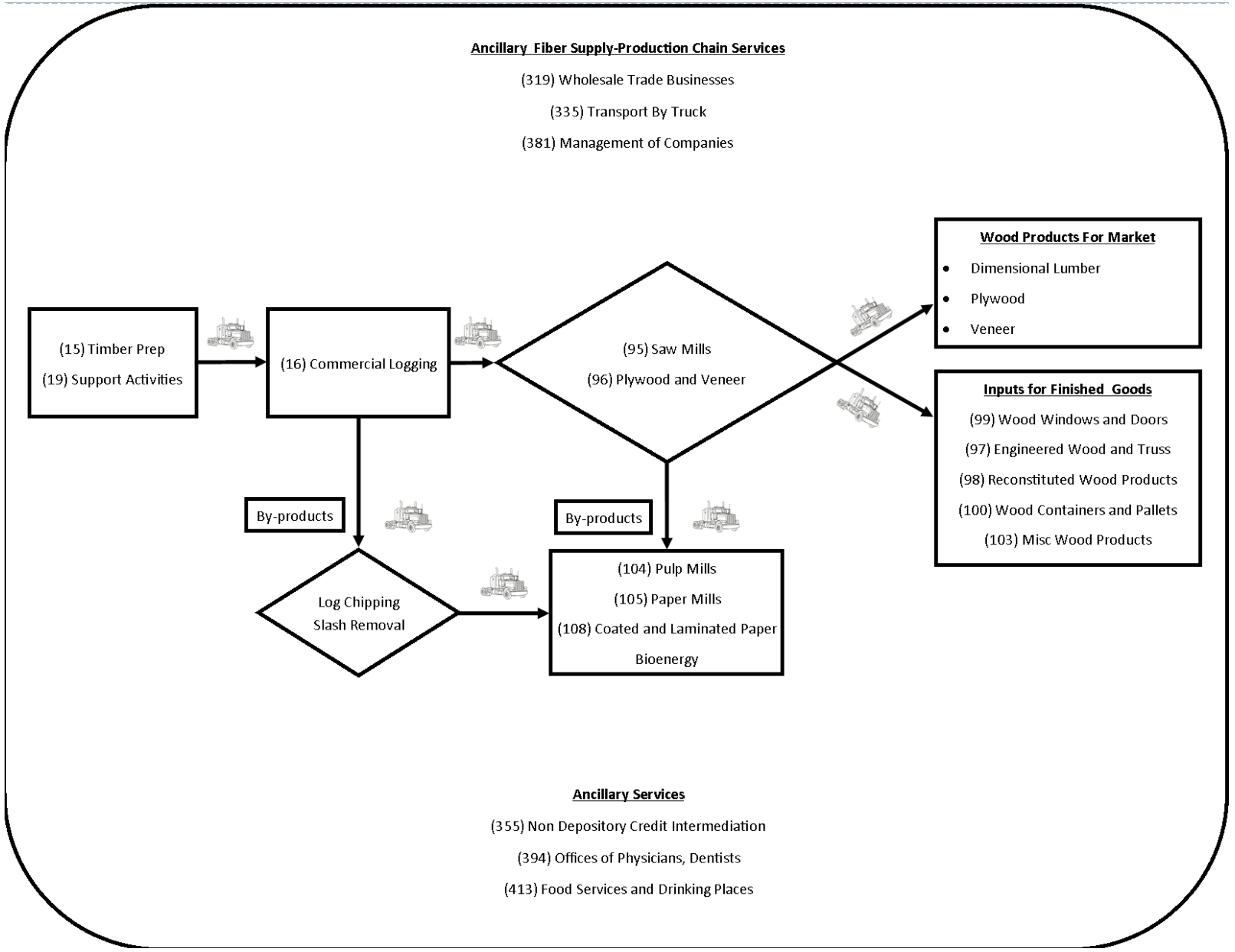


Figure 1. Model of Olympic Peninsula fiber supply-production chain.

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between harvest and employment are warranted. For other sectors, like milling, step wise reductions in production and employment are observed. Firms in this sector alter output discretely and discontinuously. While output can be altered through use of overtime, often the option is to idle a shift. In the extreme, shut down occurs.

The geographic proximity of where harvest reductions occur combined with the location of a firm (sector) determines the economic viability of alternative sources of fiber. The cost of substitute sources of fiber are a linear function of distance, the feasibility of using two-way hauling, and competition with other bidders. Resulting increases in costs decrease operating revenues and economic margins. As an example, interviews with Interfor indicate the first response to negative margins will be to idle operations at their Beaver-Forks facility, and the loss of 79 jobs. Step wise reductions would then proceed to the Port Angeles facility, first with the loss of a single shift and 18 jobs followed by mill shut down and the loss of an additional 99 jobs.[24]

These discontinuous reductions in the fiber supply-production chain caused by idling a saw mill shift or facility reduces the supply of hog fuel and wood chips, the primary inputs for paper and pulp production and bioenergy generation. Substitution potential of hog fuel and wood chips from other sources – chipping trees, imports from Canada, or trucking from distances in excess of 75 miles – is not economically viable as long term options. While these sources have and will serve as options to compensate for short term fiber shortages, the associated price premium cause a net financial loss to overall operations, and are not sustainable.[25] Should such reductions in the fiber supply-production chain continue, possible responses in the paper and bioenergy sectors are limited. In the case of Nippon Paper, there are two step-wise responses. The first will be to idle the number 2 production line which will reduce employment by one third, or 66 jobs. The second is shut down all operations, or an additional 134 jobs. Bioenergy production will likewise end at this point, causing an immediate indirect loss of 35 jobs.

The integrated market with discontinuous and step wise reductions in employment also feed from users of mill by-products back to saw mills. By-product sales constitute approximately 20 percent of revenues to saw mills.[26] Thus, the economic viability of saw mills not only depends on a reliable flow of timber and sale of finished products, but on the sale of by-products to the paper, pulp, and bioenergy sectors. Loss of a primary customer like Nippon Paper would require local saw mills to seek distant markets for those by-products, with transport costs increasing linearly with distance causing commensurate reductions in the net margin of by-product sales. Reductions in those net revenues will reduce overall operating margins. Shut down is a possibility.

[24] Interview, Steve Kroll, Interfor. Likelihood confirmed; Interview, Terry Smith, Mary's River Lumber.
[25] Interview, Harold Norlund and Edward Tolan, Nippon Paper Industries.
[26] Interview, Steve Kroll, Interfor.

The information obtained from interviews and integrated into the model described above make clear that reductions in timber harvest can cause both continuous and discontinuous reductions in employment. The potential for utilizing alternative fiber supply sources is limited given the geographic location of mills and the constraints in the transportation network. Economic margins decrease as haul distance increases. As negative margins cannot be sustained, the operational responses of mills are step wise and limited to idling a shift, facility, or a complete shut-down. Those outcomes will have indirect and induced effects on employment and labor income across the Olympic Regional Economy.

Economic Impact

The employment values described in a previous section are sufficient to estimate direct, indirect, and induced effects on employment, labor income, state and local business taxes, timber excise taxes, and federal remittances. Direct effects were obtained using direct employment values from Table 11 in the appropriate IMPLAN sectors: Commercial Logging; Saw Milling; and Paper Production. The sum of those direct effects and resulting indirect and induced effects from wilderness designations are presented in Tables 12 and 13; those for wild and scenic river designations in Tables 14 and 15.

Table 12. Reduction in yield and employment resulting from proposed wilderness by county.

County	Yield [a]	Direct forest sector employment [b]			Total employment [c]			
		Logging	Milling	Paper	Direct	Indirect	Induced	Total
Clallam	0.144	0.2	0.4	0.2	0.8	0.6	0.5	1.9
Grays Harbor	0.023	0.0	0.1	0.0	0.1	0.1	0.1	0.3
Jefferson	0.195	0.3	0.6	0.2	1.1	0.6	0.3	2.0
Mason[d]	0.046	0.1	0.1	0.1	0.3	0.2	0.2	0.7
Total	0.409	0.6	1.2	0.5	2.3	1.5	1.1	4.9

[a] Yield from Table 9, reduced by ½ the annual yield expected from overlapping upland areas identified in both the wilderness proposal and the wild and scenic river proposal; distributed across counties in proportion to acreages.

[b] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf; Table 11.

[c] Source: IMPLAN.

[d] There are no paper and pulp production facilities for Mason county. Hog fuel and wood chip by-products are sold in adjacent counties; Grays Harbor and Jefferson. A paper production scenario was run for Grays Harbor to estimate indirect and induced employment, and reported for Mason county. While all those jobs and corresponding labor income and local taxes may not accrue to Mason, they are reported in this row of Table 13, and all other tables for Mason county where paper production appears.

Table 13. Summary of economic impacts from proposed wilderness by county.

County	Jobs	Annual wages [a] (1,000s)				Annual taxes (1,000s)		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Clallam	1.9	$62.7	$33.6	$14.6	$110.8	$10.3	$1.3	$8.3
Grays Harbor	0.3	$6.0	$4.9	$1.8	$12.7	$1.0	$0.2	$1.3
Jefferson	2.0	$47.0	$12.2	$6.4	$65.6	$8.0	$1.8	$11.2
Mason	0.7	$20.5	$11.8	$4.4	$36.6	$3.9	$0.4	$2.6
Total	4.9	$136.2	$62.5	$27.2	$225.7	$23.2	$3.7	$23.4

[a] Source: IMPLAN. Wages include benefits.

[b] Portion of Washington State timber excise tax returned to counties (4%) based on yield from Table 12 and stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on yield from Table 12 and stumpage of $230 / MBF.

Table 14. Reduced yield and employment resulting from wild and scenic river proposal by county.

County	Yield [a]	Direct forest sector employment [b]			Total employment [c]			
		Logging	Milling	Pulp	Direct	Indirect	Induced	Total
Clallam	0.201	0.3	0.6	0.2	1.1	0.8	0.7	2.6
Grays Harbor	0.056	0.1	0.1	0.1	0.3	0.3	0.2	0.8
Jefferson	0.301	0.4	0.8	0.3	1.5	0.8	0.4	2.7
Mason[d]	0.083	0.1	0.2	0.1	0.4	0.3	0.2	0.9
Total	0.641	0.9	1.7	0.7	3.3	2.2	1.5	7.0

[a] Yield from Table 10, reduced by ½ the annual yield expected from overlapping upland areas identified in both the wilderness proposal and the wild and scenic river proposal; distributed across counties in proportion to acreages.

[b] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf; Table 11.

[c] Source: IMPLAN

[d] There are no paper and pulp production facilities for Mason county. Hog fuel and wood chip by-products are sold in adjacent counties; Grays Harbor and Jefferson. A paper production scenario was run for Grays Harbor to estimate indirect and induced employment, and report for Mason County. While all those jobs and corresponding labor income and local taxes may not accrue to Mason, they are reported in this row of Table 13, and all other tables for Mason County where paper production appears.

Table 15. Summary of economic impacts from wild and scenic river by county.

County	Jobs	Annual wages [a] (1,000s)				Annual taxes (1,000s)		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Clallam	2.6	$80.6	$44.9	$19.0	$144.5	$13.2	$1.8	$11.4
Grays Harbor	0.8	$20.1	$12.2	$5.4	$37.7	$4.0	$0.5	$3.0
Jefferson	2.7	$65.6	$17.0	$8.9	$91.5	$11.3	$2.6	$16.4
Mason	0.9	$27.6	$16.3	$5.6	$49.5	$4.8	$0.7	$4.5
Total	7.0	$193.9	$90.4	$38.9	$323.2	$33.3	$5.6	$35.1

[a] Wages include benefits. Source: IMPLAN

[b] Portion of Washington State timber excise tax returned to counties (4%) based on yield from Table 14 and stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on yield from Table 14 and stumpage of $230 / MBF.

In Clallam County, wilderness designations will result in combined job losses of 0.8 across direct sectors, and indirect employment losses of 0.6 and 0.5 induced, with lost labor income of $62,700, $33,600 and $14,600 respectively. The average annual wages by sector are $78,300, $56,000, and $29,100. These direct and indirect jobs pay a living wage.[27] Revenue impacts are $10,300 for state and local business taxes, $1,300 in timber excise taxes, and $8,300 in remittances. Wild and scenic river designations will result in an additional 1.1 direct jobs, 0.8 indirect and 0.7 induced jobs, with labor income of $80,600, $44,900, and $19,000 respectively. Revenue impacts are $13,300, $1,800 and $11,400. The combined impact on Clallam County of

[27] Underwood, D.A.; Cross, J.C. (2011) Wilderness declarations, Wild and scenic river designations, and additions to Olympic National Park: Evaluating the cumulative economic impacts on Clallam and Jefferson counties. Report to the Port of Port Angeles.

both wilderness and wild and scenic river designations are a total of 4.5 jobs with total labor income losses of $255,300, with an annual average wage across sectors of $56,700. Total revenue impacts are $23,600 in state and local business taxes, $3,100 in timber excise taxes, and $19,700 in remittances. These losses will likely be greater as a result of recreational river designations on Washington State Trust Lands, which could reduce harvests by up to 1.12 MMBF annually, resulting in an additional 1.8 direct, indirect and induced jobs; $101,100 in total labor income, $9,600 in state and local business taxes, and $1,300 in excise taxes.

