A COMPARISON AND EVALUATION OF EXISTING LAND MANAGEMENT PLANS AFFECTING SPAWNING AND REARING HABITAT OF SNAKE RIVER BASIN SALMON SPECIES LISTED UNDER THE ENDANGERED SPECIES ACT

Technical Report 95-4

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September 1995

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September 1995

Abstract

This report summarizes and evaluates the major provisions of seven land management approaches for their likely effectiveness in protecting and restoring vital attributes of habitat for Snake River Basin salmon species listed as "endangered" under the Endangered Species Act (ESA) by the National Marine Fisheries Service (NMFS). The following plans were selected for comparison and evaluation: a) the South Fork Salmon River "STEP" Plan (Payette National Forest, 1988); the Boise National Forest Land and Resource Management Plan (Boise National Forest, 1990); the Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan (Anderson et al., 1992; 1993); Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USFS and USBLM, 1994); the Interim Protection for Late-Successional Forests, Fisheries, and Watersheds in National Forests East of the Cascade Crest, Oregon and Washington (Henjum et al., 1994); A Coarse Screening Process for Evaluation of the Effect of Management Activities on Salmon Rearing and Spawning Habitat in ESA Consultations (Rhodes et al., 1994); and "PACFISH" – Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (USFS and USBLM, 1995). These plans were selected for evaluation because they: a) are detailed enough to evaluate; b) have been adopted or proffered for implementation; c) are based on comprehensive assessments; and, d) in aggregate, represent a spectrum of approaches to land management and habitat protection.

The plan provisions summarized and evaluated include: riparian protection measures; the use of standards for habitat attributes in adaptive land management; constraints on logging, grazing, mining, roads, and water withdrawal; cumulative effects strategies; management direction for watersheds where aquatic resources are emphasized; roadless area management; monitoring requirements; and restoration direction. Accountability associated with each plan provision was factored into evaluations of long term effectiveness in protecting and restoring channel morphology, substrate, cover, water quantity, and water temperature and the ecological processes and elements that shape these core attributes of salmon habitat.

The major plan provisions were rated individually and these ratings were summed for each plan to provide an overall index of the likely effectiveness of each plan in protecting and restoring habitat in the Snake River Basin. Based on this overall index, the plans are listed as follows in order of rated overall effectiveness: Rhodes et al. (1994); Anderson et al. (1992; 1993); Henjum et al. (1994); USFS and USBLM (1994); Payette National Forest (1988); USFS and USBLM (1995); and Boise National Forest (1990). However, if all watersheds with critical habitat in the Snake River Basin are afforded the protection measures for "Aquatic Diversity Areas" under Henjum et al. (1994), then Henjum et al. (1994) is rated as having the greatest promise of protecting and restoring critical habitat for salmon species listed under the ESA. The four plans given the lowest overall ratings are unlikely to be adequate to result in widespread habitat improvement needed to contribute to stabilizing listed salmon runs in the Snake River Basin; the approach of the Boise National Forest (1990) allows considerable degradation of vital habitat attributes by most activities and is likely to contribute to the species extirpation via habitat degradation.

Acknowledgements

The content of this report was improved by many who provided reviews of the draft and helpful discussions of some of its aspects. The following people deserve credit for their role in improving this report and absolutely none of the blame for any inaccuracies, deficiencies, or excesses that may remain: Rowan Baker (NMFS), David Bayles (Pacific Rivers Council), Dr. Daniel Bottom (Oregon Dept. of Fish and Wildlife), Kelly Burnett (USFS PNW Research Station), Dr. David Burns (Payette National Forest), F. Al Espinosa, Jr. (Fisheries Consultant), Dr. Christopher Frissell (Univ. of Montana), Jeffrey Lockwood (NMFS), Dr. James Karr (Univ. of Wash.), John Kelley (Confederated Tribes and Bands of the Warm Springs Indian Reservation of Oregon), Dr. Dale McCullough (Columbia River Inter-Tribal Fish Commission), Bruce McIntosh (USFS PNW Research Station), and Michael Purser (Confederated Tribes of the Umatilla Indian Reservation) and the helpful staff of the Columbia River Inter-Tribal Fish Commission: Phil Roger, Roberta Stone, and Jim Weber.

This report was funded by BIA/NMFS Inter-Agency Agreement Contract No. 40ABNF3

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List of Abbreviations and Acronyms

ACS: Aquatic Conservation Strategy from USFS and USBLM (1994)
ACSO: Aquatic Conservation Strategy Objectives from USFS and USBLM (1994)
ADA: Aquatic Diversity Area
AMP: Allotment Management Plan
ASQ: Allowable Sale Quantity of timber
BMP: "Best" management practice
BNF: Boise National Forest
CE: Cobble embeddedness
CNF: Clearwater National Forest
CRITFC: Columbia River Inter-Tribal Fish Commission
CSP: Coarse Screening Process (CSP)
CTUIR: Confederated Tribes of the Umatilla Indian Reservation
DFC: Desired future condition
ESA: Endangered Species Act
ESSPR: Eastside Scientific Society Panel Report (Henjum et al., 1994)
FEMAT: Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (USFS et al., 1993)
LS/OG: Late successional/old growth vegetation
LWD: Large woody debris
LRMP: Land and Resource Management Plan for a national forest
NFMA: National Forest Management Act of 1976
NMFS: National Marine Fisheries Service
PNF: Payette National Forest
RHCA: Riparian Habitat Conservation Areas
RMO: Riparian Management Objective
ROD: Record of Decision
S&Gs: Standards and Guidelines
SFSR: South Fork Salmon River
SFSRP: South Fork Salmon River Plan in the PNF LRMP
UGRR: Upper Grande Ronde River
UGRRP: Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan (Anderson et al., 1992; 1993)
USBLM: US Bureau of Land Management
USFS: US Forest Service
WA: Watershed analysis (USFS and USBLM, 1994; 1995)
WWNF: Wallowa-Whitman National Forest

"We trained hard, but it seemed that every time we were beginning to form teams, we would be reorganized. I was to learn later in life that we tend to meet any new situation by reorganizing; and a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency, and demoralization." --Petronius Arbiter, 210 BC

"Life is something that happens to you while you're making plans" --John Lennon

Introduction

Many land management plans have been developed in portions of the Columbia River Basin. These plans were developed at different times by different government and scientific entities with different missions responding to sometimes different issues; hence, the plans differ in emphases, location and scale of geographic focus, and detail. For instance, the USFS Land and Resource Management Plans (LRMPs) were generally designed to provide the maximum amount of commodities (timber, grazing, etc.), and assumed that additional habitat damage would be consistent with meeting the minimum legal mandates of legislation such as the National Forest Management Act (NFMA). In contrast, more recent plans have focused on providing management that is adequate to avoid additional damage and allow restoration of aquatic habitat as part of approaches focusing primarily on aquatic resources (Anderson et al., 1992) or a wider array of forest ecosystem concerns (Henjum et al., 1994).

This report provides summaries, comparisons, and evaluations of selected land management plans with respect to their likely effects on salmon habitat, especially with respect to the adequacy of habitat protection and restoration. The overview of the various plans includes the following: a) purpose; b) geographic focus; c) planning entity(ies); d) primary provisions for protection/restoration of salmon habitat; and e) implementation status.

While summary overviews of other plans are provided, the following plans were selected for comparison and evaluation: a) the South Fork Salmon River "STEP" Plan (Payette National Forest, 1988); the Boise National Forest (BNF) LRMP (BNF, 1990); the Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan (UGRRP) (Anderson et al., 1992; 1993); "Alternative 9" of the Forest Ecosystem Management Assessment Team (USFS et al., 1993) as amended by the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USFS and USBLM, 1994); the Interim Protection for Late-Successional Forests, Fisheries, and Watersheds in National Forests East of the Cascade Crest, Oregon and Washington (Henjum et al., 1994); "PACFISH" -- Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (USFS and USBLM, 1995); and A Coarse Screening Process for Evaluation of the Effect of Management Activities on Salmon Rearing and Spawning Habitat in ESA Consultations (Rhodes et al., 1994). These plans were selected for comparison and evaluation because they met one or more of the following criteria: a) they are somewhat comprehensive and are detailed enough to evaluate; b) they have been implemented or proffered for implementation; c) they are based on comprehensive assessments. While not all of the plans selected met every one of these criteria, these plans were also selected for comparison and evaluation because, in aggregate, they allow comparison and evaluation of effectiveness across a

spectrum of potential approaches to specific issues affecting salmon habitat.

A brief synopsis of current habitat conditions in the Snake River Basin and their effects on salmon populations is provided as a background for comparisons and evaluations of the plans. Primary problems afflicting salmon habitat in the Snake River Basin and their causes are briefly described.

While the selected land-management plans affect a wide array of resources, this report confines itself to the major aspects and attributes relating to aquatic resources. Each of the plans is summarized, compared, and evaluated in terms of elements that available assessments and information indicate are important determinants of the effects of land management on salmon habitat. These elements of land management plans include the following: a) standards and/or guidelines for specific attributes of salmon habitat (e.g., large woody debris, stream shading, etc.) and linked management response; b) riparian area management provisions and constraints; c) constraints and/or standards for logging, grazing, roads, mining, recreation, and water withdrawals; d) cumulative effects strategies including standards or guidelines for watershed-scale driving variables such as sediment delivery; e) "aquatic emphasis" watersheds; f) roadless area management; g) monitoring requirements; and h) approaches to the restoration of degraded habitat. Additionally, clarity and accountability of the various plans are compared with respect to the provisions, as well as their applicability to the management situation in the Snake River Basin.

The evaluations of plan provisions affecting salmon habitat incorporated consideration of the condition of salmon populations and habitats in the Snake River Basin, and the mandates of the Endangered Species Act (ESA) regarding habitat. Salmon species listed under the ESA continue to decline. While habitat degradation is not the only cause of salmon decline, it is a major cause of reduced survival. The ESA mandates that critical habitat not be adversely affected by actions funded, authorized, or carried out by federal agencies. Much of the best remaining habitat in the Snake River Basin is located on federal land, although it is widely degraded. Stabilization of salmon populations in the Snake River Basin not only requires protection of all critical habitat, it will also require widespread and significant improvement in habitat conditions that affect the survival and production of salmon. Land management that merely maintains degraded conditions or degrades them further contributes to the extinction of the listed salmon.

1.0 Brief Overviews of Some Land Management Plans in the Columbia River Basin

In the following overviews of land management plans, some plan provisions are not reproduced verbatim in the interest of brevity. (The primary source documents for these plans are about 10 inches high when stacked). While every attempt was made to retain the thrust of the provisions, abbreviation can alter accuracy. Therefore, the reader is referred to the source documents for complete statements of the plan provisions.

The overviews also necessarily include some degree of interpretation to clarify what the plans actually require. This is not unique to this report. Plans are interpreted in site-specific implementation by resource professionals, in assessments by decision-makers, in legal arguments, and in legal decisions. The author's interpretations are based on years of experience in assessing land management plans and their on-the-ground implementation. Readers can draw their own interpretations of the plans

by reading the source documents.

1.1 The South Fork Salmon River (SFSR) "STEP" Plan (SFSRP) (PNF, 1988)

Purpose: The SFSRP was developed as part of the Land Resource Management Plan (LRMP) for the Payette National Forest (PNF) in Idaho; the provisions of the SFSRP were also developed for management of the SFSR on the Boise National Forest (BNF). (The primary purposes of the USFS LRMPs are described in section 1.2). The SFSRP was developed in response to catastrophic sedimentation of the SFSR in 1964-65, a high level of attention from state, federal, and tribal governments and the general public, and the perceived importance of the SFSR, especially with respect to salmon production. The major purpose of the SFSRP is to improve the overall capability of damaged salmon habitat in the SFSR.

The SFSR was once one of the greatest producers of summer chinook salmon in Idaho. Logging roads and timber harvest caused massive landslides triggered by winter storms in 1964-65. These landslides caused high levels of sedimentation that greatly increased fine sediment levels and reduced pool volumes. These and other changes caused by the landsliding reduced the survival and populations of resident and anadromous fish in the SFSR. A logging and road construction moratorium was initiated in the upper SFSR watershed in 1965, in concert with efforts to reduce sediment inputs into the river. Initial recovery in substrate conditions occurred and was apparently due to the combined effects of the logging moratorium and the closure and treatment of over 500 miles of logging roads to reduce erosion and sediment delivery (D. Burns, Fish. Bio., PNF, pers. comm., 1995). Logging resumed under a new management plan signed in 1977. From 1981 to 1987, annual increases in fine sediment occurred. The SFSR Monitoring Committee, comprised of scientists from several organizations, concluded that fine sediment conditions were unlikely to continue to improve without further reductions in erosion and recommended that no activities should be initiated that had the potential for increasing sediment delivery until monitoring data indicated that recovery had resumed in the SFSR. The moratorium on logging and road construction resumed in 1984 (PNF et al., 1989; Megahan et al., 1992). The draft LRMP for the PNF called for a resumption of logging in the SFSR with concurrent active restoration measures to reduce erosion. The approach came under heavy criticism by state, federal, and tribal water quality and fish management entities, shaping the ultimate nature of the SFSRP.

Geographic focus: The SFSR watershed occupies an area of about 1300 mi^2 in central Idaho and is almost entirely underlain by the Idaho batholith which has highly erosive granitic soils. The SFSRP applies to all land on the BNF and PNF in the watersheds of the SFSR above the confluence of the SFSR with the Secesh River PNF and BNF. The BNF LRMP provisions for the SFSR also tiered largely to the SFSRP of the PNF, with some modifications. The BNF manages the watersheds of Johnson Creek, a tributary to the East SFSR and the southernmost headwaters of the SFSR. About 67% of the watershed is on the PNF with the remaining 33% on the BNF.

Planning Entities: The PNF had the lead role for developing management for the parts of the SFSR watershed. Although the SFSRP was primarily developed by the PNF, some of the approach was developed by a consensus group put together by the PNF to attempt to resolve the conflicts over proposed resource uses in the SFSR. This group was comprised of representatives and staff from

Indian Tribes with treaty-reserved fishing rights, conservation organizations, concerned citizens, the Idaho Dept. of Fish and Game, outfitters and guides, the forest products industry, and local residents.

Primary Provisions: The interim objective of the SFSRP is to provide habitat conditions that are sufficient for "fishable" populations of salmon and trout by 1997 and full restoration of the river's productive capability by the year 2007. Because high levels of sedimentation were consistently identified as a major cause of reduced habitat quality, the SFSRP
is primarily aimed at reducing sediment delivery and limiting activities that increase erosion until interim numeric goals for substrate conditions are met. The standards and guidelines (S&Gs) are as follows: 1) reduce sediment delivery via active restoration, prioritizing the upper sections of the watershed; 2) the "tentative" interpretation of interim objective (habitat sufficient for fishable salmon and trout populations) is: a) photographic evidence of improvement and a change from existing conditions to conditions similar to those in Chamberlain Creek, reaches of the Secesh River or other "appropriate" streams; b) five-year mean cobble embeddedness (CE) <32% with no individual yearly value >37% in all locations where CE was >32% and five-year mean fine sediment by depth <27% with no individual yearly value >29% in areas where fine sediment was >27%, with all other locations exhibiting no increase in sedimentation outside of estimated natural variability; 3) until the criteria for the interim objective are achieved, land-disturbing activities are limited to private property access, mining, actions designed to improve fish habitat (e.g., prescribed fire), research, maintenance of existing facilities, grazing allotments and guide and outfitter operations under permit, small timber sales (houselogs, firewood, utility poles, etc) without road construction or reconstruction, and other timber sales once about 25% of the proposed sediment reduction measures have been implemented and available monitoring data have been considered; 4) implementation of any timber sales prior to achievement of interim objective criteria must be based on the Forest Supervisor's review of monitoring data, and recommendations from forest hydrologists and fish biologists, scientists at the Forest and Range Experiment Station, conservation organizations, timber industry, concerned citizens, and tribal, state, and federal entities; 5) any timber sales are to be phased in with the first ones occurring in the lower SFSR with no road construction or reconstruction; 6) all timber sales or other land-disturbing activities are to be combined with sediment abatement in the affected area that reduces sediment delivery by at least the amount anticipated from the new land disturbance; 7) detailed S&Gs for hazardous material transport and winter access management; 8) a schedule of short- and long-term road management projects including drainage improvement, surfacing, relocation, and closures. Approximately 17 million board feet (MMBF) of timber harvest per decade was scheduled under the LRMP, contingent on achieving documented improvement in the SFSR.

Other salient S&Gs from the LRMP apply, including the following: limit forage utilization of livestock to less than 66%; meet Idaho Forest Practice Rules; make "reasonable" efforts to minimize adverse water quality impacts; limit detrimental soil damage to less than 20% of an activity area; on granitic slopes >60%, yard timber via full suspension for yarding distance >300 ft and retain at least 40% of natural basal area with no logging except "necessary" salvage within 100 ft of streams on such slopes; no scheduled timber harvest in riparian zones along all streams that support fisheries or are perennial; maintain streambank stability at 90% of "natural levels;" prohibit road construction paralleling streams; mitigate >50% of erosion from roads constructed within the SFSR or in riparian zones; and, complete sediment yield analyses in watersheds with significant potential for increased sedimentation from cumulative effects.

Implementation Status: The SFSRP has been in place since adoption of the PNF LRMP in 1988, although many aspects have not been implemented. For instance, many projects aimed at reducing sediment delivery from roads are well behind their scheduled implementation dates in the SFSRP. In 1991, the USEPA developed a total maximum daily load (TMDL) approach to sediment abatement in the SFSR watershed based, primarily, on the SFSRP (IDHW, 1991). To date, the moratorium on large scale timber harvest has remained in place. Although the moratorium on logging and road construction combined with extensive road closures initially allowed the substrate conditions to in some parts of the SFSR to improve during the 1970s, they have not exhibited significant improvement since about 1980. Areas affected by on-going mining have remained degraded while areas subjected to cattle grazing on the BNF (Johnson Creek) have extremely poor habitat conditions that have greatly reduced salmon survival (Rhodes et al., 1994). Nonetheless, the SFSR appears to be the only degraded river within the Idaho batholith to have undergone documented improvement over the past 30 years. The logging scheduled in the SFSRP contingent on substrate improvement has not been implemented and it remains unknown if it can occur without further degrading the river. In the spring of 1995, the BNF and PNF proposed amending the SFSRP to accommodate expedited salvage logging in the SFSR prior to realization of the substrate goals (BNF and PNF, 1995).

1.2 Northwest Power Planning Council Subbasin Plans

Purpose: The primary goal was to develop integrated options and strategies at the subbasin scale that could contribute to doubling salmon and steelhead production in the Columbia River Basin. The subbasin plans were used as the basis for the development of an Integrated System Plan for the entire Columbia River Basin. Additionally, the subbasin plans were aimed at documenting current and potential anadromous fish production, summarizing the fish management goals of the tribes and state agencies co-managing the resource, describing the existing management efforts, and identifying obstacles and opportunities to increase anadromous fish production.

Geographic focus: Subbasin plans were developed for all subbasins within the Columbia River Basin. Scale differed widely among subbasins. The subbasin plan for the Salmon River of Idaho covered issues in a subbasin with an area of more than 14,000 mi^2, while the subbasin plan for the Little White Salmon River, in south central Washington addressed fishery issues within a 134 mi^2 watershed. Within the Snake River Basin, subbasin plans were developed for the Grande Ronde River, Oregon; the Imnaha River, Oregon; the Tucannon River, Washington; the Walla Walla River, Washington; the Salmon River, Idaho; and the Clearwater River, Idaho.

Planning Entities: Planning entities involved varied by subbasin; however, tribal and state fishery co-management entities generally had lead roles in writing the subbasin plans. Technical work teams contributed background information, ideas, and reviews of drafts to the planning process. The technical work teams typically consisted of representatives from federal agencies (e.g. USFS, USEPA), state agencies (e.g. state water resource departments), academia, and/or other interest groups (e.g. environmental groups, power companies). Public advisory committees also contributed feedback on strategies and options for increasing fish production.

Primary Provisions: The subbasin plans evaluated an array of opportunities to increase fish production at the subbasin scale, including supplementation and habitat protection and restoration. All of the subbasin plans generally called for protection and improvement of salmon habitat as part of the rebuilding of salmon populations. While the subbasin plans discussed existing habitat problems in some detail and called for improved land management, they did not contain specific land management provisions for habitat protection because they are broadly programmatic. Due to the lack of specificity, the subbasin plans are not evaluated in this report.

1.3 USFS Land and Resource Management Plans--The Boise National Forest.

Purpose: Development of LRMPs for each national forest was mandated under the National Forest Management Act (NFMA) of 1976. NFMA required that the plans provide guidance for the management of all natural resources for each forest over a 10-15 year period. Under NFMA, the LRMPs were subject to a wide variety of requirements, including, but not limited to, coordination and consideration of plans by other governmental entities, public involvement, management consistent with meeting state water quality standards and maintenance of well-distributed populations of native species, and avoidance of deposits of sediment from logging that adversely affect fish habitat. The LRMPs were also to determine the following: lands suitable for logging, mining, and grazing; which roadless areas would remain so; and, S&Gs for land management activities as part of attempts to make these activities (logging, mining, etc.) compatible with other resources such as wildlife, fish, and water quality. For each forest, the LRMPs also set the "allowable sale quantity" (ASQ), the estimated maximum volume of timber that could be logged without damaging other forest resources such as soils or water quality.

Geographic focus: Each LRMP provided direction for the resources within the individual national forest. However, some of the LRMPs analyzed environmental cumulative effects outside of their boundaries. All national forests in the Columbia River Basin analyzed the effects of regional and multi-forest logging levels on timber supply and related economic conditions. Notably, none of these national forests analyzed multi-forest effects on fisheries and associated regional economic effects. LRMPs have been completed for all of the national forests in the Snake River Basin: the Wallowa-Whitman National Forest in Oregon, the Umatilla National Forest in Washington, and the Clearwater, Boise, Sawtooth, Salmon, Challis, Payette, and Nez Perce National Forests in Idaho. Review of each of the LRMPs within the Snake River Basin is beyond the scope of this report. The Boise National Forest (BNF) LRMP is chosen for evaluation in this report.

The BNF LRMP provides management plans and direction for salmon bearing streams in the upper SFSR drainage, including Johnson Creek. The BNF also manages the watersheds of salmon-bearing tributaries to the Middle Fork Salmon River, including Bear Valley, Elk, Porter, and Sulphur Creeks. Almost all of these anadromous watersheds are underlain by the highly erosive Idaho batholith.

Planning Entities: Generally, planning was done by staff at each national forest. However, some aspects of the LRMPs were done by staff in USFS Regional Offices. For instance, the standards and guidelines for livestock grazing were identical for all LRMPs for national forests in Region 6 (comprising the national forests of Oregon and Washington) and were undoubtedly produced and

mandated by the Regional Office. Likewise, the analysis of environmental effects at the forest level were constrained by direction from the Region 6 Office that mandated that forests could not forecast any reduction in fish habitat quality caused by commodity outputs (timber, grazing, etc.) at the forest scale because Best Management Practices (BMPs) had to be assumed to adequately protect aquatic resources (Anonymous by request, Malheur National Forest, pers. comm., 1990); such assumptions have consistently been erroneous (Espinosa, 1994 in Rhodes et al., 1994). Targets for commodity outputs are sometimes also shaped by government officials outside of the USFS, whether by budget or mandated commodity outputs (Hirt, 1994). Ostensibly, the LRMPs were also shaped by the participation of other state and federal agencies, tribal governments, and the interested public.

Primary Provisions: The provisions for protection of fish habitat come primarily from the S&Gs. However, fish habitat conditions are also affected by assessments of suitability for grazing, logging, or mining, land allocations, decisions on roadless areas, and, more generally and indirectly, scheduled commodity outputs in the LRMPs, because these shape the amount, location, and type of land disturbance and attendant effects. Each LRMP included plans for a program of habitat "improvement" which generally equated to adding large woody debris (LWD) to streams. Although there are some similarities among LRMPs in provisions affecting fish habitat, there are also some differences. Because each LRMP is, at least, slightly different, the Boise National Forest was chosen as an example of the LRMPs for the purposes of comparison and evaluation.

For the SFSR, the BNF tiered the PNF's SFSRP with some modification. Domestic livestock grazing in the SFSR watershed on the BNF is restricted to the Johnson Creek watershed (BNF LRMP, p. IV-95, 1990). The primary provisions of the SFSRP have already been listed above; the following is a description of the BNF LRMP's provisions for watersheds with salmon outside of the SFSR.

The aims, purposes, and strategies of the BNF LRMP are set forth in a confusing array of goals, objectives, desired future conditions, and S&Gs. Generally, only the S&Gs have any aspect of accountability. In the murky parlance of the BNF LRMP, desired future conditions result from achieving the LRMP goals that are to be achieved SOMETIME in the future (emphasis is theirs), while objectives are planned results. Only the standards specify conditions or levels to be achieved. In almost all cases, the S&Gs are inadequate to achieve objectives and goals while management direction and estimated outputs are incompatible with meeting stated objectives. For instance, the BNF's desired future conditions and objectives for most resources is to "maintain or improve" existing conditions while, in almost every case, the S&Gs for specific resources only limit, but do not eliminate, the amount of degradation caused by land-disturbing activities implemented to meet the outputs scheduled under the LRMP.

For soil and water, the desired future condition is to improve degraded conditions "where possible" or maintain existing conditions, conduct monitoring, and maintain a program of sediment abatement in the SFSR and Bear Valley Creek watersheds. Goals include minimizing impacts and maintaining water quantity and quality to support on- and off-forest uses. The objectives include quantification of federal reserve water rights and implementation of 'watershed improvement' projects. Standards include limiting detrimental soil damage to 20% of activity areas, meeting state water quality standards, maintaining beneficial uses, implementing BMPs from a USFS handbook, monitoring BMP implementation on 10% of projects, using the "BOISED" sediment model and the R1/R4 fish response

model to evaluate effects of alternatives, and limiting estimated sediment delivery **from timber sales and roads** <20% over natural.

The BNF's array of aims and provisions for riparian zones is even more arcane.[1] The primary desired future condition is to improve or maintain conditions by logging, managing recreation and grazing, eliminating parallel road construction "wherever possible," and providing instream flows. The general goals are to maintain or improve soil, water, vegetation, streambanks, streamside vegetation, sediment-buffering capability of vegetation and soils, and provision of LWD. However, desired future condition and goals vary by "riparian value class." Riparian areas designated "Class 1" have anadromous fisheries and have the following desired future condition (DFC): key plant species in "high" vigor; 85% plant cover and 85% of potential natural species composition; <5% lost soil productivity; <10% soil damage in activity areas with no more than 3% of the soil resource totally committed; 85% coverage of streambanks by native vegetation or rock; and a "fish habitat condition index" of 85%.[2] Riparian areas that support "regionally significant" fisheries or are important for spawning are designated "Class 2" and have the following desired future condition: key plant species in "good" vigor; 80% plant cover and 70% of potential natural species composition; <10% lost soil productivity; <15% soil damage in activity areas with no more than 4% of the soil resource totally committed; 80% coverage of streambanks by native vegetation or rock; and a "fish habitat condition index" of 80%. Riparian areas designated as "Class 3 and 4" have still lower desired future conditions/goals. The BNF LRMP apparently would manage streams within watersheds with anadromous fish for lower goals if the specific reaches did not support anadromous fish. The objectives for riparian areas are to develop manuals for riparian zones evaluation and the identification of problem road segments, revise allotment management plans (AMPs) so that some improvement could occur by the year 2000, and gather baseline fish habitat/water quality data.

Applicable S&Gs for activities in riparian areas include the following: delineate and evaluate riparian areas prior to project implementation; evaluate cumulative impacts of proposed activities; avoid changes in water quality and sedimentation; construct recreation facilities only if there is a need and no other practical alternatives exist; restrict dispersed recreation and mechanized recreational vehicles; remove/relocate trails that impact riparian zones; incorporate grazing management sufficient to make some progress towards DFCs; develop techniques to determine compliance with forage utilization standards and the trend and condition of riparian areas within grazing allotments; prohibit season-long grazing; maintain streambank cover consistent with Riparian Value Class DFC; retain composition and productivity of "key" riparian vegetation; "convert" riparian vegetation only where it meets the needs of riparian-dependent species; prioritize fish habitat "improvements" in degraded

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(1) For instance, the LRMP uses both the terms "goals" and "desired future condition" interchangeably in referring to its aims for riparian areas (BNF LRMP, p. IV-10 to IV-14), despite its excruciating effort to differentiate among these terms and their ramifications elsewhere in the LRMP.

(2) The fish habitat condition index is an arbitrary ranking of fish habitat condition based on the estimated condition of five habitat attributes: streambank stability, streambank cover, streamflow, water quality, and substrate.

streams; log on an "extended rotation"[3] to maintain and enhance riparian resources, multi-layered stands, and vegetative patchiness; meet Idaho Forest Practices Act minimum requirements; limit stream shade reduction **from logging (only)** to 10% of "original" within 10 feet of perennial streams, with 30% stream shade reduction allowed outside of this distance; construct of log landings together with decking and mechanical slash piling only where these activities do not degrade areas below riparian class DFCs; avoid road construction "whenever possible"; mitigate >70% of erosion from constructed roads; pursue mitigation of sediment from existing roads, prioritizing those adjacent to riparian value class 1 and 2 streams; maintain and improve roads to avoid or minimize degradation of water quality and fish habitat; prohibit entry of soil sidecast and snow removed from roads into waterbodies and 100 year floodplains; obliterate or relocate roads only where practical transportation alternatives exist; provide fish habitat reclamation in reclamation plans for mining activities that may degrade habitat; and require "specific" (but not specified) mitigation measures for mining activities that damage streambanks and vegetation.

The DFCs and goals for fisheries are similar to those for riparian areas. Standards for fisheries only include provision of fish passage at all new road crossings and maintenance of habitat condition in streams above the riparian value class DFC.

The S&Gs for range include the following: limit forage utilization of grasses by livestock to 45% in riparian areas in "unsatisfactory" condition and 60% in "satisfactory" condition until AMPs are updated; areas with slopes >60% are not included as suitable for range; modify or eliminate grazing causing undesirable changes in soil, vegetation, or water quality.

Watersheds with anadromous fish habitat outside of wilderness areas are managed under a general prescription that allows continued grazing, timber harvest, road construction, and mining, even on sensitive soils as long as there is concurrent mitigation to reduce sediment production (BNF LRMP, p. IV-94, 1990).

Outputs levels under the LRMP include the following on an annual basis: timber harvest of about 850 MMBF from 10,300 acres, road construction of about 27.3 miles with 46.4 miles of reconstruction, and maintenance of livestock grazing at about existing levels. The LRMP forecast logging in about 7350 acres of inventoried roadless areas[4] per year during the first decade under the LRMP. This equates to entry into about 6.5% of existing inventoried roadless area outside of existing wilderness by the end of the decade for logging purposes; other roadless areas such as those within the upper reaches of Bear Valley Creek are open to road construction for mining (BNF LRMP, p. IV-353,

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(3) The length of the "extended rotation" was not disclosed in the BNF LRMP.

(4) This projection of entry into inventoried roadless areas probably underestimates entry into roadless areas. Inventoried areas include only areas that were potential candidates for wilderness designation. Smaller roadless areas are not included in the assessment; many of the smaller roadless tracts would probably be entered under the LRMP. In an analysis of roadless tracts on national forests in Oregon and Washington, Henjum et al. (1994) found that some areas meeting RARE II criteria were "missed" in previous assessments and were not included in inventories.

