

Economic Effects of Point Source
Runoff Regulations
Estimated for Private Forests
of the Pacific Northwest

Funded by the
National Alliance of Forest Owners (NAFO)

Analytical Methods and Results Report
December 9, 2011

Forest Econ Inc

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Executive Summary

Synopsis

In response to a 2010 Ninth Circuit Court ruling, the Environmental Protection Agency (EPA) may soon redefine runoff from forests as individual point sources of potential pollution instead of non-point sources. This would change how forest roads and activities are permitted under the Clean Water Act (CWA). For 35 years, EPA maintained that forestry best management practices (BMP's), as designed and enforced by state forest practice acts (FPA's), were the most effective approach to maintaining water quality.

New point source National Pollution Elimination Discharge System (NPDES) permitting requirements would raise forestry costs and change how forestry is practiced nationwide. The National Alliance of Forest Owners asked Forest Econ Inc. (FEI) to study the potential regulatory cost effects on private forestry across California, Idaho, Montana, Oregon and Washington.

These five states have stringent forest practices acts and high compliance rates for BMP's that have been updated to consider water quality for endangered species habitat. FEI concludes that a new NPDES point source permit system might constitute an almost redundant regulatory layer.

One plausible system of federal point source permitting applied to northwestern states might cause aggregate regional private forest wealth losses approaching \$13.1 billion, equivalent to annual costs of \$654 million/year. The largest impacts would concentrate on small forests (<1000 acres). Their potential wealth losses of \$633/acre equate to income losses of \$31.65/acre/year. Larger private forests (>10,000 acres) have compliance economies of scale that would lower their average wealth losses to \$31/acre (\$1.55/acre/year). Increased regulatory costs could stimulate forest owner responses that range from redesigning road systems to opting out of forestry.

Methods Summary

FEI analysts built a point source NPDES point source permitting cost simulator to estimate the additional costs of a hypothetical new federal permitting system. The model responds to forest ownership scale as well as differences in state FPA procedures. Besides estimating aggregated costs of a base scenario in income and wealth effect terms,

the model is used to measure the sensitivity of assumed permitting requirements and test changes in the values of individual parameters.

The cost estimation model treats EPA runoff point source permitting as a new and duplicative regulatory layer applied in addition to existing state FPA pollution control procedures and required BMP's. Estimated changes due to new forest private owner federal permitting costs included:

- Increased regulatory fees for each forest owner for...
 - default upfront general permit of \$1,8000,
 - default annual permit renewal fees of \$500

- Increased forest owner compliance costs for ...
 - permit requirement and compliance training,
 - initializing and maintaining a crossings inventory,
 - writing an initial storm water prevention plan
 - permit application, compliance process design and administration,
 - quarterly monitoring with 5% representative sampling
 - reporting and remediation activities

Primary Findings

FEI finds that water quality on private forests is already tightly regulated under all five state forest practices acts (FPA's) with compliance rates of 97% or above. All Northwestern state BMP's have been updated to meet endangered species habitat water quality standards that typically exceed clean water act requirements. Procedural FPA states (California, Oregon, and Washington) would have slightly lower federal permitting cost impacts than notification FPA states (Idaho, Montana).

We also find that applying the same new permitting requirements on all forests would cause significantly different per acre cost impacts on large small and large forest ownerships. Smaller owners would have higher per acre permitting costs even though they typically have fewer crossings and are less timber management oriented. Larger forest owners have an organizational economy of scale in having existing internal expertise and procedures necessary for FPA compliance. On larger ownerships fixed fees and compliance overhead costs are spread out over more land.

There is a well-defined function of per acre costs declining with ownership size. Smaller forest owners would be the most heavily impacted. A narrow upfront cost amortization base causes per acre permitting costs to be enormous for <10 acre forests. Increasing ownership scale to 100 acres reduces upfront costs to \$63.08/acre in procedural FPA states and \$71.35/acre in notification FPA states. Annual costs are high, averaging \$21.43/acre across the region. 100 acre parcel wealth loss averages \$494/acre across the five states. At 300 acres, the average upfront cost in procedural FPA states could drop to \$21.56/acre, and \$24.80/acre in notification ones. Annual costs could also be significantly smaller at \$7.50/acre. Regulatory loading wealth losses drop to \$173/acre.

Larger ownership acreage costs become almost asymptotic at lower rates. Under procedural FPA's, we estimate that the largest large forest owners could face upfront permitting costs of \$1.52/acre. In notification FPA states, this is higher at \$2.00/acre. Their recurrent annual costs are invariant at \$1.30/acre. Calculated as a present value of combined upfront and annual costs, we found large ownership regulatory wealth losses that could range from about \$17/acre in Washington to \$51/acre in Montana depending on the distribution of ownership sizes in each state.

The aggregate regional wealth loss of this new regulatory process for all western private forest owners could be about \$13.1 billion. The annual income loss equivalent is \$654.4 million/year. Large forest ownerships (>1000 acres) bear \$590 million of this (about \$29.5 million/year). Each individual state's burden varies by private forest area, type of drainage topography, forest type productivity, and proportions of various forest ownership sizes. This ranges from \$0.6 billion in Idaho to \$4.2 billion in California.

The regulatory burden on larger landowners, although lower than for smaller landowners, may nevertheless affect silvicultural practices and the extent of permanent road systems, and accelerate sales of forestlands that are particularly burdensome. The inelasticity of timber supply and demand would allow larger landowners to shift some portion (not quantified here) of regulatory costs forward to wood users. The potential direct, indirect or induced job and income effects of such potential market shifts could be substantial, but quantification was beyond the current study.

The small forest owners' disproportionate regulatory burden should further reduce their limited participation in active forest management. The capitalized regulatory loading exceeds bare forest land values on smaller ownerships in most forest use zones. For example: in medium site western Cascades Douglas-fir forests the confiscation size is at forests less than 66 acres. In the Inland Empire good site confiscation occurs on ownerships of less than 91 acres. On the smaller western forest ownerships (<100 acres) many are already non-timber oriented so that a huge portion of their calculated burdens are logically irrelevant. On those small forests which still use roads for timber management, we would expect high new regulatory burdens to accelerate inventory liquidation where it is practical and cause rapid opting out of forestry into less regulated or post-regulatory higher valued land uses.

Limitations

This analysis is based on estimated costs in an assumed structure of an undefined regulatory system. Cost estimates change significantly as permitting requirements and standards are redefined. The large aggregate regulatory burdens are mostly due to small ownership amortization of large fixed fees and plan preparation costs.

The analytical precision of the results is low. Alternative hypothetical permitting system structures might have very different five state aggregate regulatory burdens. A shared permit scenario found a \$3.4 billion wealth effect with 82.8% borne by small forests. A

higher general permit fee with 100% monitoring caused a \$17.7 billion wealth effect with 88.5% borne by small ownerships. There is also a degree of uncertainty in the values of assumed parameters. In the base case scenario, we found that sensitive data and assumptions include initial EPA general permit fees, the discount rate, accuracy of crossings per acre coefficients, labor wage, and labor productivity rates.

FEI only analyzed estimated direct permitting costs, but other costs would occur. Indirect costs estimation was considered beyond the scope of this project. We would expect several indirect cost types to be substantial and worth estimating. These include costs of increased citizen suit litigation on individual forestry point sources under the new permits, and eventual job and income losses as higher cost forest management translates into reduced wood products sector activity.

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Potential New Forestry Point Source Permitting

Unless changed by Congressional action, an 8/17/2010 ruling by the Ninth Circuit Court of Appeals could require that the Environmental Protection Agency (EPA) apply point source instead of non-point source Clean Water Act (CWA) storm water runoff standards to forest roads. After appeal, the original ruling was strengthened to clarify subject matter jurisdiction, but did not change the essential findings. The revised court report ended with “we conclude that stormwater runoff from logging roads that is collected by and then discharged from a system of ditches, culverts, and channels is a point source discharge for which an NPDES permit is required.”¹

These rulings would require a change in how the EPA regulates forestry related stormwater discharges. Presumably, EPA would design widely expanded National Pollution Discharge Elimination System (NPDES) permitting to include the logging road outfalls specified. NPDES permitting might be required on individual forest roads, sites, and projects reversing EPA’s own three decade long interpretation of section 402 of the CWA that treated forest operations as non-point sources. Depending on the existing structure of state forest practices regulations, applications of such new federal standards and individual permitting requirements could change the nature and feasibility of private forest land management in several ways, including reduced financial viability, changes in active management, and practicability of forest land usage.

The Analytical Charge

The National Alliance of Forest Owners (NAFO) has asked FEI to quantify the potential cost effects of extending NPDES point source permitting to Northwestern private forests. The task includes hypothesizing a likely point source permitting system, extrapolating current industrial fees to forestry, estimating costs of application, implementation, monitoring, compliance and administration. Such costs must be identified, estimated and aggregated into focused measures of potential financial impacts to private forest owners in five western forested states. These states include: California, Idaho, Montana, Oregon and Washington. Where possible, the project’s estimates of permitting cost differences are between groups of states with regulatory forest practices acts (procedural FPA’s) and those with non-regulatory FPA’s (notification FPA’s). Although NAFO’s members are primarily industrial forest owners, they cooperate with many state non-industrial private

¹ Judge William A. Fletcher. May 17, 2011. United States Court of Appeals for the Ninth Circuit. Report No. 07-35266, CV-06-01270-GMK. Portland, Or.

forest owner (NIPF) associations. As permitting impacts would be different for different sizes of forest ownerships, NAFO requested that ownership size dependent impacts be addressed, regardless of whether the forest is industrial or non-industrial.

Permit Cost Estimation Logic

The FEI approach uses a low resolution cost identification and aggregation simulation technique. It is designed to emulate a hypothetical NPDES permitting system whose final regulatory parameters have not yet been established. The model identifies cost elements and the production rates associated with them as they might vary for different sizes of private forest ownerships. These are aggregated into cost patterns that vary by forest ownership size ranging from small family forests to very large industrial holdings.

One reason for low resolution estimation is that detailed tabulation of potential NPDES point sources on private forests adds only the appearance of precision to an analysis of an imperfectly defined regulatory system. The relative size of the permitting task is based instead on secondary data on state forest acreage and harvest activity. An indicator of the number of possible run-off point sources comes from a NAFO corporate member survey. NAFO totals are converted into watercourse crossing coefficients (e.g. sites/acre, sites per road mile) and extrapolated to represent the crossings on non-NAFO private forest lands. This affected area approach provides both a lineal and a spatial basis for assessing the general magnitude of the regulatory costs estimates, but this estimate is approximate.

Another reason to employ a simulator is that there is considerable variability in how the permitting system might affect forest owner compliance efforts. Three of the western states (California, Oregon and Washington) have existing procedural² forest practices acts (FPA's) with applications and/or documentation, state approval processes, existing hydrologic permitting, and mandated best management act (BMP) compliance. The intermountain states (Idaho and Montana) have intended activity notification FPA's with similar BMP's, but with lower documentation requirements and randomly audited compliance.

Forest owners' efforts to comply with a new regulatory layer could be significantly different between states. In procedural FPA states, existing FPA data and procedures could already meet requirements of new EPA permitting. In these states, new federal permitting might be only a new veneer of redundant activities with low costs. In notification FPA states, it is likely that significant new administrative and information management efforts may be required for some, particularly smaller, forest owners to comply with new NPDES requirements.

A review of all these FPA's found few differences in BMP standards or compliance between FPA types. The actual efficacy of state FPA's is beyond the present scope of

² Both procedural and notification FPA's are established by state laws and require adherence to well-defined BMP's to maintain water quality standards. The distinction is that procedural FPA's require forest activity documentation and existing layers of permitting. Notification FPA's are based on forest activity notifications with randomly audited compliance.

study. Our review leads us to conclude principally that BMP's under existing FPA's already meet or exceed CWA runoff standards. We do not address any road or silvicultural BMP costs. If it is later found that BMP standards would have to be raised, the compliance costs could be orders of magnitude above our estimate of procedural costs.

The cost components of new permitting that we did consider included: data and inventory changes, expanded mapping, completely new SWPP³ pollution abatement plans for each point source, operator monitoring, and compliance checking. To quantify typical activity levels, FEI is using each state's FPA applications or notifications data along with state private harvest statistics to get at the relative activity levels in the two private ownership categories. This yields an estimate of the size of the new costs of fixed requirements for the general permit and the variable ones associated with activity levels.

The permit cost simulator aggregates costs across types, categories, and flow patterns. It differentiates between forest ownership sizes and applicability of different FPA structures. Results are grouped by FPA type and ownership size classes in several per acre formats including upfront and annual costs to measure income effects and present values of cost streams to measure wealth effects. Finally, we estimate the expected aggregate regulatory loading (present value of costs) for each state.