In Grays Harbor County, employment losses from wilderness designations are estimated at 0.1 direct, 0.1 indirect and 0.1 induced; corresponding losses to total labor income are $6,000, $4,900, and $1,800; corresponding annual average wages are $60,000, $48,800 and $18,000. Revenue impacts are $1,000 for state and local business taxes, $200 in timber excise taxes, and $1,300 in remittances. Wild and scenic river designations will result in an additional 0.3 direct jobs, 0.3 indirect and 0.2 induced jobs lost, with labor income losses of $20,100, $12,200, and $5,400 respectively. Revenue impacts are $4,000, $500 and $3,000. The combined impact on Grays Harbor County of both wilderness and wild and scenic river designations are a total of 1.1 jobs with total labor income losses of $50,300, with an annual average wage across sectors of $45,700. Total revenue impacts are $5,100 in state and local business taxes, $700 in timber excise taxes, and $4,200 in remittances. Washington State Trust Lands in the county will not be affected by recreational river designations.

In Jefferson County, employment losses from wilderness designations are estimated at 1.1 direct, 0.6 indirect and 0.3 induced; corresponding losses to total labor income are $47,000, $12,200, and $6,400; corresponding annual average wages are $42,700, $20,400, and $21,200. Revenue impacts are $8,000 for state and local business taxes, $1,800 in timber excise taxes, and $11,200 in remittances. Wild and scenic river designations will result in an additional 1.5 direct jobs, 0.8 indirect and 0.4 induced jobs lost, with labor income of $65,600, $17,000, and $8,900 respectively. Revenue impacts are $11,300, $2,700 and $16,400. The combined impact on Jefferson County of both wilderness and wild and scenic river designations are a total of 4.7 jobs with total labor income losses of $175,700, with an annual average wage across sectors of $37,400. Total revenue impacts are $19,300 in state and local business taxes, $4,400 in timber excise taxes, and $27,600 in remittances. These losses will likely be greater as a result of recreational river designations on Washington State Trust Lands, with an additional 5.5 direct, indirect and induced jobs; $197,200 in total labor income, $24,500 in state and local business taxes, and $5,300 in excise taxes.

In Mason County, employment losses from wilderness designations are estimated at 0.3 direct, 0.2 indirect and 0.2 induced; corresponding losses to total labor income are $20,500, $11,800, and $4,400; corresponding annual average wages are $68,300, $58,800, and $21,800; revenue impacts are $3,900 for state and local business taxes, $400 in timber excise taxes, and $2,600 in

remittances. Wild and scenic river designations will result in an additional 0.4 direct jobs, 0.3 indirect and 0.2 induced jobs lost, with labor income of $27,600, $16,300, and $5,600 respectively. Revenue impacts are $4,800, $700 and $4,500. The combined impact on Mason County of both wilderness and wild and scenic river designations are a total of 1.6 jobs with total labor income losses of $86,100, with an annual average wage across sectors of $53,800. Total revenue impacts are $8,600 in state and local business taxes, $1,100 in timber excise taxes, and $7,200 in remittances. These losses will likely be greater as a result of Recreational river designations on Washington State Trust Lands, with an additional 5.5 direct, indirect and induced jobs; $197,200 in total labor income, $24,500 in state and local business taxes, $5,300 in excise taxes, and $32,800 in remittances. These losses will likely be greater as a result of Recreational river designations on Washington State Trust Lands, with an additional 5.5 direct, indirect and induced jobs; $297,600 in total labor income, $26,500 in state and local business taxes, and $3,800 in excise taxes.

For the Olympic Regional Economy, job losses resulting from wilderness designations are estimated to be 2.3 direct, 1.5 indirect and 1.1 induced with losses in total labor income of $136,100, $62,500 and $27,000 respectively. Total revenue impacts are $23,200 from state and local business taxes, $3,700 in timber excise taxes, and $23,400 in remittances. Job losses from wild and scenic river designations are estimated to be 3.3 direct, 2.2 indirect and 1.5 induced, with corresponding reductions in labor income of $193,900, $90,400 and $38,900. Revenue impacts are $33,300 in state and local business taxes, $5,600 in timber excise taxes, and $35,100 in remittances. The total reduction in employment resulting from the proposed legislation is estimated to be 11.9 jobs paying $548,900 in annual labor income for an annual average wage across sectors of $46,100. Total revenue impacts are $56,500 in state and local business taxes, $9,300 in timber excise taxes, and $58,500 in remittances. Consideration of the potential impacts of restrictions on harvests from Washington State Trust Lands could result in employment losses of an additional 12.8 direct, indirect and induced jobs, $595,900 in total labor income, $70,800 in state and local business taxes, and $10,400 in excise taxes.

Mill closure scenarios

Reductions in timber harvests have direct, indirect, and induced effects on employment and labor income within and across counties in the Olympic Regional Economy. Some of these effects are continuous and proportionate to timber harvest. More precisely, as the volume of timber is harvested, employment in some sectors change in a near smooth and continuous fashion. In other sectors, employment changes are abrupt and discontinuous. The result is step wise changes in employment that occur when a shift is idled or a mill ceases operations. While it is beyond the scope of this study to estimate precise probabilities of such events, interviews with managers revealed their perception that policy decisions reducing harvest increase those probabilities.[28] Conversely, increases in harvest will lead to expanded operations and, hence, employment and labor income.[29]

The economic impacts across the peninsula vary proportionately to harvest from public lands, with relatively greater impacts on the northern counties than southern counties. One reason to expect differential impacts on employment associated with reduced harvests results from differing geographic proximities. The southern half of the peninsula is connected by ground transportation networks with southern and eastern markets. This is different from the northern peninsula which competes with the southern region for harvest, and confronts additional premiums to import wood from Canada[30]. Thus, a higher degree of integration between firms and sectors exists in the north than in the south. In this section the economic impacts of reduced shifts, spillover effects between sectors, and mill shut downs are modeled, first for the South Olympic Peninsula, and second, for the North Olympic Peninsula. In addition, the economic impacts of the emerging bioenergy sector are explored.

Impacts on the South Olympic Peninsula

The first scenario focuses on the economic impacts of a single saw mill closure on the South Olympic Peninsula, composed of Grays Harbor and Mason counties. Mary's River Lumber was used as an example, as it was destroyed by fire in October, 2012.[31] As this mill has been temporarily idled, the economic impacts of this scenario capture the indirect and induced reductions in employment, labor income, and business taxes in the region. These results are

[28] The structural analysis that follows was derived from interviews with Harold Norlund and Edward Tolan, Nippon Paper Industries; Bill Hermann, Hermann Brothers; Steve Kroll, Interfor; Randy Johnson, Green Crow; Terry Smith, Mary's River Lumber; Chuck Madison and George Cave, Port Townsend Paper.

[29] One and possibly two additional shifts are expected if harvests from Olympic National Forest are tripled. In addition, other expansions in the Forest Products Industry are likely. Interviews, Steve Kroll, Interfor; Randy Johnson, Green Crow; Bill Hermann, Hermann Brothers.

[30] One element of this additional premium results from salt contamination of wood, which increases processing costs and reduces the value of wood byproducts. The alternative is to use barge transportation which imposes a greater transportation cost. Interviews, Steve Kroll, Interfor; Randy Johnson, Green Crow.

[31] http://thedailyworld.com/sections/news/local/mary's- river- lumber- mill- burns.html

presented in Table 16. Closure resulted in direct effects of 105 saw mill jobs at an annual average wage of $60,300 and $6,335,000 in total labor income; $25,982,400 in economic output was lost and $188,800 is state and local business taxes. Indirect job losses are 97.2 at an annual average wage of $51,500, with a decrease in total labor income of $5,001,200, lost economic output was $14,429,900, and $476,400 in state and local business taxes. Induced losses are 60.9 jobs at an annual average wage of $28,000, with lost labor income of $1,706,600, value of output at $6,588,700 and state and local business taxes at $412,800. Indirect and induced sectoral impacts can be found in the appendix for Top 10 by employment and Top 10 by income. Those results help indicate how direct effects in the Forest Products Industry spill over to a wide range of economic sectors.

Table 16. Aggregate economic impacts from closure of Mary's River Lumber [a].

Impact Type	Employment	Labor income	Average wage	Value output	Business taxes
Direct effect	105.0	$6,335,000	$60,300	$25,982,400	$188,800
Indirect effect	97.2	$5,001,200	$51,500	$14,429,900	$476,400
Induced effect	60.9	$1,706,600	$28,000	$6,588,700	$412,800
Total effect	263.1	$13,042,900	$49,600	$47,001,100	$1,078,000

[a] Source: IMPLAN. Monetary values rounded at one hundred.

Impacts on the North Olympic Peninsula

The North Olympic Peninsula consists of Clallam and Jefferson counties. While inter-regional flows of fiber also move north and south, for mill operations in the Port Angeles area, the economically viable end point for imports/exports of fiber is near county boundaries with Grays Harbor and Mason. The fiber supply-production chain is highly integrated. The primary consumers of hog fuel, wood chips, and saw dust for saw mill operations are Nippon Paper Industries (NPI), located in Port Angeles (Clallam County) and Port Townsend Paper (PTP) located in Port Townsend (Jefferson County) for both paper and cardboard production, a flow of approximately 65,000 and 40,000 dry bone tones respectively. These numbers will increase to 145,000 and 115,000 with commencement of bioenergy operations.[32] Sale of by-products is an important revenue source for saw mills, accounting for approximately 20 percent of total operational revenues.[33] In the absence of these local markets, saw mill operations are not economically viable. Likewise, in the absence of these local suppliers of hog fuel and wood chips, additional input costs to end users from using alternative suppliers can be cost prohibitive.[34] A reduction in timber harvest thus increases the probability of reduced shifts

[32] Interview, Bill Hermann, Hermann Brothers.
[33] Interview, Steve Kroll, Interfor.
[34] Interview, Harold Norlund and Edward Tolan, NPI.

across sectors. In the worst case scenario, a process could be initiated that ultimately leads to multiple shut downs across sectors.

To capture the economic impacts of intersectoral spillover effects probable under reduced harvests, a series of scenarios were run using IMPLAN. While actual labor income data for NPI and PTP was used to conduct the scenario analysis, the average income in the Paper Mill sector for the entire Olympic Regional Economy ($82,079) is presented to protect the confidential nature of that data.[35] Here four scenarios are presented for the North Olympic Peninsula to capture the high degree in interdependence between sectors of the fiber supply-production chain and illustrate possible step wise employment spillovers across sectors. The first scenario estimates the economic impacts to be realized from bioenergy generation at NPI and PTP, and is presented in Table 17. Direct employment is derived from employment for operator-harvesters and truck drivers. Median employment values were used with corresponding wages by occupation.[36] Direct employment of 35 is to be expected generating $2,827,500 in total labor income at an average wage of $80,800. State and local business taxes of $65,600 will be derived. Indirect employment is 7.5 at an annual average wage of $47,200; induced employment is 17.3 at an annual wage of $27,800. Direct and indirect employment pays on average a living wage; induced employment does not. The annual average wage of $61,300 from direct, indirect and induced employment results from the relatively high paying employment in the fiber supply-production chain, not in the induced sector, though some high paying employment is found in ancillary services. These results are detailed for the Top 10 sectors in the appendix.

Table 17. Aggregate economic impacts of the bioenergy sector[a].

Impact Type	Employment	Labor income	Average wage	Value output	Business taxes
Direct effect	35.0	$2,827,500	$80,800	$4,525,100	$65,600
Indirect effect	7.5	$353,900	$47,200	$44,100	$44,100
Induced effect	17.3	$480,400	$27,800	$1,801,700	$113,300
Total effect	59.7	$3,661,800	$61,300	$7,428,800	$223,000

[a] Source: IMPLAN. Monetary values rounded at one hundred.

[35] IMPLAN underestimates the true payroll; thus, failure to use actual values would underestimate indirect and induced effects. Olympus Consulting recognizes that it is possible to reverse engineer the values presented to approximate those payrolls. We urge others to respect the proprietary nature of the data and avoid conduct of unethical analysis.

[36] Estimated employment ranges were: operator-harvesters, 10-15; truck drivers, 20-25. Interview, Bill Hermann, Hermann Brothers.

The second scenario estimated the economic impacts of shutting down Interfor's operations at the Beaver-Forks facilities.[37] The scenario begins under the assumption that Interfor finds it necessary to shut down those operations because of increased costs to obtain fiber inputs caused by harvest reductions.[38],[39] The results are presented in Table 18. The current 60 hour shift creates $5,635,800 in labor income for an annual average wage of $71,300; the economic value of output is $19,034,400, and $141,800 in state and local business taxes are paid. Indirect employment is 63.6 for an annual average wage of $61,800 and $404,100 in state and local taxes. Induced employment of 52 pays an annual average wage of $27,800 and $341,900 in state and local taxes. The annual average wage of $56,600 from direct, indirect and induced employment results from the relatively high paying employment in the fiber supply-production chain, though some high paying employment is found in ancillary services.[40] These results are detailed for the Top 10 sectors in the appendix.

Table 18. Aggregate economic impact from Interfor's Beaver-Forks operations[a].