1990). Entry into roadless areas by helicopter logging are not included in the roadless area entry estimate in the LRMP; roadless areas in the upper SFSR watershed were scheduled for helicopter logging. About 20 miles of road construction and 4700 acres of timber harvest were scheduled in the Bear Valley Creek watershed during the first decade of LRMP implementation. About 1000 acres of logging was scheduled for areas within the SFSR watershed.

Implementation Status: The LRMP has been in place since late 1990. However, as with most LRMPs, many aspects have not been implemented fully. For instance, it is unlikely that AMPs have not revised at the scheduled pace. LRMP standards are routinely violated on many national forests, and progress towards espoused objectives is typically non-existent or negligible. For instance, although the LRMP espoused improvement of habitat conditions in Johnson Creek and Bear Valley Creek, short term data trends indicate deterioration in substrate conditions.

1.4 Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan (Anderson et al., 1992; 1993)

Purpose: The UGRRP was developed in response to environmental and social issues. Spring chinook populations had declined precipitously over the past three decades in the Upper Grande Ronde River (UGRR). A 1989 flood following a fire killed many adult and juvenile steelhead and salmon using the river at the time, further reducing the low salmon population, and heightening concern over salmon survival in the river. Evidence indicated that the combined effects of mining, grazing, logging, and an extensive road network had increased sedimentation and summer water temperatures, while reducing bank stability, LWD recruitment, and pool frequency and volume (Anderson et al., 1993; McIntosh et al., 1994). The Wallowa-Whitman National Forest (WWNF) LRMP proposed additional timber harvest, road construction, and entry into roadless areas in the watershed. These activities promised to further degrade salmon habitat and became a source of conflict between fishery co-managers and the WWNF.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Columbia River Inter-Tribal Fish Commission (CRITFC) began to appeal every timber sale in the watershed and pressed for a comprehensive watershed scale approach that adequately addressed problems in salmon habitat. The CTUIR has a federally-secured treaty right to take those harvestable salmon from the Upper Grande Ronde River that pass their usual and accustomed fishing places; the CRITFC works on behalf of the CTUIR and three other Tribes' with similar treaty rights (the Nez Perce, Warm Springs, and Yakama Tribes). The entire UGRR watershed lies within lands ceded by the CTUIR; the USFS has federal trust responsibilities to manage national forest lands consistent with the rebuilding of Columbia River salmon stocks mandated by obligations under treaties with the Tribes, an international treaty with Canada, and federal legislation such as NFMA.

In response to these issues and events, the WWNF assembled a team of aquatic resource specialists to develop a scientifically sound management plan for the UGRR. Subsequent to the development of the UGRRP, the National Marine Fisheries Service (NMFS) included spring chinook salmon in the Grande Ronde River as a component of the Snake River salmon species listed as "threatened" and then, "endangered" under the ESA. Although spring chinook salmon are a primary concern, the UGRRP is also aimed at protecting and restoring steelhead habitat.

Geographic focus: The Grande Ronde River occupies the northeastern corner of Oregon and is a tributary to the Snake River in the Columbia River basin and provides habitat for spring chinook salmon and steelhead. Most of the approximately 390 mi^2 watershed of UGRR is part of the WWNF with some interspersed private land.

Planning Entities: The UGRRP was developed through a consensus process among multi-disciplinary personnel from agencies and organizations with fish habitat expertise and management responsibilities, including the CTUIR, the Nez Perce Tribe, the CRITFC, Oregon Dept. of Fish and Wildlife, Oregon State University, USFS Pacific Northwest Research Station, and the WWNF.

Primary Provisions: The overarching goal of the UGRRP is to restore water quality, fish habitat, and riparian areas by restoring ecosystem processes at the watershed scale. More specifically, the UGRRP aims to reduce sediment loads and summer water temperatures, and re-establish natural loading of LWD to the streams with riparian protection and rehabilitation as the primary means to achieve the goals. The UGRRP also contains measures to reduce the high sediment loads caused by activities throughout the watershed.

The UGRRP set quantitative habitat standards as performance standards. Non-compliance with the standards triggers management changes and protection actions at the watershed and subwatershed scale. The following were set as quantitative habitat standards in the UGRRP: <20% fines by depth and surface fines in channel substrate in salmon spawning habitat (with no increase in areas with < 20% fine sediment); decrease maximum summer water temperatures such that maximum daily water temperatures are <61°F in small subwatersheds and <65°F in streams greater than 6th order; LWD frequency <20 pieces per 1000 feet;(5) for meadow ecosystems, >80% streambanks coverage shrubs with more than half of the shrubs >8 ft in height; an increasing trend in pool volume and depth; width-to-depth ratios <10; no removal of forest vegetation within buffer zones within a distance of 75 feet times Strahler stream order from the outer edges of floodplains (or stream edge where floodplains are absent)(6) with a minimum buffer width of 300 foot from the edges of floodplain on streams greater than 4th order.

The following land management standards were developed to ensure resource protection and progress towards meeting the standards for habitat attributes: Mandatory pre-project monitoring of parameters set as performance standards; no implementation or continuation of activities that could forestall an improving trend in habitat attributes in watersheds where habitat standards are not met; suspension of riparian grazing in watersheds and reaches that do not meet habitat standards and rapid revision of grazing allotments plans to be consistent with recovery of riparian vegetation in areas where standards are met; where substrate standards are not met, any land-disturbing activity that produces

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(5) LWD is defined as pieces with diameter >1 ft and length >35 ft. Additionally, the standard specifies that >80% of the pieces should be >1.67 ft in diameter.

(6) Although this provision is prescriptive, it was set in lieu of quantitative standards for vegetation community composition, stream shading, and recruitable wood (tree stocking).

sediment must be preceded by rehabilitation activities which actively reduce existing sediment loading by about three times the sediment delivery expected from the land-disturbing activity, until an improving trend in downstream substrate conditions is documented through monitoring for three consecutive years; active program of obliteration or rehabilitation of roads; roads in riparian zones have the highest priority; upgrade erosion control on all roads which cannot be obliterated for management purposes; construction of roads paralleling streams is prohibited; annually monitor of habitat attributes set as standards in representative reaches for analysis of trends and effectiveness; use data to adapt the UGRRP and its implementation over time; undertake long-term validation monitoring of fish populations and fish habitat interactions; roadless areas remain roadless until there is a documented improving trend in downstream habitat. The small fragments of roadless area in the watershed serve as the anchor points for restoring riparian vegetation, water quality, and fish habitat.

Implementation Status: The UGRRP remains unimplemented. Portions were used as a general foundation for the development of the WWNF's Conservation Strategy for Snake River Salmon under the ESA. The WWNF put out a draft environmental analysis (EA) for the Conservation Strategy in spring 1994 (WWNF, 1994), with an adaption of the UGRRP as one of the alternatives, but an alternative patterned after the existing of "PACFISH" was the preferred alternative. In November 1994, the WWNF withdrew the UGRRP from consultation with NMFS, but, in correspondence with the CTUIR, the USFS maintained it was NMFS that had withdrawn it from consultation.

1.5 "Alternative 9" of FEMAT (USFS et al., 1993) as Amended by USFS and USBLM (1994)

Purpose: FEMAT was, perhaps, the first federal forest planning process undertaken to fulfil a promise made during a successful presidential campaign. FEMAT (USFS et al., 1993) was aimed at developing a multi-forest management plan that would produce predictable and sustainable levels of timber while meeting applicable laws. A primary goal was the resumption of logging in national forests under injunction after several rounds of litigation under various laws, primarily over issues regarding the effect of logging under existing LRMPs on the fate of the spotted owl. However, the viability of other species was factored into the development of most of the options explored in FEMAT. The Aquatic Conservation Strategy (ACS) was developed as part of FEMAT in response to the legal mandates of NFMA regarding species viability and information and data indicating that aquatic and riparian resources had been significantly degraded within the planning area and that many aquatic species or stocks were declining, depressed, and/or at risk of extirpation. The ACS was aimed at retaining, restoring, and protecting the ecological elements and processes that provide habitat conditions for fish and other aquatic and riparian-dependent species.

Geographic focus: Federal lands within the range of the spotted owl which includes most of the national forests and USBLM districts west of the Cascades from northern California to the Canadian-US border.

Planning Entities: Personnel from USFS, USEPA, USFWS, USBLM, NMFS, and NPS.

Primary Provisions: The ACS has nine objectives (ACSOs), which are to maintain and

restore the following: 1) the diversity and complexity of watersheds for the protection of aquatic habitats; 2) connectivity between and within watersheds; 3) the physical integrity and structure of aquatic systems; 4) water quality to a level benefitting ecosystem maintenance and aquatic and riparian communities; 5) the aquatic system's sediment regime; 6) in-stream flows needed to create and maintain habitats and hydrologic and material transfers; 7) frequency and duration of floodplain inundation and water table elevations in meadows and wetlands; 8) the species composition and structural diversity of riparian plant communities needed to provide thermal regulation, and regulation of material transfers (e.g. nutrients, LWD, sediment, etc.) needed to maintain habitat complexity; and, 9) habitat to support well-distributed populations of riparian-dependent species.

The ACS relies strongly on the protection of riparian reserves and key watersheds concurrent with comprehensive watershed restoration. Watershed analysis is a major analytical tool to support ACS implementation. Watershed analysis is required to alter reserve widths and can determine restoration and monitoring approaches. However, it must be stressed that although watershed analysis is required prior to implementing many management activities, USFS and USBLM (1994) does not require any correspondence between the results of watershed analysis and the ultimate land management decisions made at the site or project level.

USFS and USBLM (1994) sets the initial dimensions of riparian reserves. These dimensions are subject to an unspecified amount of revision through to the results of watershed analysis and broad management discretion to implement management that is inconsistent with the findings of watershed analysis or attainment of ACSOs. The initial, interim widths are as follows: 1) for fish-bearing streams, widths extend from the edge of the stream to the top of the inner gorge, or the outer edge of the 100-year floodplain or riparian vegetation, or a slope distance of 300 ft or two site-potential tree heights, whichever is greatest; 2) for perennial nonfish-bearing streams, widths extend from the edge of the stream to the top of the inner gorge, or the outer edge of the 100-year floodplain or riparian vegetation, or a slope distance of 150 ft or one site-potential tree height, whichever is greatest; 3) for constructed ponds, reservoirs and wetlands >1 acre, widths extend to the outer edge of riparian vegetation or the extent of seasonally saturated soil, or unstable and potentially unstable areas, or a slope distance of one site-potential tree height or 150 ft from the edge of the wetland or the maximum pool elevation of ponds and reservoirs, whichever is greatest; 4) for lakes and natural ponds, riparian reserve widths extend to the outer edge of riparian vegetation, seasonally saturated soil, unstable or potentially unstable areas, or a slope distance of 300 ft or two site-potential tree heights, whichever is greater; 5) for ephemeral and intermittent streams, wetlands <1 acre, and unstable areas, reserve widths extend to the outer edge of unstable and potentially unstable areas, from stream edge to the top of the inner gorge, or from the edge of the wetland or stream to the outer edge of riparian vegetation, or a slope distance of 100 ft or one site-potential tree, whichever is greatest. Completion of watershed analysis is required to change these reserve widths, but widths are actually changed within project level decisions that do not have to consistent with meeting ACSOs or the findings of watershed analysis.

The following S&Gs apply within the riparian reserves: 1) No timber harvest except salvage when deemed necessary to meet ACSOs; 2) "minimize" road construction (only after completion of watershed analysis); 3) initiate management plan for road operation, design, construction, maintenance, inspections, traffic regulation, drainage, erosion control, monitoring, and mitigation; 4) avoid sediment delivery and hydrologic disruption from roads; 5) determine the effect of roads on ACSOs via

watershed analysis; 6) reconstruct roads posing a risk to riparian resources prioritized on the basis of current or potential damage and associated ecological values; 7) close, obliterate, and/or stabilize roads based on current and potential effects on both ACSOs and transportation needs; 8) provide and maintain fish passage at all road crossings; 8) modify or eliminate grazing activities that prevent or retard attainment of ACSOs; 9) manage recreation facilities and practices consistent with attainment of ACSOs; 10) avoid locating mining activities and facilities within riparian reserves unless no alternative exists; 11) rely on BMPs, monitoring, and reclamation bonds for mining activities likely to affect ACSOs; 12) minimize disturbance to ground cover and vegetation from fuel treatments and fire suppression and manage these consistent with ACSOs; 13) identify and require instream flows needed to maintain riparian resources, channel conditions, and fish passage; 14) locate new hydroelectric support facilities outside of riparian reserves and recommend relocation of existing support facilities where they interfere with meeting ACSOs; 15) manage leases, permits, and rights-of-way, and easements to eliminate effects inconsistent with attainment of ACSOs; 16) use land acquisition and exchange to meet ACSOs and facilitate restoration of fish stocks and species at risk of extinction; 17) manage application of toxicants (e.g., herbicides) to avoid retarding or preventing attainment of ACSOs; 18) locate water drafting sites to minimize adverse effects on channels, sedimentation, and streamflows needed to maintain channel conditions and fish habitat; 19) design and implement watershed, and fish and wildlife habitat restoration to promote ecological integrity of ecosystems, genetic integrity of native species, and attainment of ACSOs; 20) cooperate with federal, state, local, and tribal governments and agencies together with private landowners to develop Coordinated Resource Management Plans (or other agreements) to meet ACSOs; 21) do not rely on mitigation or planned restoration as a substitute for preventing habitat degradation; 22) analyze research activities in key watersheds and riparian reserves and re-locate if there is substantial risk that cannot be mitigated, unless the activities cannot be relocated elsewhere and will produce results critical to ACS implementation (e.g. testing assumptions).

While the S&Gs tier to the ACSOs, the S&Gs do **not** require that activities that must be preceded by watershed analysis (e.g., roads and landings in reserves and key watersheds) must be determined by watershed analysis to meet ACSOs in order to proceed (USFS and USBLM, p. C-32, 1994). Therefore, it appears that activities that are inconsistent with meeting the ACSOs can be implemented and considered consistent with S&Gs, the only binding aspect of adopted management plans under NFMA besides land allocations. Therefore, the level of accountability regarding attainment of ACSOs is negligible. Further, no analytical vehicle is identified to trigger the determination that grazing activities are retarding attainment of ACSOs and must be modified.

Two categories of "key watersheds" are established that have different management requirements than other watersheds. "Tier 1" key watersheds were judged to provide relatively high quality habitat for at-risk salmonids and other resident fishes and have a high restoration potential. A network of 141 "tier 1 key watersheds" comprising about 8.1 million acres within the planning area were designated to provide widely distributed refugia (USFS and USBLM, p. 10). "Tier 2" key watersheds were judged to be important sources of high quality water. Twenty-three "tier 2" key watersheds were designated, comprising about 1.0 million acres. About 15.3 million acres of watersheds within the planning area are considered "non-key."

No road construction will occur in inventoried (Rare II)[7] roadless areas within key watersheds (USFS and USBLM, 1994, p. B-19). Watershed analysis must be completed prior to management activities within key watersheds and riparian reserves, except those (not including timber harvest) categorically excluded under NEPA. However, the USFS and USBLM (1994) is entirely unclear on how continuing actions in key watersheds are to be treated in the absence of watershed analysis. Neither USFS et al. (1993) nor USFS and USBLM (1994) provide any explicit direction regarding whether watershed analysis must precede the continuation of on-going activities such as mining or grazing in key watersheds or riparian reserves. Absent explicit direction to suspend on-going activities, it is likely that on-going activities will continue in key watersheds in the absence of completed watershed analysis.[8] The S&Gs for mining in riparian reserves or key watersheds do **not** require that watershed analysis precede implementation. The S&Gs for key watersheds require that reductions in system and nonsystem road mileage; if reductions are not funded, there will be no net increase in road mileage. Designated key watersheds also have the highest priority for watershed restoration.

Land-disturbing activities are constrained with Late Successional Reserves and habitats for various species under USFS and USBLM (1994). These constraints serve to limit total disturbance at the watershed scale, although summary and evaluation of these constraints are beyond the scope of this report.

Watershed analysis is proposed as the primary support tool for land management under the ACS, although it does not determine the outcome of management decisions. Once watershed analysis is completed there is broad management discretion to completely disregard its results and implement projects that degrade watersheds. Watershed analyses are required to alter riparian reserve widths. It must also precede road construction or timber harvest in key watersheds or within reserves. It is not required prior to road construction or logging in non-key watersheds outside of riparian reserves. It is also not required to precede new or on-going mining in any area not withdrawn from mining or for continuation of on-going grazing. Watershed analyses are aimed at attempting to describe processes operating and current conditions within a watershed and how they interrelate. Watershed analyses are to be conducted by interdisciplinary teams of hydrologists, biologists, soil scientists, geomorphologists, and other specialists as needed. Watershed analysis is also supposed to identify the most useful parameters for monitoring environmental trends at the watershed scale.

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(7) As mentioned, inventoried roadless areas only include roadless tracts >5000 acres. Even then, inventories may also be inaccurate.

(8) USFS and USBLM (1994) requires watershed analysis prior to "resource management" in inventoried roadless areas and key watersheds; however, it does not state that on-going activities must be suspended in these areas until watershed analysis is completed. The S&Gs for grazing and minerals management make no mention of watershed analysis in initiating or continuing these activities (USFS and USBLM, pp. C-34 to C-37). Because the S&Gs explicitly require watershed analysis prior to initiating logging-related activities, it is fair to assume that watershed analysis is not required prior to continuing on-going grazing or mining activities or initiating new grazing and mining activities in any part of the landscape.

Monitoring focuses on implementation monitoring of standards and guidelines, such as riparian reserve width, completion of watershed analysis prior to logging, green tree retention in logged areas, etc. Effectiveness monitoring will occur at reference sites (USFS and USBLM, p. B-33, 1994). Specific approaches to the monitoring of aquatic resources are not given. USFS and USBLM (1994) stresses ecosystem complexity and the purportedly resultant difficulties in linking activities to environmental change in aquatic systems. The following are noted as key monitoring items: pool frequency and quality, fine sediment, LWD size and quantity, water temperature, bank stability and morphology, and width-to-depth ratio. While these habitat attributes are noted as important, USFS and USBLM (1994) does not state that they will be monitored. Explicit direction is not given for the use of monitoring results nor what results might trigger management changes (USFS and USBLM, p. E-14 to E-15, 1994).

No quantitative standards are set for any aspect of aquatic habitat and such approaches are explicitly argued against (USFS et al., 1993). Instead, it is broadly suggested that quantitative targets may ultimately be set at the watershed scale after watershed analysis. No explicit commitment is given that this will occur.

Implementation Status: Alt. 9 is in the nascent phase of implementation, with an injunction on logging lifted after the plan cleared the first major legal hurdle in being declared "legal" in the 9th Circuit Court of Appeals in 1994. The 9th Circuit decision noted that monitoring of results and attendant management adjustments were crucial given the nature of the plan and uncertainty regarding its effectiveness. As of July 1995, watershed analysis procedures have not been finalized nor undergone peer review, although some watershed analyses have been completed.

1.6 Interim Protection for Late-Successional Forests, Fisheries, and Watersheds in National Forests East of the Cascade Crest, Oregon and Washington (Henjum et al., 1994)

Purpose: Scientific evidence had continued to accrue that land management on national forests in the interior of Washington and Oregon had extensively degraded forest ecosystems including the embedded watersheds and riparian zones, contributing to more fish and wildlife species listed as threatened, endangered, or sensitive. Together with increasing public concern about these resources, this evidence prompted seven members of the US House of Representatives to request several scientific societies in April 1992 to form a panel to review and report on conditions on eastside national forests in Oregon and Washington. These House members requested that the panel review and report on the condition of old-growth ecosystems, riparian zones, watersheds, and wildlife and fish habitats; they also requested recommendations for interim management guidelines to preserve management options until a longer term approach was developed (Henjum et al., 1994).

Henjum et al. (1994) concluded that late-successional/old-growth forest (LS/OG) had been diminished considerably by logging on eastside national forests, particularly within lower elevation ponderosa pine/larch/Douglas fir forests. Little of the remaining LS/OG was protected and it was highly fragmented in small patches. Road construction, grazing, mining and fire control had also contributed to LS/OG degradation. Remaining roadless areas were highly fragmented, ecologically important, and not well protected administratively or by statute. Many aquatic species, including

anadromous fish, resident fish, and amphibians were imperiled with extinction. Riparian areas important for the habitats of these species are significantly degraded from logging, road construction, and grazing. Soils on steep terrain within the eastside national forests are prone to erosion if disturbed, contributing to sedimentation and loss of soil productivity; logging in fragile areas could result in the permanent loss of forest cover. Land management in these national forests has reduced the diversity of species and habitats and heavily altered the natural hydrologic, biologic, and ecologic processes. Continued degradation and loss of aquatic biodiversity was likely if land management did not change. Existing monitoring was inadequate. The grazing program lacked adequate standards and administration.

While the purpose of the ESSPR was to provide recommendations to protect a broad range of ecosystem elements and processes within the geographic area studied, this report only summarizes and evaluates the attributes of the ESSPR related to aquatic resources.

Geographic focus: The interim recommendations of Henjum et al. (1994) are based on analysis of information on conditions in the Ochoco, Winema, Deschutes, Wallowa-Whitman, Fremont, Umatilla and Malheur National Forests in Oregon, and the Colville, Okanogan, Umatilla, and Wenatchee National Forests of Washington. Their interim recommendations also addressed needed protection measures for national forest lands in Montana and Idaho.

Planning Entities: The Eastside Scientific Society Panel was comprised of members of the American Fisheries Society, American Ornithologists' Union, Ecological Society of America, Society for Conservation Biology, and The Wildlife Society. The Sierra Biodiversity Institute aided in many aspects of the report, especially digital data management and analysis.

Primary Provisions: Henjum et al. (1994) stressed that their recommendations are interim in nature and were designed to protect resources until a long-term protection and restoration plan is developed. The primary provisions are as follows:

1) Cease the cutting of: a) late-successional/old-growth (LS/OG) forests; b) trees greater than 20 inches diameter at breast height (dbh) or older than 150 years; and, c) any dominant or codominant ponderosa pine.

2) Do not log, construct roads, or mine within Aquatic Diversity Areas (ADAs). ADAs were defined as locations with native aquatic species at risk of extinction and sensitive to additional land disturbance, intact watersheds with high quality aquatic ecosystems, or aquatic corridors that provide critical links to habitats needed by fish during important lifestages. More than 90 ADAs with a combined area of about 2.4 million acres were recommended in Oregon, as a starting point. The need for identification and establishment of ADAs in Montana, Washington, and Idaho was stressed as critical.

3) Do not log or construct roads in roadless areas greater than 1000 acres or in biologically significant roadless areas smaller than 1000 acres.

4) Restrict logging, road construction, grazing, and fuelwood cutting within at least 300 horizontal feet from all perennial streams, and 150 horizontal ft from all lakes, wetlands, and ephemeral and intermittent streams. These activities should be restricted within the 100 year floodplain of all perennial streams where the 100-yr floodplain extends beyond 300 horizontal distance from the streams.

5) Prohibit logging in areas prone to mass failures and erosion unless peer-reviewed study conclusively demonstrates that it will not degrade soils or deliver sediment to streams. No logging should be permitted on slopes >30% in pumice soils and >60% on other soils. At least 40% of the maximum basal area should be retained on slopes from 30-60%, with at least half of the remaining basal area comprised of trees with diameters greater than the quadratic mean diameter of the stand prior to logging.
6) Allow livestock grazing in riparian areas only under strictly defined management that protects riparian areas. Evaluation of the status of grazed riparian zones and the effects of grazing on them is required. Grazing should be prohibited where evaluation and monitoring indicates a threat to the health of LS/OG or ADAs. Grazing should be suspended in degraded riparian areas until conditions are restored. Grazing should be permitted in non-degraded and restored riparian areas only after allotment management plans have been revised to include appropriate ecological standards and the management needed to meet these standards. Forage utilization standards were not recommended as ecologically relevant indicators of aquatic protection.
7) Prohibit mining and logging on fragile sites until peer-reviewed scientific study conclusively demonstrates that soils are protected and forest regeneration is assured.
8) Establish panels with broad expertise to develop management guidelines to protect forest health and to develop coordinated strategies for eastside ecosystems emphasizing biological systems and ecological processes upon which the systems depend. The panels should be comprised of ecologists, wildlife and fishery biologists, hydrologists, soil scientists, entomologists, and forest pathologists and silviculturists, as well as members from state and federal agencies, tribes, academia, scientific societies, and groups with appropriate expertise. Silvicultural restoration techniques should not be widely applied until approved by the recommended panels. A major priority of the panel charged with developing coordinated restoration strategies should be the development of a framework for monitoring and assessing ecological trends.

Implementation Status: The recommendations served as part of the basis for development of the "eastside screens" applied to USFS Region 6 timber sales starting in late summer 1993. Some conservation groups have advocated that the ESSPR be used as interim management guidance pending completion of new LRMPs for Columbia Basin forests. Most of the recommendations of the ESSPR remains unimplemented.

1.7 Coarse Screening Process for Evaluating the Effect of Management Activities on Salmon Habitat in ESA Consultations (CSP) (Rhodes et al., 1994).

Purpose: The primary purpose of the CSP is to assure that degraded habitats recover through passive restoration[9] and some active restoration and that undegraded habitats are not subjected to activities that have the potential, singly or cumulatively, to incrementally degrade water quality and habitat conditions. The CSP tiers heavily to ESA mandates and related policies. The ESA requires that activities carried out, funded, or authorized by the federal government do not adversely affect designated critical habitat for listed species; NMFS interim goal is that land management, in aggregate

(9) Passive restoration is defined as allowing natural recovery of degraded systems by eliminating the anthropogenic causes of degradation (Kauffman et al., 1993; Rhodes et al., 1994).

should lead to improvement in salmon spawning and rearing habitat and survival. The CSP provides a consistent set of quantitative, objective criteria for evaluating the consistency of land management with these mandates and NMFS interim policy goal for land management/habitat conditions under the ESA. A major objective is ensuring that land management is consistent with the achievement of key habitat conditions required for salmon survival.

Geographic focus: The CSP focuses on designated critical habitat in the Snake River Basin. However, due to the high likelihood of rapid extirpation of most of the geographically isolated spawning populations within the Snake River Basin, the CSP is also recommended for application to adjacent river basins that can provide refugia for colonists to and from currently designated critical habitat.

Planning Entities: CRITFC staff and a consulting fish biologist as consultants to NMFS.

Primary Provisions: The CSP sets biologically-based habitat standards for substrate conditions, bank stability, and water temperature. Where these standards are not met, all activities that have the potential to delay improvement in these conditions are to be curtailed or deferred.

The CSP also sets land management standards as a screening mechanism for ascertaining the consistency of activities with the goals of improving habitat conditions and survival. Activities that do not comply with the land use standards are considered inconsistent with ESA goals for spawning and rearing habitat. Some land use standards are set regardless of in-watershed habitat conditions: 1) riparian reserves extending 300 feet in slope distance from the edge of the floodplain (or streams where floodplains are absent) or to the topographic divide, whichever is less, along all streams; 2) no additional anthropogenic disturbance of soils or vegetation within riparian reserves; 3) no additional road construction in any watershed; 4) no entry into existing roadless areas >1000 acres and no entry into roadless areas <1000 acres until peer-reviewed study documents that entry will have no effect on habitat recovery or habitat recovery options; 5) elimination of grazing in perennially saturated riparian zones with non-cohesive soils and without woody vegetation; 6) limiting all ground disturbing activities so that there is no increase in estimated sediment delivery from management-induced sources; 7) seasonal restrictions on the transport of toxics along spawning and rearing streams and elimination of the storage of toxic chemicals within watersheds that contain spawning and rearing habitat; 8) suspension of additional groundwater and surface water withdrawals until studies have been completed indicating that remaining streamflows will be adequate to maintain and restore habitat conditions, spawning, rearing, and passage and will not cumulatively constrain downstream passage options in the mainstem. These land management standards are recommended to remain in place until habitat conditions in >90% of managed watersheds in the Snake River Basin either meet habitat standards or exhibit a statistically significant improving trend over at least five years.

Additional land use standards are set on the basis of habitat conditions. Where average surface fine sediment in spawning habitat exceeds 20% or cobble embeddedness exceeds 30% in rearing habitat, all land disturbing activities that can increase on-site erosion (e.g. grazing, mining, etc.) should be curtailed or deferred until estimated sediment delivery from all anthropogenic sources is <20% over natural and substrate conditions either meet standards or have exhibited a statistically significant improving trend. Where bank stability averages <90%, livestock grazing should be

suspended within half a tree height of the edge of the floodplain, or streams where floodplains are absent, until bank stability exceeds 90% or exhibits a statistically significant improving trend. Where maximum daily water temperature exceeds 60°F in historically used spawning and rearing habitat, grazing and other activities that can potentially forestall vegetative and water temperature recovery should be suspended and deferred within riparian reserves until water temperatures either meet the 60°F standard or exhibit a statistically significant improving trend. In all cases, statistically significant improving trends must be documented through monitoring over at least five years.

Where habitat standards are not met, active watershed restoration aimed at ameliorating or eliminating the persistent impacts of past activities is highly recommended to accelerate recovery and attainment of improving trends where likely to be effective. Examples of recommended restoration include obliterating and re-vegetating roads or improving sediment control and drainage on existing roads. In-channel additions of LWD are not recommended except where: it is ecologically appropriate, other causes of degradation have been successfully addressed, ***and*** all other habitat attributes are amenable to salmon production. Mechanical bank stabilization methods (e.g. riprap or gabions) and pool excavation are prohibited.

Monitoring of all habitat attributes set as standards is required prior to initiating or continuing any activity that could potentially affect these habitat attributes. Baseline and trend monitoring is also required for LWD, pool frequency, and residual pool volume. Annual monitoring is required at an intensity such that the minimum detectable effect is no greater than a 10% deterioration in the state of the variable monitored. Monitoring of fines at depth in spawning areas concurrent with monitoring of surface fine sediment is highly recommended, though not required as part of the screening process. Data on land use attributes necessary to determine compliance with land use standards are also required. Data are also required on the amount and type of riparian disturbances (e.g., road density, etc.)

The CSP recommends against using some approaches to habitat assessment or protection. The use of ranges of natural variability to set habitat standards or objectives is not recommended due to its propensity for allowing highly degraded conditions to persist without making management adjustments. Forage utilization standards are not recommended for use as an indicator of the adequacy of aquatic protection from livestock impacts because such standards can be ecologically irrelevant and unrelated to the damage caused in some riverine systems. Assessment of the risk of cumulative effects based on estimated fractions of watersheds in an "equivalent clearcut area" (ECA) are not recommended because such approaches fail to address damage caused by grazing, the sensitivity of different landscape and channel types, and issues related to ecological recovery.

1.8 Alt. 4 of "PACFISH"--Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (USFS and USBLM, 1995)

Purpose: As with other recent approaches, PACFISH was developed in response to compelling evidence that salmonid habitat had been severely degraded on federal lands and that the trend was likely to continue under the management prescribed in the LRMPs (USFS and USBLM, 1995). The purported purpose of PACFISH is to improve land management on federal lands pending

completion of a new round of forest planning. The improvements are aimed at lessening the existing rate of degradation of natal habitat for salmon. Another purported purpose of PACFISH is to meet the legal requirements of the ESA for the listed salmon and critical habitat.