Limits to the Cost Analysis

Policy changes should have intended benefits and potential costs. Although the expansion of NPDES permitting to forest roads is seen as a legal matter by the courts, any subsequent EPA or Congressional action to design and impose a permitting system would have to weigh benefits and costs of expanded regulation. The presumed environmental benefits of new federal regulatory oversight in excess of state forest practices acts would eventually have to be compared against the total economic costs, a consideration of who bears them, and the extended implications of new costs within and potentially outside of the forestry sector.

Quantification of additional net benefits is crucial to the regulatory requirements decision, but such analyses are difficult, imprecise and are the responsibility of the EPA. FEI's analysis only provisionally identifies and estimates many potential private costs of proposed NPDES permitting expansions to the forestry sector. We do not address the public costs of expanding and maintaining a new level of regulatory bureaucracy, and other economic costs in the regional economy caused by policy shifts.

There are undoubtedly potential private wood products sector implications beyond private forests and other downstream market effects of new NPDES regulatory requirements. Our primary focus is on the new direct regulatory costs as if they would be borne entirely by private forest owners. Relaxation of this analytical simplification is addressed qualitatively following the results section.

³ SWPPP is storm water pollution prevention plan. It identifies potential sources, describes practices to reduce it and outlines compliance procedures.

The Affected Private Forest Land Base

Forested lands statistics differentiate between both forested⁴ lands and timberlands.⁵ Although all forest area would be subject to new point source water pollution regulation, few roads and crossings would be found in the non-commercial land base. Where possible, we use timberlands area as the statistical reference base, although this convention does cause some small inconsistencies where data bases with different delineations are combined.

This new interpretation of the CWA applies to all forest owners including municipal, county, state and federal public forests.⁶ In the five northwestern forested states (CA, ID, MT, OR, WA) the forest area is extensive, about 132 million acres.⁷ The new EPA regulatory task for point source permitting and compliance on the entire forested landscape would be substantial.

This analysis is focused on the regulatory cost implications and effects of only the western private forestry sector that contains only 43.6 million acres (33.1%). As the effects could be different for large corporate forest holdings than smaller non-corporate ones, our analysis is sensitive to ownership size. Table #1 shows a summary of affected acres in the five western forestry states is shown by ownership category.⁸

Table 1: Western Public and Privately Owned Forest Area
In 1000's acres, Smith et al 2009

Western State	Total Forest	Private Forests	Percent Private	Corporate Owned	Non-corp Owned
California	32,817	13,202	40.2%	4,603	8,600
Idaho	21,430	2,553	11.9%	1,230	1,323
Montana	25,014	7,026	28.1%	2,193	4,834
Oregon	30,169	11,059	36.7%	5,995	5,063
Washington	22,279	9,806	44.0%	4,905	4,901
Total	131,709	43,646	33.1%	18,926	24,721

⁴ “Forest land” is any land with at least 10% covered with live trees or cleared forest land not yet shifted to another use category.

⁵ “Timberlands” have denser forest cover, often are considered to grow more than 20/cu.ft./acre/year and are generally considered to have commercial potential.

⁶ One defendant of the Ninth Circuit Court case was the State of Oregon.

⁷ Smith, Miles, Visage, and Pugh. 2004. Forest Resources of the United States, 2002. USDA-Forest Service. North Central Experiment Station, General Technical Report NC 241. Table 10

⁸ Smith, W. Brad; Patrick D. Miles; Charles H. Perry; Scott A. Pugh. 2009. Forest Resources of the United States, 2007. Gen. Tech. Rep. WO-78. Washington, D.C.: USDA-Forest Service.

How Many Forestry Point Source Permits Might There Be?

Point-source pollution is defined as “pollution that can be traced back to a single origin or source such as a sewage treatment plant discharge.”⁹ Most industrial point source permitting uses point of origin terms.¹⁰ The spatial dimensions of a forestry point source have yet to be defined, but Phase 1 industrial precedents suggest a specific point of origin approach.

If point of origin is the basis for the definition of runoff type, two primary shapes of forestry activities would be considered to affect storm water runoff pollution point sources that could be subject to NPDES permitting. These are: (1) linear features such as forest road construction, use and maintenance where water crossings or diversion structures can be considered outfalls, and (2) spatial features where activities are measured in acres and affected point source run-off might be associated with temporary roads and crossings. This spatial dimension; includes silvicultural activities including thinning, harvesting and stand treatment practices. We are not looking at spatial permitting, but spatial activity also implies increased lineal activity such as temporary spur and skid roads. Also, new road usage may not always be within a single private ownership boundary, e.g. log trucks crossing other ownerships.

The actual number of new NPDES permits that might be required on PNW private forests is unknown. The existing regulatory model is for EPA, or a state agency designate, to issue a general permit to an individual industrial site owner that is usually less than a few acres. Then each permittee submits a SWPPP that lists potential pollution point sources within the boundaries and how they are to be managed.

Linear Activity Estimates: There is as yet no clear operational definition of what constitutes a point source discharge on a forest road network. If a permitting applies widely across all roads of a same owner’s forest holding, the number of permits required would only be the general permit. The total number of general permits could equal the number of forest owners in each state. There could be hundreds of thousands of these across five states as the bulk of non-industrial forest ownerships in the region are 20 acres or less.

Our model considers the total number of possible individual private road crossings on existing forest road networks, but these road crossings are all assumed to be covered under a single general permit. Individual crossings numbers would increase the variable costs of the SWPPP and permit compliance processes. The NAFO member survey includes information on ownership acres, road miles, crossings and stream miles. In some cases this data would be specific to forest zones within a state. From this aggregate data, we calculate expansion factors that can be applied to all private forests within a state forest zone. Table 2 shows the NAFO road miles surveyed and our calculations of

⁹ Watertechnology.net. 9/14/2011. The website for the water and wastewater industry.

¹⁰ Water quality engineer, Rubix environmental Inc.. Reno, Nevada personal communication 9/14/2011

expansion coefficients that are applied to total private forest area. Idaho and Montana were combined to prevent data disclosure of the few industrial forestry firms there.

Table 2: Surveyed Industrial Forest Roads
FEI calculated expansion coefficients

Western State	Survey Miles	Miles /acre	Xings /mile
California	6,508	0.010	2.607
Idaho/Montana	24,230	0.012	1.898
Oregon	30,274	0.010	2.277
Washington	29,964	0.011	2.525
5 States	90,976	0.011	2.281

The variability in crossings per mile appears to be topographically correlated. The Cascade Mountain states (CA,OR,WA) have more and the inland states (ID,MT) have fewer. There are some check statistics sources. For example, FPA data in WA indicates that 57,442 miles of private forest roads were assessed between 2001 and 2009 to meet fish passage standards.¹¹ This almost doubles the Washington survey miles must include an unknown mileage of NIPF roads as well. Unfortunately, such references were often inconsistent with the NAFO survey, its coefficients were used as reported.

If individual site enumeration is required, in keeping with a definition of singular facility-based point sources,¹² the 44 million acres of already roaded private Northwestern forests would immediately require about 870 thousand new permits. Table 3 shows the estimated private forest road crossings (Xings) by state based on NAFO survey numbers of crossings per acre. The expansion factor from NAFO industrial survey crossings data to NIPF¹³ crossings is set at 60% of the crossings rate shown.¹⁴

Table 3: Estimated NW Forest Road Stream Crossings (Xing)
NAFO survey 9/2011, NIPF @ 60%, Acreage Smith et al 2009

Western State	Xings per acre	Corp M Acres	NIPF M acres	Corp M Xings	NIPF M Xings	Total M Xings
California	0.025	4,603	8,600	115	129	244
Idaho/Montana	0.023	3,423	6,157	79	142	221
Oregon	0.023	5,995	5,063	138	70	208
Washington	0.025	4,905	4,901	123	74	196
Total 5 States	NA	18,926	24,721	454	414	869

¹¹ Washington State Department of Natural Resources. 2010. Forest Practices Habitat Conservation Plan Annual Report July 1, 2009-June 30, 2010. HCP Division Olympia, WA

¹² US Environmental Protection Agency. 2008. Multi-Sector general permit for stormwater discharges associated with industrial activity (MSGP)

¹³ NIPF is non-industrial private forest

¹⁴ Estimate by Rick Dunning, Washington Farm Forestry Association. Personal communication 10/7/2011

Activity Area Estimates: Most forest owners have already developed their permanent forest road network under state FPA's. New system expansions would be designed to avoid new crossings to the extent possible. Temporary area-related permitting would occur for on-going and new forestry activities requiring supplemental access. Based on industrial interviews, we assumed that any new management activity with access spurs would have temporary crossings added to the SWPPP as needed and be terminated when the activity was completed.¹⁵

Some state FPA data bases show current forest activity areas. However, annual harvest area data is sporadic and varies significantly over time. We use a stable proxy that is more consistent between states. Rate of Inventory Turnover (RIT) is an index of the physical rate of return to forestry. As the forest stocking per acre can be calculated from FIA data, the RIT multiplied by the private acreage generates a rough estimate of private acres cut annually. Forest area entered is the starting point for estimating the rate of new temporary point source site development. Table 4 is indicative rather than precise. Wide variation in RIT is caused by two factors, forest zone growing conditions, and already existing constraints in the ability of forest owners in various zones to harvest timber.

Table 4: Western States Rates of Private Forest Inventory Turnover (RIT)
Sources FIA 2009; state harvest statistics base year 2006

State	Zone	Pvt acres	Pvt Cut MMBF	Pvt Stock MMBF	RIT	Est. Acres Cut
California	All	8,717,810	1,495	161,713	0.9%	80,594
Idaho	North	2,453,014	744	28,893	2.6%	63,175
	South	714,035	58	5,445	1.1%	7,553
	All	3,167,049	802	34,338	2.3%	73,943
Montana	All	5,947,519	602	34,599	1.7%	103,482
Oregon	West	6,430,302	3,222	118,803	2.7%	174,410
	East	3,438,672	374	27,740	1.3%	46,300
	All	9,868,974	3,596	146,542	2.5%	242,161
Washington	West	5,463,722	2,342	106,200	2.2%	120,474
	East	4,064,307	445	45,706	1.0%	39,535
	All	9,528,029	2,786	151,907	1.8%	174,765
5 West States	Total	37,229,381	9,281	529,099	1.8%	653,031

South Idaho, eastern Oregon and eastern Washington forest zones have low private RIT's because they are characterized by scattered dry montane forests. Growth is slower and accumulated per acre growing stocking is light. Coastal wet temperate forests are faster growing and better stocked so their reentry cycle to any one acre is faster. California's private forests present an anomaly. They have high private per acre stocking (18.5 MBF/acre), but exceptionally low private harvest (RIT = 0.9%). After reviewing the limited number of remaining forest practices applications there, we conclude that

¹⁵ Eric Beech. Green Diamond Timber Company. Personal communication. 10/7/2011

California's existing state FPA regulatory costs may have already caused substantial land use shifts out of forestry.

Many private forest parcels are scattered in a matrix of interspersed private and public holdings. As a result, new forestry activities within an ownership usually imply access and regular transport through others. To the extent that this occurs on publically dedicated roads, drainage and crossings are the responsibility of state and county road authorities. Otherwise, forest transportation activity may require joint road use, maintenance and pollution abatement responsibility and agreements on numerous other ownerships. We use simple expansion factors for off-ownership NPDES responsibilities.

Types of Potential Negative Economic Effects:

New regulatory actions impose costs on those regulated. This analysis estimates several types of direct effects¹⁶ costs and ignores costs associated with indirect effects.¹⁷ We make the simplifying assumption that costs added to timber production would be absorbed by producers. The more complicated and realistic incidence is that some production cost changes would be passed to consumers. Measured timber demand and supply are both inelastic so production cost changes would shift market equilibria and cause welfare redistributions. We address this qualitatively following the results.

Direct effects of new regulation are largely financial. We estimate these from existing costs records and experience. These apply to all forest owners, but only to the extent that their actions would not already be covered under existing state Forest Practices Acts. These direct effects include both costs that are fixed regardless of forest size and costs that vary with size. Direct costs include:

1. Initial permitting fees are a fixed cost of the general permit, initially assumed at \$1,800 up front. That permit is ownership based so any acreage or inventory amortization of the fixed cost is a function of ownership size.
2. Operating under the general permit requires preparation of a SWPPP. It lists existing point sources and the intended handling of run-off. Preparation would be a high priority up-front regulatory cost and would vary by ownership size.
3. Existing FPA administration would have to expand for new permitting training, processes, and compliance. Smaller owners would have to hire outside expertise.
4. Each year there would be renewal fees (base case = \$500/year) and relatively fixed permit overhead maintenance
5. For existing crossings, each year inventories would have to be updated, quarterly inspections made, and reports issued. This cost would vary with ownership size.