Impact Type	Employment	Labor income	Average wage	Value output	Business taxes
Direct effect	79.0	$5,635,800	$71,300	$19,034,400	$141,800
Indirect effect	63.6	$3,933,500	$61,800	$11,440,900	$404,100
Induced effect	52.0	$1,445,900	$27,800	$5,419,200	$341,900
Total effect	194.6	$11,015,200	$56,600	$35,894,500	$887,700

[a] Source: IMPLAN. Beaver-Forks facility currently operates on a single 12/hour shift. Monetary values rounded at one hundred.

Interfor plays a direct role in the fiber supply-production chain through sales of hog fuel and wood chips to NPI and PTP. Thus, a shut-down of the Beaver-Forks facilities will likely spillover to NPI and/or PTP. The third scenario estimates the economic impacts resulting from NPI shutting down production line 2, which will result in the loss of 66 jobs.[41] These results are presented in Table 19. The direct employment losses will remove $5,417,200 in labor income from the local economy, paying an average annual wage of $82,000. $52,247,800 in economic

[37] Insufficient fiber supplies or the need to import fiber from distances in excess of a 75 mile radius from the site will be the likely driver of such an event. Interview, Stever Kroll, Interfor; interview, Terry Smith, Mary's River Lumber.

[38] This is not to assume that the Wild Olympics would necessarily create this outcome. However, fiber markets are tight and a number of mills on the North Olympic Peninsula import fiber from Canada at a price premium that narrows margins. Further restrictions of fiber supply will likely increase the probability of such an event.

[39] The same outcome could also result from reduced demand from NPI and/or PTP.

[40] The average annual wage from direct employment is partly attributable to 20 hours of overtime weekly. An additional shift would reduce the overtime component and thus the annual average wage, though total labor income would increase.

[41] This would be the first phase of any changes in NPI operations. This could result from reductions in the hog fuel and wood chip supply. The additional costs associated with using alternative sources are cost prohibitive in the long run. Interview, Harold Norlund and Edward Tolan, NPI.

output would be lost and $703,600 in state and local business taxes.[42] Indirect employment losses are 80.3; $3,633,100 in labor income will be removed from the local economy along with $323,400 in state and local business taxes. On average, direct and indirect employment pays a living wage. Induced employment losses of 64.6 remove an additional $1,795,300 in labor income and $423,800 in state and local taxes. Detailed results for Top 10 by Employment and Income can be found in the appendix.

Table 19. Aggregate economic impact of Nippon Paper production line 2[a].

Impact type	Employment	Labor income	Average wage	Value output	Business taxes
Direct effect	66.0	$5,417,200	$82,100	$52,247,800	$703,600
Indirect effect	80.3	$3,633,100	$45,200	$11,120,6005	$323,400
Induced effect	64.6	$1,795,300	$27,800	$6,731,600	$423,800
Total effect	210.9	$10,845,700	$51,400	$70,100,000	$1,450,900

[a] Source: IMPLAN. Monetary values rounded to one hundred.

The effects modeled in scenarios 2 and 3 can occur independently; they can also occur in conjunction. Fiber markets are tight, and firms in each sector at present import fiber at premium prices.[43] This in turn reduces economic margins, which are often negative for the marginal source. A shut down at Interfor's Beaver-Fork facilities would force NPI to use imported fiber at a premium which could result in closure of production line 2. This causality can work both ways. Should NPI close production line 2, Interfor could be forced to sell its hog fuel and wood chips in distant southern markets. Haul distances reduce net margins and total operational revenues decline. There is a probability the result would be a shut down at the Beaver-Forks facilities. The combined effect of these reductions in operations would result in the loss of 405.5 jobs, $21,860,900 in labor income, $105,994,500 in value of output, and $2,338,600 in state and local business taxes. The economic impact would be particularly acute in west Clallam with its small economic base.

Scenario four estimates the economic impacts that would result if a large scale saw mill or paper mill ceased operations. Independently, both NPI and PTP are the primary market for hog fuel and wood chips on the North Olympic Peninsula. Without those local markets, Interfor's revenues would be substantially reduced, and there is a distinct probability all their operations would be terminated.[44] Thus, under this scenario, NPI terminates paper production and

[42] The labor income value presented was derived from IMPLAN which under represents the actual payroll. All other values presented were derived using the true payroll and thus capture indirect and induced effects.

[43] Interviews, Harold Norlund and Edward, NPI; Bill Hermann, Hermann Brothers; Steve Kroll, Interfor; Randy Johnson, Green Crow.

[44] Interviews, Harold Norlund and Edward Tolan, NPI; Steve Kroll, Intefor; Steve Smith, Mary's River Lumber.

bioenergy generation. Interfor terminates all operations in Beaver-Forks and Port Angeles.[45],[46] The results are presented in Table 20.

Table 20. Aggregate economic impact of an intersectoral shutdown[a].

Impact type	Employment	Labor income	Average wage	Value output	Business taxes
Direct effect	431.0	$31,411,900[b]	$72,900	$210,147,400	$2,550,900
Indirect effect	408.7	$21,129,100	$51,700	$63,209,000	$2,028,000
Induced effect	332.2	$9,235,300	$27,800	$34,622,200	$2,181,300
Total effect	1,171.8	$70,360,400	$60,000	$307,978,600	$6,760,100

[a] Source: IMPLAN.

[b] The reported value for labor income and, hence, average wage was computed using the Olympic Regional Economy's average wage for paper production to protect the confidentiality of NPI's payroll. This results bias reported results downward.

Direct employment losses from Interfor and NPI, and indirect jobs from bioenergy generation, are 431 jobs paying an annual average wage of $72,900. Total direct labor income would fall by $31,411,900; the value of economic output would fall by $210,147,400, while state and local business taxes would decrease by $2,550,900.[47] Indirect employment losses in the fiber supply-production chain and ancillary services are 408.7 at an annual average wage of $51,700. Lost labor income is $21,129,100, value of output $63,209,000, and state and local business taxes $2,028,000. Induced employment losses are 332.2 at an annual average wage of $27,800; lost labor income is $9,235,300, economic value of output, $34,622,200, and state and local business taxes $2,181,300. The total effect is 1,171.8 jobs at an annual average wage of $60,000; lost labor income $70,360,400; value of output $307,978,600; and state and local business taxes $6,760,100. These losses are presented only for the first round of expenditures associated with direct employment losses. Secondary rounds initiated from step wise losses in indirect and induced sectors caused by step wise shutdowns have not been modeled.

Table 21 presents economic impacts by the Top 10 Employment. This may help illustrate the interstices between sectors across the economy. In addition to the direct effects at Interfor, there are spillover effects to other sawmills. The 116 jobs lost in commercial logging pay an average annual wage of $85,400; the 57.7 trucking jobs paid $54,000. Two additional sectors effected with living wage income are offices of physicians and dentists, and management of

[45] Causality could work in the opposite direction. Should Interfor ceases it's operation, NPI would likely do the same. Likewise, this result could be step wise and incremental, beginning with either NPI production line 2 which leads Interfor to shut down the Beaver-Forks facilities; this event could lead to NPI shutting down completely, Interfor's Port Angeles operation might follow.

[46] The potential impacts of this scenario have not integrated PTP as insufficient information is available to assess how its operations might be affected. However, spillovers are possible, even likely. Thus this scenario likely underestimates the total economic impact.

[47] While the actual payroll of NPI was used for all estimates, the IMPLAN value is reported for Paper Mills, and used to reconstruct direct labor income. Thus, the values reported have a downward bias.

companies; with losses of 28.7 jobs at an annual average wage of $55,500 and 21.2 jobs at an annual average wage of $65,500, respectively.

Table 21. Economic impacts of intersectoral shutdown by Top 10 employment-ranked sectors[a].

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	218.6	$13,389,600	$61,300	$52,668,500
Paper mills	200	$16,415,800	$82,100	$158,844,800
Commercial logging	116	$9,907,800	$85,400	$16,508,300
Transport by truck	57.7	$3,115,500	$54,000	$7,054,400
Food services and drinking places	51.2	$841,900	$16,400	$2,791,400
Services to buildings and dwellings	40.4	$478,000	$11,800	$1,978,500
Real estate establishments	35.6	$199,500	$5,600	$4,791,300
Offices of physicians, dentists	28.7	$1,592,500	$55,500	$2,971,500
Wholesale trade businesses	26.2	$947,800	$36,200	$3,295,300
Management of companies	21.2	$1,388,100	$65,500	$3,342,200
Total	795.6	$48,276,400	$60,700	$254,246,200

[a] Source: IMPLAN. Monetary values rounded to one hundred.

Table 22. Economic impacts of intersectoral shutdown by Top 10 income-ranked sectors[a].

Sector description	Employment	Labor income	Average wage	Value output
Paper mills	200	$16,415,800	$82,100	$158,844,800
Sawmills and wood preservation	218.6	$13,389,600	$61,300	$52,668,500
Commercial logging	116	$9,907,800	$85,400	$16,508,300
Transport by truck	57.7	$3,115,500	$54,000	$7,054,400
Offices of physicians, dentists	28.7	$1,592,500	$55,500	$2,971,500
Forestry, forest products, timber prep	10.5	$1,409,700	$134,300	$9,361,700
Management of companies	21.2	$1,388,100	$65,500	$3,342,200
State and local government electric	17	$1,298,200	$76,400	$5,211,300
Wholesale trade businesses	26.2	$947,800	$36,200	$3,295,300
Nondepository credit intermediation	11.6	$845,000	$72,900	$1,712,800
Total	707.5	$50,310,000	$71,100	$260,970,800

[a] Source: IMPLAN. Monetary values rounded to one hundred.

Differences between ranking on the basis of employment and income are clear from Table 22 where Top 10 sectors are presented using income. While the first four sectors are the same, paper mills rise to the first tier as they pay higher wages on average.[48] Offices of physicians and dentists rise from an eighth rank using employment to fifth using income. Food services which ranked fifth on the basis of employment does not appear in the Top 10 on the basis of income. Combined, these tables provide readers with a more comprehensive understanding of

[48] The average wage for the Olympic Regional Economy is used here; the actual value for NPI is higher.

contributors to economic development, especially in regards to spillover effects driven by changes in timber harvests. A total of 95 indirect sectors are effected as are 98 induced sectors. This helps emphasize the depth and breadth of interstices between sectors across the North Olympic Peninsula.

Future management alternatives

The Record of Decision (ROD) for the Northwest Forest Plan (Plan) adopted Standards and Guidelines for the following purposes: (1) Take an ecosystem management, scientifically supported approach to forest management; (2) Meet the requirements of existing laws and regulations; (3) Maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including protection for riparian areas and waters; (4) Maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis[49]. The Port of Port Angeles, Clallam County, and City of Forks expressed interest in opportunities that may best achieve these objectives.

The Northwest Forest Plan: opportunities?

The Plan originally envisioned an annual yield of 900 MMBF; with half expected to come from stands older than 200 years. The sale of timber from older stands has not been realized and in the past decade, sale volumes have averaged only 54 percent of Plan goals[50]. One of the consequences of reduced harvest levels is reduced budgets: Forest Service field units in the Plan area lost more than one-third of their budgets and workforce over the decade 1994-2003; roughly one-quarter of field offices closed or consolidated. The impact on Region 6 (that includes Olympic National Forest) in terms of budget and employment (measured in job-years) has been a decline of about 50 percent since the Plan was adopted.

While the Plan as implemented has failed to reach its harvest objectives, the 10- and 15-year monitoring reports indicate significant opportunities for increase in timber sale activity within the current Plan framework. However, as Olympic National Forest is without matrix lands, increases must occur within AMAs and young LSRs. Over the first decade of the Plan, reviews' estimated thinnings in LSRs on fewer than 300,000 out of 2.2 million eligible acres. At this rate, many stands will surpass 80 years before being thinned[51].

Adaptive Management Areas were designed to be testing grounds for new ideas and management approaches; additionally, they would be available for regularly scheduled timber harvest. The management flexibility required to implement AMAs as designed involves uncertainty and risk, and the 10 year review noted a (perceived or real) lack of flexibility for managers to test strategies that departed from Standards and Guidelines. The burden of proof

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[49] Davis, Ray; Falxa, Gary; Grinspoon, Elisabeth; Harris, Gary; Lanigan, Steven; Moeur, Melinda; Mohoric, Shawne. 2011. Northwest Forest Plan- The First 15 Years [1994-2008] : Summary of Key Monitoring Findings. Tech. Paper R6-RPM-TP-03-2011. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region.

[50] Sale targets for Olympic National Forest are set at the region, and may differ from year to year. Source: personal communication with Robin Shoal [date].

[51] Grinspoon, E.; Phillips, R. (2011) Northwest Forest Plan the first 15 years (1994-2008); Socioeconomic Status and Trends. Tech. Paper R6-RPM-TP-02-2011. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region.

required to modify the Standards and Guidelines is unclear; the result has been an abundance of caution which has prevented adapting some active management even in cases with apparent benefits[52]. As a result, the monitoring report notes the most common implementation in AMAs has been a passive form of adaptive management: a single management approach with regional monitoring as the primary mechanism for feedback and learning, where protective measures were often favored over active management. The institutional change through adaptive management was not achieved to the degree expected.