Geographic focus: Although PACFISH is proposed for application on USBLM and USFS lands in Oregon, Washington, Idaho, and parts of California, it essentially applies only to activities within zones termed "riparian habitat conservation areas" (RHCAs) in watersheds supporting anadromous fish on 15 national forests and 7 USBLM districts. Forests involved include the following: Lassen and Los Padres in California; Bitterroot, Clearwater, Nez Perce, Boise, Challis, Payette, Salmon and Sawtooth in Idaho; the Malheur, Ochoco, Umatilla, and Wallowa-Whitman in Oregon, and the Okanogan and Umatilla in Washington. BLM districts include the following: Bakersfield and Ukiah in California; Couer d'Alene and Salmon in Idaho; Prineville and Vale in Oregon; and Spokane in Washington. The interim management direction under PACFISH applies primarily to new activities within RHCAs. However, it also applies on-going projects within RHCAs that are determined on a case-by-case basis to pose "unacceptable risks" to anadromous fish stocks or habitat and to activities outside of RHCAs that are deemed likely to degrade RHCAs.

Planning Entities: USFS and USBLM were the primary planning entities. However, consultation with NMFS also shaped the preferred alternative.

Primary Provisions: Under Alt. 4 of PACFISH, 8 riparian goals are set. These goals are to maintain or restore: 1) water quality needed for stable and productive riparian and aquatic systems; 2) stream channel integrity, processes, and sediment regime under which the aquatic ecosystem developed; 3) instream flows needed to support healthy riparian and aquatic habitats; 4) natural timing and variability of water table elevations in meadows and wetlands; 5) diversity and productivity of native and desired non-native plant communities in riparian zones; 6) riparian vegetation needed to provide natural levels of LWD, water temperature regulation, and aid in controlling erosion and sedimentation; 7) aquatic habitats needed to protect locally-adapted fish stocks; 8) habitat to support populations of well-distributed native and desired non-native plants, vertebrates, and invertebrates that contribute to the viability of riparian-dependent communities.

Six quantitative interim objectives (RMOs) are set for aspects of aquatic habitat. However, all targets are subject to change based on conjecture regarding local attainability. The RMOs are not standards, only targets, and are set as follows: 1) pool frequency ranging from 9-96 pools/mile as a function of channel width (wider streams have a lower pool frequency RMO); 2) no measurable increase in the 7-day moving average of maximum daily water temperature during the warmest consecutive 7-day period with maximum water temperatures $<64^{o}$F in rearing and passage areas and $<60^{o}$F in spawning habitat; 3) >20 pieces LWD/mile (>1 foot in diameter and >35 ft in length); 4) bank stability >80% in non-forested systems; 5) greater than 75% of banks undercut (bank angle $<90^{o}$) in non-forested systems; and 6) a mean width/depth ratio <10.

The width of RHCAs for **fish-bearing** perennial streams is a slope distance of 300 feet or equal to two site-potential tree heights from the edges of the stream channel, the outer edge of the 100-year floodplain or riparian vegetation, whichever is greatest. The width of RHCAs on perennial streams without fish, are set at a slope distance of 150 ft or one site-potential tree height from the edge of the streams, the outer edge of the floodplain or riparian vegetation, whichever is greater. The widths of

RHCAs on wetlands >1 acre and lentic waterbodies are set at similar distances as those for perennial streams without fish. In "key watersheds," widths on ephemeral and intermittent streams, wetlands <1 acre, and landslide-prone areas are set at a slope distance of one site-potential tree height or 100 ft from the edge of the channels, whichever is greater; in non-key watersheds the RHCA width is a slope distance of 50 feet or half of a site-potential tree height, whichever is greater, from the edge of the channel or feature. In non-forested systems, RHCA widths on perennial streams extend to the outer edge of the 100 year floodplain.

The following standards and guidelines apply only to proposed activities and on-going activities determined on a case-by-case basis to pose "unacceptable risks" to anadromous fish or their habitat **within RHCAs**: 1) No timber harvest except salvage when consistent with RMOs; 2) minimize road construction (only after completion of watershed analysis); 3) initiate a management plan for road operation, construction, maintenance, traffic regulation, drainage, erosion control, monitoring, and mitigation; 4) avoid sediment delivery and hydrologic disruption from roads; 5) determine the effect of roads on RMOs; 6) reconstruct roads not meeting design standards or retarding attainment of RMOs prioritized by the current or potential damage to anadromous fish, riparian resource value, and feasibility of other logging transportation options; 7) prioritize roads not needed for future management for closure and obliteration based on their damage to anadromous fish and habitat; 8) modify or eliminate grazing activities that retard attainment of RMOs or adversely affect anadromous fish listed under the ESA; 9) manage recreation facilities and practices so that attainment of RMOs is not retarded; 10) avoid siting mining activities within RHCAs unless no alternative exists; 11) require BMPs, monitoring, and reclamation bonds for mining activities likely to affect RMOs or anadromous fish; 12) manage fuel treatments and fire suppression activities so that attainment of RMOs is not prevented; 13) require instream flows that maintain or restore favorable channel conditions, and fish passage, reproduction, and growth; 14) locate new hydroelectric ancillary facilities outside of RHCAs; 15) manage leases, permits, rights-of-way, and easements to eliminate effects that retard RMO attainment; 16) use land acquisition and exchange to meet RMOs and facilitate restoration of fish stocks and species at risk of extinction; 17) cooperate with governments to secure instream flows needed to maintain channel conditions and aquatic habitat; 18) prohibit storage of toxics; and 19) implement watershed and fish habitat restoration projects to promote ecosystem integrity, conserve native species, and contribute to attainment of RMOs. Some of these S&Gs may also apply to activities outside of RHCAs that are deemed likely to degrade RHCAs. Notably, PACFISH does not commit to evaluating all or any on-going activities for their level of risk within any specified timeframe. Although watershed analysis must precede construction of roads and landings in RHCAs, construction does not have to be deemed consistent with RMO attainment to proceed. That is, PACFISH allows road construction in RHCAs that is inconsistent with RMOs and also allows on-going activities with unacceptable risk to continue until an evaluation is conducted sometime in the future.

"Unacceptable risk" is defined in PACFISH as "a level of risk from an ongoing activity or group of activities that is determined through NEPA analysis or ...biological assessments/evaluations...to be 'likely to adversely affect' listed anadromous fish or their designated critical habitat, or 'likely to adversely impact' the viability of non-listed anadromous fish." PACFISH interim standards and guidelines only apply to on-going activities after it is determined to have an "unacceptable risk." Such determinations are wholly subjective and solely the purview of the action

agencies (USFS and USBLM, App. K, 1995). These determinations apply only to activities within RHCAs except where activities outside of them are deemed likely to degrade the RHCAs.

Watersheds within the affected area will be designated as "key" based on the following criteria: a) they have stocks listed under the ESA or as "at risk" under the 1991 American Fisheries Society status report or other scientific status reviews; b) they contain excellent habitat; or c) they have high restoration potential. During the interim period, all watersheds with designated critical habitat for listed species would be treated as "key." No criteria or rationale are given as to how restoration potential or high quality habitat will be identified.

Watershed analysis or site-specific analysis, using unspecified analytical tools, can be used to adjust both RHCA dimensions and RMO values. Under Alt. 4, four or five analyses might be completed during the 18 month interim direction period within the Snake River Basin. The goals of watershed analysis are to: characterize hydrologic and material transfer processes; characterize of fish distribution, abundance, habitat requirements, and limiting factors; identify sensitive and/or critical portions of the watershed; provide conjecture on the combined effects of the watershed's disturbance history (anthropogenic and natural) on processes; provide information that can be used to set "ecologically and geomorphically appropriate" RHCAs and RMOs; identify possible adjustments in commodity outputs (e.g., timber, etc.); identify watershed restoration strategies and priorities; provide background for the design of monitoring and evaluation of effects of activities on attainment of RMOs and effectiveness of standards, guidelines, and restoration efforts; monitor modifications to projects and activities. Watershed analysis is not required to continue on-going activities in RHCAs even when they are causing damage. Watershed analysis is also not required to precede new activities outside of RHCAs, new mining within RHCAs, or entry into roadless areas or key watersheds.

Under Alt. 4, PACFISH also proffers guidance that may be used to alter restoration approaches and targets, although PACFISH does not provide any additional funding for restoration efforts. The guidance includes: regionalization of strategies, use of watershed analysis to identify locations and habitat objectives; amelioration of anthropogenic impacts; and monitoring and evaluation of effectiveness.

Implementation monitoring is required. Effectiveness and validation monitoring are not required. USFS and USBLM (1995) notes that effectiveness monitoring is unlikely to be completed during the period of interim direction and explicitly provides no requirements for validation monitoring. Monitoring of the habitat attributes set as RMOs are <u>not</u> required prior to implementing or continuing any activity.

Implementation Status: PACFISH was adopted by the USFS in early 1995 after consultation with NMFS. NMFS issued a biological opinion on PACFISH in January 1995. As of June 1995, the PNF has already suggested amending PACFISH at the forest plan level to accommodate road construction in RHCAs without watershed analysis (PNF, 1995).

2.0 Background for Evaluation of Plans: An Overview of Habitat Status in the Snake River Basin and the Effects of Land Management

In general, salmon habitat has been seriously degraded in watersheds subjected to mining, grazing, road construction, and logging. Though any one of these activities can degrade watersheds, habitats have usually been degraded by the combined impacts of these activities. Habitat degradation has greatly reduced salmon survival and production and contributed to population declines; in combination with the high mortality of salmon through the hydroelectric gauntlet on the Columbia and Snake River mainstems, the productivity of salmon stocks has been reduced far below levels that allow replacement and stabilization of population levels.

Strikingly similar conclusions regarding habitat conditions and their causes have been made by a number of scientific evaluations by different groups evaluating conditions at different scales in different regions. The following is a just a sample of the conclusions of recent scientific evaluations regarding habitat conditions.

At the forest level, an extensive survey of habitat and watershed conditions on the Clearwater National Forest (CNF) indicated that about 70% of the watersheds on the forest have been degraded below plan standards (CNF, 1991). High levels of sedimentation caused by logging and road construction have been the main cause of degradation. The many flaws in the CNF LRMP that contributed to these conditions is reviewed in Espinosa (1994, in Rhodes et al., 1994). Huntington (1994) found that streams in logged and roaded drainages on the CNF had higher levels of fine sediment than unmanaged drainages. These differences were statistically significant in all channel types despite high variability (Huntington, 1994). Spring chinook densities were highly variable but also higher in the unmanaged drainages with less fine sediment. On the CNF, very few of the most important habitat types exist within roadless areas. The overwhelming majority were in damaged areas managed for logging (Huntington, 1994). This pattern holds for most watersheds in the Snake River Basin (Rhodes et al., 1994). Thus, it is clear that protection of existing high quality habitats, alone, will be insufficient to protect and restore salmon populations. Heavily degraded habitats will have to be protected and restored.

At the watershed level, an inter-agency group of fishery and watershed scientists formed to develop UGRRP concluded that almost every aspect of water quality and fish habitat in the river had been severely damaged by road construction, grazing, mining, and logging (Anderson et al., 1992; 1993). Water temperatures had been severely elevated by the removal and suppression of riparian vegetation by logging, grazing, mining, and road construction within riparian zones; this also reduced LWD recruitment, contributing to pool loss. These same activities at the watershed scale also greatly increased sediment delivery contributing to pool loss and increased levels of fine sediment. Concurrent studies documented that the pool loss had been severe in the UGRR over the past 50 years (McIntosh et al., 1994).

Watershed level evaluations have also documented severe sedimentation problems in the SFSR (Platts et al., 1989; NMFS, 1993) and Bear Valley Creek in Idaho (BNF, 1993). Theurer et al. (1985) documented water temperature and fine sediment problems in the Tucannon.

Similar conclusions have been reached by broader scale evaluations. Beschta et al. (1991) evaluated habitat improvement efforts on national forests in eastern Oregon and concluded that degradation in grazed areas was pandemic. The loss and suppression of riparian vegetation due to grazing was cited as the most serious cause of general habitat degradation, including poor bank stability and channel morphology, high water temperatures, and elevated sedimentation (Beschta et al., 1991). They also concluded that structural approaches to restoration either had negative or no beneficial effects and were unlikely to have any positive effects in the absence of rest from grazing.

Henjum et al. (1994) evaluated conditions on national forests in eastern Oregon and Washington and concluded that most stream conditions throughout the geographic area had serious water quality problems that were likely to get worse under existing forest management. Henjum et al. (1994) concluded that logging, grazing, mining, and road construction had increased sedimentation and summer water temperatures and reduced habitat complexity. In a similar vein, McIntosh et al. (1994) came to similar conclusions regarding habitat trends in eastern Oregon watersheds. Increased sedimentation and the loss of riparian vegetation by logging, grazing, road construction, and mining was again indicted as the primary cause of habitat degradation.

Less intensive, but more extensive evaluations have also come to broadly similar conclusions. ODEQ (1989) notes that many stream reaches in northeast Oregon are "moderately" to "severely" impaired due to elevated sedimentation and water temperature caused by the disruption of riparian vegetation. A large number of streams in Idaho have also been designated "water quality limited" under the Clean Water Act.

Existing information clearly indicates that many watersheds managed for logging, roads, grazing, and mining have been degraded and that salmon survival has been greatly reduced; it appears likely that hospitable habitats are small fragments surrounded by systems rendered dysfunctional by the significant alteration of basic ecosystem elements and processes. It is also clear that while the land management history is slightly different among watersheds, the effects are different in degree, not in kind. More details on specific interactions among ecosystem stresses, aquatic system responses, and piscine response to habitat alteration can be found in Everest et al. (1985), Geppert et al. (1985), Meehan (ed.) (1991), Naiman et al. (1992), and Rhodes et al. (1994). However, existing evaluations and process-level studies indicate that the following generalizations apply.

The loss of riparian vegetation has decreased stream shading, bank stability, and the rate and size of LWD recruitment. This has contributed to increases in seasonal temperature extremes, reduced rearing area, reduced pool volume and frequency, reduced cover, reduced channel complexity, increased channel erosion, and increased fine sediment levels in spawning habitat. In cases where channel incision has occurred, summer baseflows have also been decreased. Logging, grazing, road construction, and mining within riparian zones all contribute to the loss, suppression, and alteration of riparian vegetation to varying degrees.

Increased sediment delivery leads to increases in sediment transport, sedimentation, fine sediment levels, pool in-filling, habitat simplification, channel widening, and seasonal water temperature extremes. These same effects can be exacerbated by the loss of LWD and in-channel sediment storage. Logging, grazing, mining, and road construction within riparian areas have

combined impacts on soils, hydrology, and vegetation that increase sediment delivery. These same activities in uplands also increase sediment delivery but generally to a lesser degree per unit area impacted and in a more lagged fashion than activities in riparian zones; one glaring exception is when the activities trigger mass failures.

These findings indicate that the following are critical aspects of an adequate habitat protection plan: protection of riparian vegetation and soils adequate to prevent further damage and allow recovery; measurable indicators of habitat conditions that serve as "yardsticks" to track trends and trigger needed changes in land management to arrest and reverse degradation; constraints on the extent, location, magnitude, and intensity of individual land-disturbing activities (mining, road construction, etc.) adequate to prevent incremental damage and allow recovery; approaches to addressing cumulative effects at the watershed scale including constraints on environmental stressors such as sediment delivery adequate to prevent additional degradation and allow recovery in degraded systems; a no-risk approach to protection of existing high quality areas with functioning ecosystems, until, at least, improvement occurs in the "sea" of degraded habitats; monitoring of habitat conditions; and, restoration of degraded systems. The importance of these protection measures is corroborated by their inclusion in some of the credible approaches to habitat protection and restoration (PNF, 1988; Anderson et al., 1992; 1993; USFS and USBLM, 1994; Henjum et al., 1994; Rhodes et al., 1994). A brief overview of each plan's provisions for these primary aspects of habitat protection is summarized in Tables A-G. However, other non-scientific issues also factor in. The recent history of land management adequately indicates that approaches must stress clarity and accountability. Otherwise, habitat protection is usurped by the culture of commodity extraction, as the recent history of federal land management amply attests.

Therefore, the aforementioned plans are compared and evaluated based on the following: riparian protection,[10] including area considered and the type and kind of activities allowed within these areas; standards for specific attributes of salmon habitat, standards (constraints) for logging, grazing, mining, roads, recreation, and water withdrawals; cumulative effects strategies including constraints and directions for controlling sediment delivery; strategies for "aquatic emphasis" watersheds[11] and roadless areas; monitoring requirements and recommendations; and strategies for restoration. To some degree, specific aspects of these plan elements may obviate the necessity of other aspects. For instance, complete prohibition of all land-disturbing activities in a watershed is, in itself, a cumulative effect strategy that renders standards for habitat conditions less important as a tool for protecting and restoring of aquatic resources. Therefore, where the evaluated plans specifically lack the elements listed above, other aspects of plans are evaluated as potential surrogates. In all cases, these issues are evaluated solely on the basis of effects on salmon survival and habitat conditions.

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(10) In each plan, different nomenclature is used to refer to riparian area protection and the areas afforded special management. For brevity, riparian protection and management provisions and areas affected are referred to in this report under the umbrella term "riparian reserves."

(11) Again, nomenclature for areas and/or watersheds where management for aquatic resources is the primary focus varies considerably among plans. For brevity, these approaches and the areas to which they apply are referred to under the blanket term "aquatic emphasis watersheds."

Likewise, the clarity and accountability of plan provisions are considered in evaluating their adequacy in protecting salmon habitat.

2.1 Riparian Reserves

Riparian ecosystems provide functions that shape habitat conditions that strongly influence salmon survival, including provision of LWD, thermal regulation, bank stability, hydrologic regulation, and sediment detention and storage (Naiman et al., 1992; USFS et al., 1993; Rhodes et al., 1994). While some of these functions are shaped by conditions throughout the watershed, riparian area conditions exert a primary influence due to their proximity. Water quality and fish habitat cannot be protected without protecting riparian areas. Although upland ecosystems must also be protected, there are no measures that can serve as a surrogate for adequate riparian protection. Table H summarizes and evaluates the riparian management provisions of each of the reviewed plans, including the defined width of riparian reserves and applicable provisions for logging, grazing, and mining within these defined widths.

The evaluations are based on the following considerations. First, the entire channel network must be adequately protected if fish habitat and water quality are to be protected and restored. Although most approaches have provided greater protection along larger streams or those reaches containing fish habitat, the implicit premises for such approaches is probably not valid. Although the rationale for providing greater protection (in terms of expanded reserve widths) to larger, fish-bearing streams has seldom been given in any detail, it appears that it is implicitly premised on three linked notions: a) impacts to stream segments are predominantly transmitted laterally from uplands (the direction of impact transfer is normal to flow) and the risk of lateral transmission of impacts increases in the downstream direction; b) there is limited connectivity between the conditions in smaller upstream segments and downstream fish habitat in larger streams; and b) vegetation is more important along larger streams than on smaller streams. Notably, there is limited evidence or scientific rationale to support these premises for providing lesser vegetative protection to smaller streams. Because ephemeral and non-fish-streams typically comprise the 70-90% of the channel network by length in most watersheds in the Snake River Basin, their conditions have a strong effect on water temperature, streamflow timing and magnitude, and sediment transport, delivery, and deposition which strongly affects channel morphology, habitat complexity, and pool frequency in downstream salmon habitat. There is little reason to believe that the major impacts to large stream reaches are primarily transmitted laterally at the reach level or that riparian conditions on are the primary determinant of all habitat conditions within that reach. Riparian conditions at the reach level clearly affect all the major attributes of salmon habitat but substrate, channel morphology, water temperature, and, to some degree, LWD[(12)] are also strongly affected by riparian conditions throughout the channel network. Although reach level conditions can ameliorate some impacts from upstream reaches, such as limited increases in sediment delivery or peakflows, they do not eliminate these impacts and in the case of shade on water temperature, have almost no effect. Small streams are sensitive to degradation caused

(12) The stability of LWD of given size appears to decrease as channel width and peak streamflow increases. Channel width is partially a function of sediment and flow dynamics shaped at the watershed and channel network scale.

by the loss of vegetation. USFS et al. (1993) suggested that smaller streams may not need wider vegetative protection because smaller LWD is more stable in small streams than large streams (USFS et al., 1993). However, LWD size is not a solely a function of reserve width. Further, the shift to smaller and less frequent LWD reduces sediment storage at the reach and channel network scale and can increase downstream sediment delivery over time. Further, small streams in headwaters tend to be flanked by steeper hillslopes rendering them more susceptible to increased sediment delivery from land disturbance. Smaller streams also tend have greater temperature increases per unit of shade loss, other factors remaining equal. For these reasons, affording inadequate protection of the upstream portions of the channel network will likely result in cumulative degradation in downstream salmon habitat over time.

Second, riparian reserves must afford adequately protect floodplains in order to protect streams in floodplains. Due to the long-term nature of riparian impacts and the migratory nature of floodplains, riparian reserves that fail to adequately protect floodplains are likely to fail to protect streams as they migrate. For instance, 100 to 200 years may be needed for full ecological recovery of LWD recruitment after logging. If a stream migrates into logged areas within floodplains within this time period, salmon habitat will be degraded with respect to LWD until recovery of LWD recruitment is complete.

Third, riparian reserves must be wide enough to fully protect all identified riparian functions important to the maintenance of salmon habitat and water quality, even though not all important ecological functions are known. Likewise, the allowed activities within these specified widths must protect identified ecological functions in order to protect salmon habitat and allow recovery of degraded systems to occur. This report evaluates the adequacy of riparian reserve widths and management in protecting the following, identified functions: thermal moderation of streamflow; sediment routing, including delivery, transport, and storage; LWD recruitment; and bank stability.

Ample information exists to delineate the widths of protected vegetation needed to provide natural levels of ecological functions such as stream shading,[13] bank stability, and LWD recruitment (See Figure 1 and USFS et al., 1993). However, there is greater uncertainty regarding the width needed to provide adequate levels of microclimatic regulation, sediment detention, and hydrologic function needed to prevent habitat from cumulative degradation from multiple activities over time. For instance, the widths needed to protect intermittent streams in various lithologies and with various slopes in the absence of slope stability concerns was estimated to range from about 75 ft in gentler terrain in sedimentary rock to >200 ft in relatively steep granitic rock; professional judgment and experience by interagency scientists was used to estimate the widths needed (USFS et al., p. V-38, 1993). Some assessments have cited studies indicating that overland sediment travels distances of about 200-300 ft over short time periods (See: USFS et al., 1993; USFS and USBLM, 1995). However, most studies of overland sediment movement have not investigated long-term sediment

(13) Maintenance of stream shading, alone, may not prevent water temperature increases. The interception of groundwater at roadcuts, heating of shallow groundwater via vegetation removal, channel widening in response to elevated sediment delivery, or decreased baseflows can increase water temperatures even where the shade from vegetation is maintained (Rhodes et al., 1994).

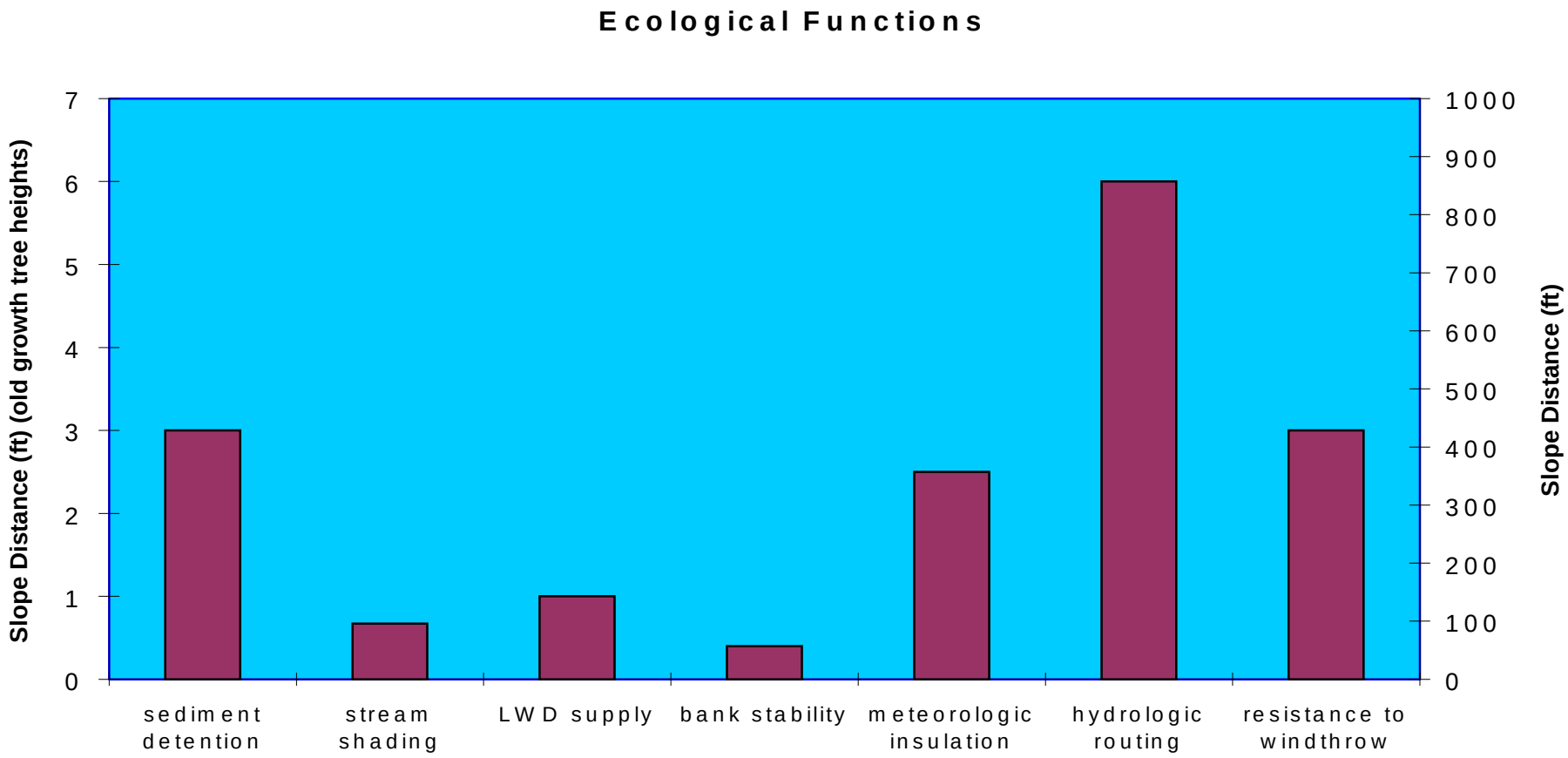

Figure 1. Estimated widths of protected areas, measured in slope distance from the edge of floodplain, needed to provide completely natural levels of ecological function over time with respect to some of the discrete ecological functions of riparian vegetation. Estimated slope distances in feet are based on the assumption that average old growth tree height is 150 feet. Widths of riparian reserves would have to extend to topographic divide to completely protect against increased sediment delivery during extreme events, alteration of hydrology, and increased susceptibility to windthrow.

transport. There has been limited investigation of the effect of reductions in the size and frequency of LWD in reducing sediment detention and storage in headwater streams, and hence, increased sediment delivery to downstream reaches. Riparian reserves cannot completely eliminate increased sediment delivery from channelized sediment flows or channel erosion triggered by increased peakflows.

Microclimatic control at the near stream environment is also clearly critical to protecting and restoring water temperature, yet investigations of how far meteorologic conditions from cutover areas extend into forest stands have not been conducted in a wide variety of settings (See: Rhodes et al., 1994). The distance of penetration of meteorologic conditions into undisturbed stands probably varies considerably among stand types because it is influenced by the physical structure of vegetation. USFS et al. (1993) presented data from Western Washington indicating the cutover areas alter micrometeorology in undisturbed stands for a distance of about 300 ft.

Given the uncertainty and the long times needed for full ecological recovery of tree removal within riparian zones (25-200+ years), the prudent approach to protecting salmon habitat is to hedge, take actions that are reversible, and include a factor of safety. The level of protection afforded by reserves can be rapidly reduced; once lost it cannot be regained rapidly.

In this report, the widths needed to protect the identified ecological functions as shown in Figure 1 (Rhodes et al., 1994) are used to evaluate the adequacy of riparian reserves. Activities that remove vegetation or compact or disturb soils within the distances shown in Figure 1 are judged to allow either direct or cumulative degradation of key habitat attributes: channel morphology, cover, substrate, and water temperature.

Notably, the adequacy of riparian reserve approaches are not evaluated with respect to hydrologic function because it is unlikely that natural hydrologic characteristics of watersheds can be completely maintained by reserves, alone, unless they extend to watershed divides. Process-level studies indicate that flows will be altered if there is modification of topography (e.g. roadcuts), soil properties, or vegetation (especially in watersheds where peak flows are predominantly generated from snowmelt). These modifications at the watershed scale can alter the timing and magnitude of baseflows, groundwater contributions, and peak flows, although natural variability makes statistically significant detection of such changes impossible, even with considerable monitoring effort, until changes are pronounced or persistent. It is unlikely that any riparian reserve approach can fully protect natural watershed hydrology unless it prescribes that only natural processes are allowed to operate at the watershed scale.

Fourth, only provisions that are hard constraints in the various plans and approaches were considered in evaluating the adequacy of riparian protection provisions. That is, stated objectives of analysis were **not** factored into the evaluations unless they are required to be met as part of standards. Notably, the SFSRP (PNF, 1988), BNF LRMP (1990), and USFS and USBLM (1994; 1995) set various objectives related to the treatment of riparian areas, but do not require that these objectives are met in implementing some given activities. In some cases, watershed analysis can be used to revise riparian reserve widths to an extent that inadequately protects for resources (USFS and USBLM 1994; 1995). In its own evaluation of effectiveness, USFS et al. (p. V-64, 1993) assumed that revised widths

would always adequately meet all objectives and protect ecological functions and habitat. However, such assumptions are not warranted given inherent uncertainty of the results of watershed analysis. Much of existing degradation of salmon habitat on federal lands in the Columbia River Basin has been caused cumulatively by activities that had been deemed by natural resource analysts to have beneficial, benign, or insignificant effects on aquatic resources. Possibly, natural resource analysts are less deterred by past errors than even economists (See: Galbraith, 1987) in continuing to incorrectly predict the future environmental consequences of land use activities. There is little evidence that judgment has improved; due to incomplete knowledge about complex natural systems, assessment of the effects of land management and their acceptability will remain a matter of judgment in the near future. For these reasons, it cannot be assumed uniformly that the ultimate protection afforded by riparian reserves will be adequate, even though analysts making the revisions may deem them so. In addition, USFS and USBLM (1994) provides latitude to alter riparian protections at the project level beyond that recommended by watershed analysis once watershed analysis is completed.

2.2 Numeric Standards for Elements of Salmon Habitat

There is no unanimity among the selected plans evaluated in this report regarding the role and development of numeric habitat standards. Nonetheless, for more than two decades, numeric targets have been proposed for a wide variety of attributes and to serve a variety of purposes. Many states have set numeric water quality standards, that if violated, trigger processes to improve pollution control under the Clean Water Act. Some of the USFS LRMPs adopted standards for attributes such as substrate and pools that, ostensibly, mandated that these targets be met (e.g., Mt. Hood National Forest LRMP, 1991). Numeric standards for habitat attributes have also been proposed as "yardsticks" to assess cumulative effects (Peterson et al., 1993) or habitat quality. Numeric standards for fish habitat attributes have also been proposed as measures of compliance with protection/restoration objectives and as criteria for when to increase or relax habitat protection or restoration measures (PNF, 1988; Anderson et al., 1992; Rhodes et al., 1994). Numeric targets for various habitat attributes have been developed based on conditions in unmanaged watersheds (e.g., Peterson et al., 1993), the biological habitat requirements of salmon (Rhodes et al., 1994), or conditions estimated to be necessary to protect vital habitat attributes (Anderson et al., 1992; 1993). USFS et al. (1993) and USFS and USBLM (1995) mention the need to develop target habitat conditions based on regionalized assessments that would factor in attainability. In contrast, Rhodes et al. (1994) argued that assessments of attainability were inherently flawed; habitat targets based on such an approach may not adequately protect salmon, even if attained. Rhodes et al. (1994) also stated that numeric habitat targets must be based on the biological requirements of salmon and that where targets were unattainable, activities that could worsen conditions should not be implemented.