¹⁶ Direct effects relate to costs of new regulatory activity whether in imposition or compliance. Direct effects are usually easily identifiable, often pecuniary, and lend themselves to accountancy.

¹⁷ Indirect effects (cumulative effects) are caused by changes, but not usually associated with the principal actors. Such external effects, often peripheral to policy intent, are less concrete, less clearly defined, and require provisional methods to identify and quantify them.

6. Subsequent new projects would require survey, mapping and preparation of new plans and operations permitting, administration, monitoring and inspection could be costly in terms of time demands, productivity delays and extra efforts.
7. Future costs of new temporary permitting as new forestry operations require temporary access on owned lands and crossing other ownerships.
8. However, we do not consider reinvestment in existing road and drainage infrastructure to meet point source standards because all the states analyzed have BMP's with standards that we concluded already exceed CWA requirements.

Indirect effects of new permitting exist to a currently unknown extent. These should largely be found as potential changes in the economic conditions affecting timber markets and the viability of future forest land management. Such effects include timber and timberland market shifts, price effects, redistribution of economic welfare as well as job and income effects. Although this report eventually hypothesizes some forestry behavioral responses to new permitting that would cause indirect effects, their quantification is beyond the scope of analysis.

Highlighting State Forest Practice Act Differences

State FPA's began using forestry BMP's to control silvicultural non-source point pollution and achieve forest runoff water quality soon after the passage of the CWA. While forestry activities were considered non-point sources, the EPA referenced various state BMP's as pollution reduction examples.¹⁸ Today, almost all states with significant forest management activities require that forest management activities be conducted under comprehensive BMP's.¹⁹ Most BMP's are developed and states maintain regulatory or non-regulatory BMP programs under Sections 208, 319, and 404 of the CWA in order to achieve water quality goals. Effective development and implementation of BMPs are typically unique to ecosystems within a state. They are designed by interactions of local forestland owners, loggers, state and federal agencies, research organizations and environmental stakeholders. Forest BMPs, when properly applied, reduce sediment inputs and maintain water quality.²⁰

Although not all states have FPA's, all five of the western states do. We reviewed and evaluated individual state forest practices acts (FPA's) relative to their procedures, BMP standards, and current practice. The pertinent questions include:

¹⁸ EPA maintains a reference list of over 150 documents on achieving non-point source water quality with BMPS at <http://www.epa.gov/owow/NPS/MMGI/Chapter3/ch3-4.html>. Many of these references are individual state BMP manuals.

¹⁹ National Council for Air and Stream Improvement, Inc. (NCASI). 2009. Compendium of Forestry Best Management Practices for Controlling Nonpoint Source Pollution in North America. Technical Bulletin No. 0966. Research Triangle Park, NC.

²⁰ Ice, George, Liz Dent, Josh Robben, Pete Cafferata, Jeff Light, Brian Sugden, Terry Cundy. 2004. Programs Assessing Implementation and Effectiveness of State Forest Practice Rules and BMP's in the West. *Water, Air, and Soil Pollution: Focus* 4: 143–169, 2004. Kluwer Academic Publishers. Netherlands.

1. Do state forest practice acts have BMP's already sufficient to meet point source pollution reduction objectives? If they do, we assume that no additional silvicultural activity or road standard upgrade costs would occur.
2. Does current FPA enforcement achieve BMP compliance by forest owners, or does additional EPA oversight imply the need for more stringent forest owner oversight at higher cost?
3. To what extent do internal owner administrative practices under an FPA already facilitate another layer of regulatory permitting? If limited, to what extent would owners be required to augment internal procedures for NPDES permitting?
4. Are all forest owners within a state treated similarly under FPA rules or are different types, sizes, or regional differences sufficient to change the costs of additional permitting?

Our FPA review focused on these four elements. In the process, other details emerged about the extent of forestry in these states and how existing forest regulations varied between states. A summary of FPA's by state is attached as report appendix #1.

Western states' listed BMP's were originally designed to achieve water quality consistent with CWA objectives. The various states initially established somewhat different BMP details and standards. This was due to political differences in water quality issues and physical differences in ecotype and topography that varied riparian area definition and quantification. We found that all of the western FPA's have been revised since the adoption of the Endangered Species Act (ESA) to also consider federal endangered fish habitat requirements. Typically, these define even higher water quality and more stringent BMP's tied to specific habitat standards. The two most pervasive habitat layers are the PacFish anadromous fish requirements that affect all of the coastal states and the upper Columbia River basin ecosystem that covers most of the inland northwest except Montana. The western interior waters (including Montana) are mostly subject to bull trout recovery habitat requirements.

We reviewed individual state FPA's to determine whether we could assume that western BMP's established to achieve non-point pollution objectives would also meet point source objectives. We conclude that current BMP's do. As to BMP compliance rates, the lowest state rate found is 97%. This is uniformly high enough to assume that existing BMP's specifications are widely adhered to. We could find no rationale to tabulate additional costs associated with upgrading current BMP's specifications. If it were found elsewhere that western revised BMP's would not meet point source CWA standards, there would be substantial additional BMP costs that would have to be added to our permit administration and compliance cost estimates.

The need to augment existing FPA procedures to achieve NPDES permitting and compliance depends on each state's FPA requirements. We lumped western FPA's into two basic types. These are "procedural" and "notification" FPA's. The distinction can be misleading. All western FPA's have a legal basis in their respective state codes. All forest owners are required to comply with the BMP's specified. Our distinction between FPA

types depends on the intensity of existing processes and extent of documentation already provided by forest owners with regards to hydrologic reporting and/or permitting.

California, Oregon and Washington have procedural approaches. Two have formal applications to engage in activities. Oregon actually has a “notification” format, but is otherwise highly procedural. All three have rigorous FPA’s such that forest owners there would have almost all of the overhead requirements in place that could be applied in a duplicative manner to NPDES permitting. Idaho and Montana have notification FPA’s. They typically require forest owners to notify the state of impending activity and employ audit sampling to measure compliance. Documentation, mapping, reporting practices vary significantly by owner with large industrial firms having similar overhead to the process FPA states. We expect that small forests’ costs of upgrading internal compliance procedures to apply for and comply with NPDES permitting would be even higher.

Ownership Scale Cost Differences

Based on the assumed structure of general permitting costs, we expected to find that different owners operating under the same state FPA might have different NPDES point source permitting compliance costs. Our hypothesis is that extra costs of NPDES permitting is ownership size dependent with larger ownerships having measurable economies of scale, i.e. more capable of absorbing additional costs. In order of expected influence, the reasons include:

1. The smallest forest ownerships have few active forest management objectives and little incentive to engage in activities requiring permitting. NWOS²¹ findings indicate that propensity to include timber management among multiple objectives rises with ownership size.
2. Smaller forest ownerships could have exponentially higher per acre fixed permitting costs effects due to having a smaller amortization base for general permit fees and other fixed costs; and
3. Smaller forest ownerships would have less administrative permitting economies of scale for variable costs because:
 - a. They have less in-house dedicated technical expertise and would have to hire a variety of trained personnel capable of administering the permitting requirements for both fixed and variable activities, and
 - b. Where larger landowners typically have required more-detailed management plans in place, smaller owners may have less existing data about their own crossings, less data management and existing GIS mapping, and require more augmentation of internal procedures.
4. Some existing state forest practices acts (FPA’s) have differing subregional BMP’s or compliance regulations so that NPDES permitting costs could vary by ownership type.²²

²¹ NWOS is National Woodland Owner Survey. Description and data base are available at <http://www.fia.fs.fed.us/nwos/>

²² Both Oregon and Washington have “east-side” FPA variants

Modeling based on ownership size categories incorporates the first three factors above. Factor one is represented by a timber management probability function to adjust the number of existing forest road sites requiring permitting. Small ownerships have less than a 10% probability of active timber management. The participation rises rapidly as a logarithmic function of acreage until ownerships above 100 acres have about 60% participation rates. Above 750 acres the function becomes asymptotic to 100%.

To address factor two, as ownership size rises, we divide fixed costs by ownership size to identify extreme differences in per acre amortized fixed costs as a function of size. Finally, factor three is addressed two ways: (1) lower productivity rates in meeting permitting requirements and higher variable expenditures in planning and compliance activities as outside expertise is hired to handle regulatory and monitoring efforts. We have no way of testing factor four with the currently available data.

Each western state has significant private forestry acreage. This distinction was evident in table 1 showing that private forest ownership ranges from 11.9% of all forests in Idaho to 44% in Washington. The private forests' economic importance is even higher when their relative harvest contribution is considered. Using 2006 as a reference year, the private forests provided more than half of the annual harvest, ranging from 52% in Montana to 60% in Oregon.²³

There are a wide variety of private forest landowner ship types and sizes. Typically, each state has a few large landowners whose ownerships are measured in tens, or hundreds, of thousands of acres. These include a rapidly declining number of vertically integrated forest products companies, as well as the newer ownership structures replacing them. These include: timber investment management organizations (TIMO's) and real estate investment trusts (REIT's). Then there are numerous non-industrial forest ownership types. These vary widely in types, objectives and sizes. Types include: single proprietors, partnerships, estates and various trusts.

Distinctions between industrial and non-industrial ownership types are less relevant in NPDES permitting than the positive economies of scale that might be enjoyed by larger private ownerships of any type. We find this to be true in most dimensions that we checked. As a result, ownership size became an important variable. Resultant cost estimates are not simple rates, but are instead rate functions of acres owned.

Data on private ownership sizes comes from a reference²⁴ where ownership characteristics are defined slightly differently than federal forest survey statistics. Rather than a corporate/non-corporate labeling, it is industrial/non-industrial. There is some ambiguity about the contemporary labeling of large REIT's. Still, as shown in table 5, each state has large non-industrial ownership size variability.

²³ Compiled from Smith, et all. 2007. opus cit and individual state private harvest reports.

²⁴ National Forest Ownership Survey opus cit.

Table 5: Western State Non-Industrial Forest Acres by Ownership Size
In 1000's acres, source National Forest Ownership Survey

Western State	NIPF Total	0 to 49 acres	50-99 acres	100-499 acres	500-999 acres	1000-4999 acres	> 5000 acres
California	7,912	1,575	831	2,092	1,041	1,604	768
Idaho	1,186	178	178	534	178	59	59
Montana	3,628	654	297	952	535	892	297
Oregon	4,329	1,445	259	937	418	855	416
Washington	2,680	1,399	300	554	204	201	23
Total	19,735	5,251	1,865	5,069	2,376	3,611	1,563
% of Total	100%	27%	9%	26%	12%	18%	8%

The concentration of non-industrial acreage as smaller size ownerships is obvious. A significant 62% of this ownership category is less than 500 acres. These are typically sole proprietor and family forests that: (1) have higher priority non-timber objectives, (2) have timber management plans that are cursory, and (3) harvests occurring infrequently. This small forestry subsector should be expected to react to increased regulatory process and costs differently than larger forest owners would.

An overview of the adoption of California's strong procedural FPA²⁵ showed that these ownership sizes had two typical reactions to expensive new FPA requirements: (1) more intensive timber liquidation when infrequent harvesting did occur, and (2) significant reorientation of the properties to alternative uses including accelerated real estate development. Imposing costly regulatory constraints has already reduced private forestry there. They have about seven times the NIPF forest acreage as Idaho, but now cut less than two times the annual harvest from it.

Identifying Cost Categories and Input Specifics

Expected new NPDES permitting costs are both fixed and variable. Fixed costs are invariant with ownership size and variable costs are those which change with ownership size and the level of forestry and road system activity. These cost types occur either as single up-front expenditures or are annually recurrent. Within each of the cost type permutations are numbers of individual expected costs. Our four primary cost categories follow with examples of their dominant elements.

1. **Upfront fixed costs:** general permit cost, initial owner training, process design
2. **Upfront variable costs:** management planning, SWPPP, internal administration and reporting existing sites

²⁵ Gasser, Donald P. 1985. Impacts of forest practice regulation in California. *In: Forest Operations in Politically and Environmentally Sensitive Areas, Proceedings of the Council of Forest Engineering, Tahoe City, CA. ASAE Proceedings, UC Davis, CA.*

3. **Annual fixed costs:** recurrent training, annual reporting, permit system maintenance
4. **Annual variable costs:** new activities inclusion, termination, quarterly monitoring, reporting,

Upfront fixed costs are dominated by general permitting costs, and to a lesser extent training. Our baseline scenario expects that point source permitting would be based on a general permit for an ownership. In addition there would be an annual fixed cost for a nominal annual permit renewal fee. Such fixed costs have to be amortized over a forest's ownership size so the ratio of fee to acreage becomes a critical element.

