Salmon, Timber, and the Economy

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EXECUTIVE SUMMARY

Facing imminent loss of their wild salmon, Oregonians have decided the problem warrants extraordinary effort to solve. Americans, in polls and through their agent, the National Marine Fisheries Service (NMFS), agree with them. At the forefront of efforts to solve the problem are proposals to restrict logging and related practices on private and state lands. In this report we examine these proposals and the potential economic consequences of implementing them.

WHY FOCUS ON LOGGING RESTRICTIONS?

Logging and related forest practices are an important, but not sole, cause of declining salmon populations—agricultural practices, urban development, fishing practices, and dams also are important. Private entities and the state own 56 percent of Oregon's timberland, about 9 million acres. Past timber production on these lands has degraded the habitat salmon need to survive by increasing sedimentation in streams, stream temperatures, and the incidence of harmful landslides. It also has destroyed spawning sites and created impediments to the movement of spawners upstream and juveniles downstream.

Furthermore, three recent science-based reviews have concluded that the state's current forest-practice regulations will not prevent further degradation, let alone reverse past degradations (IMST 1999; NMFS 1998; Pacific Rivers Council 1999). The reviews generally recommend restricting logging near streams and in landslide-prone areas, rehabilitating existing roads and changing the design of future roads, and protecting areas with the best salmon habitat that serve as refuges amid habitat desolation.

WHY FOCUS ON THE ECONOMIC CONSEQUENCES?

The proposals to restrict logging and related activities on private and state forest lands have triggered considerable opposition, largely because many landowners believe the proposals would cause them to forgo substantial expected revenues from the production of timber. After NMFS issued its initial proposal, for example, the two organizations representing landowners complained the proposal would take 39 percent of the private timberland out of production at a cost of about $8,700 per acre, or $29 billion total (Oregon Small Woodlands Association and Oregon Forest Industries Council 1998).

Costs to landowners, however, are only part of the story. Rebuilding healthy salmon populations offers large benefits for the economy. The importance of looking at both the benefits and the costs was recognized by 78 economists, who recently sent a letter to the governors of the four Pacific states and the premier of British Columbia (Whitelaw et al. 1998), urging them to look beyond those who cast conservation as a salmon-vs.-economy

contest by focusing solely on the costs of salmon conservation. This report takes the broader view recommended in the economists' letter.

WHAT ARE THE MAJOR POTENTIAL ECONOMIC CONSEQUENCES?

As salmon-related restrictions generate costs and benefits for the economy, they also will have positive and negative impacts on jobs. These major effects will occur against the backdrop of several important issues.

Costs and Benefits

Recent studies indicate that implementing the logging and other restrictions needed to restore healthy salmon habitat on private and state forest lands would remove 15-45 percent of the lands from timber production. Though some landowners argue the proposals would cost landowners as much as $8,000 per acre, most studies conclude the costs would be 1–10 percent this level, i.e., $80-800 per acre. Even these estimates, however, fail to account for the opportunities available to landowners for mitigating the costs. These include conducting watershed analyses to determine where, exactly, the restrictions are warranted and where they are not. Absent such analyses, it is prudent for the agencies charged with restoring salmon populations to paint the restrictions with a broad brush.

Restricting logging would create numerous benefits. The most apparent is an increase in salmon populations, important to the commercial-fishing industry, recreationists, and those who treasure salmon's intrinsic value. In addition, logging reductions should yield cleaner streams, by reducing logging-related sediment. With past logging practices common in the western Cascades, for example, clearcutting one acre imposed $208 in flood-damage and other costs on downstream firms and households.

Other benefits are less direct but no less important. The cleaner streams, fewer clearcuts, and other environmental improvements accompanying logging reductions would enhance the profits of firms in the recreation and tourism industries. They also would improve the quality of life for those Oregonians who value such things and, when the improvement is enough to influence workers and households to locate in Oregon, it would increase the profits of firms that hire and sell goods and services to them.

Quantifying these and other benefits is devilishly hard. There is evidence, though, indicating that the benefits are commensurate with, or even exceed, the costs.

Studies of federal lands east of the Cascades, for example, found that recreational services account for about 90 percent of the total value of all services and commodities derived from these lands. Fishing is especially important. Timber accounts for only about 10 percent of the total, and this percentage is expected to fall.

Another useful comparison entails recognizing that salmon habitat acts like financial assets, generating a flow of economic benefits over time. Evidence from the past decade indicates that, if habitat improvements resulting from salmon-related logging restrictions

generated one additional fish for the recreational fishery per year per acre for the foreseeable future, the asset value of the habitat would be about $2,800 per acre.

By comparison, the average timber-asset value of state and private land used for growing timber in Oregon is about $400 per acre in Western Oregon, and the average value of land plus standing timber is about $4,000 per acre. Values are less east of the Cascades.

Thus, if logging restrictions converted one acre of private or state land from producing timber to producing one salmon per year for the recreational fishery, the asset value of the new salmon habitat would be about seven times the forgone timber-asset value of the land, alone. The recreation-related, habitat-asset value would be about two-thirds the average value of the timber-asset value of the land plus the current stocking of timber. Furthermore, some foresters believe that the forgone timber-asset value could be reduced by half because, with appropriate forest-practice regulations, landowners could improve salmon habitat and produce some timber from some acres.

To weigh the costs and benefits fully, one would have to incorporate into the comparison other benefits, such as reductions in sediment-related damage and the intrinsic value of salmon. Surveys indicate, for example, that Oregon households, on average, are willing to pay $2.50–7.00 per month to protect or restore salmon. Applied to the 1.25 million Oregon households, the total is about $3-8.75 million per month. Some undetermined portion of this applies to salmon restoration in private and state forests.

Thus, instead of costing billions of dollars, as some have concluded by looking only at gross estimates of the effects on the timber industry, the actual net effect of the proposed logging restrictions would be much different. The costs and benefits of logging reductions would vary from place to place and it is impossible to trace them all. The available data indicate, though, that many, perhaps most, of the costs could be mitigated, and many—in some instances, perhaps all—of those that remain, would be offset by benefits.

Negative and Positive Impacts on Jobs

Restricting logging on 15-45 percent of private and state lands would potentially jeopardize up to 3,500—18,500 jobs in the timber industry. Every job lost in the timber industry would jeopardize roughly two more jobs in other industries. Given the robust strength of the state's economy, however, these risks would quickly evaporate in most instances.

Oregon's robust economy would help dislocated workers find replacement jobs. Most would find new jobs within three months, and the percentage remaining unemployed after one year probably would not exceed the background percentage for the workforce as a whole. Unemployment-insurance benefits and other forms of assistance would smooth the transition. This is not to discount the trauma of being laid off or the fact that some workers would experience declines in earnings. Still, the region has, over the past decade, demonstrated its ability to mitigate and adjust to contractions in the timber industry.

The positive impacts on jobs would be less visible, but persist longer. If successful in restoring healthy salmon populations, the proposed logging restrictions would generate jobs

in the commercial and recreational fisheries, and in related forms of recreation. By reducing the costs logging imposes on others—by reducing logging-caused sediment in streams, for example—the logging restrictions would improve the profits of the firms and the incomes of the households that currently bear those costs. Perhaps most important, by improving the state's overall natural-resource amenities, the logging restrictions would make the state more attractive to workers, households, and investors. Through its impacts on Oregon's quality of life, the logging restrictions would affect all sectors of the state's economy, even those with no direct link to forests, streams, or salmon.

Important Background Issues

This is not the first time that Oregon's timber industry has faced reductions in logging. Over the past two decades the state has adjusted to reductions far larger than those needed to restore salmon habitat on forest lands. These experiences have taught many lessons.

One is that, although some workers, families, firms, and communities endured severe difficulties as logging diminished, far more have prospered. There is no apparent reason to expect a different outcome following salmon-related reductions in logging. A rosy statewide picture, though, can mask the problems that logging restrictions might generate for some individuals, firms, and communities. These problems can be dealt with directly.

Another lesson is that the rights and responsibilities of landowners frame the definition of all the economic consequences that might follow implementation of tighter restrictions on logging and related activities. How one defines landowners' rights and obligations determines the composition of the costs and benefits associated with the proposed logging restrictions. Some in the state believe salmon-related restrictions on logging would restrict the rights of landowners to produce timber and, thus, impose costs on them. Others have a different view. To them, landowners have an obligation not to inflict further harm on salmon, not to impose costs on others, and to repair the harm from past logging activities. The rights and obligations of landowners have yet to be fully clarified.

A final lesson is the importance of weighing the consequences of making decisions that do not yield the intended results. One of the most frustrating characteristics of the proposals to restrict logging is that nobody can say definitively what impact they will have on salmon. Landowners understandably conclude from this that it would be unfair to them to impose restrictions that later prove fruitless. Given the public's strong opposition to allowing salmon to go extinct, however, it appears that it is better to err in favor of salmon than in favor of timber. If logging restrictions later prove unwarranted, the unlogged trees will have grown and become more valuable. In the meantime, there are numerous options available for mitigating unreasonable costs to landowners. In contrast, if needed restrictions are not implemented, so that salmon slide further toward extinction, the challenge of reversing the slide will become even greater.

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READER'S GUIDE TO THIS REPORT

WHAT IS THIS REPORT?

In this report, we describe the economic consequences that are likely to materialize if Oregonians decide to restrict logging and related activities on private and state timberlands for the purpose of restoring salmon habitat that has been degraded by past logging and of preventing further degradation. Although the analysis is specific to Oregon, our findings are generally applicable to other states where salmon-related restrictions on logging are being considered.

WHY WAS THIS REPORT PREPARED?

Over the past three years, the National Marine Fisheries Service (NMFS) has determined that the salmonid species (salmon, steelhead, and sea-run cutthroat trout) shown in Table 1.1 are headed toward extinction and warrant listing as "endangered" or "threatened" under the provisions of the federal Endangered Species Act. Additional species, although they have not been listed as threatened or endangered, have experienced declines in abundance.

Table 1.1: Oregon's Threatened and Endangered Salmon Species

Species	Administrative Status	Historic Escapement[a] (ca. 1900)	Current Escapement
Mid-Columbia River Steelhead	Threatened-1999	100,000+	13,400
Lower Columbia River Chinook	Threatened-1999	NA	40,000
Lower Columbia River Chum	Threatened-1999	700,000	2,000
Upper Willamette River Chinook	Threatened-1999	100,000+	3,000
Upper Willamette River Steelhead	Threatened-1999	200,000	4,000
Sea-Run Cutthroat	Endangered-1996	NA	NA
Umpqua Cutthroat[b]	Endangered-1996	NA	NA
So. Oregon/No. Calif. Coho	Threatened-1997	NA	10,000
Oregon Coastal Coho	Threatened-1998	1,000,000	39,000

[a] Escapement is the number of adult fish that return to the river to spawn.

[b] NMFS is considering a proposal to delist the Umpqua cutthroat because it is part of a larger, more dispersed population.

Source: ECONorthwest with data from Brinckman (1999), the Register-Guard (March 17, 1999), and other sources.

Past forest-management practices (logging, road-building, etc.) have been a major contributing factor underlying the decline in salmon populations and many fear that additional logging will jeopardize salmon even further. Hence, the state and other interested parties are wrestling with the challenge of determining which changes in forest-

management practices are appropriate for arresting and reversing salmon's slide toward extinction.

Mounting evidence indicates that major changes in forest-management practices are needed on Oregon's private and state forest lands. Three scientific reviews have concluded that altering the activities on these lands, so their influence on streams more closely resembles natural conditions, is a necessary step for preventing salmon extinctions and rebuilding healthy salmon populations (Independent Multidisciplinary Science Team 1999; National Marine Fisheries Service 1998; Pacific Rivers Council 1999). Particular importance is placed on restricting logging in riparian-management areas (corridors adjacent to stream banks), increasing the amount of large wood in streams, reducing sedimentation from logging roads, and eliminating barriers to fish passage from culverts and other impediments. Another important recommendation is to manage logging's impacts on salmon at a larger, watershed-level scale, to reduce the likelihood that the logging operations of individual landowners in a watershed, acting independently of one another, will unravel the entire habitat fabric.

Similar proposals have emerged for forest lands all along the west coast of North America, where salmon are at risk of extinction, in part, because of past and current forest-management practices. Because these proposals would increase the costs of logging and restrict logging on some lands, they have raised many economic issues, among them:

- What will be the costs of making the forest-management changes on private and state lands that scientists have called for to prevent salmon extinctions?
- Will there be any economic benefits? If so, how do they compare to the costs?
- Who will bear the costs? Who will enjoy the benefits?
- How readily will workers, communities, firms, and the state's overall economy adjust, if the recommended limits on logging are implemented and salmon populations rebound?

In this report we answer these and other, related questions. Although we focus our discussion on Oregon, we fully expect that our logic and general findings apply to other areas with similar issues.

WHAT IS THE REPORT'S STRUCTURE?

Chapters 1 and 2 provide the conceptual and empirical foundation for analyzing the economic consequences of limiting logging and making other changes in forest-management practices on private and state forests to help salmon. Chapter 1 describes six analytical principles recently defined by 78 economists in a letter to the governors of the four Pacific states and the premier of British Columbia. It also summarizes the recent relevant literature and the extent which the different studies satisfy the analytical principles. Chapter 2 describes an analytical model, consistent with the six principles, for describing how the economy will react to the implementation of salmon-related restrictions on logging.

Chapters 3-5 apply the analytical model to describe the potential costs, benefits, and impacts of additional restrictions on logging on private and state forests. Chapter 6 then finishes the report by summarizing the major issues and findings.

WHO PREPARED THIS REPORT?

Four economists with ECONorthwest—Ernie Niemi, Ed Whitelaw, Anne Fifield, and Michelle Gall—prepared this report, under a contract with the Audubon Society of Portland, the Institute for Fisheries Resources, Oregon Trout, and Pacific Rivers Council with the generous support of the Bullitt Foundation. We gratefully acknowledge the comments and the assistance of the many individuals who provided us with information and insight. We alone, however, are responsible for the report's contents.

We have prepared this report based on our general knowledge of the timber industry and Oregon's economy, and with information derived from government agencies, private statistical services, the reports of others, interviews of individuals, or other sources we believe to be reliable. We have not verified the accuracy of information obtained from elsewhere, however, and make no representation regarding its accuracy or completeness. Any statements nonfactual in nature constitute our current opinions, which may change as more information becomes available.

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CHAPTER 1: THE ECONOMICS OF SALMON CONSERVATION—PRINCIPLES AND PRACTICE

On September 9, 1998, 78 economists sent a letter to the governors of the four Pacific states and the premier of British Columbia urging them "to consider the full range of economic consequences" when they and members of their administrations make salmon-management decisions (Whitelaw et al. 1998). We include the letter as an appendix. The economists also described six principles, shown in Figure 1.1, that should guide any assessment of the full economic consequences of salmon conservation.

Salmon conservation will generate not just costs, but also benefits.

Two of the six principles have a primary role, in that they address the two principal analytical arenas: (1) the effect of salmon conservation on the value of the goods and services derived from salmon, streams, forests, and other resources; and (2) the impact on jobs and associated variables, such as incomes and the well-being of communities. The other four play a secondary role, offering guidance regarding issues that should be addressed when applying the first two.

The first principle—first in order and first in priority—admonishes the political leaders to consider both the benefits and the costs. While this may seem eminently reasonable, the economists observed that many past economic studies of conservation focus on only the costs. Doing so gratuitously reduces the economic importance of salmon conservation. When weighing the benefits and costs, one should take into account how salmon conservation would affect all goods and services with economic value, not just those traded in markets with monetary prices.

Salmon conservation also will have both positive and negative impacts on jobs and incomes. When examining these impacts, one should take into account the economy's ability to adjust over time to exploit the positive and attenuate the negative. Some of the impacts on jobs and incomes may materialize as conservation measures expand or contract specific demands for labor and, hence, increase or decrease job opportunities. Others may occur as the measures affect the quality of life in a local area or region and, hence, influence where households prefer to live, work, play, and shop.

The four secondary principles are just as important as the primary ones, but they play a different role, defining the range of issues that should be taken into account as one looks at the benefits, costs, and impacts on jobs.

Salmon conservation will have both positive and negative impacts on jobs. When examining these impacts, one should take into account the economy's ability to adjust over time to exploit the positive and attenuate the negative.

Figure 1.1: Six Principles that Should Guide Any Analysis of the Full Economic Consequences of Salmon Restoration

Primary Analytical Principles

1. **Benefits as well as Costs**
   Salmon conservation will generate economic benefits as well as economic costs. Consider them both to understand the full effect on the value of the goods and services derived from streams, forests, and other resources.

2. **Positive as well as Negative Impacts on Jobs**
   Salmon conservation will have both positive and negative impacts on job opportunities. Consider them both to understand the full impact on workers, their families, and their communities.

Secondary Analytical Principles

3. **Distribution of Consequences and Fairness**
   Those who enjoy the benefits or positive job impacts of salmon conservation will not necessarily be the same as those who bear the costs or negative job impacts. Consider the full distribution of economic consequences to understand who wins, who loses, and the fairness of the distribution.

4. **Rights and Responsibilities**
   With salmon conservation, property owners and resource users will behave differently than they otherwise would have. Consider whether these changes represent infringement on their rights or enforcement of their responsibilities.

5. **Uncertainty and Sustainability**
   Salmon-conservation decisions unavoidably will be based on information insufficient to guarantee the outcome. Since the fundamental goal of salmon conservation is to sustain salmon populations, give full consideration to the potentially high costs that might materialize from decisions that increase the probability of undesirable outcomes that are irreversible or extremely difficult to reverse.

6. **More than just Salmon Conservation**
   Salmon conservation will have a variety of ecological and economic consequences, such as changes in the quality of stream water used for other purposes, that may be peripheral to the salmon themselves. Consider the full set of consequences derived from salmon-conservation efforts.

Source: A letter from 78 economists to the governors of the four Pacific states and the premier of British Columbia (Whitelaw, et al. 1998).

As salmon conservation generates both benefits and costs, and produces both positive and negative impacts on jobs and incomes, it will create both winners and losers. The economists recommended that such distributional effects not be overlooked. They also expressed the importance of having a clear understanding of how salmon conservation would affect the rights and responsibilities of landowners and resource users. The value society places on conservation measures that restrict property owners' rights can differ markedly from the value of otherwise comparable measures that induce them to comply with their responsibilities. In addition, the economists observed that, given the uncertainty regarding salmon conservation, there always is the possibility salmon-related decisions will yield undesired outcomes, and care should be taken to avoid outcomes that are costly—or even impossible—to reverse. Finally, the economists admonished the governors and the premier to recognize that although the primary economic consequences of salmon-conservation have to do with the salmon themselves, others do not. A full analysis would include the costs, benefits, and impacts peripheral to salmon.

The six principles identified in the economists' letter provide an analytical foundation for assessing the economic consequences of salmon-conservation measures. We apply the principles in the remainder of this report to assess the economic consequences of proposed restrictions on logging practices for private and state forest lands to promote salmon conservation. We begin, in the balance of this chapter, with a quick survey of recent studies to see how fully they reflect the principles.

A SURVEY OF RECENT STUDIES

In the past fifteen years, numerous studies have examined the economic consequences of curtailing logging in Oregon and neighboring states to accomplish environmental and other objectives. Some of these studies have focused on proposals to restrict logging on private and state lands to promote salmon conservation. In this chapter we examine some of the most prominent studies to determine the extent to which they meaningfully can inform the decisions Oregonians must make as they craft a salmon-conservation plan for private and state forest lands.

In particular, we compare the studies against the six analytical principles we discussed in the first part of this chapter. These principles have set a professional standard for studies of the economic consequences of salmon-conservation programs. We find that, with limited exceptions, past studies from this region violate the most basic of the economists' principles: they ignore the positive consequences of curtailing logging and focus solely on the negative. In other words, virtually the entire literature on the economic implications of logging restrictions in the Pacific Northwest seriously misrepresents the full economic importance of forest-management actions that affect salmon.

With limited exceptions, past studies from this region violate the most basic of the economists' principles: they ignore the positive consequences of curtailing logging and focus solely on the negative.

Not all the studies are so seriously flawed. Several recent ones reflect most, if not all of the economists' principles, demonstrating that there is no analytical excuse for those who

represent the costs and negative economic impacts as the only, or even major, economic consequences of salmon conservation.

Most Studies Violate Most of the Economists' Principles

There have been countless proposals over the past decade or so to reduce logging in Oregon and throughout the Pacific Northwest, and nearly as many assessments of their potential economic consequences. Nearly all have asserted, implicitly or explicitly, that logging would have only negative economic consequences.

This conclusion is especially true of the recent studies of proposals to restrict logging on private and state lands. Table 1.1 describes eight of these studies, which have figured prominently in the debate over salmon conservation. The last column of the table summarizes their major findings. All eight studies estimate the potential negative economic costs, measured as the value of the forgone timber, job losses, or both. None, however, fully examines the potential benefits or potential gains in employment, although Lippke et al. (1999) and Lorensen and Birch (1994) do mention the possible existence of some benefits while Brown and Steel (1994) estimate the value of the commercial and recreational fisheries.

Furthermore, none discusses how costs and negative impacts might vary among the landowner types, or with respect to different views regarding the rights and responsibilities of landowners to protect salmon habitat. That is, each author assumes that landowners have the right to manage their forest lands in a manner that degrades salmon habitat and, hence, views logging reductions to help salmon as an imposition on landowners rather than their obligation.

None of the studies weighs the economic importance of the uncertainties associated with logging-reduction proposals. In particular, they all fail to acknowledge that, because salmon are threatened with extinction, and Oregonians and Washingtonians place a great value on preventing extinction, logging and related activities that push salmon closer to extinction impose additional—perhaps huge—costs on the economy. Instead, these studies ignore the potential economic benefits associated with the reduced risk of salmon extinction, that would flow from restrictions to reduce the degradation of salmon habitat caused by logging and related activities.

Only two of the studies look beyond salmon and timber to consider the effects of logging reductions on other resource values. Lorensen and Birch qualitatively mention the possible importance of improvements in water quality. Lippke, et al., draw on the results from forest-landscape models to assume that active forest management can generate habitat for salmon and other species more quickly than will occur if riparian areas are left alone, and permit extraction of timber at the same time.

