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The Economic Impact on the Forest Sector of Critical Habitat Delineation for Salmon in the Columbia and Snake River Basin

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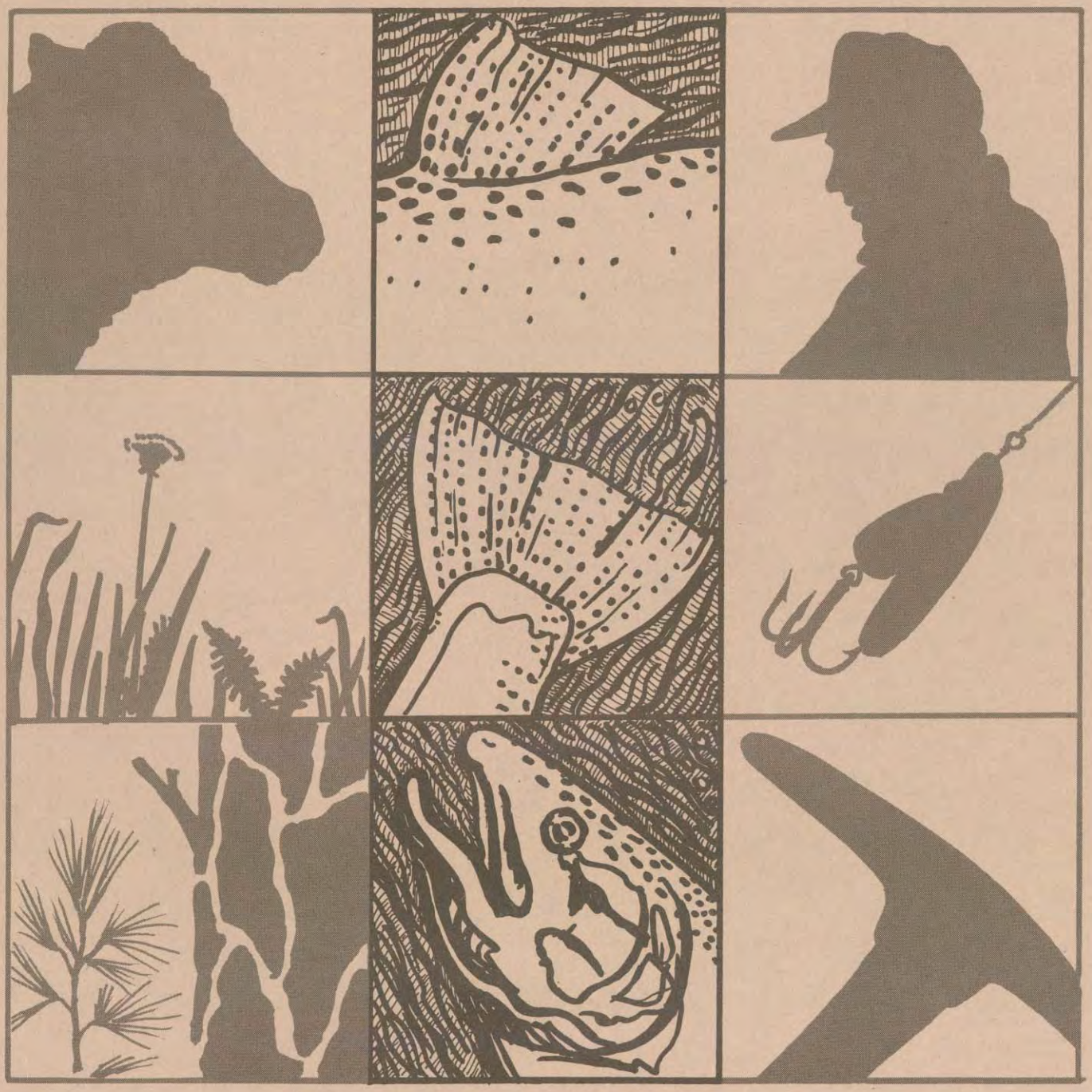

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Abstract

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Economic implications of critical habitat designation (CHD) for salmon in the Columbia River basin were estimated in advance of actual designation and recovery plan development. Economic impacts on Pacific Northwest, Intermountain, and Northern Region National Forests' range, recreation, timber, and mineral programs in the Columbia and Snake River basin were analyzed. Two cases were considered: a worst case, where CHD results in a total reduction in the anadromous portions of the various programs, and a mitigated case, where all or part of the loss is mitigated. Results were analyzed over the 10-year Forest planning period under 4- and 9- percent interest rates. The recreation and timber programs showed values greater than costs for CHD mitigation, while the range program did not. The minerals program initially seemed to fall into the same situation as range, but limited information in the analysis for minerals made this judgment subjective.

Keywords: Critical habitat designation, policy analysis, salmon, economic impacts, National Forests.

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Introduction

The National Marine Fisheries Service (NMFS), in anticipation of the listing of various salmon runs in the Columbia and Snake River basin as endangered under the Endangered Species Act (ESA; 1973), is attempting to assess the biologic and economic implications of critical habitat designation (CHD) for salmon.[1] The economic assessment covers nine major areas of direct economic impacts: (1) flood control; (2) irrigated agriculture; (3) hydropower production; (4) transportation and navigation; (5) recreation; (6) salmon fisheries-commercial, sport, treaty and nontreaty, subsistence, and hatchery; (7) land management: (8) municipal and industrial water use; and (9) nonsalmon wildlife and fish and riparian wildlife. This assessment focuses on the direct net economic costs of ESA actions concerning Snake River sockeye (*Oncorhynchus nerka* (Walbaum)) and chinook (*O. tshawytscha* (Walbaum)) salmon.

The advanced (prior to recovery plan) availability of economic data is a new concept for NMFS and ESA. Economic data normally are compiled after the formulation of the recovery plan and designation as critical habitat. Even with this approach, another economic assessment focusing on economic cost-effectiveness is likely once final identification of critical habitat has been made.

The USDA Forest Service is the sole land management agency involved in the economic assessment. The NMFS has asked the Forest Service to provide natural resource data related to timber, livestock grazing, recreation, and minerals as they pertain to National Forest System (NFS) lands. The objective of this report is to provide that information and assess the costs to the NFS of CHD beyond protection already afforded in the Forest plans.[2] These plans served as the base case in this analysis and already included significant measures taken to protect salmon habitat prior to CHD; in identifying incremental costs associated with CHD, total costs therefore will be understated. The analysis was performed regionally, with national effects mentioned where measurable. It was assumed that no reduction in habitat would occur for any salmon-bearing Forest watershed downriver from Hells Canyon Dam in the Snake River system.

Definition of Critical Habitat

Critical habitat areas are those designated as critical by the Secretary of Commerce for the survival and recovery of listed species. Because use of the term has legal implications, the Forest Service limits its use to only those habitats officially determined as critical by the Secretary of Commerce.

For the preliminary (prior to recovery plan) effort of identrfying the direct net economic costs of critical habitat, the area of consideration was "ridge to ridge" for the mainstem and tributaries and included spawning, rearing, and migratory habitats.

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[1] These particular runs are the Snake River sockeye and spring and fall chinook runs in the Columbia and Snake River basin.

[2] Forest plans are a product of a continuous land management planning process that addresses changing resource demands made on the supply of renewable resources and minerals. Every decade the Forest Sewice, with public input, updates and amends Forest plans to ensure that adequate resources will be available for future generations These plans are used to provide the Administration and Congress with accurate program and budget information and to guide program implementation on the ground for each National Forest.

In this analysis, we dealt only with National Forest lands that are largely in river head water regions. We did not deal with private lands. We generalized some NMFS concerns[3] to fit the National Forests involved because not all species of salmon occur on all involved Forests, and it is generally only river headwaters that occur on Forest Service managed land. Concerns about the spring-summer chinook and fall chinook salmon were combined and considered only below Hells Canyon Dam. There is a lack of biological information available for the area above Hells Canyon Dam to C.J. Strike Dam. Various concerns about sockeye salmon runs were analyzed for recreational impacts only in the Sawtooth National Forest.

The analysis focused on two cases: a worst case scenario, in which the Forest Service is forced to restrict activities in all areas in the Columbia and Snake River basin containing anadromous fish habitat, and a second case, in which various mitigation activities wholly or partially restore Forest Service programs. Most of our discussion focuses on the second or mitigated case, with less emphasis on the worst case scenario where habiiat protection on the various National Forests results in a total reduction of timber, range, recreation, and mineral programs in anadromous fish-related drainages.