Generally, there is greater agreement among the evaluated plans that sole reliance on habitat standards cannot be assumed to protect habitat (Anderson et al., 1992; 1993; USFS et al., 1993; Henjum et al., 1994; Rhodes et al., 1994). Many of the plans include protection measures aimed at preventing or limiting habitat degradation in combination with quantitative habitat standards or (PNF, 1998; Anderson et al., 1992; 1993; Rhodes et al., 1994) or without them (USFS et al., 1993; Henjum et al., 1994).

The use of numeric standards is worth evaluating, because, regardless of the lack of unanimity, several of the plans include numeric standards for some habitat attributes as keystones in how activities are managed and implemented (PNF, 1988; Anderson et al., 1992; Rhodes et al., 1994). Habitat standards that limit habitat degradation may not be necessary where effective protection for vital aspects of salmon habitat can be identified and implemented with a high degree of certainty. However, the long-term, cumulative effectiveness of some protection measures for some habitat attributes is fairly uncertain. For instance, it is not known that the ultimate size of reserves determined by WA will completely protect habitat from additional damage caused by increases in sediment delivery or peakflow generated by the effects of upland logging, nor is it certain that continued grazing under revised management will, without fail, allow habitat recovery. On the other hand, approaches that prohibit tree removal within one tree height of streams and/or floodplains provide relatively high assurance that natural LWD recruitment will occur and, hence, LWD standards are not a pressing need. Numeric habitat standards provide a measurable and accountable way to limit habitat damage and fine tune land management where the effectiveness of protection measures is uncertain.

The following criteria were used to evaluate each plan's approach to numeric standards for habitat elements. First, habitat parameters set as standards should be linked to salmon survival and the standards should be set at levels that protect salmon survival, if attained. Second, the standards should preclude degradation in high quality habitats. Third, land management should be contingent on the status of parameters set as standards so that management is consistent with meeting standards. For instance, activities that can forestall or preclude habitat recovery in degraded areas that do not meet standards should not be continued or initiated. Such an approach requires the pre-project monitoring of parameters set as standards. Fourth, parameters set as a standards should be sensitive to land management and cumulative effects. Standards for habitat parameters that change slowly in response to cumulative effects from land management allow degradation to persist. Plans that did not adopt standards were evaluated for the adequacy of protection measures as surrogates for numeric habitat standards in preventing or limiting habitat damage from the cumulative effects of land management. Table I contains the summary of plan provisions regarding numeric habitat standards and evaluations of their effectiveness.

2.3 Standards for Logging at the Watershed Scale

Logging in uplands can increase erosion and sediment delivery and, especially in areas with hydrology dominated by snowmelt, increase peakflows. These changes can alter salmon habitat and salmon survival. Constraints on how and where logging may occur at the watershed scale have a number of ramifications for salmon habitat.

The plans evaluated differ considerably in constraints on logging in uplands. The provisions of the plans regarding upland logging are made primarily within the context of watershed condition, allowed on-site effects, and entry into roadless areas. Notably, USFS and USBLM (1994) contains detailed constraints on logging within habitats for various species, and areas with various designations (e.g. "Matrix" or "Late Successional Reserves"). Although these constraints undoubtedly have bearing on the effectiveness in protecting aquatic habitat and were used in the viability assessments for aquatic species (USFS et al., 1993), detailed evaluation of these provisions are outside of the scope of this report. The constraints on upland logging in the evaluated plans are summarized and evaluated in

Table J.[14]

2.4 Standards for Grazing Management in Riparian Areas and Uplands

The protection of aquatic resources from damage by grazing is critical to protecting and restoring salmon habitat. Grazing is the most widespread land-disturbing activity affecting public lands in the Snake River Basin. Due to the proclivity of livestock to concentrate in riparian areas, its effects on aquatic systems are profound, as discussed in reviews of the ecological effects of grazing (Platts, 1991; Fleischner, 1994). Grazing has had a major role in degrading fish habitat throughout the Interior Columbia River Basin (Beschta et al., 1991; USBLM and USFS, 1994; Henjum et al., 1994; Rhodes et al., 1994). Due to its geographic extent and the multiplicity and intensity of ecological effects, no other measures can substitute for standards that arrest and reverse habitat damage caused by grazing.

The approaches to grazing management differ among the evaluated plans, but generally fall into one of three categories: a) the suspension of on-going grazing until the condition of watershed and reaches are determined, with suspension continuing in degraded areas until recovery is documented (Anderson et al., 1993; Henjum et al., 1994; Rhodes et al., 1994); b) continuation, regardless of resource condition and ecological effects, until determined to be impeding progress towards objectives, with subsequent revision/elimination (USFS and USBLM; 1994;1995); and c) continuation, regardless of resource condition or effects on aquatic resources, with forage utilization levels as the primary control (PNF, 1988; BNF, 1990).

The following criteria were used to evaluate the grazing provisions for consistency with habitat protection and restoration. First, the continuation of grazing must be predicated on determination of watershed condition and existing cumulative effects. In the absence of evaluation of conditions and trends in habitat and riparian areas and the effects of current grazing practices, continuation of on-going grazing is likely to cause further damage or forestall recovery of salmon habitat. Second, degraded riparian zones are unlikely to improve unless rested for some period of time (Clary and Webster, 1989; Platts, 1991); approaches that do not require rest in degraded systems are inconsistent with protection and restoration. Third, many grazing management strategies are inconsistent with the protection and recovery of vital habitat attributes (Platts, 1991; Elmore, 1992). Continuing degradation is likely where on-going grazing strategies are allowed to continue without revision. Fourth, cattle access to streams during the incubation period allows the trampling of salmon redds which can result in high levels of mortality. Livestock access to streams also retards the recovery of bank stability and can preclude recovery where bank stability is a problem. Fifth, any grazing strategy must include monitoring of both use and ecological trends with management adjusted based on the results of the monitoring. Unless this monitoring is required as part of every allotment, it is inconsistent with protection/restoration needs. Sixth, forage utilization standards are important, but inadequate, alone, to protect salmon habitat due to their limited ecological relevance (Henjum et al., 1994; Rhodes et al., 1994). Unless grazing is contingent on meeting ecologically relevant standards (e.g. bank stability,

(14) The plan provisions for logging in riparian reserves are summarized and evaluated in Table H.

vegetation metrics, etc.), it is considered inconsistent with habitat protection and restoration. Nonetheless, the author's field reviews over six years consistently indicate that in degraded systems in the Interior Columbia River Basin, recovery is negligible and annual damage occurs at forage utilization levels in excess of 20%. Although there is no clear threshold for utilization levels that allow recovery and prevent damage, due their limited correspondence with ecological effects, approaches that allow utilization in excess of 20% in degraded systems are considered inadequate for protection/restoration. Seventh, both upland and riparian grazing should be contingent on assessments of suitability that do not allow grazing in areas where ecological damage from grazing is likely. The grazing management provisions of the plans are summarized and evaluated in Table K.

2.5 Standards for Roads

Roads and their construction have a number of major, long-term effects on salmon habitats and the ecological functions that maintain them, as reviewed in Furniss et al. (1991) and Rhodes et al. (1994). Roads have had major impacts on conditions in the Columbia River Basin and significantly contributed to the degradation of the SFSR. There does not appear to be any measure that can serve as a surrogate to standards that adequately protect fish habitat from road-related damage.

The following criteria were used to evaluate standards for road management. First, road construction in riparian reserves leads to cumulative degradation, especially where they cross streams. Second, roads in unstable areas can cause significant and long-term habitat damage. Standards must assure that new roads are not built in unstable areas and provide guidance to obliterate those existing in unstable areas. Third, elevated sediment delivery from road construction exacerbates problems in watersheds where cumulative sediment delivery is already reducing salmon survival, unless it is required that sediment delivery from the roads be more than fully offset in advance of construction. Road construction must be not contribute to cumulative degradation and be contingent on resource condition. The more prudent and lowest risk approach in watersheds damaged by sedimentation is to defer road construction until habitats exhibit recovery (PNF, 1988). Because sedimentation is such a pervasive and pressing problem in most Snake River Basin habitats, at a minimum, sediment delivery from road construction should be fully offset by active sediment reduction measures (e.g. road obliteration), even in watersheds where sedimentation is not currently a problem. Fourth, the on-site and off-site effects of roads are not immediately reversible and, thus have persistent impacts that are expensive and difficult to arrest. In order to provide sound protection, standards must prevent damage from roads. Fifth, while road construction increases risk to all aquatic systems, in roadless areas it puts larger scale restoration efforts at risk, because these remaining areas are the anchor points for restoration efforts (Anderson et al., 1993; USFS et al., 1993; Henjum et al., 1994; Rhodes et al., 1994). Sixth, because roads are a persistent source of cumulative habitat degradation, standards must <u>assure</u> that road mileage in managed watersheds is reduced over time. The standards for roads under each plan are summarized and evaluated in Table L.

2.6 Standards for Mining

Mining can severely disrupt many ecological functions by significantly altering soil properties, topography, hydrology, vegetation, and surface and groundwater chemistry. Mining has contributed to habitat degradation in many subbasins in the Snake River Basin. Although mining may be less

ubiquitous than other activities such as logging or grazing, due to the intensity and longevity of its effects, adequate protection of aquatic resource from mining is a critical measure for which there is no surrogate.

Although effects of mining can differ considerably in magnitude from those caused by roads, the types of physical effects on ecological processes and elements are generally similar.[15] Therefore, the criteria used to evaluate the plan provisions for mining are similar to those used for roads. Table M contains the summary and evaluation of the plans' provisions for mining.

2.7 Standards for Water Withdrawals

Water withdrawals not only affect streamflow and habitat conditions in tributaries, but also cumulatively affect passage conditions in mainstem migration corridors. Absent adequate flow, other habitat concerns can be moot. Most of the evaluated plans included some guidance regarding water withdrawals. Although a wide variety of activities alter flow conditions, it is unlikely that adequate baseflows can be protected absent standards to control water withdrawals.

The following criteria were used to evaluate plan provisions for water withdrawals. First, standards for water withdrawals must include both groundwater and surface water withdrawals, because groundwater is commonly important to both the quantity and quality of baseflow in spawning and rearing habitat. Second, water withdrawals should not be allowed prior to full assessment of existing flow conditions and their affects on habitat conditions and passage. The assessment of habitat conditions must include evaluation of the role of flow in maintaining channel morphology, sediment routing, and temperature control. Assessments of passage conditions should evaluate the cumulative effects of water withdrawals and flows on passage conditions including water temperature. Third, because water withdrawals in tributaries can exert a cumulative effect on flows and passage survival in the mainstem, additional water withdrawals in tributaries should not be permitted prior to assessing cumulative effects and flow needs in the mainstem. Fourth, some direction should be provided for acquiring additional instream flows where existing instream flows are inadequate for habitat maintenance, habitat conditions, tributary passage, and mainstem passage. The summary and evaluation of plan provisions regarding water withdrawal are contained in Table N.

2.8 Cumulative Effects Strategies

Although individual activities can affect habitat conditions, salmon habitat in many watersheds has been significantly affected by the cumulative effects of natural processes and land use, including road construction, grazing, mining, and logging (McIntosh et al., 1994; Wissmar et al., 1994). Adverse cumulative impacts on some habitat attributes may be prevented via specific protection provisions that apply at the project level. For instance, full protection of all recruitable LWD should prevent

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(15) Mining can profoundly alter stream chemistry with respect to acidity, metals, and other constituents (Nelson et al., 1991), unlike roads. Although changes in water chemistry from mining can significantly reduce salmon survival and have done so in the watersheds in the Snake River Basin (Nelson et al., 1991), mining effects on water chemistry is beyond the scope of this report.

cumulative reductions in LWD over time. However, other impacts are difficult to avoid absent watershed scale protection. For instance, substrate conditions are influenced by sediment delivery from all sources within a watershed; it is unlikely that substrate conditions can be protected without limiting total anthropogenic sediment delivery to levels that prevent sedimentation. As long as on-going land disturbance occurs, there are no surrogates for cumulative effects strategies that can limit cumulative degradation from effects generated at the watershed scale.

The following criteria were used to evaluate the effectiveness of the plans' strategies for addressing cumulative effects. First, protection measures (e.g., riparian reserves) applied at the activity level must be sufficient to prevent degradation from individual activities. These measures must also allow recovery to be initiated in degraded habitats. Strategies that allow individual projects to degrade riparian reserves lead to increased cumulative degradation of salmon habitat (See Table H). Second, protection measures must apply to all activities that can singly or cumulatively degrade habitat. Third, strategies must constrain the type and magnitude of land-disturbance at the watershed scale to a level that avoids or limits damage from driving variables that operate at the watershed scale such as elevated sediment delivery. Fourth, cumulative effects must be reduced in degraded watersheds to allow habitat recovery. All activities that can forestall or preclude recovery in degraded habitats should be suspended or deferred so that recovery can occur. Widespread improvement in degraded habitats will be necessary to stabilize aggregate populations of salmon species at the basin scale, as well as geographically isolated spawning populations. Fifth, provisions should require that active restoration measures be taken in degraded systems where cumulative effects from existing impacts persist (e.g., roads in riparian areas). Sixth, where numeric habitat standards are used to limit cumulative effects, the standards must be set at levels that protect salmon survival, if met. Otherwise, cumulative degradation and habitat conditions that reduce salmon survival is allowed to persist before management is adjusted to allow recovery. Seventh, any approach that allows continued disturbance has some risk of failing to protect habitat due to inherent uncertainties, lagged effects of activities on habitat conditions, and low reversibility of on- and off-site effects. The summary and evaluation of plan provisions regarding cumulative effects strategies are in Table O.

2.9 "Aquatic Emphasis" Watersheds

Over the past few years, a number of regional approaches to habitat protection and restoration have included networks of watersheds that receive greater protection than other watersheds, based on their perceived ecological importance for fish populations or high potential for recovery (e.g., USFS et al., 1993; Henjum et al., 1994). Because some of the plans evaluated in this report include the establishment of "aquatic emphasis watersheds" as keystones to protecting and restoring salmon habitats, the plan provisions for aquatic emphasis watersheds are summarized and evaluated.

There are questions regarding the effectiveness of approaches that emphasize greater aquatic protection for watersheds identified to provide important habitat or high potential for restoration, as well as how aquatic emphasis watersheds are identified; these questions merit brief exploration. First, such approaches are premised on the notion that important habitats and those likely to have a high potential for restoration can be properly identified. Currently, such identification is a matter of professional judgement, especially regarding the recovery potential of various habitats. Notably, USFS et al. (1993) identified key watersheds but did not identify the criteria used to determine which

watersheds had high recovery potential. If watersheds that are ecologically important or have a high likelihood for restoration are misidentified they may be afforded inadequate protection and opportunities to recover species may be foregone. For instance, under an aquatic emphasis approach, the SFSR might not have been identified as an aquatic emphasis watershed in the late 1960's due its degraded state; however, under a logging moratorium combined with extensive road closure, the SFSR initially exhibited significant recovery. Under less stringent protection, the SFSR might never have recovered. Second, as long as there is continued land-disturbance at the watershed scale, the cumulative effectiveness of habitat protection measures is uncertain, especially in highly degraded systems. There is a risk of degrading or precluding recovery in "less important" watersheds due to lower levels of protection and combined with higher levels of land-disturbing activities. The effectiveness of the aquatic emphasis approach is untested, and the biological ramifications and risks of failing to adequately protect watersheds judged as less important should be kept in mind. While it is essential that the best remaining habitats be protected and allowed to recover, the restoration of these habitats, alone, is unlikely to be sufficient to maintain salmon populations that use widely dispersed habitats and need a high degree of habitat connectivity (Henjum et al., 1995). Stabilization and restoration of salmon runs will probably require restoring many formerly productive, but degraded, habitats over a wide geographic range. This is forestalled where protection of some watersheds is inadequate.

The following criteria were factored into the evaluation of the plan provisions for aquatic emphasis watersheds. First, the aquatic emphasis watersheds must be afforded complete protection that is adequate to ensure that degradation does not occur and that recovery is initiated without fail where watersheds have been degraded. At minimum, riparian areas within these watersheds must be fully protected and increases in anthropogenic sediment delivery must be prohibited. Cumulative effects must be reduced in areas with degraded conditions. Second, in the Snake River Basin, protection and restoration of only the best remaining habitats is inadequate to provide the quality, quantity, and connectivity of salmon habitat needed to stabilize and rebuild salmon populations. Many of the most important habitats for salmon have been degraded. Therefore, strategies that fail to protect and restore all salmon habitats are considered inadequate for application in the Snake River Basin. Areas that are not selected as aquatic emphasis watersheds must be at least afforded protection that prevents additional degradation. In degraded areas, activities that maintain degradation should be suspended or deferred. Table P contains the summary and evaluation of plan provisions for aquatic emphasis watersheds.

2.10 Roadless Areas Protection

Many assessments have indicated that roadless areas are fragmented, fragile, and/or important for habitat restoration efforts because they are areas where ecological functions or habitats have not been as compromised as in roaded areas (Anderson et al., 1993; USFS et al., 1993; Henjum et al., 1994; Rhodes et al., 1994; Huntington, 1995). Although relatively little salmon habitat remains entirely within roadless areas, many assessments have called for greater protection of remaining roadless areas than in other areas. Given existing fragmentation and degradation, protection of remaining roadless areas is a necessary, but insufficient, step towards restoring damaged habitats at scales ranging from the watershed to the region. Because some of the plans evaluated have explicitly emphasized the importance of protecting roadless areas, the plans' provisions for roadless areas are

summarized and evaluated.

The following criteria were used to evaluate roadless area provisions. First, roadless areas must be adequately protected from additional degradation; at a minimum, riparian functions must be protected. Second, some roadless areas have been degraded by grazing (Rhodes et al., 1994). Therefore, grazing direction must be adequate to ensure prompt recovery. Third, the risk of degradation in roadless areas increases with land disturbance; land disturbance in roadless areas may preclude maintenance or recovery of habitat quality needed by salmon (USFS et al., 1993). Expedited entry into roadless areas runs the risk of expediting the extent and intensity of cumulative effects especially when protection measures are inadequate. Fourth, many roadless areas have been considerably fragmented, and larger roadless blocks are relatively infrequent. Therefore, provisions that do not protect smaller roadless areas have greater potential for increasing the scale, magnitude, and intensity of degradation. The plans' provisions for roadless areas are summarized and evaluated in Table Q.

2.11 Monitoring

Every plan evaluated contains some discussion of the importance of monitoring various conditions, however, there are considerable differences among the plans regarding specificity and the linkage among monitoring requirements, activities, and the use of monitoring results. Although monitoring and its results are not protection measures, they can be used to improve habitat protection and aid in assessing compatibility of land management actions with recovery and protection goals. Given the unanimous inclusion of monitoring direction in the evaluated plans, the provisions for monitoring related to aquatic resources are compared and evaluated.

The following criteria were used to evaluate the monitoring provisions in each plan for effectiveness in fine-tuning protection measures. First, baseline conditions of aquatic habitat are necessary to ascertain the consistency of on-going or new activities with efforts to protect and restore aquatic habitat. Therefore, monitoring direction must ensure that activities are contingent on the collection of baseline data on habitat conditions that could be affected by the activity. Second, both effectiveness and implementation monitoring are critical in every watershed where land-disturbing activities continue to be implemented. Further, there should be explicit guidance for adjusting land management actions where the results of effectiveness monitoring indicates that degradation is occurring or degraded conditions are not improving. Third, the basic habitat attributes that are affected by land management and that affect salmon survival should be monitored, including, at least, the following core attributes of salmon habitat: structure (pools, channel width, etc.), water temperature, channel substrate, and riparian vegetation. Each plan's provisions for monitoring and linkages to management are summarized and evaluated in Table R.

2.12 Restoration Direction

The plans' provisions for habitat restoration are major determinants of their likely effectiveness in contributing to stabilizing the salmon populations in the Snake River Basin. Salmon habitats in the Snake River Basin have been widely degraded and widespread improvement in degraded habitat conditions is needed to help restore salmon populations. All of the plans evaluated in this report

acknowledge that there is a need to restore degraded habitats and reduce the adverse effects of activities and watershed conditions on salmon habitat and water quality. However, the approaches to restoration vary among the evaluated plans.

The following criteria were used to evaluate the adequacy of plan provisions for the restoration watersheds and salmon habitat. First, absent adequate protection of ecological function, habitat restoration can be precluded. Therefore, plan provisions that allow degradation are inadequate to assure the restoration of degraded conditions. Second, in degraded systems, passive restoration is a necessary first step to allowing habitats to recover. That is, activities that cause or maintain degradation must be suspended or deferred. Third, on-going activities may forestall or preclude restoration unless their continuance is contingent on assessment of the status and trend in habitat conditions and the effect of activity, including its contributions to cumulative effects. Therefore, approaches that do not require baseline monitoring of habitat conditions and cumulative effect assessment prior to continuing activities, have a high risk of failing to restore habitat. Fourth, structural habitat enhancement measures (e.g. LWD addition) provide negligible benefits to salmon or their habitat when other habitat attributes are degraded (e.g. riparian vegetation, water temperature, sedimentation, etc) (Beschta et al., 1991; Frissell and Nawa, 1992). Therefore, structural habitat enhancement is assumed to have no net benefit for habitat restoration in the absence of adequate habitat protection. Fifth, in some degraded watersheds, active restoration (e.g., road obliteration/improvement or mine reclamation) will be needed to restore some habitats. While adequate direction for active restoration is important, active restoration is not a surrogate for passive restoration and prevention of degradation. Sixth, due to inherent uncertainties regarding the long term effectiveness of watershed and habitat protection measures, there is a risk of failing to restore degraded habitat in watersheds where land-disturbing activities continue to be implemented. The plans' provisions for restoration are summarized and evaluated in Table S.

2.13 Summary Indices of Overall Effectiveness of Major Protection Provisions of the Plans.

In an effort to provide some notion of the overall strengths and weaknesses of the plan's protection provisions, the most important aspects of the plan provisions are scored individually, based on their likely effectiveness. These scores are summed to provide a non-weighted total score that can be used as an aggregate index of the overall effectiveness of each plan. While the numeric rating of specific plan provisions were not weighted, it should be kept in mind that some plan provisions may be more important than others. For instance, it is unlikely that a highly effective monitoring program that requires effective management response can completely compensate for inadequate protection of riparian functions. However, some strengths in plan provisions may partially compensate for weaknesses in other provisions. For instance, a weak monitoring plan or a lack of habitat standards that can limit the duration and magnitude of degradation is a less critical weakness in watersheds where most land-disturbing activities are prohibited, such as in the ADA approach of Henjum et al. (1994). Because of the number of potential permutations of compensating provisions within and among each plan, the numeric rating of specific plan provisions were not weighted in developing the total score for each plan.

It should be kept in mind that such exercises in rating effectiveness are always somewhat subjective. Nonetheless, such attempts to refine evaluations of complex approaches into simple metrics of effectiveness remain common (e.g. USFS et al., 1993).

In all cases, plan provisions are rated on a scale of 1 to 10. A score of 10 denotes completely adequate provisions that ensure protection and that restoration is not hampered by the treatment of the activity (e.g. grazing) or element (e.g., riparian vegetation). As long as land-disturbing activities are implemented there is a risk of degradation, hence, provisions that allowed for continued land-disturbance were not given ratings of 10. A score of 5 denotes equivocal results; some limited degradation may occur in some areas, but recovery may be initiated, slowly, in some areas. Scores less than 5 denote consistent allowances for degradation. Ratings for individual plan provisions and summed ratings for each plan are summarized in Table T.

One plan, the ESSPR, was given two numeric ratings for some provisions because it is not certain how ADAs would be delineated in the Snake River Basin. If all watersheds with critical habitat for the listed salmon species were delineated as ADAs, then many of the provisions of the ESSPR are rated as being highly effective in protecting and restoring salmon habitat and some weaknesses in its provisions are not critical impediments to effectiveness. However, if only some critical habitat is delineated as ADAs, then some of the provisions allow degradation. Although almost all of the watersheds with critical habitat for the listed species within the geographic focus of the ESSPR were identified as ADAs (Henjum et al., 1994), it cannot be assumed that this would be the case if it were applied to the entire Snake River Basin. Therefore, the reader should keep in mind that where ratings for of the ESSPR are expressed as range, the higher rating is based on the assumption that all watersheds with critical habitat are treated as ADAs and the lower rating is based on the assumption that not all watersheds with critical habitat are treated as ADAs.

While these numeric ratings provide only indices of effectiveness, it should be kept in mind that plans that do not ensure widespread and unimpeded improvement in habitat conditions affecting salmon survival cannot contribute to stabilizing dwindling salmon populations; additional habitat degradation accelerates the rate of decline in salmon populations. Plans with total composite ratings of 55 or less in Table T are unlikely to allow widespread habitat improvement and re-establish the habitat connectivity needed to contribute to stabilizing dwindling salmon populations in the Snake River Basin, and, therefore, have a high risk of contributing to salmon extirpation.
The lower the overall rating of a plan, the greater is the likelihood that its implementation will contribute to exterminating salmon.

The primary rationale for the scoring of each major provision in each plan is briefly provided in the following discussion.

Riparian Reserves: The SFSRP (PNF, 1988) is given a rating of 4 due to its failure to prohibit damaging grazing and mining in riparian areas; further, once substrate improvement occurs, damaging road construction and logging can also occur within these areas. Although the watershed-scale moratoria on logging-related activities until substrate recovers has allowed some recovery to occur, the SFSRP allows this progress to be reversed by mining. The approach has allowed grazing to contribute to the maintenance of extremely degraded habitat conditions and low salmon survival in

Johnson Creek on the BNF in the SFSR watershed (NMFS, 1993).

The BNF LRMP is given a rating of 1 because it consistently allows degradation of riparian areas by all major land-disturbing activities. Habitat degradation by mining and grazing is not limited by habitat standards or monitoring.

The UGRRP is given a rating of 6 because although the minimum reserve widths are inadequate to protect all ecological functions on streams less than 2nd order, it suspends riparian grazing where forestalling habitat recovery, completely protects against vegetation removal within the reserves, and employs habitat standards to limit degradation and initiate passive restoration. Further, the UGRRP provision for roadless area protection and reductions in sediment delivery in watersheds not meeting substrate standards ameliorate the deficiencies in reserve widths on streams <2nd order.

Alt. 9 of FEMAT (USFS and USBLM, 1995) is given a rating of 4 because mining is allowed to degrade riparian reserves, as is grazing until identified as a problem. The lack of accountability of the protection measures factors into the rating. After the completion of WA, there is management discretion to implement damaging road construction within reserves outside of inventoried roadless areas in key watersheds even if identified as impeding attainment of ACSOs. Further, the ultimate effectiveness of riparian protection is partially dependent on the ultimate veracity and quality of WA in a given watershed. Habitat degradation is not limited by application of habitat standards and monitoring.

The ESSPR (Henjum et al., 1994) is given a rating of 5-9 because it restricts, but does not prohibit, road construction and logging within riparian reserves outside of ADAs. Mining within riparian reserves is not restricted outside of ADAs. The rating was improved by the provisions for suspension of grazing in degraded riparian areas and complete protection of riparian areas within ADAs from degradation from additional mining, road construction, and logging.

The CSP (Rhodes et al., 1994) is given a rating of 9 because it protects widths on all streams that are adequate to provide most major ecological functions from additional degradation via most activities except grazing within watersheds that meet habitat standards. While continuance of grazing within reserves is contingent on monitoring within allotments and at the watershed scale, there is some limited potential that degradation may occur to a degree limited by monitoring and habitat standards.

PACFISH (USFS and USBLM, 1995) is given a rating of 3 because mining and on-going grazing within reserves are allowed to degrade reserves and habitat, except where individual grazing activities are determined on a case-by-case basis to adversely affect habitat. After WA completion, there is management discretion to construct roads in RHCAs, even when deemed inconsistent with RMO attainment. Width of protected vegetation on non-perennial streams is inadequate to protect ecological functions. Habitat damage is not limited by habitat standards and monitoring.

Habitat Standards: The SFSRP is given a rating of 4, because although the approach has been adequate to protect against additional sedimentation from logging-related activities, mining and grazing are allowed to cause damage that is not limited by habitat standards. Grazing under the SFSRP has

contributed to the maintenance of degraded habitat conditions in Johnson Creek on the BNF that have significantly reduced salmon survival. The substrate standard is set at levels that impair salmon survival. Riparian reserve widths are not prescribed at widths that assure protection of LWD and water temperature. The SFSRP does not include standards for LWD.

The BNF LRMP is given a rating of 1 because it combines inadequate protection provisions with a complete dearth of habitat standards and no requirement to alter management where monitoring indicates degradation has occurred.

The UGRRP is given a rating of 8 because habitat standards comprehensively cover important habitat and riparian attributes, are set at protective levels, mandate no degradation when conditions are better than standards, apply to all on-going and proposed activities, and attendant management guidelines require passive restoration approaches where habitat standards are not met. Mandatory pre-project monitoring for all activities strengthens approach.

Alt. 9 of FEMAT is given a rating of 3 because the ACSOs are subject to broad interpretation and there is limited accountability regarding required consistency between land management and attainment of ACSOs. There are no explicit provisions for altering management even when basic habitat attributes, such as summer water temperature, are degraded. Mining is allowed to prevent ACSO attainment, as is grazing until identified as a problem. After completion of WA there is management discretion to implement road construction that precludes progress towards ACSOs. Monitoring of measures of ACSO status and trend are not required.

The ESSPR is given a rating of 4-7 because although it calls for the development of ecologically sound standards, activities allowed in the interim may degrade habitat outside of ADAs. Further, the ESSPR provides very limited detail on the role of ecological standards in land management once standards are developed. These deficiencies are ameliorated by ADA protections and grazing direction.

The CSP is given a rating of 9 because habitat standards address major habitat attributes that may not be adequately protected or restored by riparian reserve approach (water temperature, substrate, and pool volume trend) and apply to all on-going and new land-disturbing activities. Although habitat standards are set at levels that are conducive to salmon survival and prohibit degradation of conditions where better than the standards, the approach may not allow full recovery of habitat to potential. Further, though protection provisions are fairly complete (e.g., riparian reserves) there is some risk that activities in watersheds meeting standards may cause degradation.

PACFISH is given a rating of 2 because the RMOs do not include substrate which is a critical concern, are set at levels representing degraded conditions (e.g. LWD), allow incremental water temperature increases, and increased protection is not required where RMOs are not met. These deficiencies are exacerbated because riparian protection and direction for mining and on-going grazing allow degradation of major habitat attributes. After WA is completed, there is management discretion to construct roads in RHCAs even where deemed to prevent RMO attainment.

Logging Standards: The SFSRP is given a rating of 7 because major logging-related activities at the watershed scale are contingent on meeting substrate standards. Although the SFSRP's provisions have allowed improvement, the riparian protection provisions are inadequate to ensure prevention of loss of thermal regulation, LWD, and sediment prophylaxis. However, these weaknesses are ameliorated by requirements that sediment delivery from logging-related activities be offset in advance of the activity.

The BNF LRMP is given a rating of 2 because it allows logging to reduce thermal regulation and LWD recruitment and increase sediment delivery; the damage is not limited by habitat standards. Although the constraint on sediment delivery from logging limits contributions, it still allows logging to increase sediment delivery where total sediment delivery from all sources, such as mining, are already degrading salmon habitat.