Table 1.1: Examples of Studies That Focus on Costs and Negative Impacts

Author	Study Area	Analytical Focus	Major Findings[a]
1. Lippke et al. (1999)	9.4 million acres of commercial forest land in western Washington	Estimates costs and negative impacts of proposal to expand riparian buffers from 85 ft. to 150 ft. on Class 1-3 streams, from zero to 100 ft. on Class 4 streams, and from zero to 50 ft. on other streams. No management is allowed in the buffers.	· 1.1 million acres removed from logging · $7.4 billion loss in net present value of timber · 45,000 loss in jobs over first 20 years · $245 million loss in tax receipts per year
2. Oregon Small Woodlands Association & Oregon Forest Industries Council (1998)	8.3 million acres of private timberland in Oregon	Estimates costs to private timberland owners of tightening Oregon's forest-practice regulations to promote salmon conservation.	· 3.25 million acres of private timberland removed from logging · 8.3 million cubic feet reduction in total logging volume · $1.73 billion loss in land value · $23.7 billion loss in timber value · $25.4 billion loss in land and timber value
3. Schillinger and Helvoigt (1998)	3.8 million acres of private industrial forest land in western Washington	Estimates costs of increasing riparian buffers	· $747/acre loss in net present value of timber of increasing from 33 ft. to 98 ft. · $80/acre loss in net present value of timber of increasing from 98 ft. to 164 ft.
4. Lorensen and Birch (1994)	Public and private forest land in eight Oregon townships.	Estimates costs and negative impacts of 1994 proposal to tighten protection of riparian areas and water quality.	· 407 loss in jobs · $0.47/mbf increase in overall logging costs for northwest Oregon · $0.36/mbf increase in overall logging costs for southwest Oregon · $0.06/mbf increase in overall logging costs for eastern Oregon
5. Brown and Steel (1994)	16,873 acre Clallam Bay watershed on the Olympic Peninsula	Estimates costs of increasing riparian buffers	· $48/acre loss in net present value of timber of increasing from 25 ft. to 45 ft. · $77/acre loss in net present value of timber of increasing from 45 ft. to 70 ft. · $87/acre loss in net present value of timber of increasing from 70 ft. to 100 ft. · Loss of timber value is greater than the gain in the commercial and recreational fishery value as buffers are increased above 25 feet.
6. Vomocil/Oregon Forest Industries Council (1986)	6.3 million acres of private forest land in western Oregon	Estimates costs and negative impacts of proposal to restrict logging in riparian areas	· 225,290 acres of private forest land in western Oregon removed from logging · 187 million board feet loss in logging volume per year · $17.1 million loss in net present value of harvest · 6,119 loss in jobs · $159 million increase in net present value of logging costs · $140 million loss in payroll per year · $2.2 million loss in lost severance tax per year
7. Olsen et al. (1986)	1,336 acre tract in Oregon's Coast Range	Estimates costs of increasing riparian buffers	· $82/acre loss in net present value of timber of increasing from 35 ft. to 50 ft. · $318/acre loss in net present value of timber of increasing from 35 ft. to 70 ft.

[a] All values in 1998 dollars.
Source: ECONorthwest.

Studies that Satisfy Most or All of the Economists' Principles

One should not conclude from the preceding discussion that, because so many studies violate them so egregiously, the economists' principles described in the first part of the chapter are unreasonable and beyond reach. At least one study of regulations affecting private and state forests addresses most of the concerns expressed in the economists' letter, as do several studies of federal forest regulations. We briefly describe these studies and extract some of their findings to highlight the extent to which researchers have documented that restrictions on logging and related activities can generate economic benefits as well as costs and have positive as well as negative impacts on jobs and other variables.

Washington Forest-Practice Rules. In 1987, the Washington Department of Natural Resources (WDNR) sponsored an analysis (ECONorthwest 1987) of the economic consequences of numerous proposed changes in the state's forest-practice regulations. The study focuses largely on methodological issues, giving WDNR a template for evaluating individual proposals. Although it explicitly examines the potential costs and negative impacts on jobs of proposals that would tighten restrictions on logging and related activities, more than half the report is dedicated to issues associated with the potential benefits and positive impacts on jobs. The authors discuss issues related to the distribution of economic consequences and the risks associated with habitat degradation, but do not discuss issues associated with landowners' rights and responsibilities. They address environmental consequences other than salmon, such as clean water.

Two major impediments to the analysis were (1) the difficulty in describing how the proposed tighter regulations would affect fish, wildlife and other resources; and (2) the absence of monetized values for many of the benefits of tighter regulations. Nonetheless, the study team simulated the outcomes for two proposed regulations. Table 1.2 shows the results. One entailed widening riparian buffers to protect fish habitat; the other limited the use of tractor skidding, i.e., dragging logs from where they fell to a collection point, an activity that gouges, scars the land, and increases sedimentation in streams. The researchers found that the quantifiable benefits of the riparian buffers were almost three-quarters the quantifiable costs. For the restrictions on tractor skidding, the quantifiable benefits exceeded the quantifiable costs nearly two-to-one.

Table 1.2: One Study in Washington Found the Potential Benefits of Some Streamside Logging Restrictions Can Offset Most, or All, of the Potential Costs

Proposed Change in Forest-Practice Rules	Non-Timber Benefits[a, b, c]	Costs of Reduced Timber Production[a, b, c]	Net Costs or Benefits[a, b, c]
Wider Riparian Buffer	$162 mil.	$221 mil.	-$59 mil.
Restricted Tractor Skidding of Logs Through Streams	$149 mil.	$78 mil.	$71 mil.

[a] Net present value.

[b] The values shown are the midpoint of the identified range of estimates.

[c] Excludes benefits and costs for which economic values could not be estimated.

Source: ECONorthwest (1987).

FEMAT. Since 1993, three federal studies have satisfied most or all of the principles outlined in the economists' letter as they examined the economic consequences of tighter restrictions on logging and related activities. The first was prepared by the Forest Ecosystem Management Assessment Team (FEMAT 1993), in response to court injunctions barring new timber sales on federal lands that were potentially injurious to northern spotted owls. The FEMAT effort also was an important prelude to the development of the Northwest Forest Plan, which secured the lifting of the injunctions and now governs the management of federal forests west of the Cascades.

The FEMAT report clearly identifies the economic costs of reduced logging and, to a limited extent, recognized some of the economic benefits. It examines the potential negative impacts on jobs, but mentions the potential positive impacts only in passing. Accordingly, it discusses at length the distribution of the potential costs, but fails to describe the distribution of benefits, and ignores the different perspectives of the fairness of the proposed logging reductions.

Since 1993 three federal studies have satisfied most or all of the principles as they examined the economic consequences of tighter restrictions on logging and related activities.

The FEMAT report also fully acknowledges the responsibilities of the property owner—in this case the federal government—to manage forest lands to accomplish environmental objectives. It contains an ecological discussion, but no economic discussion, of the uncertainties and risks associated with forest management. Although it does not focus on salmon issues, it generally recognizes that logging reductions to protect an at-risk species could have economic benefits other than the species' conservation.

ICBEMP. The economic analysis conducted four years later by Haynes and Horne (1997), as part of a similar planning effort, the Interior Columbia Basin Ecosystem Management Project (ICBEMP), takes the analytical methods used by FEMAT several important steps further. The authors explicitly examine and estimate the potential economic benefits of reduced logging, as well as the costs. They find that, for the Basin as a whole, the environmental and recreational values associated with federal lands far exceed the timber value. Table 1.3 shows some of the results. The value Americans place on the existence of unroaded and unlogged areas in the ICBEMP region is $1.2 billion, and the annual value of the recreational attributes of federal lands is almost as large. By contrast, the annual value of the timber derived from federal lands is $0.3 billion. Furthermore, Haynes and Horne predict that, by 2045, the environmental and recreational values will have increased markedly relative to the timber value.

The values in Table 1.3 are instructive, for two reasons. One, they provide important information about the economic importance of other forest uses relative to timber. Two, they demonstrate that economists can, indeed, assess the economic benefits—and not just the costs—from forest-management decisions that restrict logging.

Table 1.4 shows the details for different types of recreational uses and for different areas of eastern Oregon. In only one area, the Upper Klamath Basin, do timber values currently

Table 1.3: Forest Service Economists Concluded that Non-Timber Outputs from Federal Lands in the Interior Columbia Basin Are More Valuable than Timber Outputs

	Value (1995 dollars)
Unroaded & Unlogged Areas (total, present value)	$1.2 billion
Recreation (annual value)	$1.0 billion
Timber (annual value)	$0.3 billion
Other (annual value)	$0.1 billion

Source: ECONorthwest derived from Haynes and Horne (1997) and the U.S. Department of Agriculture (1996).

dominate. Even here, though, Forest Service economists anticipate that the recreational value will exceed the timber value by the year 2005 (U.S. Department of Agriculture 1996).

Haynes and Horne also explicitly acknowledge that logging reductions can have both negative and positive impacts on jobs, incomes, and related variables. More important, they recognize that the true economic importance of these impacts is determined by the ability of individuals and communities to adjust quickly and smoothly. Accordingly, Haynes and Horne develop an index showing the relative difficulty that residents of different counties, on average, will have in adjusting. The index, which measures the diversity of regional economies centered on major cities, is a strong indicator of their resiliency, i.e., their ability to absorb abrupt changes in economic conditions—such as a change in logging restrictions—and rebound smoothly and quickly.

For their analysis, Haynes and Horne consider three regional economies in eastern Oregon, centered around Bend-Redmond and Pendleton in Oregon, and Boise, Idaho. The indices are 0.80, 0.79, and 0.81, respectively (the highest possible score is 1.00), substantiating the conclusion that each of these economies is diverse and highly resilient to economic shocks. In other words, the regional economies spanning eastern Oregon are capable of responding smoothly and quickly to changes in logging.

Elsewhere in their analysis, Haynes and Horne test the hypothesis that counties with higher per capita incomes also have a higher incidence of wood-processing facilities, a higher concentration of timberland (federal or private), or both. Their analysis rejects the hypothesis in the interior Columbia Basin. The authors conclude, therefore, that the presence of timberlands or forest industries does not have a measurable effect on personal income.

Table 1.4: Percent of Total Value of Goods and Services from Federal Lands, by Area, 1995 and 2045

Region	Year	Camping	Day Use	Fishing	Hunting	Motor Boating	Motor Viewing	Non-motor Boating	ORV	Snow Mobiling	Trail Use	Viewing Wildlife	Winter Sports	Timber	Range	Unroaded Existence
Cascades & Foothills (north of Upper Klamath Basin)	1995	5.2	10.5	19.3	5.7	0.16	4.44	0.99	0.11	0.12	4.42	10.02	12.18	13.86	0.03	13.01
	2045	5.5	13.3	12.1	3.5	0.12	18.5	0.81	0.09	0.07	6.0	11.02	10.78	2.96	0.02	15.31
Upper Klamath Basin	1995	8.46	4.78	6.21	4.35	0.69	1.09	0.19	0.07	0.12	2.18	1.17	0.93	48.96	0.15	20.66
	2045	12.16	7.28	5.04	3.37	0.65	4.66	0.19	0.06	0.08	3.74	1.56	0.91	21.08	0.12	39.09
Columbia Plateau (includes parts of WA and ID)	1995	3.76	5.28	51.31	11.46	0.19	1.39	0.58	0.13	0.07	3.76	2.46	1.86	13.41	0.31	4.03
	2045	5.12	8.93	42.01	9.04	0.18	6.96	0.62	0.13	0.06	7.46	3.52	2.15	10.12	0.26	3.43
Blue Mountains (includes parts of WA and ID)	1995	5.01	5.99	11.93	11.08	0.12	1.35	0.08	0.15	0.13	3.66	2.12	6.53	12.65	0.19	39.01
	2045	5.98	9.05	8.28	7.64	0.1	5.79	0.08	0.13	0.09	7.21	2.76	7.41	5.69	0.14	39.65
Northern Great Basin	1995	8.53	7.93	22.48	14.66	1.09	3.85	0.48	0.55	0.15	3.38	3.35	4.95	27.02	0.07	1.51
	2045	11.64	12.0	16.54	10.68	0.97	16.54	0.45	0.51	0.11	6.09	4.36	5.09	13.77	0.05	1.19
Owyhee Uplands (includes parts of ID and NV)	1995	5.27	3.08	26.75	30.59	4.11	1.77	0.33	0.53	0.09	3.38	1.36	11.79	0.06	1.99	8.93
	2045	8.43	5.55	18.16	21.29	3.53	7.57	0.31	0.49	0.07	8.99	2.15	14.9	0.03	1.53	6.99

ORV=Off road vehicles.

Source: ECONorthwest derived from Haynes and Horne (1997).

Marbled Murrelets. In 1996, a study prepared for the US Fish and Wildlife Service examined the potential economic consequences of designating critical habitat for the marbled murrelet, which had recently been listed as a threatened species (ECONorthwest 1996). Marbled murrelets spend most of their lives at sea, but fly inland as much as 50 miles to nest in old-growth forests. The critical-habitat designation forbids federal agencies from taking, permitting, or providing assistance to activities that would degrade the bird's nesting habitat. In this instance, though, the designation did not tighten the existing restrictions on lands in Oregon. It did, however, raise the possibility that the Washington Department of Natural Resources (WDNR) would tighten its restrictions on state and private forests. The study addresses all of the issues raised in the economists' letter to the governors of the four Pacific states and the premier of British Columbia. Whenever possible, it offers quantitative estimates of potential consequences, but recognizes that quantitative estimates often do not exist.

SUMMARY

The bulk of the economic studies of proposals to restrict logging and related activities to protect salmon habitat set out to demonstrate a simple conclusion: the restrictions would have only negative consequences. Simple, but wrong. Those who adopt this approach do a disservice to Oregonians who are looking for a balanced assessment of the full economic consequences of salmon-recovery proposals that entail restrictions on logging and related activities.

There is no analytical excuse for looking solely at the economic costs and the negative impacts of salmon conservation. Since 1993, three studies in the region have taken a broader perspective. In the next chapters we follow their lead to examine the economic consequences of proposals to protect and improve salmon habitat degraded by logging and related activities on private and state lands in Oregon.

CHAPTER 2: APPLYING THE PRINCIPLES—THE FULL MODEL

In Chapter 1 we describe six analytical principles for examining the economic consequences of salmon conservation. In this chapter we use these principles to develop an analytical model that explains how salmon conservation can generate a wide range of economic consequences, and describes how the economy responds to salmon-conservation initiatives. We call it the Full-Competition, Dynamic-Adjustment Model, or the Full Model.

The Full Model has two major components, corresponding to the two primary principles identified in the economists' letter to the governors of the four Pacific states and the premier of British Columbia. One recognizes that Oregon's private and state forests are capable of producing not just logs but also other goods and services, including clean water, recreational opportunities, and the habitat essential for fish and wildlife. The forests cannot produce all things for all people, however, and so there is competition. Except where competitors can find ways to satisfy their desires jointly, any action that results in one group getting what it wants from the forest means that others will not get what they want. The full-competition model establishes a framework for understanding these tradeoffs.

The Full Model's other component recognizes that the economy is highly dynamic and adaptable. Over time, the demands for some forest-related goods and services grow relative to those for others. When one group successfully competes for forest resources, those who are unsuccessful adapt quickly. The Full-Competition, Dynamic-Adjustment Model provides a structure for describing how these characteristics come into play and for assessing how the economy responds over time to changes in forest management.

In this chapter we describe each of these major components of the model. The discussion is long, reflecting a major message of this report: the relationships among Oregon's salmon, streams, forests, and economy are complex. For those interested in better understanding this relationship, we invite you to plunge in—we've written the text to be technically sound, but accessible to someone with limited exposure to economics. For those who prefer to focus more on the results of applying the model to proposals for restricting logging and related activities on Oregon's private and state forests, we encourage you to proceed to the next chapters.

We set the stage, however, by briefly describing an ecological perspective of the relationship between Oregon's forests and its economy.

THE ECOLOGICAL PERSPECTIVE

When speaking of how ecological systems—ecosystems—affect humans, ecologists sometimes talk about ecosystem goods and services, functions, and states (Quigley et al. 1996).[1] *Ecosystem goods and services* are specific components of ecosystems that might be extracted (e.g., timber or forage) or remain *in situ*, as when sections of a forest are used for recreational hiking, or when a waterfall is a notable landmark. *Ecosystem functions* are processes, such as the stabilization of soils on upland slopes or a riparian zone's filtration of sediment in runoff from uplands. *Ecosystem states* are systemic or integrated characteristics, such as those associated with old-growth forests, scenic landscapes, and watersheds with low flood risk.

Economically Important Goods and Services from Forested Wetlands and Rivers

Water Supply for
- **Household use** (drinking, cooking, washing, waste disposal)
- **Industrial use** (production input, process medium, heating and cooling)
- **Irrigation** (commercial agriculture, subsistence gardens, lawns and flowers, parks and golf courses)
- **Aquaculture**
- **Aesthetics** (fountains, swimming pools)

Goods Other than Water
- **Animal products** (fish, shellfish, fur-bearers)
- **Plant products** (cereals, landscaping)
- **Mineral products** (nutrients, gravel)

Nonextractive Goods and Services
- **Flood control**
- **Soil fertilization**
- **Aesthetics** (scenery)
- **Waterborne transportation**
- **Hydroelectric generation**
- **Recreation** (boating, swimming, fishing, wildlife viewing, hunting)
- **Pollution control** (dilution of effluent, removal of pollutants)

Source: Based on Postel (1997).

An ecosystem's goods, functions, and states all contribute to the economy. The adjacent text box, for example, illustrates some of the economically important goods and services from forested wetlands and rivers. These are produced as the forested wetlands and rivers perform various functions. The set of functions and their robustness are determined, in turn, by the state of the forested wetlands and rivers.

Looking at economic issues from the ecological perspective is useful because it drives home the fact that a forested ecosystem and the surrounding economy continuously interact with one another in many, complicated ways. Human activities associated with the production, distribution, and consumption of wealth derive many different goods and services from the ecosystem but, in doing so, they alter the ecosystem's physical and biological characteristics. These changes, in turn, affect the state of the ecosystem and the stock of goods and services available for enhancing human standards of living, thereby altering future human activities. So the cycle of interactions between the ecological system and economic system continues.

[1] For a wide-ranging discussion, from an ecological perspective, of the economic importance of ecosystems, see Daily (1997).

FULL COMPETITION[2]

No forest in Oregon can satisfy all the demands for goods and services and, so there is competition for forest resources. This leads to an inescapable conclusion: it is impossible to understand the economic consequences of adjusting Oregon's forest practices to promote salmon recovery without understanding how it affects the competition for forest resources.

One could categorize the competition in any of a number of ways, but we propose a taxonomy that distinguishes among four types of products derived from the goods and services forests provide. The four types of products are illustrated in Figure 2.1. The left side of the figure shows two types of demand for production amenities, i.e., forest characteristics that help firms earn profits. The right side shows two types of demand for consumption amenities, i.e., forest characteristics that directly influence individuals' quality of life and standard of living. Each type of demand exists independently, but the competition among them is best understood by assuming that one type (Type 1) prevails, and then looking at the consequences for the others.

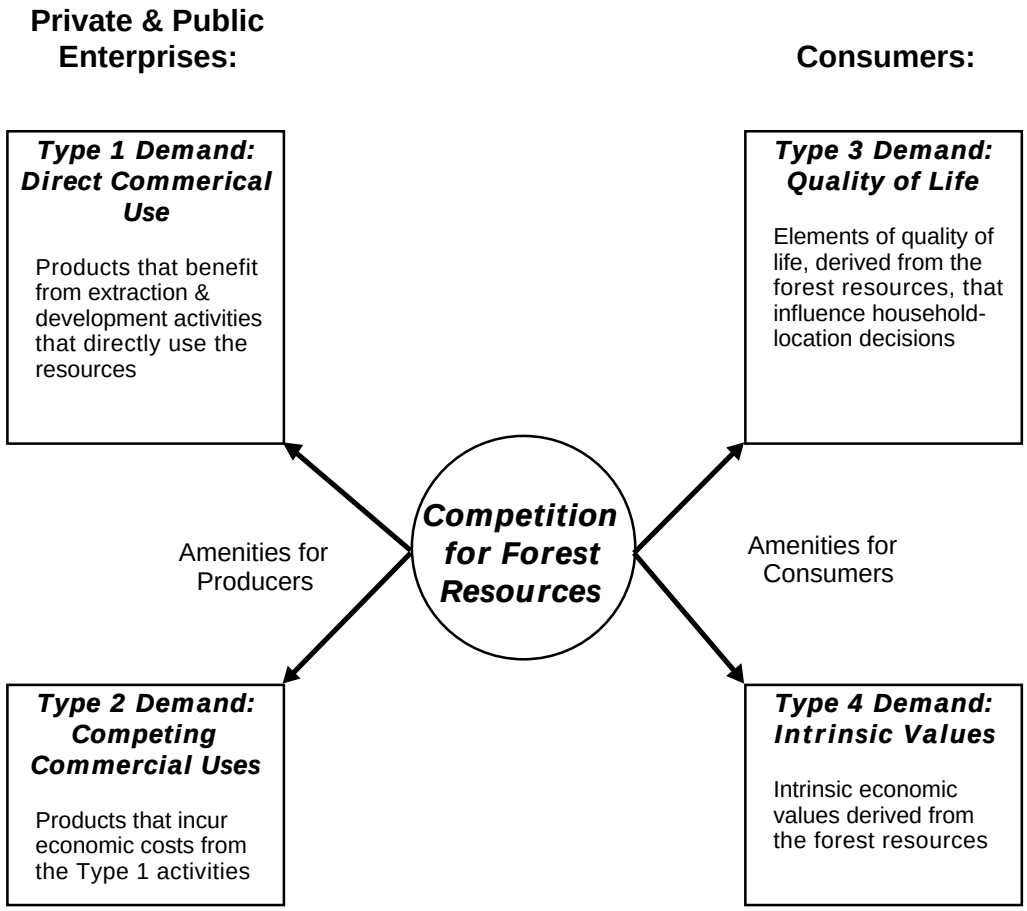
Competition for Production Amenities

The most easily identifiable demands for productive amenities entail the extraction or development of forest resources. We use the term, extraction, to embrace activities, resource uses, and industries associated with crop production, timber production, grazing, mining, and other activities that chemically, electrically, or physically remove one or more elements (flora, fauna, mineral, or energy) of the ecosystem from its source.

We use the term, development, to refer to the occupation of a site by human structures, such as occurs during urbanization. Development also includes intense human activity—draining a wetland, changing the composition of a forest's floral community, concentrating off-road-vehicle traffic, and so forth—that substantially alters a forest's ecosystem processes. Logging, mining, ranching, and development are the most important of the demands for the production amenities of Oregon's forests, although there are many others, including commercial fishing, and, to a certain extent, tourism. Demand for the productive amenities of a forested ecosystem comes from "private and public enterprises," which we define broadly, to include chartered institutions, such as private corporations, incorporated cities, and public agencies, as well as to households that farm land, build a house, and recreate, and to other groups that sponsor extractive or development activities.