It is reasonable to conclude – based on the analysis of acreage by age class by LUA presented previously, and on a reasonable reading of the Standards and Guidelines and the conclusions of the 10- and 15-year monitoring reports – that Olympic National Forest could *ecologically* support an annual yield of 30 MMBF. However, the probability of achieving such a goal would have to be *extremely* low given the reduced institutional capacity and budgets, coupled with the inactivity within LSRs, and AMAs that are being managed as an LSR. If the barriers to implementation are known, it is reasonable to ask why changes (i.e. increased sales to achieve Plan objectives) have not already occurred. After all, the ostensible goal of the Plan is recovery of the northern spotted owl, the probability of which can increase through active management. Nonetheless, Table 23 presents the economic impacts should harvests under the Plan reach the ecologically sustainable threshold of 30 MMBF.

Table 23. Increased employment resulting from marginal increase in annual yield of 20.5 MMBF to 30 MMBF total, by county.

County	Yield	Direct forest sector employment [b]			Total employment [c]			
		Logging	Milling	Paper	Direct	Indirect	Induced	Total
Clallam	6.972	9.1	20.7	7.9	37.7	28.1	24.1	89.9
Grays Harbor	4.782	6.2	14.2	5.4	25.8	24.1	15.2	65.1
Jefferson	4.494	5.8	13.3	5.1	24.2	12.7	6.0	42.9
Mason	4.252	5.5	12.6	4.8	22.9	19.5	11.1	53.5
Total	20.500	26.6	60.8	23.2	110.6	84.4	56.4	251.4

[a] Yield distributed across counties in proportion to acreages (see Exhibit 6).

[b] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf

[c] Source: IMPLAN

[52] Rapp, Valerie. 2008. Northwest Forest Plan—the first 10 years (1994–2003): first-decade results of the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-720. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 42 p.

Table 24. Summary of economic impacts from ecologically sustainable yield under the Plan, by county.

County	Jobs	Annual wages [a] (1,000,000s)				Taxes (1,000s)		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Clallam	89.9	$2.836	$1.588	$0.669	$5.092	$469.6	$64.1	$400.9
Grays Harbor	65.1	$1.659	$1.098	$0.457	$3.215	$313.4	$44.0	$275.0
Jefferson	42.9	$1.081	$0.281	$0.146	$1.508	$186.3	$41.3	$258.4
Mason	53.5	$1.572	$0.927	$0.315	$2.814	$260.3	$39.1	$244.5
Total	251.4	$7.148	$3.894	$1.587	$12.629	$1,229.6	$188.6	$1,178.8

[a] Source: IMPLAN. Monetary values rounded to one thousand for wages; one hundred for taxes.

[b] Portion of Washington State timber excise tax returned to counties (4%) based on yield from Table 12 and stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on yield from Table 12 and stumpage of $230 / MBF.

The potential economic impact on the Olympic Regional Economy to be expected if Olympic National Forest attained allowable harvests under the Plan were estimated using IMPLAN by integrating direct employment effects for sectors: 16, Commercial Logging; 95, Saw Milling; and 105, Paper Production, as discussed in previous sections. The values presented in Table 24 present economic impacts of the additional annual harvest of approximately 20 MMB to reach the upper ecologically sustainable threshold. In Clallam County, a total additional 37.7 direct jobs would be sustained, along with indirect employment gains of 28.1 and 24.1 induced jobs with labor income of $2,836,000, $1,588,000, and $669,000 respectively. The average annual wages by sector are $75,200, $56,500, and $27,700. The direct and indirect jobs gained pay a living wage.[53] The increased economic activity in the Forest Projects sector would create a total of 89.9 jobs with total labor income of $5,092,000 at an annual wage of $56,646. Revenue impacts would be $469,600 in state and local business taxes, $64,100 in timber excise taxes, and $400,900 in remittances.

In Grays Harbor County, an additional 25.8 direct jobs would be sustained, along with 24.1 indirect and 15.2 induced jobs; corresponding gains to total labor income are $1,659,000, $1,098,000, and $457,000; corresponding annual average wages are $64,300, $45,600 and $30,100. The increased economic activity in the Forest Projects sector would sustain an additional 65.1 jobs with total labor income of $3,215,000 at an annual average wage of $49,400. Revenue impacts would be $313,400 in state and local business taxes, $44,000 in timber excise taxes, and $275,000 in remittances.

In Jefferson County, an additional 24.2 direct jobs would be sustained, along with 12.7 indirect and 6.0 induced jobs; corresponding gains to total labor income are $1,081,000, $281,000, and

[53] Daniel A. Underwood and Jason Cross, *Wilderness declarations, Wild and Scenic river designations, and additions to Olympic National Park: Evaluating the cumulative economic impacts on Clallam and Jefferson counties*. September, 2011, Port of Port Angeles.

$146,000; corresponding annual average wages are $44,700, $22,100 and $24,400. The increased economic activity in the Forest Projects sector would sustain an additional total of 42.9 jobs with total labor income of $1,508,000 at an annual average wage of $35,100. Revenue impacts would be $186,300 in state and local business taxes, $41,300 in timber excise taxes, and $258,400 in remittances.

In Mason County, an additional 22.9 direct jobs would be sustained, along with 19.5 indirect and 11.1 induced jobs; corresponding gains to total labor income are $1,572,000, $927,000, and $315,000; corresponding annual average wages are $68,600, $47,500 and $28,400. The increased economic activity in the Forest Projects sector would sustain an additional total of 53.5 jobs with total labor income of $2,814,000 at an annual average wage of $52,600. Revenue impacts would be $260,300 in state and local business taxes, $39,100 in timber excise taxes, and $244,500 in remittances.

For the Olympic Regional Economy, attaining maximum ecologically sustainable harvest levels under the Northwest Forest Plan would susgtain direct employment of 110.6 additional jobs with total labor income of $7,148,000 at an annual average wage of $64,600. Indirect effects would be 84.4 additional jobs with total labor income of $3,894,000 at an annual average wage of $46,100. Induced effect would be an additional 56.4 jobs with total labor income of $1,587,000 at an annual average wage of $28,100. Revenue impacts would be $1,229,600 in state and local business taxes, $188,600 in timber excise taxes, and 1,178,800 in remittances.

The Olympic Forest Plan: opportunities?

As mentioned in the introduction, the ROD for the Plan amended existing management plans for 19 national forests. The Olympic Forest Plan is one of the amended plans. The Olympic Forest Plan was adopted in 1990, shortly before the listing of the northern spotted owl. It may be useful to examine the management strategies developed prior to listing for scenery, recreation, old-growth forests, timber harvest, sedimentation, fish habitat, wildlife habitat(s), unroaded areas, and wild and scenic rivers. Specifically, we examine the projected levels of timber harvest and corresponding economic impact.

The annual yield proposed in the Olympic Forest Plan was approximately 100 MMBF annually. If the average yield at harvest was 35,400 BF/ac[54], then (regeneration) harvest operations would be expected on approximately 2,850 acres per year, representing a harvest rate of 1.2 percent and a rotation length of 83 years[55]. This harvest would result in a significant

[54] The Olympic Forest Plan estimated a yield at harvest of nearly 47,200 BF/ac, operating on only 2,140 acres annually. These values would change the harvest rate to .9% with a implied rotation of 109 years. The value above of 35,500 BF/acre represents the yield at harvest of Washington State Trust Lands on the Olympic and Kitsap Peninsulas for the period 2008-2009 and may more accurately represent current retention requirements and utilization standards. See note 11 for citation.

[55] If only operating on 243,902 acres of upland AMA and young LSRs.

redistribution of age-classes, eliminating many of the older age classes (which are a surrogate in the Plan for structure). Old-growth suitable for timber production will be scheduled for timber harvest, resulting in a reduction of the total acreage of old-growth from the present 266,800 acres to about 173,000 acres by the end of the fifth decade.

It is reasonable to propose that Olympic National Forest could *ecologically* support an annual yield of 100 MMBF: If all 129,600 acres of AMA and only 70,000 (of the 413,700 total) acres of LSR were employed, the annual increment (i.e. growth) would be 120 MMBF. However, the strategies employed in the Olympic Forest Plan to achieve this yield are in direct conflict with the Northwest Forest Plan's Standards and Guidelines. Yield would be achieved at the expense of the age classes and structures associated with improving owl populations. It may be possible to yield 100 MMBF annually and be in compliance with the Endangered Species Act; however, it is extremely unlikely to happen within the framework of the Plan as it currently exists. It may be useful to project the economic activity supported by harvest levels proposed in the Olympic Forest Plan if only to set an upper bound of what may be sustainably derived from Olympic National Forest, with results summarized in the tables below.

Table 25. Employment supported by annual yield of 100 MMBF, by county.

County	Yield [a]	Direct forest sector employment [b]			Total employment [c]			
		Logging	Milling	Paper	Direct	Indirect	Induced	Total
Clallam	34.010	44.2	101.0	38.4	183.6	136.7	117.1	437.4
Grays Harbor	23.327	30.3	69.3	26.4	126.0	117.8	74.1	317.9
Jefferson	21.921	28.5	65.1	24.8	118.4	62.2	29.3	209.9
Mason	20.741	27.0	61.1	23.4	112.0	95.4	54.4	261.8
Total	100.000	130.0	297.0	113.0	540.0	412.1	274.9	1227

[a] Yield distributed across counties in proportion to acreages (see Exhibit 6).

[b] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf; Table 11.

[c] Source: IMPLAN.

Table 256. Economic impacts from increased yield under the Olympic Forest Plan, by county.

County	Jobs	Annual wages [a] (1,000,000s)				Taxes (1,000s)		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Clallam	437.4	$13.804	$7.736	$3.256	$24.796	$2,286.2	$312.9	$1,955.6
Grays Harbor	317.9	$8.103	$5.364	$2.233	$15.700	$1,530.7	$214.6	$1,341.3
Jefferson	209.9	$5.278	$1.372	$0.714	$7.364	$909.5	$201.7	$1,260.5
Mason	261.8	$7.685	$4.527	$1.539	$13.752	$1,271.8	$190.8	$1,192.6
Total	1227.0	$34.871	$18.999	$7.743	$61.612	$5,998.2	$920.0	$5,750.0

[a] Source: IMPLAN. Wages rounded to one thousand; taxes rounded to one hundred.

[b] Portion of Washington State timber excise tax returned to counties (4%) based on yield from Table 12 and stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on yield from Table 12 and stumpage of $230 / MBF.

The potential economic impact on the Olympic Regional Economy to be expected if allowable harvests under the Olympic Forest Plan are attained were estimated using IMPLAN by integrating direct employment effects for sectors: 16, Commercial Logging; 95, Saw Milling; and 105, Paper Production, as discussed in previous sections. In Clallam County, an additional 183.6 direct jobs would be created, along with indirect employment gains of 136.7 and 117.1 induced jobs with labor income of $13,804,000, $7,736,000, and $3,256,000 respectively. The average annual wages by sector are $75,200, $56,600, and $27,800. The direct and indirect jobs gained pay a living wage.[56] The increased economic activity in the Forest Projects sector would create a total of 437.4 jobs with total labor income of $24,796,000 at an annual wage of $56,700. Revenue impacts would be $2,286,200 in state and local business taxes, $312,900 in timber excise taxes, and $1,955,600 in remittances.

In Grays Harbor County, an additional 126.0 direct jobs could be created, along with 117.8 indirect and 74.1 induced jobs; corresponding gains to total labor income are $8,103,497, $5,363,944, and $2,233,001; corresponding annual average wages are $64,300, $45,500 and $30,100. The increased economic activity in the Forest Projects sector could create a total of 317.9 jobs with total labor income of $15,700,000 at an annual average wage of $49,400. Revenue impacts would be $1,530,700 in state and local business taxes, $214,600 in timber excise taxes, and $1,341,300 in remittances.

In Jefferson County, an additional 118.4 direct jobs could be created, along with 62.2 indirect and 29.3 induced jobs; corresponding gains to total labor income are $5,278,000, $1,372,000, and $714,000; corresponding annual average wages are $44,600, $22,100 and $24,600. The increased economic activity in the Forest Projects sector could create a total of 209.9 jobs with total labor income of $7,364,000 at an annual average wage of $35,100. Revenue impacts would be $909,500 in state and local business taxes, $201,700 in timber excise taxes, and $1,260,500 in remittances.

In Mason County, an additional 112.0 direct jobs could be created, along with 95.4 indirect and 54.4 induced jobs; corresponding gains to total labor income are $7,685,000, $4,527,000, and $1,539,000; corresponding annual average wages are $68,600, $47,500 and $28,300. The increased economic activity in the Forest Projects sector could create a total of 261.8 jobs with total labor income of $13,752,000 at an annual average wage of $52,500. Revenue impacts would be $1,271,800 in state and local business taxes, $190,800 in timber excise taxes, and $1,192,600 in remittances.

For the Olympic Regional Economy, attaining maximum feasible harvest levels under the Olympic Forest plan could create direct employment of 540 with total labor income of

[56] Daniel A. Underwood and Jason Cross, *Wilderness declarations, Wild and Scenic river designations, and additions to Olympic National Park: Evaluating the cumulative economic impacts on Clallam and Jefferson counties*. September, 2011, Port of Port Angeles.