Area of Analysis

Ten National Forests in Oregon and Idaho (Forest Service Regions 1, 4, and 6 [defined below]) are included in the analysis. The area considered is that portion of the Snake River basin up to and including all tributaries below Hells Canyon Dam on the Snake River (see fig. 1). The analysis does not include any NFS drainages above Hells Canyon Dam. The areas included are:

Northern Rocky Mountains (Region 1)-
- Bitterroot National Forest [4] (Clearwater River drainage)
- Cleanrvater National Forest (Clearwater River drainage)
- Nez Perce National Forest (Clearwater, Salmon River drainages)

Intermountain Region (Region 4)--
- Boise National Forest (Salmon River drainage)
- Challis National Forest (Salmon River drainage)
- Payette National Forest (Salmon, Snake River drainages)
- Salmon National Forest (Salmon River drainage)
- Sawtooth National Forest (Salmon River drainage)

Pacific Northwest Region (Region 6)-
- Umatilla National Forest Vucannon River drainage)
- Wallowa-Whitman National Forest (Grande Ronde River drainage)

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[3] Personal communication. 1992. Daniel Huppert, associate professor; David Fluharty, research associate professor; and Libby Kenney, research assistant, University of Washington, School of Manne Affairs, HF-05,3707 Brooklyn Avenue N E., Seattle, WA 98195.

4 The Bitterroot NF has only designated wilderness in the Columbia and Snake Rver basin Designation as cntrcal habitat is assumed to have no impact on wilderness uses.

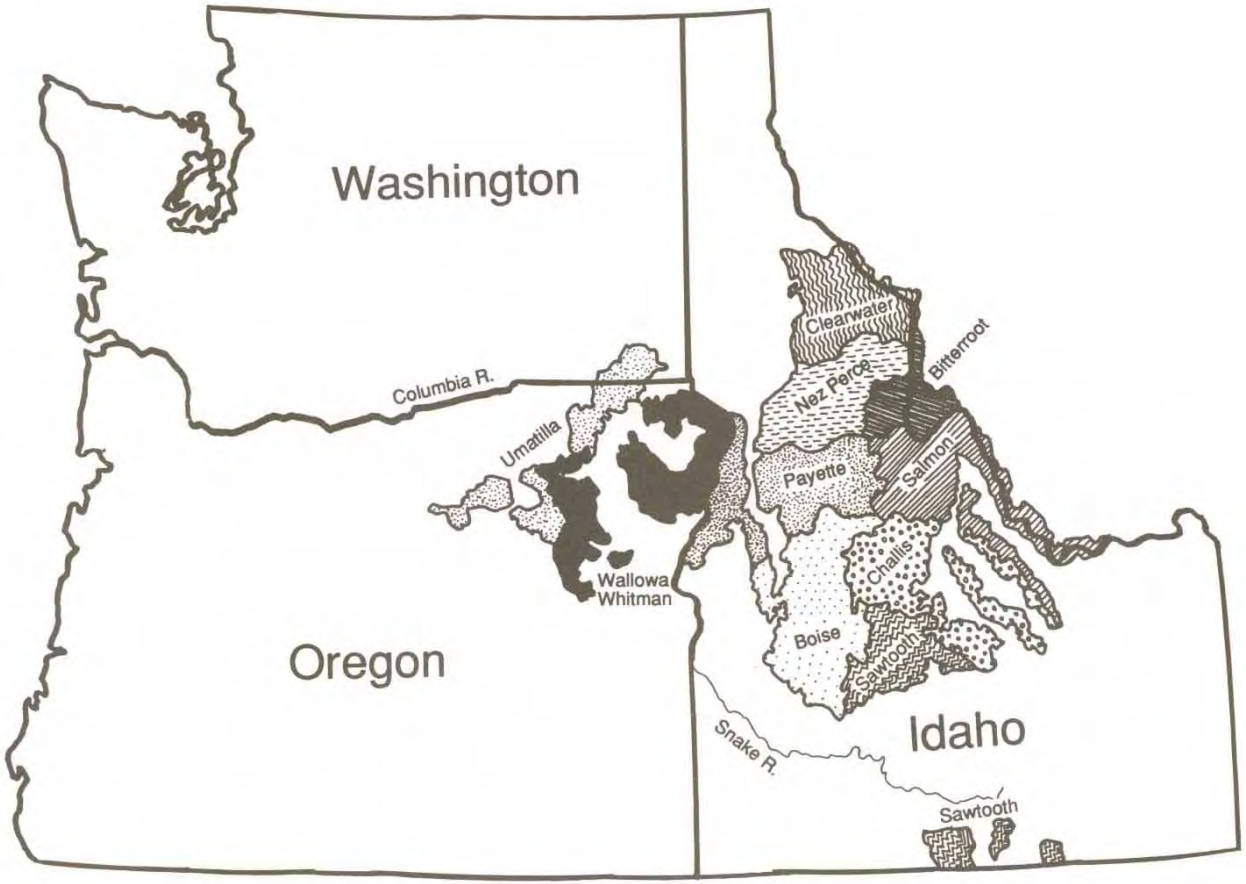

Figure 1—National Forests in the area of analysis.

Methods

Data Collection Process

Data were collected from individual forests by a workgroup composed of both Planning and Fish and Wildlife Staff from Forests and Regional Offices in the Snake River basin. The various assumptions and definitions of terms for gathering data are given in appendix 1.[5] Output levels for other than fish resources were held at Forest plan implementation levels (base case). The worst case and mitigated case, as described earlier, formed benchmark net direct cost estimates to the NFS due to CHD.

The forests listed above provided data under the format found in the data collection sheets in appendix 1. The data were summarized for range (see appendix 2, table 5, which later was revised by using regional level data, tables 3 and 4), recreation (appendix 3, tables 13 and 14), timber (appendix 4, table 16), and minerals (appendix 5, table 18). As Forest plans formed the basis for the analysis upon which CHD would be imposed and because Forest plan outputs are measured over a 10-year planning period, the data in this analysis are decade based. Forests were to assume that the Forest plans would be fully implemented (this assumption was later modified for range), that all project activities would comply with Forest plan standards and guides, and that the "Columbia River Basin: Anadromous Fish Habitat Management Policy and Implementation Guide"[6] would be implemented throughout the Snake River basin.

Detailed analysis methodology for each resource occurs in the section "Results," below, and in appendix tables.

Assumptions

Use of Forest plans—Several assumptions were made in this analysis. Forests were to analyze salmon habitat for Forest watersheds as defined in their Forest plans. Those drainages for which Forest plans specify a reduction in habitat capabiltty were to be identified. All salmon-bearing Forest watersheds below Hells Canyon Dam in the Snake River drainage were considered, excluding Forest watersheds that historically did not have documentation of the proposed or listed salmon. The riparian standards and guidelines in each Forest plan and the "Columbia River Basin: Anadromous Fish Habitat Management Policy and Implementation Guide" (see footnote 6) would be fully implemented. Under ESA, Section 7 (consultation provisions), the burden of proof of no impact of land management activities on habitat lies solely on the Agency. We assumed, based on the data provided, that substantial funding increases would be required to meet Forest standards and guides for range. Cost savings from any reductions in the timber program was assumed to exist because timber is fully funded and any reductions will result in cost savings. This was not the case for the range, recreation, and minerals

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5 The data originally were gathered under two options. Option A, for range, recreation, timber, and minerals, has the least cost deviation (to the Government) from Forest plan implementation to meet the objective of no reduction in habitat. Costs for that portion of the program remaining economically feasible plus any costs associated with portions that are no longer feasible in anadromous fish-related drainages after CHD are shown Option B has the least cost (to Government) for total mitigation of salmon habitat. Data were collected under this latter option for ttmber only, as full mittgation of range, recreation, and minerals was not felt possible or data were not avarlable. Due to inconsistencies in the data between the two options, options A and B were assimilated into one data set, which is carried forward throughout the analysis as the mitigated case for timber.

6 U.S. Department of Agriculture, Forest Service. 1991. Columbia River Basin: anadromous fish habitat management policy and implementation guide. 30 p. On file with: Gordon Haugen, inter-regional fisheries coordinator, P.O. Box 3623, Portland, OR 972083623.

programs where due to underfunding, cost savings were assumed to be used for the remaining anadromous and nonanadromous portions of the programs. Investments to restore or improve salmon habitat capability were not considered.

As mentioned above, the analyses presented here in accordance with Forest plans are decade (1990-2000) based. The opportunity cost foregone or worst case scenario for range, recreation, timber, and minerals occur annually throughout the decade. In the range analysis, however, updating the Forest allotment management plans through the National Environmental Policy Act (NEPA; 1969) process has to be accelerated to occur within the first 4 years of the decade. The range improvement costs, the loss of animal unit months[7] and additional administrative funding costs would occur throughout the decade. (It needs to be noted here that many actual mitigation costs are borne by the permittee, not the Forest Service.) Once specific affected allotment areas are identified, more accurate range improvement cost data can be estimated, part of which may be borne by the Forest Service. Such costs may include a specific amount of miles of fence to be built and maintained as well as the number of additional range riders necessary.