[2] For a more technical and thorough treatment of the competition for forest resources, see Courant et al. (1997a).

Figure 2.1: The Competing Demands for Forest Resources



Source: ECONorthwest.

Type 1 Products - Extractive and Development Activities. We separate the demands for productive amenities into two groups. We first identify a specific extractive or development product derived from a forest and call it Type 1. Type 1 products have two important characteristics: they directly use natural resources and they deplete the stocks of resources. The identification of a particular product as Type 1 is arbitrary, but purposeful. This type of demand usually is associated with a familiar extractive industry, such as farming, ranching, logging, or mining, or with common development activities: developed recreation, urbanization, bridge construction, and the like. In general, only one Type 1 product benefits from a particular use of forest resources, but sometimes there may be more than one. Logging, for example, may benefit the timber industry and some sectors of the recreation industry (Quigley et al. 1996).

Type 2 Products - Products Upon Which Type 1 Production Imposes Costs. After identifying the products that benefit from a specific resource use, we then identify those that incur costs from that use, and call these Type 2 products. We purposefully distinguish

between Type 1 and Type 2 products to drive home the message that there often is competition, within the extractive and development sectors, for forest resources. This message is important because, too often, the competition for forest resources is characterized as simply a jobs-vs.-environment contest between an industry seeking to use a resource as a productive input and those who want to protect the environment. By highlighting products that incur economic costs from extractive and development activities, we emphasize the point that the positive consequences arising from one set of extractive or development activities frequently has negative effects on one or more others.

There are two main sets of mechanisms by which production of outputs associated with extractive and development activities (Type 1 products) can impose costs on Type 2 products: direct displacement and subsidies.

Direct displacement can follow two pathways: competitive bidding and negative externalities. The former materializes when an increase in the output of given Type 1 product, other things equal, reduces the output of a Type 2 product, making the latter more costly or scare than would otherwise be the case. There currently is considerable concern in the Pacific Northwest, for example, about the impacts of logging and related activities on the quality of surface water available downstream for municipal-industrial water use (Bernton 1996). With reductions in water quality, the affected water utility would have to curtail production or incur additional costs to obtain water from other sources.

Displacement also occurs when the production of a Type 1 product is accompanied by negative externalities.[3] Negative externalities are ubiquitous when Type 1 activities affect the quality of air, water, habitat and landscapes.[4] Increased sedimentation from timber production, for example, can create additional costs for downstream fisheries, landowners, municipal-industrial water users, and public agencies (Meehan 1991; Reid 1993). These costs arise not because of competitive bidding for the use of the relevant resource but because the downstream effects are external to the incentives facing those who determine the upstream economic activities.

The second mechanism by which a Type 1 use of forest resources can impose costs on other producers comes into play when government subsidies distort the prices or production levels of a Type 1 product. Similar distortions can arise from regulatory and other actions, such as trade policy, but, to conserve space, we lump them all under the rubric of subsidies. Subsidies draw money from, and thereby restrict the output and profits of, other producers, including some who have no other relationship to the Type 1 product or its use of forest resources. Hence, subsidies are akin to externalities.

Subsidies can arise in three ways. One entails subsidies to the Type 1 product itself, for example, price-support payments for certain products for overseas export (Environmental Working Group 1995; Offutt and Shoemaker 1990). Another occurs through subsidies to the

[3] In some cases externalities are positive. We include such cases as a part of the input demand.

[4] There is an extensive literature regarding when a particular cost or benefit is or is not an externality, or whether a particular price or production phenomenon stems from displacement, an externality, or a subsidy. See, for example, Baumol and Oates (1988 pp. 14-15).

Type 1 use of a resource as a productive input, for example, below-cost pricing for timber, forage, hydropower, and navigation derived from federal lands and facilities (Council of Economic Advisors 1994; U.S. House of Representatives 1994). Subsidies also can be directed at labor, capital, or some other nonresource input to the Type 1 production process (Black and Smillie 1988; Meyer and Rosenbaum 1996; Nauth 1992).

Subsidies may be conspicuous, as when states give tax concessions to Type 1 industries or protect them from competition (Black and Smillie 1988; Nauth 1992), but they may be more hidden, as when firms in other sectors of the economy subsidize (relative to actuarial cost) unemployment insurance in some highly cyclical resource-extraction industries (Meyer and Rosenbaum 1996). Regardless of their visibility, subsidies suppress the level of Type 2 production and lower the well-being of those who otherwise would benefit from the forgone production and enjoyment of Type 2 products. These effects may materialize in the vicinity of the forest resources used in the production of the Type 1 product, but not necessarily.

Competition Directly from Consumers

On the left side of Figure 2.1, forest resources are economically important because they are inputs in the production of other things, such as housing, transportation systems (e.g., pallets), and hydroelectricity that consumers want to have. On the right side, the connection between these resources and consumers is more direct. That is, consumers consider these resources economically important for what they are and for how they directly contribute to consumers' well-being. Figure 2.1 shows there are two types of demand for forest resources coming directly from consumers: one affects consumers' residential location decisions; the other does not.

Type 3 Products - Consumption Amenities and Residential Location. Sometimes forest produces amenities, such as recreational opportunities, scenic vistas, and healthy environments, contribute directly to the well-being of people who have access to them. In economic parlance, these are known as consumption amenities. Their contribution to consumers' well-being makes consumption amenities economically important in their own right, but they also influence the location decisions of households and firms (Knapp and Graves 1989; Mathur 1993; Mueser and Graves 1995), thus, adding to their economic interest. The nearer people live to these amenities, the better their access and the greater their consumer surplus. We use the term, Type 3 products, to represent consumption amenities that influence location decisions.

Whitelaw and Niemi (1989) have likened this relationship to a *second paycheck* residents receive by living in a place where they have easy access to amenities, so that the total welfare of residents within commuting distance of the amenities is the sum of this second paycheck plus the purchasing power of their money income. The size of the second paycheck affects behavior in the local and regional economies by influencing household demand for residential location. That location-specific consumption amenities are an important influence in residential location decisions is well documented.[5]

[5] The early contributions are Rosen (1979) and Roback (1982). For more recent work on this topic see Beeson (1991), Berger and Blomquist (1992), Blomquist et al. (1988), Brady (1995), Brown (1994),

Essentially all of the existing literature on the value of amenities implicitly assumes that the amenity value is reflected in wages and prices in the same county or city as the amenity itself. This view probably is too restrictive. Natural-resource amenities a few hours drive from an urban area also will plausibly contribute to the quality of life in that area, showing up as lower wages and higher housing costs at locations that are some distance from the amenity itself. Furthermore, forest resources in one place can materially influence the quality and quantity of recreational opportunities and other amenities some distance away.

In effect, residents of an area receive a *second paycheck* by living where they have easy access to amenities, such as recreational opportunities, scenic vistas, and healthy environments. The *second paycheck* can influence the locational decisions of households and firms. Thus, the quantity and quality of natural-resource amenities can affect the levels and types of jobs throughout the local and regional economies, including sectors with no direct link to the resources.

As pointed out by Roback (1988) and others, lower real wages that arise from consumption amenities act as a special type of production amenity for firms that are able to reduce their costs by locating where wages are lower. This mechanism allows natural-resource consumption amenities to affect where goods and services are produced. Thus, the quantity and quality of natural resource amenities can affect the levels and types of jobs (and economic activities in general) throughout the local and regional economies, including sectors with no direct link to the use of ecosystem resources.

Type 4 Products - Intrinsic Economic Value. The Type 4 products shown in Figure 2.1 are ecosystem products people value for their intrinsic properties. Intrinsic values, often termed "existence values," do not entail an explicit current use of the resource.[6] They arise whenever individuals place a value on maintaining the existence of a species, scenic waterfall, or other resource for its own sake, or on the prospect that the resource will be useful, for example, to future generations. Actions that increase the robustness of the resources, for example, by preventing degradation of critical habitat for an endangered species or by ensuring the flow of the waterfall, increase the welfare of those concerned about these issues, and actions that degrade the resources decrease this welfare.

Browne (1984), Cooper (1994), Cromartie (1998), Cushing (1987), Figlio (1996), Gabriel et al. (1996), Gottlieb (1994), Greenwood et al. (1991) and Sherwood-Call (1994).

[6] Some argue that none of the intrinsic value categories fully recognize the value of the life-support services ecosystems provide that make the earth habitable (Baskin 1997). Although some economists have attempted to include biological diversity in their calculations of the value of life support services, they have not been able to directly get at what it is worth to have species work together within ecosystems to provide these services. It could be argued that they constitute a fifth type of demand in our typology. On the other hand, a case could also be made that without life-support services, Types 1−4 would be faced with large problems. We do not debate the point here but, instead, expand the category of Type 4 products to include this life-support value.

Unlike the other three uses of ecosystem amenities that we have discussed, Type 4 products, by themselves, are unlikely to have any manifest economic effect on jobs, income, or other indicators of economic activity. Oregon's nonfederal forests may be of intrinsic value to some residents of Miami, Los Angeles, and other distant places, but the effect of this on economic activity in the region of the forests will be small unless it is articulated through the political system. Still, the resource affects the real well-being of real people, and this well-being belongs in any comprehensive analysis of the value of the resource. For some environmental issues, such as maintaining the biodiversity and integrity of ecosystems passed to future generations, Type 4 values may be very large.

DYNAMIC ADJUSTMENT

The full-competition perspective illuminates several aspects of the economy's potential response to proposed restrictions on logging and related activities on private and state lands to improve salmon habitat in Oregon. It is useful for estimating the costs and benefits, i.e., the negative or positive changes in the value of the bundle of goods and services derived from the state's forests and streams. Most, however, are more immediately interested in the restrictions' impacts, i.e., the resulting changes in jobs, incomes, and other indicators of how workers, households, and communities will be different.

Adjusting to change is one of the widely trumpeted virtues of market economies. When a specific industry in a specific location goes into decline, for whatever reasons, two sets of things must happen in some combination: (1) other activities will replace the industry in decline; and (2) capital and people whose incomes fall will leave the area. To forecast how a given local economy will adjust requires not only a detailed knowledge of what that economy currently does, but also knowledge of other things that it might do.

This is the approach we take in the Full-Competition, Dynamic-Adjustment Model. The model recognizes that restricting logging and related activities on private and state lands will alter the relationship between these resources and Oregon's economy along two pathways. Along the first, which is the most direct, the restrictions and the ecosystem's response will alter the vegetation, hydrology, and other biological and physical characteristics not just on the affected private and state forests but also elsewhere in the watershed, especially downstream. These alterations will change the supply of the four types of production and consumer amenities, shown in Figure 2.1.

Along the second pathway, the restrictions will lead to alterations in society's knowledge about the interactions between forests and salmon, the institutions Oregonians use to manage these resources, and the incentives the institutions create for different types of forest-management behavior. Information developed during watershed analyses, for example, might improve Oregonians' understanding of and stimulate a change in their behavior toward these resources. The restrictions might lead to changes in institutions, such as the property-tax system and the willingness of private lenders to extend credit to landowners helping restore salmon habitat.

There is no simple way to trace all the changes. If one wants to understand the impacts logging reductions will have on jobs, incomes, and the like, one has no alternative but to trace the economy's adjustments, recognizing that each worker, household, firm, and

community will try to mitigate the impacts it considers negative and to accentuate those it considers positive. In the following discussion we present some of the highlights. Elsewhere we describe the steps one must take to apply the dynamic-adjustment model fully.[7]

The Ecosystem's Production Amenities

For emphasis, we repeat the point we made earlier, in our discussion of the competing demands for amenities used in production (which we call Type 1 and Type 2 demands): restricting logging and restoring salmon habitat may affect other extractive or development activities, such as commercial fisheries, municipal water utilities, and residential development. These effects may offset one another, more or less. Each group will be concerned primarily about the gross impacts on it, but society as a whole should also be concerned about the overall net impact.

The Behavior of Consumers

When consumers' demand for amenities affects household-location decisions, which we have termed Type 3 demand, the mechanisms that translate salmon conservation into changes in economic behavior are varied and complicated. Generally, measuring the outcomes from this translation requires estimating the changes in the relative attractiveness of location at different sites in the region to various kinds of households.[8] The changes in attractiveness in turn affect residential location. In effect, an amenity-rich region exports the amenity by importing population.[9]

Rural amenities can affect residential location in or near the state's regional urban centers. The improvement (or degradation) of a natural-resource amenity in the hinterland affects the attractiveness of residential location for workers (and, possibly, retirees) in metropolitan areas, because these households value proximity, even at some distance, to the amenity. Continuing our example with an improvement in the quality of rural amenities, the increase in demand for residential location in regional cities by urban households will bid up the price of housing and bid down the wage, in some combination. The latter effect turns the consumption amenity in the hinterland into a production amenity in the city, because it allows firms in the city to operate at lower cost (from lower wages) than would otherwise be the case. In this way, rural resource management can affect urban and regional development.

How big these effects are we (and others) don't yet know. Two relevant lines of empirical economic research suggest, however, that the effects could be important. The first is

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[7] See Courant, et al. (1997b), Power and Niemi (1998), and Niemi, Gall and Johnston (1999).

[8] It is important, however, to remember that despite our current inability to measure the impact accurately, the evidence clearly supports the conclusion that it exceeds zero, often by a large amount.

[9] If analyzed in a standard international trade framework, the region has a comparative advantage in a nontraded good—the amenity. See Courant and Deardorff (1992).

reflected in the literature on amenities, wages, and housing prices, which persuasively establishes that wage and price differentials across the U.S. are generally more closely related to amenity levels than to cost-of-living differences or temporary, labor-market disequilibrium. Surveys of in-migrants to Oregon, for example, indicate that consumers are willing to accept considerably lower wages to enjoy Oregon's quality of life (Judson, 1999).

The second appears in the literature on the sacrifices households make to gain access to amenities, such as outdoor recreation opportunities, scenic beauty, clean air and water, secure neighborhoods, etc. (Bergland and Brown 1988; Brown and Mendelsohn 1982; Eberle and Hayden 1991; Englin and Mendelsohn 1991; Stewart and Stynes 1994; Uysal and Crompton 1985). This literature establishes that people who live near recreational sites use them more. Thus, as Oregon's population grows, the demands for amenities should grow even faster.

Changes In The Demand For Labor

Generally, changes in employment will correlate with changes in income tax revenues, school enrollments and related phenomena. One should not assume, though, that all these changes will occur adjacent to wherever salmon-conservation measures restrict logging and related activities. The competing demands for a forest's resources generally do not originate from a common set of workers, households, firms, communities, and regions.[10] Only by chance will all the competing demands for a forest's resources share a common boundary and, hence, the different types of impacts on jobs, etc. will go in different directions and different distances. In most situations, the relevant *economic* landscape extends far beyond the forest itself.

A general, but typical, illustration reinforces this conclusion. In a given situation, the competition for forest resources coming from those who benefit from timber production (Type 1) might be concentrated on one side of the forest, in nearby communities having both milling capacity and transportation facilities appropriate for hauling heavy loads. If the timber production degrades salmon habitat and increases turbidity and flooding in streams, the competition coming from those who incur these environmental externalities (Type 2) might encompass residents of the mill communities as well as others living hundreds of miles downstream in the watershed. The competition coming from those who see timber production as having an adverse impact on the quality of life (Type 3) might include residents of the watershed, as well as residents who live nearby but are outside the watershed. Those competing for forest resources because they place an intrinsic value on forest resources affected by timber production (Type 4) may live in the vicinity of the forest or far afield.

[10] A particular individual, household, or community may, however, express all four types of demand. A timber worker, for example, may lobby for more trees to be cut in part of the forest, oppose logging elsewhere to reduce logging's adverse effects on the quality of water his wife uses in her food-processing enterprise, live where he does largely to have easy access to unlogged-forest recreation, and place an intrinsic value on protecting salmon.

This dispersal of impacts has important implications. Many, if not most, of the economic impacts of salmon-related restrictions on logging and related activities probably will occur away from the forest and especially in the state's metropolitan centers (Niemi and Whitelaw 1994; Duffy 1994).

Trace The Adjustments Over Time

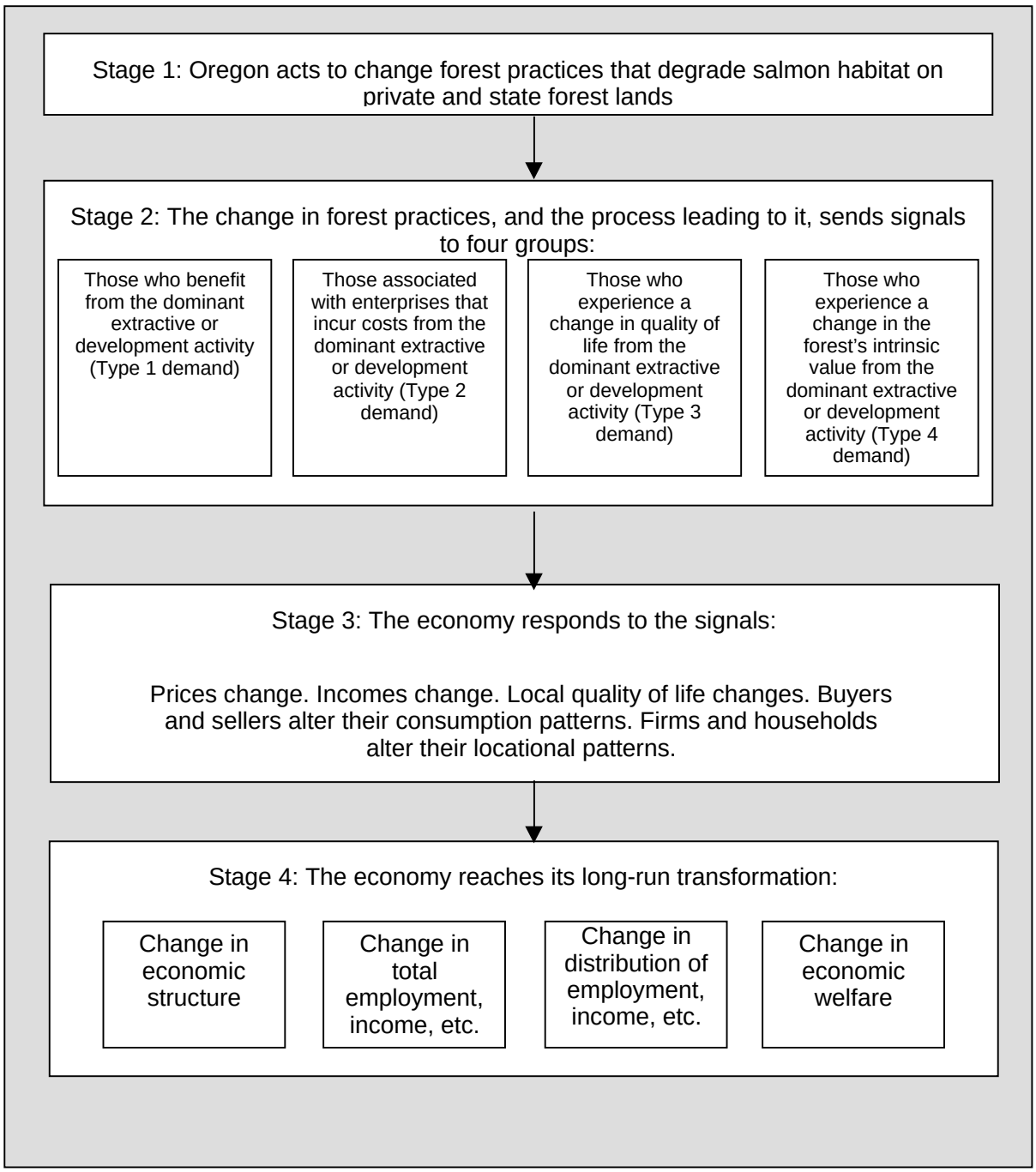
Restrictions on logging and related activities will not have a single, one-time-only impact on the economy. Instead, the economy's response will evolve over time. Whatever the initial, negative impacts, the economy will attempt to mitigate, and whatever the initial, positive impacts, it will try to accentuate.

The evolution will occur in the four general stages shown in Figure 2.2. In Stage 1, restrictions on logging and related activities are adopted and, in Stage 2, this action sends economic signals to the local, statewide, regional, and national economies, indicating a change in the economic role of the state's streams and its private and state-owned forests. The signals have four major destinations, represented by the four types of competing demands for the forest resources, as indicated in Figure 2.1. Although Figure 2.2 shows Stages 1 and 2 occurring as a single, abrupt event, they generally transpire over a longer period.

Stages 3 and 4 of Figure 2.2 illustrate the dynamic character of the economy's response to the adoption of the restrictions. In Stage 3, the economy responds with changes in prices or incomes or both. In Stage 4, prices and incomes reach their new levels, and the economy exhibits the long-run effects of the adoption of the forest-management decision. The long-run adjustment may entail feedback loops, through which changes in prices and incomes may influence future forest-management decisions.

How long does the transition—Stages 3 and 4—take? There is no single, simple answer. There are good reasons, however, to believe that many aspects of the economy are adjusting more quickly than in the past to changes in forest-management policy. For example, by the middle of 1997, lumber prices throughout the U.S. had stabilized in response to the April 1994 adoption of the Northwest Forest Plan. This was far quicker than many industry analysts had expected (Bernton 1997). Labor markets also are dynamic. Power (1996) reports that, of the workers nationwide who lost their jobs because of plant closures or other mass layoffs in the 1980s, about half were unemployed 10 weeks later and the percent remaining unemployed after twelve months was roughly the same as the background rate of unemployment in the overall labor force.

Figure 2.2: The General Transition Process by Which a Logging Restriction Leads to Changes in the Economy



Source: ECONorthwest.

This is not to say that everyone adjusts this quickly, or that the costs of adjusting to logging reductions are trivial. Instead, we are only pointing out that adjusting to change is one of the widely-trumpeted virtues of market economies. To understand the economic consequences triggered by restrictions on logging and related activities, one must take this dynamism into account. Ignoring it invariably leads to exaggerated estimates of job losses and unrealistic predictions of economic catastrophe.