Unfortunately, there is no clear standard for the new forestry point source general permit fee. Reference points for the general permit fee can vary radically. In an Oregon system, industrial general permit application fees range from \$470 special permits to \$49,311 for a tier 1 pulpmill permit. Annual fees for wood products range from a tier 2 sawmill's \$ 2,744 to \$ 17,242 for a tier 1 pulpmill.²⁶ Individual construction fees are much lower, for example a stormwater fee affecting more than 1 acre is \$782 application fee with an \$804 annual fee.²⁷ However, we hypothesize instead a low general permit default value of \$1,800 fee with a \$500 annual renewal fee. We had extrapolated our base case fees from Oregon and Washington NPDES fee schedules for industrial sites related to forest products and then adjusted them after consulting forest industry representatives from the various states.²⁸

Other costs, both upfront and variable, are for internal procedures that tend to be labor oriented. To facilitate the costing process, we look at the individual cost elements in human productivity terms. In other words, how long would it take technologically trained personnel to complete specific tasks? In some cases, there are crosschecks as in SWPP plan preparations that are currently contracted out in other sectors.

Two forest main ownership characteristics affect the type and extent of expertise needed to apply for, maintain, and comply with new point source permits. The first distinction, ownership size, has already been discussed and we separate private forests into large ownerships (>10,000 acres) and small ownerships (<10,000 acres). This affects permitting labor and resources such that large ownerships typically have in-house expertise whose responsibilities grow marginally. Large forest ownerships would have internal expertise, Small ownerships are prone to hiring consultants to provide even basic forestry services, and now would have to contract for outside NPDES permitting. However, rather than make point estimates on only two ownership scales, we calculate a cost as a function of size relationship.

Productivity rates of the same type personnel would vary by the size of the task. In addition, notification FPA states sometimes have less required documentation, There, new NPDES permitting requirements would be a larger job that takes more time. For

²⁶ <http://www.deq.state.or.us/WQ/rules/div045/indvindpermitfees.pdf>

²⁷ <http://www.deq.state.or.us/WQ/rules/div045/genpermitfees.pdf>

²⁸ NAFO western guiding committee conference call 10/14/2011

example, Idaho and Montana’s FPA harvest notifications do not require GIS mapping of perimeters or roads. However, we expect that the SWPPP of point source permitting would require mapping of every included crossing. Appendix #2 is a matrix of our assumed labor production rates for various tasks under each variant—ownership size and FPA type.

Each cost parameter’s entry is either a set price (such as a fee) from a schedule or a computed cost for a specific regulatory compliance task. In the latter case, there is a production rate element measured in days to accomplish or units of accomplishment per day. These production rates are converted to daily accomplishment estimates and multiplied times the appropriate wage rates and necessary equipment costs. In some cases such as training, a per diem charge is included, or travel costs added.

Forestry consultants in the Northwest typically charge \$520 to \$600/day plus mileage.²⁹ Specialized services such as GIS mapping or a hydrologist can be more.³⁰ A typical SWPPP development service might cost \$15 to \$25 thousand for a large forest.³¹ There are numerous other appropriate wages utilized. For example; general operations managers make \$113/year, environmental engineers are \$83 thousand, foresters are \$56 thousand, and hydrologists \$89 thousand.³² In addition, we add 20% overhead to these representative figures to conservatively account for benefits and various employment taxes.

An Analytical Aside--Cost Amortization Across Ownership Size

As fixed upfront costs are invariant with ownership size, amortizing them over an ownership acreage base generates a steep hyperbolic per acre cost function. This predetermines that small forest ownerships would have a large per acre regulatory burden, but that the costs per acre would become asymptotic and closer to zero with increasingly large acreages. For example, just as an assumed EPA general permit fee drops from \$1,800/acre for 1 acre, a 100,000 acre parcel would have an amortized general permit fee of less than \$ 0.02/acre. Figure 1 shows the amortization patterns by ownership size for several levels of initial permit fees.

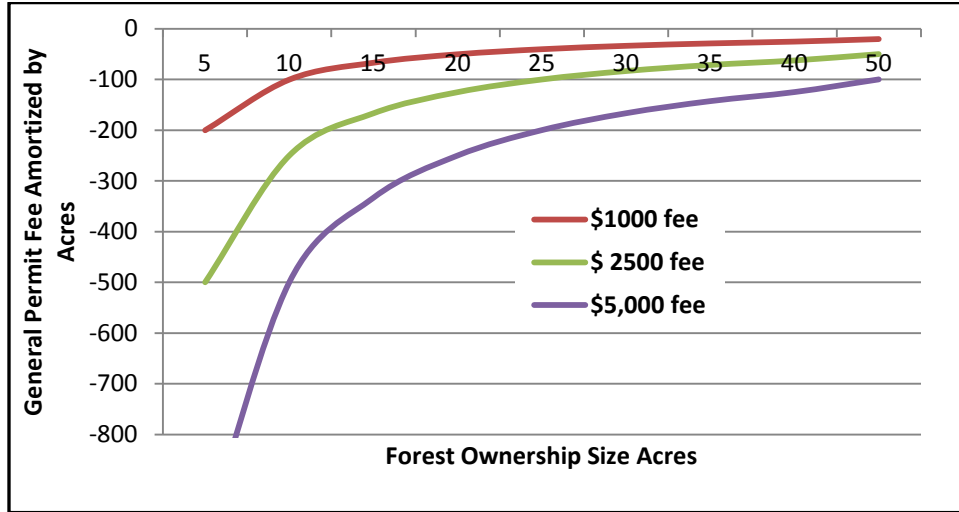
²⁹ Greg Bassler. 9/14/2011. Partner. Northwest Management Consulting Foresters. Moscow, ID. Personal communication.

³⁰ Rubix Environmental Inc. personal communication 10/14/2011

³¹ Forest industry cost references personal communications.10/14/2011.

³² Bureau of Labor Statistics (BLS). Occupational employment statistics.
http://www.bls.gov/oes/current/oes_nat.htm

Figure 1: Hyperbolic Form of Acreage Amortized General Permit Fees

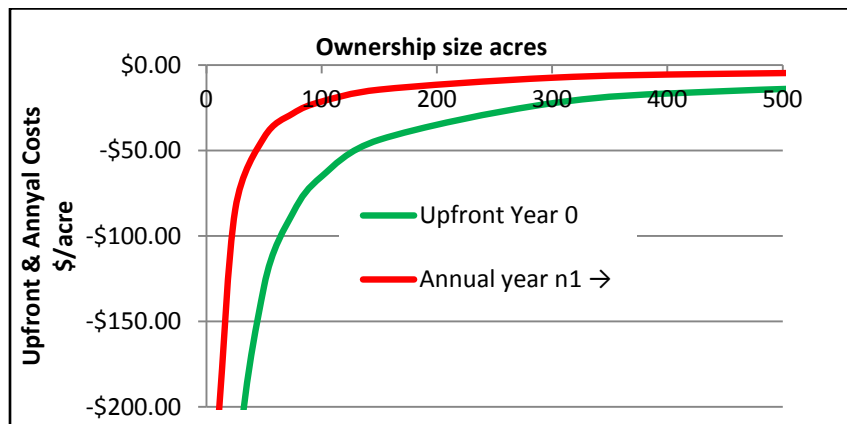


Variable costs are driven by increasing compliance responsibility on larger ownerships coupled with proportionally larger sets of regulated activities. The initial point sources must be managed and serviced every year.

Resultant Permitting Cost Streams—An Income Effect

Every private forest would pay upfront costs (e.g. fees and SWPPP) and every year a compliant ownership would also have to pay annual costs (e.g. training, administration, monitoring etc.). The size of year_n costs would reduce year_n income accordingly. NPDES permitting cost effects are functions of ownership size, and between 0 and 400 acres there are significant differences (figure 2). Although the curves look similar, the upfront costs occur only once. Even though the annual costs look smaller, they are paid every year. Mathematically that makes their overall impacts several orders of magnitude higher.

Figure 2: Permitting Costs by Frequency and Ownership Size



As evidenced by the examples above, the complicated form of the results requires some simplification to aid in drawing conclusions. Three ownership size point examples of calculated per acre cost effects by cost incidence and indicative ownership sizes are shown in table 6.

Table 6: Calculated Per Acre Permitting Cost Examples by Ownership Scale examples, Cost Frequency and State

Western State	100 acre up front	100 acre annual	300 acre up front	300 acre annual	10 K acre up front	10 K acre annual
California	-\$63.09	-\$21.43	-\$21.58	-\$7.49	-\$1.54	-\$1.29
Idaho/Montana	-\$71.35	-\$21.43	-\$24.80	-\$7.50	-\$2.00	-\$1.30
Oregon	-\$63.05	-\$21.43	-\$21.52	-\$7.49	-\$1.50	-\$1.28
Washington	-\$63.09	-\$21.45	-\$21.58	-\$7.53	-\$1.51	-\$1.31
5 State Mean	-\$65.15	-\$21.44	-\$22.37	-\$7.50	-\$1.64	-\$1.30

Upfront costs include both fixed (not scale dependent) and variable (scale dependent) costs that occur only once in the application and granting of the general permit and setting up the internal compliance procedures. The annual costs are the sum of recurring fixed costs and variable costs that should happen every year in a sustainable forest ownership. Although the 25 acre size relative costs appear to be enormous in the figure, these small forests are often not timber producers and may have no permanent crossings. A 100 acre ownership may be associated with intermittent harvests but few system crossings. A 300 acre forest is of sufficient scale that could represent a pre-regulatory family economic unit based on forestry and is likely to have a permanent road system with crossings. The 10 thousand acre scale could be either large NIPF or small industrial REIT. Per acre cost streams for even larger ownerships do not vary substantially from the 10 thousand acre example shown.

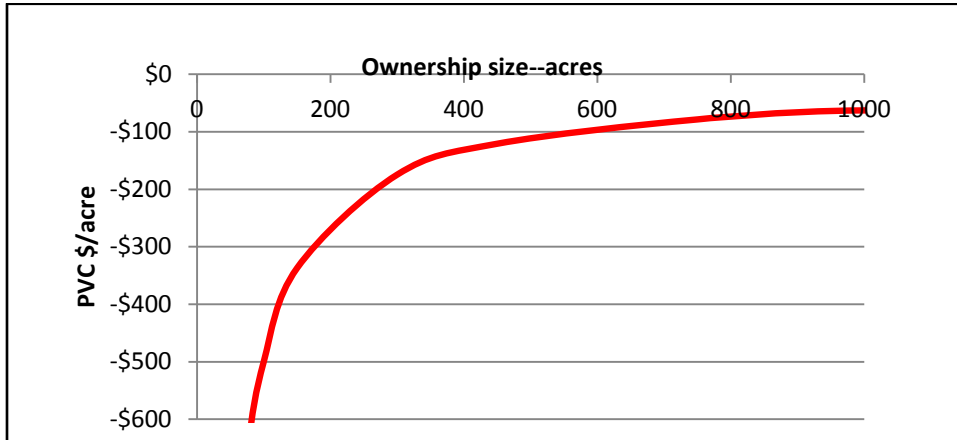
There are only small differences between the procedural and notification FPA states. These differences are based almost entirely on estimated task completion differences. Not shown are the 25 acre ownerships (\$217 upfront, and \$85 annual) where the costs are dominated by the amortization of fees and SWPPP costs. This effect declines with size so that by 100 acres, the ownership size class differences across all states are based mostly on task diseconomies of scale.

Discounted Inter-temporal Costs—A Wealth Effect

Inter-temporal costs are not directly additive. Our analysis converts the cost streams calculated above into their equivalent present values. As permit cost item timing is either time zero or annual, the resultant present value of costs (PVC) is the sum of undiscounted upfront costs and a discounted perpetuity. The aggregate cost streams are more easily represented as single present value of costs estimates for each size class. The example given in figure 3 is based on the Idaho/Montana notification FPA calculations. In discounting, the time zero fixed and variable cost sums are simply added in without

adjustment to the present value of the annual fixed and variable cost perpetuities. The size of this wealth reduction is often called “regulatory loading” or “regulatory burden.”³³ In this case it refers to a net cost effect of a single additional regulation.

Figure 3: Present Value of Per Acre Permitting Costs by Ownership Size



This ownership size effect is mainly driven by the cost amortization problem and the task achievement diseconomies. Notice that PVC goes asymptotic after 600 acres. That explains the small differences in regulatory loading estimates between the procedural FPA states and the notification FPA states at for the largest ownership sizes in table 7. This is partly caused by the assumption that larger forests in notification states would have most of the permitting documentation in place for normal management purposes.