$34,871,000 at an annual average wage of $64,576. Indirect effects could be 412.1 jobs with total labor income of $18,999,000 at an annual average wage of $46,100. The induced effect could be 274.9 jobs with total labor income of $7,742,376 at an annual average wage of $28,164.

The total impact would be 1227 jobs, with total labor income of $61,612,452 and an average annual wage of $50,214. Revenue impacts would be $7,742,376 in state and local business taxes, $920,000 in timber excise taxes, and $5,750,000 in remittances.

A third way

It may be possible to achieve increased ecologically sustainable yields (with corresponding economic impacts) while speeding the development of structures associated with recovery of the northern spotted owl. To understand how, it is important to examine what specifically is being measured, monitored, and targeted within LSRs by the Plan: late-successional and old-growth monitoring characterizes the status and trend of older forests to answer the question: Is the Plan maintaining or restoring late-successional and old-growth forest ecosystems to desired conditions on federal lands in the Plan area? The Forest Service's monitoring plan describes these forests:

> ***Medium and large older forest.*** Forests with a minimum average tree diameter at breast height (d.b.h.) of 20 inches, with either single-storied or multistoried canopies. Corresponds closely to the definition of late-successional forest used in the Plan.
>
> ***Large, multistoried older forest.*** Forests with average tree d.b.h. of 30 inches and greater, with multistoried canopies. Includes minimum structural elements of old-growth forest such as large old-growth trees and multiple canopy layers.

It is reasonable to conclude that if the Plan is to be successful and the spotted owl recovered, then large trees must continually be produced and maintained across Olympic National Forest. The annual increment on Olympic National Forest ranges from 20 to over 200 cubic feet per acre per year with an acre-weighted average of 125[57]; this translates to 600 BF/acre/year[58]. An average acre in Olympic National Forest can produce a yield at harvest of 35,400 BF (i.e. the amount that was being clear cut from Washington State Trust Lands on the Olympic Peninsula in 2008-2009) in 59 years. Growth rate is not the limiting factor. The limiting factor appears to be the fundamental silvicultural philosophies embedded in both the Northwest Forest Plan and the Olympic Forest Plan: begin with planted or natural regeneration, followed by some combination of pre-commercial thinning, commercial thinning(s). Most pathways end with a regeneration harvest. Each acre harvested is an acre unavailable to the spotted owl for several

[57] Olympic Forest Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_049438.pdf page IV-14

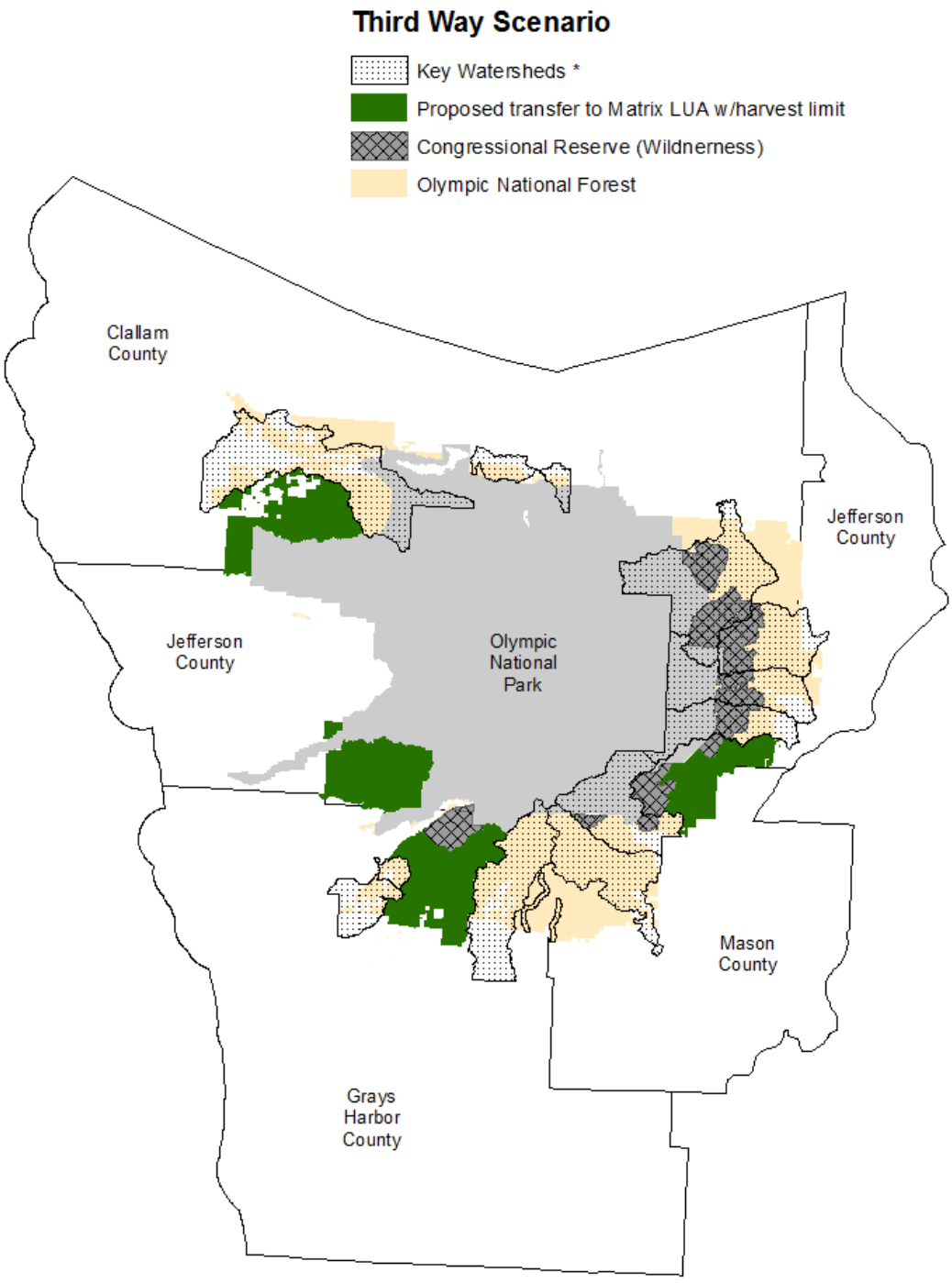
[58] See ratio of BF to CF in Table 8.

decades. At the same time, the Plan's Standards and Guidelines are built on the premise that thinning operations and other silvicultural manipulations can restore ecologic diversity and accelerate the development of old-growth characteristics[59]. Thus, *each forgone acre of thinning that does not develop the necessary structure(s) and function(s) but is equally unavailable to recovery efforts and reduces the probability of northern spotted owl recovery*. A change in silvicultural philosophy from pathways that end in regeneration harvests (i.e. clear cuts) to pathways that maintain a continuous cover would be most beneficial to owl recovery efforts. This must be met with institutional changes that remove the well-documented barriers to action in LSRs and AMAs.

The Third Way scenario described in Exhibit 6 would yield 49.4 MMBF annually. This would be accomplished by transferring approximately 168,200 acres of both AMA and LSR into Matrix status, with an imposed harvest intensity limit of 18,500 BF/acre. Re-entry could be barred until growth replaces harvested volume, requiring approximately 28 years. Approximately 3,000 acres would be thinned per year with an implied rotation of 120 years. A key element of the Third Way is to develop and maintain large trees everywhere; harvest would remove only half the increment for any given period. That is, for every 2 board-feet grown, only one would be removed in a thinning. The lands in Exhibit 6 are all outside of Key Watersheds in order to avoid conflict with additional ecological objectives and constraints. With institutional barriers removed (with the transfer to Matrix), such an effort can serve as a large-scale experiment on strategies to develop large trees and late-successional/old-growth characteristics: these lands would be adjacent to AMAs and LSRs in Key Watersheds, where management to sustain ecological values would continue as before. The location and distribution of acres by county, as well as the economic impacts of the scenario are summarized in Exhibit 6.

[59] Testimony by John Tappeiner to the Subcommittee on Public Lands and Forest of the Senate Committee on Energy and Natural Resources (3/13/08).
See also: http://www.fsl.orst.edu/Oldgrowthworkshop/statements/Tappeiner.pdf

Exhibit 6. Third Way scenario for owl-recovery and economic development.



* Sol Duc and Big Quilcene watersheds are Tier 2, all others are Tier 1.

Exhibit tables on next page.

Table 27: Summary of Third Way scenario attributes, by county.

County	Total Acres	Projected annual		
		Increment [a]	Yield [b]	Acres [c]
Clallam	32,219	23.531	11.523	698
Grays Harbor	52,990	31.794	15.569	944
Jefferson	55,873	33.524	16.417	995
Mason	20,099	12.059	5.905	358
Total	168,181	100.907	49.415	2,995

[a] Source: Olympic Forest Plan: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_049438.pdf page IV-14.

[b] Based on a harvest rate of 0.83%.

[c] Based on a harvest intensity of 16.5 MBF/acre

Table 28: Projected employment supported by Third Way scenario, by county.

County	Yield	Direct forest sector employment [b]			Total employment [c]			
		Logging	Milling	Paper	Direct	Indirect	Induced	Total
Clallam	11.523	15.0	34.2	13.0	62.2	55.6	45.8	163.6
Grays Harbor	15.570	20.2	46.2	17.6	84.0	78.5	49.4	211.9
Jefferson	16.417	21.3	48.8	18.6	88.7	46.6	22.0	157.3
Mason	5.905	7.7	17.5	6.7	31.9	27.2	15.5	74.6
Total	49.415	64.2	146.7	55.9	266.8	207.9	132.7	607.4

[a] Yield distributed across counties in proportion to acreages.

[b] Source: http://www.ruraltech.org/pubs/working/09/working_paper_09.pdf; Table 11.

[c] Source: IMPLAN

Table 29: Summary of economic impacts resulting from Third Way scenario, by county.

County	Jobs	Annual wages [a] (1,000,000s)				Taxes (1,000s)		
		Direct	Indirect	Induced	Total	Business [a]	Excise [b]	Remit [c]
Clallam	163.6	$4.910	$2.929	$1.273	$9.111	$1,574.8	$106.0	$662.6
Grays Harbor	211.9	$5.402	$3.576	$1.489	$10.467	$1,020.5	$143.2	$895.2
Jefferson	157.3	$3.956	$1.028	$0.535	$5.519	$681.7	$151.0	$944.0
Mason	74.6	$2.189	$1.290	$0.439	$3.918	$274.7	$54.3	$339.6
Total	607.4	$16.458	$8.823	$3.735	$29.015	$3,551.7	$454.6	$2,841.4

[a] Source: IMPLAN. Monetary values for wages rounded at one thousand; for taxes rounded at one hundred.

[b] Portion of Washington State timber excise tax returned to counties (4%) based on yield from Table 12 and stumpage of $230 / MBF.

[c] Federal remittance to county in which timber is harvested (25%) based on yield from Table 12 and stumpage of $230 / MBF.

The potential economic impact on the Olympic Regional Economy to be expected from harvests possible under the Third Way were estimated using IMPLAN by integrating direct employment effects for sectors: 16, Commercial Logging; 95, Saw Milling; and 105, Paper Production, as discussed in previous sections. In Clallam County, an additional 62.2 direct jobs would be sustained, along with indirect employment gains of 55.6 and 45.8 induced jobs with labor income of $4,910,000, $2,929,000, and $1,273,000 respectively. The average annual wages by sector are $78,900, $52,700, and $27,800. The direct and indirect jobs gained pay a living wage.[60] The increased economic activity in the Forest Projects sector would create a total of 163.6 jobs with total labor income of $9,111,000 at an annual wage of $55,700. Revenue impacts would be $1,574,800 in state and local business taxes, $106,000 in timber excise taxes, and $662,000 in remittances.

In Grays Harbor County, an additional 84.0 direct jobs would be sustained, along with 78.5 indirect and 49.4 induced jobs; corresponding gains to total labor income are $5,402,000, $3,576,000, and $1,489,000; corresponding annual average wages are $64,300, $45,600 and $30,100. The increased economic activity in the Forest Projects sector would sustain a total of 211.9 jobs with total labor income of $10,467,000 at an annual average wage of $49,396. Revenue impacts would be $1,020,500 in state and local business taxes, $143,200 in timber excise taxes, and $895,200 in remittances.

In Jefferson County, an additional 88.7 direct jobs would be sustained, along with 46.6 indirect and 22.0 induced jobs; corresponding gains to total labor income are $3,956,000, $1,028,000, and $535,000; corresponding annual average wages are $44,600, $22,100 and $24,300. The increased economic activity in the Forest Projects sector would sustain a total of 157.3 jobs with total labor income of $5,519,000 at an annual average wage of $35,000. Revenue impacts would be $681,700 in state and local business taxes, $151,000 in timber excise taxes, and $944,000 in remittances.

In Mason County, an additional 31.9 direct jobs would be sustained, along with 27.2 indirect and 15.5 induced jobs; corresponding gains to total labor income are $2,189,000, $1,290,000, and $439,000; corresponding annual average wages are $68,600, $47,400 and $28,300. The increased economic activity in the Forest Projects sector would sustain a total of 74.6 jobs with total labor income of $3,918,000 at an annual average wage of $52,500. Revenue impacts would be $274,700 in state and local business taxes, $54,300 in timber excise taxes, and $339,600 in remittances.