Relevant Autonomous Trends

The precise path through the transition will depend not just on the characteristics of the restrictions on logging and related activities but also on the multiple economic forces and trends that are continuously altering and shaping the economy at all levels. Four of these seem especially important:[11]

- *Increasing importance of education.*
- *Growing competition in the lumber-and-wood-products industry.*
- *Increasing integration of metropolitan and nonmetropolitan economies.*
- *Rising demand for consumer amenities.*

The four are closely related, and define fundamental changes not just in Oregon's economy but throughout the Pacific Northwest. In past decades, workers could increase their expected earnings by locating near an exploitable resource, such as a forest about to be logged. Sawmills and other resource-exploitation industries located in rural communities, and Oregon's large stock of high-quality old-growth timber commanded premium prices that supported high wages for workers in the timber industry. Logging was deemed so crucial to the economy that people accepted the pollution and ecosystem degradation it caused.

Today, though, things are different. It is more important for a worker to have a good education than to locate near a logging operation or sawmill. With the exhaustion of its premium timber, Oregon's producers of lumber-and-wood products no longer command the premium prices and their workers no longer receive the premium wages they once did. Indeed, firms in the timber industry can survive only if they cut labor and other costs. Economic activity, including log-milling operations, are increasingly concentrated in metropolitan areas, but improved roads and communication systems have reduced the economic isolation of smaller communities. Virtually everyone has less tolerance for the pollution, degraded streams, and unattractive landscapes associated with logging. Moreover, communities and firms of all types are learning that they have difficulty attracting and keeping skilled workers if the environment is degraded and the quality of life is low.

If these trends hold, workers and communities seeking to prosper will increasingly have to look for opportunities other than the timber industry. Hence, throughout Oregon strong economic pressures will push the timber industry from the economy's center stage to its

[11] For a more detailed discussion of these trends, see ECONorthwest (1996) and Niemi, Gall and Johnston (1999).

periphery. It will continue as an important part of the economy, but it will not be a major source of new jobs and higher incomes, regardless of decisions regarding the extent to which logging and related activities on private and state lands are allowed to degrade salmon habitat.

Feedback To The Ecosystem

As we argue above, changes in logging and salmon populations may affect the geographic distribution of the human population as well as its consumption and production behavior. These, in turn will have effects on the ecosystem which, in turn, will have effects on the economy. Of particular concern is the potential for a feedback loop in which logging restrictions and salmon conservation represent enhanced consumption amenities, which induce development, which degrades the amenity, which reduces the amenities' value.

This outcome is not that different from the one that occurs when the timber industry logs private and state lands without having to bear the full costs. If nothing regulates the use of forests, streams, and salmon habitats, the demand will exceed the optimal level. If competitive market conditions and fully specified property rights do not exist to provide this regulation more or less automatically, through Adam Smith's "invisible hand," then it must come through deliberate societal management and regulation. If neither approach suffices, then an assessment of the economic consequences of salmon-conservation efforts must acknowledge the likelihood that the restoration may ultimately fail.

SUMMARY

The competition for the resources affected by logging and related activities on private and state lands is becoming increasingly intense. It embraces far more than the common concepts of competition: two sawmills trying to outbid one another for logs from a timber sale. Logging affects so many things people value—not just salmon habitat at the logging site but habitat for salmon and other animals, onsite and far downstream, water quality and quantity, visual aesthetics, recreational opportunities, and so much more. In a perfectly monetized world consumers could make their preferences known by bidding for resources alongside the sawmills. But the world is not like that. So, instead, society looks for means other than money and markets, such as rules and regulations and moral suasion, to compete for forests, salmon, and other resources.

One cannot understand all the economic ramifications of different proposals to enhance salmon habitat by restricting logging and related activities unless one takes this broad view of the competition. The competition is dynamic, and so too the economy's ability to adjust to changes in timber production, salmon populations, and so forth. The Full-Competition, Dynamic-Adjustment Model offers a conceptual framework for taking into account all the competing demands and the economy's dynamic adaptability.

CHAPTER 3: POTENTIAL COSTS OF CURTAILING LOGGING TO RESTORE DEGRADED SALMON HABITAT

The first of the analytical principles described in Chapter 1 is to consider the economic benefits of salmon conservation as well as the costs. We apply the principle in two steps. In this chapter we describe the potential economic costs of the restrictions on logging and related activities being proposed for private and state lands in Oregon. In Chapter 4 we consider the benefits.

We separate the discussion into separate chapters to keep each one short and to facilitate the exposition, but we recommend that the reader view them as a single package. One cannot fully understand the costs of the proposed restrictions without considering the benefits, and vice versa.

We describe the different types of costs and summarize recent estimates. Then, we consider these estimates in the context of the several factors that will influence the size of the actual costs that would materialize if Oregon further restricted logging and related activities on private and state forest lands.

RECENT ESTIMATES OF ECONOMIC COSTS

Two primary types of economic costs are likely to materialize as a result of salmon-related restrictions on logging on private and state lands. The restrictions may reduce the net value of logs produced from these lands by taking lands out of timber production, delaying logging, or increasing the costs of producing logs. In addition, implementing the restrictions will draw labor, capital, and other assets away from alternative uses and the net forgone production also represents a loss to the economy.

We are aware of no definitive estimate of the implementation costs. There certainly will be some, for the labor, capital and other factors needed to conduct detailed watershed analyses, remove roads injurious to salmon, replace culverts that block fish passage, and complete other tasks, could be used productively in other activities. A rough idea of some of the implementation costs comes from a March 3rd, 1999, briefing for the Oregon Board of Forestry, prepared by staff of the Oregon Department of Forestry. It reports that industrial landowners have committed to spending $13 million per year for 10 years to improve roads in the coastal region and the state has committed to spending more than $2.5 million over the current biennium.

Given the paucity of data regarding implementation costs, we focus the remainder of the discussion on the other element of potential costs, the reduction in the net value of logs produced from private and state lands. To simplify the discussion, we generally assume that the full reduction in the net value of log production accrues to the landowners. In reality, however, landowners generally will not bear the full cost. Instead, some of the costs

will be spread among taxpayers, workers, vendors, and communities. Thus, as we talk about the potential costs to landowners, the reader should bear in mind that they will not, in fact, shoulder the full load.

Over the past decade there have been several attempts to estimate the reduction in the net value of log production associated with proposals to prohibit logging in streamside areas, often called riparian buffers. In Chapter 1 we introduce these studies, and discuss their failure to reflect the six analytical principles for assessing the full economic consequences of salmon-conservation measures. Their primary failure is to focus solely on the potential costs of salmon conservation and to ignore the potential benefits. Nonetheless, they do provide the current analytical foundation for estimating the potential costs and, in Table 3.1, we summarize their findings. We do so reluctantly, though, because the studies represent such a wide variety of assumptions that comparing them is like comparing apples and oranges. Nonetheless, we offer the table with the caveat that the reader should investigate the assumptions underlying each study before making too much of the findings we describe here.

Table 3.1: Landowners' Potential Costs per Acre—Summary of Past Studies

Study	Value Per Acre of Logs in Potential Riparian Buffer (Net Present Value, 1998 Dollars)
Lippke, et al. (1999)	$6,727
Oregon Small Woodlands Association & Oregon Forest Industries Council (1998)	$8,714
Schillinger and Helvoigt (1998)	$80-747
Brown and Steel (1994)	$48-87
Lorensen and Birch (1994)	NA
Vomocil/Oregon Forest Industries Council (1986)	$76
Olsen (1986)	$82-318

Source: ECONorthwest.

The data in Table 3.1 show each study's estimate of the net value per acre of timberland that might be included in an expansion of the riparian buffer beyond their current width. The estimates generally reflect the net present value of the expected proceeds from logging the current stock of trees. The term, *net present value*, refers to the calculation of the lump sum, if received this year, that the landowners would consider equivalent to the promise of the stream of future net earnings from logging. The Oregon Small Woodlands Association and the Oregon Forest Industries Council (1998) also include the net present value of future generations of trees.

Each study reflects its own study site and different assumptions about several variables, such as the future price of logs, the cost of logging, the extent of the riparian buffer, and the nature of the restrictions associated with the buffer. No single study gives a definitive answer to the question, What will be the costs to landowners if salmon-related restrictions

on logging and related activities are implemented? The entire set of studies, though, offers these insights:

- **The cost estimates vary by a factor of 100—from about $80 to over $8,000 for each additional acre removed from timber production.**

- **The highest estimates seem unreasonably high.** Explaining the variation among the estimates would require in-depth comparisons of the studies' assumptions and methods, a task beyond the scope of this effort. Instead, we take a more cursory approach to check the reasonableness of the two highest estimates—one by Lippke, et al. (1999) in Washington, and the other by Oregon's two major forest-landowner organizations. They are at least ten times larger than the others. A cursory comparison of them with some general indicators of forest conditions, however, reveals enough inconsistencies to call the estimates into question.

  For example, the average current timber stock on private lands in Oregon is less than 10 thousand board feet (mbf) per acre (Lettman and Campbell 1997). It is difficult to determine the price of timber on private land because transactions are not regularly compiled, but prices for timber sold off public lands in Oregon have been about $400 per mbf. Much of the standing timber on private lands is too young to command this price, though, so it is likely that its average net value per acre is below $4,000, less than two-thirds the amount estimated by Lippke, et al. and less than half the amount estimated by Oregon timber-industry organizations. Both these studies also consider the net present value of future generations of timber, but it is inconceivable that these values would be large enough to make up the difference.

- **The researchers do not agree on whether the cost per acre increases or decreases as riparian buffers widen.** Schillinger and Helvoigt (1998) found that, if buffers in western Washington were widened from 33 to 98 feet, the cost per acre would be $747, but extending the buffer further, to 164 feet, would cost only $80 per acre. By contrast, in their study of a watershed on the Olympic Peninsula, Brown and Steel (1994) determined that the costs would increase with successive expansions of buffers: from $48 per acre for widening from 25 to 45 feet; to $77 per acre (45 to 70 feet); and $87 per acre (70 to 100 feet).

  The differences apparently reflect the different characteristics of trees found adjacent to streams. In many places, especially low-gradient streams, the adjacent riparian areas contain high concentrations of alder and other hardwoods with less commercial value than the upland conifers. Here, all else equal, timber value would increase as one moves away from the stream. In other areas, though, better growing conditions and forest-management activities, such as brush control, encourage the growth of more valuable conifers next to streams, so that timber values decline as one moves away from the stream.

- **The cost per acre should be highest in the Coast Range and markedly smaller east of the Cascades.** In deciding to focus on the Coast Range, Olsen (1986) observed that the stream density is highest and the timber value often highest in the Coast Range. These factors, plus the smaller acreage of private and state timberland east of the Cascades mean that most of the salmon-related costs will accrue to Westside

landowners. As an illustration, the forest industry (Oregon Small Woodlands Association and Oregon Forest Industries Council 1998) estimated that the percentage of Westside private timberland removed from production with implementation of a salmon protection proposal offered by the National Marine Fisheries Service (1998), would double the Eastside percentage.

Table 3.2 uses each study's cost-per-acre estimate to calculate the total cost to landowners, using different assumptions—15, 30, and 45 percent—about the amount of additional land to be included in riparian buffers and other zones where logging would be prohibited to protect salmon. These three assumptions illustrate the range of estimates of the amount of private and state timberland that would be removed from timber production under recent salmon-protection proposals.

It is important to note, however, that the most recent estimate specific to western Oregon (Adams 1999) indicates that the impact on timber production is likely to be nearer the lower than the higher end of the range. It shows that, if logging were prohibited within 40 meters (130 feet) of streams and lakes, timber yields would decline by about 20 percent. Expanding the logging prohibition to include steep, landslide-prone slopes outside riparian buffers would increase this percentage somewhat.

When applied to the 8.2 million acres of private land and the 0.8 million acres of state land, the enlarged riparian and other buffers, under the 15, 30 and 45 percent assumptions, would contain 1.2, 2.5, and 3.7 million acres of private land, and 0.1, 0.2, and 0.4 million acres of state land. The estimates in Table 3.2 show the value of the total for private plus state land, 1.3, 2.7, and 4.1 million acres.

Table 3.2: Landowners' Potential Total Costs, Derived from Recent Studies

	Total Value[a] of Logs in Riparian and Other Buffers (15, 30, and 45 percent of total private and state timberland)		
Cost/Acre Estimate	**1.3 million acres**	**2.7 million acres**	**4.1 million acres**
Lippke, et al. (1999)	$8,745 mil.	$18,163 mil.	$27,581 mil.
Oregon Small Woodlands Association & Oregon Forest Industries Council (1998)	$11,328 mil.	$23,528 mil.	$35,727 mil.
Schillinger and Helvoigt (1998)[b]	$971 mil.	$2,017 mil.	$3,063 mil.
Brown and Steel (1994)[b]	$113 mil	$235 mil.	$357 mil.
Lorensen and Birch (1994)	NA	NA	NA
Vomocil/Oregon Forest Industries Council (1986)	$99 mil	$205 mil.	$312 mil.
Olsen (1986)[b]	$413 mil.	$859 mil.	$1,304 mil.

[a]1998 dollars.

[b] High estimate from a range reported in the study.

Source: ECONorthwest.

The range of estimates is wide. If salmon-related restrictions prohibit logging on 15 percent on private and state lands, recent studies indicate the estimated total cost to landowners

would be between $99 million and $11,328 million. With prohibitions on 30 and 45 percent of the land, the costs would double and triple. As we indicated above, and explain in greater detail below, however, there are strong reasons to believe that, for a given amount of land included in a salmon-related restricted zone, the actual cost to landowners would be at the lower end of the range indicated by these studies, or even below it.

PUTTING THE ESTIMATES IN CONTEXT

Even a limited review of the assumptions and methods used in the studies reported in Table 3.1 and applied in Table 3.2 reveals that their findings must be interpreted carefully. They overlook several factors that probably will make the actual costs attributable to salmon-related restrictions on logging less—perhaps much less—than the estimates.

This is not to say that logging levels and landowners' revenues will not decline with the implementation of expanded riparian buffers and other measures called for by recent scientific analyses and proposals related to salmon protection (Independent Multidisciplinary Science Team 1999; National Marine Fisheries Service 1998; Pacific Rivers Council 1999). Instead, there are several factors that one should consider to place the cost estimates into their proper context:

Salmon-related restrictions on logging will impose costs on timberland owners *only if*, absent these restrictions, there would be no other restrictions or obligations preventing the logging.

- Although salmon-related restrictions might be the immediate cause of reduced logging, at least some of these reductions probably will occur anyway, for other reasons, in the near future.
- Landowners will have some opportunities for mitigating the initial reductions in their revenues from salmon-related changes in forest-management practices.
- From one perspective, the concept of costs to landowners is rendered moot because landowners have long had an obligation to cease harmful activities if salmon populations were threatened.

Potential Non-Salmon Restrictions

Salmon-related restrictions on logging will impose costs on timberland owners *only if*, absent these restrictions, there would be no other restrictions or obligations preventing the logging. Many Oregonians believe such restrictions and obligations exist now or will materialize in the future. These may materialize to accomplish environmental and economic objectives other than conserving salmon or to stop logging from causing a nuisance.

Potential restrictions to accomplish non-salmon objectives. The cost estimates in Tables 3.1 and 3.2 assume that salmon protection will be the sole cause for landowners to forgo timber revenues in riparian and other areas. This view is too narrow. In the coming years, numerous concerns other than protecting salmon may lead to additional reductions in logging.

For example, efforts to improve water quality or to stem declines in populations of species other than salmon may trigger additional layers of regulations stemming from the Clean Water Act or the Endangered Species Act. Initiatives to coordinate the land-management practices of landowners across a large landscape, and to reduce the ecological disruption of logging, can be expected in light of scientific findings about the threats of forest fragmentation to biodiversity. A recent report by the National Research Council (1998, p. 59), for example, observes that "Fragmentation of forests and other habitats is considered one of the greatest threats to biodiversity worldwide."

Even market forces come into play, increasing the likelihood that some logging restrictions will be implemented on some private and state lands in Oregon, if salmon-related restrictions are not implemented. Over the past few years, an increasing number of landowners have voluntarily adopted tighter logging restrictions to demonstrate to retailers and consumers that their products conform with standards for sustainability and environmental stewardship. It is reasonable to anticipate more of the same in the future.

It is impossible to know exactly how these non-salmon-related pressures for logging restrictions will play out. It seems clear, though, that the pressures are likely to intensify, so that, even in the absence of salmon-related restrictions, landowners cannot be confident of being able to log their lands under current logging rules in the future.

Potential restrictions to prevent logging-related nuisances. Additional non-salmon-related challenges to logging might arise from landowners' obligation not to impose unreasonable costs on their neighbors. This obligation underlies the long tradition of laws that prohibit landowners from creating a nuisance. The concept of nuisance is that every person should use his own property so as not to injure that of another. The concept developed under common law to address the problem of externalities from the use of private land, that is, the effects of a property use on other landowners and the public at large (Prosser 1971).

These laws change from time to time and are invoked as activities that once were not a nuisance become one. Thus, it might be reasonable for Oregonians to conclude that, whereas logging and other activities once were not a nuisance, they now are. Such a change in attitude occurred recently, after landslides originating on private forest lands during 1996 caused widespread environmental harm, damaged personal property, and killed several people. In response to the public outcry, the timber industry agreed to significant tightening of logging rules. More tightening can be expected in the future, as the state's population grows, and conflicts between logging and other human activities increase.

Options for Mitigating Landowners' Revenue Reductions

Even if one determines that salmon-related restrictions on logging and related activities will reduce landowners' revenues, there are many reasons to believe that the estimation techniques underlying the studies listed in Tables 3.1 and 3.2 overestimate the actual costs. These techniques assume landowners will stand by helpless, and do nothing to limit their losses. Known as the "dumb-landowner assumption" it is inconsistent with the innovative, entrepreneurial character of the American economy.

Figure 3.1 identifies some of the options available to landowners for mitigating their costs. The following, short description of these options is not intended to be comprehensive. Instead, it only illustrates that there are several significant options for landowners to continue earning income from forests, once logging and related activities have been restricted. Some options are in place now, others will have to be developed. Until now, landowners have not paid much attention to these options because it was more lucrative to earn income by producing timber in a manner harmful to salmon. Given the ingenuity of landowners, financiers, legislators, and others, however, it seems plausible that all the options identified here, as well as others not yet conceived, will be investigated and implemented if Oregonians make a serious effort to reduce the degradation of salmon habitat from logging and related activities on private and state lands.

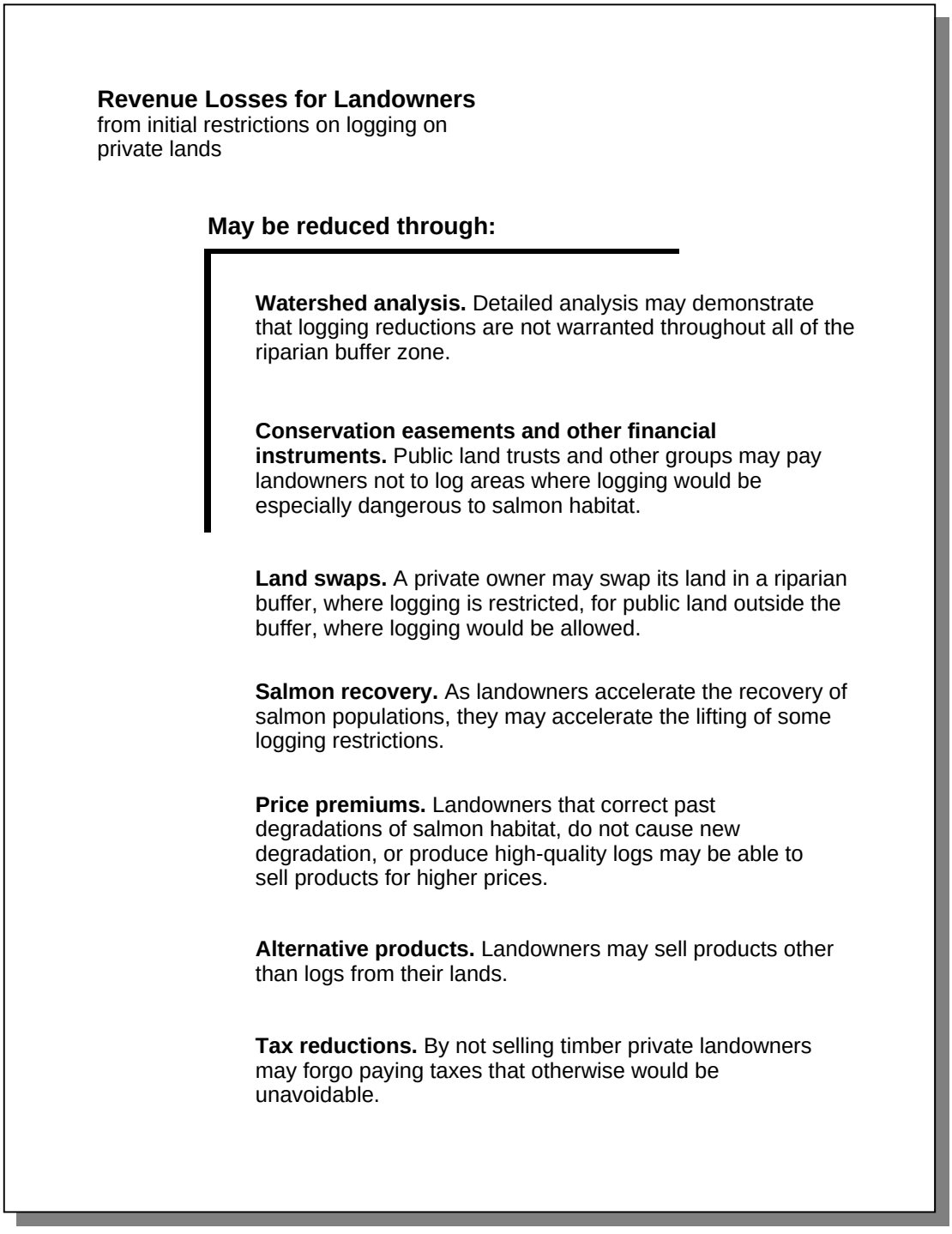
Watershed analyses. The most immediate need is to analyze each watershed to determine where restrictions on logging and related activities are warranted and where they are not. The discussion so far of potential logging restrictions generally acknowledges that landowners and salmon managers have insufficient knowledge to tailor a habitat-protection and -restoration plan for individual streams and watersheds.

This raises two general options. Oregonians can opt to restrict logging only where they know for certain that it will help salmon and then expand the restrictions as scientists and resource managers finish their analyses of each watershed, or they can do the reverse: restrict logging whereever they think it will help salmon and ease the restrictions as watershed analyses show doing so coincides with the state's salmon-conservation objectives. So far, Oregonians have shown a preference for the option that affords greater protection for salmon. This is prudent, for allowing logging because we don't know how it will affect salmon and then finding that the effect is negative would increase both the risk to salmon and the overall costs of salmon conservation.