Table 7: Present Values of Permitting Costs by Ownership Scale

FPA Type	25 acre cost/acre	100 acre cost/acre	300 acre cost/acre	10,000 acre cost/acre
Procedural	-\$1,941	-\$492	-\$171	-\$27
Notification	-\$1,972	-\$500	-\$175	-\$28

A particular utility of regulatory cost capitalization is that the PVC can be deducted directly from the preregulation market value of a capital asset to predict a post-regulation effective asset value. This simplistically assumes a unique marginal change. However, any system-wide regulation costs that affect all forests would certainly affect timberland market equilibrium. This calculation is discussed further in the dynamic behavioral response section.

³³ The cost involved in complying with regulatory requirements, collecting taxes and responding to information demands from government.

Aggregate State and Regional Permitting Costs

NWOS identifies seven ownership size categories for NIPF ownerships and estimates the acreage in each category by state. We find aggregate state permitting costs by multiplying the category midpoint acreage by the cost function value for that acreage. This creates a step function of regulatory loading by size class. Using the midpoint value of each category step actually understates the average per acre regulatory loading. For example, a \$1,500 per acre value of a 25 acre midpoint for the 0-49 acre ownership class severely understates the \$4,400 loading of the many 10 acre parcels and slightly overstates the \$450/acre loading of the fewer 49 acre parcels. For lack of size distribution data in industrial ownerships, that sector expands by the costs for an assumed 20 thousand acre midpoint value. This arbitrary representation is not critical because the ownership size PVC function is relatively flat above 10 thousand acres.

In wealth effect terms, aggregate regulatory costs are significant at the regional level as shown in table 8. The base case scenario aggregate regional wealth effect of \$13.1 billion is almost as large as a worse case scenario wealth effect of \$ 17.7 billion (discussed in the sensitivity analysis section). These aggregate regional effects can also be expressed in income effect terms as an annual equivalent cash flow. Using a 5% discount rate, this equates to annual costs of \$654.4 million/year to \$883.3 million/year respectively.

Table 8: Aggregate Capitalized Permitting Costs by State and Ownership Size

Western State	Private Acres in 1000's	Total PV Costs in \$1000's	Large Owners in \$1000's	Small Owners in \$1000's
California	12,515	-4,247,066	-210,290	-4,036,776
Idaho	2,416	-600,193	-23,651	-576,542
Montana	5,821	-1,806,734	-111,270	-1,695,464
Oregon	10,324	-3,325,382	-159,356	-3,166,026
Washington	7,585	-3,107,752	-85,193	-3,022,559
5 State Totals	38,661	13,087,127	-589,760	12,497,367
Totals/acre	NA	-\$339	-\$31	-\$633

The large forest ownership (>1000 acres) estimate of \$590 million is likely to be an appropriate measure of the regulatory wealth loss to forests that are regularly and actively engaged in timber production. The largest and most obvious impact is \$12.5 billion (95.5%) that accrues to smaller forest ownerships even though they account for only 37.7% of private forest acreage. They have huge per acre capitalized costs because of their small amortization sizes, but this impact estimate could easily be misinterpreted.

Calculated small ownership regulatory loading is huge, but potentially misleading. Almost \$8.9 billion of this effect is concentrated in the 5.3 million acres of the 1 to 49

acre ownership size class. In other words, it is highly concentrated on many small family forests that are not now regularly engaged in timber management. They typically have multiple objectives that only peripherally include timber harvesting.³⁴ Their road and crossings systems are not highly developed nor heavily used. Probably of more concern are the 6.9 million acres of the 50 to 499 acre ownerships that more frequently harvest timber. A regulatory burden of \$1.7 billion for those size classes has the potential to radically change their forest management.

The small ownerships' large apparent impacts should be adjusted by their propensity to generate measurable point source runoff, but there is no obvious metric for doing so. The more appropriate approach would be to have a permit system that flexibly adjusts to a small ownership's much lower silvicultural activity levels. One such alternative is explored in a subsequent analysis of permit system design sensitivity.

Another variability is seen between individual states' aggregate cost impacts. This ranges from \$0.6 billion (Idaho) to \$4.2 billion (California). Most of the gross variability is caused simply by differences in each state's forest acreage. The two notification FPA states (ID and MT) have lower aggregate total costs because they have small private forestry sectors, even though they had higher per acre costs. Conversely, the individual states' per acre wealth losses vary significantly between \$17 (Washington) to \$51/acre (Montana), and that variability is caused by differences in each state's large to small ownership proportions.

Sensitive Assumptions—Permit System Specifications

Any analysis is only as good as the data and assumptions that it is based on. This early in the regulatory development process, there is no concrete evidence of actual regulatory fees, procedural form or requirements. The definition of a permitted site, the fee structure, and the application and compliance requirements remain nebulous. Our specification of a base system scenario is a composite guess compiled from numerous agency and industry representatives. To address the sensitivity of this totally hypothetical system structure, we created two alternative system scenarios, a worst case rigid specifications system and an ownership size sensitive system.

Worst Case: The worst case scenario is characterized by a higher fees, costly SWPPP preparation, application fees, and permitting and monitoring of all crossings. The upfront general permit fee is \$10 thousand for all owners. There is an additional fixed cost of SWPP planning of \$2 thousand. SWPP variable costs are higher because more time is allotted to inventory, map and write prescriptions for individual crossings. Setting the crossings monitoring rate at 100% significantly increases annual costs particularly for larger ownerships.

³⁴ A 2006 survey representing 47 thousand Idaho family forest owners found only 3 thousand owners who included timber in their forest objectives lists. Other western states have similar proportions. National Woodland Owners Survey <http://www.fia.fs.fed.us/nwos/>

The most interesting comparison is the relative effect on larger ownerships (table 9). Smaller ownership results are shown later in a three case comparison. The worst case has significantly higher negative income and wealth effects. Less of this is due to the higher fees than to the worst case requirement to fully monitor all crossings instead of a representative 5%. Even larger ownerships (50K+ acres) have slightly lower negative per acre effects.

Table 9: Worst Case Comparison for 10K Acre Ownerships

System Scenario	upfront \$/acre	annual \$/acre	PVC \$/acre
Base Case	-\$1.64	-\$1.30	-\$28
Worst Case	-\$3.43	-\$3.89	-\$114

Size Sensitive Case: In the base case results we observed extreme regulatory loading for small ownerships. The big factor is that they have little acreage base to amortize fixed costs over. In addition they have diseconomies of permitting compliance including the need to hire outside expertise for SWPPP preparation and annual tasks. Wage rates are higher and for each task a lower accomplishment productivity rate recognizes the extra time to prepare and package widely dispersed small parcels.

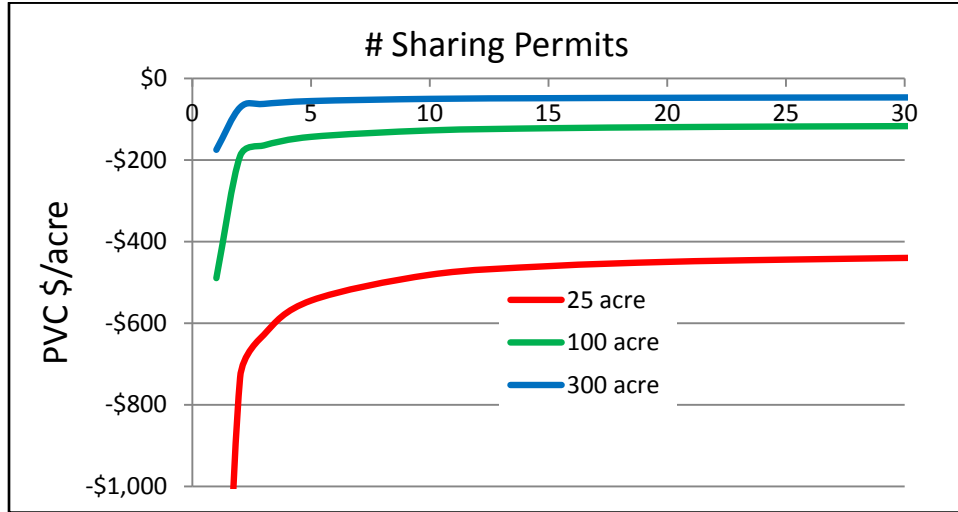
Small ownership permit accommodation allow for a permit holding host to service multiple small ownerships. Shared permit assumptions radically change the magnitude of regulatory loading for these forests. Table 10 compares average upfront and annual per acre permitting cost figures for several of the smaller ownership size classes. It doesn't take much permit sharing to significantly reduce upfront and annual fees effects per owner. More than 25 owners sharing a permit only lowers fee amortization a little more. Permit sharing does not offset the other small owner diseconomies of having to hiring outside NPDES compliance services.

Table 10: Shared Permitting Upfront and Annual Costs

Owners per Permit	25 acre up front	25 acre annual	100 acre up front	100 acre annual	300 acre up front	300 acre annual
1	-\$281.95	-\$84.51	-\$61.15	-\$21.44	-\$24.80	-\$7.50
2	-\$166.65	-\$28.35	-\$42.53	-\$7.39	-\$15.19	-\$2.82
5	-\$97.47	-\$22.35	-\$25.23	-\$5.89	-\$9.42	-\$2.32
10	-\$74.41	-\$20.35	-\$19.47	-\$5.39	-\$7.50	-\$2.15
25	-\$60.57	-\$19.19	-\$16.01	-\$5.09	-\$6.35	-\$2.05

Figure 4 shows that this same effect occurs in regulatory loading (PVC/acre). PVC values taper off quickly with increasing ownership size, but the small scale diseconomies still imply high regulatory loading for ownerships smaller than 100 acres.

Figure 4: Small Forest Regulatory Loading with Shared Permits



Comparing all three case scenarios, the highest regulatory cost burden is always in the smallest ownership classes. This is visible in both the income and wealth measurement indicators (table 11). The worst case has very large negative income effects on these ownership classes. The base case greatly reduces the impacts, mostly because there is less upfront cost to amortize. Allowing these ownership classes to share permits and contracted expertise under the base case fee structure has a huge effect.

Table 11: Comparative Cases Upfront and Annual Permitting Costs

System Scenario	25 acre upfront	25 acre annual	300 acre up front	300 acre annual	750 acre up front	750 acre annual
Base Case	-\$258.35	-\$84.51	-\$22.37	-\$7.50	-\$9.66	-\$3.39
Worst Case	-\$639.92	-\$82.85	-\$57.42	-\$12.77	-\$26.43	-\$10.14
Size Sensitive Case	-\$53.65	-\$18.55	-\$5.77	-\$2.00	-\$3.41	-\$1.19

The aggregate PVC magnifies the differences in the wealth effect (table 12). The worst case carries a similar small ownership bias as does the base case for the smallest size classes. Widespread confiscation or management redirection would be expected under either. Permit sharing reduces the wealth effect significantly, but the loading remains oppressive on the smallest forests.

Table 12: Comparative Cases Regulatory Loading (\$PVC)

System Scenario	25 acre PVC	300 acre PVC	750 acre PVC
Base Case	-\$1,972	-\$175	-\$79
Worst Case	-\$2,291	-\$299	-\$212
Size Sensitive Case	-\$431	-\$46	-\$27

Sensitive Assumptions—Input Parameters

Our analysis has been based on reasoned approximation of many indeterminate or approximate input variables. Under such conditions it is prudent to perform a sensitivity analysis of those parameters that could be influential.

In this section, we make permutations of one of the higher estimated cost regions in the base case scenario. NPDES point source permitting was found to be more costly for the notification FPA states, Idaho and Montana. In these calculations, small changes would have the largest visible influence.

The sensitive variables are chosen based either on their initial magnitude, the degree of estimation confidence, or their expected degree of influence. The tested cost categories and their reasons for consideration include:

1. **General permit fee**—the actual level is unknown. Our default is \$1,800 upfront with a \$500 annual fee. Actual fees could vary in future regulations. Hyperbolic acreage amortization makes this assumption critical for smaller ownerships.
2. **Discount rate assumption**—although the default of 5% real cost of capital is common in forestry investment calculations, this is the expansion base for an exponential relationship and can have large effects.
3. **Water crossings (Xings) per acre**—This is a NAFO industrial survey variable that has almost no variability leading to concerns about its precision. As this coefficient drives long-run activity rates, the effect could be mildly exponential.
4. **Labor compensation rates**—although there is potential estimation error in average forest sector wages, responses to these coefficients tend to be linear.
5. **Task production rates**—tasks include application, SWPPP creation, GIS mapping, monitoring and termination activities. Labor productivity rates are based on expert, but anecdotal estimates. There is potential for large error, but the effect is mostly linear.
6. **Monitoring & inspection representation rates**—Some industrial point source permits and municipal general permits allow for representative site sampling. This rate influences variable annual costs.