For the Olympic Regional Economy, harvests under the Third Way would sustain direct employment of 266.8 with total labor income of $16,458,000 at an annual average wage of

[60] Daniel A. Underwood and Jason Cross, *Wilderness declarations, Wild and Scenic river designations, and additions to Olympic National Park: Evaluating the cumulative economic impacts on Clallam and Jefferson counties*. September, 2011, Port of Port Angeles.

$61,700. Indirect effects would be 207.9 jobs with total labor income of $8,823,000 at an annual average wage of $42,400. Induced effect would be 132.7 jobs with total labor income of $3,735,000 at an annual average wage of $28,100. The total impact would be to sustain a total of 607.4 jobs, with annual labor income of $29,015,000 and an average wage of $47,800. Revenue impacts would be $3,551,600 in state and local business taxes, $454,600 in timber excise taxes, and $2,841,300 in remittances.

Appendix: Economic Impacts by Top 10 Employment and Income

This appendix provides additional detail of analyses contained in this report. In the subsections that follow, the economic impacts of Top 10 sectors effected under the alternative management scenarios: increased harvests under the Northwest Forest Plan, Olympic National Forest Plan and A Third Way. In addition Top 10 Tables are provided for the shutdown scenarios, including the bioenergy sector. For each scenario, economic impact tables are provided for each county and the Olympic Regional Economy. The counties are modeled as independent entities and thus do not capture cross county boundary expenditures flows. The Olympic Regional Economy model effects for all four counties as a single economy. As a result, the sum of individual county values will not equal that for the Olympic Regional Economy, as was not the case in previous analyses where a sum of county values was presented as a total.

Each Top 10 table presents employment, total labor income, average annual wage (including benefits), economic value of output, and state and local business taxes. The values contained for each sector represent the total for direct, indirect, and induced effects for the Top Sectors. As these sectors are but part of total effects, the values reported will be less than the direct, indirect and induced effects found in the tables "Aggregate Economic Impacts" appearing in the body of the study. In addition, sectors present in Top 10 tables contain employment values resulting from direct, indirect, and induced effects. Thus, the reader may see an employment value in a Top 10 table that differs from a direct effect reported under Aggregate Economic Impacts. An example can be sector 95, Sawmills; some direct effects that have been modeled have spillover effects that appear as indirect effects, but are still a part of the sector 95, Sawmills. Thus, employment at one sawmill can effect employment at another with the result that the total employment values appearing in a Top 10 table exceeds the direct effect modeled. Another example is sector 413, Food Services and Drinking Places, which contains both indirect and induced effects. Thus, changes in timber harvest will have an indirect effect of employment in that sector. In addition, employees in the fiber supply-production chain also, during after working hours, conduct business at such establishments that result in induced effects. The same is true for sector 394, Offices of Physicians and Dentists. These results and this discussion re-emphasize the complexity of an economy: changes in one sector have spillover consequences what might otherwise appear as quite distinct economic sectors. What the non-economist should keep in mind when consulting these tables is that they provide a comprehensive view of the total effects resulting from a change being modeled. This is very useful in evaluating the wide extent to which sectors are actually related in terms of employment, income, and business taxes as shaped by the scenarios contained in this report.

Economic Impacts of Increased Harvest under the Northwest Forest Plan

Olympic Regional Economy: Top 10 by Employment, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	67.2	$4,064,602	$60,485	$16,634,811
Commercial logging	64.5	$4,136,353	$64,130	$8,109,704
Paper mills	23.3	$1,912,441	$82,079	$26,132,397
Food services and drinking places	10.7	$173,570	$16,221	$579,535
Transport by truck	9.7	$242,144	$24,963	$903,301
Real estate establishments	7.1	$40,623	$5,722	$953,724
Wholesale trade businesses	7.0	$297,827	$42,547	$925,803
Services to buildings and dwellings	6.6	$70,005	$10,607	$314,359
Offices of physicians, dentists	5.3	$258,000	$48,679	$510,103
Support activities, agriculture, forestry	4.0	$100,893	$25,223	$131,307
Total	205.4	$11,296,458	$59,857	$55,195,044

[a] Source: IMPLAN.

Olympic Regional Economy: Top 10 by Income, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Commercial logging	64.5	$4,136,353	$64,130	$8,109,704
Sawmills and wood preservation	67.2	$4,064,602	$60,485	$16,634,811
Paper mills	23.3	$1,912,441	$82,079	$26,132,397
Wholesale trade businesses	7	$297,827	$42,547	$925,803
Nondepository credit intermediation	3.4	$265,192	$77,998	$518,818
Offices of physicians, dentists	5.3	$258,000	$48,679	$510,103
Forestry, forest products, timber prep	2.1	$256,235	$122,017	$1,823,241
Transport by truck	9.7	$242,144	$24,963	$903,301
State and local government electric	2.9	$232,566	$80,195	$894,670
Food services and drinking places	10.7	$173,570	$16,221	$579,535
Total	196.1	$11,838,930	$65,462	$57,032,383

[a] Source: IMPLAN.

Clallam County: Top 10 by Employment, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	22.5	$1,215,731	$54,032	$5,420,033
Commercial logging	18.3	$1,466,397	$80,131	$2,591,308
Paper mills	7.9	$648,424	$82,079	$6,274,773
Food services and drinking places	3.6	$58,698	$16,305	$194,629
Real estate establishments	2.5	$13,737	$5,495	$329,948
Services to buildings and dwellings	2.3	$27,430	$11,926	$113,550
Transport by truck	2.2	$119,185	$54,175	$270,269
Offices of physicians, dentists	2.1	$114,769	$54,652	$214,156
Wholesale trade businesses	1.6	$57,566	$35,979	$200,143
Nursing and residential care	1.3	$38,448	$29,575	$71,522
Total	64.3	$3,760,385	$58,482	$15,680,331

[a] Source: IMPLAN.

Clallam County: Top 10 by Income, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Commercial logging	18.3	$1,466,397	$80,131	$2,591,308
Sawmills and wood preservation	22.5	$1,215,731	$54,032	$5,420,033
Paper mills	7.9	$648,424	$82,079	$6,274,773
Forestry, forest products, timber prep	1.3	$168,362	$129,509	$1,118,041
Transport by truck	2.2	$119,185	$54,175	$270,269
Offices of physicians, dentists	2.1	$114,769	$54,652	$214,156
Management of companies	1.1	$69,903	$63,548	$168,308
State and local government electric	0.9	$66,767	$74,186	$268,021
Food services and drinking places	3.6	$58,698	$16,305	$194,629
Nondepository credit intermediation	0.8	$58,618	$73,273	$118,825
Total	60.7	$3,986,854	$65,681	$16,638,363

[a] Source: IMPLAN.

Grays Harbor County: Top 10 by Employment, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	15.7	$939,183	$59,821	$3,867,243
Commercial logging	15.5	$925,901	$59,736	$1,880,237
Paper mills	5.4	$438,281	$81,163	$4,077,751
Transport by truck	2.8	$43,040	$15,371	$233,959
Food services and drinking places	2.5	$40,744	$16,298	$137,404
Support activities for agriculture, forestry	1.7	$38,203	$22,472	$51,825
Wholesale trade businesses	1.5	$78,970	$52,647	$212,623
Offices of physicians, dentists	1.3	$62,311	$47,932	$125,536
Real estate establishments	1.3	$7,000	$5,385	$170,288
Nondepository credit intermediation	0.9	$59,776	$66,418	$128,024
Total	48.6	$2,633,409	$54,185	$10,884,890

[a] Source: IMPLAN.

Grays Harbor County: Top 10 by Income, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	15.7	$939,183	$59,821	$3,867,243
Commercial logging	15.5	$925,901	$59,736	$1,880,237
Paper mills	5.4	$438,281	$81,163	$4,077,751
Wholesale trade businesses	1.5	$78,970	$52,647	$212,623
Offices of physicians, dentists	1.3	$62,311	$47,932	$125,536
Nondepository credit intermediation	0.9	$59,776	$66,418	$128,024
State and local government electric	0.7	$57,060	$81,514	$217,908
Transport by truck	2.8	$43,040	$15,371	$233,959
Food services and drinking places	2.5	$40,744	$16,298	$137,404
Support activities agriculture, forestry	1.7	$38,203	$22,472	$51,825
Total	48.0	$2,683,469	$55,906	$10,932,510

[a] Source: IMPLAN.

Jefferson County: Top 10 by Employment, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	13.5	$511,833	$37,914	$3,040,291
Commercial logging	9.0	$202,118	$22,458	$755,220
Paper mills	5.1	$418,602	$82,079	$3,928,241
Services to buildings and dwellings	1.5	$8,350	$5,567	$65,015
Food services and drinking places	1.3	$20,114	$15,472	$69,739
Real estate establishments	0.9	$6,508	$7,231	$121,748
Support activities agriculture, forestry	0.7	$11,034	$15,763	$16,741
Animal production, except cattle, poultry	0.6	$4,197	$6,995	$23,339
All other crop farming	0.6	$17,335	$28,892	$91,693
Transport by truck	0.5	$12,391	$24,782	$49,289
Total	33.7	$1,212,482	$35,979	$8,161,316

[a] Source: IMPLAN.

Jefferson County: Top 10 by Income, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	13.5	$511,833	$37,914	$3,040,291
Paper mills	5.1	$418,602	$82,079	$3,928,241
Commercial logging	9.0	$202,118	$22,458	$755,220
Nondepository credit intermediation	0.2	$39,084	$195,420	$57,874
Food services and drinking places	1.3	$20,114	$15,472	$69,739
Offices of physicians, dentists	0.5	$17,586	$35,172	$41,441
All other crop farming	0.6	$17,335	$28,892	$91,693
Automotive repair and maintenance	0.5	$16,812	$33,624	$39,946
Wholesale trade businesses	0.4	$15,048	$37,620	$55,205
Maintenance and repair construction	0.4	$13,528	$33,820	$52,645
Total	31.5	$1,272,060	$40,383	$8,132,295

[a] Source: IMPLAN.

Mason County: Top 10 by Employment, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	13.9	$975,386	$70,172	$3,567,546
Commercial logging	14.2	$766,836	$54,003	$1,642,857
Food services and drinking places	1.6	$27,169	$16,981	$88,992
Transport by truck	1.4	$68,439	$48,885	$163,275
Wholesale trade businesses	1.4	$62,220	$44,443	$186,343
Real estate establishments	1.3	$6,312	$4,855	$162,189
Support activities agriculture, forestry	0.7	$7,439	$10,627	$12,696
Nondepository credit intermediation	0.6	$39,992	$66,653	$78,862
Nursing and residential care	0.5	$14,597	$29,194	$27,107
Civic, social, professional org	0.4	$8,270	$20,675	$25,144
Total	36.0	$1,976,660	$54,907	$5,955,011

[a] Source: IMPLAN.

Mason County: Top 10 by Income, Northwest Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	13.9	$979,678	$70,480	$3,575,321
Commercial logging	14.2	$760,085	$53,527	$149,938
Transport by truck	1.4	$68,439	$48,885	$163,275
Nondepository credit intermediation	0.8	$58,171	$72,714	$114,710
State and local government electric	0.5	$55,595	$111,190	$201,910
Wholesale trade businesses	1.4	$51,789	$36,992	$172,375
Forestry, forest products, timber prep	0.1	$37,826	$378,260	$147,995
Offices of physicians, dentists	0.6	$33,552	$55,920	$66,136
Food services and drinking places	0.9	$28,046	$31,162	$89,902
Nursing and residential care facilities	0.5	$14,597	$29,194	$27,107
Total	34.3	$2,087,778	$60,868	$4,708,669

[a] Source: IMPLAN.

Economic Impacts of Harvests Under the Olympic National Forest Plan

Olympic Regional Economy: Top 10 by Employment, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	325.7	$19,692,135	$60,461	$80,592,139
Commercial logging	304.7	$19,539,022	$64,125	$38,308,068
Paper mills	113.4	$9,307,759	$82,079	$95,580,277
Food services and drinking places	46.9	$762,292	$16,254	$2,545,219
Transport by truck	41.3	$1,031,910	$24,986	$3,849,475
Real estate establishments	31.1	$178,332	$5,734	$4,186,762
Wholesale trade businesses	29.6	$1,248,926	$42,193	$3,882,316
Services to buildings and dwellings	27.3	$289,876	$10,618	$1,301,693
Offices of physicians, dentists	23.4	$1,145,888	$48,970	$2,265,588
Support activities, agriculture, forestry	18.9	$481,456	$25,474	$626,590
Total	962.3	$53,677,596	$57,171	$233,138,127

[a] Source: IMPLAN.

Olympic Regional Economy: Top 10 by Income, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	325.7	$19,692,135	$60,461	$80,592,139
Commercial logging	304.7	$19,539,022	$64,125	$38,308,068
Paper mills	113.4	$9,307,759	$82,079	$95,580,277
Wholesale trade businesses	29.6	$1,248,926	$42,193	$3,882,316
Forestry, forest products, timber prep	9.9	$1,227,636	$124,004	$8,735,259
Nondepository credit intermediation	14.8	$1,158,720	$78,292	$2,266,904
Offices of physicians, dentists	23.4	$1,145,888	$48,970	$2,265,588
Transport by truck	41.3	$1,031,910	$24,986	$3,849,475
State and local government electric	11.5	$930,424	$80,906	$3,579,295
Food services and drinking places	46.9	$762,292	$16,254	$2,545,219
Total	921.2	$56,044,712	$62,291	$241,604,540

[a] Source: IMPLAN.

