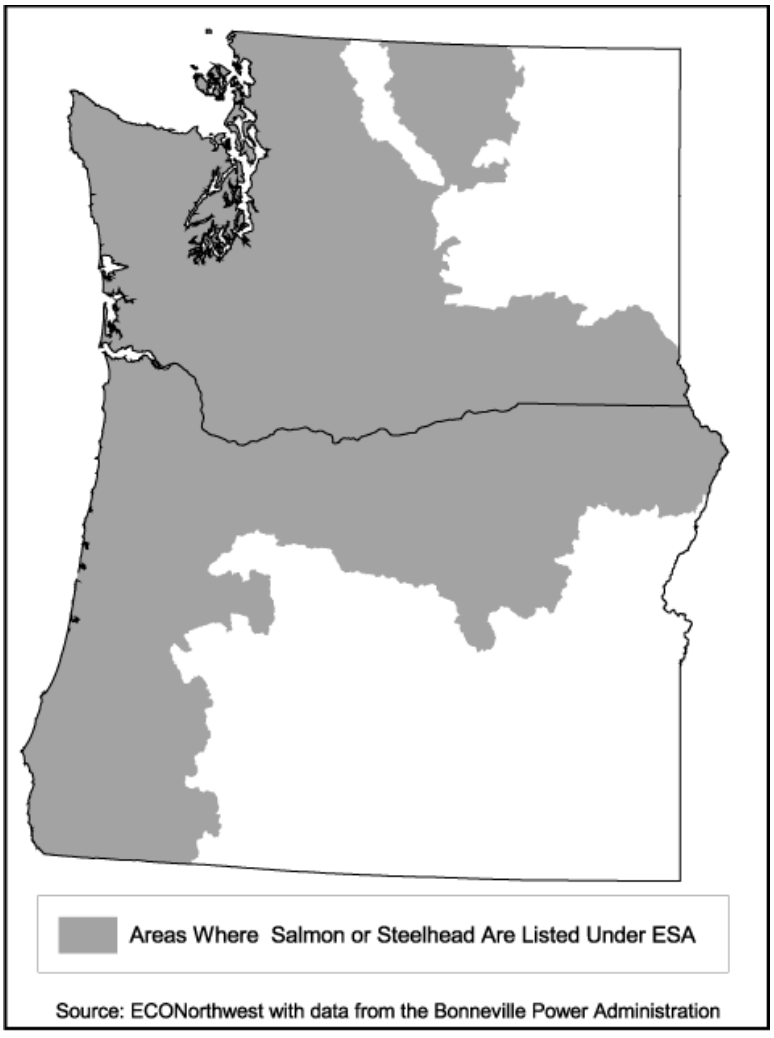
Salmon and the Economy

A Handbook for Understanding the Issues in Washington and Oregon



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WHY WAS THIS HANDBOOK WRITTEN?

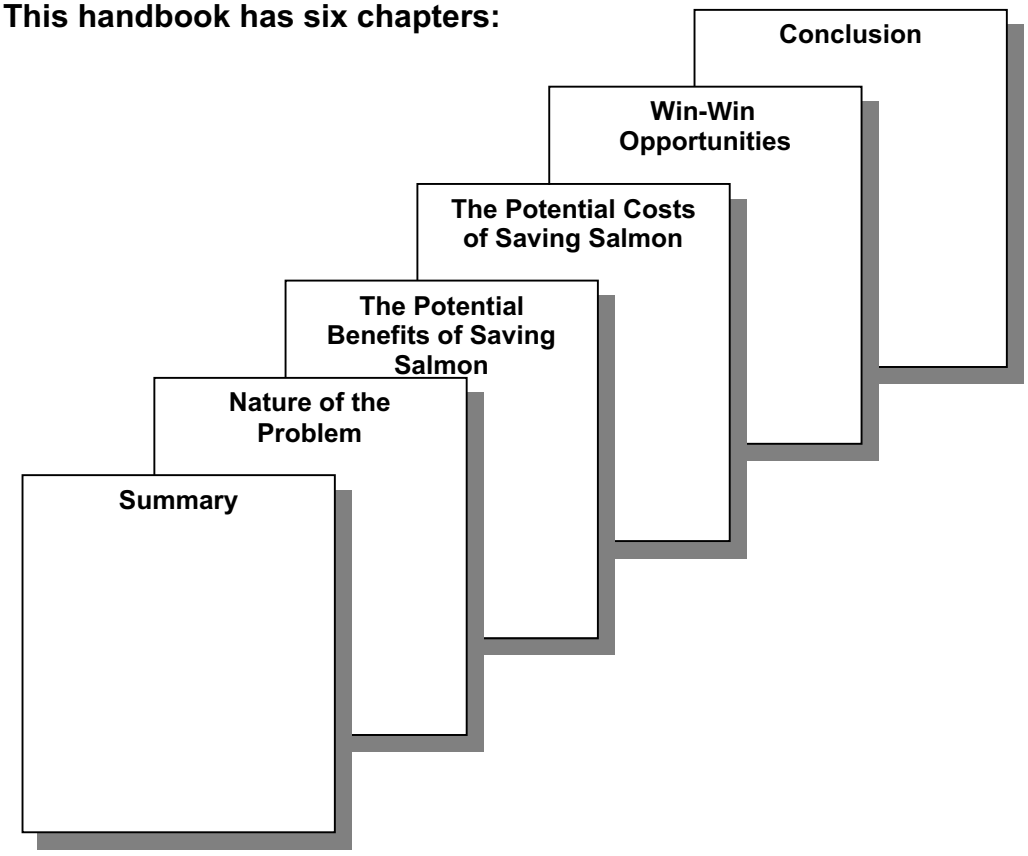
The citizens of Washington and Oregon know that salmon are in trouble and want to help, but often hesitate because they fear the economic consequences will be too severe. Their fears are understandable, for much of the information available from the news media and public officials focuses on only one aspect of the economic consequences—the costs that might materialize under the worst-case scenario. This perspective sees salmon conservation as a choice: salmon vs. the economy. The region can have one or the other, but not both.

This is a false choice. In reality, the actual costs will not be so large and, in many, if not most, instances, taking actions to conserve salmon will create economic benefits at least as large as the costs. Oregon and Washington can have both a robust, prosperous economy and healthy salmon populations.

Getting the economics right is important. The full richness of this importance was recently addressed by 76 economists, who sent a letter to the governors of California, Oregon, Washington, and Alaska, and to the premier of British Columbia, urging them "to consider the full range of economic consequences" when they make salmon-management decisions.[1]

The Center for Watershed and Community Health (CWCH), which is affiliated with the Hatfield School of Government at Portland State University, responded to the economists' letter by initiating a project to help decisionmakers throughout the Pacific Northwest better understand the economic issues and facts associated with salmon. The CWCH's Salmon Economics Project aims to provide accurate, objective, and easy-to-understand information about the potential costs and benefits associated with rebuilding healthy salmon populations. The Salmon Economics Project is an integral part of the CWCH's focus on developing new, effective approaches to environmental governance.

This handbook has six chapters:



This handbook is one of the products from the Salmon Economics Project. Few people want to plod through all the evidence regarding the economic theory, facts, and implications of proposals to rebuild healthy salmon populations. The CWCH therefore asked the economists at ECONorthwest, an economic consulting firm with offices in Seattle, Portland, and Eugene, to provide a comprehensive summary of their views of ways in which rebuilding healthy salmon populations would affect the economies of Washington and Oregon.

WHO PREPARED THIS HANDBOOK?

This handbook was prepared by Ernie Niemi, Ed Whitelaw, David Lindahl, Anne Fifield, and Michelle Gall, economists with ECONorthwest, under a grant provided through the Salmon Economics Project of the Center for Watershed and Community Health (CWCH), which is affiliated with the Mark O. Hatfield School of Government at Portland State University.

The CWCH gratefully acknowledges the financial support of the Ford Foundation, Brainerd Foundation, Lazar Foundation, and Harder Foundation, as well as the comments from reviewers. The authors are solely responsible for the content.

HOW SHOULD THIS HANDBOOK BE USED?

Read the summary. It offers the main points of how salmon conservation will affect the economy.

Read the sections of the handbook that interest you.

Get more information.

Check out the references. The handbook has a list of references where you can obtain further information regarding the economics of salmon conservation.

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Get the updates. The authors intend to provide occasional updates, as new information becomes available. If you received this handbook from CWCH, you'll receive the updates automatically. Or, check the CWCH website: www.upa.pdx.edu/CWCH/.

Contact CWCH. The Center for Watershed and Community Health at Portland State University is developing and implementing innovative proposals for improving the environment and the economy simultaneously. Phone: 503-725-8101.

SUMMARY

Rebuilding Healthy Salmon Populations Requires Significant Changes in Washington and Oregon.

- **The problems are widespread.** Watersheds with salmon and related species listed as threatened or endangered cover 71 percent of Washington and 50 percent of Oregon.[2]
- **The underlying causes have deep roots.** Human activities have altered nearly all factors that influence the health of salmon populations: water quality, streamflows, in-stream and streamside habitat, the number of adults surviving to spawn, and the genetic makeup of hatchery fish.[3]
- **Habitats must be restored across large landscapes.** There is no quick fix. Salmon recovery will require permanent changes in fish-harvest practices and hatchery operations, in the management of water in streams and rivers, and in the activities on nearby lands that influence in-stream salmon habitat. Changes must occur at different scales, from specific sites to entire watersheds.[4]
- **Federal law mandates change.** If Washingtonians and Oregonians don't design and implement the necessary changes, federal agencies and courts will.