If, given current knowledge, areas with logging restrictions are painted with a broad brush, then landowners probably can erase part of them by completing watershed analyses that determine more precisely where restrictions are, and are not, warranted. Some landowners already have recognized the opportunities. Weyerhaeuser Company, for example, has undertaken watershed analyses in several locations (Weyerhauser 1995), based on the belief that doing so will reduce both the adverse environmental impacts and the economic costs of their operations.

Conservation easements and other financial instruments. There is at least one financial instrument that might enable a landowner to earn income while forgoing logging and related activities harmful to salmon habitat, and other instruments could be developed in the future. The current option is a conservation easement. With it, the private group or public agency acquiring the easement would pay the landowner who, in return, would agree to manage the land in some prescribed manner (Buist et al. 1995).

Figure 3.1: Landowners Have Several Options for Mitigating Reductions in Revenues if Logging is Restricted in Riparian Buffers



A wide range of new financial instruments has been proposed, and some are being developed. Foremost among these are efforts to develop a functional market that would allow landowners who grow trees to sequester atmospheric carbon to receive income from electric utilities and others who generate atmospheric carbon by burning fossil fuels (Best and Jenkins 1999).

Land Swaps. Under the third option shown in Figure 3.1, a private landowner would swap timberland in a riparian buffer where logging is restricted for public land away from streams, where logging is allowed. Although they often are controversial (Simon et al. 1998), swaps of private and public timberlands have occurred frequently, with the public acquiring lands with high environmental value and private entities acquiring lands with fewer environmental impediments to logging.

Salmon recovery. The present consideration of logging restrictions is prompted by the serious threat of salmon extinctions. As this threat recedes, in response to successful conservation efforts, landowners may be able to argue successfully for relaxation of the stringent actions necessary today, while the threat is large. Landowners have the option of trying to accelerate the reversal of habitat degradation caused by past logging and related activities on their own lands. They also may choose to promote the restoration of habitat degraded by other activities.

Lippke, et al. (1999), argue that foresters may be able to accelerate the restoration of environmental and habitat conditions degraded by past logging practices, markedly reducing the effects of salmon-related logging restrictions on landowners' revenues. By running computerized simulations of how riparian forests might respond to various silvicultural actions, they conclude that merely designating and protecting riparian buffers containing 11.5 percent of the private timberlands in western Washington would reduce logging from current, base-case levels by 23 percent over the next 20 years, and by 15 percent in the long run. In contrast, the short-run reduction in logging would be only 17 percent if landowners applied to the same lands an "active management" strategy aimed at accelerating the attainment of "biodiversity and habitat conservation goals," such as salmon recovery. Moreover, the long run logging levels would be 9 percent *higher* than the base case. Under the "active management" strategy, the discounted, present value of the landowners' costs would be nearly halved.

Different opportunities exist for accelerating salmon recovery by promoting the restoration of habitat degraded by others. Some timberland owners have complained that they have received undue attention in efforts to conserve salmon, while owners of agricultural and urban properties have virtually escaped scrutiny. Insofar as this complaint is justified—and a casual review of the record indicates that it is—then timberland owners probably have opportunities for accelerating salmon recovery by lobbying for measures that will ensure farmers and urban residents carry their fair share of the burden. There also may be opportunities for investing in restorative activities that cover entire watersheds.

Price premiums. Landowners can follow two paths to increase the price they receive for whatever logs they do produce. One would require using pruning and other techniques to increase the quality of the wood in trees in the restricted-logging zone so that, when the

restrictions are lifted and at least some of these logs can be removed, they command a higher price. The other would entail capitalizing on consumer-education movements that seek to reward firms producing logs with the least-possible environmental degradation. Though nascent, this movement has successfully influenced some consumers, especially in Europe, and it recently has induced a major wood-products producer, MacMillan Bloedel, in British Columbia to alter its logging practices and phase out clearcutting (Hunter 1998).

Alternative products. At least some landowners may be able to sell products other than logs from their lands. Mushrooms, boughs, berries, and other plant products are gathered throughout the state. Total sales for the Pacific Northwest are nearly $200 million (Haynes and Horne 1997). The greatest activity—about 85 percent of the total—occurs west of the Cascades, although eastside output is growing rapidly. Growth in this industry is impeded not by a shortage of forest products but by the lack of harvesters and limited infrastructure for gathering, storing, and shipping products (Mater Engineering LTD. 1998).

At least in concept, the sale of products other than logs is not limited just to berries and other plant products. Nearly all the state's freshwater originates as precipitation on forest lands. As Oregon's population grows—it is expected to double within the next forty years or so—so too will the demand for reliable quantities of clean water. If landowners are not obligated to deliver clean water to those downstream, then perhaps they can sell the same.[12] Especially where a municipal water utility is immediately downstream of forest lands, it may be possible to negotiate a deal whereby the utility pays the landowner a fee commensurate with the clarity of the water passing the forest's borders.

Tax reductions. Privately owned forest lands in Oregon have long received special tax treatment. Until tax-law changes adopted by the 1999 legislature, no tax was paid on timber, whether standing or logged, because the tax code treated timber as a crop, rather than as real property. For the land itself, the state, for taxation purposes, calculated land values based on each parcel's ability to grow timber and an index of log values. The owner was obligated to pay annual property taxes on only 20 percent of this value. On the remainder, taxes were deferred until the timber was logged, when the owner paid a percentage—3.2 percent in western and 1.8 percent in eastern Oregon in 1998—of the logs' value (State of Oregon 1998).

Thus, under the old tax laws, if salmon-related restrictions had prevented the logging of $100 of timber, the landowner would have forgone paying $3.20 in western Oregon and $1.80 in eastern Oregon. To appreciate the overall magnitude of the tax consequences of salmon-related reductions in logging, consider the 1997-98 tax year, when private landowners paid about $37.3 million in taxes on logged timber (State of Oregon 1998). If, instead, salmon-related restrictions had reduced logging, then landowners would have realized a tax saving. With a 15 percent reduction in logging, for example, landowners would have realized a tax saving of $5.25 million.

[12] Of course, if they are obligated to provide clean water, then landowners cannot justifiably claim that the proposed salmon-related restrictions will impose a cost on them. Instead, the restrictions merely enforce the landowners' obligations to be good neighbors.

The tax savings will be less under the new tax law, which was adopted in response to the perception of many landowners that their taxes should be reduced. In the future, owners of parcels with 5,000 or more acres must pay taxes on 100 percent of the specially assessed values. Owners of smaller parcels may opt to pay 100 percent annually or 20 percent annually and the remainder when the timber is logged. After 2003 an alternative, as yet undetermined, taxing program will be available to the owners of smaller parcels (State of Oregon 1999).

Landowners may be able to secure additional tax relief by taking advantage of special programs to promote the protection of riparian habitat and improve fish habitat. Landowners participating in the Riparian Habitat Land tax exemption (ORS 308.796) have withdrawn only $200,000 of riparian land from production. The Fish Habitat Improvement tax credit (ORS 315.134) provides a credit against personal or corporate income taxes equal to 25 percent of the cost of fish habitat improvement projects. Projects are infrequent and total less than $5,000 a year (State of Oregon 1998). These programs currently are small and rarely used, but they could be expanded, or similar programs created, to reduce landowners' costs.

Landowners' Debt Obligations

Some Oregonians believe that imposing salmon-related logging restrictions will impose no costs on landowners. Although they acknowledge that landowners' revenues will decline below their current expectations, they believe the owners have long known that society expected them to engage in logging and related activities harmful to salmon only so long as the fish remained plentiful. Once the risk of salmon extinctions became known and unacceptable, however, landowners would have to cease imposing further damage on salmon and shoulder the burden of correcting the damage of past logging.

When a landowner takes out a loan from a bank, it does not consider the repayment of the loan as unreasonable—something to be set aside so the landowner can earn a higher income. Instead, repaying the debt is an obligation. Just so, many Oregonians believe private and state landowners have for decades borrowed salmon habitat and other environmental assets, and now have an obligation to repay their debt.

In effect, those who hold this view see landowners' obligation to help salmon as similar to the obligation a landowner has to repay a mortgage. When a landowner takes out a loan from a bank, it generally does not consider the repayment of the loan as unreasonable—something to be set aside so the landowner can earn a higher income. Instead, repaying the debt is an obligation. Just so, many Oregonians believe private and state landowners have for decades borrowed salmon habitat and other environmental assets, and now have an obligation to repay their debt.

This belief has several roots. One, mentioned above in the discussion regarding nuisance law, is the view that no landowner ever has a right to infringe on the public's rights in fish and wildlife (see, e.g., the discussion in National Research Council 1998). Logging that harmed salmon was okay as long the damage was minimal, but now that salmon are threatened with extinction, owners have an obligation to cease. With this view, the

landowners have brought the need for logging restriction upon themselves, and it is inappropriate for them to say that they are incurring costs imposed by the National Marine Fisheries Service or others who enforce the obligation.

The belief that timberland owners have an obligation not to repay a debt to salmon also is rooted in the tax subsidies they have received over the years. The subsidies have been large. There is no comprehensive analysis of the magnitude, but these examples offer important insights:

- Data from the Department of Revenue indicate the average assessed value on which timberland owners paid property taxes was between 48 and 69 percent of the average market value during the years, 1993-96, while assessed values for other types of property equaled market values (Brian Reeder, personal communication, 18 May 1999).
- For years, timberland owners paid only 20 percent of their property-tax bill each year. In theory, the remaining 80 percent was deferred until the land was logged. The net effect was that landowners enjoyed an interest-free loan from local governments.
- For the 1997–99 biennium (from July, 1997, to June, 1999), private owners of timberland were exempt from paying property taxes on $52.5 billion of property. The exemptions enabled the owners to avoid paying $1.25 billion in taxes (State of Oregon 1998).
- Timberland owners saved about $32.1 million per year in 1997-99 because, unlike most other types of land improvement, logging roads have been taxed as if the improvement did not exist (State of Oregon 1998).
- Other tax breaks in 1997-99 included $8.3 million associated with timber-growing costs, and $700,000 for reforestation (State of Oregon 1998).
- In 1997, the most recent year for which data are readily available, local governments received $5.80 per acre of private timberland (Oregon Department of Revenue). By contrast, local government received nearly twice that amount, $9.27 per acre, for federal forest lands, in the form of Payments In Lieu of Taxes, Owl Guarantee Payments, and O&C Land Payments (U.S. Forest Service, Bureau of Land Management, and National Association of Counties).[13]

SUMMARY

By some calculations, the potential cost of restricting logging and related activities on private and state lands is huge. The two largest organizations representing private landowners, for example, concluded that implementation of the National Marine Fisheries Service proposal concerning Oregon forest practices "would take at least 39 percent of the private timberland base out of production, at a cost to private landowners of $25 billion dollars—an overall 41 percent reduction of the $62 billion statewide value of private timber

[13] This comparison is especially interesting insofar as many local-government officials and others assert that the revenues they receive from Congress are inadequate, i.e., the revenues do not cover the full costs local governments incur to provide services associated with the nearby federal timberlands. By implication, the revenues they receive from private lands cover an even smaller portion of the costs of providing services associated with these lands.

and timber land" (Oregon Small Woodlands Association and Oregon Forest Industries Council 1998). A more thoughtful review of the matter, though, indicates that the actual cost almost certainly will be less. Furthermore, there is a possibility that the actual cost is zero, or nearly so.

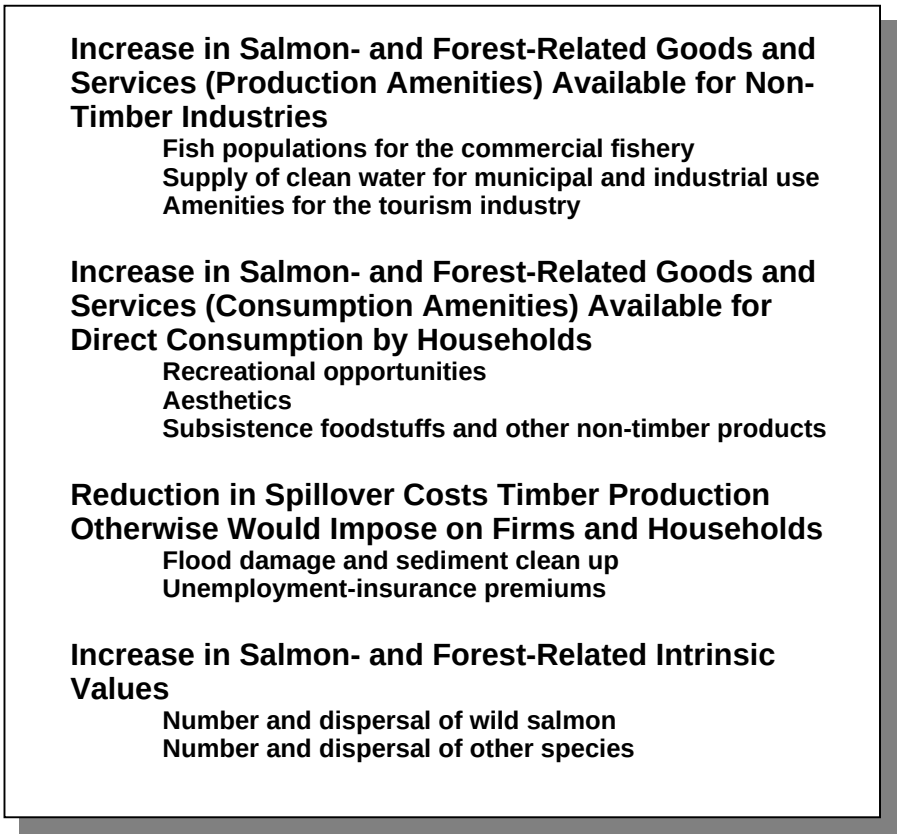
These conclusions rest on technical, analytical issues that adjust downward the costs derived from recent studies, as well as on realistic expectations that landowners will avail themselves of options for reducing their costs. They also explicitly recognize that there are important issues Oregonians must resolve regarding the rights and obligations of timberland owners. Do they have the right to degrade salmon habitat, so that logging restrictions to protect the habitat infringe on that right? Or, do they have an obligation not to degrade habitat? If the latter, then even though implementing restrictions on logging and related activities to protect salmon will reduce landowners' revenues below their expectations, the reductions cannot legitimately be construed as a cost to landowners but, instead, as the enforcement of long-standing obligations.

CHAPTER 4: POTENTIAL BENEFITS OF RESTORING DEGRADED SALMON HABITAT

This chapter's discussion of the potential economic *benefits* of the proposed restrictions on logging and related activities on private lands is a companion to the previous chapter's discussion of the potential *costs*. One must consider the two jointly to understand the restrictions' potential *net* change in the overall value of the affected goods and services.

Restrictions on logging and related activities on private and state lands should generate many types of economic benefits for Oregonians. Figure 4.1 lists some of the potential benefits, using the structure of the full-competition model described in Chapter 2 and illustrated in Figure 2.1. The restrictions should increase the supply of forest and water resources, including salmon, for other industries and for direct household consumption. They also should reduce the costs that industrial timber production otherwise would impose on firms and households and enhance the intrinsic values of wild salmon and other species.

Figure 4.1: Primary Economic Benefits that May Arise from Salmon-Related Restrictions on Logging and Related Activities



PRODUCTION AMENITIES FOR NON-TIMBER INDUSTRIES

The proposed restrictions on logging and related activities should increase the supply of goods and services beneficial to the commercial fishing industry, municipal-industrial water users, and the tourism industry. These are representatives of the Type 2 Demand described in Chapter 2. None can be fully quantified, but there is some evidence regarding the general size of the first two.

Commercial Fishery

Successful salmon-recovery efforts should yield some fish for harvest by the commercial fishing industry. These fish will be valuable both to those who invest and work in the industry and to consumers.

Estimating the value of increasing the supply of fish to the commercial fishing industry, however, is made difficult by many factors, including recent disruption of the industry by closures of fishing seasons because of declining fish populations. These disruptions complicate further an industry already made complicated because fish are caught far from the streams where they were spawned and, hence, individual fishing boats may be regulated by multiple authorities. Increasing competition from farmed salmon operations adds another layer of complexity.

Against this backdrop, the past provides an unclear picture of what to expect in the future, and there is no single measure of value in the commercial fishing industry. Each estimate is dependent on powerful assumptions about market conditions, and how fishers will respond to the reopening of fishing seasons.

Increased supplies of fish to the commercial fishing industry would be worth about $5–70 per fish, depending on the species.

To illustrate the possibilities, though, Table 4.1 shows representative dockside, or ex-vessel prices of different species in recent years, derived from an analysis of salmon runs in the Columbia River (Radtke and Davis 1995). The data indicate that increased supplies of fish to the commercial fishing industry would be worth about $5–70 per fish, depending on the species and method of harvest.[14] Niemi, et al. (1995) concluded that $23 (1998 dollars) was the average value per fish produced by the interior Columbia River Basin and caught by the commercial fishery during 1987-91.

[14] Ex-vessel prices represent the gross value of commercially-caught fish. The net benefit to the national economy of an increase in the supply of fish for the commercial fishery would be the gross value minus the costs of catching the fish and bringing them to market.

Table 4.1: Representative, Recent Ex-Vessel Prices of Salmon

Species	Avg. Weight per fish (pounds)	Price[a] ($ per pound)	Average Value[a] per Fish
Spring chinook	20	$3.48	$69.60
Summer chinook	20	3.48	69.60
Fall chinook	20	1.07	21.40
Coho	9	1.07	9.63
Sockeye	3.5	2.14	7.49
Chum	12	0.64	7.68
Steelhead	8.5	0.64	5.44

[a]Prices and values in 1998 dollars.

Source: Institute for Fisheries Resources (1996).

Municipal-Industrial Water

Logging, road-building, and related activities accelerate soil erosion and increase sediment levels in streams. Downstream industries and municipal water utilities have to remove the sediment, often at considerable cost. Insofar as the proposed restrictions on logging and related activities diminish stream sedimentation, they will increase the downstream supply of clean water and enable municipal-industrial users to avoid the cost of filtering dirty water.

The City of Salem provides a rough measurement of the economic benefits downstream water users might realize from curtailing stream sediment. The city obtains its water from the North Santiam River, which generally is so clear that the city relies on what is known as a slow-sand-filtration system. If the river water were muddier, the city would have to install a more expensive system requiring additional infrastructure and the use of chemicals to remove the sediment. The clean river water saves Salem's residents about $3–5 million per year, or about $24–40 per resident per year (Niemi et al. forthcoming).

Reductions in sedimentation stemming from the proposed salmon-related restrictions on logging and related activities would not yield benefits of this magnitude for all Oregonians. Many, if not most, rely on water sources that are not below private and state forest lands that would be subject to the restrictions. Those who do use water drawn from streams below private and state forest lands typically have already installed the higher-cost type of filtration system and, at least in the short run, would realize benefits only in the form of lower operating costs. If the restrictions result in cleaner streams that persist for decades, however, some of these systems may be converted to cheaper technologies.

Tourism

Tourists don't spend much money to see stumps. Or dirty streams depleted of fish. Research has demonstrated that visitors to the Pacific Northwest prefer natural landscape features, rather than clearcuts (Magill 1992). To the extent that the proposed salmon-related

restrictions on logging and related activities curtail the timber industry's production of these disamenities, they will bolster the fortunes of firms throughout the tourist industry. Nobody has quantified this effect, to our knowledge, but there can be no doubt that it exists.

CONSUMPTION AMENITIES FOR DIRECT CONSUMPTION BY HOUSEHOLDS

Most Oregonians believe the state's environmental attributes—recreational opportunities, subsistence foodstuffs and other non-timber products, and aesthetics—provide them with a high quality of life (Oregon Business Council 1993). Economists recognize that these attributes, called consumer amenities, are important economically because they directly contribute to the standard of living of those who use and enjoy them. In effect, they constitute a second paycheck that augments the well-being Oregonians derive from their first paycheck.

Oregon's private and state forests have important impacts on the state's quality of life, which might be enhanced by the proposed salmon-related logging and related restrictions. Although nobody has yet developed techniques for fully measuring these effects, which relate to what we call Type 2 Demand for resources in Chapter 2, there are some rough indicators.

A general indication of the potential value of reducing the harm to salmon habitat and other environmental elements comes from surveys of current residents and new in-migrants. In a survey of residents, the Oregon Business Council (1993) found that they strongly believe that tightening environmental protections would enhance, not hurt, the state's economic outlook. In surveys of new in-migrants, the Oregon Employment Department has found that, when asked why they moved to Oregon, far more said they came to take advantage of the state's quality of life than to capitalize on its job opportunities. Furthermore, many in-migrants willingly accepted a reduction in earnings to relocate in Oregon.

On average, the wage reduction for 1993 in-migrants was 25 percent (Judson 1993). This amount indicates that current residents as well as in-migrants derive great value from, and place great value on, the state's environmental, cultural, and other amenities. The portion of this amount that would be affected by the proposed salmon-related restrictions on logging is unknown. It seems reasonable, however, to anticipate that the effect would be considerable, especially insofar as the restrictions would contribute to preventing widespread extinctions of salmon, a highly visible environmental and cultural icon.

Recreation

Perhaps the greatest quality-of-life effect will occur as the proposed restrictions enhance existing recreational opportunities and generate new ones. Much of this effect will materialize if the restrictions and other salmon-conservation efforts result in salmon populations sufficiently large to support fishing and other recreational activities associated with salmon. Other recreational benefits might accrue to those who enjoy hiking, hunting, and other outdoor activities.

Recreational Fishing. Salmon and steelhead are important recreational resources. If restrictions on logging are effective, they will increase the populations of salmon and steelhead. With more fish available, the catch per angler will rise, inducing more people to go fishing. As with the commercial fishery, it is difficult to estimate the value of future increases in fish populations to the recreational fishery. Since most past studies of recreational values have been conducted during periods when salmon populations have been declining, they provide little direct insight into how anglers are likely to respond after a prolonged hiatus in fishing. As fish populations dropped in recent years, so too did catch rates, and many anglers cut back or stopped completely. Even more recreational fishing will be suspended as the region watches to see if recovery efforts are successful in restoring salmon populations sufficiently healthy to allow renewed angling.

Past studies of the recreational fishery do, however, support some general conclusions. One of the most important is that the value of adding salmon (especially steelhead) to the recreational fishery substantially exceeds their value to the commercial fishery. Alkire (1993) for example, concluded that a "conservative" estimate of the average recreational value per fish can be obtained by multiplying the average ex-vessel price of commercially-caught fish by three.