The UGRRP is given a rating of 7 because it completely protects vegetation within reserves, requires that sediment delivery from logging be more than offset in watersheds that do not meet substrate standards, and protects high-quality roadless areas until habitat improvement is documented. Inadequate reserve widths on streams <2nd order reduced the rating.

Alt. 9 of FEMAT is given a rating of 5 because it allows management discretion to implement road construction and landings after completion of WA, subjects roadless areas to continued logging, does not ensure that sediment delivery from logging-related activities is not increased or maintained at levels that degrade habitat. The ultimate dimension of riparian vegetation protected is partially dependent on the veracity WA, which is uncertain. However, these deficiencies are somewhat ameliorated by constraints on logging in uplands within LS/OG reserves, prohibitions on logging road construction in inventoried roadless areas within key watersheds and limiting road mileage in key watersheds to existing levels.

The ESSPR is given a rating of 6-10 because it completely protects ADAs and roadless areas from additional damage from logging, and constrains logging in fragile soils. However, it only calls for restricting logging within riparian reserves which may allow degradation outside of ADAs.

The CSP is given a rating of 8 because it completely protects roadless areas (<1000 ac.) and riparian reserves from damage from additional logging until the majority of habitats in managed watersheds meet habitat standards or exhibit improvement. However, the CSP provides no explicit direction on logging activities outside of reserves.

PACFISH is given a rating of 3 because there is discretion to construct logging roads in riparian reserves upon completion of WA even if found to be inconsistent with objectives. PACFISH fails to constrain sediment delivery from logging and does not protect roadless areas from logging.

Grazing: The SFSRP is given a 2 because it relies primarily on forage utilization standards to control grazing regardless of resource condition; this is an ineffective approach to protection and restoration. Habitat standards that can limit habitat damage are not applied to grazing. The BNF LRMP is given a rating of 2 because it uses the same approach as the SFSRP.

The UGRRP is given a rating of 7 because riparian grazing is contingent on resource status and monitoring is required. In watersheds or reaches where habitat standards are not met, riparian grazing is to be suspended until recovery is documented.

Alt. 9 of FEMAT is given a rating of 5 because it calls for the modification or elimination of grazing that is identified to interfere with ACSO attainment. However, it allows all on-going grazing to continue until identified as a problem.

The ESSPR is given a rating of 8 because grazing is contingent on resource assessment, resource condition, management revision, and on-going monitoring. It requires that grazing be suspended in degraded reaches until recovery is complete. The CSP is also given a rating of 8 because it employs a similar approach to the ESSPR.

PACFISH is given a 3 because it calls for modifying or suspending grazing management that interfere with attainment of RMOs. However, PACFISH applies only to those on-going activities that are determined, on a case-by-case basis, to adversely affect salmon habitat.

Roads: The SFSRP is given a rating of 3 because it makes construction of logging roads contingent on substrate improvement and sediment abatement. However, it does not protect riparian areas from construction of logging roads once stream substrate recovers and provides no firm constraints on mining. The focus on active road restoration somewhat ameliorates the lack of constraints on road construction.

The BNF LRMP is given a rating of 2 because it allows degradation of riparian reserves and watersheds by construction of logging roads subject to limited constraints on location and sediment delivery, regardless of resource condition. Roads associated with mining are not subject to the same constraints as logging roads.

The UGRRP is given a rating of 6 because it fully protects riparian reserves from road construction, requires that sediment delivery from road construction be more than offset in watersheds that do not meet substrate standards, and prohibits entry into high quality roadless areas until recovery is documented in degraded habitat. While protected widths in riparian reserves are inadequate on streams <2nd order, habitat standards, active road restoration, and sediment abatement requirements ameliorate this deficiency.

Alt. 9 from FEMAT is given a rating of 4 because it allows road construction in reserves after completion of WA, does not assure that sediment delivery from road construction is not increased, and does not make road construction contingent on resource status. However, FEMAT does not subject larger roadless areas in key watersheds to road construction and prohibits increases in road mileage in key watersheds. Road-related damage is not constrained by habitat standards and monitoring; road construction and attendant damage is expedited outside of key watersheds.

The ESSPR is given a rating of 5-9 because it completely protects ADAs and roadless areas >1000 ac. from degradation from additional roads. However, outside of ADAs and roadless areas, road construction within riparian reserves is "restricted." Restricted road construction is likely to cause

degradation. Increased sediment delivery from roads is not directly constrained.

The CSP is given a rating of 9 because it prohibits the construction of roads in all watersheds until the majority of managed watersheds meet habitat standards or exhibit documented recovery. The impacts of existing roads may persist until addressed by active restoration.

PACFISH is given a rating of 2 because it allows road construction within RHCAs upon completion of WA, does not require that increases in sediment delivery from roads are avoided, does not limit increases in road mileage, allows road construction in roadless areas. Damage from road construction is not limited by habitat standards. Mining roads can proceed prior to completion of WA.

Mining: The SFSRP and the BNF LRMP are both given ratings of 1 because both allow significant habitat damage of all areas not withdrawn from mining.

The UGRRP is given a rating of 6 because it fully protects vegetation within riparian reserves from additional mining and requires sediment reductions as part of new mining outside of reserves. It also requires suspension of activities forestalling recovery in watersheds where habitat standards are not met.

Alt. 9 of FEMAT is given a rating of 2 because new and on-going mining are allowed within riparian reserves and allowed to degrade habitat. It is entirely unclear if new mining operations in key watersheds and riparian reserves must be preceded by WA. New mining operations are to be located outside of reserves only where possible.

The ESSPR is given a rating of 4-9 because it fully protects ADAs from degradation from new mining. However, the ESSPR does not call for restricting mining within riparian reserves or roadless areas outside of ADAs.

The CSP is given a rating of 7 because it protects the riparian reserves from new mining activities and requires suspension of mining activities contributing to degradation or forestalling recovery in watersheds that do not meet habitat standards. Mining activities are subject to constraints on sediment delivery, however, the constraints on sediment delivery may not fully protect salmon habitat. Although new and on-going mining are contingent on monitoring and habitat status, direction for mining in uplands lacks detail.

PACFISH is given a rating of 2 because it employs an approach similar to FEMAT.

Cumulative Effects: The SFSRP is given a rating of 4 because although its approach to constraining logging-related activities effects on sedimentation and substrate is fairly protective, grazing and mining are not adequately constrained by either habitat or land management standards. Grazing and mining are allowed to maintain degraded habitat conditions or increase cumulative effects.

The BNF LRMP is given a rating of 1 because it allows significant degradation of riparian reserves by all major land-disturbing activities. An increase in the extent and intensity of habitat conditions caused by cumulative effects is likely.

The UGRRP is given a rating of 6 because all on-going and new activities are addressed and are contingent on monitoring and resource conditions. In watersheds that do not meet standards, riparian grazing is to be suspended and reductions in sediment delivery are required. Roadless areas are to be protected until habitat recovery occurs, providing evidence that adverse cumulative effects at the watershed scale have been reduced. Although the UGRRP addresses all major land-disturbing activities, reserve widths on streams <2nd order may allow cumulative downstream degradation over time.

Alt. 9 of FEMAT is given a 3 because there is latitude to degrade riparian reserves by road construction after WA is completed, sediment delivery is allowed to increase in systems damaged by sedimentation, mining is allowed to degrade riparian reserves, damaging grazing can continue until identified as a problem, and implementation of activities is not contingent on resource status or monitoring. These deficiencies are somewhat ameliorated by direction for active restoration of road network, prohibitions on increased road mileage in key watersheds and road construction in roadless areas >5000 ac in key watersheds, and constraints on activities in LS/OG reserves. In cases where habitat damage does occur and is documented, specific management adjustments are <u>not</u> required.

The ESSPR is given a rating of 5-9 because it fully protects ADAs from degradation from additional mining, road construction, and logging. Grazing direction is adequate to initiate recovery in most degraded areas. However, outside of ADAs adverse cumulative effects on fish habitat can increase because riparian reserves may be degraded by restricted road construction and logging together with unrestricted mining. Constraints on logging in uplands ameliorates potential cumulative effects from logging at the watershed scale, outside of ADAs.

The CSP is given a rating of 8 because it requires that there be evidence of reduced cumulative effects (documented improving trend) before continuing or implementing activities that can degrade habitat or forestall recovery. Riparian reserve dimensions are adequate to protect most, but not all, ecological functions on all streams. All activities are contingent on monitoring and results. Although the CSP aims at limiting or reducing sediment delivery, there is question regarding the effectiveness of the approach (Rhodes et al., 1994). Roadless areas and riparian reserves are protected from new land-disturbing activities with grazing allowed to continue only in areas that meet habitat standards and where monitoring is in place.

PACFISH is given a rating of 2 because it is similar to Alt. 9 of FEMAT, but does not limit road mileage in key watersheds and does not require WA prior to initiating major land disturbing activities in key watersheds outside of RHCA widths.

<u>Aquatic Emphasis Watersheds</u>: The SFSRP is given a rating of 3 because although it is aimed primarily at preventing additional degradation via erosion from logging, the approach has some promise for other watersheds <u>if the implementation or continuation of all activities were made subject</u> to documented improvement in affected habitat conditions. Nonetheless, the SFSRP allows degradation by mining and grazing, and standards for activities are not assured to be adequate to protect against losses in LWD sources, thermal regulation, etc.

The BNF LRMP is given a rating of 1 because it programs the degradation of watersheds and riparian areas by grazing, mining, road construction, and logging which is not a prudent approach for watersheds where aquatic resources are emphasized.

The UGRRP is given a rating of 6 because although it addresses only one watershed, the aggregate approach has promise for initiating recovery in degraded watersheds via reductions in sediment delivery, full protection of riparian reserves, and suspension of grazing in reaches and watersheds where standards are not met. However, while the UGRRP protects areas within the reserves from logging, mining, and road construction, reserve widths are inadequate to protect some ecological functions on streams <2nd order. The potential for some cumulative degradation is ameliorated by comprehensive habitat standards and sediment reduction requirements.

Alt 9. of FEMAT is given a rating of 4 because although the network of key watersheds are the focus for protection and restoration efforts, the following could cause degradation or prevent recovery in key watersheds: 1) latitude to construct roads and landings in riparian reserves after completion of WA; 2) inadequate reserve widths set after WA; 3) continued grazing until identified as problem; 4) mining in riparian reserves; and 5) allowed increases in sediment delivery. There is greater potential for degradation outside of key watersheds. There are no specific provisions for reducing disturbance and/or increasing protection measures should habitat be degraded or fail to recover.

The ESSPR is given a rating of 7-9 because it provides a high degree of protection for ADAs that should allow recovery to occur. However, outside of ADAS, activities, especially mining, allowed within riparian reserves may cause degradation. Grazing management and logging provisions limit the potential for degradation outside of ADAs.

The CSP is given a rating of 7 because it subjects watersheds that meet all standards to some risk via allowed activities outside of riparian reserves and roadless areas. However, it provides a high degree of protection for all watersheds with critical habitat via habitat standards, riparian reserve direction, and constraints on road construction and sediment delivery. All on-going and new land disturbing activities are addressed.

PACFISH is given a rating of 2 because it employs an approach to key watersheds to similar to Alt. 9 of FEMAT except that WA is not required prior to implementing logging and mining outside of RHCAs in key watersheds and road mileage is allowed to increase in key watersheds.

Roadless Areas: The SFSRP is given a rating of 4 because it allows logging-related activities in roadless areas, but only after substrate targets have been met. However, mining and grazing provisions are inadequate to prevent degradation in roadless areas.

The BNF LRMP is given a rating of 2 because it allows entry into roadless areas regardless of watershed conditions and allows considerable degradation of watersheds and riparian areas by all activities. Degradation is only weakly limited by S&Gs.

The UGRRP is given a rating of 6 because it fully protects roadless areas from entry until habitat improvement is documented. Grazing management provisions are adequate to allow recovery to be initiated in roadless areas. However, the UGRRP riparian reserve widths may be inadequate to protect against cumulative degradation, if roadless areas are entered.

Alt. 9 of FEMAT is given a rating of 5 because it allows logging, road construction, and mining in roadless areas <5000 ac.,[16] although some of these activities must be preceded by WA in key watersheds. After completion of WA, the plan allows logging in roadless areas >5000 ac. in key watersheds and road construction in roadless areas >5000 ac. outside of key watersheds. Grazing direction allows degradation of roadless areas to persist until identified as problem.

The ESSPR is given a rating of 6-9 because although it calls for the protection of roadless areas >1000 ac. from road construction and logging, it does not prohibit mining in roadless areas outside of ADAs. Grazing direction is adequate to reverse grazing damage in roadless areas.

The CSP is given a rating of 9 because it protects roadless areas from major land-disturbing activities until recovery has been documented in managed watersheds. Grazing direction is adequate to initiate recovery in roadless areas degraded by grazing.

PACFISH is given a rating of 3 because it takes an approach similar to FEMAT, but with roads allowed in roadless areas, no limit on road mileage increases, and expedited implementation of logging, construction, and mining.

Monitoring: The SFSRP is given a rating of 4 because logging-related activities are contingent on documented improvement in substrate. Although the approach is credible, it does not include important habitat attributes (e.g. water temperature) nor does it apply to mining and grazing.

The BNF LRMP is given a rating of 1 because activities are not contingent on monitoring nor monitoring results. This gravity of the omission is increased due to lack of adequate protection measures.

The UGRRP is given a rating of 8 because all activities are contingent on monitoring and results; specific actions are required where monitoring indicates that habitat standards are not met.

Alt. 9 of FEMAT is given a rating of 3 because activities are not contingent on monitoring or results. It does not require monitoring of all important habitat attributes, nor does it specify what specific monitored thresholds would trigger changes in protection measures or activities.

The ESSPR is given a rating of 4-6 because although grazing is subject to monitoring and results, monitoring direction for other activities is not clear. Although development of a monitoring program is given a high priority, the monitoring approach and use of monitoring results in making management adjustments is not specified. The lack of monitoring detail is ameliorated by protection measures in ADAs and grazing direction.

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(16) Generally, inventoried roadless areas are >5000 ac. in area.

The CSP is given a rating of 8 because it takes an approach similar to the UGRRP. Use of monitoring results in adjusting management is specified, however, direction for implementation monitoring of activities is weak.

PACFISH is given a rating of 2 because it takes an approach similar to FEMAT, but is combined with a more expedited approach to implementing land-disturbing activities. PACFISH also allows small water temperature increases, provided that they are unmeasurable downstream, that setback and prevent water temperature recovery.

Restoration: The SFSRP is given a rating of 3, because although it been effective at allowing some substrate recovery via protection from logging-related activities, it does not adequately address all activities and the need to restore habitat attributes such as water temperature. Mining is allowed to reverse existing recovery in substrate conditions.

The BNF LRMP is given a rating of 1 because it does not provide protection adequate to allow habitat recovery.

The UGRRP is given a rating of 7 because it addresses all activities that could forestall recovery of major habitat attributes. Passive and active restoration efforts are to be continued until habitat conditions exhibit improvement.

Alt. 9 of FEMAT is given a rating of 4, primarily because there is broad latitude to implement activities that can forestall or prevent recovery and because specific management responses are not required if recovery does not occur. FEMAT's active restoration of road networks and direction to prevent increases in road mileage in key watersheds improved the rating.

The ESSPR is given a rating of 4-9 because it emphasizes passive restoration in areas degraded by grazing and in ADAs. However, outside of ADAs, "restricted" logging and road construction in riparian reserves and lack of restrictions on mining in riparian reserves and roadless areas can cause degradation that precludes habitat recovery.

The CSP is given a rating of 8 because it requires that all activities that could forestall recovery be suspended or deferred and requires specific adjustment of all major land-disturbing activities should recovery not occur.

PACFISH is given a rating of 2 because it takes an approach similar to FEMAT in combination with more expeditious implementation of land disturbing activities and allowed increases in road mileage in all watersheds.

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Appendix A:

Tables cited in the text

Table A. Summary--SFSRP from PNF LRMP (1988)

Purpose	* Multiple use, commodity outputs, NFMA requirements, improve habitat conditions in SFSR degraded by sediment, establish process for resumption of logging in the SFSR, schedule sediment reduction projects, and prioritize and schedule logging based on improvement in habitat conditions.
Geographic Focus	* Approximately 1300 mi^2 of the SFSR watershed on the PNF and BNF in central Idaho within the Idaho batholith
Objectives	* Improve habitat conditions to a level capable of supporting fishable salmon populations by 1997 (see interpretation below under habitat standards) and "near" full capability by 2007. * Reduce sediment delivery, implement rehabilitation projects and road system direction.
Riparian Reserves	* **Widths:** No fixed distance(s) set. Generally includes the area dominated by riparian vegetation. * **Logging:** Not scheduled within 100 ft along perennial and mapped intermittent streams, but allowed. "Some" riparian zones along intermittent streams scheduled for logging. Although these are general LRMP provisions, <u>all</u> logging is contingent on improvement in habitat conditions or reductions in sediment delivery. Sediment delivery expected from roads/timber must be fully offset. Constraints on riparian logging somewhat different for BNF (See BNF LRMP description). * **Grazing:** Allowed in all riparian zones identified as suitable. Forage utilization limited to less than 66%. Currently, livestock grazing in the SFSR is confined to outfitter and pack livestock except in Secesh R. on PNF and Johnson Creek on the BNF (See BNF LRMP for forage utilization standards). * **Mining:** Allowed. Sediment reduction standards not considered applicable. * **Roads:** New construction allowed, provided construction parallel to streams is avoided. Sediment from road construction associated with logging must be fully offset, but not so for road construction associated with mining.
Numeric Standards for Habitat Attributes	* 1997 objective is interpreted in terms of substrate conditions: 5-yr mean cobble embeddedness of <32% with no annual value >37% in all areas where existing cobble embeddedness was >32%; a 5-yr mean of fine sediment by depth of <27% with no annual value >29% in areas where existing fine sediment by depth was >27%; all other locations must not exhibit increased sedimentation. * Maintain bank stability at 90% of "natural" levels * No other quantitative standards set for other habitat attributes.
<u>Logging</u> Standards	* No major logging allowed until the substrate standards for the interim objective are achieved, except small timber sales (houselogs, firewood, utility poles, etc) not requiring road construction, or until about 25% of the proposed sediment reduction measures have been implemented and the following are met: * Any logging prior to achievement of interim objective criteria must be based on the Forest Supervisor's review of monitoring data, and recommendations from forest hydrologists and fish biologists, scientists at the Forest and Range Experiment Station, conservation organizations, timber industry, concerned citizens, and tribal, state, and federal entities; timber sales are to be phased in with the first ones occurring in the lower SFSR with no road construction or reconstruction.

Table A. (cont'd) Summary--SFSRP from PNF LRMP (1988)

Logging Standards (cont'd)	* Any logging must be combined with sediment abatement in the affected area that reduces sediment delivery by at least the amount anticipated from the new land disturbance; * Meet minimum requirements of Idaho Forest Practices Act * Limit detrimental soil damage to <20% of activity area * Make "reasonable" effort to minimize sedimentation and adverse water quality impacts * On granitic slopes >60%: fully suspend yarded logs; retain 40-60% of natural basal area; do not log areas within 100 feet of perennial streams except where salvage is "absolutely necessary" * Allowed but not scheduled within riparian areas
Sched. Output	* Approximately 17 MMBF/decade of timber harvest on the PNF was scheduled under the LRMP, contingent on achieving documented improvement in the SFSR.
Grazing Standards	* Limit forage utilization to <66% * Livestock grazing limited to pack and outfitter animals and permitted allotments (Johnson Cr on BNF and Secesh R. basin on PNF) * Quantitative habitat/soil damage standards do not apply to grazing.
Roads Standards	* Substrate and sediment abatement standards do not apply to mining roads * Any new construction for logging contingent on achieving habitat improvement * Implement schedule of short- and long-term road management projects including drainage improvement, surfacing, relocation, and closures. * Until substrate standards are met, sediment delivery from logging roads must be offset by sediment abatement within the affected area * Construction parallel to streams is prohibited * Detailed S&Gs for hazardous material transport, winter access management, and a schedule of short- and long-term projects to reduce sediment delivery.
Mining	* Carte blanche. Reliance on BMPs and reclamation bonds, no firm standards apply
Recreation	* Not specifically addressed within aquatic context
Water withdrawals	* Quantify instream flow needs, file for federally reserved water rights, purchase water where necessary for forest administration. Instream flow needs primarily based on channel stability, timber, and federal trust responsibilities.
Aquatic Emphasis Watersheds	* Only deals with one watershed.
Roadless Areas	* Entry allowed after substrate improves, if expected sediment delivery can be fully offset. Initial logging activities are not to include road construction or reconstruction.

Table A. (cont'd) Summary--SFSRP from PNF LRMP (1988)

Cumulative Effects Strategy	* S&Gs and limitations on land disturbance do not apply to mining * Estimation and analysis of sediment delivery required for all proposed activities * Until objectives and substrate standards are met, sediment delivery from all proposed activities except mining must be fully offset
Monitoring	* Annual substrate monitoring required * Effectiveness and implementation monitoring required on all sediment abatement projects used to offset sediment delivery from proposed land disturbance
Restoration	* Strong emphasis on passive restoration from logging-related activities until substrate conditions show improvement and meet objectives * Lists specific active restoration efforts to reduce sediment delivery and instream sediment. Active restoration focus is mainly on treatment of road network. Also calls for direct removal of fine sediment from streams

Table B. Summary--BNF LRMP (1990)

Purpose	* Multiple use, commodity outputs and NFMA requirements.
Geographic Focus	* The Boise National Forest in central Idaho. Salmon-bearing watersheds include the upper 33% of the SFSR, and tributaries to the Middle Fork Salmon River including Bear Valley Cr
Objectives	* Meet commodity output forecasts but "maintain and improve" resources related to aquatic habitat and water quality conditions. Minimize water quality impacts. Objectives for fish habitat capability, amount of allowable soil damage, level of vegetation suppression vary with "riparian value class." SFSR objectives are the same as in the PNF LRMP
Riparian Reserves	* **Widths:** None set. * **Logging:** Scheduled on "extended rotation," but length undisclosed. Allows 10% reduction in original stream shade within 10 feet of perennial streams and 30% reduction in areas more than 10 ft from perennial streams. Open season on non-perennial streams. * **Grazing:** Allowed in all riparian zones identified as suitable. Until AMPs updated, forage utilization limited to <60% in areas in "satisfactory" condition and <45% in areas in "unsatisfactory" condition. Areas with slopes >60% are considered unsuitable for grazing. Stream shade standards do not apply * **Mining:** Relies on BMPs and reclamation plans. * **Roads:** New construction allowed, provided construction parallel to streams is avoided and fish passage provided at all new crossings. Requires 70% mitigation of sediment delivery from road construction. Maintain and improve roads to avoid or minimize water quality degradation.
Numeric Standards for Habitat Attributes	* None set, except for the SFSR (same as PNF LRMP)
<u>Logging</u> Standards	* Allows 10% reduction in original stream shade within 10 feet of perennial streams and 30% reduction in areas more than 10 ft from perennial streams. Vegetation removal not limited on non-perennial streams. * Limit estimated sediment delivery from logging-related activities to less than 20% over natural * Meet minimum requirements of Idaho Forest Practices Act * Scheduled within riparian areas on an undisclosed "extended rotation"
Sched. Output	* Annually: 850 MMBF from 10,300 ac forest-wide with about 470 ac/yr of logging in Bear Valley Creek and 1000 acres in the SFSR over 10 yrs contingent on habitat improvement.
<u>Grazing</u> Standards	* Allowed in all riparian zones identified as suitable. Until AMPs updated, forage utilization limited to <60% in areas in "satisfactory" condition and <45% in areas in "unsatisfactory" condition. Areas with slopes >60% are considered unsuitable for grazing. * Stream shading and sediment delivery standards do not apply. * Continuance **<u>not</u>** predicated on resource condition evaluation

Table B. (cont'd) Summary--BNF LRMP (1990)

Roads Standards	* Construction parallel to streams is prohibited * Allowed in riparian areas, but 70% of sediment delivery from construction must be mitigated and fish passage must be provided at all crossings * Pursue mitigation of existing road impacts prioritizing treatments of those adjacent to streams supporting fisheries * Obliterate or close **only** where "practical" transportation alternatives exist * Conduct road maintenance and improvement to minimize or avoid water quality impacts * Prohibit entry of sidecast snow or soil into waterbodies or 100-yr floodplains
Mining	* Relies on BMPs and reclamation bonds, no other standards apply
Recreation	* Not specifically addressed within aquatic context
Water withdrawals	* Quantify instream flow needs, file for federally reserved water rights, purchase water where necessary for forest administration. Instream flow needs primarily based on channel stability and timber needs.
Aquatic Emphasis Watersheds	* Not explicitly addressed. Watersheds with salmon habitat are generally scheduled for less logging and have a standard to constrain sediment delivery from logging-related activities to a lower level than watersheds without salmon.
Roadless Areas	* Scheduled entry into about 6.5% of inventoried roadless areas outside of wilderness areas (about 7350 ac/yr) forest-wide; entry into smaller roadless areas not included in this estimate
Cumulative Effects Strategy	* Continuance of existing mining and grazing not subject to resource condition or evaluation. Requires cumulative analysis only for **proposed activities** * Total **sediment delivery** is not constrained; sediment delivery standard applies only to logging-related activities, but not mining and grazing * Plans for programmed degradation of LWD and shading via riparian logging * No constraints on the amount of shade loss from grazing and mining * Does not use habitat standards to limit cumulative habitat degradation
Monitoring	* Sets implementation monitoring as a standard on at least 10% of "major" land-disturbing activities for BMP implementation * Effectiveness monitoring mentioned but not specified; approach is to be developed
Restoration	* Primary emphasis on structural habitat enhancement approaches, such as LWD addition * Lists specific active restoration efforts to reduce sediment delivery and instream sediment. Active restoration focus is mainly on road improvement, relocation, and obliteration; however, commits only to pursuing these where transportation alternatives exist

Table C. Summary--UGRRP (Anderson et al., 1992)

Purpose	* Address concerns over heavily degraded habitat conditions, likely additional degradation under WWNF LRMP, declining salmon populations, tribal treaty rights to take salmon, and conflicts between the WWNF and fishery co-managers over land management
Geographic Focus	* Upper Grande Ronde River in northeastern Oregon. Primarily directed at approximately 390 mi^2 area owned by the WWNF.
Fish Habitat Objectives	* Protect and restore salmon and steelhead habitat by reducing sediment delivery and water temperatures and increasing LWD sources. Primarily focuses on protection and re-establishment of riparian vegetation.
Riparian Reserves	* **Widths: Channelized streams (perennial, ephemeral, and intermittent):** Minimum of 75 horizontal feet times Strahler stream order measured from the outer edges of floodplains or from the outer edge of streams where floodplains are absent. On streams >4th order, 300 foot from the edges of floodplain is the minimum width. **Unchannelized ephemeral streams/"zero order" swales**: At least 25 ft on both sides of the longitudinal axis of the swale. * **Logging:** Prohibited, salvage included. * **Grazing:** Prohibited in riparian zones along reaches that do not meet all habitat standards and along all reaches in watersheds not meeting all habitat standards. * **Mining:** New activity prohibited, unless it can be accomplished without removing vegetation or disturbing soils. * **Roads:** Construction prohibited. Heavy emphasis on relocation, obliteration, re-vegetation, or improvement to reduce sediment delivery of existing roads. * **Recreation:** Construction of new facilities prohibited. Relocate areas posing problems.
Numeric Standards for Habitat Attributes	* **Substrate:** Maintain surface fines and fines by depth in channel substrate at less than 20% in salmon spawning habitat. Where conditions are lower than standards, maintain them. * **Water Temperature:** Achieve a decreasing trend in maximum summer water temperatures such that they are <61°F in small subwatersheds and <65°F in streams >6th order. Where summer water temperatures are less than standards, maintain them. Maintain minimum winter water temperature at >32°F in all perennial streams * **Turbidity:** Achieve a decreasing trend in turbidity. * **LWD**: Watershed average of at least 20 pieces of LWD per 1000 feet of stream; all pieces >1 foot diameter with minimum length >35 feet and at least 80% of these pieces with a diameter >1.67 feet. * **Meadow riparian vegetation:** At least 80% of banks covered with shrubs with at least 50% of shrubs >8 feet tall * **Floodplain and Riparian Vegetation:** Achieve 100% of plant composition and 90% ground cover naturally associated with each site. * **Pools:** Achieve an increasing trend in volume and depth. * **Width-to-depth ratios:** <10.
Logging Standards	* Must be preceded by monitoring of habitat conditions set as standards * If monitoring indicates that substrate conditions do not meet standards, logging must be preceded by sediment reduction measures that are expected to reduce sediment delivery equivalent to three times the amount expected from logging.

Table C. (cont'd) Summary--UGRRP (Anderson et al., 1992; 1993)

Logging Standards (cont'd)	* Prohibited within riparian reserves. * Prohibited within existing roadless areas until monitoring indicates an improving trend in habitat conditions. * Must not forestall compliance with habitat standards
Sched. Outputs	None set; outputs dependent on measurable progress towards habitat standards
Grazing Standards	* Allowed in riparian zones and uplands in watersheds that meet standards * Prohibited in riparian zones along reaches that do not meet standards and in all riparian zones in watersheds that do not meet standards until an improving trend occurs * Eliminate livestock access to spawning reaches from onset of spawning through incubation
Roads Standards	* Construction prohibited in riparian reserves; until habitat conditions exhibit an improving trend, road construction in roadless areas is prohibited * Must be preceded by monitoring of habitat conditions set as standards * If substrate standards are not met, road construction must be preceded by sediment abatement measures that are expected to reduce sediment delivery by an amount equivalent to three times the amount expected from road construction and use * Calls for obliteration of 10% of roads parallel to streams per year, upgrading existing roads within riparian areas to improve drainage and reduce sediment delivery, identifying problem roads, and treating 10% of the road network per year to reduce sedimentation and improve drainage * Reduce road density by closing or obliterating roads that will not be used within 10 years
Mining Standards	* Subject to same constraints as logging and road construction * Identify mining-related water quality problems within 1 year and begin ameliorating them * Mining plans must mitigate or eliminate water quality problems and protect riparian vegetation * Purchase problem areas and withdraw critical areas from mineral entry
Recreation Standards	* Construction of facilities subject to the same constraints as logging and road construction * Prohibits construction of new facilities within riparian areas * Calls for identification and relocation of all facilities forestalling attainment of standards within 5 years
Water Withdrawal	* Calls for establishment of water rights for instream flows
Cumulative Effects Strategy	* Addresses both on-going and proposed activities; requires that activities that forestall recovery in watersheds not meeting standards be suspended until recovery occurs (e.g., riparian grazing in degraded reaches or watersheds) * Constrains **sediment delivery** and mandates reductions in watersheds not meeting substrate standards. Where substrate standards are not met, new land-disturbing activities must be preceded by reductions in sediment delivery by an amount estimated to be equal to 3 times the amount estimated to result from the proposed land-disturbing activity * Stresses road obliteration, relocation, improvement, especially in riparian areas * Focus on passive restoration of riparian vegetation to reduce sediment delivery

Table C. (cont'd) Summary--UGRRP (Anderson et al., 1992) (cont'd)

Aquatic Emphasis Watersheds	***** Addressed one watershed.
Roadless Areas	***** No entry into roadless areas until there is a documented improving trend in downstream habitat. Roadless areas to serve as the anchor points for restoring aquatic resources.
Monitoring	***** Requires pre-project monitoring of all habitat conditions set as standards that could be potentially affected. ***** Calls for trend monitoring of conditions set as standards in representative reaches for effectiveness monitoring and adaptive management. Also notes key research needs.
Restoration	***** Passive restoration required where monitoring indicates that habitat standards are not met (e.g., suspension of riparian grazing and foregoing activities that can forestall improvement in habitat conditions not meeting standards) ***** Calls for active restoration to abate sediment via road closures, obliteration, re-vegetation, and improvement to reduce sediment delivery. Also calls for active restoration in advance of activities to offset sediment delivery expected from new activities in watersheds that do not meet substrate standards. ***** Does not explicitly comment on in-stream enhancement approaches, but stresses that natural recovery of ecological functions is preferable path to restoration.