Rebuilding Healthy Salmon Populations Will Generate Important Economic Benefits.

Although the full range of the potential benefits of salmon conservation in WA and OR has not been estimated, it is clear that conservation will produce significant economic benefits:

- **Salmon, themselves, are valuable.** Allow salmon to go extinct, and the Pacific Northwest (PNW) loses an important asset. The recreational value, alone, of each fish often exceeds $200.[5] Intrinsic and other values can be even larger. Polls show residents of WA and OR are willing to pay $30-97 per household, or $102-330 million total, per year to finance recovery efforts.[6]
- **Salmon provide a warning of wider environmental hazards.** Like the canary in a coal mine, salmon alert us to declines in environmental quality that may endanger other species, including humans.
- **There will be many related benefits.** Done the right way, restoring healthy salmon habitat should improve water quality, reduce flood risks, and improve the PNW's quality of life.
- **Government may become more efficient.** Salmon conservation offers opportunities to reduce inefficient regulations and costly subsidies.
- **Salmon conservation will create employment and business opportunities.** Firms and workers with appropriate skills in conservation and habitat restoration should prosper.
- **Acting now will reduce future obligations.** Failing to rebuild salmon populations will make the task more costly in the future and place the burden on future generations.

The Costs of Rebuilding Healthy Salmon Populations Probably Will Not Be as Bad as Many Believe.

There is no reliable, comprehensive estimate of the potential costs of salmon conservation in OR and WA. Nonetheless, the general characteristics of the costs are already apparent:

- **Many changes will entail doing things differently, but will have few costs.** Affected firms, households, and agencies will be able to plan for the changes, phased in over time, and adopt salmon-friendly technologies, products, and services, with little or no costs.
- **Many costs can be attenuated.** For example, some foresters believe the potential reductions in timber-sale revenues from salmon-related restrictions on logging can be largely offset by changing forest-management practices.[7]
- **Many costs can be spread out.** For example, federal conservation programs can compensate farmers for reductions in sales when they take streamside land out of production.[8]
- **Few workers will be adversely affected.** Job losses probably will be smaller than those to which the PNW successfully adjusted during the 1990s.
- **Most workers will adapt fairly easily.** If recent trends hold, about 50 percent of displaced workers would find replacement jobs in 2 months or less, and 55 percent of those reemployed would have equal or higher wages than before.[9] Unemployment insurance, job-retraining, and similar programs are available for those needing temporary help.
- **The alternative may be even more costly.** The costs of keeping salmon perched on the edge of extinction can be enormous.[10] In the long run, especially, it almost certainly will be cheaper to rebuild healthy salmon populations and craft an economy that is salmon-friendly.

Win-Win Opportunities Are Possible.

There are many things Oregonians and Washingtonians can do to strengthen the health of both salmon populations and the economy. Among the most important are these three steps:

1. **Adopt tax incentives and other subsidies that help, not hurt, salmon.** Revoke tax breaks and other subsidies that encourage activities—such as some aspects of logging, agriculture, and urban development—harmful to salmon.

2. **Adopt environmental-regulation systems that boost BOTH salmon populations and economic prosperity.** Create incentives encouraging households and firms to avoid products and activities harmful to salmon.

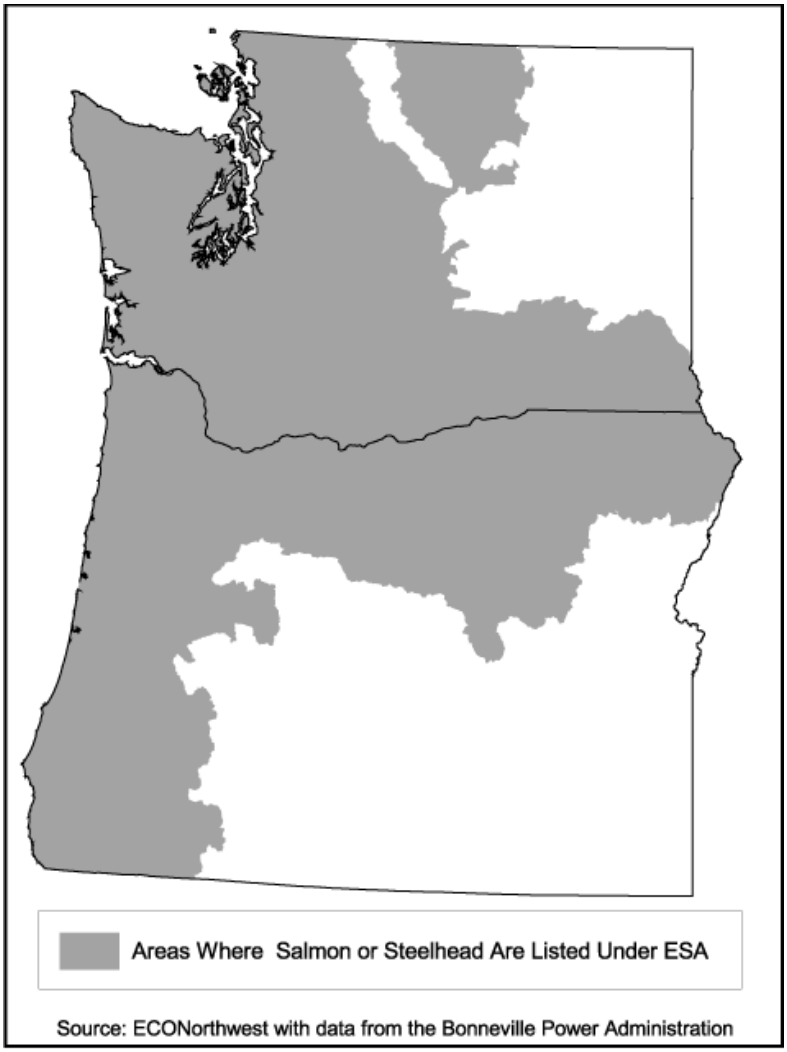
    - Provide incentives for firms and industries to participate in designing innovative, efficient ways to resolve salmon-related and other environmental problems.
    - Develop effective strategies to help consumers distinguish between products and services harmful to salmon from those that are not.

3. **Implement effective transition programs.** Recognize that rebuilding healthy salmon populations cannot be accomplished without change, and bolster programs for facilitating the change.

    - Stimulate demand for salmon-friendly technologies, products, and services.
    - Address the concerns of those who believe they would bear an unfair share of the burden of rebuilding healthy salmon populations. Make help available for workers, families, firms, and communities.

NATURE OF THE PROBLEM

Salmon Are in Trouble throughout Oregon and Washington. At least 19 salmon populations in Washington and Oregon already are extinct and nearly all the remainder—including chinook, coho, chum, pink, sockeye, steelhead trout, sea-run cutthroat trout—are in trouble.[11] The problem isn't in just one locale or with just one salmon species. Indeed, the populations of other aquatic species, such as bull trout, also have plummeted.[12]



Percent of Area Covered by Listings of Endangered or Threatened Salmon[13]

Washington		Oregon	
Western	96.9	Western	88.5
Eastern	55.2	Eastern	31.9
Total	70.6	Total	49.6

Threatened and Endangered Salmon Species in the Pacific Northwest[14]

Species	Evolutionarily Significant Unit	Administrative Status	Estimated Population	
			Historic	Current
Coho	So. Oregon/No. California	Threatened-1997	NA	10,000
	Oregon Coast	Threatened-1998	1 million	39,000
Chinook	Snake River (fall & spring)	Threatened-1992	1.5 million	10,320
	Puget Sound	Threatened-1999	690,000	71,000[a]
	Lower Columbia	Threatened-1999	NA	40,000[a]
	Upper Willamette	Threatened-1999	NA	4,000
	Upper Columbia	Endangered-1999	NA	5,000[a]
Chum	Hood Canal & Columbia River	Threatened-1999	500,000	1,500-4,000
Sockeye	Snake River	Endangered-1991	NA	<600
	Ozette Lake	Threatened-1999	2,000-20,000	600
Steelhead	Upper-Columbia River	Endangered-1997	NA	1,250
	Snake River	Threatened-1997	NA	9,400
	Lower Columbia	Threatened-1998	NA	100-1,100
	Upper Willamette	Threatened-1999	NA	3,000
	Mid-Columbia	Threatened-1999	>300,000	39,000
Cutthroat Trout	Umpqua River[b]	Endangered-1996	950	62
	SW Washington/Columbia River	Threatened-1999	NA	NA

[a] Includes hatchery-raised fish.

[b] North Umpqua River only.

NA indicates that population estimates are unknown.

What Are the Major Factors Contributing to the Problem?

Many factors underlie declining salmon populations. Among them are changes in freshwater habitat, ocean habitat, losses to sea lions and other predators, dilution of the genetic stock from hatcheries, dams that impede fish movement and alter salmon habitat, and increased competition for food from exotic species. There is insufficient information to weigh the relative contributions of these and other factors, and no single factor or set of factors can be singled out as the key for rebuilding healthy salmon populations. Much of the attention, though, focuses on the adverse effects on salmon of five types of activities:

- Urban development
- Timber production
- Agricultural production
- Salmon harvest
- Dams

We briefly summarize the readily available evidence regarding how these activities affect salmon, and the types of corrective measures that must be taken to reverse these effects.

Adverse Effects of Inappropriate Urban Development on Salmon.