The data for the recreational analysis were originally reported in recreational visitor days then converted to activity days, based on 4 hours of recreational effort a day. The value of the lost activity days resulting from a salmon listing was determined by using Resource Planning Act (RPA; 1974) net consumer surplus prices (see appendix 3, table 10). The RPA cold water fishing value includes anadromous fishing, because conflicting evidence between this and actual cold water fishing values as well as a lack of sufficient recent empirical studies did not allow a difference to be established (USDA Forest Service 1990).

In one case, the Payette National Forest, it was felt that no recreational opportunities would be lost but that increased law enforcement and education would be necessary. This would include keeping people off the banks and out of the streames at critical times and places to reduce soil erosion and harassment during spawning and migration, year-round educational programs in schools, and signage and interpretive sites for general education on salmon. We have not included costs associated with increased demand for fish viewing and the projected site development caused by such. We assumed that on the average these activities would be needed by the other Forests as well, and this is reflected in the analysis (see appendix 3, tables 13 and 14). The Wallowa-Whitman National Forest with additional recreational visitor days may have a greder need than the Payette National Forest, but this is probably offset by the Clemater National Forest, which has fewer visitor days and probably will need less.

The categories of recreation affected on those Forests showing activity losses are noted in appendix 3, table 11. A second recreational analysis was done, becauke for the Sawtooth National Forest, the Idaho Department of Fish and Game (IDF&G) was able to supply recreational use data on the activity hours that they felt would be lost as a result of the salmon listing (see appendix 3, table 12). This latter analysis assumed that all sockeye salmon-related recreational losses were from coldwater fishing only and did not include other recreational categories (see appendix 3, table 14). Also, their recreational use data were collected under a different methodology than that used by the NFS.

[7] An animal unit month is the amount of forage required to sustain one animal unit for 1 month An animal unit is one mature cow of approximately 1,OOO pounds, or equivalent.

Other assumptions-other assumptions included estimates of real market clearing prices for range, recreation and minerals, interest rates, and various measures of indirect economic activity. The range, recreation, and mineral prices were taken from the 1990 RPA program (USDA Forest Service 1990) and include real price appreciation rates (net of inflation) of 0.6, 0.3, and 2.0 percent per year, respectively. These rates also were included in this analysis to reflect increasing scarcity throughout the decade. Real price appreciation of 3.2 percent per year and the values for timber were estimated by using the same methodology as was used foc the 1990 RPA Timber Assessment and Program (Haynes 1990), only modified to include the reductions in the timber programs of the various National Forests (see Timber" in the section "Results"). Interest rate assumptions of 4 and 9 percent were required by NMFS.

Weaknesses of Approach

There are several weaknesses to the approach used in this analysis. The first is lack of clear delineation of the critical habitat and the delineation of activities and programs in the basin that would need to be adjusted to meet recovery plan standards. Limitations specific to the Forest planning process included limiting the analysis to only those watersheds with identified negative impacts to fish, the potential discrepancy between activities and standards identified in Forest plans from actual implementation (the role of monitoring, inventory, administrative oversight), Forest plan emphasis on programmatic data rather than site-specific informatbn, and inconsistencies in Forest plans among Regions and Forests.

Although not necessarily a limitation, many Forest plan decisions acknowledged costs of managing for salmon habitat and made adjustments in the land allocations (that is, allowable sale quantity or animal unit month reductions in riparian areas) in the current Forest plans. Such decisions will reduce the cost estimates presented in the section 'Results."

One real limitation is that this analysis did not include (nor was it intended to) all land ownerships within the various river basins: for example, the analysis includes the land in the headwaters of, say, the Grande Ronde River but does not consider the economic costs associated with private agricultural and ranching activities along the various privately owned river valleys where intense grazing occurs. Private costs associated with CHD and that effect on NFS programs were not included.

Several limitations were imposed by the various means of accounting for economic impacts.[8] There was an inconsistency, for example, between casting methoddogies: consumer surplus vs. surrogate value for preparing NEPA documents. Cost-effectiveness criteria were not a consideration in this preliminary economic analysis. Indirect costs or

[8] Willingness-to pay values are used because of value for increased (marginal) consumption of natural resource goods. Whereas willingness-to-accept values are probably more appropiate for measuring welfare adjustment due to decrements in rebOurce supplies, willingness-to-accept and willingness-topay values will converge lor homogeneous undifferentiated products. Most recreational activities derived horn natural resources will not meet the strict test necessary for willingness-to-accept and willingness-to-pay values to be considered equivalent. Although we recognize this theoretical truth for valuation, for ESA-imposed changes in resource recreational uses, the only available measures of value for assessing social welfare and economic impacts due to changes in recreational resource useare willingness-topay vaiues

regional economic impacts were addressed for timber, range, and recreation. The analysis for minerals was the weakest. Finally, the methodology for determining casts ssociated with critical habitat management and mining activities were not well defined.

Results

Results are shown for the two cases described earlier: the worst case scenario, in which the Forest Service is forced to restrict activities in all areas of the Columbia and Snake River basin containing anadromous fish habitat and a second case, in which various mitigation activities wholly or partially restore Forest Service programs. Given the relatively small magnitude of lasses in the mitigated cases, national effects probably would occur only with the lass of timber; loss of other resources generally would cause only regional effects. In addiiion, timber is the only resource having a model available for measuring the national impacts with any degree of reliability.

The results for each resource are shown in various tables (as referenced) in the appendices. The total net cast in present value terms of these various reductions for the next decade can be summarized in common units as follows:

Analysis	Present value			
	Range	Timber	Recreation	Minerals[9]
	Million *1990* dollars			
Worst case:				
4 percent	**10.3**	**480.8**	**2030.4**	**72.8**
9 percent	**8.1**	**380.4**	**1603.7**	**56.9**
With mitigation:				
4 percent	**19.3**	**1.8**	**15.2-19.1**	**87.3**
9 percent	**15.7**	**1.4**	**12.0-15.1**	**68.2**

Detailed present value results are discussed below and are shown in appendices 1 through 5. Range and minerd losses were estimated, but once impacts for specific areas are completed through the NEPA process, specific reductions may be better known.

Range

Two range analyses were considered, a worst case and a mitigated case. For the latter, the three regions each provided four types of range cost data (see appendix 2, table 3): (1) the incremental cast to attain full Forest plan implementation, (2) the increw in cost due to accelerating the allotment management plans, (3) range improvement costs, and (4) the cost due to last animal unit month output.

Current Forest plans provide overall direction for the range management programs but are not funded at levels allowing full implementation. To account for this, the difference between the current level of funding and thst needed to achieve specified Forest plan levels was incorporated. In addition the plans are too general to carry out range management for CHD, thus the NFS must develop allotment management plans within 4 years to meet the timeframe committed to at the salmon summit conference. The total estimated cast of updating the affected allotment management plans in accordance with NEPA specifications therefore was included (see appendix 2. table 4). The original collected range data appear in appendix 2, table 5, to give readers an idea of how many animal

[9] Worst case estimates are conservative as they include only placer mine losses.

unit months and allotment management plans in anadromous fish-related drainages there are and how many of the plans need updating. Because these plans would have to be completed regardless of CHD, it is the difference between completing the plans in 4 years as compared to 10 that is the true cost of CHD to the Forest Service. For consistency with other range costs, the total cost to speed the allotment management planning process was annualized and used on a per-animal-unit-month basis (see appendix 2, table 4). The other costs include increased range improvements and an estimate of the animal unit months that would be lost as a result of CHD (see appendix 2, table 3). Range improvements might include remedial fencing, water structures, and so forth not included in Forest plans. It was estimated that a 25-percent reduction in anadromous fish-related animal unit months would occur.[10] To assess this loss, a weighted-average fair market rental value taken from the 1990 RPA was used (USDA Forest Service 1990). The final case looks at the opportunity cost if all animal unit months allocated to anadromous drainages in the Forests were lost; a weighted-average RPA fair market rental value per animal unit month for Forest Service Regions 1, 4, and 6 was used (see appendix 2, table 9).

It should be noted that the estimated fair market rental value is considerably more than the actual fee charged by the NFS ($1.97 per animal unit month) for grazing on National Forest land. This fee is set by Presidential Executive order, not by the NFS. The fair market rental value reflects costs to the Federal Government but not to private parties who use NFS lands for grazing. When coupled with administrative costs, the fair market rental value is a reasonable estimate of net direct costs for range,

Appendix 2, tables 6 and 7, show the present value results over the decade by total for each region and type of cost at 4 and 9 percent, respectively. Region-supplied estimates show that the cost of achieving Forest plan implementation level, speeding up the allotment management planning process, making additional range improvements, and losing 61,675 animal unit months will be $19.3 million Over the next decade (at 4 percent interest). In the worst case, if all animal unit months in drainages considered anadromous are lost (246,700) for the next decade, the cost would be $10.3 million (at 4 percent). Figures for interest at 9 percent can be seen in appendix 2, tables 6 and 7.