Generally we tested per acre cost reactions to a 10% increase in the specification of tested parameters. The corresponding percentage change in estimated costs yields information

about how critical the input value assumption must be. The results responses in table 13 are for a small (100 acre) and a larger (10,000 acre) private indicator forest situation.

Table 13: Permit Cost Assumptions Sensitivity by Ownership Size

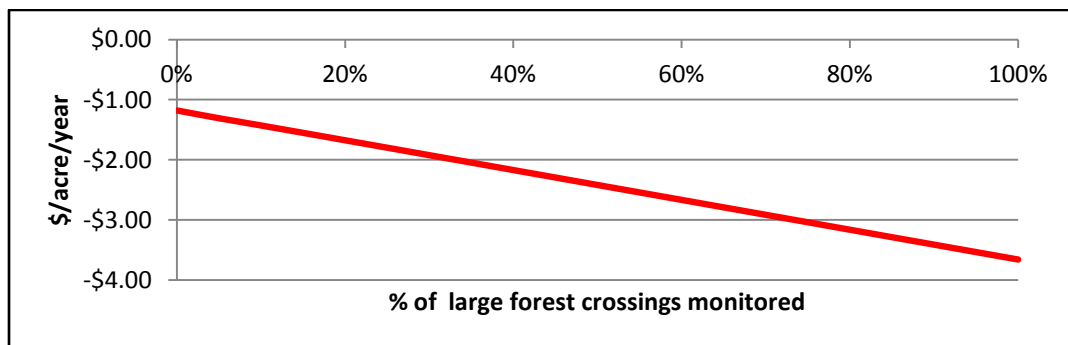
Sensitive Variable Tested	Default Value	test Δ scenario	100 acre PVC/acre	% Δ Small Forest	10,000 acre PVC/acre	% Δ Large Forest
All Values @ Default	Unchanged	NO Δ	-\$500	0.0%	-\$28	0.0%
General permit fee	\$1,800/\$500	\$1,980/550	-\$502	0.4%	-\$28	0.0%
Discount rate	5.0%	5.5%	-\$461	-7.8%	-\$26	-7.1%
base Xings per acre	0.023	0.025	-\$501	0.2%	-\$29	3.6%
Labor compensation	multiple	up 10%	-\$529	5.8%	-\$31	10.7%
Labor production rates	multiple	up 10%	-\$500	0.0%	-\$28	0.0%

As expected, the most sensitive variable for both large and small owners is the discount rate. The small owner sensitivity to the 10% reduction of the large general permit fee is low because the per acre amortization at the reference size of 100 acres is only \$1.80/acre. As it is an upfront cost, it is undiscounted. With the low crossing monitoring rate of the base case, monitoring productivity rates are insensitive. Larger owners are more affected by labor wage changes.

Monitoring intensity is such a sensitive assumption that we display it separately. The base case scenario assumes that annual monitoring only requires actual measurements at a representative 5% of all crossings. Increased monitoring costs for small forests (100 acres) are small relative to their large overhead costs measured as \$/acre/year. For large forests crossings monitoring could become a substantial component of annual costs if the degree of representation were to increase.

Small forests' annual costs with zero monitoring are \$21.29/acre. This rises to \$24.02/acre at 100% monitoring (\$0.27 per 10% rise). Large forests (>10,000 acres) have significant economies of scale for overhead, but monitoring intensity requirements (figure 5) have proportionally higher impacts.

Figure 5: Large Forest Annual \$/acre Costs by Crossings Monitoring Intensity



Annual large firm annual costs would be \$1.18/acre at zero monitoring. Even though there are only 0.025 crossings per acre depending on state, extra monitoring is relatively expensive at our expected accomplishment rates. A hydrology tech only measures above and below soil movement (or turbidity at the class 1 sites) at the rate of 18/day (3 crossings/hour plus 2 hours travel/day). The estimated rate is cut in half for the required storm conditions monitoring. Although monitoring intensity increases annual per acre costs at almost the same rate (\$0.25 per 10% rise) as in small forests, the large forests' \$/acre/year cost at 100% monitoring is over three times their cost at 0%.

One analytical assumption had such a large influence that we examined it separately and eventually deleted it from all scenarios. Originally, we had assumed that continued silvicultural activity would expand the number of permanent crossings slowly over time. Depending on the state we used rates of 1.8 to 2.5% from measuring the rate that their private forests sustainably cycle through their acres. The present value cost for recurrent variable costs takes the mathematical form of a growing perpetuity.³⁵ Table 14 shows the enormous effect of a permitting expansion assumption. After several industrial interviews, we found that firms are not actually expanding permanent road systems. We replaced this assumption with an analysis based on adding new crossings for silvicultural activity at the turnover rate and terminating them at the same rate.

Table 14: Testing the Annual Permitting Expansion Effect

State FPA Type	PVC with expansion \$/acre	PVC w/o expansion \$/acre	Assumption Influence % Δ
Notification FPA	-\$263	-\$148	43.7%
Procedural FPA	-\$157	-\$109	30.6%

Forest Owner Responses to Regulatory Costs

Much of the cost function discussion above presumes simplistically that regulatory burdens are decision neutral, e.g. imposition of new costs does not affect resource inputs or product at the intensive production margin. That implies that no forest owners would change forest or road practices activity or intensity in response to additional costs. In addition, there would be no shift of acres out of forest use. Those assumptions served to simplify an analysis with many components and emphasize the basic effects. However, in reality, if significant new production costs were imposed, such decision neutrality is overly simplistic and is an unlikely assumption.

Newly regulated timberland owners are quite likely to change production/investment decisions to optimize remaining net profitability under new regulatory constraints. Fixed

³⁵ Financialformulas.net. 2011. Present value of a growing perpetuity is calculated as a ratio of the first annual payment over the discount rate minus the rate of payment growth. In this case the rates are in real (uninflated) terms.

cost avoidance might stimulate forest ownership concentration for those sites remaining within forest uses or forest fragmentation caused by land use shifts away from the regulated uses. Variable cost avoidance could change an ownership's silvicultural investment rate particularly in regard to standing inventory. Higher transportation development costs would require more intensive harvest practices and higher initial volume removals to justify them. The immediate inventory turnover rate might be bumped up to unsustainable levels, with subsequently fewer intensive management practices and eventual private harvest reductions. In addition, the optimal technology of transportation systems should change to increase drainage avoidance and reduce crossings.

Quantifying silvicultural responses would be an interesting exercise, but it is complex and beyond the scope of this analysis. However, even if the simplifying assumption is made that individual site silvicultural intensity would be unaffected, the extent of land use responses can be identified and predicted to some extent. Capitalized regulatory costs can be compared directly to pre-regulation asset values to demonstrate two effects. The first is a theoretical one that is unlikely to occur in reality, but the second is quite likely for some forest ownerships and could be significant in the aggregate.

Regulatory land confiscation would occur for those capital assets whose post-regulatory capital value (the land rent) becomes zero or negative. The problem is determining bare forest land value as it varies by productivity, markets, interest rates and cost environments. Often reported forest land values are preferential set values for forestry in current use property taxation.³⁶ A check of all coastal state forest tax valuations showed similar tendencies. For demonstration purposes, we use North Idaho good quality land that has a reported tax value computed as \$518/acre.³⁷ It is may be representative of market values as it is based on a Faustmann SEV calculation.³⁸ For comparison, medium productivity Washington Douglas-fir timberlands under conservative management and capitalized at 5% is reported at \$756/acre.³⁹

The confiscation point and post-regulatory land values behavior shows up well in the cost curves for Idaho, one of the non-regulatory FPA states. However, the optimal ownership scale is quite large. Large ownership post-regulatory values tend to keep rising slowly with size as the cost burden becomes asymptotic. Figure 6 shows the pattern of post point source regulation land values for the most productive forests in the Inland West. The horizontal line is pre-regulatory bare land value. The lower curve is the PVC function. The middle curve is the post-regulatory bare land value. This curve goes negative below 66 acres—the confiscation point.

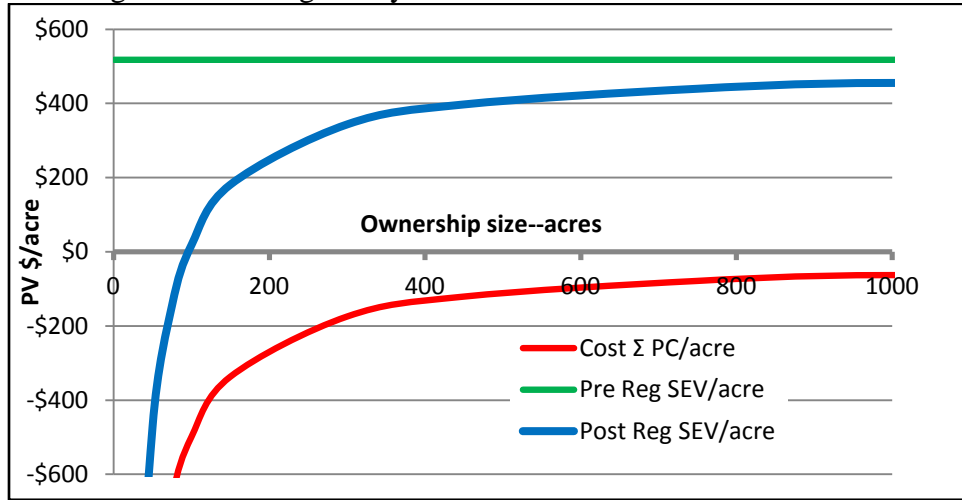
³⁶ The official timberland property tax valuations in all three coastal state timber tax agencies appear to have artificial values well below soil expectation value (SEV) estimates.

³⁷ Idaho Tax Commission. 2011. Forestland Taxation Law. Information pamphlet of 5/24/2011. 3 pp.

³⁸ SEV is soil expectation value a proxy for bare forest land value based on the discounted cash flow from an infinite series of identical timber rotations.

³⁹ Zobrist, Kevin. 2005. Economically Sustainable Working Forests: Financial Analysis Principles and Applications. U of Washington, Seattle. Rural Technology Initiative. 16 pp.

Figure 6: Post-regulatory Notification FPA Forest Land Values



As per acre regulatory cost burdens are extremely ownership sensitive and bare forest land values vary tremendously by location, there would actually be an extreme number of confiscation points. Table 15 shows just two examples from opposite sides of the region. These are medium site Douglas-fir west of the Cascades, and good site White Pine ecosystem lands of the Inland West. In the base case permitting scenario, PVC's are sufficient to confiscate forest ownerships of less than 66 acres in the coastal example and of less than 91 acres in the inland example.

Table 15: Post Regulatory Forest Bare Land Value Change Examples.

Forest Zone	Example Species & Site Index	Initial SEV \$/acre	Post Reg high SEV \$/acre	Post Reg high SEV @ acreage	Post Reg zero SEV @ acreage
Western Cascades	Douglas-fir medium site	\$756	\$685	50,000 ac	66 ac
Inland Empire	White pine ecosystem good site	\$518	\$504	50,000 ac	91 ac

While interesting to calculate, actual confiscation would logically never occur except under extreme use constraint or unusual economic circumstances. Instead, owners would shift their lands out of forest uses long before actual confiscation would occur. A more practical indicator would be an evaluation of the margin of transference.⁴⁰ The transfer margin is the equilibrium point between intensive rent margins for alternative uses of the

⁴⁰ Barlowe, Raleigh. 1978. Land Resource Economics: the Economics of Real Estate. Printice-Hall: Englewood Cliffs NJ. the "margin of transference" is sometimes called the "transfer margin."

same land. It reveals a value at which a pre-regulation forest owner would shift land uses out of forestry into either less regulated, or more profitable, uses. The post regulation transfer margin could be used to estimate the magnitude of the shift. This regulatory land use effect would operate inversely to state preferential tax systems that intentionally use lower property and income tax burdens on environmentally preferred uses to retard commercial development of forestry and agricultural lands.

The transfer margin effect varies between states. California's costly procedural FPA may have already shifted most small ownerships out of forestry uses leaving those with substantial margins. FPA initiated shifts would have happened to a smaller extent in Oregon and Washington so the potential for NPDES shifting may be higher. It is in the notification FPA states where the largest remaining shifts out of forestry uses could occur.