Although cities make up a tiny portion of the total land base, they dramatically alter salmon habitat at key locations by creating impervious surfaces, generating sediment and other pollutants, and destroying in-stream and riparian (streamside) habitat.[15]

Developed Acres in Oregon and Washington, 1992[16]

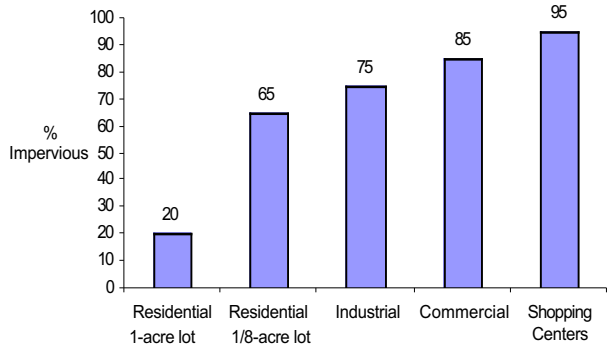
	OR	WA
Total Land	62,126,720	42,606,080
Developed Land[a]	1,125,400	1,850,500
Percent of Total	1.8%	4.3%

[a] Developed land includes urban and statewide transportation infrastructure.

Impervious surfaces. Pavement, roads, roofs, and other barriers that water cannot penetrate accelerate storm runoff and increase the flow of pollutants into streams. Hence, the greater the amount of impervious surfaces in a watershed, the lower the health of its streams.[17]

Studies near Puget Sound, show that, in natural forests, less than one percent of rainfall becomes surface runoff, 33 percent becomes groundwater, and 46 percent returns to the atmosphere via evapotranspiration. In contrast, on impervious surfaces 84 percent of the rainfall becomes surface runoff, none becomes groundwater, and 16 percent is evapotranspirated.[19] Almost all of the pollution deposited on impervious surfaces that is not removed by street cleaning, wind, or decay will end up in surface waters.[20]

Impervious Surface by Land Use[18]



The amount of impervious surfaces varies with land use. Although low-density residential subdivisions have the lowest impervious surface per lot, their longer roads, driveways, and sidewalks generally create more overall impervious surface than cluster-style housing.[21]

Sediment and other pollutants. Urban lands deliver lots of pollution harmful to salmon. Studies in the Willamette Basin show that, per acre, urban sites deliver the greatest amount of suspended sediment to streams.[22] Construction activities generate 59,670 pounds of sediment per acre per year while general urban activities produce 27-44 pounds per acre.[23]

Pesticides. In the Puget Sound Basin, more types of pesticides were detected in urban streams than in agricultural areas. Urban use of pesticides, about 1.1 million pounds per year, is more than three times greater than agricultural use in the Puget Sound area.[24] Pesticides used on lawns and gardens often end up in streams, where concentrations frequently exceed water-quality standards.[25]

Loss of riparian habitat. As urbanization increases, riparian buffers often are narrowed and degraded, reducing the quality of salmon habitat in adjacent streams. The number of culverts and other stream crossings increases in proportion to the intensity of urban development, often resulting in barriers to fish passage.[26]

Adverse Effects of Inappropriate Forest Practices on Salmon.

Inappropriate and unsustainable logging on forest land has degraded salmon habitat by generating sediment and other pollutants, changing streamflows (by increasing surface runoff from forest lands), eliminating natural riparian vegetation, and blocking fish passage. Most of the private and state forest lands on Washington's Olympic Peninsula and western lowlands have been clearcut within the last 80 years. Private and state lands along the western Cascades are largely cutover, and heavy logging over the past century has eliminated most old-growth forests in Oregon's Coast Range.[28] On federal land east of the Cascades, less than 15 percent of the original ponderosa pine forests remain.[29]

Forest Land In Oregon and Washington[27]

	OR		WA	
	Acres	% of Total	Acres	% of Total
Total Land Area	62,126,720	100.0	42,606,080	100.0
Nonfederal Forest Land	11,856,700	19.1	12,633,500	29.7
Federal Forest Land	18,697,900	30.1	9,474,300	22.2

Sediment and other pollutants. Unsustainable logging practices disturb soils, build inappropriate roads, and increase sediment in streams. Large-scale clearcutting is especially harmful. Research in the western Cascades shows that clearcutting one acre, with the associated roads, causes sedimentation to increase by 3.5 tons per year for about 25 years.[30] Large-scale clearcutting also increases the risk of massive landslides that can scour streambeds and obliterate spawning sites.[31] New, sustainable logging practices are much better than those of the past, but the legacy of past, inappropriate logging continues to harm salmon.

Loss of natural riparian (streamside) vegetation. Logging of riparian areas is especially harmful to salmon because it:

- **Increases stream temperatures.** Shade from nearby trees keeps streams from getting so warm that salmon cannot survive. New laws require leaving a buffer strip of trees, but earlier logging took them all. Research on streams west of the Cascades found maximum stream temperatures in 70 percent of the streams exceeded 20^{o} Celsius, deemed potentially stressful for salmon, and 25^{o} Celsius (potentially lethal) in 20 percent of the streams.[32]
- **Reduces large wood in streams.** Research has shown that, when large trees fall into a stream, they provide important habitat for salmon. Surveys in Oregon's Coast Range, though, indicate that only 17–23 percent of stream miles have a "desirable" number of pieces of large wood.[33] Similar reductions have likely occurred elsewhere in Oregon and Washington. Seedlings planted after logging will not be large enough to supply new large pieces of wood into streams for at least 60 years. However, because many landowners plan to log the new trees at 35-65 years of age, many streams may never see new supplies.[34]

Blocking fish passage. Logging roads often keep adult salmon from reaching spawning grounds or prevent juvenile fish from migrating downstream. There are about 4 miles of road per square mile of commercial forest.[35] One study in western Washington found three of every four culverts in forested areas block or impede fish movement. Field surveys in Oregon to determine how high fish could pass up streams found that 15 percent of the time, access was terminated by human-made barriers.[36]

Adverse Effects of Inappropriate Agricultural Practices on Salmon.

Croplands, pasturelands and rangelands account for 46 percent of Oregon's land base and 39 percent of Washington's. Croplands and pasturelands are located primarily on valley bottoms and floodplains, historically the most productive fish sites,[37] and contain the mainstem of rivers and streams essential for salmon migration.[38] The number of salmon directly affected by industrial agriculture is not known, but data from Oregon indicate that about 20 percent of freshwater salmon streams on private lands in Oregon pass through agricultural land use areas.[39]

Agricultural Land in Oregon and Washington[40]

	OR		WA	
	Acres	**% of Total**	**Acres**	**% of Total**
Total Land Area	62,126,720	100.0	42,606,080	100.0
Total Cropland	4,347,700	7.0	7,758,100	18.2
Irrigated Land	1,751,500	2.8	1,623,800	3.8
Pasture	1,915,900	3.1	1,420,500	3.3
Rangeland	22,288,200	35.9	7,241,700	17.0
Federal	13,135,800	21.1	1,667,600	3.9
Nonfederal	9,152,400	14.7	5,574,100	13.1

Inappropriate land-use practices on farms and rangelands have degraded salmon habitat by generating sediment and toxic pollutants, eliminating natural vegetation, removing water from streams, and modifying stream channels.[41]

Sediment and other pollutants. Up to 64 percent of sediment found in streams comes from cropland, pasture, and rangeland.[42] Agricultural lands in Oregon's Willamette Basin lose about 1.8 million tons of soil per year.[43] The highest pesticide concentrations, which are highly toxic to salmon, often occur in streams draining agricultural areas.[44] Runoff from agricultural and grazing lands can send animal wastes carrying viruses, bacteria, and other microorganisms into salmon habitat.[45]

Clearing of natural riparian (streamside) vegetation. The loss of natural riparian vegetation, which results when farming and ranching occupy the stream edge, can affect the rate of runoff carrying sediment and other pollutants, the nutrient levels of steams, and the shade that keeps streams cool. The adverse effects tend to be more severe than those of forestry and other land uses because soil disturbances can occur several times a year and vegetation removal can be permanent.[46] Grazing has damaged about 80 percent of stream and riparian ecosystems in the western U.S.[47]

Removing water from streams. Irrigators divert about 5.9 million acre-feet (maf) of water from streams in Oregon and 6.3 maf in Washington, roughly 70 percent of total water withdrawals.[48] Irrigators return to streams about one-half of what they withdraw. Water withdrawals in dry summer months can be especially harmful to juvenile salmon. In some cases, all the water is removed and streams run dry in summer months.

Changing stream channels. Agricultural practices often use diking, dredging, and the installation of large rocks (riprap) to force streams into straight, simplified channels. These activities can destroy habitat for salmon spawning and young fish, alter food supplies, and prevent salmon passage.[49] In the Puget Sound lowlands, the diking and diversion of streams and rivers in agricultural areas is the most cited cause for salmon habitat reduction.[50]

Adverse Effects of Inappropriate Harvest Practices on Salmon.