Clallam County: Top 10 by Employment, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	109.8	$5,931,456	$54,021	$26,443,920
Commercial logging	88.9	$7,135,500	$80,264	$12,609,330
Paper mills	38.5	$3,160,042	$82,079	$30,500,168
Food services and drinking places	17.4	$285,824	$16,427	$947,726
Real estate establishments	11.9	$66,889	$5,621	$1,606,652
Services to buildings and dwellings	11.3	$133,552	$11,819	$552,849
Transport by truck	10.8	$580,469	$53,747	$1,316,292
Offices of physicians, dentists	10.1	$558,814	$55,328	$1,042,738
Wholesale trade businesses	7.8	$280,263	$35,931	$974,398
Nursing and residential care facilities	6.2	$187,207	$30,195	$348,246
Total	312.7	$18,320,016	$58,587	$76,342,319

[a] Source: IMPLAN.

Clallam County: Top 10 by Income, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Commercial logging	88.9	$7,135,500	$80,264	$12,609,330
Sawmills and wood preservation	109.8	$5,931,456	$54,021	$26,443,920
Paper mills	38.5	$3,160,042	$82,079	$30,500,168
Forestry, forest products, timber prep	6.1	$820,553	$134,517	$5,449,034
Transport by truck	10.8	$580,469	$53,747	$1,316,292
Offices of physicians, dentists	10.1	$558,814	$55,328	$1,042,738
Management of companies	5.2	$340,203	$65,424	$819,117
State and local government electric	4.3	$324,942	$75,568	$1,304,399
Food services and drinking places	17.4	$285,824	$16,427	$947,726
Nondepository credit intermediation	3.9	$285,463	$73,196	$578,666
Total	295	$19,423,266	$65,842	$81,011,390

[a] Source: IMPLAN.

Grays Harbor County: Top 10 by Employment, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	76.4	$4,583,644	$59,995	$18,873,920
Commercial logging	75.7	$4,522,196	$59,738	$9,183,272
Paper mills	26.5	$2,142,707	$80,857	$19,935,661
Transport by truck	13.7	$210,213	$15,344	$1,142,701
Food services and drinking places	12.4	$198,988	$16,047	$671,063
Support activities agriculture, forestry	8.5	$186,537	$21,946	$253,052
Wholesale trade businesses	7.4	$385,756	$52,129	$1,038,627
Offices of physicians, dentists	6.5	$304,315	$46,818	$613,089
Real estate establishments	6.2	$34,186	$5,514	$831,663
Nondepository credit intermediation	4.4	$291,936	$66,349	$625,252
Total	237.7	$12,860,478	$54,104	$53,168,300

[a] Source: IMPLAN.

Grays Harbor: Top 10 by Income, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	76.4	$4,583,644	$59,995	$18,873,920
Commercial logging	75.7	$4,522,196	$59,738	$9,183,272
Paper mills	26.5	$2,142,707	$80,857	$19,935,661
Wholesale trade businesses	7.4	$385,756	$52,129	$1,038,627
Offices of physicians, dentists	6.5	$304,315	$46,818	$613,089
Nondepository credit intermediation	4.4	$291,936	$66,349	$625,252
State and local government electric	3.4	$278,789	$81,997	$1,064,679
Transport by truck	13.7	$210,213	$15,344	$1,142,701
Food services and drinking places	12.4	$198,988	$16,047	$671,063
Support activities agriculture, forestry	8.5	$186,537	$21,946	$253,052
Total	234.9	$13,105,081	$55,790	$53,401,316

[a] Source: IMPLAN.

Jefferson County: Top 10 by Employment, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	66.3	$2,505,229	$37,786	$14,881,085
Commercial logging	44	$991,572	$22,536	$3,705,034
Paper mills	24.9	$2,043,767	$82,079	$19,102,051
Services to buildings and dwellings	7.5	$40,725	$5,430	$317,096
Food services and drinking places	6.4	$98,209	$15,345	$340,518
Real estate establishments	4.4	$31,787	$7,224	$594,687
Support activities agriculture, forestry	3.5	$54,100	$15,457	$82,083
Animal production, except cattle, poultry	3.2	$20,559	$6,425	$114,325
All other crop farming	3.1	$84,916	$27,392	$449,160
Transport by truck	2.6	$60,492	$23,266	$240,628
Total	165.9	$5,931,356	$35,753	$39,826,667

[a] Source: IMPLAN.

Jefferson County: Top 10 by Income, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	66.3	$2,505,229	$37,786	$14,881,085
Paper mills	24.9	$2,043,767	$82,079	$19,102,051
Commercial logging	44	$991,572	$22,536	$3,705,034
Nondepository credit intermediation	1.2	$190,851	$159,043	$282,607
Food services and drinking places	6.4	$98,209	$15,345	$340,518
Offices of physicians, dentists	2.5	$85,889	$34,356	$202,390
All other crop farming	3.1	$84,916	$27,392	$449,160
Automotive repair and maintenance	2.6	$82,067	$31,564	$194,991
Wholesale trade businesses	2.2	$73,420	$33,373	$269,354
Maintenance and repair construction	2.2	$65,957	$29,980	$256,683
Total	155.4	$6,221,877	$40,038	$39,683,873

[a] Source: IMPLAN.

Mason County: Top 10 by Employment, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	67.7	$4,686,177	$69,220	$17,102,133
Commercial logging	69.6	$3,382,397	$48,598	$7,288,152
Food services and drinking places	8	$77,179	$9,647	$247,397
Real estate establishments	5.9	$21,388	$3,625	$562,623
Wholesale trade businesses	6.8	$144,764	$21,289	$481,832
Support activities for agriculture, forestry	3.3	$39,020	$11,824	$66,596
Nursing and residential care facilities	2.3	$71,421	$31,053	$132,631
Nondepository credit intermediation	3.0	$231,978	$77,326	$457,434
Transport by truck	6.6	$332,191	$50,332	$792,518
Civic, social, professional organizations	0.3	$47,198	$157,327	$143,551
Total	173.5	$9,033,713	$52,068	$27,274,867

[a] Source: IMPLAN.

Mason County: Top 10 by Income, Olympic National Forest Plan

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	67.7	$4,686,177	$69,220	$17,102,133
Commercial logging	69.6	$3,382,397	$48,598	$7,288,152
Transport by truck	6.6	$332,191	$50,332	$792,518
Nondepository credit intermediation	3.0	$231,978	$77,326	$457,434
State and local government electric	2.5	$226,550	$90,620	$822,796
Forestry, forest products, timber prep	0.8	$211,526	$264,408	$827,609
Offices of physicians, dentists	2.3	$159,336	$69,277	$314,069
Wholesale trade businesses	6.8	$144,764	$21,289	$481,832
Food services and drinking places	8	$77,179	$9,647	$247,397
Nursing and residential care facilities	2.3	$71,421	$31,053	$132,631
Total	169.6	$9,523,519	$56,153	$28,466,571

[a] Source: IMPLAN.

Economic Impacts of Harvests under the Third Way Scenario

Olympic Regional Economy: Top 10 by Employment, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	162.0	$10,536,901	$65,043	$43,123,378
Commercial logging	156.6	$10,386,235	$66,323	$20,363,179
Paper mills	56.1	$4,604,632	$82,079	$46,680,703
Food services and drinking places	24.4	$397,262	$16,281	$1,326,419
Transport by truck	21.3	$531,935	$24,973	$1,984,350
Real estate establishments	16.2	$92,914	$5,735	$2,181,373
Wholesale trade businesses	15.2	$640,704	$42,152	$1,991,641
Services to buildings and dwellings	13.9	$148,073	$10,653	$664,923
Offices of physicians, dentists	12.3	$599,495	$48,739	$1,185,289
Support activities agriculture, forestry	10.1	$256,610	$25,407	$333,964
Total	488.1	$28,294,761	$59,115	$119,835,219

[a] Source: IMPLAN.

Olympic Regional Economy: Top 10 by Income, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	162.0	$10,536,901	$65,043	$43,123,378
Commercial logging	156.6	$10,386,235	$66,323	$20,363,179
Paper mills	56.1	$4,604,632	$82,079	$46,680,703
Forestry, forest products, timber prep	5.3	$654,995	$123,584	$4,660,627
Wholesale trade businesses	15.2	$640,704	$42,152	$1,991,641
Nondepository credit intermediation	7.7	$602,634	$78,264	$1,178,984
Offices of physicians, dentists	12.3	$599,495	$48,739	$1,185,289
Transport by truck	21.3	$531,935	$24,973	$1,984,350
State and local government electric	5.8	$469,767	$80,994	$1,807,173
Food services and drinking places	24.4	$397,262	$16,281	$1,326,419
Total	466.7	$29,424,560	$64,460	$124,301,743

[a] Source: IMPLAN.

Clallam County: Top 10 by Employment, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	37.1	$2,007,660	$54,115	$8,950,653
Forestry, forest products, timber prep	16.7	$2,243,930	$134,367	$14,901,240
Commercial logging	14.0	$1,125,975	$80,427	$1,989,739
Paper mills	13.0	$1,067,027	$82,079	$10,325,891
Food services and drinking places	6.7	$110,561	$16,502	$366,593
Support activities agriculture, forestry	6.1	$365,390	$59,900	$404,228
Services to buildings and dwellings	4.7	$55,485	$11,805	$229,686
Real estate establishments	4.6	$25,860	$5,622	$621,153
Offices of physicians, dentists	3.9	$218,510	$56,028	$407,736
Transport by truck	3.7	$197,358	$53,340	$447,537
Total	110.5	$7,417,756	$67,129	$38,644,456

[a] Source: IMPLAN.

Clallam County: Top 10 by Income, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Forestry, forest products, timber prep	16.7	$2,243,930	$134,367	$14,901,240
Sawmills and wood preservation	37.1	$2,007,660	$54,115	$8,950,653
Paper mills	13.0	$1,067,027	$82,079	$10,325,891
Commercial logging	14.0	$1,125,975	$80,427	$1,989,739
Support activities agriculture, forestry	6.1	$365,390	$59,900	$404,228
Offices of physicians, dentists	3.9	$218,510	$56,028	$407,736
Transport by truck	3.7	$197,358	$53,340	$447,537
Nondepository credit intermediation	1.7	$126,087	$74,169	$255,592
Management of companies	1.8	$117,496	$65,276	$282,899
State and local government electric	1.5	$114,097	$76,065	$458,013
Total	99.5	$7,583,530	$76,216	$38,423,528

[a] Source: IMPLAN.

Grays Harbor County: Top 10 by Employment, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	51.0	$3,055,763	$59,917	$12,582,613
Commercial logging	50.4	$3,014,798	$59,817	$6,122,181
Paper mills	17.7	$1,428,471	$80,705	$13,290,442
Transport by truck	9.1	$140,142	$15,400	$761,801
Food services and drinking places	8.3	$132,659	$15,983	$447,375
Support activities agriculture, forestry	5.7	$124,358	$21,817	$168,701
Wholesale trade businesses	4.9	$257,171	$52,484	$692,418
Offices of physicians, dentists	4.3	$202,877	$47,181	$408,726
Real estate establishments	4.1	$22,791	$5,559	$554,442
Nondepository credit intermediation	3.0	$194,624	$64,875	$416,835
Top 10 by Employment	158.5	$8,573,654	$54,092	$35,445,534

[a] Source: IMPLAN.

Grays Harbor County: Top 10 by Income, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	51.0	$3,055,763	$59,917	$12,582,613
Commercial logging	50.4	$3,014,798	$59,817	$6,122,181
Paper mills	17.7	$1,428,471	$80,705	$13,290,442
Wholesale trade businesses	4.9	$257,171	$52,484	$692,418
Offices of physicians, dentists	4.3	$202,877	$47,181	$408,726
Nondepository credit intermediation	3.0	$194,624	$64,875	$416,835
State and local government electric	2.3	$185,859	$80,808	$709,786
Transport by truck	9.1	$140,142	$15,400	$761,801
Food services and drinking places	8.3	$132,659	$15,983	$447,375
Support activities agriculture, forestry	5.7	$124,358	$21,817	$168,701
Total	156.7	$8,736,722	$55,754	$35,600,878

[a] Source: IMPLAN.

Jefferson County: Top 10 by Employment, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	49.7	$1,877,963	$37,786	$11,155,115
Commercial logging	32.9	$741,813	$22,548	$2,771,803
Paper mills	18.7	$1,534,877	$82,079	$14,326,537
Services to buildings and dwellings	5.6	$30,535	$5,453	$237,753
Food services and drinking places	4.8	$73,618	$15,337	$255,252
Real estate establishments	3.3	$23,825	$7,220	$445,735
Support activities agriculture, forestry	2.6	$40,493	$15,574	$61,438
Animal production, except cattle, poultry	2.4	$15,400	$6,417	$85,637
All other crop farming	2.3	$63,610	$27,657	$336,462
Transport by truck	2.0	$45,348	$22,674	$180,390
Total	124.3	$4,447,482	$35,780	$29,856,122

[a] Source: IMPLAN.