Table D. Summary--Alternative 9 from FEMAT as Amended by USFS and USBLM (1994)

Purpose	* Lift existing injunction on logging within the range of the northern spotted owl, provide multiple use and commodity outputs, meet and comply with NFMA, ESA, and other laws.
Geographic Focus	* Federal lands within the range of the northern spotted owl. Includes approximately 38,200 mi^2 of federal land in California, Oregon, and Washington, primarily west of the Cascade Crest.
Fish Habitat Objectives	* Sets broad qualitative objectives under the ACS primarily to maintain the following habitat attributes/conditions within the natural range of variability: watershed complexity, connectivity, integrity and structure, water quality, sediment regime, hydrologic and material transfers, floodplain and wetland hydrology, composition and diversity of riparian vegetation complexes for thermal regulation and material transfers, habitat for well-distributed populations of riparian-dependent species.
Riparian Reserves	* **Widths:** All widths are interim and are subject to change after watershed analysis (WA). Interim widths: **perennial fish bearing streams**--slope distance of 300 ft, 2 site potential tree heights, or outer edge of 100-yr floodplain or riparian vegetation; **perennial streams without fish:** slope distance of 150 ft, 1 site potential tree ht, or outer edge of 100-yr floodplain or riparian vegetation **ephemeral and intermittent streams, wetlands <1 ac., unstable areas**--outer edge of unstable area, slope distance of 100 ft or 1 site-potential tree height, or outer edge of riparian vegetation; **lakes and natural ponds**-- slope distance of 300 ft. or 2 site potential tree height, or outer edge of riparian vegetation, seasonally saturated soil; **constructed ponds, reservoirs, wetlands > 1 ac.--** slope distance of 150 ft. or 1 site potential tree height, or outer edge of riparian vegetation, seasonally saturated soil, or maximum pool elevation * **Logging:** Allowed within interim widths, but must be preceded by WA. Salvage logging is allowed within ultimate reserve widths when deemed necessary to meet ACSOs * **Grazing:** Allowed. Continuance not contingent on WA or resource condition. Eliminate or modify if eventually identified as impeding attainment of objectives. * **Mining:** Allowed. New and existing mining not contingent on WA or resource conditions; can be inconsistent with ACSOs * **Roads:** "Minimized" construction allowed, if preceded by WA, except in inventoried (Rare II) roadless areas within "key" watersheds.
Numeric Standards for Habitat Attributes	* None set. Standards might be developed at the watershed scale in the future via watershed analysis
Logging Standards	* In "key" watersheds, must be preceded by WA * Restricted in LS/OG reserves and habitats of terrestrial species * Allowed, but not scheduled within interim riparian reserves, subject to completion of WA and broad management discretion. Salvage logging allowed within reserves where needed to meet ACSOs
Sched. Outputs	Approximately 1 billion BF/yr set as "probable" sale quantity

Table D. (cont'd) Summary--Alt.9 from FEMAT as Amended by USFS and USBLM (1994)

Grazing Standards	* No use limits set * Modify or eliminate, if eventually identified as impeding attainment of ACSOs * Continuation **not** predicated on WA or resource condition
Roads Standards	* Minimize construction in riparian reserves * Construction in riparian reserves must be preceded by WA, but not required to be consistent with ACSOs * Prohibited in inventoried Rare II roadless areas within key watersheds * Requires inventory, maintenance, and improvement to improve drainage and reduce sediment delivery on existing road system * Provide for fish passage at all road crossings * Calls for general reduction in road density over time via obliteration (not a standard). * Avoid hydrologic disruption and sediment delivery from roads * Determine road network effects on ACSOs via WA
Mining	* Reliance on BMPs, reclamation bonds and plans for mining likely to affect ACSOs; continuance of existing mining not contingent on WA or consistency with ACSOs * Locate outside of reserves where alternatives exist
Water Withdrawal	* Identify and require instream flows needed for fish passage, riparian resources, and channel conditions
Cumulative Effects Strategy	* Weakly addresses degradation caused by on-going grazing and mining; new and existing mining allowed to cause additional degradation * No firm constraints on **sediment delivery**. Although sediment delivery may eventually be reduced in some drainages, it can be increased by combined effects of additional logging and road construction * Does not use habitat standards to limit magnitude or duration of habitat degradation * Spatially restricts logging-related land disturbance in LS/OG and riparian reserves, roadless areas, and key watersheds, ultimate levels are partially contingent on both the results of WA and management discretion
Aquatic Emphasis Watersheds	* Establishes 164 key watersheds covering about 9.1 million ac. * New land-disturbing activities in key watersheds must be preceded by WA. Mining, road construction, and logging allowed subject to findings of WA, even within areas initially within interim riparian reserve widths. Prohibits road construction within inventoried RARE II roadless areas. On-going grazing and mining not contingent on completion of WA or resource conditions. * Selection criteria: need for connectivity, existing watershed condition, diversity of fish population, and level of risk of extirpation of endemic fish populations.
Roadless Areas	* Prohibits road construction in inventoried RARE II roadless areas in key watersheds * New logging and mining in inventoried roadless areas within key watersheds must be preceded by WA * Road construction and logging in uninventoried roadless areas (<5000 ac.) outside of key watersheds are not contingent on completion of watershed analysis * Roadless areas <5000 ac within key watersheds can be roaded after completion of WA in key watersheds

Table D. (cont'd) Summary--Alt. 9 from FEMAT as Amended by USFS and USBLM (1994)

Monitoring	* Monitoring approach not specified; emphasis on implementation monitoring * Approach to be determined after WA * Possible aquatic parameters for monitoring include pool and LWD attributes, fine sediment, temperature, channel morphology, and bank stability; no commitment made to monitor any of these habitat parameters
Restoration	* Passive restoration in riparian reserves pending WA * Predicated strongly on the assumption that the effects of active restoration focusing on the road network and interim protection of riparian reserves can outpace the combined impacts of continued land-disturbance at watershed and regional scales together with the persistent effects of existing watershed conditions * Slow rate of recovery of aquatic resources explicitly stated * Standard instream enhancement efforts should not be considered as a surrogate for protection or as mitigation for habitat damage

Table E. Summary--ESSPR (Henjum et al., 1994)

Purpose	* Provide interim recommendations for management guidelines to preserve management options and protect old-growth and aquatic, old-growth- and riparian-dependent species; supply Congress with information on old-growth systems and species dependent on them
Geographic Focus	* USFS lands in Oregon and Washington East of the Cascade crest.
Objectives	* Protect terrestrial and aquatic systems from further damage from forest management
Riparian Reserves	* **Widths (horizontal distance from edge of streams): Perennial streams**--at least 300 ft or to the outer edge of the 100-yr floodplain. **Ephemeral and intermittent streams, lakes, and wetlands**--at least 150 ft * **Logging:** "Restricted." Prohibited within Aquatic Diversity Areas (ADAs)(see below), fragile sites, steeper slopes, where sediment delivery is likely, or in roadless areas that are >1000 ac or biologically significant. Fuelwood cutting explicitly included. * **Grazing:** Restricted. Prohibited in degraded reaches until recovery is complete. Suspension of all grazing until adequate management and standards are incorporated into AMPs and resource status fully evaluated. * **Mining:** Not explicitly restricted. Prohibited on fragile sites, where sediment delivery to streams is likely, and in ADAs. * **Roads:** Restricted. Prohibited in fragile sites, where sediment delivery is likely, ADAs, and in roadless areas >1000 ac or biologically significant.
Numeric Standards for Habitat Attributes	* None set. Calls for development and establishment of ecologically relevant standards.
<u>Logging</u> Standards	* Restricted within riparian reserves. * Prohibit logging of all trees within LS/OG areas, >20 in. dbh, older than 150 yrs, or dominant or codominant ponderosa pine * Prohibited on slopes >30% in pumice soils and in all soil types on slopes >60%. On slopes of 30-60%, retain at least 40% of basal area including some of the larger trees within the original stand. * Prohibited in ADAs and roadless areas >1000 ac or that are biologically significant * Allowed only where peer-reviewed scientific study demonstrates that soils are protected, sediment will not be delivered to streams, and forest regeneration is assured.
Sched. Output	* Did not set outputs.
<u>Grazing</u> Standards	* Allowed only under management that protects riparian areas and where completed status evaluation indicates healthy status and no threat to health of LS/OG or ADAs. * Suspend until evaluation complete and management revised, including ecological standards * Prohibited in degraded riparian areas until recovery is complete * Recommended against reliance on forage utilization standards; calls for development of ecologically relevant standards

Table E. (cont'd) Summary--ESSPR (Henjum et al., 1994)

Roads Standards	* Construction prohibited in ADAs and roadless areas that are >1000 ac. or biologically significant * Restricted within riparian areas
Mining Standards	* Prohibited within ADAs * Prohibited on fragile sites unless peer-reviewed scientific study conclusively demonstrates that soil protection and forest regeneration are assured
Recreation Standards	* Not specifically addressed within aquatic context
Water Withdrawal	* Not addressed
Cumulative Effects Strategy	* Addresses both on-going and proposed activities, as well as current resource status. Constrains cumulative effects by spatially restricting mining, road construction, grazing, and logging in LS/OG areas, riparian reserves, roadless areas, ADAs, degraded reaches, steep slopes, and fragile and erosive sites. Also suspends grazing until conditions are evaluated and management has been altered and until recovery occurs in degraded areas. * Constrains **sediment delivery** by requiring that logging not occur except where documented that sediment delivery into streams will not occur; however, does not explicitly constrain cumulative sediment delivery * Cumulative damage not limited by measurable, in-channel habitat standards
Aquatic Emphasis Watersheds	* Recommends establishment of 90 ADAs covering about 2.4 million acres in Oregon as a starting point. Stresses need to establish ADAs in Washington, Idaho, and Montana * Mining, logging, road construction prohibited within ADAs. Grazing allowed **only** after status evaluation completed and indicates that grazing poses no threat to ADA health.
Roadless Areas	* Prohibits logging and road construction in roadless areas that are >1000 ac. or biologically significant
Monitoring	* Requires monitoring of trend and status of grazed areas prior to continuance of grazing. * Strongly recommends monitoring of trend and status, but approaches not specified. * A major priority of interdisciplinary scientific panels is the development of framework for monitoring and assessing ecological trends.
Restoration	* Emphasis on passive restoration via suspension of riparian grazing in degraded reaches, restricted land disturbance in roadless and riparian areas, fragile areas, and ADAs * Calls for active restoration to abate sediment via road obliteration and improvement. * Discourages use and reliance upon standard instream enhancement approaches * Recommends that active restoration proceed from headwaters downstream * Recommends against reliance on forage utilization standards to restore grazed areas * ADA network serves as primary initial step in regional approach to aquatic restoration * Development of coordinated restoration strategies is a major priority for interdisciplinary scientific panels. * Silvicultural restoration techniques should not be widely applied until approved by the recommended panels.

Table F. Summary--Coarse Screening Process (Rhodes et al., 1994)

Purpose	* Develop comprehensive, objective criteria for determining the consistency of proposed and on-going land-use activities with goals and policies of the ESA as applied to listed salmon in the Snake River Basin based on existing scientific information
Geographic Focus	* Watersheds containing critical salmon habitat in the Snake River Basin. However, due to high likelihood of rapid extirpation of many spawning populations, the process is recommended for application to adjacent river basins (John Day, Umatilla and Clearwater) to provide refugia for colonists to and from critical habitat.
Fish Habitat Objectives	* Ensure that the aggregate effect of land-use and existing watershed conditions results in improvement in salmon survival and natal habitat conditions * Determine the consistency of proposed and on-going activities with above objectives, based partially on existing habitat conditions * Provide a consistent management framework for modifying land management consistent with ESA mandates and policy for salmon habitat
Riparian Reserves	* **Widths: <u>All</u> streams**--slope distance of 300 ft as measured from the outer edge of the floodplain (or stream edge where floodplains are absent) or to the crest of the topographic divide, whichever is less. * **Logging:** Prohibited, including salvage. * **Grazing:** Allowed in some riparian zones in watersheds that meet all habitat standards provided monitoring is in place, evaluation of habitat condition has been completed, and riparian compatible management. Prohibited in: riparian zones in watersheds not meeting habitat standards, fragile meadows, where assessment of condition of habitat standards is incomplete, and where monitoring is not in place. * **Mining:** New mining not allowed unless it can be done without disturbing soils or vegetation. On-going mining may continue where all habitat standards are met, but in most cases it would be suspended where habitat standards are not met. * **Roads:** Prohibits new construction. Road obliteration, re-location, re-vegetation, and improvement to reduce sediment delivery and hydrologic alteration is a major priority for active restoration in watersheds not meeting standards.
Numeric Standards for Habitat Attributes	* **Substrate:** Average surface fine sediment <20% in spawning areas with no increase allowed when surface fine sediment is <20%. Average cobble embeddedness <30% in rearing areas with no increase allowed when cobble embeddedness <30%. Establish moratoria on ground disturbing activities and reduce sediment delivery via active restoration when standards are exceeded. * **Water temperature:** No activity allowed on any stream that can potentially increase water temperature. Achieve and maintain summer water temperatures at <60°F in historic salmon habitat. Reductions in shading prohibited. * **Pools and LWD:** Protection of riparian reserves set in lieu of a numeric target as a screening element. Achieve an improving trend in residual pool volumes and pool and LWD frequency. * **Bank stability:** Achieve and maintain 90% of all banks within a watershed in stable condition; where average bank stability exceeds 90%, allow no decrease.

Table F. (cont'd) Summary--Coarse Screening Process (Rhodes et al., 1994)

Logging Standards	* Allowed only outside of riparian and roadless reserves in watersheds that meet substrate and sediment delivery standards or have exhibited improving trends in substrate condition * No entry into roadless areas that are >1000 ac. or smaller roadless areas unless it can be demonstrated through peer-reviewed scientific study that it will not impede regional salmon restoration efforts nor foreclose management options * No other standards explicitly stated
Sched. Outputs	Not set, contingent on existing habitat conditions and improving trends
Grazing Standards	* Suspend until habitat conditions set as standards are monitored * Suspend in watersheds that do not meet substrate standards until standards are met or an improving trend is documented * Suspend in riparian reserves in watersheds where water temperature standard is not met until standard is met or an improving trend is documented. * Suspend within 0.5 tree heights of floodplain (or stream edge when floodplain absent) in watersheds where bank stability standard is not met until standard is met or an improving trend is documented * Allow in uplands and riparian areas in watersheds where all habitat standards are met provided: monitoring is in place and grazing management has been revised to be compatible with aquatic resources. * Eliminate access to streams during and after the onset of migration and spawning. * Do not rely on forage utilization standards solely for protection from livestock damage
Roads Standards	* No new road construction until 90% of habitats in managed watersheds either meet all habitat standards or exhibit improving trends * Prioritizes riparian roads for obliteration, relocation, revegetation, or improvement to reduce sediment delivery and hydrologic disruption in watersheds not meeting standards * Calls for general reduction in road density over time via obliteration (not a standard).
Mining Standards	* New activities prohibited in riparian reserves and roadless areas * In most cases, continuation not allowed in watersheds where standards are not met * Suspend operations until assessment of habitat condition is completed and indicates compliance with standards
Water Withdrawal	* Suspend issuance of all additional groundwater and surface water withdrawals in all watersheds with salmon habitat until studies are completed to determine flows needed by salmon for passage, spawning and rearing, and for restoration and maintenance of desirable habitat conditions, as well as regional cumulative effects on mainstem passage options, and that resulting flows will be adequate for all of these concerns. * Purchase or otherwise acquire instream flows needed for concerns above, where studies indicate existing flows are inadequate

Table F (cont'd). Summary--Coarse Screening Process (Rhodes et al., 1994) (cont'd)

Cumulative Effects Strategy	* Addresses all on-going and proposed land-disturbing activities; requires that all activities that potentially forestall recovery be suspended or deferred in watersheds not meeting habitat standards until recovery is documented; specific direction for specific activities provided contingent on resource condition * **Sediment delivery** from all anthropogenic sources constrained; reductions mandatory in all watersheds where substrate standards are not met or where total management-induced sediment delivery is estimated to be >20% over natural rates. No increase in sediment delivery allowed in other watersheds. * No additional land disturbance in riparian reserves and roadless areas until the bulk of managed watersheds recover * Uses habitat standards to trigger management changes to reduce cumulative effects via passive restoration. Habitat standards integrate natural and management-induced effects on habitat and salmon survival.
Aquatic Emphasis Watersheds	* Consistent with ESA, <u>all</u> watersheds with critical habitat are protected uniformly
Roadless Areas	* Prohibits entry into roadless areas >1000 ac. * Prohibits entry into smaller roadless areas unless it can be demonstrated through peer-reviewed scientific study that entry will not affect regional salmon restoration efforts nor foreclose management options * Prohibitions hold until >90% of habitats in managed watersheds either meet habitat standards or have exhibited an improving trend
Monitoring	* Monitoring specified. All habitat conditions set as standards must be monitored annually prior to continuing or initiating activities * Status and trend monitoring also required for riparian conditions and LWD and pool frequency and volume * Monitoring of habitat standards must be sufficient to detect change at a minimum detectable effect of 10% of initial value at $p<0.4$
Restoration	* Requires <u>complete</u> passive restoration in watersheds where habitat standards are not met * Active restoration is strongly recommended in watersheds not meeting standards; active restoration should focus on causes rather than symptoms of habitat degradation * Active restoration not treated as a surrogate for passive restoration in watersheds not meeting standards * Prohibits mechanical channel stabilization methods (e.g., riprap, gabions, etc.), pool excavation, and pool construction * Recommends that standard instream enhancement efforts (e.g. LWD addition) should be undertaken <u>only</u> where ecologically appropriate, sources of degradation have already been adequately addressed, and all other habitat conditions are amenable to salmon survival * Standard instream habitat enhancement efforts should never be considered as adequate surrogates for habitat protection or adequate mitigation for habitat damage

Table G. Summary--"PACFISH" (USFS and USBLM, 1995)

Purpose	* Develop interim recommendations for riparian areas pending completion of revised LRMPs for interior Columbia River Basin, arrest degradation under existing LRMPs, and comply with ESA
Geographic Focus	* Riparian areas in USFS and USBLM lands in watersheds with anadromous fish in Oregon, Washington and California outside of the range of the Northern Spotted Owl. Affects 15 national forests and 7 USBLM districts.
Objectives	* Maintain or restore: water quality, channel process and sediment regime, instream flows, wetland and riparian hydrology, riparian plant communities, LWD sources, thermal regulation, and aquatic habitat
Riparian Reserves	* **Interim widths (all distances are slope distances from the edge of streams): Fish-bearing, perennial streams:** 300 ft or 2 site-potential tree heights (hts), or outer edge of riparian vegetation or 100-yr floodplain. **Non-fish-bearing perennial streams, wetlands >1 ac, and lakes:** 150 ft or 1 site-potential tree hts, or outer edge of riparian vegetation or floodplain. **Ephemeral and intermittent streams, wetlands <1 ac, and landslide prone areas:** 100 ft or 1 site-potential tree height from the edge of the channel or feature in key watersheds; 50 ft or 0.5 site-potential tree ht in non-key watersheds. All widths are subject to unlimited revision by WA. * **Logging:** Allowed, but not scheduled. * **Grazing:** Allowed. Modify only where deemed "likely to adversely affect" critical habitat *and* inconsistent with RMOs. Continuation is not contingent on WA or RMO status * **Mining:** Allows new and on-going mining. Avoid siting within reserves where alternatives exist. Rely on BMPs and reclamation where aquatic damage likely. Modify on-going mining only when deemed "likely to adversely affect" critical habitat. Mining is not contingent on RMO status, condition evaluation, or WA. * **Roads:** Construction allowed even if inconsistent with RMOs, if preceded by WA
Numeric Standards for Habitat Attributes	* None set. Sets RMOs as "targets" rather than standards as follows: * **Pool Frequency:** 9-96 pools/mi depending on channel width * **Water Temperature (Highest annual 7-day moving average):** No measurable increase; <64°F in rearing and passage habitat and <60°F in spawning habitat * **LWD (length>35 ft and diam.>1 ft):** 20 pieces/mile * **bank stability:** >80%; applies only to non-forested systems * **bank angle:** >75% of all banks undercut; applies only to non-forested systems * **width-to-depth ratio:** <10
Logging Standards	* Applies to logging outside of RHCAs that are deemed likely to degrade RHCAs, but no specific constraints are provided * Allowed within interim riparian reserve widths if preceded by WA
Sched. Output	* Did not set outputs. May reduce outputs scheduled in LRMPs
Grazing Standards	* Modify or eliminate grazing in RHCAs only if determined to be likely to adversely affect habitat and retard RMO attainment. Evaluation of RMO status or resource condition not required continue of grazing

Table G. (cont'd) Summary–"PACFISH" (USFS and USBLM, 1995)

Roads Standards	***** The following applies only to roads within RHCAs or roads that may degrade RHCAs: ***** Construction allowed in key watersheds after completion of WA. WA not required prior to construction in non-key watersheds. Construction in RHCAs **not** required to be consistent with RMO attainment. ***** Prioritize for obliteration/closure only those roads not needed for future management. Does not require obliteration nor closure. ***** Avoid sediment delivery and hydrologic disruption by road construction ***** Determine, some time in the future, of the effects of roads on RMOs ***** Initiate management plan addressing construction, maintenance, and monitoring
Mining	* Provisions do not apply to on-going mining in RHCAs unless determined on a case-by-case basis to be likely to adversely affect habitat. Standards do not apply to mining outside of reserves unless deemed likely to degrade RHCAs The following apply to mining activities within RHCAs: ***** Avoid locating facilities only where alternatives exist ***** Rely on BMPs and reclamation bonds and plans where aquatic damage is likely to occur. ***** New and on-going mining does not have to be preceded by WA
Recreation Standards	***** Applies to activities within RHCAs or activities outside of RHCAs that may degrade them: manage facilities consistent with RMO attainment
Water Withdrawal	***** Not addressed--only calls for requiring instream flows needed for RMOs
Cumulative Effects Strategy	* Does not apply to on-going activities except those within RHCAs deemed on a "case-by-case" basis to pose unacceptable risks to salmon or habitats or to activities outside of RHCAs that may degrade RHCAs ***** Does not constrain **sediment delivery**; unlimited increases allowed in all watersheds ***** RMOs do not constrain the amount of damage done to vital habitat attributes ***** Roads in RHCAs allowed after completion of WA even if inconsistent with RMOs ***** New mining allowed in RHCAs prior to WA ***** No limit on increased road mileage in key watersheds
Aquatic Emphasis Watersheds	* None identified. Key watersheds to be identified in the future. In the interim, watersheds with critical habitat are treated as "key" ***** Logging and road construction within RHCAs in key watersheds must be preceded by WA; not required for activities in key watersheds outside of RHCAs or mining ***** Logging within riparian zones in key watersheds must be found to be consistent with RMOs; this does not apply to mining, road construction, or continued grazing
Roadless Areas	***** Does not treat roadless areas differently than other areas. Entry into roadless areas not contingent on completion of WA
Monitoring	***** None required, not even assessment of the disposition of RMOs. ***** Stresses implementation monitoring. Effectiveness monitoring may target most important issues. These issues are not identified.
Restoration	***** Regionalize efforts but rely on WA to identify opportunities. Recommends monitoring of restoration efforts for effectiveness.

Table H. Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
SFSRP (PNF, 1988)	Width determined by a 6 step process to meet objectives set at the project level. Generally includes area dominated by riparian vegetation.	Not scheduled within 100 of perennial streams. Non-salvage and salvage allowed. Scheduled on "some" intermittent streams. All logging contingent on improvement in habitat conditions or reductions in sediment delivery, and must have sediment delivery fully offset.	Allowed in riparian areas identified as suitable. Forage utilization limited to <66%; maintain bank stability at 90% of natural. Grazing in the SFSR is confined to outfitter and pack livestock except in Johnson Ck on BNF and Secesh R. Shading and soil standards do not apply to grazing.	Allowed in all areas not withdrawn for minerals, regardless of habitat conditions. New activities, including road construction not contingent on habitat improvement. Standards for sediment delivery and reduction, soils, and shading do not apply. No constraints on continuing activities.	New construction allowed. For logging roads, construction is contingent on improvement in habitat and reductions in sediment delivery, construction parallel to streams prohibited, and sediment delivery must be fully offset. No constraints or standards apply to construction for mining or private property access.
Evaluation	Inadequate, allows de-gradation. Area dominated by riparian vegetation often does not include area influencing riparian conditions, e.g. LWD recruitment. Objectives set at the project level may not result in widths adequate to protect thermal regulation, LWD recruitment, or sediment prophylaxis.	Inadequate. Allows degradation, but only after substrate conditions have improved. Offsetting sediment delivery may protect substrate from additional degradation, but may not prevent loss of thermal regulation, sediment prophylaxis, LWD sources. Failure to protect ephemeral streams allows cumulative degradation of fish habitat.	Inadequate, allows degradation of thermal regulation, sediment delivery and substrate, bank stability, and channel morphology. Forage utilization standards are of questionable utility, but allowed levels typically cause on-going degradation and prevent recovery. Grazing is a major problem in Johnson Ck on the BNF.	Inadequate, allows considerable degradation of all vital aspects of salmon habitat and the processes maintaining them. Existing mining is a major problem in many tributaries in the SFSR, e.g., Stibnite Mine.	Inadequate, allows degradation by logging roads, once substrate has improved. Offsetting sediment delivery from logging road construction may prevent substrate degradation but loss of LWD and thermal regulation likely. Mining roads allowed to cause severe degradation of all aspects of habitat.

Table H. (cont'd) Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
BNF LRMP (1990)	Does not establish reserves of any distance on any stream.	Allowed. Scheduled on an "extended rotation" (rotation length undisclosed) subject to following: limiting shade reduction to original shade by 10% within 10 feet of perennial streams and by 30% at distances >10 ft. Allows up to 20% of soils within activity area to be damaged. No constraints on non-perennial streams. Limit sediment delivery from logging activities to <20% O.N. in watersheds with salmon outside of SFSR.	Allowed and scheduled. Forage utilization limited to 45% in areas in "unsatisfactory" condition and 60% in areas in satis-factory condition. Shade reduction and soil damage standards do not apply.	Allowed. Only requires BMPs and reclamation plans for new mining activities likely to damage aquatic resources. No other standards apply.	Allowed. Construction of roads paralleling riparian areas prohibited. Requires fish passage at new road crossings, and 70% mitigation of sediment delivery from new roads. Conduct maintenance and operation to reduce sediment delivery from existing roads.
Evaluation	Inadequate, programs degradation. Does not commit to protecting vegetation or soils within any specified width.	Inadequate. Programs degradation of stream shading, LWD sources, bank stability, soils, hydrology, and thermal regulation. Sediment delivery constraints inadequate because not all sources of sediment delivery are addressed.	Inadequate, allows degradation of thermal regulation, substrate, bank stability, and channel mor-phology, regardless of condition. While utilization standards have little utility, allowed levels typically cause degradation and prevent recovery. Allows redd trampling	Inadequate, allows considerable degradation of all vital aspects of salmon habitat and the processes maintaining them.	Inadequate, allows degradation. Limiting sediment delivery from logging road construction only limits, but does not prevent, substrate deg-radation (if effective). Loss of LWD, and thermal regulation allowed. Mining roads allowed to severely de-grade all aspects of habitat.

Table H (cont'd). Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
UGRRP (Anderson et al., 1992)	**All channelized streams:** A horizontal distance of at least 75 ft times stream order, measured from the edge of the floodplain (or the edge of the stream where floodplains absent) up to 4th order; 300 ft minimum width on streams >4th order. **Un-channelized swales:** At least 25 feet horizontal distance from the long-itudinal axis of the swale.	Prohibited.	Allowed only where all habitat standards (e.g. temperature, etc.) are met at the reach and watershed scale. Suspend in reaches not meeting standards or in all reaches in watersheds not meeting all standards. Eliminate livestock access to spawning reaches at the onset of salmon migration through incubation period.	Prohibits new mining removing vegetation or disturbing soil. Requires suspension of on-going mining forestalling habitat improvement in watersheds not meeting standards.	Construction prohibited. Heavy emphasis on improvement, relocation, closure, or obliteration of existing roads. In watersheds not meeting substrate standards, sediment delivery from construction must be offset by a factor of 3 or construction deferred
Evaluation	On larger streams, protects all ecological vegetative functions (e.g., sediment prophylaxis, LWD recruit-ment) even as channels migrate across floodplains. Inadequately protects LWD sources, sediment prophylaxis, and shading on perennial and non-perennial streams <2nd order. Allows cumulative downstream degradation, although limited by sediment delivery constraints and fish habitat standards.	Adequate protection from logging on larger streams, even as channels migrate across floodplains. Inadequate protection of shading, sediment prophylaxis, thermal regulation and LWD sources on streams <2nd order may degrade larger streams. Substrate standards and sediment delivery constraints at the watershed scale ameliorate the potential for sediment damage to streams.	Adequate to protection of grazed reaches from continuing damage. Allows passive restoration in damaged systems. May not protect streams meeting standards. Allows restoration of bank stability on all streams. Prevents redd trampling.	Adequately protects larger streams from damage from new mining within reserves, but inadequate protection of smaller streams may allow cumulative degradation limited by sediment delivery constraints and habitat standards. Suspension of mining in watersheds not meeting standards allows passive restoration to begin in mining-affected reaches.	Adequate to prevent damage from construction along streams >2nd order, but inadequate pro-tection of vegetative func-tions along streams <2nd order may allow cumulative damage. Substrate standards and sediment delivery guide-lines limit potential damage by construction Active restoration of roads aids recovery.

Table H. (cont'd) Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Interim widths (slope dist. from edge of streams): **fish bearing streams:** 300 ft or 2 site potential tree hts, outer edge of 100-yr floodplain or riparian vegetation; **perennial streams without fish:** 150 ft, 1 site potential tree ht, or outer edge of 100 yr floodplain or riparian vegetation **non-perennial streams:** 100 ft, 1 site-potential tree ht, or outer edge of riparian vegetation.	Allowed subject to watershed analysis. salvage logging is allowed within revised widths when deemed consistent with ACSOs.	Allowed in all riparian zones regardless of status; continuation does not have to be preceded by WA. Modify or eliminate if eventually identified as impeding attainment of objectives. No limits on forage utilization or seasonality.	Allowed. New and on-going mining not required to be preceded by WA or to be consistent with ACSOs. Site outside of reserves only where feasible alternatives exist. Relies on BMPs and reclamation for activities likely to damage habitat.	Construction allowed, except in inventoried roadless areas in key watersheds. Construction must be preceded by WA, but does not have to be deemed consistent with ACSOs.
Evaluation	Interim widths adequately protect fish-bearing streams. Inadequate protection of sediment prophylaxis on perennial streams without fish and non-perennial streams may allow degradation. Sediment prophylaxis, LWD sources and thermal regulation may not be protected as floodplain channels shift. Ultimate protection depends on the final widths after revision.	Inadequate. Allows loss of thermal regulation, LWD, and increased sediment delivery if watershed analysis (WA) is not perfectly executed and fails to provide adequate reserve widths. WA lacks control criteria that can be used to avoid damage to damaged systems. Interim widths on non-perennial streams allow cumulative downstream degradation.	Inadequate, allows degradation of thermal regulation, sediment delivery, substrate, bank stability, and channel morphology in watersheds with grazing regardless of condition, until eventually identified as a problem.	Inadequate, allows considerable degradation of all vital aspects of salmon habitat and the processes maintaining them by new and existing mining.	Inadequate. In all areas except inventoried roadless areas in key watersheds, allows degradation by roads even when deemed inconsistent with ACSOs, regardless of resource status. Mining roads allowed to cause severe degradation of all aspects of habitat.