This analysis does not show any of the cost impacts that will be borne by private individuals or companies as a result of the salmon listing. Increased costs surrounding mitigation to meet habitat requirements could include more range riders, fencing, maintenance, and other range-associated costs, some of which may be borne by the Forest Service.

Recreation

Three recreation cases were considered. The forests each supplied their estimated loss in recreational visitor days for anadromous fish (see appendix3, table 13). Two Forests, the Sawtooth and Umatilla, foresaw unmitigable recreational losses. Consumer surplus netted from the RPA recreational prices for nonmotorized and motorized boating and coldwater fishing were used to estimate the net direct economic costs for each activity lost. To these losse were added increased law enforcement and educational costs as described earlier for all Forests. We based this on the estimates provided by the Payette National Forest. The assumption here was that each Forest would need on

[10] Personal communication. 1992. Ray Hall, director, Range and Watershed Management, Intermountain Region, 324-25th Street, Ogden, UT 84401.

average, 2.5 person years per year at the GS-9 level for increased law enforcement, as well as $7,000 for education (1992 dollars). The same analysis was run with the Idaho Department of Fish and Game recreational use data for the Sawtooth National Forest as described earlier (see appendix 3, table 14). The final case looks at the opportunity cost if all Forests' recreation relating to anadromous fish is lost; an average RPA coldwater fishing value for Forest Service Regions 1, 4, and 6 was used (see appendix 3, table 15).

Appendix 3, table 14, gives a summary of results for the two NFS recreation analyses. Given Forest-supplied estimates, the recreation costs, including 41,400 total lost activity days (13,800 recreational visitor days) and additional law enforcement and education, will be $15.2 million over the next decade (at 4 percent interest). The Idaho Department of Fish and Game data (see appendix 3, table 13), which includes the assumption that all sockeye salmon-related recreation on the Sawtooth National Forest would be lost, uses coldwater fishing consumer surplus values and leads to a cost of $19.1 million (at 4 percent) and 46,130 total activity days lost. In the worst case scenario, if all recreation related to anadromous fish (2.1 million recreational visitor days) is lost for the next decade, it would cost $2 billion (at 4 percent). Figures for interest at 9 percent can be seen in appendix 3, table 14.

Timber

Market impacts of changes in the National Forest timber sale program were estimated by using the timber assessment market model, or TAMM.[11] All assumptions in the analysis reflect current Forest Service plans and views of macroeconomic activity, supply behavior on private timberlands, and demand behavior in both product and factor markets. The data from table 16 (appendix 4) suggest that in a worst case scenario the National Forest harvest levels would fall by nearly 300 million board feet per year. In TAMM, we assumed that this impact would be spread across two different traditional timber regions: the east side of the Pacific Northwest and the Rocky Mountains. The reductions in National Forest harvest flows are shown below:

[11] TAMM is described in Adams and Haynes (1980) and Haynes and Adams (1985). In general, projections from TAMM reflect an economic context where supply and demand are balanced. The projections used here reflect harvest levels adjusted for both the Interagency Scientific Committee report (ISC 1990) and the injunction issued by Judge Dwyer in May 1991.

Region and year	Total harvest	Change in total harvest	Reduction in NFS harvest	Stumpage price
	- - - - - - - - - - - -	*MMBF*	- - - - - - - - - - - - - -	*1990 dollars per MBF*
Pacific Northwest east side:				
1992	2,167	1,705	112	329.28
1993	2,284	1,903	112	270.90
1994	2,252	1,899	112	251.77
1995	2,311	1,933	112	268.57
1996	2,308	1,956	112	250.17
1997	2,289	1,957	112	236.37
1998	2,277	1,962	112	224.33
1999	2,237	1,928	112	219.67
2000	2,209	1,922	112	203.99
2001	2,324	1,971	112	251.46
Rocky Mountains:				
1992	3,713	3,614	189	72.85
1993	3,783	3,663	189	88.54
1994	3,824	3,696	189	94.28
1995	3,974	3,789	189	137.05
1996	3,998	3,828	189	125.16
1997	4,024	3,841	189	134.75
1998	4,043	3,858	193	136.25
1999	4,034	3,834	193	147.79
2000	4,050	3,860	193	139.87
2001	4,277	3,979	193	219.33

We assumed that price arbitrage takes place in these two regions and that prices would converge across the various Forests in each timber region. This is not the same as saying that prices are the same everywhere, because species, quality, and other differences lead to local price differences.

If Forest plans are fully implemented and additional mitigation activities identified by each National Forest are carried out, then the loss drops to 18.36 million board feet. Mitigation generally includes changes in sale and road design and location. Because the timber program is fully funded to Forest plan levels, when the allowable sale quantity is reduced, cost savings occurs. Based on Payette National Forest data, this was assumed to occur at $147 thousand per million board feet. This savings offsets some of the costs of mitigation.

Appendix 4, table 17, gives a summary of results for the two cases: worst and mitigated. Without any mitigation, and assuming that no timber program exists in anadromous fish-related areas, the net loss is $481 million Over the decade (at 4 percent). With mitigation and cost savings, the net loss drops to $1.8 million. Included in this latter figure are additional monitoring costs of $1500 per million board feet (based on estimates provided by the Payette National Forest) for mitigation of harvest impacts Over and above current Forest plan levels. Figures for interest at 9 percent can be seen in appendix 4, table 17.

Minerals

Mineral activities taking place on Federal lands potentidly affected by CHD include hard rock mining, placer mining, the possible development of existing claims, and staking of new claims. The NFS role in managing mineral activities on Federal lands is primarily through its permit authority over access to mine sites. Mineral claims are for the most part privately owned. Although numerous claims exist on Federal lands, many are of insufficient value to develop in the future. If a claimant declared an intention to develop a mineral claim, the NFS might be placed in a position of denying a permit based on its responsibility to protect critical habitat. This is difficutt to predict and not accounted for in this analysis. The most direct impact of mineral activlty on the National Forest lands that could affect salmon critical habitat is from placer mining. Net direct economic impacts can be considered the loss of production of minerals from these mines. Even though these impacts are largely borne by private permittees, a potential halt in placer mining activity can be estimated.

The variability of the mineral resource and lack of easily obtained information made it the least well defined of the resource methodologies. Even so, the Forests were able to obtain production data for estimating the cost of lost placer mining associated with CHD (see appendix 5, table 18). The RPA price for the right to extract minerals per troy ounce of gold was used (USDA Forest Service 1990). The mitigation costs included an increase in biological evaluations, coordination, monitoring, and compliance efforts and have been estimated by summing current Forest mineral program funding levels.'2

Appendix 5, table 19, gives a summary of results for the mineral analysis. The Forest-supplied estimates show a cost of around $87.3 million over the next decade (at 4 percent interest). In the worst case scenario, the shut down of all mining in anadromous drainages for the next decade was not determinable; however, the lost placer mining can serve as a conservative estimate, at $72.8 million (at 4 percent). Figures for interest at 9 percent can be seen in appendix 5, table 19.

This analysis does not show any of the cost impacts that will be borne by private individuals or companies as a result of the salmon listing. Increased costs surrounding mitigation to meet habitat requirements could include possible increases in structures, labor, and operational costs of the mines. For situations where mitigation is not attainable, buyouts may occur. If mine buyouts occur, Forest Service costs could differ tremendously.

Implications for Forest Service Programs

Atthough ramifications of the results are not required by NMFS or the Economic Technical Committee, it is useful to summarize some implications for Forest Service programs. One implication independent of resource area is the extent to which the Forest Service in its planning process anticipates a number of mitigation activities in the Forest plans. One disadvantage is that this hides the true mitigation cost and may shift much of those costs to the Forest Service. There also is concern that the Regions and Forests have neither funding nor staff to fully implement these plans, thereby complicating measurement of mitigation costs.

Local, regional, and national significance—The scales of these impacts differ depending on the geographic scale they are viewed from. In communities dependent on these National Forests, where the bulk of job losses will occur, economic impacts will be

[12] Personal communication. 1992. Lynn Sprague, director, Minerals and Geology Management, USDA Forest Senrice, Auditors Building, 201 14th Street, S.W., Washington, DC 20250

perceived as enormous. At the regional levels, other than stumpage prices or the lack of access to popular recreational areas, the impacts are less noticeable. At the National level, these impacts have a small impact on lumber prices (less than 1 percent in the near term). The economic impacts of listing the Columbia and Snake River salmon are focused almost entirely on the Forests and dependent communities that are directly affected.

Range—The small losses and the relatively large mitigation costs associated with reductions in the range program will again bring into question the efficiency of the Forest Service range program.