Overfishing. Catching fish faster than they reproduce has contributed to the decline of most salmon species.[51]

International waters. Salmon from spawning grounds in Oregon and Washington migrate far into the ocean. The different species show four general patterns of marine distribution:

- Chum and sockeye migrate north along the continental shelf to the northern Gulf of Alaska, then they swim south into the open ocean until they mature.
- Coho and chinook usually rear in coastal waters, but some migrate to the open ocean. Although coho often remain within a few hundred miles of their stream of birth, chinook migrate into Alaskan waters.
- Steelhead migrate directly to the open ocean and back.
- Cutthroat trout generally spend only the summer in the ocean, near their rivers of origin.[52]

Because the fish migrate so far, many are harvested outside of Oregon's and Washington's jurisdiction. For example, Oregon and Washington fisheries harvested only 3 percent of the chinook that spawned along the Washington coast. Canadian and Alaskan fisheries harvested the remaining 97 percent.[53]

Before the 1910s, most salmon were caught in rivers as they returned to their spawning grounds. Then the development of gasoline engine and refrigerators enabled ocean fishing to become the dominant harvest method, and river catches declined.[54]

Fish can be harvested wherever they migrate. In the first half of the 20th century, no international agreements existed to control harvest levels. Domestic or statewide measures were ineffective because of the international travels of the fish. Domestic controls to limit harvest levels typically focused on fish that spawn in domestic rivers. So, as one entity restricted the harvest for locally-spawned fish, the local fisheries were likely to pursue fish spawned in elsewhere.[55]

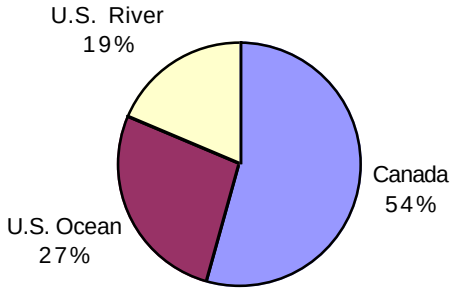
After 15 years of negotiations, Canada and the United States signed the first Pacific Salmon Treaty Agreement in 1985. The agreement established management regimes to allocate catches for particular species and areas. The agreement was set to last for 8 years, however, and it expired after 1992. Between 1992 and June 1999, the two countries had no agreement about harvest levels.

In June 1999, Canada and the U.S. renewed long-term fishing arrangements under the Pacific Salmon Treaty. The new agreement emphasizes conservation, with catch levels based on abundance of fish.[56]

Bycatch. Many salmon are unintentionally killed during the harvest of other ocean fish. The "bycatch," an incidental death rate, for chinook was estimated at 30-50 percent of the intended catch during the mid-1980s.[57] Bycatch has been reduced, but it cannot be eliminated with current fishing methods. Some studies show that replacing the ocean fishery with one that relies on fish wheels in rivers could eliminate the bycatch and increase commercial profits.[58]

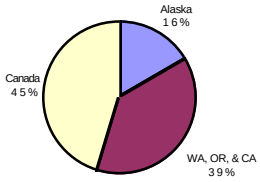
Large demand. The capacity of commercial fishing fleets is much larger than the harvestable supply of salmon. Recreational fishing demand has also grown.[59]

Most PNW Coho are Harvested in Canada[60]

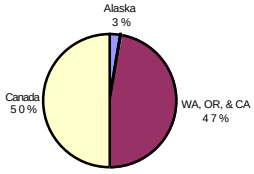


Most PNW Chinook are Harvested in Alaska and Canada[61]

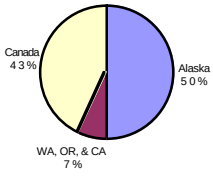
Snake R. Fall (1991-94 ave.)



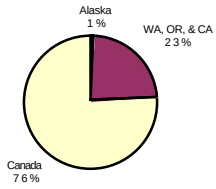
Puget Sound (Stillaguamish) Fall (1991-96 ave.)



Washington Coastal (Hoko) Fall (1991-94 ave.)



Puget Sound (Nooksack) Spring (1991-96 ave.)



Adverse Effects of Dams on Salmon.

There are 1,014 dams in Washington and 1,203 in Oregon, plus major 4 dams spanning the border, on the Columbia River.[62] About 60 percent are privately owned. They range from the mammoth federal structures, such as Grand Coulee and Bonneville dams, to small temporary irrigation diversion dams.

Dams in Oregon and Washington[63]

	Public	Private	Total
Number of Dams			
Washington[a]	359	655	1,014
Oregon[b]	497	706	1,203
Columbia River	4		4
Total	860	1,361	2,221
Storage Capacity (acre feet)			
Washington	22,066,000	5,700,000	27,766,000
Oregon			10,033,284
Columbia River	2,434,000		2,434,000
Total			40,233,284

[a] These numbers only include dams with a storage capacity greater than 10 acre-feet.

[b] These numbers only include dams over 10 feet high and with a storage capacity greater than 9.2 acre-feet.

In addition to the dams listed in the above table, thousands of smaller dams are not included in the state inventory.[64]

Dams in Washington and Oregon have blocked salmon from spawning and rearing habitat. Operation of dams in a manner inappropriate for salmon conservation alters habitat conditions in reservoirs and downstream.

Blocked access to habitat. Before any dams were built in the Columbia River basin, salmon and steelhead had access to over 163,000 square miles of habitat. Now, dams block 55 percent of the total area and 33 percent of the total stream miles.[65] In Puget Sound, nine dams have blocked access to an estimated 201 miles of streams with substantial spawning areas.[66]

Many dams have fish ladders and other structures to allow adult salmon to move upstream. But poorly designed fishways can inhibit movement of adults upstream, forcing the fish to work harder to reach their spawning grounds. The exhausted fish arrive late and have limited reproductive success, or die before spawning.[67]

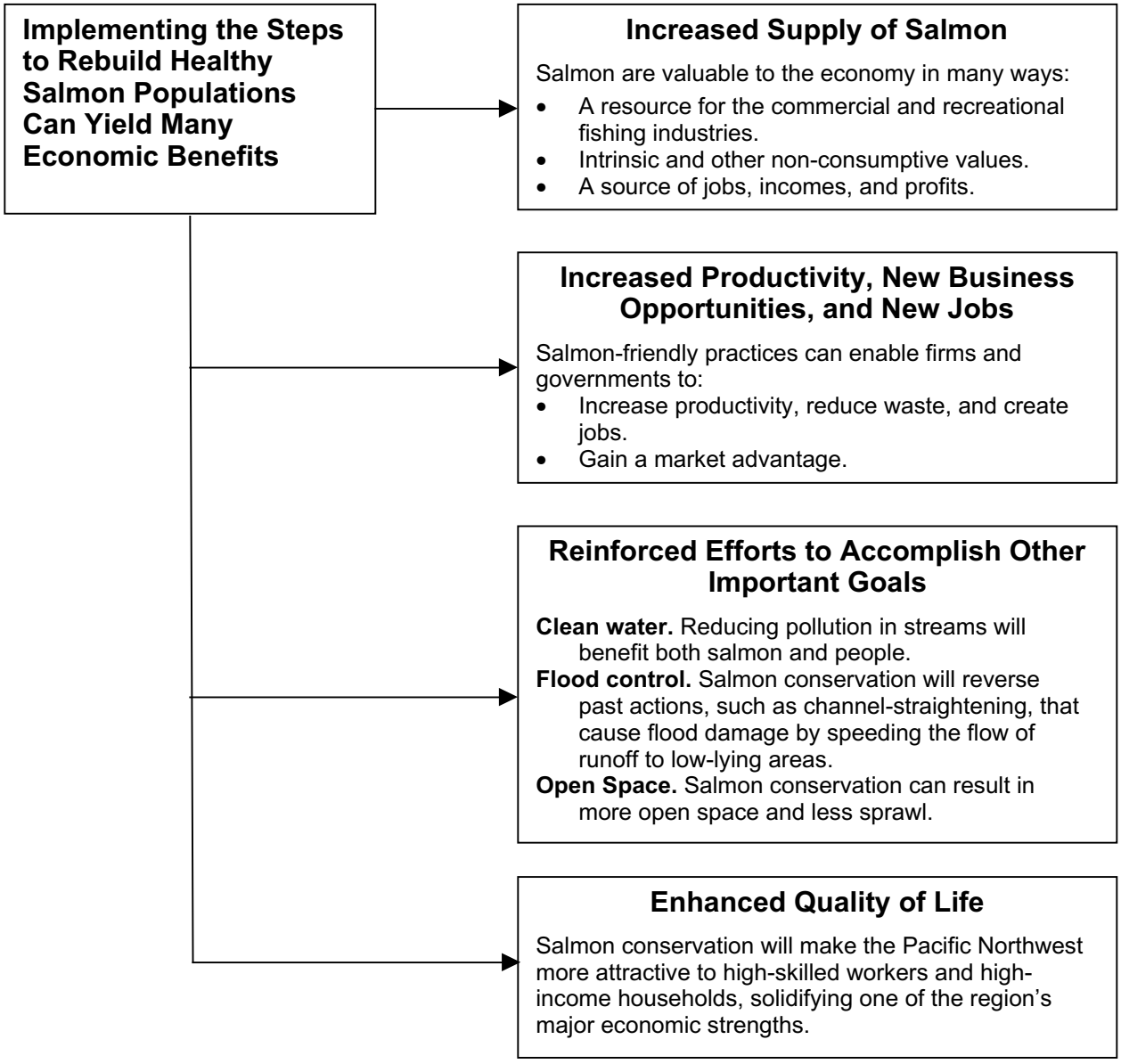
Altered habitat in reservoirs. The water in reservoirs behind dams no longer flows rapidly downstream. Consequently, young salmon must exert more effort to move downstream, and have less energy remaining when they reach the ocean. Furthermore, the slower travel times may mean the salmon undergo morphological changes needed to adapt to saltwater while they still are in freshwater. The standing water in the reservoir has inundated spawning beds.[68] Changes in water-levels reduce the availability of salmon habitat, and can strand fish or desiccate spawning beds.[69] Higher temperatures and still water in reservoirs create favorable conditions for warm-water fish that prey on the salmon.[70]

Mortalities in dam passage. Young fish passing through dams can be killed as they are swept through hydropower turbines or when a dam supersaturates the water passing through it with nitrogen, incapacitating the fish in a manner similar to “the bends” that affects human divers.