This cost analysis found clear instances of potential regulatory confiscation and numerous suggestions of post-regulatory higher and better uses. Such findings could be interpreted as an indirect, but causal, effect for several potential timberland owner behavioral shifts including:

1. Changes in forest management propensity to engage in some existing and particularly developmental forest management practices;
2. Increased necessary scale of efficient forest management, and smaller ownerships that do less active forest management;
3. Shifts at the transfer margin out of private forestry land uses into unaffected (and perhaps less regulated) alternative uses such as rural recreation and residence; and
4. Increased timber inventory liquidation intensity prior to land use changes.

Quantification of such specific silvicultural effects is beyond the scope of the present analysis.

Larger Considerations—Market Dynamics and Indirect Effects

The original simplifying analytical assumption was that regulatory costs would be borne entirely by private forest owners and be totally capitalized into forestry capital assets. In a more realistic scenario, extra marginal costs of production would be added to an already inelastic supply curve ($\epsilon_S \approx + 0.29$).⁴¹ The new equilibrium with a very inelastic timber demand curve ($\epsilon_D \approx - 0.5$) should lead to a modest negative industrial contraction, but a significant positive timber price increase should be evident. In other words, a substantial portion of variable costs would be passed forward to timber consumers. There would also be welfare redistribution as surviving private forestry owners could enjoy a policy-induced quasi-oligopoly⁴² extraction of wood users' consumer surplus.⁴³

⁴¹ Adams, D. and R. Haynes. 1996. The 1993 timber assessment market model: structure, projections, and policy simulations. Portland, OR: USDA-Forest Service, Pacific Northwest Station. PNW-GTR-368. 58p p.

⁴² When a few firms dominate a market they can act with monopoly powers, i.e. raise prices above competitive market equilibrium levels.

As this is a national regulatory effect, we should expect to see a wide range of extended effects on others than timberland owners in all wood using regions. To varying degrees, such indirect effects should include the following systematic changes:

1. **Supply side**--reductions of marginally profitable timber operations could cause reductions in local timber supply and lower demand for loggers, truckers and equipment;
2. **Supply side**--depending on the extent of reduced local timber supply, surviving wood product mills pay higher log costs, lowering operating margins. This causes regional capacity contraction, ownership concentration, reduced manufacturing and distribution employment and local reductions in market competition;
3. **Supply side**—transaction reductions in local economies with forest products sectors with changed transaction behavior across regional trade hierarchies causing negative indirect and induced job and income effects in other sectors.
4. **Demand side**—wood price increases reduce net gains from transactions with the forestry sector and subsequent reductions of regional induced multipliers.
5. **Demand side**--a joint implication of all previous points is to reduce property, business, sales and income taxes to various levels of government; and
6. **General equilibrium**—a net welfare loss occurs within wood markets. This does not necessarily imply a loss in social benefits as it is possible that regulatory benefits may be larger than the cost and market inefficiencies that they cause.

A precursor model for similar changes at local levels occurred in the late 1980's and early 1990's throughout the west. Simultaneously, federal harvests declined to protect endangered species habitat, and states began adopting varying degrees of forest practices acts to meet CWA and other environmental standards. Timber production costs rose, log supplies dropped precipitously, the forestry sector contracted in varying degrees, lumber prices generally rose and forest sector jobs and income fell substantially. California is perhaps the most visible example of this phenomenon. Many mills closed and few small forests continue to harvest timber. When this happens on a national scale, there should be significant job and income loss. However, the extent of domestic timber market shifts would be damped somewhat by the availability of basic lumber and pulp imports probably from Canada, and other wood products from the Pacific Rim.

Indirect effects estimation would be imprecise, but no less important to quantify. For each of the five types of expected effects within forestry the logical comparative statics are already worked out. Timber marketing models⁴⁴ exist that are capable of estimating the direct effects of increasing costs on a multi-regional basis. Once that it done, there are existing models that can estimate the sequential job and income influences of an initial

⁴³ Consumer surplus is the total value between what a consumer would be willing to pay for a good above the competitive market price that one actually has to pay.

⁴⁴ The USDA-Forest Service already uses TAMM (Timber Assessment Market Model) on a five year cycle to extrapolate dynamic changes in the forestry sector as required by the Resource Planning Act.

Economic Effects of Point Source Runoff Regulations Applied to Private Forests of the Pacific Northwest

Appendix #1: Overview of Western State Forest Practices Acts

FEI reviewed the forest practice acts (FPA's) of all five western states. The purpose was to gain information about the extent of FPA requirements, the standards of their BMP's, and gain some familiarity with the magnitude of regulated forestry activity.

Procedural FPA—California

Although there are 13.2 million private forest acres in California¹, only 8,717.8 thousand acres are considered private timberlands.² In 2006, these had a timber harvest of only 1.5 billion board feet.³ The harvest is considered small as measured by a 0.9% rate of inventory turnover (RIT), when normal western RIT's usually exceed 2.5%. California's private timberlands are already under-performing from a commodity production standpoint, suggesting either broadly non-timber objectives, or tight regulatory constraints.

California issued updated FPA regulations in 2011.⁴ These regulations speak directly to higher standards for water supplies and endangered fish habitat than traditionally specified under CWA standards. The BMP set is already extensive, highly specific, and compliance inspected. FEI expects no increase in activity costs due to increased BMP requirements with NPDES.

In practice, the California FPA approval process is already restrictive. The success probability for silvicultural approval appears to be low and the time span for harvest activity approval (when successful) is long. For example, of the 95 timber harvesting plan (THP) applications filed in 2011, most were for large industrial applicants, with few of the smaller practices normally associated with the non-industrial owners. Of the total, only 14 (14.7%) had been approved by early September.⁵ The state FPA processes are sufficiently laborious that we expect the extra step of NPDES permitting to the EPA would add only an administrative and monitoring cost layer, with few delays longer than under the existing FPA.

Procedural FPA—Oregon

Oregon is a major forested state with 25.2 million acres of timberland. Slightly more than half of the timberland is located west in the Pacific coastal ranges through the Cascade Mountain crest. These forests are wetter and highly productive. East of the Cascade crest the forests tend to be drier, higher altitude and less productive. Forest rotations are longer and sustainable reentry cycles are longer. In 2006, the eastern zone accounted for only 10.4% of the total timber harvest.

¹ Smith, Miles, Perry and Pugh. 2009. *ibid*

² USDA-Forest Service. 2011. Forest Inventory and Analysis (FIA). FIDO data retrieval tool at <http://apps.fs.fed.us/fido/>

³ California Department of Revenue and Taxation. 2010. California timber harvest statistics

⁴ California Department of Forestry and Fire Protection. 2011. California forest practices act rules 2011: Title 14 Californiacode of regulations chapters 4.0, 4.5, and 10. CalFire Sacramento, CA. 333pp.

⁵ <http://www.fire.ca.gov/ResourceManagement/THPStatusUpload/THPStatusTable.html>

Based on NAFO industrial survey data there would be about a third of the number of live stream crossings in these forests.

Table 1-1: Oregon Timberland Acres by Zone⁶

Forest Zone	Total 1000 acres (% of state)	Private 1000 acres (% of zone)
Westside	13,856 (54.9%)	6,430.3 (65%)
Eastside	11,395	3,438.7 (26%)
Statewide	25,251 (100.0%)	9,869.0 (49%)

Oregon’s FPA is a mixture of the regulatory/non-regulatory FPA distinction made above. It has a 15 day activity notification process rather than an application requiring approval, but does require written management plans for harvest and forest road construction. These plans contain process elements that could reduce the costs of an extra layer of NPDES permitting. The data requirements in “notification” are also extensive.⁷ As a result, we lump Oregon with the regulatory FPA states for analytical consistency.

Procedural FPA—Washington

Washington has 20.9 million acres of total forest that could be subject to NPDES point source permitting. Of this, only 9.7 million acres (47%) are private. This is split between 4.8 million (49%) industrial acres owned by about 60 firms and 4.9 million (51%) acres of other private forests (including Indian forests). There is a significant difference between these distributions from the private land distributions between the lush forests west of the Cascade Mountains (Westside) and those of the more arid Eastside. Table 1-2 shows this distribution.

Table 1-2: Washington Private Forestland Acres

Forest Zone	Total 1000 acres (%)	Industrial 1000 acres (%)	Other Private 1000 acres (%)
Westside	5,810 (100%)	3,785 (65%)	2,035 (35%)
Eastside	3,936 (100%)	1,020 (26%)	2,916 (74%)
Statewide	9,746 (100%)	4,805 (49%)	4,941 (51%)

In the west, the private forest RIT is 2.2%, normal for this level of regulation. As the eastside is similarly regulated under the state FPA, its lower 1.0% RIT is most likely due to significantly lower stocking and longer rotation ages. Indeed, our per acre stocking check showed 19.4 and 11.2 live MBF/acre respectively.⁸

Washington went through a habitat conservation plan (HCP) process for private forests. There is also a recent Timber-Fish-Wildlife (TFW) in place. There is already concern that existing

⁶ USDA-Forest Service. 2011. FIA-FIDO. Ibid.

⁷ <http://www.oregon.gov/ODF/privateforests/fpaFACTS.shtml>

⁸ USDA-Forest Service. 2011. FIA-FIDO. Ibid.

pressures (higher regulatory costs and development opportunities) on private Washington forestland parcels have already accelerated forestland use shifts.⁹ The areas already affected by increased FPA regulation are well enumerated by county.¹⁰

Voluntary FPA—Idaho

There are 21.4 million total acres of forest in Idaho that could be subject to new NPDES permitting. However, 88.1% of the area is publically owned. State of Idaho owns or holds in trust only 2.2 million acres of this. Much of the federal ownership is either non-productive, reserved or receives little active management. Most of the annual harvest comes from the 2.6 million acres of private forest ranging from 60% to 74% of the total timber harvest since 2000.¹¹ Most of the NPDES activity permitting and monitoring would occur on these private, and some state, lands.

Table --- Idaho Timberland Acres by Zone¹²

Forest Zone	Total 1000 acres	Private 1000 acres (%)
Northern	8,307.5	2,453.0 (%)
Southern	5,487.8	714.0 (%)
Statewide	13,795.3	3,167.0 (%)

There are two dominant forested zones. Wetter northern Idaho has more private forest acreages with higher stocking and has typically accounted for 93% of the state’s private timber harvest. It has an RIT of 2.6%. Southern Idaho is arid and its scattered private montane forests have lower productivity.

The Idaho FPA was passed in 1974 (Idaho Code 38-1304). It defines forestry activities that require FPA notification. The BMP’s for water quality are specific, particularly for Stream Protection Zones (TPZ’s).¹³ As of 2010, 97% of audited sites were in FPA compliance.¹⁴ We expect that NPDES permitting standards should be met by existing state BMP’s and compliance rates.

⁹ Erickson, Ara and Jim Rinehart. 2005. Private Forestland Ownership in Washington State. University of Washington. Northwest Environmental Forum background paper. 10/24/2005. 16pp.

¹⁰ Rural Technology Initiative. 2007. The Future of Washington’s Forests and Forest Industries. Report to the Washington State Legislature. University of Washington College of Forest Resources. 7/31/2007.

¹¹ USDA-Forest Service. Annual. Idaho timber harvest summary. Region 1-State and Private. Missoula, MT.

¹² USDA-Forest Service. 2011. FIA-FIDO. Ibid.

¹³ Idaho Dept of Lands. 2000. Idaho Forestry Practice BMP’s: Forest Stewardship Guidelines for Water Quality. With U of Idaho Cooperative Extension. December 2000. 36 pp.

¹⁴ Andrea, Ara. 2011. Idaho Forest Practices Year-end Report. Idaho Dept of Lands. Service and Regulatory Program. Coeur d’Alene, ID. 16 pp.

Voluntary FPA--Montana

In Montana, 25.0 million acres could be subject to NPDES point source permitting. Of this only 7.0 million acres (32%) is private, with only 8% of the total forest lands considered corporate and 24% non-corporate. Of this only 5.9 million acres are considered operable timberlands.

Rather than take a regulatory approach to water quality standards, private forestry operations have been subject to voluntary compliance with listed BMP's since 1989. Although compliance was only 78% in the first audited year (1990), by 2008 compliance had risen to 97%.¹⁵

¹⁵ Harrington, Bob. 2009. State trust management and forest regulation in Montana. Office of the state forester. www.mt.gov/dnrc/forestry. public presentation.

Appendix 1: NPDES permitting productivity matrix for western forestry activities and roads (10/17/2011 revisions)

Western states' FPA's have BMP's designed for endangered fish species habitat quality. Such BMP's generally exceed CWA water quality standards. Private forest landowners are already operating under these standards. New NPDES permitting would be an additional regulatory effort beyond FPA administration. Owners in non-regulatory states currently have less required documentation and would require more permitting effort. Large forest owners (> 10,000 acres) are assumed to have existing expertise.¹ Smaller ownerships are assumed to hire external expertise as is done for FPA compliance. This table adapts and compresses Cabbage and Abt's² task time categories. It estimates labor productivity to achieve permitting requirements. Its achievement time estimates are revised for expected western conditions. Estimated time demands are those **in excess of** existing FPA administration and BMP requirements.