Employment impacts associated with the 246.7 thousand anadromous fish-related animal unit months lost through the worst case scenario amount to 74 jobs across all Forests.[13] These job losses are mostly ranchers. With mitigation, only 25 percent of these animal unit months will be lost (see footnote 9), reducing the loss to 61,675 animal unit months and 19 jobs per year.

Income impacts from the lost animal unit months in the worst case amount to $740,100, while the mitigated case shows reduced impacts of $185,025.

Recreation–Loss of recreation is minor, other than in the Sawtooth National Forest, and is not a pertinent cost. Increased administrative costs will be the relevant and major cost resulting from the salmon listing.

Employment impacts associated with the loss of all anadromous fish-related recreational visitor days under the worst case scenario amount to 4,383 jobs lost across all Forests. With mitigation, only 13,800 recreational visitor days will be lost resulting in 29 job losses, most of those in Region 4.

Income impacts from the lost recreational visitor days in the worst case amount to $58.3 million, while the mitigated case shows reduced impaqs of $420,000.

Timber—Dealing with only net direct costs does not answer the most commonly asked question about changes in the Forest Service timber program; that is, "What is the job impact of such changes?" Briefly, for the worst case these direct and indirect job impacts[14] can be summarized as being between 94 and 925 jobs in the Pacific Northwest, east side, and between 205 and 2,046 jobs in the Rocky Mountains, depending on the extent that increases in private harvests affect reduction on public timberland. Some job losses would come in communities with no alternative manufacturing sector and consequently would fundamentally alter those communities. Finally, there is little private timber in these specific areas that could help mitigate the loss in Federal harvest. With mitigation, the allowable sale quantity is reduced by 18.36 million board feet, thereby resulting in 195 job losses per year, mostly in Regions 1 and 4.

Income impacts from lost timber due to CHD amount to $148.2 million in the worst case, while mitigation reduces this to $10 million.

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[13] All range and recreation employment and income impacts are based on the Umatilla National Forest employment and income multipliers. The range multipliers are 0 3 jobs and $0.003 million per thousand animal unit months. The dispersed recreation multipliers are 2.1 jobs and $0 020 million per thousand recreational visitor days.

[14] The various employment and income multiplien were taken from limber Sale Program Information Reporting System data for Regions 4 and 6 and ranged from 9.5 to 11 5 jobs for employment and $433,000 to $569,OOO in income per million board feet harvested.

Another measure of interest is the impact of allowable sale quantity reductions on timber-based revenues. The concern is that timber harvest is an important source of Federal revenue to many counties. Under the worst case scenario, the upward changes in stumpage prices in both regions actually increase Federal revenues, especially in the Rocky Mountains where they are expected to rise an average of $195 million per year during the next decade.

Minerals—Loss of placer mining seems to be the major issue in the minerals case, as gold cardes a high value relative to other minerals and the production is better quantified. Other mining impacts borne by the Forest Service are assumed to be accounted for in the mitigation costs reported; however, most of the cost will be borne by permittees.

Employment and income impacts associated with the loss of all anadromous fish-related mining is not currently known, as muttipliers determining them are not available.

Implications for NMFS

For consistency among reports from the nine sectors experiencing direct economic impacts from CHD, NMFS requested results displayed in annualized values. Tables 1 and 2 reflect annualized values originating from tables in the appendices. Mitigation costs do not reflect any program cost savings, except for timber. Any effort, time, and money saved due to CHD in the range, recreation, and mineral programs is assumed to be reallocated to the remainder of the anadromous drainage (that is, the 75 percent of the animal unit months not lost) and nonanadromous drainages because of traditional underfunding of the programs relative to the work load. This is less the case for timber where, in general, forests are funded to meet Forest plan riparian standards and guidelines. We assumed that reductions in the timber program would result in cost savings of $147 thousand per million board feet (based on data from the Payette National Forest).

Lost values are computed by applying RPA market clearing prices to the quantity of lost resources except for recreation where willingness to pay is used. Consumer surplus measures for range, recreation, and minerals were computed as the area above the market clearing price as described in the RPA (USDA Forest Service 1990). The difference between market clearing price and market clearing price plus consumer surplus (that is, consumer surplus) was applied to the quantity of lost resources. We chose to estimate consumer surplus for timber markets as the sum of changes in all regional stumpage markets for changes in Forest Service harvest in the Rocky Mountains.

Due to project time and data constraints, to obtaining consistency among resources, and in keeping with economic analysis (not an engineering cost stance), appraisals of replacement costs were not analyzed. Costs to private individuals because of the reductions in the NFS programs also were not considered.

Conclusions

If the Forest Service implements its Forest plans, than the impact of CHD is minor except for the range and mineral programs. For range, the issue is both a lack of funding to implement the plans and the need for mitigation measures. For minerals, there is no way to mitigate placer mining for no reduction in salmon habitat. Other mining activities can be mitigated, and Forest mineral program budgets will need additional funding to monitor and assure compliance.

From an economic perspective, this analysis shows that the benefits of protecting critical habitat outweigh the costs for recreation and most likely minerals. The case is less clear for timber, and in the case of range, the costs of mitigation apparently outweigh the benefits of the program.

Table 1—NMFS annualized costs at 4 percent

Resource	Mitigation costs	Cost savings	Lost value	Total	Consumer surplus
	- - - - - - - - - - - - - - - - - -		*Thousand dollars*	- - - - - - - - - - - - - - - - - -	
Range	2,065	0	317	2,382	161
Recreation:					
NFS	1,122	0	*756*	1,878	756
Idaho Department of Fish and Game	1,122	0	1,227	2,349	1,227
Timber	973	-3,191	2,440	222	47,800
Minerals	1,787	0	8,974	10,761	8,973

Table +NMFS annualized costs at 9 percent

Resource	Mitigation costs	Cost savings	Lost value	Total	Consumer surplus
	- - - - - - - - - - - - - - - - - -		*Thousand dollars*	- - - - - - - - - - - - - - - - - -	
Range	2,123	0	315	2,438	160
Recreation:					
NFS	1,120	0	754	1,874	754
Idaho Department *of* Fish and Game	1,120	0	1,225	2,345	1,225
Timber	955	-3,129	2,393	219	35,900
Minerais	1,766	0	8,869	10,635	8,868

Acknowledgments

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SNAKE RIVER SALMON HABITAT

ALTERNATIVE OPTIONS AND ASSUMPTIONS

FOR

ECONOMIC ANALYSIS

BASE ALTERNATIVE

Forest Plan implementation with full mitigation (no reduction in habitat in any specific area from the date of Forest Plan implementation.) The Forests will analyze two options and provide data tables for each.

Option A o Least cost (to Government) deviation from Forest Plan implementation to meet the objective of no reduction in habitat.

Option BL'o Least cost (to Government) for total mitigation of salmon habitat. Output level for other than fish resources held at Forest Plan levels.

ASSUMPTIONS:

- o Forest will analyze salmon habitat for Forest watersheds as defined in Forest Plan. Identify those drainages which Forest Plans specified reduction in habitat capability.
- o All salmon bearing Forest watersheds below Hells Canyon Dam in the Snake River Drainage will be considered in this analysis, Excludes Forest watershed which historically did not have documentation of pro?osed or listed salmon.
- o Meet Forest Plan Riparian Standards & Guidelines and Columbia River Basin Anadromous Fish Policy and Implementation Guide.
- o Best Management Practices (ie,, Forest Plans) will provide adequate protection for non-salmon bearing Forest watersheds.
- o Investments to restore or improve habitat capability will not be considered at this time.

L' For timber resource only.

FOREST: _____

SNAKE RIVER BASIN SALMON HABITAT AND THE EFFECTS ON FOREST PLAN IMPLEMENTATION

OPTION A

FOREST WATERSHED	TIMBER: TOTAL ASQ (MMBF)	TIMBER: ANAD. ASQ (MMBF)	TIMBER: MITIGATED ASQ (MMBF) 1/	TIMBER: MITIGATION COST (M$) 1992 $	TIMBER: SPECIES MIX-BY VOLUME	RANGE: TOTAL AUM'S (MAUM)	RANGE: ANAD. AUM'S (MAUM)	RANGE: ANAD. ALLOTMENTS (#)	RANGE: ANAD. ALLOT. NEEDING UPDATE 2/	RANGE: AMP UPDATE COST (M$) 1992 $
	DECADAL TOTAL									
TOTAL										

ASSUME:
- o ASQ is calculated as an average beginning in 1992. (Annual ASQ for the first 10 years of Forest Plan)
- o AUM's = Permitted not actual use.

1/ To meet objectives of Base Alternative and associated assumptions (See Option A page 1).

2/ Allotment management plans needing update to meet Forest Plan Standards and Guidelines.