The total value of fish to the recreational fishery is the amount anglers are willing to pay to fish for them. Economists typically break the total value into two parts. One is the amount anglers actually spend to fish. In most cases, though, anglers are willing to spend more than they actually do. The difference, which economists call the consumer surplus, is the amount the angler's willingness to pay exceeds what she actually pays. Consumer surplus is important because it represents a real gain in overall economic well-being, i.e., anglers obtain something (the recreational enjoyment of fishing and catching fish) that is worth more than they pay for it (their actual expenditures). Conceptually, consumer surplus is analogous to the net value (gross value minus harvesting costs) of fish caught by the commercial fishery.

Anglers' total willingness to pay—the sum of their expenditures plus their consumer surplus—to catch a salmon or steelhead in recent years has been about $190 per fish.

The data and recent studies of recreational salmon fisheries included in an extensive review by the Bonneville Power Administration and other agencies (1994) support the conclusion that, in recent years, the average consumer surplus (in 1998 dollars) per fish caught has been about $109. They also show that anglers' fishing expenditures averaged $80 per fish caught. Thus, the anglers' total willingness to pay—the sum of their expenditures plus their consumer surplus—to catch a salmon or steelhead in recent years has been about $190 per fish.[15]

[15] The sum of recreational expenditures and consumer surplus represents the gross value of fish available to the recreational fishery. The net benefit to the national economy of increasing the supply of fish to the recreational fishery generally is measured differently: the incremental increase in consumer surplus as anglers catch more fish per trip or shift to fishing from another recreational activity.

This estimate provides a general backdrop for weighing the potential benefits that would accrue if restrictions on logging and related activities lead to an increase in the supply of salmon for the recreational fishery. The estimate draws on some specific assumptions—the agencies assumed a 40:60 distribution of fish between those caught in the ocean and those caught in the river, for example. Furthermore, it reflects average values that prevailed about a decade ago. Since then the region's human population has increased, as have incomes, and the supply of fish for the recreational fishery has declined. Economic theory indicates that all these factors have pushed the value per fish higher.

As these trends continue, the value per fish should increase even further. Thus, if restrictions on logging and related activities yield increases in the supply of fish, the value per fish, at least initially, should be higher than $190 per fish. If the increase in supply grows large enough, however, the value per fish eventually should decline. For now, though, it seems reasonable to conclude that future increases in the supply to the recreational fishery of fish resulting from logging restrictions will have a gross value worth at least $200 per fish. The consumer surplus will be at least $110 per fish.

Other Recreation. Anglers would not be the only ones to derive recreational benefits from improvements in forest-related salmon habitat. Many Oregonians would derive pleasure from watching the fish, learning about their migrations, and so forth. In addition, the improved habitat and increased fish populations would enhance the recreational value of hiking, sightseeing, and other recreational activities.

Nobody has directly estimated these benefits, but several studies demonstrate that their value is substantial. One was conducted by Forest Service researchers, who investigated the relative value of different types of goods and services that would be affected by restrictions imposed on national forests in the Snake River Basin to protect endangered salmon. They found that the value of the forgone recreation was 3–4 times the value of the forgone timber, range, and mining (Haynes et al. 1992).

Another study, completed as part of the Interior Columbia Basin Ecosystem Management Project (ICBEMP), gives these findings sharper focus. Richard Haynes and Amy Horne (1997) assessed the value of recreation on federal lands in the Columbia River Basin between the Cascades and the Rockies. They found that over 56 million days of recreation activity days per year were made to federal land-management units falling wholly or partially within eastern Oregon between 1991 and 1993. The total value of the recreational visits to federal lands in eastern Oregon visits was $373 million.

Haynes and Horne also estimated the values per acre of federal land for different types of recreational activities. Table 4.2 shows their findings. For the Interior Columbia Basin as whole, all recreational activities generated a total value of $23 per acre per year. This was about one-third FEMAT's (1993) finding that the average value of recreation on federal lands in the range of the northern spotted owl (Western Washington, Oregon, and Northern California) in 1990 was $76 per acre, in 1998 dollars.

Table 4.2: Recreational Value Per Acre, Federal Lands in the Interior Columbia Basin

Activity	Dollars Per Acre[a]
Fishing	5.54
Hunting	5.32
Day Use	2.96
Winter Sports	2.84
Camping	1.94
Trail Use	1.84
Motoring Viewing	1.05
Viewing Wildlife	0.94
Nonmotor boating	0.22
Off-Road Vehicle Use	0.13
Snow Mobiling	0.07
Total	22.85

[a] 1998 dollars.

Source: ECONorthwest with data from Haynes and Horne (1997).

How these values for federal lands compare with those for private and state forest lands is not known. Although private and state land managers typically place greater emphasis on timber than on recreation and often restrict recreational access to their lands, considerable recreation does occur on them. If the recreational values per acre on private and state lands are comparable to those on federal lands, however, then the 2,447,000 acres of private timberlands in eastern Oregon provide about $56 million of recreation benefits, and the 5,765,000 acres in western Oregon provide $438 million of benefits annually. It is important to note that both Haynes and Horne (1997) and FEMAT (1993) found that fishing has the highest value of all recreational activities. This is the activity that would be most directly affected by salmon-related restrictions on logging and other activities.

The services associated with unroaded areas, fishing, and other activities is 89 percent of the total value of all commodities and services derived from federal lands in the interior Columbia River Basin. The value of timber is only 11 percent of the total.

Logging and related activities can have a complex impact on the recreational values derived from forest lands—increasing values associated with motorized sightseeing, for example, while decreasing fishing values—but, the net effect in many, perhaps most, cases is negative. Table 4.3 illustrates some of the positive impacts on recreation that might result from restrictions on logging and logging roads.

Haynes and Horne subsequently compared the value of logs versus the value of services derived from federal lands in the Columbia River Basin between the Cascades and Rockies. They found that the services associated with unroaded areas, camping spots, fishing, and

other activities was 89 percent of the total value of all commodities and services derived from those lands in 1995. The value of timber was only 11 percent of the total. Their analysis indicated that, by 2045, timber will have decreased to just 5 percent of the total.

Table 4.3: Potential Positive Impacts on Recreation of Restrictions on Logging and Related Activities[a]

	Effect on Recreation
Increase in the number of trees per acre	* Increases the recreation benefits associated with camping, picnicking, backpacking, hiking, and fishing. Research in Colorado, for example, found that a decrease from 200 to 50 trees per acre produced these reductions in per-visitor benefits: from to Camping: $175 $3 Picnicking $204 $17 Backpacking $194 $0 Hiking $363 $139 Fishing $386 $153 (Loomis and Walsh 1986). * Increases total recreation benefits. Rosenberger and Smith (1997) found that a 15 percent decrease in the number of trees per acre reduced annual benefits by $98-$324 per visitor. Walsh et al. (1990) found that total recreational benefits in Colorado were maximized with an average density of 150 trees per acre
Increase in the average tree size	* Increases the recreation benefits associated with camping, picnicking, backpacking, hiking, and fishing. Loomis and Walsh (1986) found that annual recreation benefits per visitor in Colorado from $34 with trees 2.5 inches diameter breast height (d.b.h.) to $252 with trees 10.5 inches d.b.h.
Decrease in the number of road miles	* Protects opportunities for camping, hiking, and other activities experienced in a backcountry setting (Rice 1989). * Increases the value of hiking. Hiking in Colorado's roadless areas, for example, generated benefits of $20 per visitor day, while hiking in roaded areas generated benefits of $14 per visitor day (Walsh et al. 1984).

[a] All dollars figures are 1998 dollars.

Source: ECONorthwest with data from Loomis and Walsh (1986); Rosenberger and Smith (1997); Walsh et al. (1990); Rice (1989); Walsh et al. (1984).

These numbers give only a rough approximation of the recreational value that might be associated with logging reductions on private and state lands. It is important to recognize that these estimates represent only a small portion of the overall contribution Oregon's nonfederal forests make to the state's quality of life. What is clear, however, is that restricting logging and related activities to promote salmon conservation can boost the second paychecks of everyone in the state who values living in proximity to unlogged forests.

Aesthetics

When private and state forests are logged in a manner that creates unappealing landscapes and streams, they diminish the well-being of most Oregonians. Although no study quantifies the aesthetic values that might be affected if salmon-related restrictions on logging reduce the amount of logging on private and state lands, considerable research indicates that they are not trivial.

People like the aesthetics of forests and streams with a natural appearance. Homes with views of wildlands have higher sale prices than those without (Magill and Schwarz 1989), and visitors to wildland areas prefer natural landscape features (Magill 1992). Few Oregonians prefer to live next to a clearcut or a muddy stream rather than next to a standing forest or stream with clean water. Indeed, the timber industry itself has recognized that travelers prefer driving past natural-looking forests and streams rather than clearcuts and muddy streams, and they often manage their forests to minimize the number of clearcuts viewed by the public. “Aesthetics resource management” has become the way of doing business in the northwest (Schuh 1995).

Subsistence

In the past, catching salmon was an important source of subsistence nourishment for many Oregonians. It could be in the future, if populations are large enough. Catching fish to put food on the table has a long history as a way for low-income families to survive. The potential subsistence value of salmon seems particularly important to Tribal families, but not exclusively so.

It seems reasonable to conclude that subsistence benefits are embraced by the state's mission for salmon conservation as stated in the Oregon Plan. We know of no study, however, estimating the potential subsistence value of increased salmon populations that might result from restrictions on logging and related activities. Nonetheless, we identify subsistence values to identify that they are real, potentially important benefits that might materialize from such restrictions.

REDUCTIONS IN SPILLOVER COSTS

Logging and related activities on private and state lands in Oregon often impose costs on households and non-timber firms throughout the state. Economists often call these spillover costs. Insofar as salmon-related restrictions on these activities would reduce these costs, they also would generate economic benefits for the same households and firms.

Figure 4.2 identifies nine categories of spillover costs that could be avoided through restrictions to promote salmon recovery. We've already discussed some of these, such as impacts on commercial fishing and municipal water supplies. We address the others here.

Most of the spillover costs stem from the impacts logging and related activities, such as road construction, have on streams. These activities can alter streams by increasing the

level of sediment, raising the water temperature, and increasing streamflows during some periods. They also can alter riparian vegetation and the hydrologic structure of stream channels. These alterations, in turn, can degrade the productivity of salmon habitat and reduce salmon populations, which has an adverse impact on the commercial and recreational fishing industries.

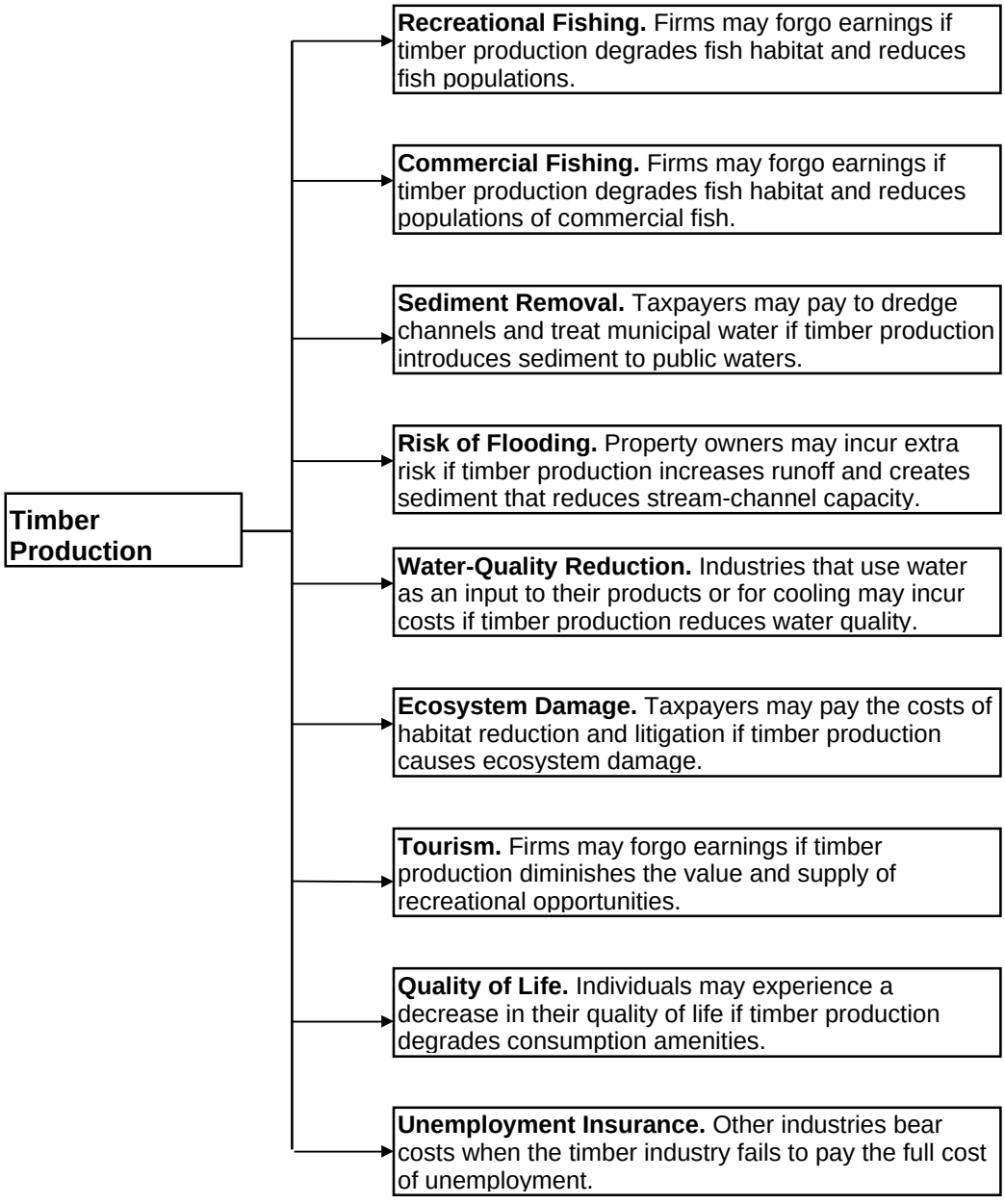
Sediment in streams fills stream channels and increases costs to taxpayers, land owners, and water consumers who must pay to remove the sediment. Industries that use sediment-laden water in their industrial processes often incur additional costs to maintain their machinery, remove the sediment, or both. As sediment clogs stream channels, the risk of flooding increases for owners of adjacent land, and this risk is increased further whenever logging leads to increases in runoff.

Although there is no study that estimates directly the spillover costs associated with logging and related activities on Oregon's nonfederal forests, there is some evidence one can use to estimate the general magnitude of the sediment-related costs. Ribaudo (1989) estimated that, on average, each ton of sediment in streams in the Pacific states imposes costs of $3.66 (measured in 1998 dollars). Other studies, such as Grant and Wolff (1991) and Weaver and Hagans (1994) have estimated the impacts of logging and related activities on the amount of sediment in streams, and found that the impact varies from place to place and according to the logging techniques that are employed. Based on 30 years of data associated with a research forest, though, Grant and Wolff determined that clearcutting, alone, can generate an additional ton per acre, and clearcutting plus roads can generate 3.5 tons per acre per year for about 25 years. These numbers indicate that each acre logged can put in place sedimentation processes that, using a discount rate of 4 percent, have a discounted present value of about $208.

About 93,000 acres of private timberland have been clearcut each year for the past decade (State of Oregon various years). The various salmon-related proposals would restrict logging and related activities on roughly 15-45 percent of the state's private and state-owned timberlands. If the restrictions reduced the clearcut acreage by 15 percent of the recent annual total, or 13,950 acres, and prevented sediment-related spillover costs of $12.81 per acre, then the benefit per year would be $178,700. If the restrictions prevented 45 percent of the logging, the benefit per year would be three times larger, or $536,100. At $208 per acre, the discounted present value of not initiating the sedimentation processes associated with clearcutting would be $2.9 million for a 15 percent reduction (13,950 acres) and $8.7 million for a 45 percent reduction (41,850 acres).

These are rough estimates of the average benefits per acre not logged. The actual amount would vary from place to place, being smaller for acreage where logging would add less than average sediment to short streams with few natural and physical assets downstream that are susceptible to sediment-related damage. The benefits would be larger than average where conditions are the reverse. There are several reasons to anticipate that, overall, the actual benefits from stopping logging are increasing. The first is that Ribaudo (1989) based his cost estimate on economic conditions in 1986. Oregon's population and economy already are much larger and, as they grow, so do the benefits of keeping sediment out of streams. Furthermore, Ribaudo did not take into consideration the benefits associated with reducing the risk to human lives. The recent deaths caused by mass movements (land slides) demonstrate that these risks are high, as are the economic benefits of reducing the risks.

Figure 4.2: Spillover Costs from the Timber Industry That Could be Avoided through Restrictions on Logging and Related Activities



Source: ECONorthwest.

Sediment-related spillover costs from logging also may be magnified insofar as logging, besides generating sediment that clogs stream channels, also increases the flow of flood water from forest lands. Ribaudo did not address the interaction between sedimentation and increased flood flows. From their review of 34 years of data from a research forest in the Oregon Cascades, however, Jones and Grant (1996) found that clearcut areas have higher peak discharges and greater volumes of storm-water runoff than forested areas, and that roads exacerbate these effects. The authors concluded that "Forest harvesting has increased peak discharges [of runoff water] by as much as 50% in [small] basins and 100% in large basins over the past 50 years." These effects persisted for 25 years after an area was logged or roaded. Research to estimate the economic damages associated with such increases in runoff has not yet been completed.

Spillover costs occur when the timber industry fails to pay the full costs of labor practices that yield high unemployment for the industry's workers. Virtually all employers must pay an annual premium to provide unemployment insurance for their employees. The unemployment-insurance program, in concept, is designed so that, over time, each firm's premiums would balance the amount of unemployment-insurance benefits paid to its laid-off workers. In the past, however, the amount of benefits paid to workers in the timber industry have exceeded the amount of the industry's premiums. For example, between 1980 and 1997 the unemployment-insurance benefits paid to workers laid off from Oregon's lumber-and-wood-products industry exceeded the industry's total premiums by almost $358 million (measured in 1998 dollars). Business owners in other industries, and their workers, bore the burden of making up this difference.

Perhaps the largest spillover cost is what all Oregonians pay to clean up the environmental mess created by timber production. Although logging is not the sole cause, it is a major contributor to a large set of environmental problems (Beschta et al. 1995). Besides degrading habitat, the underlying cause of declines in Oregon's salmon populations, it also has had an adverse effect on other fish, northern spotted owls, marbled murrelets, and other species. Logging is a major cause of declines in the quality of the state's streams, adding sediment and raising water temperatures. Slash burning following logging pollutes the air, and many believe the industry's application of pesticides has adverse impacts on the health of humans and other species. Logging practices also can facilitate the spread of noxious exotic plants and diseases, such as a root disease that kills Port Orford cedar.

In sum, adjusting Oregon's forest practices to promote salmon recovery would reduce the logging-related spillover costs that otherwise would have accrued to firms in other industries and to workers and households. Firms that otherwise would have borne these costs would presumably increase their investment, hire additional employees, and pay owners higher profits. This could boost Oregon's economy insofar as the sectors that would benefit from the logging reductions exhibit a far greater ability, relative to the timber industry, to generate new jobs and higher incomes.

LOGGING RESTRICTIONS SHOULD INCREASE THE INTRINSIC VALUE OF PRIVATE AND STATE FORESTS

The ecological stakes in Oregon's forests are high. They house several threatened and endangered species—including salmon, bull trout, marbled murrelets, and spotted

owls—and many believe the list will grow. They also constitute part of the ecological tapestry that many Oregonians, and others, feel is so special. The intrinsic character of the forests make important contributions to the overall economic well-being of those who care about such things and the proposed logging restrictions can create economic benefits by reinforcing this well-being.

Measuring the economic importance of protecting intrinsic values requires different tools than the prices one uses to measure the economic importance of logs and other market-oriented goods and services derived from forests. Currently, economists are relying on carefully crafted surveys that ask people how much they would be willing to pay to accomplish certain levels of security that the intrinsic values of forests would be maintained or enhanced.

Table 4.4 summarizes four studies that have estimated households' willingness to pay money to protect salmon in the Pacific Northwest. The results indicate that Oregon households, on average, are willing to pay $2.50–7 per month to protect or restore salmon. If these survey findings apply to the 1.25 million households in Oregon (U.S. Department of Commerce 1998), then the total willingness to pay to protect salmon is $3-8.75 million per month. These numbers illustrate the general magnitude of the intrinsic values associated with protecting salmon. Different surveys and assumptions will likely yield different results. In addition, it is important to recognize that these estimates represent only the intrinsic value that Oregonians place on protecting salmon. Adding the value those living elsewhere place on protecting salmon in Oregon would increase the numbers.

Table 4.4: Estimates of Willingness to Pay to Protect Salmon (1998 Dollars)

Study	Study Area	Average Willingness to Pay/Month
Smith et al. (1997)	Oregon Coast	$7.07
Oregon Progress Board	Oregon	$4.04
Washington Department of Fish and Wildlife (1996)	Washington	$8.08
Olsen et al. (1991)	Oregon, Washington, Idaho, and western Montana	$2.52-7.07

Source: ECONorthwest with data from Smith et al. (1997); Washington Department of Fish and Wildlife (1996); and Olsen et al. (1991).

SUMMARY

The proposed restrictions on logging and related activities would generate substantial economic benefits by increasing the supply of non-timber goods and services derived from private and state forests, and by curtailing the spillover costs that logging imposes on others. Estimating the size of these potential benefits, however, is not a straightforward task. Data often are incomplete and many of the affected goods and services lie outside the channels of commerce that generate market prices and similar indicators of value.

Not having a market price, however, does not mean that the value is zero. Indeed, many of the things that would be enhanced by taking actions to conserve salmon are too precious to be measured with monetary yardsticks. Among these is the ability to pass to future generations healthy salmon populations and the fabric of life that sustains them. Increasingly, Oregonians seem to recognize that sustaining salmon is part and parcel of sustaining the strength of Oregon's economy.

One useful way to look at the value of increased fish populations is to consider not the value of the fish, per se, but the value of the habitat that produces the fish. The two values are linked, just as the value of the annual earnings from a financial asset is linked to the value of the asset itself. Economists use a process called discounting to calculate the value of an asset capable of producing a given flow of future earnings. The present, discounted value of an asset is the lump sum, attributed to the asset, that society considers equivalent to the promised flow of earnings stretching into the foreseeable future.