Altered habitat downstream. Dams block the downstream transport of gravels, on which spawning salmon lay their eggs. Also, sudden and large water releases from dams can remove most of the smaller gravels and sediment below the dams. For example, a dam built by the City of Seattle on the South Fork Tolt blocked the primary source of gravel to important spawning areas within the mainstem Snoqualmie River.[71]

THE POTENTIAL BENEFITS OF SAVING SALMON

Rebuilding healthy salmon populations can generate economic benefits for the residents of Oregon and Washington in four major ways, which we discuss in the following pages.



Potential Benefits from Increases in the Supply of Salmon.

Salmon are economically valuable for many reasons.

Evidence from recent years, when salmon were more abundant, indicates that, if populations increased sufficiently to allow expanded recreational fishing, they would be worth about $200 per fish.[72] Each additional fish caught commercially would have a dockside value up to $70, depending on the species.[73]

People don't have to catch salmon to value them. PNW residents say they are willing to pay about $30–97 per household, per year to protect salmon. Applied over the 3.4 million households in the PNW, these figures indicate the total intrinsic value of preventing salmon extinctions is about $102-330 million per year.[74] Residents of other states also see the intrinsic value of the Pacific Northwest's salmon.

Representative Estimates of Salmon Values

Component of Value	Value Estimate[a]
Recreational Fishing	$200 per fish
Commercial Fishing	$5–70 per fish
Intrinsic (Willingness to Pay for Salmon-Protection)[b]	$30-97 per household per year

[a] Estimates based on multiple assumptions. Actual values may vary.

[b] WA and OR households only.

Some aspects of value, e.g., the spiritual value tribal members and others ascribe to salmon, have not been estimated. Thus, the estimates reported here reflect only a portion of the total value.

Increases in salmon-related jobs and profits.

If salmon populations were restored sufficiently to allow increases in commercial harvest, fishers and those in related industries would enjoy new business and job opportunities in Oregon, Washington, and elsewhere along the salmon's migration routes.

Similar opportunities would emerge with increases in the recreational catch. Anglers also would enjoy a net gain in economic well-being (called consumer surplus). The net impact on each variable would depend on the extent to which increased fish catch draws workers from other jobs and anglers from other forms of recreation.

Potential Impacts on Jobs and Other Variables from Increased Fish Catch[75]

	Impact per 1,000 Fish[a]
If Fish Are Caught Commercially…	
Jobs	1.5
If Fish Are Caught Recreationally…	
Anglers' Expenditures	$79,510
Jobs	4.0
Anglers' Consumer Surplus[b]	$108,900

[a] Estimates based on multiple assumptions. Actual impacts may vary. See references for details.

[b] Value of fish to anglers minus costs of catching them.

Potential Benefits from Increased Productivity, New Business Opportunities, and New Jobs.

Reduce waste harmful to salmon, and increase productivity. Salmon-conservation requirements may reinforce efforts of firms, governments, and households to reduce their waste. If approached the right way, waste reduction would yield opportunities for profits as well as jobs.

- Firms that reduce waste often experience surprisingly large increases in productivity. One case study found that although reducing the amount of waste generated by a manufacturing process reduced input costs by only one percent, the overall efficiency increased by 3 percent.[76]
- Scrap and sub-standard goods can become the feedstock for other producers. Recent studies, for example, found that more than 40 viable businesses could be created to use the waste material in the Columbia Gorge, the Illinois Valley in southern Oregon, and the Eugene area.[77]
- Reductions in waste can help communities reduce landfill costs and the risks of leachate from landfills that can pollute groundwater and streams.

Salmon-friendly certification. Participation by farmers and retailers in the Pacific River Council's "Salmon-Safe" program; Home Depot's commitment to phase-out wood products from old-growth forests; and efforts by MacMillan Bloedel, Willamette Industries, and other timber producers to phase out environmentally harmful practices show that firms producing and retailing salmon-friendly products can gain a market advantage.

Convert subsidies to more productive use. Past generations implemented subsidies—for dams, logging, agriculture, and urban development—that have proved harmful to salmon. Taxpayers were willing to pay these subsidies because they anticipated the benefits would be large and widespread, while the costs would be acceptable. Now, however, the benefits are smaller, only a few receive the benefits, and the costs are growing larger.

Examples of Subsidies that Could Be More Beneficial to the Economy

Subsidy	Potential Salmon-Friendly Alternative
Logging Roads. In recent years Oregon has subsidized private logging roads by about $25 million per year, even though they are a major source of sediment in streams and salmon-habitat degradation.[78]	Provide subsidies only for roads that do not harm salmon, and penalties for those that do.
Riprap. Public agencies have installed large rocks (riprap) to protect farms and other private lands from floods, but these channelize streams, dry wetlands, and block fish from access to habitat.	Remove riprap that has outlived its economic purpose and is harmful to salmon.
Urban Growth. Developers currently pay only about 50-90 percent of the total on- and off-site capital costs of new residential developments.[79]	Reduce incentives for new development that would be harmful to salmon.

Potential Benefits from Reinforcing Efforts to Accomplish Other Important Goals.

Clean water. Preventing pollution generally is cheaper than cleaning it up afterwards, and salmon conservation should prevent pollution. About 29 percent of streams and rivers in Oregon and 41 percent in Washington fail to meet clean-water standards.[80]

- Salmon restoration would reduce excess sediment that clogs channels, exacerbates floods, and causes other damage. Each ton prevented will reduce damage by about $3.66.[81]
- Preventing other pollutants would be even more beneficial. Salmon-related actions in the Puget Sound and Portland areas have initiated efforts to reduce the runoff of fertilizers and other pollutants—including toxics—from industrial plants, parking lots, farms, and commercial and residential landscaping.
- Residents of Salem save about $15-30 per person annually because its watershed delivers water so clean that it requires minimal treatment.[82]
- Sewage fees in Portland will increase $30-50 per household to fund a $1 billion project aimed at reducing sewer overflows to meet clean-water standards.[83] Some of this cost might be avoided if salmon-related incentives induced landowners to reduce the impervious surface on their properties, thereby reducing flows through the stormwater system.
- Water in the Willamette River, Puget Sound, and elsewhere can be so polluted that human exposure is unhealthy. National research shows that Americans are willing to pay about $240 per year, on average, to improve surface water quality from "nonboatable" to "swimmable".[84]

Flood control. Salmon conservation should reverse past actions, such as channel-straightening and growth in impervious surfaces, that exacerbate flood damage and discourage such actions in the future.

Floods in 1996, caused largely by runoff from urban surfaces, resulted in $60 million of damage in the Portland metro area.[88]

Salmon conservation may entail allowing flood waters to flow outside channelized stream banks. This often results in more flood exposure for relatively low-value farm land and reduced exposure for high-value cities.

Salmon Conservation = More Open Space, Less Sprawl

Salmon conservation should slow urban sprawl and enhance natural habitat along streambanks. Both outcomes have considerable economic value.

- Access to greenery and open space is a crucial element for a satisfactory quality of life.[85]
- Land in Salem next to a greenbelt is worth about $1,200 more per acre than land 1,000 feet away.[86]
- Salmon conservation favors development with mixed uses, open space, and growth around existing centers—and therefore less impervious surface—over current development patterns with lower densities. The fiscal savings are considerable. A study of 12 communities in a single watershed shows savings of $28.8 million on local road costs, $9.1 million in annual water treatment costs, $8.3 million in annual sewer treatment costs, as well as an 8.4 percent reduction in overall housing costs, and a 6.9 percent savings in annual costs of local public-sector services for a pattern of mixed uses, as compared to standard development patterns.[87]

Potential Benefits from Improvements in the PNW's Quality of Life.

Some of the PNW's prosperity stems from the region's attractiveness to high-skilled workers and high-income households. Rebuilding healthy salmon populations, by reinforcing recreational, aesthetic, and other amenities in the PNW, should enhance this attractiveness and solidify the region's economic strength. Although it currently is impossible to estimate the significance of salmon conservation's potential contribution to the PNW's quality of life, several indicators suggest that the potential is significant.

Workers. By living amid high-quality natural-resource amenities, workers in the PNW, in effect, receive a *second paycheck*—denominated in access to scenic vistas, outdoor recreation opportunities, etc.—that augments the first paycheck earned through work and investments.[89] The approximate size of the *second paycheck* is indicated by the fact that workers generally would not relocate elsewhere in the U.S. unless they received an increase in wages around 10–15 percent.[90]

In-migrants. Surveys of adults who've recently moved to Oregon indicate that about 44 percent did so primarily to take advantage of its quality of life.[91] Furthermore, these new residents tended to have higher levels of education than current residents and they often were willing to accept a reduced earnings to live in the PNW.[92]

Recreationists. Outdoor recreation is an important component of quality of life for many Oregonians and Washingtonians. Fishing is especially important. Recent studies of federal lands in the region found that, on a per-acre basis, the economic value of fishing exceeds the value of all other recreation activities.[94] Boating is another recreational activity that will benefit from salmon habitat improvements. Since 1985, boating has increased in popularity in Oregon at a more rapid rate than population growth.[95]

Consensus of economists. In 1995 more than 60 economists, primarily from Washington and Oregon, endorsed a report on the relationship between the economy and environmental protection.[96] One of the report's central findings states, "In short, the Pacific Northwest does not have to choose between jobs and the environment. Quite the opposite: a healthy environment is a major stimulus for a healthy economy."