3/ During migration period there may be a need to do area or river closure to prevent harassment from boating activities.

FOREST: _____

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SNAKE RIVER BASIN SALMON HABITAT AND THE EFFECTS ON FOREST PLAN IMPLEMENTATION

OPTION A

FOREST WATERSHED	RECREATION: TOTAL RVD'S	RECREATION: ANAD. RVD'S	RECREATION: LOST RVD'S 1/ 2/	RECREATION: VALUE RVD'S LOST 3/ 1992 (M$)	MINERALS: # OF EXISTING CLAIMS EFFECTING ANADROMOUS FISH HABITAT	MINERALS: COMMODITY	MINERALS: ESTIMATED DEPOSIT #/TONS
	----------DECADAL TOTAL----------						
TOTAL							

ASSUME:

1/ To meet objectives of Base Alternative and associated assumptions (See Option A page 1).

2/ During migration period there may be a need to do area or river closure to prevent harassment from boating activities.

3/ Use 1990 RPA values

FOREST: _____

SNAKE RIVER BASIN SALMON HABITAT AND THE EFFECTS ON FOREST PLAN IMPLEMENTATION

OPTION B

TIMBER

FOREST WATERSHED	TOTAL ASQ (MMBF)	ANAD. ASQ (MMBF)	REDUCTION IN ASQ (MMBF) 1/	MITIGATION COST (M$) 1992 $	SPECIES MIX-BY VOLUME
	----------DECADAL TOTAL----------				
TOTAL					

ASSUME:
- o ASQ is calculated as an average beginning in 1992. (Annual ASQ for the first 10 years of Forest Plan)
- o AUM's = Permitted not actual use.

1/ To meet objectives of Base Alternative and associated assumptions (See Option B page 1).

Appendix 2

Range Data

Table 3—National Forest regional range cost data for Northern, Intermountain, and Pacific Northwest Regions

Item	Cost per animal unit month			
	Northern Region	Intermountain Region	Pacific Northwest Region	Total
	1990 dollars[a]			
Mitigation to Forest plan level[b]	3.04	2.53	2.91	
Cost to speed AMP updates:[c]				
At 4 percent	.31	.37	.23	
At 9 percent	.60	.71	.45	
Range improvement[d]	6.03	2.66	6.03	
Lost AUMs[e]	1.58	1.16	1.22	
Total:				
At 4 percent	10.96	6.81	10.40	
At 9 percent	11.23	7.23	10.61	
	AUMs per year[f]			
AUMs	29,300	73,500	143,900	246,700

[a] Conversion to 1990 dollars from 1992 dollars = 0.93013.

[b] Difference between full Forest plan implementation funding needed and the current funding level.

[c] AMP (allotment management plan) acceleration cost is the difference of doing the plans in 4 years versus 10 years (see table 4).

[d] Mitigation needed to meet policy implementation guidelines on the remaining anadromous range (not lost to critical habitat designation).

[e] Estimated AUM (animal unit month) loss of 25 percent of anadromous AUMs valued in 1990 RPA fair market rental values (1990 dollars): Northern = 6.33, Intermountain = 4.62, Pacific Northwest = 4.89. Assumes that any cost savings that might otherwise be realized from lost AUMs is reallocated to remaining allotments on each Forest, as the program is underfunded and understaffed.

[f] AUMs per year = number of animal unit months in anadromous fish-related drainages per year.

Table 4—Allotment management plan cost data and analysis showing 4 and 10 years[a]

Item	Northern Region	Intermountain Region	Pacific Northwest Region
	1990 dollars		
Total needed to complete AMPs:[b]	1,078,951	3,241,503	3,980,305
Dollars per year for 4 years	269,738	810,376	995,076
Dollars per year for 10 years	107,895	324,150	398,031
Present value at 4 percent:[c]			
Cost for 4 years	993,124	2,983,654	3,663,688
Cost for 10 years	901,861	2,709,469	3,327,011
Total cost to speed AMPs	91,264	274,185	336,677
Annualized cost/AUM[d]	.31	.37	.23
Present value at 9 percent:[c]			
Cost for 4 years	885,508	2,660,342	3,266,686
Cost for 10 years	711,102	2,136,372	2,623,294
Total cost to speed AMPs	174,406	523,970	643,393
Annualized cost/AUM[d]	.60	.71	.45

[a] Time value of money is used as a proxy for the cost of acceleration of allotment management plans to accomodate critical habitat designation.

[b] AMP = allotment management plan.

[c] The RPA range value includes a 0.6 percent real price appreciation rate (net of inflation). Included in the analysis to account for increasing scarcity by subtracting it from the interest rate.

[d] AUM = animal unit month.

Table 5—National Forest range analysis in Northern, Intermountain, and Pacific Northwest Regions[a]

Forest and drainage	Forest number	Total AUMs	Anad.[b] AUMs	Anad. allotment	AMP[c] updates
		Thousands (annual)		*- - Total number - -*	
Wallowa-Whitman:	616	186.0			
Grande Ronde		--	61.5	40	34
Imnaha		--	51.4	29	28
Snake		--	27.4	5	5
Nez Perce	117	41.0	29.2	29	23
Challis:	406				
Upper Salmon		23.1	19.6	10	9
Middle Fork Salmon		3.2	3.2	2	2
Pahsim		7.0	7.0	9	9
Boise:	402				
Bear Valley		4.1	4.1	1	1
Elk Creek		3.1	3.1	2	2
L. Johnson		.1	.1	1	1
Landmark		2.3	2.3	1	1
Sawtooth	414	16.4	1.8	--	--
Umatilla:	614				
Tucannon		1.8	1.4	1	1
Asotin		2.6	1.8	1	0
Wenaha		.4	.4	1	1
Payette	412	102.0	16.1	10	9
Salmon:	413				
North Fork		1.5	1.5	4	4
Lemhi		3.5	3.5	5	5
Panther Creek		4.1	4.1	3	3
Middle Fork		.9	.9	2	2
Salmon River		6.2	6.2	9	9
Clearwater	105	.1	.1	--	--
Total			246.7	165	149

-- = no data.

[a] Decimal places do not imply accuracy, only conversion from originally decadal data.

[b] Anad. AUM = animal unit months in anadromous fish-related drainages.

[c] AMP = allotment management plans, which actually must be completed in the first 4 years of the decade.

Table 6—National Forest range analysis results (at 4 percent)

Item	Present value over 10 years[a]			
	Northern Region	Intermountain Region	Pacific Northwest Region	Total
	1990 dollars			
Mitigation to forest plan	744,898	1,554,310	3,501,762	5,800,790
Cost to speed AMP updates[b]	76,285	229,182	281,417	586,884
Range improvements	1,476,128	1,634,311	7,249,654	10,360,093
Lost AUMs[c]	387,569	709,589	1,470,441	2,567,599
Total	2,684,880	4,127,393	12,503,273	19,315,547

[a] The RPA range includes a 0.6 percent real price appreciation (net of inflation). Included in analysis to account for increasing scarcity by subtracting it from the interest rate.

[b] AMP = allotment management plan.

[c] AUM = animal unit month.

Table 7—National Forest range analysis results (at 9 percent)

Item	Present value over 10 years[a]			
	Northern Region	Intermountain Region	Pacific Northwest Region	Total
	1990 dollars			
Mitigation to forest plan	587,340	1,225,548	2,761,082	4,573,970
Cost to speed AMP updates[b]	114,945	345,332	424,040	884,317
Range improvements	1,163,903	1,288,628	5,716,234	8,168,764
Lost AUMs[c]	305,592	559,500	1,159,418	2,024,510
Total	2,171,780	3,419,008	10,060,774	17,651,562

[a] The RPA range includes a 0.6 percent real price appreciation (net of inflation). Included in analysis to account for increasing scarcity by subtracting it from the interest rate.

[b] AMP = allotment management plan.

[c] AUM = animal unit month.

Table 8—National Marine Fisheries Service annualized values[a]

Present value	1990 dollars
At 4 percent	2,381,432
At 9 percent	2,438,828

[a] Annualization factors of 0.1232909443 and 0.1558200899 are used for 4 and 9 percent, respectively.

Table 9—Range worst case analysis

		Present value over 10 years[a]	
Item	Total cost/year	4 percent	9 percent
		1990 dollars	
Opportunity cost foregone[b]	1,235,914	10,330,614	8,145,520
Annualized cost[c]		1,273,671	1,269,236

[a] The RPA range value includes a 0.6 percent real price appreciation (net of inflation). Included in analysis to account for increasing scarcity by subtracting it from the interest rate.

[b] All animal unit months (AUMs) in anadromous fish-related drainages lost. Calculated as 246,700 AUMs lost per year for 10 years at 5.01 each (weighted average fair market rental value per anadromous AUM [1990 dollars net of consumer surplus for National Forest Northern, Intermountain, and Pacific Northwest Regions]).