Fixed Permit Cost Elements (Days to Achieve)	Cost Type ³	Regulatory FPA		Non-Regulatory FPA	
		Large Owners	Small Owners	Large Owners	Small Owners
Introductory NPDES training, includes internal briefing, travel to workshops	UF	5.0	2.0	5.0	2.0
Locate technically trained expertise, including internal reassignment, hiring and or interview consultants	UF	2.0	1.0	4.0	2.5
Design internal permitting system, process requirements, format, task assignment, SWPP team coordination	UF	6.0	2.5	8.0	3.0
Permit application completion, review, submission, EPA application interactions	UF	2.0	2.0	3.0	4.0
Annual executive oversight & delegation, permit process mgmt, mgmt of technical expertise	RF	8.0	4.0	8.0	4.0
Annual update training, self-information, refresher workshops, EPA communications	RF	2.0	1.2	2.0	1.2
Annual permit process adjustment, EPA feedback, task revision, changes to submission, inventory, monitoring and termination protocols	RF	2.0	1.0	2.0	2.0

¹ On-deck permitting staff with tools (eg GIS) and expertise for handling FPA compliance,

² Cabbage, Fred and Robert Abt. 2011. Potential Administrative and economic impacts of NPDES permit requirements for forest roads in the Southeast US—key tables. Working paper

³ We use 4 cost types (UF) Upfront fixed (UV) Upfront variable (RF) recurring fixed and (RV) recurring variable

Variable Cost Elements (# sites accomplished/day) ⁴	Cost Type	Regulatory FPA		Non-Regulatory FPA	
		Large Owners ⁵	Small Owners	Large Owners	Small Owners
Write application, site measurement parameters ⁶ initialize site inventory	UV	64.0	32.0	32.0	16.0
Adapt existing runoff management plan for NPDES permit, correlate SWPPP ⁷ with FPA plan, augment site information (inc GIS if necessary), schedule activities	UV	32.0	16.0	24.0	8.0
Measure, design, GIS map ⁸ & document new sites for NPDES applications & SWPPP temporary sites	RV	24.0	12.0	16.0	8.0
Build new sites into internal management planning and administrative processes ⁹	RV	32.0	16.0	24.0	12.0
Quarterly inspections (3 annually), compliance reporting, respond to NPDES deficiencies ¹⁰	RV	18.0	9.0	18.0	9.0
Annual stormwater runoff inspection (1 annually), turbidity measurements, compliance reporting	RV	9.0	4.5	9.0	4.5
Negotiate, design, map & include non-owned sites in applications and procedures	RV	10.0	5.0	2.0	1.0
Revisit & direct revision of noncompliant sites	RV	3.0	1.5	3.0	1.5
Site termination procedures, change SWPP, notifications to EPA	RV	8.0	6.0	8.0	6.0

⁴ Sites/day accomplishment estimates based on estimated extra time required to accomplish site specific tasks in excess of forest practice act requirements.

⁵ Large owners (here > 10,000 acres) are assumed to have permanent staffs and accomplishment economies of scale

⁶ Regulatory FPA forest owners are assumed to adapt existing FPA requirements while non-regulatory FPA owners would create new documentation and procedures

⁷ SWPPP is storm water pollution prevention plan

⁸ GIS culvert and drainage mapping is normally required for regulatory FPA states and not for non-regulatory states

⁹ Non-regulatory FPA states are typically not explicitly required to maintain or submit individual site plans

¹⁰ Inspection differences assume staff, access and acreage concentration economies of scale

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Educational & Professional Certification:

Universities: Botany at U. of Texas (1963-64); forest management (BS 1966) & remote sensing (MF 1969) @ U. of Michigan; tropical ecology @ Organización Estudios Tropicales, Costa Rica (1969); forest management economics U. of Washington (Ph.D. 1984). **Professional:** Xi Sigma Pi forestry honorary society. Inland Empire Society of American Foresters: chair 1996-97, SAF forester of the year 1999; SAF certified forester 2002; named SAF fellow 2004.

Professional Forest Economics Expertise:

Natural resources micro-economist with 30 years experience in behavioral research, natural resources management, optimization analyses & extension. CEO Forest Econ Inc. specializing in: integrated forest management modeling, environmental economics, market & intangible natural resource valuation, designer of forest asset valuation & timber investment analysis software, competitive & imperfect timber market analyses, timber chip and forest biomass supply, timber investments, strategic management, fire economics, forest taxation, cost analysis, forest practices, trade & transportation, impact analysis, regional development, & public forest policy analyses. International work in strategic forest resource policy, resource-based economic development and agro-forestry. Speaks & publishes in Spanish.

Academic Experience:

Forest experiment station economist U of Idaho 1977-2002 (retired professor emeritus). Outstanding professor College of Natural Resources (twice), outstanding continuing education & service awards. Taught: Economics for Natural Resource Managers, Forest Project Evaluation, Integrated Forest Management Models, Advanced Forest Management (grad), Integrated Forest Resource Economics (grad). Continuing education in project optimization, joint output optimization & forest taxes. Visiting professor U. del Bio Bio, Chile 1985-86 & Pakistan Forest Institute 1991 & 1992.

Analytical & Extension Experience:

Projects with forest products industry, consultants, environmental groups and tribal resources. Extensive public agency experience with 4 state forestry departments, 2 state revenue departments, USDA-Forest Service, and USDI-Bureau of Land Management. Technical advisor to 2 state legislatures & 50+ other groups; technical journal reviewer. US Sec-Ag large fire cost team 2004 & 2005. Prolific public speaker at forestry and NIPF professional meetings. International work with USAID and development banks in Latin America (4 countries) & Asia (4 countries) including: Inter-American Development Bank Honduras Strategic Forest Planning 1991, USAID Philippine Strategic Forest Planning 1992, USAID Pakistan wood scarcity 1992, World Bank India forestry research team 1997 & 98, USAID Afghan forest recovery 2005.

Non-Industrial Forestry:

Owns & manages Nora Creek Forest, 420 acres in Latah, Co. Idaho since 1987. Tree Farm System certified, USDA stewardship forest. Active integrated management of all-age mixed native conifers for income, forest health, wildlife habitat quality & riparian restoration. Runs own forest practices, logging, timber sales, non-timber products and reforestation. Regular extension & professional forestry tours. Idaho tree farmer-of-the-year 2003. Inland West demonstration forest 2004. Troy, Idaho municipal forest watershed advisor. U Idaho silviculture private forestry training 2002-2011.

Other Experience:

US Forest Service Fire Lab remote sensing technician 1967, Coconino N.F. district fire control officer & recreation staff 1967-69; U.S. Marine Corps sergeant; logger; equipment operator; professional wood carver/cabinet maker; charter pilot/flight instructor; active bush pilot; certified Idaho foster parent.

Examples of Typical Reports, Publications, & Presentations:

- 2011 Forest sector outlook NIPF foresters workshop, Inland West wood sector concentration analysis, expert testimony in several family forest lawsuits. Timber market analyses for forest engineers. Bastrop fire damage assessment.
- 2010 SW Idaho timber economy for USFS EIS impact analysis; Forestry sector outlook NIPF foresters' workshop, imperfect timber market price effects Idaho Foresters' Forum; biomass economic effects template for Oregon Dept Forestry; Timber market outlook Kelowna Forests; market advice Adage N. Idaho biomass project
- 2009 Intermountain Logging Conf, Inland SAF annual meeting, W. Forest Economists technical session on BLM impact analysis. Solving the missing loggers problem for USFS impact analyses. BIA-Lincoln City Or: How tribal timber should optimize during market cycles
- 2008 U Idaho-Forest Products grad seminar: Timber market analytics (web at www.ecologyonline.net)
SAF Selkirk & Palouse chapters talks: Housing bust duration and its implications for forest managers
Quarterly Inland NW timber market projections for subscribers
Credibility of Future Inland NW timber supplies for Riley Creek/NW Management Inc.
With D. Green--BLM W. Oregon FEIS: Local economic impacts of new BLM timber harvest alternatives
UI & WSU forest extension: 15th consecutive annual timber market projections for NIPF foresters
- 2007 Forest Capital Partners LLC: Translating the housing bust into Northwestern log price projections
SISCO: Short and long-run market forecasts for Canadian silvicultural decisions
Idaho Forest Owners: Factoring fire risk into NIPF timber investment decisions
UI & WSU forest extension: 14th consecutive annual timber market projections for NIPF foresters
With D. Green--Assoc. of O&C Counties: Local economic effects of Craig-Wyden payments terminations
With D. Green--BLM W. Oregon DEIS: Local economic impacts of alternative timber harvest levels
- 2006 with D. Green--BLM W. Oregon DEIS: 18 county input/output models for timber policy economic impacts
Brookings Institute briefing on large fire cost methodology Wash DC
Forest Capital Partners LLC Inland West regional log market quarterly forecasts
USFS Fire & Aviation Management: Analyzing economic factors in high cost fire suppression
USFS R6: Salvage delay valuation loss modeling system for large fire appraisal
Post Katrina wood products markets outlook, Inland Logging Conference
Economics of fire for private forest managers, Inland Soc Amer Foresters annual meeting
- 2005 With Green & Robison--BLM: Birds of Prey DEIS economic analyses; ID Dept Lands: Tamarack land exchange valuation system, and Buttercup property development options.
Lessons from large fire cost analyses. West Forest Economists annual meeting
USAID/Kabul: Economic factors affecting Afghan Conservation Corps performance
With Ferraro et al--Large Cost Wildfires. Sec of Agriculture Review Panel report FY2004
Forest taxes affecting silvicultural investment. Soc Amer Foresters forest tax workshop
- 2004 Estimating economic effects of BLM grazing policy changes in Owyhee County Idaho
with S.T. McKetta--Forest management history of central Latah County, Idaho
USFS Fire & Aviation management: Cost-effectiveness analysis of retardant delivery systems
- 2003 With E.Camelio--TreeCents timber investment financial analysis programs see www.treecents.com
with Robison & Green --USFS SW Idaho eco-zone DEIS: timber & community economic impacts--6 reports
- 2002 with M. Konoshima--Jointly optimizing market and cultural values in tribal forestry. Nez Perce tribal forests.
Pitfalls in Forest Productivity Taxation. Lincoln Institute of Land Policy
- 2001 with E. Camelio--DL Poplar 3.0 intensive timber culture financial analysis program. Sold @ Forest Econ Inc.
South Idaho Timber Market & Forest Sector Evolution. Boise, Payette & Sawtooth National Forests
- 2000 with Rohweder & Riggs--Economic and Biological Compatibility of Timber and Wildlife Production. Wildlife Society Bulletin 28(2):435-447

policy induced change.⁴⁵ Lost tax revenue effects would have to be generalized as there are significant differences between jurisdictional levels and locations.

Another entire class of indirect effects is the effect of new permitting on the uncertainty of forest operating conditions. An increased operating cost structure in a dynamic, recently unstable, economy causes narrower survival margins for commercial operations. A regulatory specification at each potential point source increases the probability of point source targeted citizen law suits and creates an uncertain, and potentially large, future litigation cost pattern.

Caveats

This analysis looks at only a small part of a large policy question. This is not a benefit-cost analysis of federal point source permitting. It examines only a narrow slice of the costs, those potentially borne by forest owners. Initial examination suggests that EPA or designee point source permitting may be redundant under existing western forest practices acts. Accordingly, changes to BMP types and standards were not calculated. The other compliance cost effects calculated here are in financial terms only. They are imputed to a hypothetical permitting system, unknown in structure, fees, and compliance requirements. Some of the analytical uncertainty is addressed through two resolutions of sensitivity analyses, but large questions of estimation accuracy remain.

The results suggest that impacts of an additional regulatory layer vary to an extreme degree, from confiscatory to bothersome, depending on forest ownership scale and the assumed cost incidence. The potential exists for significant impacts beyond the forestry sector, but these have not estimated. The analysis has been sufficient to raise additional questions about the efficacy of additional forestry point source permitting, at least in the five strong FPA states of the Pacific Northwest. More insights must be developed if this intended regulatory policy is to achieve its desired purpose without distorting forestry decisions and causing unintended effects.

⁴⁵ An example is the Input-Output model “IMPLAN” that can automatically convert direct economic effects in one sector into regional estimates of indirect and induced job and income effects. See <http://implant.com>.