These concepts apply equally to salmon and habitat. Thus, if logging restrictions result in habitat improvements capable of generating one more fish per year, the value of the habitat improvement would be equal to the present, discounted value of the additional fish over future years. As we describe above, the value of each fish depends on whether it is caught by the commercial or recreational fishery. Also, one must distinguish between gross value and net value (or consumer surplus for the recreational fishery). The relationship between the value of habitat and its annual fish production also depends on the discount rate, which is equivalent to the rate of interest that applies to a financial asset.

During the initial stages of salmon recovery, even small improvements in habitat, probably would yield a habitat-asset value exceeding the forgone timber-asset value for many sites and streams.

There are too many uncertainties to estimate precisely the asset-value of habitat improvements that might results from salmon-related logging restrictions on private and state lands. The general order of magnitude, however, is revealed by considering the estimates of additional fish to the recreational fishery, which we discussed above: a gross value of $200 per fish and a net value, or consumer surplus, of $110 per fish. To complete the example, we use a discount rate of 4 percent, a rate that often is applied when considering large societal resource-allocation decisions. These numbers indicate that, if habitat improvements resulting from salmon-related logging restriction generate one additional fish for the recreational fishery per year per acre for the foreseeable future, the gross asset value of the habitat improvements would be roughly $5,000, and the net value would be about $2,800 per acre.

To give these values some context, consider that the asset value of state and private land used for growing timber in Oregon is about $400 per acre in Western Oregon (Lettman and Campbell 1997), and less east of the Cascades. Given that the average current standing stock of timber on the Westside is less than 10 thousand board feet per (mbf) acre (Lettman and Campbell 1997) and assuming the price of this (immature) timber is less than $400 per mbf, the total value of land plus standing timber is about $4,000 per acre. These values represent the net value of producing timber and are analogous to the net value of habitat that produces salmon.

Thus, if salmon-related restrictions on logging converted one acre of land from producing timber to producing salmon for the recreational fishery, the asset value of the new salmon habitat would be several times the forgone asset value of the timberland. It would equal the forgone asset value of the land plus the average current stocking of timber if it were capable of producing about 1.5 fish per year.

This comparison considers only one component of the economic benefits that would be generated by restrictions on logging and related activities on private and state lands. Incorporating into the comparison other components—such as benefits associated with cleaner stream water, better non-salmon-related recreational opportunities, and added protection for intrinsic values—would tip the scales toward the creation of improved habitat. Many of the benefits, measured on a per-fish basis, from improving salmon habitat would be especially high for the initial, resulting increases in salmon populations. During the initial stages of salmon recovery, even small improvements in habitat, making it capable of producing less than one fish per acre, probably would yield a habitat-asset value exceeding the forgone timber-asset value for many sites and streams. Identifying which sites and streams offer the greatest potential habitat-asset values can be determined through ecological and economic analyses of individual watersheds.

CHAPTER 5: POTENTIAL NEGATIVE AND POSITIVE IMPACTS ON JOBS

The proposed restrictions on logging and related activities on private and state lands will have both negative and positive impacts on the employment opportunities open to Oregon's workers. The negative impacts should diminish in a matter of months, however, while the positive impacts should persist for years.

The restrictions will have similar impacts on other economic characteristics, such as incomes and tax revenues, that often are important considerations when making forest-management policies. For brevity's sake, however, we examine only the job impacts.

POTENTIAL NEGATIVE IMPACTS

Insofar as the proposed restrictions reduce logging and related activities on private and state lands, they will reduce the number of timber-related job opportunities open to Oregon's workers. The various proposals would restrict logging and related activities on roughly 15-45 percent of private and state timberlands. These lands currently produce about 3.5 billion board feet (bbf), 82 percent of the total timber logged in Oregon (Oregon Board of Forestry 1999). A 15-45 percent decrease in production from them would reduce the overall timber supply by about 0.5–1.6 bbf, or 12-37 percent.

The timber industry currently employs about 50,000 workers.[16] If the reduction in timber-related employment were proportional to the reduction in timber production, then the proposed restrictions would lead to a drop in timber-industry employment of about 6,000–18,500 jobs. The employment reduction probably would be less than proportional, however, as the smaller timber supply should induce manufacturers to increase the degree of processing, in an effort to get more value from the smaller amount of wood. A study by the Oregon Department of Forestry (ODF) of the potential economic impacts of changes in timber production from state lands in Northwest Oregon determined that each increase or decrease of one million board feet (mmbf) would cause timber-industry employment to increase or decrease by 7 jobs (Angle et al. 1996). Using this estimate, the proposed reduction in timber production of 0.5–1.6 bbf would reduce timber-industry employment by about 3,500–11,200.

In sum, the proposed salmon-related restrictions on logging and related activities might cause a decline in the state's timber-industry employment somewhere in the range between 3,500 and 18,500 jobs. Although the impacts on affected workers and families could be serious, even traumatic, there would be little impact on the state's overall economy. Table 5.1, for example, compares the potential loss in timber-industry jobs with several indicators of the state's economy and past changes in jobs. It shows that the potential reduction,

[16] For this discussion we focus on the predominant component of the timber industry, the lumber-and-wood-product industry, Standard Industrial Classification (SIC) number 24.

3,500–18,500 jobs, is less—perhaps far less—than the number of jobs managers of timber firms eliminated during the 1980s as they broke the unions and cut labor costs. It also is perhaps somewhat larger than, but probably less than, the industry's job losses during the 1990s, which stemmed from reductions in federal timber production and cutbacks elsewhere in the industry (Goodstein 1999; Niemi et al. 1999).

The comparison with the job losses the industry already has experienced in the 1990s is especially important. The loss of 17,000 jobs did not noticeably impede growth in total, statewide employment during this decade. Indeed, the annual growth in total employment during the decade has far exceeded the job losses in the timber industry. The timber industry is just too small a part of the state's economy for a loss of 17,000 timber jobs to have much effect on the state's overall economic performance. The potential salmon-related job losses in the timber industry, which would affect about one percent of the state's total employment, should similarly have little effect.

Workers in the timber industry would not be the only ones affected. Whenever a business lays off workers, the effects ripple through the rest of the economy. Hence, as a firm in the timber industry and its laid-off workers reduce their spending, other firms and workers feel the pinch, and they too cut back their spending. This ripple effect spreads through to all sectors of the economy, but eventually it dies out. Economists have tried to sum up the total reduction in jobs associated with the loss of one job in the timber industry, and such totals are called total-job multipliers.

Table 5.1: The Potential Reduction in Timber-Industry Jobs Is Small Relative to the Economy and Past Changes

Potential reduction in timber-industry employment to restore and protect salmon habitat	3,500–18,500 jobs
By comparison:	
Jobs the timber industry eliminated to reduce labor costs in the 1980s	more than 27,000
Timber-industry jobs lost in the 1990s	17,000
Total statewide, nonfarm, payroll employment, 1998	1,556,600
Average annual growth in total, statewide, nonfarm, payroll employment, 1990-1998	38,700

Source: ECONorthwest.

Most studies have concluded that the total-job multiplier associated with the loss of one job in the timber industry is about 2.0. That is, roughly one job outside the timber industry is affected for every job affected within it. Some analysts believe the multiplier is considerably larger. Angle, et al. (1996), for example, conclude that the total-job multiplier is about 3.4. Whatever multiplier one uses, however, it is *incorrect* to conclude that every time a timber worker loses his or her job, one or more workers in other industries lose their jobs. That is, one *should not* assume that, if the salmon-related restrictions cause 1,000 timber workers to lose jobs, another 1,000–3,400 workers also would lose their jobs. Such a view is simplistic.

A total-job multiplier does no more than provide a general sense of the maximum amount of adjustment workers would face following implementation of the restrictions. The adjustment can be easy, hard, or anywhere in between. Oregon's reaction to reductions in timber-industry layoffs in the 1990s shows that the state can adjust quickly. As a mill laid off workers and cut back its purchases from vendors generally of electricity, trucking services, office supplies, and so forth, the vendors were able to find other, replacement customers. And, as the laid-off timber workers cut back their purchases from the gas station and supermarket, these firms also generally found replacement customers.

It didn't happen this smoothly always and all places, of course, but the job-loss ripples coming from the timber industry were generally swamped by the job-creation ripples emanating from the state's rapid population and economic growth. Barring a collapse of the state's economy, it should respond similarly to any timber-industry job losses resulting from salmon-related restrictions on logging and related activities.

What of the workers who would lose their jobs? In no way does our description of how smoothly the economy as a whole would adjust diminish the hardship and even trauma for individual workers and their families. For most dislocated workers, though, unemployment probably would persist for less than three months, and the percentage remaining unemployed after one year probably would not exceed the background percentage for the workforce as a whole (Power 1996).

Most timber-industry workers live in or near the state's metropolitan centers and will have the easiest time finding replacement jobs. No definitive estimate of the percentage living near metropolitan areas exists, but several studies indicate the majority do. Angle, et al. (1996), for example, indicate that about half the timber logged from state lands in Clatsop and Tillamook counties is processed elsewhere, primarily in the more urbanized counties of the Willamette Valley. Niemi and Whitelaw (1994) found that more than 80 percent of the timber jobs in Lane County are located in the immediate vicinity of Eugene and Springfield.

POTENTIAL POSITIVE IMPACTS

The proposed restrictions on logging and related activities will stimulate the development of new employment opportunities for Oregon's workers through three mechanisms. One, it will reduce the economic costs industrial timber production imposes on firms and households. Two, it will increase the supply of nontimber goods and services available from Oregon's forests for use by nontimber industries. Three, it will enhance the supply of

consumer amenities available to Oregonians, reinforcing those elements of the state's economy dependent on the state's quality of life.

Reduce the Logging-Related Costs on Others

In Chapter 4 we discuss the costs that logging imposes on households and non-timber firms. Figure 4.2 shows the different types of spillover costs from industrial timber production throughout Oregon.

Coping with these environmental and other problems consumes large amounts of public and private funds. By imposing these costs on others, the timber industry, in effect, imposes a tax on the rest of the economy. Sometimes called backdoor taxes, the spillover costs imposed by the timber industry reduce the profits of nontimber firms and the disposable incomes of families throughout the state. By reining-in these spillover costs, the proposed restrictions on logging and related activities will lighten this burden and stimulate jobs and growth in the nontimber sectors of the economy.

Increased Goods and Services for Nontimber Industries

If fewer forest and stream resources are devoted to timber production on private and state lands, more will be available for activities that benefit other industries. The most obvious of these are commercial fishing and the various industries associated with recreation and tourism.

The commercial fishing industry would enjoy positive impacts from the proposed restrictions on logging and related activities insofar as they lead to better habitat and, hence, populations of Oregon's salmon stocks large enough to support commercial catches. Oregon is committed to producing populations larger than just the minimum needed to lower the risk of extinctions (State of Oregon 1997). Future commercial fishing is a possibility, although the precise impacts cannot be estimated reliably.

As the salmon populations recover, however, another impact on commercial fishing might emerge. Currently, fishing for some abundant species is limited to avoid inadvertently killing off Oregon's at-risk species. As these species recover, the limitations on fishing for the abundant stocks presumably will be relaxed (Kitzhaber 1999).

The geographic distribution of the potential impacts on the commercial fishery is unknown. Some expansion of commercial fishing may occur within Oregon's waters by Oregonians, the rest may accrue to residents of neighboring states, British Columbia, or Alaska.

Several studies illustrate the potential economic importance of commercial fishing. The Pacific Rivers Council (1992) estimated that $120.5 million (measured in 1998 dollars) of personal income and 4,450 jobs were generated by commercial fishing for salmon, steelhead, and trout in Oregon in 1988. Another study estimated that restoring salmon and steelhead runs to pre-development levels in the Klamath Basin could generate 4,145-6,870 commercial-fishing jobs earning $20,000 per year (Institute for Fisheries Resources 1998).

A similar study for the Columbia River Basin estimated that restoring salmon and steelhead runs to pre-development levels could generate 13,000-25,000 commercial-fishing jobs earning $20,000 a year (Institute for Fisheries Resources 1996). This study also estimated that the economic contribution to lower Columbia River communities of runs typical of those in 1992-4 was only about 1 percent of the potential contribution if salmon runs were fully restored.

Improved salmon habitat and increased salmon populations also would create new job opportunities associated with recreation and tourism. Again, it is impossible at this time to develop reliable predictions of how large these would be or where they would manifest themselves. It is useful, however, to examine some of the available evidence regarding this sector of the state's economy.

In 1996 the US Fish and Wildlife Service sponsored a survey of outdoor-related recreation. Table 5.2 shows some of the findings and provides insight into the general magnitude of the economic impact of recreational fishing, hunting, and wildlife viewing on Oregon's economy. About 1,666,000 people over the age of 16 fished, hunted, or observed wildlife in Oregon in 1996. Of this total, 498,000 (30 percent) were nonresidents. Anglers, hunters, and wildlife viewers spent about $1.97 billion on lodging, food, transportation, and equipment.

Table 5.2: Economic Impacts of Fishing, Hunting, and Wildlife Watching in Oregon, 1996 (1998 Dollars)

	Fishing	Hunting	Wildlife Viewing
Number of Participants	658,000	293,000	715,000
Total Direct Expenditures (millions)	641.5	911.0	418.9
Direct, Indirect, and Induced Expenditures (millions)	1,206.1	NA	731.9
Jobs	14,940	NA	11,759
Average Earnings Per Job	$21,020	NA	$18,928
State Income Tax Revenue (millions)	$16.8	NA	$13.0

Source: ECONorthwest with data from Caudill and Laughland (1998), Maharaj and Carpenter (1998), and the U.S. Department of Interior, Fish and Wildlife Service (1997).

Fishing and wildlife viewing, alone, supported almost 27,000 jobs, paying an average annual wage of $18,000-21,000. The job and wage data understate the total impact, insofar as they overlook the impacts on proprietors of small businesses. Angle, et al. (1996) found that any increases in recreational activity associated with state lands in Northwest Oregon would have relatively small impacts on employment, as shown in Table 5.3, but generate relatively large amounts of income for small-business proprietors. They observe, "This results from most local visitor expenditures being made in retail establishments where wages are relatively low but the businesses are often locally owned."

Table 5.3: Economic Impacts of Recreational Visits to State Forests in Northwest Oregon (1998 Dollars)

	Change per 1,000 Visits to Northwest Oregon				
	Total Employment	Total Wages & Salary	Average Wage per Job	Proprietor's Income	Total Income
Hunting	4.48	$87,670	$19,569	$46,530	$134,200
Fishing	1.87	$33,990	$18,176	$19,580	$53,570
All Other Recreation	2.40	$50,270	$20,946	$31,900	$74,800

Source: Angle, et al. (1996).

Not all of the recreational jobs indicated in Table 5.2 and 5.3 are associated with salmon, but angling and other recreational activities associated with salmon are an important part.

A rough approximation of the recreational-salmon fishery's impact on statewide employment and incomes can be obtained by dividing anglers' expenditures by the economy-wide average wage per job. According to the Oregon Department of Fish and Wildlife (1998), anglers, on average, caught 458,786 salmon and steelhead in Oregon per year between 1984 and 1996. On average, anglers spent about $80 per fish (see Chapter 4), and total expenditures exceeded $36 million annually. If each job pays about $21,000, as the data in Table 5.2 indicate, then, over the past decade or so, the recreational salmon fishery has generated about 1,700 jobs. Respending of the anglers' expenditures would generate additional jobs. These are rough approximations and the actual employment impact of the recreational salmon fishery depends on the species, distribution between ocean and in-river fishery elements, the year-to-year variation in the fishery, and numerous other factors.

Goods and Services for Consumers

Restricting logging and its adverse environmental impacts can generate new job opportunities by directly enhancing the quality of life for many Oregonians. To see this, consider the two different ways in which economies grow. In the first, some event creates jobs in a particular location and people move to the location with hopes of finding employment and higher incomes. This is the so-called jobs-first-people-follow mechanism. In the second, the relationship is reversed, namely, people-first-jobs-follow. In it, workers and households move to the location, with or without immediate prospects of finding employment. In response to the influx of workers and consumers, investors and entrepreneurs establish new enterprises or expand existing ones.

The people-first-jobs-follow mechanism seems to be especially important in Oregon. There are, of course, multiple reasons why workers, households, and employers are moving to, and remaining in, the state. But the quality of life, and particularly the quality of the state's natural-resource amenities, plays a major role.

Much of the evidence corroborating the economic importance of natural-resource amenities comes from research conducted by state agencies, business groups, and others, exploring

the factors influencing the state's economic performance. A 1998 survey of recent immigrants to Oregon by the Oregon Employment Division (Helvoigt 1999) found that over 40 percent of those who moved to the state did so to take advantage of its quality of life. A 1993 survey of current residents of Oregon (Oregon Business 1993) reinforced the notion that quality-of-life concerns play an important role in the state's economy. For example:

> When asked, "What do you personally value about living in Oregon?" only 2.6% of Oregonians identified the state's economy, whereas one-half identified the natural-resource components of the area's quality-of-life:
>
> 36.0% "Natural beauty and recreation."
> 14.0% "Environmental quality."
>
> When asked, "Which is more important to economic growth in Oregon? Relax environmental regulations to make it easier for companies to do business or maintain a quality environment to attract people and companies to Oregon?" Oregonians overwhelmingly recognized the economic importance of environmental quality:[17]
>
> 75% "Maintain a quality environment."
> 16% "Relax environmental regulations."

Anecdotal evidence consistent with the survey results is common. Owners, managers, and workers of firms, especially in Oregon's growing high-tech manufacturing and service sectors, cite the quality of the state's natural resources as an important factor in the future growth of these industries (Oregon Business 1993).

This conclusion was reinforced in a 1995 consensus report by more than 60 economists. They examined the relationship between the natural resources of the Pacific Northwest and its economy and observed:

> [T]he region is successfully navigating from being dependent on a few extractive industries to having a modern, widely diversified economy.
>
> What is driving this transition? There are of course many contributing factors in an economy as complex as this one, but two factors are most important: the region's quality of life and the increasing mobility of people and businesses.
>
> This region is outperforming the rest of the nation in the growth of jobs and incomes … primarily because people want to live, work, and raise a family here. … The region's quality of life is especially important in a world where many economic activities are footloose and, hence, prefer to locate wherever there is a growing pool of productive workers and expanding consumer markets. These are precisely the conditions that exist in the Pacific Northwest. ***As long as the region is able to provide a quality of life that many people find attractive, it should continue to prosper.*** (emphasis in original) (Power et al. 1995).

[17]Another 9% responded, "Don't know."

A WRONG WAY TO THINK ABOUT IMPACTS—THE ECONOMIC-BASE MODEL[18]

The most common model used to predict the impacts of reductions in timber production is the *economic-base model*. We explicitly reject the validity of this model because it so often yields widely misleading results. But, because it is so widely used, we briefly describe it and explain why it doesn't work.

An economic-base model divides the economy of an area into two sectors: the *export sector*, which produces goods and services sold to buyers outside the area, and the *local sector*, which sells its products within the area. Proponents of the economic-base model conclude that, because the export sector brings in from the outside money that is spent and respent on local goods, it is the "economic base" that "supports" the local sector. Because Oregon's timber industry typically exports its products to other regions or countries, proponents of the timber industry frequently rely on the economic-base model to conclude that this industry supports—or plays the primary role in supporting—Oregon's economy (Beuter 1995; Schallau 1994).

An economic-base analysis typically proceeds in a straightforward manner. The analyst first assumes that the *export sector* consists of only those industries with certain characteristics. Besides timber, they almost always focus on other resource-extraction or manufacturing industries, although sometimes they include major industries in the service and trade sectors, such as tourism, universities, or a concentration of government agencies. After deciding which industries are included in the *export sector* pie, the analyst then decides how big a slice to allocate to the timber industry. This typically is done by looking at the percent of statewide employment in each of the so-called exporting industries and comparing it to the industry's national percentage. The reasoning is that the more Oregon's percentage exceeds its national counterpart, the more the industry contributes to the state's total exports. Having determined that the timber industry produces X percent of the total exports from the *export sector* the analyst concludes that the industry supports the same percentage of the *local sector*.

With this line of reasoning, economic-base studies have found that the timber industry exerts tremendous leverage over the economies of Oregon and its communities. During the late 1980s and early 1990s, economic-base studies commonly concluded that the timber industry, which directly employed about 5 to 10 percent of the workers in the state or in one of its subregions, supported 50 percent or more of the total employment. Often, these numbers were expressed by declaring that 50 percent, or more, of the overall economy depended on the timber industry. Not surprisingly, with these results, both the analysts who applied such models and the lay members of the community who accepted the reasoning of the economic-base model readily believed that any curtailment in logging in the region would have devastating economic and social consequences.

[18] This discussion is derived from Niemi et al. (1999).

Why the Economic-Base Model Doesn't Work

Several serious flaws in reasoning cause economic-base models to give a highly inflated sense of the timber industry's economic importance. It takes only some common sense, plus a quick look at the region's economic history, to expose these flaws.

The ultimate flaw, of course, is that the model gives the wrong answer. Table 5.4 lists several economic-base studies of the timber industry in the Pacific Northwest and shows their findings for the subject economy's timber dependency, i.e., the percentage of total employment dependent on the timber industry. Table 5.4 then shows the decline in employment that, according to each study, should have occurred following the 1991 court ruling prohibiting new timber sales on the spotted-owl national forests of Washington, Oregon, and Northern California. Then, the table compares this with the actual change in employment. *In every case, the economic-base model predicted a decrease but total employment actually increased.*

It is nonsense to say that the timber industry is a substantial part of the economic base when *decreases* in timber employment are accompanied by *increases* in total employment. It is also nonsense to say that the economies of such areas depend on the timber industry. The disconnect between the real economic landscape of the Pacific Northwest and the economic-base view of that landscape is so great that the only reasonable response is to sack the entire line of reasoning underlying the economic-base model. To help drive home this message, in the following paragraphs we discuss some of the particular flaws in this line of reasoning.

It is nonsense to say that the timber industry is a substantial part of the Oregon's economic base when *decreases* in timber employment are accompanied by *increases* in total employment.

The initial steps of an economic-base analysis entail identifying the industries included in the *export sector* and determining their relative strengths. The typical approach is to look only at an area's big industries, especially resource extraction and manufacturing, and to concentrate on those whose percentage of the subject area's total employment exceeds the comparable, national percentage. Here's how one such study explains the process:

> "The primary wood products sector provides a telling example. It made up 4.18 percent of Oregon's employment in 1990. However, it accounted for .57 percent of the nation's employment. The higher percentage for Oregon suggests that the wood products industry is part of the state's economic base. The difference between the state and the nation, 3.61 percent is a relative index of how much 'excess' employment Oregon has in the wood products industry. The sum of the comparable indices for all basic industry sectors in Oregon was 9.75 percent. Thus, the relative importance of primary wood products among all of Oregon's basic industrial sectors is estimated by the percentage determined from the ratio 3.61/9.75, or 37 percent …." Beuter (1995).