Table H. (cont'd) Comparison and Evaluation Summary: **Riparian Reserves**

Constraints on Activities within Reserves

Plan	Width	Logging	Grazing	Mining	Roads
ESSPR (Henjum et al., 1994)	**Perennial streams**--at least 300 ft horizontal distance or to the outer edge of the 100 yr floodplain. **Non-perennial streams, lakes, and wetlands**--at least 150 horizontal distance from the edge of feature.	"Restricted," including fuelwood cutting. Prohibited within Aquatic Diversity Areas (ADAs), fragile sites, on steeper slopes, where sediment delivery is likely, or in roadless areas that are >1000 ac or biologically significant.	Prohibited in degraded reaches until recovery is complete and in all other reaches until resource status fully evaluated and adequate management and standards are incorporated.	Not restricted outside of ADAs. Prohibited on fragile sites, where sediment delivery to streams is likely, in ADAs and roadless areas.	Restricted. Prohibited in fragile sites, where sediment delivery likely, ADAs, and roadless areas >1000 ac or biologically significant.
Evaluation	Adequately protects functions on perennial streams until channels shift in floodplains. Adequate protection of all vegetative functions except sediment prophylaxis on non-perennial streams; this can result in cumulative downstream degradation.	Where logging prohibited, adequately protects functions on perennial streams until channels shift across floodplains. However, "restrict" direction is too nebulous to evaluate. All ADAs and most roadless areas are completely protected from additional degradation from logging. Inadequate protection of sediment prophylaxis on non-perennial streams may be partially offset by constraints on logging in areas where sediment delivery is likely (See summary table and text)	Adequately protects all systems from additional degradation until assessments completed and management altered. Adequately assures that recovery of shading, LWD sources, bank stability, soils, riparian hydrology and other riparian functions is complete prior to risking additional damage. May not assure complete protection in non-degraded systems, depending on effectiveness of "improved" management and the ecological standards to be developed.	Inadequate. Although completely protects riparian areas from damage from mining in ADAs, failure to restrict mining in reserves outside of ADAs allows degradation. Direction for existing mining outside ADAs is too vague to evaluate.	Adequately protects riparian areas from damage from construction in areas where prohibited. Direction for other areas not specific enough to evaluate, with respect to both existing roads and construction. Inadequate protection of sediment prophylaxis on non-perennial streams allows cumulative downstream degradation, but may be ameliorated by standards addressing sediment delivery from roads. Adequately protects perennial streams until channels shift across floodplains.

Table H. (cont'd) Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
CSP (Rhodes et al., 1994)	**All streams:** 300 ft slope distance measured from the outer edge of the floodplain (or the edge of channels where floodplains are absent) or to the topographic divide, whichever is less	Prohibited until at least 90% of managed water-sheds either meet all habitat standards or exhibit a statistically significant improving trend over at least 5 years.	Allowed in watersheds meeting all habitat standards, with monitoring in place, completed evaluation of habitat condition, and revised to be compatible with protection of aquatic resources. Prohibited in watersheds not meeting habitat standards, areas with sandy soils lacking woody vegetation, where habitat assessment incomplete, or where monitoring not in place.	New mining not allowed unless it can be done without disturbing soils or vegetation. On-going mining may continue where all habitat standards are met, but it most cases it would be suspended where habitat standards are not met.	Construction prohibited Road obliteration, re-location, re-vegetation, and improvement to reduce sediment delivery and hydrologic alteration is a major priority for active restoration in watersheds not meeting standards.
Evaluation	Protects all functions on all segments of stream network, even after channels completely shift across floodplains. Additional degradation from new activities unlikely, but persistent effects from existing impacts within riparian zones may maintain degradation, even absent continuance of activities.	Adequately protects all functions important for habitat from incremental damage by logging on all streams, even after floodplains shift. May not completely protect against anthropogenically elevated sediment delivery during extreme events.	Adequately protects all streams from degradation until monitoring and assessment occurs. Assures recovery is initiated in degraded streams; protects sensitive meadow systems from de-gradation. May not pre-vent degradation in areas meeting standards under "improved" management but damage limited by monitoring requirements and habitat standards.	Adequately protects against damage within reserves from new mining. En-sures that damage from existing mining is not exacerbated by continuance in watersheds not meeting standards. May not pre-vent lagged damage from on-going mining, but limits the magnitude and duration via habitat standards and monitoring. Mining out-side of widths may in-crease sediment delivery.	Prevents additional damage to all ecological functions (even as channels shift) from construction within and outside of reserves. Watershed moratoria on land disturbance provides an incentive for aggressive treatment of road problems in damaged systems.

Table H. (cont'd) Comparison and Evaluation Summary: Riparian Reserves

Plan	Width	Constraints on Activities within Reserves: Logging	Grazing	Mining	Roads
Alt. 4 from PACFISH (USFS and USBLM, 1995)	Interim widths (slope distance measured from streams): **Fish-bearing, perennial:** 300 ft or 2 site-potential tree hts, outer edge of riparian vegetation or 100-yr floodplain. **Non-fish-bearing perennial:** 150 ft or 1 site-potential tree hts, outer edge of riparian vegetation or floodplain. **Non-perennial**: (key watersheds) 100 ft or 1 site-potential tree ht; (non-key) 50 ft or 0.5 site-potential tree ht. Widths subject to revision by WA. See text for unstable areas, wetlands and lentic waters	Allowed, but not scheduled. Logging allowed within interim widths if adjusted by WA or "site-specific analysis."	Allowed. Calls for modification only where on-going grazing deemed both "likely to adversely affect" critical habitat *and* inconsistent with RMO attainment. Continuation not subject to RMO status or condition evaluation.	New and continued mining allowed even when inconsistent with RMOs. Suggests siting elsewhere where feasible. Relies on BMPs and reclamation where aquatic damage likely. Not required to be preceded by WA. Standards apply to on-going mining only when deemed "likely to adversely affect" critical habitat; continuation is not predicated on RMO status, condition evaluation, or WA	Allowed if be preceded by WA; construction does not have to be consistent with RMOs. Consider obliteration of existing roads posing problems only where they are not needed for future logging or transportation alternatives exist.
Evaluation	Interim width adequate for vegetative functions on perennial fish-bearing streams until channels shift; inadequate protection on all other streams allows cumulative downstream degradation. WA or "site-specific" analysis can render all widths inadequate.	Logging within interim widths can cause degradation. Logging outside of interim widths on non-perennial streams allows cumulative downstream degradation via loss of LWD volume, thermal regulation, and sediment prophylaxis.	Inadequate, allows cumulative degradation because it only addresses individual activities that are determined to pose "unacceptable risk." Unlikely to allow recovery to be initiated in degraded systems. Allows redd trampling.	Inadequate, allows degradation of all habitat attributes.	Inadequate, allows degradation as soon as WA completed. Construction outside of interim widths can significantly increase sediment delivery and reduce LWD sources and cumulatively degrade downstream areas.

Table I. Comparison and Evaluation Summary: Numeric Habitat Standards

Plan	Habitat Standards	Activity Linkage	Evaluation
SFSRP (PNF, 1988)	**Fine sediment by depth:** 5-yr mean of <27% with no annual value >29% where existing fine sediment by depth was >27%. **CE:** 5-yr mean of <32% with no annual value >37% where existing CE was >32%; all other substrate standards must exhibit no increase in sedimentation. **Bank stability:** >90% of "natural" level. **Water Temperature (State standard):** max. daily average <48.2°F and max. daily <55.4°F during spawning period.	New, major **logging-related** disturbance contingent on meeting standards (with some loopholes (see text and summary table)). Does not apply to existing or proposed mining or grazing.	Substrate standards and approach have limited damage from logging and allowed some initial recovery, but appear inadequate to maintain recovery. Does not limit damage from mining and grazing. Substrate standards set at levels impairing salmon survival and rearing and were based on poorest conditions found in survey data from natural streams. Water temp. standards adequately protect salmon, but have limited linkage to grazing and mining.
BNF LRMP (1990)	None set except in the SFSR (Same as PNF LRMP).	None.	Damage of vital habitat attributes only limited by inadequate land management standards, as degraded habitat conditions in streams on the BNF attest.
UGRRP (Anderson et al., 1992)	**Surface fines and fines by depth:** <20% in salmon spawning habitat and maintain where lower. **Water Temperature:** decreasing trend in maximum summer water temperatures; <61°F in streams <6th order and <65°F in streams >6th order. Maintain summer water temperatures where less than standards. Minimum winter water temperature >32°F in all perennial streams. **Turbidity:** Decreasing trend. **LWD:** Watershed average of >20 pieces of LWD/1000 feet (diam. >1 foot and length >35 feet). **Meadow riparian vegetation:** >80% of banks covered with shrubs; >50% of shrubs >8 feet tall *** Floodplain and Riparian Vegetation:** 100% of plant composition and 90% ground cover naturally associated with each site. **Pools:** Increasing trend in volume and depth. **Width-to-depth ratio:** <10.	Pre-project monitoring of habitat standards required for all activities. Modify or eliminate all on-going activities forestalling recovery in watersheds not meeting standards and defer initiation of activities that forestall compliance with standards. Where substrate standards are not met, sediment delivery from any new activity must be offset by a factor of 3 or deferred.	Standards and approach limit amount of damage that can be caused and ensure that passive and active recovery is initiated in areas not meeting standards. Comprehensive standards set at levels conducive to salmon survival or maintenance of important attributes; Sediment reduction approach to new activities in watersheds not meeting substrate may retard recovery, especially if abatement measures are ineffective or sediment delivery estimates are awry.

Table I. (cont'd) Comparison and Evaluation Summary: Numeric Habitat Standards

Plan	Habitat Standards	Activity Linkage	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	None set. Sets broad, qualitative ACSOs to maintain attributes or conditions within the "natural" range of variability: watershed complexity, connectivity, integrity and structure, water quality, sediment regime, hydrologic and material transfers, floodplain and wetland hydrology, composition and diversity of riparian vegetation complexes for thermal regulation and material transfers, habitat for well-distributed populations of riparian-dependent species.	Linkages limited. Salvage logging in riparian reserves and final widths must be found consistent with ACSOs, but not road construction, new or on-going mining. Grazing can continue until deemed as impeding ACSOs. Monitoring of ACSO status not required. WA must determine effect of road system on ACSOs, but no action required.	Narrative ACSOs are extremely difficult to quantify or verify and subject to divergent interpretation. However, they can only be realized in watersheds in a natural condition. Damage from mining and road construction not limited by ACSOs due to lack of accountable linkage. Grazing damage can continue regardless of condition until identified as a problem in WA. Fails to set any approach for tracking effectiveness of protection. Interim reserve widths adequately protect LWD and shading, but road construction, mining and grazing damage allowed. Habitat attributes affected by watershed-scale processes, substrate and channel morphology, are not fully protected in the absence of standards.
ESSPR (Henjum et al., 1994)	None set. Calls for establishment of ecological relevant standards.	Grazing suspended until ecologically relevant standards are included as part of management. Biotic and ecologic monitoring deemed critical, but unspecified; to be developed by a scientific panel. Does not describe how ecological standards, once developed, would be used in land management.	Lack of measurable criteria may ham-per protection/restoration efforts. For instance, prohibits grazing in degraded areas until recovery occurs, but provides no criteria to identify degraded areas or evaluate recovery. Management guidelines for uplands limit potential for damage, but lack of criteria provide no means to assess or improve effectiveness. Lack of substrate standard is a weakness; sedimentation is a major problem. These omissions are of limited concern in ADAs and roadless areas where additional land disturbance from roads, mining, and logging is prohibited.

Table I. (cont'd) Comparison and Evaluation Summary: Numeric Habitat Standards

Plan	Habitat Standards	Activity Linkage	Evaluation
CSP (Rhodes et al., 1994)	**Surface fine sediment:** Average <20% in spawning areas with no increase allowed where <20%. **CE:** Average <30% in rearing areas with no increase allowed where <30%. **Water temp.:** Max. summer water temperatures at <60°F in historic salmon habitat. No activity allowed on any stream that can potentially increase water temperature. Reductions in shading prohibited. **Pools and LWD:** Protection of riparian reserves set in lieu of a numeric standard. Achieve an improving trend in residual pool volumes and pool and LWD frequency. **Bank stability:** >90% of all banks within a watershed in stable condition; where average bank stability >90%, no decrease allowed.	Detailed linkages. Monitoring required for all parameters set as standards prior to initiating or continuing land-disturbing activities. Where substrate standards not met, sediment reduction mandated via watershed scale moratorium on land disturbance and possibly, active restoration, until improvement is documented. Where other standards are not met, suspend or defer activities within riparian reserves that may potentially fore-stall recovery (See summary and text).	Substrate and temperature standards allow relatively unimpaired salmon survival and rearing and limit degradation, but may not require complete recovery to potential in some degraded systems, where temperature and fine sediment were once naturally lower. Degradation of existing conditions preempted. Assures initiation and measurable recovery in degraded systems. Standards integrate combined effects of natural- and management-induced habitat conditions. Standards may not be attainable in some systems, but assures that land management does not contribute to exacerbating naturally marginal habitat conditions.
Alt 4. of PACFISH (USFS and USBLM, 1995)	None set. "RMOs" set as "targets:" **Pools:** (9-96/mile) depending on width; **Water Temperature** (Highest annual 7-day moving average): No measurable increase; <64°F in rearing or passage habitat and <60°F in spawning habitat; **LWD**: (length>35 ft and diam.>1 ft): 20 pieces/mi; **bank stability**: >80% in non-forested streams; **bank angle**: >75% of all banks under-cut in non-forested streams; **width-to-depth ratio:** <10	Linkages limited. Applies only to activities within riparian reserves Salvage logging in riparian reserves and final widths must be found consistent with RMOs but not road construction, new and existing mining. Grazing allowed until identified as an impeding RMOs. Monitoring of RMOs status not required. WA must determine effect of road system on RMOs, but no action required.	RMOs for pools, LWD, and temperature are set a degraded levels that do not protect salmon survival. LWD and pools are highly insensitive indicators of aquatic trend and status. Allows small increases in water temperatures (provided they are unmeasurable in downstream habitat) that prevent recovery and cumulatively degrade systems. Bank angle has limited linkage to fish survival. None of the RMOs are adequate surrogate for substrate conditions, a major flaw given on-going activities within riparian areas, extremely weak controls on activities outside of RHCAs, and widespread substrate degradation in Snake River Basin habitats. Linkage between habitat status and effect on any management activity is extremely limited. Roads, mining, and grazing allowed to cumulatively degrade resources.

Table J. Comparison and Evaluation Summary: Logging Standards Outside of Riparian Reserves

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Any major logging is contingent on improvement in substrate conditions and must be combined with sediment abatement in the affected area that reduces sediment delivery by at least the amount anticipated from the new land disturbance. Meet minimum requirements of Idaho Forest Practices Act. Limit detrimental soil damage to <20% of activity area. Make "reasonable" effort to minimize sedimentation and adverse water quality impacts. On granitic slopes >60%: fully suspend yarded logs; retain 40-60% of natural basal area; do not log areas within 100 feet of perennial streams except where salvage is "absolutely necessary." **Scheduled Output:** Approximately 17 MMBF/decade of timber harvest on the PNF was scheduled under the LRMP, contingent on achieving documented improvement in the SFSR.	Requiring improvement in conditions prior to initiating disturbance together with mandatory offsetting of sediment delivery might protect systems depending on the effectiveness of sediment abatement measures and model veracity. Allows on-site degradation of soils and increased erosion once substrate conditions meet standards.
BNF LRMP (1990)	Sets same standards for SFSR as in PNF LRMP. Outside of SFSR, limit estimated sediment delivery from logging-related activities to less than 20% over natural and meet minimum requirements of Idaho Forest Practices Act. **Scheduled Output:** 850 MMBF/yr from 10,300 ac. forest-wide. Scheduled about 470 ac/yr of logging in Bear Valley Creek. Scheduled 1000 acres in the SFSR in the first decade contingent on habitat improvement. Entry into roadless areas scheduled.	Sediment delivery constraint does not adequately protect streams because it does **not** address total sediment delivery from all activities. Sediment delivery from upland logging and other sources allowed to degrade streams and prevent recovery in watersheds with degraded substrate conditions. Roadless area entry combined with inadequate protection of soils, vegetation, hydrology and streams makes it extremely likely that the extent of degraded areas will increase. On-site soil damage and increased erosion allowed.
UGRRP (Anderson et al., 1992)	Prohibited in roadless areas until an improving trend in habitat conditions occurs. Pre-project monitoring required for all parameters set as standards that could be affected by logging. Must not forestall compliance with habitat standards. In watersheds where substrate standards are not met, defer until improvement is documented, or precede with sediment abatement that reduces sediment delivery by at least 3 times the amount expected from logging. **Scheduled Output:** None set; outputs contingent on resource condition, compliance with standards, and habitat recovery rates.	Does not address upland soil and hydrologic modifications. Sediment delivery constraints provide some assurances that sediment delivery is reduced in watersheds with degraded substrate conditions. However, may not be effective if sediment abatement efforts or sediment delivery estimates are inadequate. While it does assure that efforts are made to reduce sediment delivery incrementally, it does not address a sediment delivery level that may be needed to allow recovery.

Table J. (cont'd) Comparison and Evaluation Summary: Logging Standards Outside of Riparian Reserves

Plan	Standards	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	In "key" watersheds and all inventoried roadless areas, must be preceded by WA. Uninventoried areas outside of key watersheds can be logged without WA. Logging restricted in LS/OG reserves and habitats for terrestrial species. **Scheduled Output:** Approximately 1 billion BF/yr set as "probable" sale quantity.	Does not address soil or hydrologic modifications; however, these might be addressed by WA. Failure to make logging contingent on aquatic/watershed condition or trend may allow cumulative degradation in some watersheds. Entry into smaller roadless area increases the risk to aquatic and riparian habitat (USFS et al., p. V-51, 1993). Restrictions on logging in LS/OG reserves reduces risks to watersheds.
ESSPR (Henjum et al., 1994)	Prohibits logging of all trees within LS/OG areas, >20 in. dbh, older than 150 yrs, or dominant or codominant ponderosa pine. Prohibited on slopes >30% in pumice soils and in all soil types on slopes >60%. On slopes of 30-60%, retain at least 40% of basal area including some of the larger trees within the original stand. Prohibited in ADAs and roadless areas >1000 ac or that are biologically significant. Allowed only where peer-reviewed scientific study demonstrates that soils are protected, sediment will not be delivered to streams, and forest regeneration is assured. **Scheduled Outputs:** Not set.	Completely protects ADAs and most larger roadless fragments from additional damage from future logging. Detailed guidance for uplands limits soil damage and cumulative degradation outside of ADAs, but possibly not to levels that prevent cumulative degradation. Sediment delivery approach will only be as effective as the veracity of the peer reviews. Spatial constraints on logging ameliorate disturbance levels and attendant aquatic damage.
CSP (Rhodes et al., 1994)	Pre-project monitoring required for all habitat parameters set as standards that could be affected. Allowed only outside of riparian and roadless reserves in watersheds that meet substrate and sediment delivery standards or have exhibited improving trends in substrate condition. Where substrate standards are met, logging must be combined with sediment abatement that fully offsets expected sediment delivery from logging being fully offset. Prohibited in roadless areas that are >1000 ac. or in smaller roadless areas unless it can be demonstrated through peer-reviewed scientific study that it will not impede regional salmon restoration efforts nor foreclose management options. No other standards explicitly stated. **Scheduled Output:** None set; outputs dependent on resource condition, compliance with standards, and rates of recovery.	Fails to address damage to soils, vegetation, and hydrology in uplands. Also fails to address specific logging practices that may damage systems, including logging in sensitive terrain. These failures may allow cumulative degradation in systems meeting standards outside of roadless areas. Spatial constraints provide some assurance that extent of degradation does not increase. Habitat standards limit the habitat damage possible from upland logging and require that some recovery occurs prior to subjecting watersheds to further devegetation. Prevents additional degradation by logging in areas not meeting standards. Fully protects roadless areas and constrains the spatial extent of degradation, at least, until most habitats in managed watersheds improve.

Table J. (cont'd) Comparison and Evaluation Summary: Logging Standards Outside of Riparian Reserves

Plan	Standards	**Evaluation**
Alt 4. of PACFISH (USFS and USBLM, 1995)	Standards only apply to activities deemed on a case-by-case basis to adversely affect fish habitat or to degrade RHCAs. Which standards may apply is vague.	Continued degradation possible. Logging outside of specified reserve widths may increase sediment delivery to stream network, especially along smaller perennial streams and non-perennial streams; the extent and intensity of such damage is not limited by a substrate standard. Entry into roadless areas combined with inadequate protection measures promises to increase the spatial extent of habitat degradation.

Table K. Comparison and Evaluation Summary: Grazing Standards

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	**Riparian Zones:** Allowed in all deemed suitable. Continuation **not** contingent on resource status, completion of status evaluation, or monitoring. Maintain bank stability at 90% of "natural" levels. Limit forage utilization to <66%. **Uplands:** Same standards apply.	Inadequate. Allows redd trampling and degradation of soils, vegetation, water quality, stream channels, and vital aspects of habitat (pools, substrate, water temperature, etc.). Bank stability target represents degraded state, but continued grazing is not contingent its status. Allowed utilization levels typically cause degradation and preclude recovery in degraded systems. Suitability criteria are not sound. Grazing in the watershed of Johnson Cr. on the BNF under this approach has contributed to maintaining significant habitat degradation, attesting to the inadequacy of the approach.
BNF LRMP (1990)	**Riparian Zones:** Allowed in all deemed suitable. Continuation **not** contingent on resource status, completion of status evaluation, or allotment monitoring. Until allotments are updated, limit forage utilization to <60% in areas in "satisfactory" condition and to <45% in areas in "unsatisfactory" condition. Season-long grazing is prohibited, but no other seasonal restrictions on use; no other standards apply regarding damage. **Uplands:** Slopes <60% are not suitable for grazing. Continuance not contingent on resource status or completion of evaluation. Limit forage utilization to <65% in areas in "satisfactory" condition and to <55% in areas in unsatisfactory condition.	Inadequate. Allows redd trampling and degradation of soils, vegetation, water quality, stream channels, and vital aspects of fish habitat Allowed utilization in uplands and riparian zones allow degradation of soils, vegetation, and hydrology contributing to cumulative effects and precludes recovery in degraded systems. Does not soundly assess area suitable for grazing. Lack of habitat standards and failure to make grazing contingent on resource status allows damage limited only by the extent of allotments and livestock behavior. "Satisfactory" and "unsatisfactory" conditions undefined. Poor stream conditions in grazed watersheds on the BNF attest to the inadequacy of the approach.
UGRRP (Anderson et al., 1992)	**Riparian Zones:** Continuance is contingent on resource status. Allowed only along reaches meeting standards within watersheds that meet standards. Suspended in other reaches and in all reaches in watersheds not meeting standards. Does not provide utilization standards, but requires revision of allotments to be consistent with protection and recovery. Prohibits livestock access to spawning reaches during salmon migration and incubation periods. Monitoring of allotments required. **Uplands:** No explicit direction given, but directs that activities that forestall recovery should not be allowed nor continued in watersheds not meeting standards.	Protection of riparian resources in degraded areas adequate to allow recovery to begin. Prevents trampling of redds. Includes cumulative effect context with respect to riparian grazing, but continued upland grazing may impede recovery of substrate conditions in watersheds where substrate standards are not met; upland soil, vegetation, and hydrologic impacts may contribute to downstream cumulative effects. Continued riparian grazing in watersheds meeting all standards may allow degradation, but standards limit the amount of degradation. Prevents livestock trampling of redds.

Table K. (cont'd) Comparison and Evaluation Summary: Grazing Standards

Plan	Standards	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	**Riparian zones:** No use limits set; interim forage utilization standards in LRMPs probably hold (<45% in riparian zones in unsatisfactory condition; <55% in areas in "satisfactory" condition). Continuation **not** contingent on resource status, completion of WA, or monitoring. Modify or eliminate, if eventually identified as impeding attainment of ACSOs. No seasonal restrictions. **Uplands:** No standards apply.	Inadequate. Allows redd trampling and continued degradation in all riparian zones currently subjected to grazing, until eventually identified impeding ACSOs. LRMP forage utilization standards allow continued riparian degradation and preclude recovery in degraded systems. Upland utilization levels allow vegetation damage contributing to downstream cumulative effects. Does not soundly assess grazing suitability.
ESSPR (Henjum et al., 1994)	**Riparian zones:** Allowed only under management that protects riparian areas, where completed evaluation indicates healthy status and no threat to health of LS/OG or ADAs. Suspend until evaluation complete and management revised, including ecological standards. Prohibited in degraded riparian areas until recovery is complete. Recommends against reliance on forage utilization standards; develop of ecologically relevant standards. **Uplands:** Not explicitly addressed.	Adequate to allow recovery to begin and proceed in degraded reaches via suspension, although this may be hampered by lack of criteria for degraded reaches. Suspension of riparian grazing until status assessments are completed prevents continuing damage. May not protect undegraded systems depending on effectiveness of grazing management and ecological standards used. Upland direction is too ambiguous to evaluate.
CSP (Rhodes et al., 1994)	**Riparian Zones:** Continuance contingent on resource status, completed watershed scale assessments, and monitoring. Allowed only in some riparian reserves in watersheds where completed assessment indicates that all habitat standards are met and monitoring is in place. Prohibited in seasonally-saturated riparian areas with non-cohesive sandy soils and no woody vegetation. Suspend in riparian reserves in watersheds where water temperature standard not met and within 0.5 tree heights of floodplain (or stream edge when floodplain absent) in watersheds where bank stability standard not met until standards met or an improving trend is documented. Suspend until grazing management revised to be compatible with aquatic resources. Eliminate access to streams during the period from salmon migration through incubation. Do not rely on utilization standards as an adequate measure of protection. **Uplands:** Allowed where monitoring completed and substrate standards are met. Suspend in watersheds not meeting substrate standards until standards met or an improving trend documented via monitoring.	Ensures grazing damage does not continue and recovery occurs unimpeded in degraded systems. Habitat standards cover attributes most likely to be affected by grazing. May not protect systems that meet standards from continuing damage from grazing, but damage is limited by standards. May not allow complete recovery in systems that have the potential for habitat attributes superior to the standards. Does not completely assess grazing suitability, but prohibits grazing in wet meadows where grazing typically causes damage. Upland restrictions assure that upland grazing does not forestall improvement in systems that do not meet substrate standards. Failure to address use levels in uplands may allow cumulative degradation limited only by habitat standards.

Table K. (cont'd) Comparison and Evaluation Summary: Grazing Standards

Plan	Standards	Evaluation
Alt 4. of PACFISH (USFS and USBLM, 1995)	**Riparian zones:** Continuance not contingent on resource status, assessment completion, or monitoring. No quantitative or qualitative guidelines on grazing in or outside of riparian reserves. Modify or eliminate on-going grazing only once it has been determined **on a case-by-case basis** that it is likely to adversely affect habitat or degrade RHCAs. **Uplands:** Does not apply to grazing outside of riparian reserve widths until some unspecified evaluation determines that it is likely to degrade RHCAs or adversely affect habitat.	Inadequate. Continued degradation of most major habitat attributes likely. "Case-by-case" approaches involves considerable delays in assessment while potentially damaging grazing continues. This approach promotes segmentation and avoids cumulative assessments. Damage not limited by habitat standards. Upland grazing likely to contribute to downstream cumulative effects especially with respect to sediment and hydrologic modification, unchecked by substrate standards. Damage allowed in all manner of systems regardless of resource condition. Allows redd trampling.

Table L. Comparison and Evaluation Summary: Roads Standards

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Construction for mining unconstrained by substrate and sediment abatement standards. Logging road construction contingent on substrate improvement. Implement short- and long-term road management projects on existing road network. Until substrate standards are met, sediment delivery from logging roads must be offset by sediment abatement within the affected area. Allowed within riparian areas, though, construction parallel to streams is prohibited. Allowed in roadless areas. No requirement to reduce road mileage, although likely under sediment delivery constraints. Detailed S&Gs for hazardous material transport and winter access management.	Riparian protection from road construction is inadequate and allows loss of stream shading, LWD sources, thermal regulation, sediment detention, and hydrologic function, although only after substrate improves. Damage from new mining roads limited only by market factors. Road mileage reduction is not required. Entry into roadless areas after substrate improves may undermine restoration recovery. Effectiveness of efforts to offset sediment from logging road construction is a function of sediment delivery estimation accuracy and sediment abatement effectiveness.
BNF LRMP (1990)	Construction parallel to streams is prohibited. Allowed in riparian areas, but 70% of sediment delivery from construction must be mitigated and fish passage must be provided at all crossings. Pursue mitigation of existing road impacts prioritizing roads adjacent to streams supporting fisheries. Obliterate or close **only** where "practical" transportation alternatives exist. Improve and maintain roads to minimize or avoid water quality impacts. Prohibits entry of sidecast snow or soil into waterbodies or 100-yr floodplains. Allowed in roadless areas. No limit on road mileage.	Inadequate. Road construction in riparian areas allows loss of LWD, thermal regulation, sediment detention, and hydrologic function and increases in sediment delivery. Calls for programmed degradation of water quality and habitat by mitigating only a fraction of sediment delivery from new road construction. Construction in roadless areas promises to increase extent of degradation.
UGRRP (Anderson et al., 1992)	Construction prohibited in riparian reserves. Until habitat conditions exhibit an improving trend, road construction in roadless areas is prohibited. Requires pre-project monitoring of habitat conditions set as standards. If substrate standards are not met, construction must be preceded by sediment abatement measures that reduce sediment delivery by an amount equivalent to 3 times that expected from construction and use. Calls for obliteration of 10% of roads parallel to streams per year, treating roads within riparian areas to improve drainage and reduce sediment delivery, and treating 10% of the road network per year to reduce sedimentation and improve drainage. Calls for reduction in road density by obliterating and closing roads that will not be used within 10 years.	Adequately protects riparian and roadless reserves from additional damage by road construction. Aggressive road obliteration approach is likely to allow recovery to occur. In watersheds not meeting substrate standards, allowed road construction in uplands may retard substrate recovery depending on the effectiveness of sediment abatement efforts and veracity of models, but, if effective, approach could prevent exacerbation of cumulative effects. In watersheds meeting standards, upland road construction along 1st and 2nd order streams likely to cause cumulative degradation due to reserve widths inadequate to protect against increased sediment delivery, although limited by substrate standards.