[c] Annualization factors of 0.1232909433 and 0.1558200899 are used for 4 and 9 percent, respectively.

Appendix 3

Recreation Data

Table 10—Average Resource Planning Act activity day values for net consumer surplus for Northern, Intermountain, and Pacific Northwest Regions[a]

Recreation categories	MCP[b]	WTP[c]	CS[d]	CS[e]
	1989 dollars			*1990 dollars*
Nonmotorized boating	0	6.00	6	7.34
Mechanized boating	0	3.00	3	4.29
Coldwater fishing	0	40.00	40	39.39

[a] Not weighted by anadromous recreation per region as activity type not given for total anadromous activity days; activity types given only for activity days lost as shown below.

[b] MCP = market clearing price.

[c] WTP = willingness to pay.

[d] CS = consumer surplus (USDA Forest Service 1990).

[e] Values adjusted to 4 hours of effort per day. Nonmotorized boating 1.18, mechanized boating 1.38, and coldwater fishing 0.95. Conversion from 1989 to 1990 = 1.03654.

Table 11—Recreation categories breakdown by affected forest[a]

Forest and fish affected	Motor boating	Nonmotorized	Fishing[b]
	Percent		
Sawtooth:			
Sockeye:			
All scenarios except	50	50	20
Redfish Lake	75	25	30
Sawtooth:			
Chinook	0	100	0
Umatilla:			
Chinook	0	50	50

[a] Used to apply consumer surplus values by activity type to lost activity days in the National Forest analysis (table 6). Table 7 uses the Idaho Department of Fish and Game data and 100 percent coldwater fishing for the Sawtooth sockeye scenario.

[b] Of the motor boating for sockeye, 40 percent is also coldwater fishing.

Table 12—Idaho Department of Fish and Game effort per activity day for Sawtooth National Forest scenarios

Area	Effort per year	
	Hours	*Days*[a]
Redfish Lake	12,500	3,125
Redfish Creek	0	0
Alturas Lake	10,100	2,525
Stanley Lake	10,100	2,525
Stanley Creek	0	0
Pettit Lake	0	0
Salmon River:		
Hell Roaring Creek, Torries Landing	32,700	8,175

[a] Idaho Department of Fish and Game effort hours converted to fishing effort days at 4 hours of effort per day.

Table 13—National Forest recreation analysis for Northern, Intermountain, and Pacific Northwest Regions, annual data in thousands[a]

Forest and drainage	Forest number	Total RVDs[b]	Anadromous RVDs	Lost RVDs	Activity days lost[c]	Value of activity days lost[d]
						Thousand
		Thousands				*1990 dollars*
Wallowa-Whitman	616	1,240.00	744.00	--	--	--
Nez Perce	117	73.72	57.19	0	0	0
Challis:	406					
Upper Salmon		100.00	15.00	0	0	0
Middle Fork Salmon		252.20	85.80	0	0	0
Pahsim		162.30	27 30	0	0	0
Boise	402	--	--	--	--	--
Sawtooth (sockeye salmon):[e]	414					
Redfish Lake		224.00	224.00	1.50	4.50	75 91
All morainal lakes		361.00	361.00	3.90	11.70	174.50
Redfish Lake and Creek, and Salmon River		245.00	245.00	1.80	5.40	88.24
All morainal lakes, Stanley Lake and Creek, Alturas Lake and Creek, Valley Creek, and Salmon River		382.00	382.00	4.20	12.60	186.82
Sawtooth (chinook salmon):						
Upper Salmon River		245.00	245.00	2.40	7.20	52.84
Umatilla:	614					
Tucannon		281.00	70.00	7.20	21.60	504.65
Asotin		27.00	4 00	0	0	0
Wenaha		42.00	30.00	0	0	0
Payette	412	800.00	320.00	--	--	0
Salmon	413	526.10	66.30	0	0	0
Clearwater	105	100.83	40.33	--	--	--
Total			2,086.92	13.80	41.40	744.31
Increased National Forest law enforcement and education costs[f]						1,105 02
Total cost						1,849.33

-- = no data.

[a] Decimal places do not imply accuracy.

[b] RVD = recreational visitor day.

[c] Activity days (AD) are based on 4 hours of effort per day.

[d] Using 1990 consumer surplus price (RPA 1990).

[e] Of the 4 Sawtooth sockeye salmon scenarios, only data from the last scenario are included in the total figures because it encompasses all prior scenarios.

[f] Based on an adjusted Payette National Forest cost of increased law enforcement and education of 2.5 person years for law enforcement and $7,000 for education per Forest per year on average. Assumes that any cost savings due to lost recreation is reallocated to the remaining recreation program on each Forest, as the program is underfunded and understaffed.

Table 14—National Forest recreation analysis for Northern, Intermountain, and Pacific Northwest Regions using Idaho Department of Fish and Game and Sawtooth National Forest data, annual data in thousands[a]

Forest and drainage	Forest number	Total RVDs[b]	Anadromous RVDs	Lost RVDs	Activity days lost[c]	Fishing activity days lost[c]	Value of activity days lost[d]
							Thousand 1990 dollars
		Thousands					
Wallowa-Whitman	616	1,240.00	744.00	--	--	--	--
Nez Perce	117	73.72	57.19	0	0	--	0
Challis:	406						
Upper Salmon		100.00	15.00	0	0	--	0
Middle Fork Salmon		252.20	85.80	0	0	--	0
Pahsim		162.30	27.30	0	0	--	0
Boise	402	--	--	--	--	--	--
Sawtooth (sockeye salmon):[e]	414						
Redfish Lake		224.00	224.00	1.50	4.50	3.13	123.09
All morainal lakes		361.00	361.00	3.90	11.70	8.18	322.00
Redfish Lake and Creek, and Salmon River		245.00	245.00	1.80	5.40	11.30	445.89
All morainal lakes, Stanley Lake and Creek, Alturas Lake and Creek, Valley Creek, and Salmon River		382.00	382.00	4.20	12.60	16.35	644.00
Sawtooth (chinook salmon):							
Upper Salmon River		245.00	245.00	2.40	7.20	8.18	59.99
Umatilla:	614						
Tucannon		281.00	70.00	7.20	21.60	21.60	504.65
Asotin		27.00	4.00	0	0	--	0
Wenaha		42.00	30.00	0	0	--	0
Payette	412	800.00	320.00	--	--	--	0
Salmon	413	526.10	66.30	0	0	--	0
Clearwater	105	100.83	40.33	--	--	--	--
Total			2,086.92	13.80	41.40	46.13	1,208.64
Increased National Forest law enforcement and education costs[f]							1,105.02
Total cost							2,313.66

-- = no data.

[a] Decimal places do not imply accuracy.

[b] RVD = recreational visitor day.

[c] Activity days (AD) are based on 4 hours of effort per day. The data for fishing activity days lost come from the Idaho Department of Fish and Game (see table 12).

[d] Using 1990 consumer surplus price (RPA 1990).

[e] Of the 4 Sawtooth sockeye salmon scenarios, only data from the last scenario are included in the total figures because it encompasses all prior scenarios.

[f] Based on an adjusted Payette National Forest cost of increased law enforcement and education of 2.5 person years for law enforcement and $7,000 for education per Forest per year on average. Assumes that any cost savings due to lost recreation is reallocated to the remaining recreation program on each Forest, as the program is underfunded and understaffed.

Table 15—Recreation analysis summary

Cost analysis summary	Cost per year	Time	Present value of annuity[a] 4 percent	9 percent
	Thousand 1990 dollars	*Years*	*Thousand 1990 dollars*	
National Forest system:				
Activity day loss costs[b]	744	10	6,128	4,841
Law and education costs	1,105	10	9,098	7,186
Total	1,849		15,226	12,027
Annualized[c]			1,877	1,874
Idaho Department of Fish and Game:				
Activity day loss costs[d]	1,209	10	9,951	7,860
Law and education costs	1,105	10	9,098	7,186
Total	2,314		19,049	15,046
Annualized[c]			2,349	2,345
Opportunity cost foregone[e]	246,603	10	2,030,378	1,603,726
Annualized[c]			250,327	249,893

[a] RPA recreation value includes a 0.3 percent real price appreciation rate (net of inflation). Included in analysis to account for increasing scarcity by subtracting it from the interest rate.

[b] Activity day (AD) = 4 hours of mixed boating and fishing effort per day.

[c] Annualization factors of 0.1232909443 and 0.1558200899 are used at 4 and 9 percent, respectively.

[d] Activity day (AD) = 4 hours of coldwater fishing effort per day.