Quality of Life and the Economy

A 1993 survey by the Oregon Business Council,[93] asked Oregonians these questions

"What do you personally value about living in Oregon?"

One-half identified the natural-resource components of the area's quality of life:

- 34% "Natural beauty and recreation."
- 16% "Environmental quality."

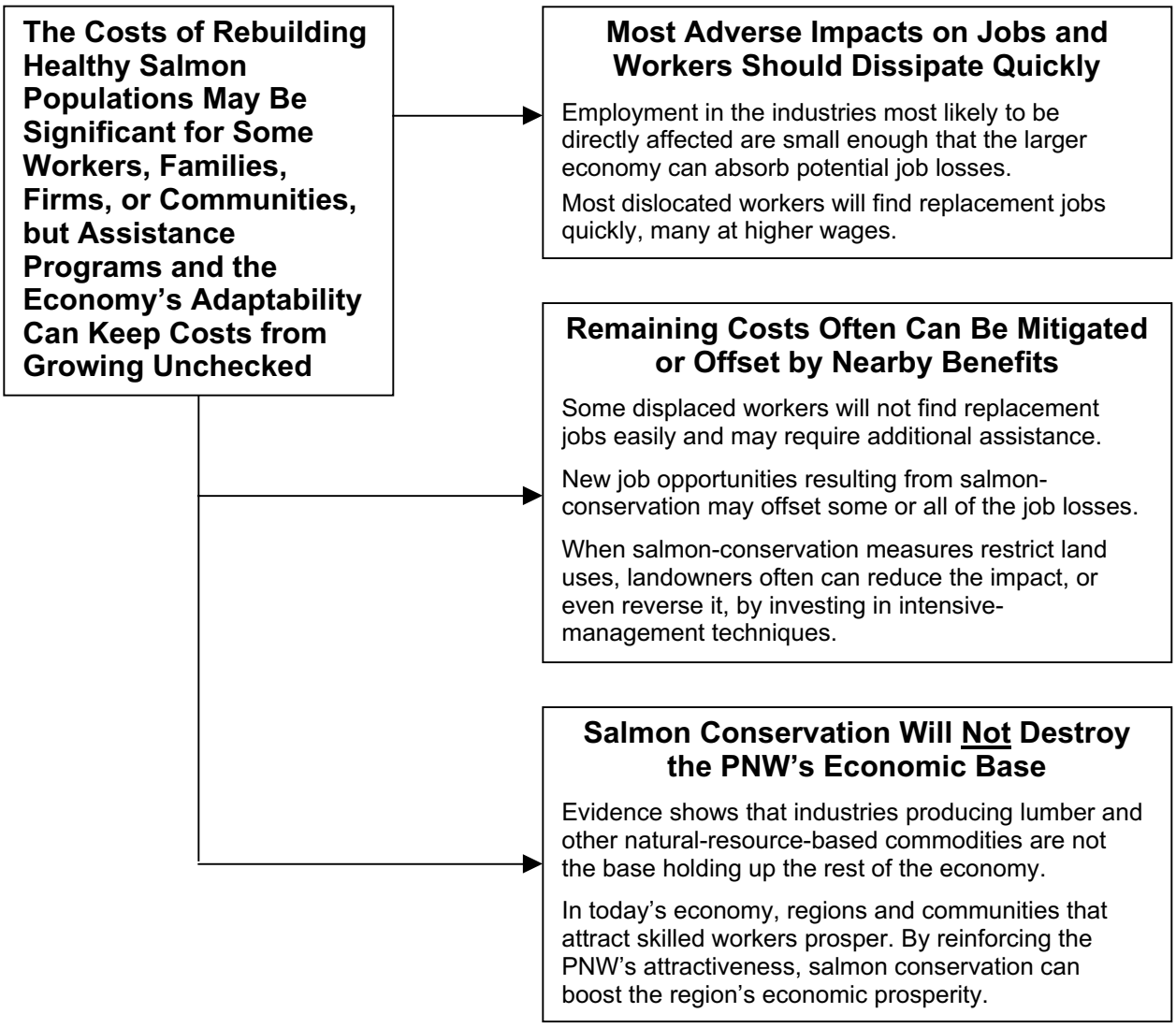
"Which is more important to economic growth in Oregon? Relax environmental regulations to make it easier for companies to do business or maintain a quality environment to attract people and companies to Oregon?"

Respondents overwhelmingly expressed their belief that environmental quality is important to the economy:

- 75% "Maintain a quality environment."
- 16% "Relax environmental regulations."
- 0% "Don't know."

THE POTENTIAL COSTS OF SAVING SALMON

The rebuilding of healthy salmon populations cannot be accomplished for free. There will be costs, especially in the short run. Strong evidence indicates, however, that many people systematically overestimate the costs because they underestimate the ability of workers, families, firms, and communities to control the costs and adapt to changing circumstances.



The Costs of Rebuilding Healthy Salmon Populations.

An economic cost will materialize whenever the task of rebuilding healthy salmon populations in the PNW causes someone—an individual, family, firm, or community—to do something differently, yielding a result that is less desirable.

Measuring costs.

Some costs are easy to measure, others less so. Economists sort through the difficulties applying several principles:

Cost Categories

Workers and families: reduction in earnings, disposable income, quality of life, or value of property and other assets.

Firms: reduction in profits or value of property, plant, and other assets.

Communities: reduction in the value of services provided to its citizens, increase in the costs borne by its citizens, or reduction in the value of community-owned assets.

- Costs usually are measured in terms of the affected party's willingness to pay to retain an asset, such as streamside property, or to engage in an activity, such as farming on the property, that would be affected by salmon-conservation efforts.[97]
- Whenever possible, costs should be measured in monetary terms. Prices are good indicators of value for goods and services traded in open markets; otherwise economists must estimate value using information from other sources. The absence of a market price does not mean the cost is unimportant.
- Costs should be measured on a with-vs.-without basis, i.e., looking forward and comparing what is expected to happen with salmon-conservation efforts against what would have been expected without them. This approach often yields different results than a before-after approach, which looks back, comparing the with-conservation scenario with what existed previously.[98]
- Costs should be measured net of all subsidies and externalities. Double-counting should be avoided.
- Timing matters. All else equal, (1) costs that would occur abruptly generally are stiffer than those that would evolve with enough warning to allow affected parties to adjust, and (2) costs that would materialize further in the future are less significant than those that would occur sooner.

Perspective is important. Sometimes controversy arises over cost estimates because the significance of a cost often depends on one's perspective. A cost to one might be a benefit to another. For example, a developer or a community paying extra to reduce the impervious surface of a new commercial building would see the cost, but residents of the larger region might see the net benefit of increased water quality and reduced flooding downstream. A worker losing a job would see the lost income as a cost, but the employer might enjoy the benefit of a smaller payroll.

Most Adverse Impacts on Jobs and Workers Will Dissipate Quickly.

The industries directly affected are small. Most fears about the costs of salmon recovery focus on the timber and agricultural industries. The impacts on these industries may be significant, but the resulting impacts on the overall economy should be limited. Current salmon-conservation proposals would affect only a portion of each industry, and neither constitutes a large percentage of the overall economy. Furthermore, they will become smaller, relative to the rest of the economy regardless of whether or not the region rebuilds healthy salmon populations.

This is not to say that the impacts on individual workers in each industry are unimportant. Instead, it indicates that the potential impacts on the timber and agricultural industries will not be large enough to have much of an impact on the overall economy. Hence, the region should be able to respond to the demands generated by these impacts through focused programs, such as those appropriate for workers displaced for reasons other than salmon conservation.

Employment in Agriculture and Timber[99]

	1997 Employment		% of Total Employment	
	OR	WA	OR	WA
Agriculture[a]	92,767	127,282	4.6	3.8
Lumber and Wood Products	58,699	41,650	2.9	1.2

[a] Includes farm employment and agricultural services.

Most impacts on these industries will dissipate quickly. Many of the headlines of salmon-recovery costs embody worst-case assumptions about the jobs that will be lost. In reality, though, most displaced workers will find new jobs.

- Of the U.S. workers who lost their jobs in 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.[100]
- Recent performance is even better. Of the U.S. workers who lost jobs in 1995–1997, 76 percent had found work by February, 1998. More than half of the workers displaced from full-time jobs who had subsequently obtained full time employment were earning as much or more than they did prior to displacement.[101]
- Rural areas are not necessarily at a disadvantage. In recent years, workers displaced from jobs in nonmetropolitan counties have fared as well, or better, than those in metropolitan areas.[102]

Remaining Costs Often Can Be Mitigated or Offset by Nearby Benefits.

Workers and families. Even though most workers displaced because of measures taken to conserve salmon will find replacement jobs fairly quickly, losing one's job can be frightening and, for some, traumatic. Existing programs, however, can ease the trauma.

- Job-search assistance generally can speed the finding of new jobs.[103]
- Although evaluative studies often conclude worker-retraining programs are not widely effective, some recent evidence suggests the programs can be made effective, by helping workers find jobs in different industries.[104]
- Most workers are covered by unemployment insurance. Those not covered, or those who exhaust their benefits, may require additional assistance.

Furthermore, it is reasonable to expect that, whenever salmon-conservation measures cause job losses, they also will stimulate the creation of new jobs, as the chart on the next page illustrates. The offsetting effects will stabilize local economies, even though individual workers displaced from one job may not have the skills to qualify for the new ones.

Property values. Some owners fear salmon-conservation measures will deprive them of the value of their property. This issue has been studied most extensively for timberlands, where studies show that most fears will not materialize.[105] If landowners adapt their management and invest in accelerating the development of good salmon habitat, their long-run yields may even increase (see box).