Jefferson County: Top 10 by Income, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	49.7	$1,877,963	$37,786	$11,155,115
Paper mills	18.7	$1,534,877	$82,079	$14,326,537
Commercial logging	32.9	$741,813	$22,548	$2,771,803
Nondepository credit intermediation	0.9	$143,064	$158,960	$211,846
Food services and drinking places	4.8	$73,618	$15,337	$255,252
Offices of physicians, dentists	1.8	$64,376	$35,764	$151,696
All other crop farming	2.3	$63,610	$27,657	$336,462
Automotive repair and maintenance	2.0	$61,512	$30,756	$146,152
Wholesale trade businesses	1.6	$55,041	$34,401	$201,926
Maintenance and repair construction	1.6	$49,456	$30,910	$192,466
Total	116.3	$4,665,330	$40,115	$29,749,255

[a] Source: IMPLAN.

Mason County: Top 10 by Employment, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	19.2	$1,359,629	$70,814	$4,961,945
Commercial logging	19.8	$1,058,935	$53,482	$2,281,719
Food services and drinking places	2.3	$38,817	$16,877	$124,427
Transport by truck	2.0	$90,590	$45,295	$151,289
Wholesale trade businesses	2.0	$74,815	$37,408	$249,015
Real estate establishments	1.7	$8,613	$5,066	$226,583
Support activities agriculture, forestry	0.9	$10,595	$11,772	$18,083
Nondepository credit intermediation	0.9	$64,997	$72,219	$128,165
Nursing and residential care facilities	0.7	$20,305	$29,007	$37,707
Civic, social, professional organizations	0.6	$13,798	$22,997	$41,957
Total	50.1	$2,741,094	$54,712	$8,220,890

[a] Source: IMPLAN.

Mason County: Top 10 by Income, A Third Way

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	19.2	$1,359,629	$70,814	$4,961,945
Commercial logging	19.8	$1,058,935	$53,482	$2,281,719
Transport by truck	2.0	$90,590	$45,295	$151,289
Wholesale trade businesses	2.0	$74,815	$37,408	$249,015
Nondepository credit intermediation	0.9	$64,997	$72,219	$128,165
State and local government electric	0.7	$54,075	$77,250	$196,392
Forestry, forest products, timber prep	0.2	$52,623	$263,115	$205,893
Offices of physicians, dentists	1.0	$46,672	$46,672	$91,996
Food services and drinking places	2.3	$38,817	$16,877	$124,427
Nursing and residential care facilities	0.7	$20,305	$29,007	$37,707
Total	48.8	$2,861,458	$58,636	$8,428,548

[a] Source: IMPLAN.

Economic Impacts of Shutdown Scenarios

Mary's River: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	113.4	$7,433,271	$65,549	$28,002,758
Commercial logging	53.1	$3,173,415	$59,763	$6,444,288
Transport by truck	11.1	$170,840	$15,391	$928,672
Food services and drinking places	10.9	$174,820	$16,039	$589,560
Support activities agriculture, forestry	8.4	$183,429	$21,837	$248,836
Offices of physicians, dentists	5.8	$272,268	$46,943	$548,525
Real estate establishments	5.4	$29,968	$5,550	$729,037
Wholesale trade businesses	5.2	$269,876	$51,899	$726,626
Nondepository credit intermediation	3.9	$255,403	$65,488	$547,007
Nursing and residential care facilities	3.1	$105,674	$34,088	$187,552
Total	$220	$12,068,964	$54,784	$38,952,861

[a] Source: IMPLAN.

Mary's River: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	113.4	$7,433,271	$65,549	$28,002,758
Commercial logging	53.1	$3,173,415	$59,763	$6,444,288
Offices of physicians, dentists	5.8	$272,268	$46,943	$548,525
Wholesale trade businesses	5.2	$269,876	$51,899	$726,626
Nondepository credit intermediation	3.9	$255,403	$65,488	$547,007
Support activities agriculture, forestry	8.4	$183,429	$21,837	$248,836
Food services and drinking places	10.9	$174,820	$16,039	$589,560
Transport by truck	11.1	$170,840	$15,391	$928,672
Private hospitals	2.0	$153,023	$76,512	$293,578
State and local government electric	1.8	$145,830	$81,017	$556,917
Total	$216	$12,232,175	$56,736	$38,886,767

[a] Source: IMPLAN.

Economic Impacts of the Bioenergy Sector: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Transport by truck	23.5	$1,660,816	$70,673	$2,871,186
Commercial logging	13.4	$1,293,641	$96,540	$1,904,358
Food services and drinking places	2.1	$35,155	$16,740	$116,567
Real estate establishments	1.7	$9,567	$5,628	$229,791
Offices of physicians, dentists	1.5	$83,125	$55,417	$155,110
Couriers and messengers	1.0	$36,996	$36,996	$89,542
Nursing and residential care facilities	0.9	$27,812	$30,902	$51,736
Services to buildings and dwellings	0.8	$9,983	$12,479	$41,326
Securities, contracts, investments	0.7	$1,029	$2,035	$65,297
Retail Stores - Food and beverage	0.6	$21,315	$31,071	$41,629
Total	46.2	$3,179,439	$68,819.03	$5,566,542

[a] Source: IMPLAN.

Economic Impacts of the Bioenergy Sector: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Transport by truck	23.5	$1,660,816	$70,673	$2,871,186
Commercial logging	13.4	$1,293,641	$96,540	$1,904,358
Offices of physicians, dentists	1.5	$83,125	$55,417	$155,110
Forestry, forest products, timber prep	0.4	$49,782	$124,455	$330,589
US Postal Service	0.5	$41,770	$83,540	$49,572
Couriers and messengers	1.0	$36,996	$36,996	$89,542
Food services and drinking places	2.1	$35,155	$16,740	$116,567
Nondepository credit	0.4	$29,453	$73,633	$59,705
Nursing and residential care facilities	0.9	$27,812	$30,902	$51,736
Retail Stores - Food and beverage	0.6	$21,315	$35,525	$41,629
Total	44.3	$3,279,865	$74,037.58	$5,669,994

[a] Source: IMPLAN.

Interfor's Beaver-Forks Operations Shutdown: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	84.4	$5,930,012	$70,261	$20,345,971
Commercial logging	27.1	$2,177,568	$80,353	$3,848,037
Food services and drinking places	7.7	$126,064	$16,372	$418,000
Real estate establishments	5.2	$29,327	$5,640	$704,417
Transport by truck	4.5	$243,013	$54,003	$551,066
Offices of physicians, dentists	4.5	$248,773	$55,283	$464,207
Services to buildings and dwellings	4.1	$48,049	$11,719	$198,904
Forestry, forest products, timber prep	3.6	$478,544	$132,929	$3,177,861
Wholesale trade businesses	2.8	$100,377	$35,849	$348,985
Nursing and residential care facilities	2.7	$83,308	$30,855	$154,972
Total	146.6	$9,465,035	$64,564	$30,212,420

[a] Source: IMPLAN.

Interfor's Beaver-Forks Operations Shutdown: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	84.4	$5,930,012	$70,261	$20,345,971
Commercial logging	27.1	$2,177,568	$80,353	$3,848,037
Forestry, forest products, timber prep	3.6	$478,544	$132,929	$3,177,861
Offices of physicians, dentists	4.5	$248,773	$55,283	$464,207
Transport by truck	4.5	$243,013	$54,003	$551,066
Nondepository credit	1.7	$127,486	$74,992	$258,428
Food services and drinking places	7.7	$126,064	$16,372	$418,000
Wholesale trade businesses	2.8	$100,377	$35,849	$348,985
Management of companies	1.4	$89,336	$63,811	$215,096
State and local government electric	1.2	$88,051	$73,376	$353,459
Total	138.9	$9,609,224	$69,181	$29,981,110

[a] Source: IMPLAN.

Interfor's Port Angeles Operations Shutdown: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	125.1	$6,968,369	$55,702	$30,132,393
Commercial logging	40.2	$3,224,972	$80,223	$5,698,933
Food services and drinking places	10.2	$167,484	$16,420	$555,338
Real estate establishments	7.0	$39,176	$5,597	$940,996
Transport by truck	6.6	$356,346	$53,992	$808,063
Services to buildings and dwellings	5.8	$69,123	$11,918	$286,142
Offices of physicians, dentists	5.8	$320,982	$55,342	$598,947
Forestry, forest products, timber prep	5.3	$708,721	$133,721	$4,706,394
Wholesale trade businesses	4.0	$143,050	$35,763	$497,346
Nursing and residential care facilities	3.5	$107,507	$30,716	$199,987
Total	213.5	$12,105,730	$56,701	$44,424,539

[a] Source: IMPLAN.

Interfor's Port Angeles Operations Shutdown: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Sawmills and wood preservation	125.1	$6,968,369	$55,702	$30,132,393
Commercial logging	40.2	$3,224,972	$80,223	$5,698,933
Forestry, forest products, timber prep	5.3	$708,721	$133,721	$4,706,394
Transport by truck	6.6	$356,346	$53,992	$808,063
Offices of physicians, dentists	5.8	$320,982	$55,342	$598,947
Nondepository credit	2.4	$174,383	$72,660	$353,495
Food services and drinking places	10.2	$167,484	$16,420	$555,338
Wholesale trade businesses	4.0	$143,050	$35,763	$497,346
Management of companies	2.0	$130,386	$65,193	$313,934
State and local government electric	1.6	$125,962	$78,726	$505,642
Total	203.2	$12,320,655	$60,633	$44,170,485

[a] Source: IMPLAN.

Nippon Paper Production Line 2: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Paper mills	66.0	$5,417,214	$82,079	$52,417,075
Commercial logging	11.6	$930,141	$80,185	$1,643,677
Food services and drinking places	10.3	$169,316	$16,438	$561,411
Services to buildings and dwellings	9.8	$115,753	$11,812	$479,168
Transport by truck	7.6	$410,870	$54,062	$931,704
Real estate establishments	7.2	$40,054	$5,563	$962,075
Wholesale trade businesses	6.3	$227,091	$36,046	$789,535
Management of companies	5.9	$382,219	$64,783	$920,279
Offices of physicians, dentists	5.6	$310,010	$55,359	$578,473
State and local government electric	4.6	$354,749	$77,119	$1,424,054
Total	134.9	$8,357,417	$61,953	$60,707,451

[a] Source: IMPLAN.

Nippon Paper Production Line 2: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Paper mills	66	$5,417,214	$82,079	$52,417,075
Commercial logging	11.6	$930,141	$80,185	$1,643,677
Transport by truck	7.6	$410,870	$54,062	$931,704
Management of companies	5.9	$382,219	$64,783	$920,279
State and local government electric	4.6	$354,749	$77,119	$1,424,054
Offices of physicians, dentists	5.6	$310,010	$55,359	$578,473
Wholesale trade businesses	6.3	$227,091	$36,046	$789,535
Other state and local government	2.5	$181,832	$72,733	$694,233
Nondepository credit intermediation	2.3	$169,461	$73,679	$343,517
Food services and drinking places	10.3	$169,316	$16,438	$561,411
Total	122.7	$8,552,903	$69,706	$60,303,958

[a] Source: IMPLAN.

Nippon Paper Industries Shutdown: Top 10 by Employment

Sector description	Employment	Labor income	Average wage	Value output
Paper mills	200.0	$16,050,080	$82,079	$158,839,626
Commercial logging	35.1	$2,818,610	$80,302	$4,980,840
Food services and drinking places	31.2	$513,078	$16,445	$1,701,245
Services to buildings and dwellings	29.6	$350,766	$11,850	$1,452,023
Transport by truck	23.1	$1,245,062	$53,899	$2,823,346
Real estate establishments	21.7	$121,375	$5,593	$2,915,378
Wholesale trade businesses	19.0	$688,155	$36,219	$2,392,530
Management of companies	17.7	$1,158,238	$65,437	$2,788,724
Offices of physicians, dentists	17.0	$939,424	$55,260	$1,752,948
State and local government electric	14.1	$1,074,998	$76,241	$4,315,316
Total	408.5	$24,959,786	$61,996	$183,961,976

[a] Source: IMPLAN.

Nippon Paper Industries Shutdown: Top 10 by Income

Sector description	Employment	Labor income	Average wage	Value output
Paper mills	200.0	$16,050,080	$82,079	$158,839,626
Commercial logging	35.1	$2,818,610	$80,302	$4,980,840
Transport by truck	23.1	$1,245,062	$53,899	$2,823,346
Management of companies	17.7	$1,158,238	$65,437	$2,788,724
State and local government electric	14.1	$1,074,998	$76,241	$4,315,316
Offices of physicians, dentists	17.0	$939,424	$55,260	$1,752,948
Wholesale trade businesses	19.0	$688,155	$36,219	$2,392,530
Other state and local government	7.7	$551,005	$71,559	$2,103,736
Nondepository credit	7.0	$513,519	$73,360	$1,040,960
Food services and drinking places	31.2	$513,078	$16,445	$1,701,245
Total	371.9	$25,552,169	$69,690	$182,739,271

[a] Source: IMPLAN.