Table 5.4: Dependency Ratios from Timber-Related Economic-Base Models Are Out-of-Touch with the Economy's Actual Behavior

Study	Area Covered in Study	Dependency Ratio	Predicted Decline in Employment From 1990 Using the Dependency Ratio [a]	Actual Change in Employment from 1990 to 1996
Economic Impact Projections for Alternative Levels of Timber Production in the Douglas-Fir Region Schallau, Maki, and Beuter, 1969	Douglas-fir region (roughly the total Spotted Owl Region [b])	44.8%	-211,515	391,682
Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide, Volume 1, Spotted Owl Region USDA Forest Service 1988	Oregon and Washington	44.0% in Oregon, 28.0 % in Washington	-102,991 for Oregon and -73,002 in Washington	229,833 for Oregon and 260,666 for Washington
Economic Impacts of the ISC Northern Spotted Owl Conservation Strategy for Washington, Oregon, and Northern California D. Olson, 1990	Spotted Owl Region of Washington, Oregon, and California	20.5%	-96,645	391,682
Legacy and Promise: Oregon's Forests and and Wood Products Industry Beuter, 1995	Oregon	33.0%	-77,243	229,883
Legacy and Promise: Oregon's Forests and and Wood Products Industry (Revised and Updated) Beuter, 1998	Oregon	18.0%	-42,133	229,883

[a] To figure out the decline in employment predicted by each dependency ratio we multiplied the percentage decline in timber employment between 1990 and 1996 by the dependency ratio and then multiplied that number by the total employment in the economy in 1990.

[b] For this exercise we define the "Owl Region" as Western Oregon and Washington.

Source: ECONorthwest with data from Beuter (1995; 1998), Olson (1990), Schallau, Maki, and Beuter (1969), and US Department of Agriculture (1988).

This reasoning seems plausible at first blush, until one considers the implications. What happens, for example, if the economic mix of a community, state, or region exactly matches the national mix? In the economic-base framework, such an economy would be dead in the water, with no *export sector*, no economic base and, hence, nothing to support the *local sector*. Furthermore, even if one accepts all the rest of the economic-base reasoning, consider how it views an industry that exports all of its product, but has a smaller percentage of local employment than its national counterpart has of total, national employment. The analyst would exclude the industry from the *export sector* even though it is entirely an exporting industry. These and other logical inconsistencies render the exercise largely meaningless.

Economic-base models also take a snapshot of the economy and pretend it is a movie. That is, they contain a simplifying assumption that arrests the economy in its current configuration so that any increase or decrease in the supply of timber can be traced through

the now-assumed-to-be-static economy. In general, the results from this approach tend to overestimate the negative impacts and underestimate, even ignore, the positive impacts of any change from the status quo. This bias can be called the dumb-person bias, because the technique explicitly assumes that investors, managers of firms, workers, and consumers will not adapt to the forest-management decision but instead will continue to behave as if the management decision had not occurred (Mendelsohn et al. 1994). In reality, though, investors, managers, workers, and consumers are neither static nor dumb. The regional and subregional economies of the U.S. are tremendously dynamic, and they adapt remarkably to changing conditions. If the supply of a productive input is restricted, or if the demand for a final product falls, investors will try to reduce their risks and the managers of firms will adapt their production processes accordingly.

Economic-base models also take a snapshot of the economy and pretend it is a movie.

Courant, et al. (1997b) demonstrate that when using an economic-base model to crank through the effect on employment or income of eliminating a given amount of employment in the basic industry, an analyst is answering the following question: What would happen if the given amount of timber employment were eliminated, and

- Those who lost their jobs as a result never worked again, but also did not move.
- The local and regional establishments that sold goods and services to the dislocated timber workers permanently lost that business and obtained no replacement business (and also did not move).
- Those enterprises in the region that used the output of the original workers when they had timber jobs obtained no replacement inputs from elsewhere (and also did not move).
- Everyone throughout this chain who lost her or his job acted exactly the same way as the original job losers, in that they never worked again and stayed put?

There may be good reasons for answering this question: it puts an upper bound on the extent of adjustment an economic region will have to undergo in response to a change in policy (or technology, or demand). However, as Power (1996) so nicely puts it, using the economic-base model for forecasting is like driving by looking in the rear-view mirror. The economic-base model generates a measure of the maximum extent to which changes might take place, but this is very different from a *forecast* of what will actually happen.

Economic base models also tell us who stands to gain or lose in the short run. This can help us develop policies and programs designed to help people who may suffer dislocation.[19] They tell us very little, however, about what the local economy will look like after it adjusts to growth, decline, or other change in an exporting industry.

[19] These are the workers who lose most, and the losses average much less than 100 percent. See, for example, Farber (1996), Heberlein (1994), Herzog and Schlottmann (1995), Jacobson et al. (1993), and Ruhm (1991).

SUMMARY

Restricting logging and related activities on Oregon's private and state forest lands to enhance and protect salmon habitat will not have a single, one-time-only impact on the economy. Instead, the economy's response will evolve over time. Whatever the initial, adverse economic impacts, the economy will attempt to mitigate them. Whatever the initial positive impacts, it will try to accentuate them.

There is no evidence indicating that the negative impacts on jobs from even the most sweeping of the proposed restrictions on private and state lands would upset the state's overall economy.

There are good reasons to believe that the state's economy will adjust quickly to any job reductions. The restrictions on logging and related activities probably will directly affect a small percentage of the state's workers, with fewer jobs lost in the timber industry than those the industry shed earlier in the 1990s and in the 1980s. In both those instances, the overall economy grew rapidly, despite the job losses in the timber industry.

This is not to say that everyone will have an easy time, or that the costs of adjusting to the restrictions on logging and related activities will be trivial. Instead, we are only pointing out that adjusting to change is one of the widely-trumpeted virtues of market economies. To understand the economic consequences that would be triggered by proposed logging restrictions, one must take this dynamism into account. Ignoring it would lead to exaggerated estimates of job losses and unrealistic predictions of economic catastrophe.

CHAPTER 6: THE NET EFFECT—GOOD OR BAD FOR OREGON'S ECONOMY?

What will be the net effect on Oregon's economy of the proposed restrictions on logging and related activities? Nobody can know, for certain. The restrictions will not, as many have asserted, have only bad economic effects. The effects extend far beyond a simple tradeoff of logs-vs.-salmon, and include both bad and good.

In this chapter we pull all the pieces together to provide a brief summary of the potential economic consequences of the proposed restrictions. The presentation is separated into six parts, corresponding to the six principles recommended by more than 75 economists for economic analyses of salmon-conservation proposals (see Chapter 1 for a discussion of the principles).

COSTS AND BENEFITS[20]

Past studies of the economic consequences of proposals to restrict logging to help salmon have generally assumed that the most important consequence would be to impose costs on landowners. This approach rests on the belief that landowners have a right to log in locations and ways harmful to salmon. Prohibiting logging adjacent to streams and increasing the costs of logging on other lands would diminish landowners' revenues. Since the timber industry is widely assumed to be a competitive industry, these reductions are commonly thought to provide a reasonable estimate of the cost to the overall economy.

In reality, things are not so simple. The first sign of this is that the range of cost estimates per acre of timberland vary more than one-hundredfold. The highest estimates, though, are at least double the current average value of standing timber. More important, the studies fail to account for several factors, such as expediting watershed analyses so that habitat-restoration efforts can be better targeted, that will make the actual costs lower than the estimates. Given the growing consumer pressure for wood products produced with benign environmental impacts, producers that produce salmon-friendly timber and aggressively promote their activities may actually realize higher prices for their products.

There is considerable ambiguity about whether the proposed logging restrictions would impose any costs at all on landowners. Landowners who intend to degrade salmon habitat may have no right to do so. Those who degraded salmon habitat in the past may have an obligation, much like a borrower's obligation to repay a loan, to correct the damage. If Oregonians reach these conclusions and they withstand constitutional tests, then it would be appropriate to conclude that the proposed logging restrictions would not create economic costs, but, instead, enforce obligations and prevent unreasonable, even illegal, activity.

[20] For a more detailed discussion, see Chapters 3 and 4.

Logging restrictions may generate substantial economic benefits. Increases in salmon populations, improvements in stream water quality and other environmental improvements would benefit the industries that use these resources. Other benefits, such as recreational opportunities, would accrue directly to consumers. Because logging imposes spillover costs on others, restrictions on logging would eliminate these costs. For example, sediment generated by clearcutting an acre can cause damage downstream totaling $208.

Most of the potential benefits are impossible to quantify, for they involve things that are not commonly part of the monetized economy. But this makes them no less real than the more easily monetized costs. Because society apparently has such a strong preference for preventing salmon extinctions the intrinsic value of salmon may exceed the other benefits and costs.

Whether a given logging restriction generates net costs or benefits depends largely on whether or not it would help salmon. If so, then there's a good chance it would yield net benefits, at least during the initial stages of salmon recovery.

If logging restrictions result in habitat improvements, these would act like financial assets, capable of generating a flow of economic benefits over time. The general size of the potential habitat-assets is revealed by considering the value of additional fish to the recreational fishery, where an increase in the supply of fish would have a net value, or consumer surplus, of about $110 per fish. Using data and assumptions described in Chapter 4, it is apparent that, if habitat improvements resulting from salmon-related logging restrictions generated one additional fish for the recreational fishery per year for the foreseeable future, the habitat-asset value of the habitat improvements would be $2,800.

By comparison, the timber-asset value of state and private land used for growing timber in Oregon is about $400 per acre in Western Oregon and the total value of land plus standing timber is about $4,000 per acre. Values are less east of the Cascades.

Many of the benefits would be especially high for initial increases in salmon populations. During the initial stages of salmon recovery, even small improvements in habitat probably would yield a habitat-asset value exceeding the forgone timber-asset value for many sites and streams.

Thus, if salmon-related restrictions on logging converted one acre of private or state land from producing timber to producing salmon for the recreational fishery, the asset value of the new salmon habitat would equal the forgone asset value of the timberland, alone, if the habitat were capable of producing about 0.15 salmon per year. In other words, the land's recreational value as salmon habitat would be about seven times its value as timberland. The habitat-asset value would equal the forgone timber-asset value of the land plus the average current stocking of timber if it were capable of producing about 1.5 fish per acre per year.

To fully weigh the costs and benefits, one would have to incorporate into the comparison other benefits, such as those associated with cleaner streams that would result from the proposed logging restrictions. Many of the benefits would be especially high for initial increases in salmon populations. Thus, during the initial stages of salmon recovery, even small improvements in habitat probably would yield a

habitat-asset value exceeding the forgone timber-asset value for many sites and streams. Identifying which sites and streams offer the greatest potential increase in asset values can be determined through ecological and economic analyses of individual watersheds.

NEGATIVE AND POSITIVE IMPACTS ON JOBS[21]

Reductions in timber production would affect some jobs negatively and others positively. The negative effects will be concentrated in the timber industry. The range of proposals to restrict logging would remove about 15–45 percent of private and state land from timber production, and initially eliminate about 3,500–18,500 timber-industry jobs. Most dislocated workers would find replacement jobs within 3 months and the percentage remaining unemployed after one year probably would not exceed the background percentage for the workforce as a whole. Earnings for some dislocated workers would decrease, while for others they would increase. Workers dislocated from jobs they've held for a long time probably would suffer the greatest reductions in earnings.

For every timber-industry job lost, another 2 or so jobs would be at risk in other industries, through the multiplier effect. The workers in these jobs probably would experience little dislocation, though. Experience from other recent reductions in timber production indicates that, given the rapid growth in the overall economy, most employers currently supported by sales to timber firms and their workers probably would find replacement customers, and the actual multiplier effect would be limited.

The impact of reductions in timber production probably would have a negligible impact on the overall economy. The predicted reductions in timber production and timber-industry employment are smaller than or comparable to those that occurred in the 1980s and again in the early 1990s. The overall economy was smaller and less vibrant then, but still overcame the timber industry's contractions. It should be even less affected now.

Reductions in timber production would affect some jobs negatively and others positively. The negative impacts probably would last for only a short time. The positive impacts, though, should persist as long as restrictions on logging and related activities improve the environment.

The proposed restrictions also should have positive impacts on jobs. These would materialize through several mechanisms. Some will occur as increased salmon populations and overall environmental improvements create jobs in commercial and recreational fishing and in the tourism industry. Others will occur as reductions in logging reduce the spillover costs the logging otherwise would impose on households and on firms in other industries.

New jobs also would be created as the logging restrictions, by increasing salmon populations, diminishing the acreages of unsightly stumps, and restoring streams and

[21] For a more detailed discussion, see Chapter 5.

riparian areas, improve the quality of life for many Oregonians. Such improvements in the quality of life can attract workers, households, and investment.

The negative impacts probably would persist for only a short period of time. Most would be gone in a year, some vestiges may last for a few years. The positive impacts, though, should persist as long as restrictions on logging and related activities improve the environment, reducing the spillover costs logging imposes on others, increasing salmon populations, and improving the environmental aspects of the state's quality of life.

DISTRIBUTION OF COSTS AND BENEFITS, AND OF POSITIVE AND NEGATIVE IMPACTS

The bad economic consequences of restrictions on logging and related activities would accrue primarily to owners of timberland and to the owners and workers in industries that otherwise would benefit from timber production. Because much of the private timberland in Oregon is owned by national corporations, most of the costs to private landowners would accrue to shareholders living outside the state. Most non-industrial landowners who would be affected by the restrictions probably are Oregonians. Reductions in timber revenues from state lands would affect the consumers of services, largely schools, the revenues otherwise would support.

The good economic consequences would have a different distribution. Some groups, such as those in the commercial fishing industry or Tribal members, would be relatively small and localized. Others, such as those who would benefit from curtailment of the spillover costs logging otherwise would impose or recreationists, are more widely dispersed. Those who would benefit from enhancements in the intrinsic value of salmon and other species would be distributed nationwide, even globally.

RIGHTS AND RESPONSIBILITIES

The rights and responsibilities of landowners frame the definition of all the economic consequences that might follow implementation of tighter restrictions on logging and related activities. If Oregonians, as a whole, possess the right to influence the management of private timberlands, then the proposed restrictions would represent the exercise of that right. If not, then the proposed restrictions would represent an imposition on landowners' rights. The rights and obligations of landowners have yet to be fully clarified. How one defines landowners' rights and obligations determines the composition of the costs and benefits associated with the proposed logging restrictions.

Some in the state appear to believe property owners have the right to log timber on their lands, even if it imposes costs on others, and see the proposed restrictions as an infringement on these rights. Others apparently believe that logging in accord with current forest-practice regulations would not harm salmon and, hence, tighter restrictions would be an infringement on the owners' property rights. Still others apparently concede that some tightening is warranted, but see the proposals put forward by the National Marine Fisheries Service and others as extreme and, hence, as an infringement on property rights.

Others have a different view. To them, landowners have an obligation not to inflict further harm on salmon, not to impose costs on others, and to repair the harm from past logging activities. One line of reasoning is that owners of timberland have always known that their activities harm salmon, salmon are economically important resources, and logging that injures the salmon has always been illegal. Another argument is that, although the harm logging imposes on salmon has long been known, Oregonians allowed logging to go forward as long as the economic benefits from logging were large and salmon were sufficiently plentiful that the economic costs of declining populations were tolerable. A third argument is that, regardless of anything else, the Endangered Species Act requires everyone to fulfill obligations to protect salmon that are threatened or endangered.

UNCERTAINTY AND SUSTAINABILITY

Uncertainty underlies any salmon-related proposal regarding logging restrictions on private and public lands. It is clear that past logging on private and state lands have degraded salmon habitat and that at least some additional restrictions on logging are warranted to prevent further degradation. Considerable uncertainty remains, however, about how intensive these additional restrictions should be to ensure timely restoration of past degradation and to prevent further degradation. Nobody knows for sure how the habitat will respond to the restrictions and how the salmon will respond to changes in habitat. So little is known about individual streams and watersheds that most proposals for riparian buffers along streams are painted with a broad brush, not tailored to site-specific conditions.

The uncertainty is currently unavoidable and, hence, should be integrated into the process Oregonians use to decide what, if any, logging restrictions to establish. Specifically, the uncertainty should be taken into account as Oregonians weigh the relative risks and rewards of selecting logging restrictions that are too strict because they later prove unnecessary for salmon conservation versus those of selecting restrictions that are too weak.

The risks of choosing restrictions that are too strict are more or less limited. The risks of choosing restrictions that are too weak appear much larger.

The risks of choosing restrictions that are too strict are more or less limited. By choosing excessively strict restrictions, Oregonians would forgo timber production on some lands and landowners would forgo revenues until the restrictions are proven unnecessary. The value of the loss is the value of the forgone timber. In the meantime, though, the potential timber on these lands would be increasing in value, so the loss would not be total. Also in the interim, the economy would benefit from the reduction in spillover costs that the logging otherwise would impose on others.

The risks of choosing restrictions that are too weak appear much larger. Failing to take steps needed now to conserve salmon would increase the risk that salmon will go extinct. Oregonians and Americans as a whole have expressed their strong preference to avoid such extinctions. If Oregonians fail to impose logging restrictions now only to find that, as a consequence, salmon are sliding faster toward extinction, the cost of recovering from the error may well exceed any benefit derived from timber production in the interim. The

timber production also will entail a continuation of the spillover costs imposed on other segments of the economy.

Nobody can be certain about what, exactly, is needed to prevent salmon extinctions and accomplish the state's other salmon-conservation objectives. Given the uncertainty, the economic risks of implementing logging restrictions that are too weak seem to far outweigh the risks of implementing restrictions that are too strong.

BEYOND SALMON AND LOGS

The debate over logging restrictions on private and state lands is far more than a debate over salmon versus logs. It also entails the weighing of jobs that would be adversely affected against those that would be affected positively. The outcome of the debate will affect the amount municipal water users pay to filter the water from their water supplies, and the risks of flooding downstream residents are exposed to because of upstream logging.

Choosing among alternative proposals for restricting logging and related activities occurs against the backdrop of fundamental changes in Oregon's economy. The policies that allowed, even promoted, logging harmful to salmon habitat were adopted because timber production was believed to be a major source of economic growth. Now it is not.

Restricting logging to conserve salmon will have wide-ranging effects on both the ecosystem and the economy. In the short run the impacts on salmon and logs probably will be the most apparent, but, over time, the others may become equally, or even more, important.

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Appendix: Salmon Letter

09 September 1998

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Office of the Governor
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Governor Pete Wilson
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Premier Glen Clark
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Dear Governors Kitzhaber, Knowles, Locke, and Wilson, and Premier Clark:

Decisions regarding the management of Pacific salmon, many of which are experiencing deep declines in numbers, can affect a vast landscape along the western edge of North America and markedly influence the region's future economy. With this letter, we hope to help lay the foundation for the public debate over the economic aspects of these decisions.

Most of the discourse on the economic issues of salmon recovery has focused too narrowly, concentrating almost exclusively on the costs of recovery. Costs are indeed important, but they tell only part of the economic story. We encourage you and the members of your Administrations to adopt a broader perspective and consider the full range of economic consequences of salmon-management decisions. Toward this end, we recommend that you examine and weigh all these factors:

* Costs, Benefits, and Net Benefits.

Salmon recovery will generate economic benefits as well as costs. To understand the net benefit (a net cost if negative) to the economy as a whole, one must consider the effects on the production of all goods and services. The effects on goods and services that are traded in markets, such as commercial salmon, timber production, and agricultural production, should receive the same consideration as those, such as recreational fishing, clean streams, and biodiversity, that are not. A full accounting must be provided of the true value of each affected good or service, taking into account the market price, where appropriate, as well as all factors, such as subsidies, taxes, and environmental externalities, that distort the level of supply or demand. Some of the benefits and costs will manifest themselves in the

immediate vicinity of the resources affected by salmon recovery, while others will manifest themselves at greater distances.

* Jobs, Incomes, and Transitions.

Salmon recovery will have diverse impacts on labor markets, increasing some demands for labor and decreasing others. It also may affect the spatial distribution of the supply of labor by influencing the location decisions of some households. To understand the resulting impacts on jobs and incomes, one must consider the salmon-related changes in demand and supply against the backdrop of the markets' ability to adjust. One should examine both the overall change in jobs and incomes as well as the transitions for affected workers, their families, and their communities.

* Distribution of Economic Consequences.

The positive and negative effects of salmon recovery will not be distributed equally. Identifying the winners and losers can create opportunities to explore options for breaking political gridlock–by clarifying mechanisms, for example, for the winners to provide some compensation to the losers.

* Rights and Responsibilities.

Owners of natural resources affected by salmon-recovery measures have both rights regarding their use of these resources and responsibilities not to exercise these rights in ways that unreasonably restrict the rights of others. This is true of both private- and public-property owners. To understand the costs and benefits associated with salmon recovery, one first must have a clear understanding of the relevant rights and responsibilities, because society might assign very different values to two recovery actions that are otherwise identical but one restricts a property owner's rights and the other forces it to comply with its responsibilities.

* Uncertainty and Sustainability.

Nobody can eliminate the uncertainty regarding how salmon-recovery decisions will affect salmon populations and the economy, and it is inevitable that some decisions will not yield the desired outcomes. Reversing undesired outcomes is always costly, however, some outcomes are less costly to reverse than others. Some, of course, are irreversible. To understand the full economic consequences of salmon-recovery decisions, one should consider the potential reversal costs if the decision should yield undesired outcomes.

* Looking Beyond Salmon.

To understand the full consequences of salmon recovery, one must look beyond those tied to the salmon, themselves, and examine those linked to the productivity and use of the surrounding ecosystem. Changes in ecosystem productivity may occur through the restoration of the ecological functions of salmon-bearing streams and the surrounding watersheds that will accompany salmon recovery. Changes in the use of the resources of the larger ecosystem may have both positive and negative effects on the economy.

We hope you will consider the factors outlined here, and use this outline to improve the public's understanding of the full economic consequences of salmon recovery.

Sincerely,

W. Ed Whitelaw
University of Oregon/ECONorthwest

Ernest Niemi
ECONorthwest

And the following co-signing economists:

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Peter Berck, University of California Berkeley
Bruce Blonigen, University of Oregon
Peter Bohmer, Evergreen College
Richard Brinkman, Portland State University
Gardner Brown, University of Washington
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Note: Affiliations are for informational purposes and do not imply consent by organizations.

cc: David Anderson, Minister, Fisheries and Oceans, Canada
Will Stelle, National Marine Fisheries Service