It seems reasonable to expect similar outcomes for agricultural and urban lands. Farmers may be able to harvest alternative products from streamside lands dedicated to salmon habitat, or use the establishment of habitat on a part of their property to secure certification of all products from their lands as salmon-friendly. Farmers participating in programs to induce conservation practices will receive financial payments.[109] Net earnings will not fall as feared and may even increase.

Urban landowners may see similar opportunities. By protecting the streamside portion of a lot and building more intensively on the remainder, for example, a developer may earn nearly the same, or even more, than by adopting a design that consumes more land.

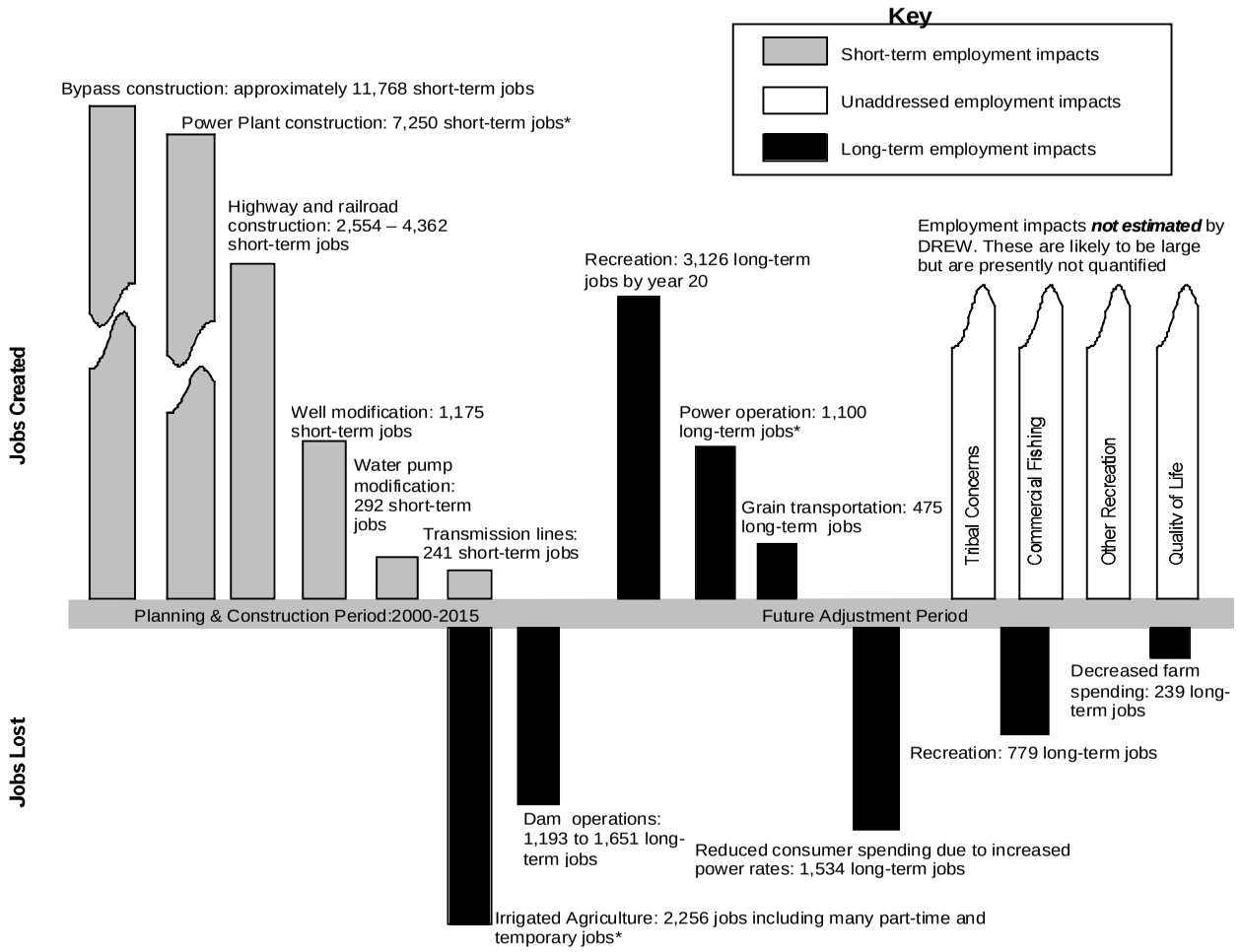
Salmon & Timberland

In response to a recent proposal to protect existing salmon habitat and restore degraded habitat on private timberlands in Oregon, major landowners concluded that it would remove 39 percent of timberlands from production, at a cost of $8,700 per acre, or $29 billion total.[106]

The actual cost, however, probably will be much smaller.

- Research by foresters not associated with the industry have concluded that the per-acre costs would be only 1–10 percent of the industry's estimate. [107]
- Using computer simulations of timber growth and habitat conditions, researchers at the University of Washington concluded that, if landowners invest in management practices designed to improve habitat, rather than do nothing, long-run logging levels can be *increased* 9 percent (and the timber will be more valuable).[108]

Illustration of the Potential Benefits of Salmon Conservation Offsetting the Potential Costs: Projected Impacts on Jobs of Bypassing Four Dams on the Lower Snake River[110]



* In considering these estimates by DREW, keep in mind that construction of new power plants may not be necessary and irrigated farming operations may be sustained through investments in infrastructure.

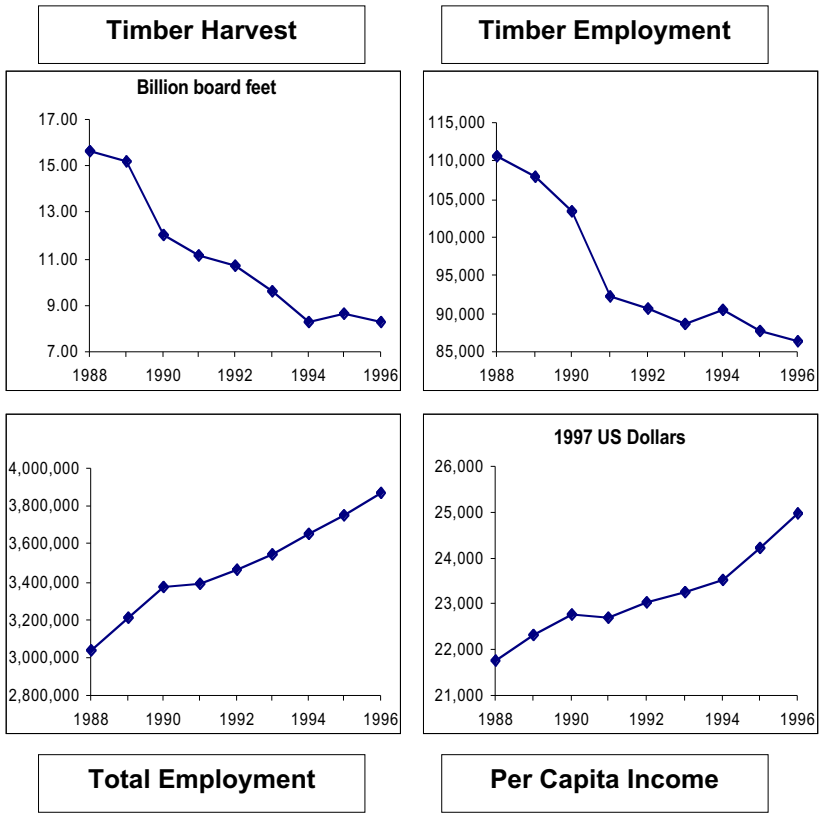
DREW = Drawdown Regional Economic Workgroup, an analytical process established by the Army Corps of Engineers.

Rebuilding Healthy Salmon Populations Will Not Destroy the PNW's Economic Base.

What economic base means. Resistance to salmon conservation often arises from a fear that any resulting limitations on traditional industries, such as timber, agriculture, or aluminum smelting will have devastating impacts on local and regional economies. The basis for many of these fears lies in the *economic-base model*. According to the economic-base model, the industries producing natural-resource-based commodities are the "economic base" that "supports" the rest of the economy, because the exported commodities bring in money that is spent and respent on other goods and services.[111]

Why it doesn't work. A decade ago, some economists argued that the timber industry was the base supporting as much as 50 percent of the total economy. If they had been correct, then, as the timber industry shrank during the past decade, the economy as a whole should have declined also. Instead, the overall economy grew rapidly.

Timber and the Overall Economy in Washington and Oregon, 1988-1996[112]



A more reasonable approach. In today's economy, regions and communities that attract and hold skilled workers prosper. Those that can't, won't. In general, rebuilding healthy salmon populations should help the PNW attract and hold highly skilled workers. Thus, if implemented wisely, salmon conservation can become a mainstay of economic prosperity.

WIN-WIN OPPORTUNITIES

Washingtonians and Oregonians have many opportunities for taking steps that will help both salmon and the economy.

Many Actions Can Help Both Salmon and the Economy

Adopt Tax Incentives and Other Subsidies that Help, Not Hurt, Salmon

Many subsidized activities harm salmon and yield little, if any, net benefit for the overall economy.

Subsidies should be targeted so they stimulate activities beneficial to both salmon and the economy.

Reform Environmental-Management Systems so They Are Beneficial to Both Salmon and the Economy

The economy and salmon (and the environment as a whole) can benefit from management systems that

- Focus scientific research to determine how much habitat-restoration is possible, and how to accomplish it.
- Prevent problems rather than create them and then have to clean them up.
- Employ sustainable business incentives.