[e] Worst case scenario where all recreation in anadromous fish related drainages is considered to be coldwater fishing and completely lost (2086.92 thousand recreation visitor days converted to 6260.8 thousand activity days by using a 4-hour activity day basis). The RPA coldwater fishing definition includes anadromous fishing (USDA Forest Service 1990). A weighted average willingness to pay value per activity day by region in 1990 dollars is used for the Northern, Intermountain, and Pacific Northwest Regions.

Appendix 4

Timber Data

Table 16—National Forest timber analysis for Northern, Intermountain, and Pacific Northwest Regions, annual data

	Forest number	Total ASQ[a]	Anadromous ASQ	Reduction in ASQ[b]	Lost ASQ[c]	Mitigated ASQ[d]	Mitigation cost[e]
							Thousand
		Million board feet					*1992 dollars*
Wallowa-Whitman:	616						
All drainages except		138.90	81.00	0	0	0	0
Lostine River Deer Creek tributaries		2.10	2.10	.50	0	.50	90.00
Nez Perce	117	108.00	108.00	12.53	12.53	0	0
Challis:	406						
Upper Salmon		15.00	11.00	6.00	2.00	4.00	0
Middle Fork		4.00	4.00	4.00	2.00	2.00	20.00
Pahsim		2.00	0	0	0	0	0
Boise:	402	115.90					
Bear Valley		--	.60	.60	0	.60	3.00
Elk Creek		--	.90	.90	0	.90	22.10
L. Johnson		--	0	0	0	0	0
Warm Lake		--	.80	.80	0	.80	2.20
Landmark		--	0	0	0	0	0
Sawtooth	414	10.50	1.50	0	0	0	0
Umatilla:	614	120.00	14.00	.20	0	.20	40.00
Tucannon		--	--	--	--	--	--
Asotin		--	--	--	--	--	--
Wenaha		--	--	--	--	--	--
Payette:	412	81.00					
Hard Creek		--	1.48	1.48	.28	1.20	39.22
Deep Creek		--	.38	.38	.04	.34	7.86
French Creek		--	3.90	3.90	.92	2.98	81.11
Warren Creek		--	3.65	3.65	.59	3.06	94.41
Salmon:	413						
North Fork		3.14	2.51	0	0	0	0
Lemhi		1.81	.54	0	0	0	0
Panther Creek		8.24	2 06	0	0	0	0
Middle Fork		1.46	1.46	0	0	0	0
Salmon River		6.45	4.84	0	0	0	0
Clearwater	105	173.00	50.00	1 00	0	1.00	10 00
Annual Totals		791.50	294.72	35.94	18 36	17.58	410.00

	Thousand 1990 dollars
Annual total[f]	381.00
Additional administration costs[g]	442.00
Cost saving[h]	-2,699.00
Value of timber[i]	2,064.00
Total costs	189.00

-- = no data.

[a] ASQ = allowable (annual) sale quantity
[b] Reduction in ASQ = estimated total reduction in anadromous ASQ due to critical habitat designation.
[c] Lost ASQ = that portion of the reduction in ASQ that cannot be mitigated and is lost.
[d] Mitigated ASQ = that portion of the reduction in ASQ that can be mitigated.
[e] Mitigation cost = the cost to mitigate that portion of the reduction in ASQ that can be mitigated.
[f] Conversion from 1992 to 1990 dollars = 0.93013.
[g] Administrative costs of $1.5 thousand/million board feet based on observed Payette National Forest costs.
[h] Cost savings due to loss of timber based on $147 thousand per million board foot to conduct the sales program. Reductions in ASQ will lead to funding reductions because timber programs generally are funded at Forest plan levels.
[i] Total lost ASQ valued at $112.43 per million board foot, based on the TAMM weighted average all species stumpage-price for all Northern, Rocky Mountain, Southwestern, and Intermountain Forest Service Regions.

Table 17—Timber analysis summary

Cost analysis summary	Cost per year	Time	Present value of annuity[a] 4 percent	9 percent
	Thousand 1990 dollars	*Years*	*Thousand 1990 dollars*	
National Forest Systems costs:				
Cost to mitigate	381	10	3,656	2,837
Administration costs	442	10	4,239	3,289
Cost savings	-2,699	10	-25,881	-20,083
Lost timber value	2,064	10	19,794	15,360
Total	189		1,809	1,404
Annualized[b]			223	219
Opportunity cost foregone[c]	59,274	10	480,765	380,400
Annualized[b]			59,258	59,258

[a] The RPA timber real price appreciation rate is 3.23 percent (net of inflation). Included in the analysis to account for increasing scarcity by subtracting it from the interest rate for the National Forest mitigated case. For the opportunity cost foregone case, TAMM has already accounted for it in the stumpage price used.

[b] Annualization factors of 0.1232909443 and 0.1558200899 are used for 4 and 9 percent, respectively.

[c] All allowable (annual) sale quantity in anadromous fish-related drainages is lost (294.8 million board feet) at $201,000/million board feet (weighted average stumpage price in 1990 dollars from TAMM; does not include consumer surplus and is volume weighted for the Pacific Northwest east side and Rocky Mountains).

Appendix 5

Mineral Data

Table 18—National Forest mineral analysis for Northern, Intermountain, and Pacific Northwest Regions

Forest and drainage	Forest number	Existing anadromous claims	Anadromous placer mine claims[a]	Annual gold production	Cost[b]
				Total troy ounces	*1990 dollars*
Wallowa-Whitman:	616		10	164	17,084
Grande Ronde		330			
Imnaha		0			
Snake		2			
Nez Perce	117	5,460	20	125	13,022
Challis:	406	1,454	32		
Upper Salmon		18			
Middle Fork		0			
Pahsim		0			
Boise:	402	--	10	32,500	3,385,599
L. Johnson		--			
Sawtooth	414	--	0	0	
Umatilla	614	--	0	0	
Payette	412	5,469	10	45,000	4,687,752
Salmon	413	3,949	4	0	
Clearwater	105	910	0	0	
Total			86	77,789	8,103,457[c]
Administrative costs					1,613,776[d]
Total cost					9,717,232

-- = no data.

[a] Many costs of standard compliance are the responsibility of permittees. In cases where mitigation cannot meet standards, buyouts may occur, as with these placer mines. Other mineral mines assumed fully mitigated.

[b] Market clearing price (MCP) of $104 (1990 dollars), for mineral extraction rights only (as in the 1990 RPA), is applied to the lost gold production. Forest Service does not lose actual market value. Consumer surplus not included.

[c] Cost due to lost placer mines.

[d] Administration costs include additional administration and NEPA costs (such as extra biological evaluations, coordination, monitoring and compliance) and is valued at the 1992 minerals budget per Forest totalling $1,735,000. Assumes that any cost savings associated with decreased administration to lost mines is reallocated to remaining mineral program, as program is underfunded and understaffed.

Table 19—Minerals cost summary

Cost item	Cost per year	Time	Present value of annuity[a] 4 percent	9 percent
	Thousand 1990 dollars	*Years*	*- Thousand 1990 dollars -*	
Placer mine loss	8,103,457	10	72,789,989	56,915,289
Administration costs	1,613,776	10	14,495,876	11,334,484
Total	9,717,233		87,285,865	68,249,773
Annualized[b]			10,761,557	10,634,686
Opportunity cost foregone[c]	8,103,457		72,789,989	56,915,289
Annualized[b]			8,974,346	8,868,545

[a] RPA mineral rate includes a 2-percent real price appreciation rate (net of inflation). Included in analysis to account for increasing scarcity by subtracting it from the interest rate.

[b] Annualization factors of 0.1232909443 and 0.1558200899 are used to 4 and 9 percent, respectively.

[c] Where all mines in anadromous drainages would be lost, but due to undeterminable actual mineral loss, a proxy is used; that is, placer mine loss.

*U.S. Government Printing Office: 1994 — 589-269/00016

Haynes, Richard W.; Bolon, Natalie A.; Hormaechea, Daniel T. 1992. The economic impact on the forest sector of critical habitat delineation for salmon in the Columbia and Snake River basin. Gen. Tech. Rep. PNW-GTR-307. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Economic implications of critical habitat designation (CHD) for salmon in the Columbia River basin were estimated in advance of actual designation and recovery plan development. Economic impacts on Pacific Northwest, Intermountain, and Northern Region National Forests' range, recreation, timber, and mineral programs in the Columbia and Snake River basin were analyzed. Two cases were considered: a worst case, where CHD results in a total reduction in the anadromous portions of the various programs, and a mitigated case, where all or part of the loss is mitigated. Results were analyzed over the 10-year Forest planning period under 4- and 9-percent interest rates. The recreation and timber programs showed values greater than costs for CHD mitigation, while the range program did not. The minerals program initially seemed to fall into the same situation as range, but limited information in the analysis for minerals made this judgment subjective.

Keywords: Critical habitat designation, policy analysis, salmon, economic impacts, National Forests.

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