Implement Effective Transition Programs

Implementing salmon-conservation measures may trigger some economic dislocation. Smoothing the negatives aspects of the transition can make both the economy and salmon conservation move more quickly.

- Eliminate economic inefficiencies, such as poor resource-pricing signals.
- Help groups who unfairly bear the costs of salmon conservation.

Adopt Tax Incentives and Other Subsidies that Help, Not Hurt, Salmon.

Many tax breaks and other subsidies encourage activities harmful to salmon, but yield little benefit to the overall economy. Examples from a long list include:

- **Relief programs.** Disaster relief encourages building in floodplains and rebuilding of flood-damaged structures. Letting owners bear the risk of repeated flooding or providing incentives to move would reduce floodplain development.[113]
- **Residential developments.** Taxpayers as a whole pay 10-50 percent of the total on- and off-site capital costs of new residential developments,[114] encouraging development that otherwise would not occur in areas and ways harmful to salmon. Letting developers bear the full cost, or extending subsidies only for salmon-friendly developments, would reduce the harm urban development imposes on salmon, and increase the efficiency of public infrastructure.
- **Agricultural chemicals.** Farmers don't pay sales tax on agricultural chemicals in Washington, which saved them $36 million in 1997.[115] This encouraged Washington's farmers to use more than they would otherwise. Since some chemicals run off into waters and harm salmon, the exemption should be modified to induce behavior less harmful to salmon.
- **Unemployment-insurance benefits.** Unemployment-insurance benefits paid to laid-off timber workers have persistently exceeded the premiums paid by the industry, reducing mill-owners costs and encouraging mills to log more than they would have otherwise. For 1980-1997 the subsidy totaled more than $358 million in Oregon alone.[116] Restructuring the program would lower the industry's overall incentives to log, including areas with sensitive salmon habitat.
- **Grazing cattle.** Ranchers grazing cattle on federal lands do not pay the fair market value for the forage and services they consume. Thus, they have incentives to place cattle in areas they otherwise would avoid, including areas harmful to salmon. In 1993, for example, subsidies totaled more than $5 million.[117]
- **Irrigation.** Taxpayers pay about $56 for each acre foot of water farmers obtain from irrigation projects constructed by the Bureau of Reclamation,[120] giving farmers an incentive to use more water than they would otherwise. The incentive is greater when electricity for pumps is subsidized. Reducing the incentives would help salmon and reduce waste.
- **Water prices.** Water is priced like nothing else. Users don't pay for the water, itself, only for treatment and conveyance costs. Worse, many water utilities give price breaks to large consumers, discouraging conservation. Price incentives are needed to reduce waste and keep water in streams.

Impervious Surfaces

City codes often require impervious surfaces needlessly.

- Driveways and parking lots generally must have asphalt or concrete; materials allowing rain to be absorbed by the ground are disallowed.[118]
- Conventional roof designs often are favored over "eco-roofs". These can reduce stormwater runoff by 15-35 percent and last 50 percent longer relative to conventional materials, but cost 30 percent more.[119]

Reform Environmental-Management Systems Beneficial to BOTH Salmon and the Economy.

Many ecologists believe the declines in salmon populations stem from wider environmental problems and, hence, conclude that efforts to rebuild healthy salmon populations cannot be successful unless they are incorporated into broad reform of environmental-management systems. Research at the Portland State University's Center for Watershed and Community Health (CWCH) and elsewhere has identified some key elements of reforms that should benefit both the environment and the economy.

Focus scientific research. Data on many key environmental conditions are nonexistent, making it impossible to know what the problems are, how they came about, and how to fix them. Scientists in Oregon have begun to redress these deficiencies and soon will complete a comprehensive assessment of the state of the environment. The analysis should lead to an assessment of how much habitat-restoration is possible, and how to accomplish it.

Prevent problems. It often is far cheaper to prevent an environmental problem, such as salmon declines, than to create the problem and then clean it up. Salmon-conservation efforts will be most beneficial to the economy if they are part of a larger effort that focuses on designing sustainable economic activities rather than on cleaning up after unsustainable ones. Rather than focusing primarily on the end of the cause-and-effect chain of decisions that result in degraded salmon habitat, more attention must be paid farther up the chain. For example, producers should be encouraged to incorporate bio-degradable, rather than toxic components in their products so that the toxics never enter the waste stream. Preventing waste often yields higher profits for firms.

Employ sustainable business incentives. Reforms in Europe and elsewhere show it is possible to increase prosperity without degrading the natural elements of ecosystems. They also demonstrate, though, that this outcome cannot be accomplished by relying solely on old approaches, i.e., voluntary efforts or centralized regulation. Instead, industries and government must collaborate on designing mechanisms that give each firm a strong incentive to prevent problems for salmon and other indicators of environmental health. Each industry, for example, might agree to reduce its total adverse impact on salmon by X percent over the next five years, and then create a set of positive and negative incentives for each firm within the industry to do its part. The firm would be judged on the outcome of its efforts, not on what steps it took to produce.

Designing a More Efficient and Effective Management System

Efforts in Oregon, Washington, other states, and other countries have identified these central features of viable, alternative approaches to economic and environmental management:

- Establish clear goals.
- Develop credible scientific analysis to define baseline conditions and assess things that must change to accomplish the goals.
- Negotiate with all key groups (industrial sectors, resource-user groups, local governments) to determine their respective responsibility for making verifiable progress toward the goals.
- Allow each group to design the most efficient means for meeting its responsibility.

Implement Effective Transition Programs.

Ideally, all segments of the economy would respond quickly and painlessly to whatever changes are needed to rebuild healthy salmon populations. In the real world, though, some workers, families, firms, and communities will adjust more slowly and only with difficulty.

Federal and state assistance should aim to ease the transition—that is, to reduce inefficiencies that arise. Mitigation also may be warranted to counter certain impacts, such as when the costs of rebuilding healthy salmon populations fall on a group that will not enjoy commensurate benefits or, alternatively, has not enjoyed the benefits of past subsidies associated with the activities that now must be reversed. Salmon-related mitigation assistance seems most warranted in these situations:

- **Labor markets.** Mitigation should aim to help workers displaced solely because of actions taken to accomplish salmon-related goals so they can quickly secure replacement jobs at a nearby location, and with similar skill requirements and wage. When such jobs are not available, assistance should help with relocation costs and training costs.
- **Agricultural land.** One objective of mitigation programs should be to ensure that land is used to grow crops only when the value of the crop exceeds the production costs; otherwise the land should be set aside for conservation. Farmers lured by past subsidies into producing crops on land that otherwise would not be profitable should be encouraged to set the land aside for conservation.
- **Urban infrastructure.** Mitigation efforts should strive to prevent bottlenecks and ensure that the prices of transportation, utilities, education, and other services reflect true costs. Where private firms and local communities are unable to make the initial investments needed to restructure transportation, water, sewer, and other systems in response to actions needed to rebuild healthy salmon populations, state and federal assistance might be justified.
- **Community stability.** When possible, mitigation should aim to structure salmon-related decisions and actions so that short-run events do not cause lasting disruption of communities. State and federal assistance should aim to avoid or, if necessary, to offset, boom-bust outcomes.
- **Resource pricing.** Consumers should pay prices that reflect the true cost of the resources they consume. This is especially appropriate for water. All water consumers—irrigators, municipal consumers, recreationists, and electricity users—should face price incentives to reduce the amount of water use harmful to salmon. Mitigation should aim to prevent higher water-related costs, such as electricity rates, from imposing unfair burdens on consumers. Candidates for rate assistance include low-income households.
- **Stream restoration and land acquisition.** Land uses harmful to salmon will have to be restricted on some land, especially near streams and in floodplains. Residents of larger communities may mitigate the impacts on individual landowners by purchasing the land, paying habitat-restoration costs, or other actions. Portland-area voters, for example, recently approved a $136-million bond to acquire 27 miles of streamfront and river greenways and 4,140 acres of natural areas.[121]

CONCLUSION

Widespread evidence indicates that Washingtonians and Oregonians want to rebuild healthy salmon populations. The challenge is huge, however, and may impinge on every household, business, landowner, and community. As the region weighs the alternatives, it is important that everyone have a sound understanding of the economic consequences. This handbook is intended to promote such understanding. These are among its main messages:

- Salmon conservation will generate both costs and benefits.
- The costs generally are more visible than the benefits, but they often are overestimated, because people fail to appreciate fully the economy's ability to adjust and adapt.
- Concern about many of the costs, such as job losses, probably can be addressed through existing programs.
- Many of the potential benefits will evolve over time, as workers, households, firms, and communities find new ways of doing things that are less harmful to salmon.
- It is important to get the economic incentives in line with salmon-related and other goals. Subsidies harmful to salmon should be scrutinized and either eliminated or restructured so they are beneficial. Proposals to subsidize the rebuilding of healthy salmon populations should receive similar scrutiny, to ensure they would be effective and have limited side effects harmful either to the economy or to non-salmon aspects of the environment.
- Salmon-conservation measures should be designed so they don't generate unnecessary costs but, instead, yield as many collateral benefits—such as cleaner water and lower waste-treatment expenses—as possible.

There is more to the story, of course, much more. This handbook offers no more than an introduction to the complicated ways in which salmon recovery interacts with economic development in Washington and Oregon. The challenge ahead includes identifying and implementing actions with a high probability of both rebuilding healthy salmon populations and promoting prosperity throughout the Pacific Northwest.

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