Table L. (cont'd) Comparison and Evaluation Summary: Roads Standards

Plan	Standards	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Construction allowed in riparian reserves, if preceded by WA, even if inconsistent with ACSOs. "Minimize" construction in riparian reserves. Prohibited in inventoried roadless areas within key watersheds, but allowed in smaller roadless areas. Prohibits increase in road mileage in key watersheds. Requires inventory and maintenance to improve drainage and reduce sediment delivery. Provide for fish passage at all crossings. Avoid hydrologic disruption and sediment delivery from roads. Determine road network effects via WA.	Degradation may continue from both new and existing roads, although less likely in key watersheds. Damage not limited by habitat standards and allowed even where inconsistent with ACSOs. Degradation via increased sediment delivery greatest along smaller channels where riparian reserve width is insufficient to buffer streams from accelerated sedimentation. Road treatment direction is too vague to evaluate.
ESSPR (Henjum et al., 1994)	Construction prohibited in ADAs and roadless areas that are >1000 ac. or biologically significant. "Restricted" within riparian areas.	Protects ADAs and roadless areas from risks of degradation by road **construction**, but direction on existing roads in ADAs is too vague to evaluate. "Restricted" construction in riparian reserves may allow degradation outside of ADAs.
CSP (Rhodes et al., 1994)	Construction prohibited until >90% of managed watersheds either meet all habitat standards or measurably improve. Prioritize riparian roads for active restoration in watersheds not meeting standards.	Completely protects all habitats from additional degradation from road construction. Assures that no increase in mileage, until the most watersheds improve. Moratorium on land disturbance at the watershed scale in areas not meeting substrate standards provides incentive to undertake sediment abatement on roads. Direction on road construction once habitats improve is too vague to evaluate.
Alt 4. of PACFISH (USFS and USBLM, 1995)	Construction for logging allowed in RHCAs if preceded by WA, even if inconsistent with RMOs. Applies outside of RHCAs only where deemed likely to degrade RHCAs and is **not** contingent on RMO status, condition evaluation, or WA. Modify existing roads only when deemed "likely to adversely affect" critical habitat; no provisions given for modifications. The following applies within RHCAs: prioritize for obliteration **only** those roads unneeded for management. Avoid hydrologic disruption and sediment effects and determine, some time in the future, the effects of current road network on RMOs. Initiate a plan to address road maintenance, construction, and monitoring. Standards do not apply to mining road construction.	Inadequate. Allows degradation of major habitat attributes from construction unchecked by habitat standards or resource condition. WA may limit the rate of degradation in RHCAs. Upland construction can cause degradation from increased sediment delivery to ephemeral channels due to inadequate RHCA. Increase in extent and intensity of degradation likely. Application of standards to existing roads in RHCAs and road construction outside of RHCAs is a matter of judgement; no clear quantitative criteria provided. "Case-by-case" approach may promotes segmentation and avoids assessment of cumulative effects. Focusing obliteration efforts on unneeded roads rather than those degrading habitat may hamper restoration. Mining roads allowed to degrade every aspect of habitat. Failure to constrain sediment delivery from roads is a major flaw, because road-related sedimentation is major cause of habitat degradation in the Snake River Basin.

Table M. Comparison and Evaluation Summary: Mining Standards

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Allowed in all areas not withdrawn. Relies solely on BMPs and reclamation bonds. Standards for land-disturbance and sediment delivery applied to logging do not apply to mining.	Inadequate, allows degradation of soils, vegetation, water quality, stream channels, and vital aspects of fish habitat (pools, substrate, cover, water temperature, etc.) by both new and existing mining activities unconstrained by land use or habitat standards. Mining allowed to undermine other aspects of the plan and its limited initial effectiveness.
BNF LRMP (1990)	Allowed in all areas not withdrawn. Relies solely on BMPs and reclamation bonds. Standards applied to logging (stream shading, soil damage, sediment delivery etc.) do not apply to mining.	Inadequate, allows degradation of soils, vegetation, water quality, stream channels, and vital aspects of fish habitat unconstrained by land use or habitat standards. Historic mining in Bear Valley Creek was a major factor in its continued degradation (Rhodes et al., 1994).
UGRRP (Anderson et al., 1992)	Prohibits new mining that disturbs soil or removes vegetation within riparian and roadless reserves. In watersheds that do not meet substrate standards, sediment delivery expected from new mining must be offset by a factor of 3 by active sediment abatement in advance of the activity. Discontinue or defer where it forestalls recovery in watersheds that do not meet habitat standards until recovery occurs. Identify mining-related water quality problems within 1 year and make efforts to ameliorate those problems. Mining plans must mitigate or eliminate water quality problems and protect riparian vegetation. Purchase problem areas and withdraw critical areas from mineral entry.	Adequately protects areas within riparian and roadless reserves from additional damage from new mining. In watersheds not meeting substrate standards, upland mining may retard recovery depending on effectiveness of sediment abatement efforts and model veracity. In watersheds meeting standards, upland mining may increase sediment delivery due to inadequate reserve widths on streams <2nd order streams resulting in cumulative degradation, limited by substrate standards. Suspension of mining forestalling recovery may allow recovery to occur in degraded systems, although criteria for identifying these activities is lacking.
Alt. 9 of FEMAT (USFS and USBLM, 1994)	New mining allowed in all areas not withdrawn. New and on-going mining is not contingent on completion of WA or effect on ACSOs. Rely on BMPs and reclamation bonds and plans for mining likely to affect ACSOs. Locate outside of riparian reserves only where alternatives exist.	Inadequate. Allows degradation of all major habitat attributes in all areas not withdrawn from mining, unconstrained by resource conditions, habitat standards, or ACSOs from both on-going and new mining.
ESSPR (Henjum et al., 1994)	Prohibited within ADAs. Prohibited on fragile sites unless peer-reviewed scientific study conclusively demonstrates that soil protection and forest regeneration are assured. Allowed in riparian reserves and roadless areas.	Completely protects ADAs and roadless areas from degradation by **new** mining activities, but direction on degradation from existing mining outside of ADAs and roadless areas is vague. Mining within roadless and riparian areas allows degradation.

Table M. (cont'd) Comparison and Evaluation Summary: Mining Standards

Plan	Standards	Evaluation
CSP (Rhodes et al., 1994)	New activities prohibited in riparian reserves and roadless areas. New and on-going activities contingent on resource status and completion of assessments indicating standards are met at the watershed scale. Sediment delivery from new mining in watersheds meeting standards must be fully offset by active sediment abatement measures. In most cases, continuation not allowed in uplands and reserves where standards are not met. Suspend on-going mining in watersheds not meeting sediment delivery or substrate standards until the standards are met or an improving trend is documented.	Completely protects riparian reserves and roadless areas from additional damage from new mining. Ensures that damaging mining does not continue; attempts to prohibit increased sediment delivery from new mining, although success depends on effectiveness of sediment abatement measures and model veracity. Although it may allow recovery processes to begin in damaged systems, recovery from mining will be slow due the nature of mining impacts. Active restoration/rehabilitation direction for on-going/historic mining is too vague to evaluate.
Alt 4. of PACFISH (USFS and USBLM, 1995)	New and on-going mining allowed within in all areas not withdrawn from mineral entry including RHCAs, key watersheds, and roadless areas. New and on-going mining are not contingent on completion of WA, consistency with RMOs, or resource status. Direction does not apply to mining outside of RHCA unless determined likely to degrade RHCAs. Suggests avoidance of siting new activities within RHCAs **only** where feasible. Relies on BMPs and reclamation where aquatic damage likely. New and on-going mining are not required to be consistent with RMOs.	Inadequate. Allows continued degradation of most major habitat attributes from new and on-going mining, unconstrained by RMOs, habitat standards, or resource conditions. Allows increase in extent and intensity of degradation from new mining in all areas subject to mining.

Table N. Comparison and Evaluation Summary: Water Withdrawals

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Quantify instream flow needs, file for federally reserved water rights, purchase water as needed for necessary to forest administration. Instream flow needs primarily based on channel stability, timber needs, and treaty-protected fisheries.	Vague and inadequate. May allow additional groundwater and surface water withdrawals absent full assessment of effects in tributaries and, especially, in mainstem. May allow additional cumulative downstream flow reduction. Fails to include direction to acquire instream flows where needed for salmon and habitat maintenance.
BNF LRMP (1990)	Quantify instream flow needs, file for federally reserved water rights, purchase water as needed for forest administration. Instream flow needs primarily based on channel stability and timber needs.	Vague and inadequate. May allow additional groundwater and surface water withdrawals absent full assessment of effects in tributaries and, especially, in mainstem. May allow additional cumulative downstream flow reduction. Fails to include direction to acquire instream flows where needed for salmon and habitat maintenance.
UGRRP (Anderson et al., 1992)	Convert instream flows to water rights.	Vague and inadequate. May allow additional withdrawals prior to full assessment of existing flows and needs, including effects on mainstem. Allows groundwater withdrawals that can cumulatively reduce low flows and increase the extent and intensity of summer water temperatures problems.
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Identify and require instream flows needed for fish passage, riparian resources, and channel conditions.	Vague. May allow additional withdrawals prior to full assessment of existing flows and needs, including effects on mainstem. Allows groundwater withdrawals that can cumulatively reduce low flows and increase the extent and intensity of summer water temperatures problems.
ESSPR (Henjum et al., 1994)	Not addressed.	Allows exacerbation of low flow problems throughout the affected area, including cumulatively lower flows on the mainstem.
CSP (Rhodes et al., 1994)	Suspend issuance of all additional groundwater and surface water withdrawals in all watersheds with salmon habitat until studies are completed to determine flows needed by salmon for passage, spawning and rearing, and for restoration and maintenance of desirable habitat conditions, as well as regional cumulative effects on mainstem passage options, and that resulting flows will be adequate for all of these concerns. Purchase or otherwise acquire instream flows needed for concerns above, where studies indicate existing flows are inadequate.	Adequately protects against reduced flows in tributaries and mainstem and specifically addresses groundwater. However, ultimate effectiveness of protection depends on the quality of the assessments.

Table N. (cont'd) Comparison and Evaluation Summary: Water Withdrawals

Plan	Standards	Evaluation
Alt 4. of PACFISH (USFS and USBLM, 1995)	Suggests requiring instream flows needed for RMOs.	Inadequate. Allows withdrawals of groundwater and surface water to worsen low flow problems. Provides inadequate direction to acquire flows where flows are currently inadequate.

Table O. Comparison and Evaluation Summary: Cumulative Effects Strategy

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Logging-related activities constrained by a combination of substrate and land management standards that do not apply to mining or on-going grazing. Estimation and analysis of sediment delivery required only for all proposed activities. Until substrate standards are met, sediment delivery from all proposed activities except mining must be fully offset. Includes measures to reduce erosion and sediment delivery from existing roads. Focuses almost solely on erosion from logging-related activities. Entry into roadless areas allowed contingent on improvement in substrate conditions.	Inadequate. Although approach was initially effective in allowing substrate recovery, it allows degradation from mining unconstrained by land use or habitat standards. Adequately protects watershed from the effects of logging-related activities while moratorium in place; sediment delivery constraints and substrate standards limit sediment-related damage from future logging and may even avoid it, depending on the effectiveness of sediment abatement measures and model veracity. Although substrate standards represent improvement for the SFSR, they are set levels that impair salmon survival. Riparian reserve width and direction inadequate to protect LWD sources, bank stability, and thermal regulation. Allowed entry into roadless areas may increase extent of degradation. Grazing standards are inadequate to prevent cumulative damage or from individual allotments.
BNF LRMP (BNF, 1990)	Limits, but allows significant removal, of stream shading and increased soil damage in riparian zones from logging. No limit to shade removal and soil damage from grazing and mining. Continuance of on-going mining and grazing not subject to resource condition. Cumulative analysis of **proposed activities** only. Limits sediment delivery from logging-related activities only to 20% over natural; no limit on cumulative sediment delivery from mining and grazing. Does not use habitat standards to limit cumulative effects. Programs entry into roadless areas.	Inadequate. Programs additional degradation of riparian areas by logging. Mining and grazing is allowed to degrade every aspect of salmon habitat. Entry into roadless areas likely to increase the extent of degraded habitat conditions over time. Constraint on sediment delivery from logging is inadequate to protect substrate from degradation by sediment delivery from logging, grazing, and mining. Sediment delivery from mining and grazing have significantly degraded streams on the BNF.
UGRRP (Anderson et al., 1992)	Combines land management (e.g. riparian reserves) and habitat standards (e.g. water temperature) to constrain cumulative effects from all on-going and proposed activities (see text and summary table). Activities that forestall recovery in watersheds not meeting standards must be suspended or deferred until recovery occurs. Constrains **sediment delivery** at the activity level by requiring net reductions in watersheds not meeting substrate standards. Calls for active restoration of roads especially in riparian areas. Prohibits entry into roadless areas until improvement documented in degraded reaches.	Comprehensive habitat standards are adequate to protect salmon survival, if realized. Effectively addresses all activities. Reserve widths on streams <2nd order do not protect LWD sources or sediment prophylaxis, and allow cumulative downstream degradation, although limited by habitat standards. Constraints on activities in watersheds not meeting standards may allow recovery to be initiated. Although sediment delivery reductions are mandated, outcome depends on the effectiveness of sediment abatement measures or modelling. Roadless areas approach prevents increased extent of degradation until cumulative effects are reduced downstream as evidenced by documented improvement.

Table O. (cont'd) Comparison and Evaluation Summary: Cumulative Effects Strategy

Plan	Standards	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Combines riparian reserves, key watersheds, WA, and ACSOs together with upland constraints (e.g., LS/OG reserves) to address degradation from future logging. Grazing allowed to continue regardless of resource condition until identified as a problem. New and existing mining allowed regardless of resource condition or effect on ACSOs. **Sediment delivery** not constrained may eventually be reduced in key watersheds with decreases in road mileage, but cumulative increases are allowed even in sediment-damaged systems. Limits logging-related disturbance in riparian reserves, roadless areas, and key watersheds to an unknown degree, contingent on exercise of broad management discretion. Calls for obliteration of unneeded roads and improvements in roads causing damage. Prohibits new roads in larger roadless areas in key watersheds, but allows logging if preceded by WA. Implicitly assumes active and passive restoration can outpace the combined effects of existing conditions and continued land disturbance (USFS and USBLM, p. V-75).	Although initial riparian reserve widths are adequate to protect most functions, ultimate effectiveness depends on revised widths that may allow degradation. Grazing approach allows degradation to continue until problem is identified, and action taken. Mining allowed to cause damage unchecked by standards or consistency with ACSOs. Degradation by road construction in riparian reserves allowed if preceded by WA, even when deemed inconsistent with ACSOs. Allowed increases in sediment delivery may cause degradation that is not limited by resource conditions or habitat standards. LS/OG reserves somewhat constrain cumulative effects from logging. The assumption that active and passive restoration will outpace impacts from additional land-disturbance may not be warranted. Roads are prioritized for obliteration based on their expendability rather than level of damage.
ESSPR (Henjum et al., 1994)	Limits new activities spatially and suspends damaging grazing; does not provide or rely on habitat standards. Restricts road construction, grazing, and logging in riparian reserves, but not mining; prohibits logging, road construction and mining in LS/OG areas, roadless areas, ADAs, steep slopes, and fragile and erosive sites. Grazing restricted in ADAs. Suspends riparian grazing until conditions are evaluated and management altered or until recovery occurs in degraded areas. Constrains **sediment delivery** by prohibiting logging except where documented that sediment delivery into streams will not occur; does not explicitly limit cumulative sediment delivery to a given level or mandate reductions. Habitat standards not used to limit cumulative damage.	Completely protects ADAs and LS/OG areas from additional damage from logging and mining. "Restricted" activities within riparian reserves outside of ADAs too vague to evaluate. Reserve widths on non-perennial streams inadequate for sediment prophylaxis; may allow cumulative downstream degradation outside of ADAs. Grazing approach allows recovery in damaged systems. Direction for on-going mining is vague and may allow degradation to persist. Mining in roadless and riparian areas may allow degradation. Although detailed recommendations address many damaging activities, they do not explicitly limit sediment delivery or require reductions in sediment-damaged systems outside of ADAs. Restrictions on logging, mining, and road construction together with suspension of grazing in degraded areas may to reduce sediment delivery in many systems over time.

Table O. (cont'd) Comparison and Evaluation Summary: Cumulative Effects Strategy

Plan	Standards	Evaluation
CSP (Rhodes et al., 1994)	Uses both land management and habitat standards to limit and reverse cumulative effects from **all** on-going and proposed activities; all activities that potentially forestall recovery must be suspended or deferred in watersheds not meeting habitat standards until recovery is documented. Specific direction for specific activities provided contingent on resource condition (see text and summary table). **Limits total sediment delivery** from all anthropogenic sources; reductions mandatory in watersheds not meeting substrate standards or where sediment delivery estimated to be >20% over natural; no increase in sediment delivery allowed in watersheds with sediment delivery estimated to be <20% over natural. Prohibits additional land disturbance in riparian reserves and roadless areas until improvement is documented in most managed watersheds. Ensures damaging activities do not continue in damaged watersheds by suspending all continuing land disturbance until resource conditions are assessed. Uses in-channel habitat standards to limit cumulative degradation.	Riparian reserves adequately protect LWD sources and thermal regulation, and retain a high degree of sediment prophylaxis. Roadless reserves assure that the extent of degraded conditions does not increase until regional cumulative effects are reduced as documented via improvement in the majority of managed watersheds. Habitat standards adequately protect salmon survival, if realized. Use of biologically-based habitat standards implicitly integrates combined natural and management-induced effects on habitat and salmon survival. Although sediment delivery standard mandates reduction to levels that <u>may</u> allow recovery and protect substrate, they are based on fragmentary data and may allow degradation, although to level limited by substrate standards. Adequately addresses all on-going and proposed activities; complete passive restoration approach ensures that recovery occurs prior to initiating/continuing activities with lowly reversible effects. Moratoria on land use activities in below-standard watersheds provides incentive for active restoration. Specific direction on upland activities outside of reserves and active restoration is vague.
Alt 4. of PACFISH (USFS and USBLM, 1995)	Approach focuses on new activities within RHCAs and only on-going activities deemed on a "case-by-case" basis to adversely affect habitat. RMOs do not limit the amount of substrate degradation and allow small incremental increases in water temperature. Sediment delivery not constrained and unlimited increases allowed even in damaged watersheds. Logging and road construction allowed in RHCAs after completion of WA, even if inconsistent with RMOs. Mining in and out of RHCAs not contingent on WA. Applies to activities outside of RHCAs only when deemed likely to degrade RHCAs. Does not limit road mileage in key watersheds.	Reserve widths on non-perennial streams inadequate to protect LWD sources and sediment prophylaxis and allow degradation. Continued road construction, grazing and mining in reserves likely to perpetuate and increase cumulative effects. "Case-by-case" approach to on-going activities promotes segmented analysis and pre-empts cumulative analysis. RMOs allow incremental temperature increases (provided it is unmeasurable downstream) and represent degraded pool and LWD conditions. Cumulative degradation of substrate conditions not constrained by RMOs. Attainment of RMOs does **<u>not</u>** ensure adequate salmon survival. Activities that increase cumulative effects are not contingent on status of RMOs. Mining allowed to increase cumulative degradation. Entry into roadless areas likely to increase extent of degradation. Together with lack of substrate standard and cap on sediment delivery, continued negative cumulative effects on substrate and density-independent salmon survival allowed and likely.

Table P. Comparison and Evaluation Summary: Aquatic Emphasis Watersheds

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Only addressed the SFSR. Prohibits major logging-related activities until substrate recovers to meet targets, or sediment abatement measures have been completed. New and on-going mining and on-going grazing are not subject to sediment-related constraints.	Although aimed at the SFSR, some of limited aspects have promise for other watersheds. Specifically establishing moratoria until measurable improvement occurs in key habitat attributes requires that recovery occur before lowly reversible activities are allowed to increase sediment delivery and other cumulative effects. The SFSRP has been effective in allowing substrate recovery, but the lack of constraints on mining and grazing could reverse recovery. Grazing has precluded recovery in Johnson Cr. on the BNF. Riparian direction could result in inadequate protection of ecological functions and allow cumulative degradation.
BNF LRMP (BNF, 1990)	Not explicitly addressed. Watersheds with salmon habitat have a lower limit for sediment delivery from logging (only) than other watersheds, although total sediment delivery is not limited because sediment delivery from grazing and mining are not limited. Standards for shade removal and soil damage in riparian areas from logging do not differ among watersheds. Standards do not constrain damage from grazing and mining and do not differ among watersheds.	Inadequate. Programs significant degradation of ecological functions in riparian areas in all watersheds. Also programs watershed-scale degradation, although with lower contributions to sediment delivery by logging. Failure to limit sediment delivery from mining and grazing is a major flaw. Johnson and Bear Valley Creeks on the BNF have been significantly degraded by elevated sediment delivery from mining and grazing.
UGRRP (Anderson et al., 1992)	Addressed only one watershed. Protects riparian reserves from additional vegetation removal, limits and reduces sediment delivery, protects roadless areas from entry until habitat improvement is documented, and calls for active restoration to the road network. Uses of habitat standards to trigger passive restoration by suspending or deferring all major land-disturbing activities, planned and on-going, that may forestall recovery.	While only addressing one watershed, the aggregate approach holds some promise as a template for restoring degraded watersheds where aquatic resources are emphasized. However, reserve widths on streams <2nd order do not protect all riparian functions and may allow cumulative downstream degradation over time after habitats improve or in watersheds that meet standards. Suspension of activities forestalling recovery in watersheds not meeting standards (e.g. on-going riparian grazing) should allow recovery to be initiated.

Table P. (cont'd) Comparison and Evaluation Summary: Aquatic Emphasis Watersheds

Plan	Standards	Evaluation
Alt. 9 of FEMAT (USFS and USBLM, 1994)	"Key Watershed" network is a cornerstone of the ACS. Establishes 164 key watersheds covering about 9.1 million ac (approx. 37% of affected land base. **Key Watersheds:** Logging-related activities must be preceded by WA, but do not have to be consistent with ACSOs. Road construction and logging allowed within interim riparian reserve widths after WA completed. Prohibits road construction in inventoried roadless areas. Outside of roadless areas, requires decrease or no net increase in road mileage. New mining not contingent on WA or effects on ACSOs. Grazing and mining not contingent on completion of WA or resource conditions. Watersheds were identified based on need for connectivity, existing condition, diversity of fish populations, and level of risk of extirpation of fish populations. Key watersheds have highest restoration priority. **Non-key watersheds**: Same as above, except: logging-related activities outside of inventoried roadless areas do not have to be preceded by WA and increases in road mileage allowed even in inventoried roadless areas if preceded by WA.	Continued degradation possible in both all watersheds depending on veracity of WA, interpretation of ACSOs, and management discretion. Allows degradation of riparian reserves in all watersheds open to management via mining, road construction, landings, and grazing even if inconsistent with ACSOs. Logging activities that can degrade habitat are expedited in non-key watersheds. USFS et al. (p. V-75, 1993) assumed that recovery would occur in all watersheds, (at a lesser rate in non-key watersheds), but provided no scientific rationale to support the assumption. Assumed recovery appears to be premised on the assumption that final reserve widths always adequately protect all ecological functions and meet ACSOs (p. V-64). However, implementation of activities in reserves that prevent ACSO attainment is allowed. Although the recovery of ecological processes is asserted, management is not contingent on recovery in fish habitat conditions; contains no specific provisions for increased protection or reduction in activity levels if degraded habitats are further damaged over time.
ESSPR (Henjum et al., 1994)	Recommends establishment of 90 ADAs covering about 2.4 million acres in Oregon as a starting point. Stresses need to establish a ADAs in Washington, Idaho, and Montana. Mining, logging, road construction prohibited within ADAs. Grazing allowed **only** after completed status evaluation indicates that grazing poses no threat and management is altered to strictly control grazing. Criteria for selection includes any of the following: presence of native aquatic species at risk of extinction; whole watersheds representing the best remaining aquatic systems and embedded biological assemblages; connecting corridors linking habitat essential for native aquatic populations. Outside of ADAs, restricts land-disturbing activities in riparian reserves, suspends grazing in degraded areas, restricts mining, logging, and road construction in uplands, and prohibits additional logging and road construction in roadless areas >1000 ac.	Completely protects ADAs from damage from additional mining, logging, and road construction. Initiation of recovery is likely in ADAs. Although aggregate protection outside of ADAs limits cumulative effects and allows recovery in areas degraded by grazing, direction for activities within reserves outside of ADAs is too vague too evaluate; may allow degradation, especially from mining. Notably, Henjum et al.'s (1994) own evaluation of the strategy is: **"Such protection alone will still not sustain migratory populations or restore the productivity in eastside watersheds of native coldwater species like salmon and bull trout...ADAs thus provide the cornerstones, but not the complete foundation, for eastside restoration; successful recovery requires better conservation of other productive habitats distributed along larger mainstem streams and rivers."**

Table P. (cont'd) Comparison and Evaluation Summary: Aquatic Emphasis Watersheds

Plan	Standards	**Evaluation**
CSP (Rhodes et al., 1994)	Consistent with ESA mandates, provides similar protections to all watersheds with salmon habitat in the Snake River Basin. Protection measures include: no entry into roadless areas >1000 ac., 300 foot riparian reserves on all streams, suspension or deferment of activities that can forestall recovery in watersheds not meeting habitat standards, until habitat conditions exhibit recovery (see text and tables). Due to high likelihood of rapid extirpation of isolated spawning populations in the Snake River Basin, also recommended for application to all watersheds in the John Day, Umatilla, and Clearwater River Basins to provide sources and sinks of salmon colonists.	Emphasizes aquatic resource protection and restoration in all watersheds. Avoids the potential for further fragmentation inherent in approaches that do not fully protect all habitats and watersheds. Although approach assures that degradation from additional activities does not occur in watersheds not meeting standards, there is a slight chance that allowed land disturbance outside of reserves and grazing within reserves in watersheds meeting standards could cause degradation to levels limited in duration by habitat standards, monitoring requirements, and required management adjustment. Although the approach aims to prohibits increases in sediment delivery and requires reductions in some watersheds, effectiveness is uncertain and may allow substrate degradation.
Alt 4. of PACFISH (USFS and USBLM, 1995)	Key watersheds are to be identified in the future within the affected area. In the interim, watersheds with designated critical habitat for salmon listed under the ESA are treated as "key." RHCA width on non-perennial streams in key watersheds is 100 ft or 1 tree ht., and 50 ft. or 0.5 tree ht. in non-key watersheds. New logging and road construction within RHCAs in key watersheds must be preceded by WA; on-going grazing and new and on-going mining not contingent on resource condition or completion of WA regardless of location. Logging within riparian zones in key watersheds must be found to be consistent with RMOs, but does not apply to new or existing mining, road construction, or continued grazing.	Inadequate. None of the watersheds afforded protection that emphasizes aquatic resources. Allows continued degradation of riparian conditions in all watersheds including key watersheds. RHCA widths on non-perennial streams and restrictions inadequate to protect major ecological functions, and allow degradation in all watersheds, but more inadequate in non-key watersheds. Activities within and outside of riparian reserves likely to cause damage to all watersheds, but more analysis is required in key watersheds; damage expedited in non-key watersheds.

Table Q. Comparison and Evaluation Summary: Roadless Areas

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Entry allowed after habitat improves, if expected sediment delivery can be fully offset. However initial resumption of logging is to be from existing roads. Mining with minimal constraints allowed in all roadless areas not withdrawn. No specific direction for grazing in roadless areas.	Mining in roadless areas allowed to increase intensity and extent of degradation, especially with respect to sediment delivery and substrate conditions. Adequately protects against logging-related damage by sedimentation until improvement occurs, thereafter, adequacy of protection is dependent on effectiveness of sediment abatement efforts and model veracity. Vague riparian reserve direction may result in widths and restrictions that are inadequate to prevent damage from activities in roadless areas. Grazing allowed to degrade roadless areas.
BNF LRMP (BNF, 1990)	Scheduled entry into about 6.5% of inventoried roadless areas outside of wilderness areas (about 7350 ac/yr) forest-wide for logging; entry into areas <5000 ac not included in this estimate. Mining with minimal constraints allowed in all roadless areas not withdrawn. No specific direction for grazing control in roadless areas.	Roadless areas likely to be degraded due to the combined effects of entry for logging and mining and continued grazing coupled with weak standards for all of these activities. Degradation not limited by resource conditions or habitat standards. In aggregate, extent and intensity of degradation from sedimentation, loss of LWD sources and thermal regulation will increase.
UGRRP (Anderson et al., 1992)	Entry prohibited until there is a documented improving trend in degraded habitats downstream. Roadless areas serve as the anchor points for restoration efforts. Does not specify the size of roadless areas to be protected Roadless areas may continue to be subjected to some grazing, where habitat standards are met.	Adequately protects roadless areas from mining and logging until an improving trend is documented. Grazing in roadless areas where standards are met may cause some degradation or retard recovery, but this is limited by comprehensive habitat standards. Once degraded habitats improve, entry into roadless areas may increase the intensity and extent of degraded conditions, although limited by habitat and land use standards. Reserve widths on streams <2nd order may allow cumulative degradation if roadless areas entered.
Alt. 9 of FEMAT (USFS and USBLM, 1994)	In key watersheds, prohibits road construction in inventoried roadless areas, but logging allowed after completion of WA. All new logging-related in roadless areas in all watersheds must be preceded by WA but are not required to be consistent with ACSOs. Uninventoried roadless areas (<5000 ac) can be mined, roaded and logged after completion of WA in key watersheds and without WA in non-key watersheds. Continuance of on-going grazing in roadless areas is not contingent on completion of WA or resource condition.	Entry into smaller roadless areas in and out of "key watersheds" likely to increase extent of degradation. Notably, FEMAT itself concedes that logging in roadless areas may undermine achievement of ACSOs within key watersheds. Continued grazing in roadless areas may perpetuate or increase degradation until identified as problem.

Table Q. (cont'd). Comparison and Evaluation Summary: Roadless Areas

Plan	Standards	Evaluation
ESSPR (Henjum et al., 1994)	Prohibits logging and road construction in roadless areas >1000 ac. or biologically significant. Grazing may continue subject to strict constraints.	Completely protects roadless areas within ADAs from degradation from additional logging, road construction and mining. However, outside of ADAs, mining allowed in roadless areas, albeit, without roads. Nonetheless, mining may degrade roadless areas outside of ADAs. Ensures recovery in all roadless areas degraded by grazing.
CSP (Rhodes et al., 1994)	Prohibits entry into roadless areas >1000 ac. Entry into smaller roadless areas prohibited unless demonstrated to have no effect on restoration options. Prohibitions hold until >90% of managed watersheds improve or meet habitat standards. Grazing provisions for roadless areas are the same as for other areas (see text and summary table).	Completely protects roadless areas from degradation from anthropogenic land disturbance until there is widespread improvement in damaged habitats. Initiates recovery in roadless areas degraded by grazing. Ensures that the extent of degraded watershed conditions does not spread until there is widespread improvement in damaged habitats.
Alt 4. of PACFISH (USFS and USBLM, 1995)	Not explicitly addressed. Apparently the same standards hold for roadless and roaded areas (see text and summary table); new logging, road construction, and mining outside of RHCAs not contingent on WA or resource condition; new and on-going mining and on-going grazing within RHCA in roadless areas are not contingent on completion of WA, resource condition or trend, or consistency with RMOs.	Inadequate. Allowable entry into roadless areas coupled with weak protection within RHCAs and expedited land disturbance outside of RHCAs is likely to increase the intensity and extent of degradation, unchecked by habitat standards.

Table R. Comparison and Evaluation Summary: Monitoring

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Annual substrate monitoring required. Effectiveness and implementation monitoring required on all sediment abatement projects used to offset sediment delivery from proposed land disturbance. Major logging-related activities are contingent on monitoring results; other activities are not.	Adequate for monitoring substrate trends and constraining logging-related activities, but inadequate for assessing the effects of other activities on substrate and status and trend of other habitat attributes, e.g. water temperature, pools, LWD, etc.
BNF LRMP (BNF, 1990)	Requires annual implementation monitoring of at least 10% of "major" land-disturbing activities. Effectiveness monitoring mentioned but not specified nor required; development of monitoring plan (but not actual monitoring) to be developed. Does not describe any explicit linkage between monitoring results and land management.	Inadequate for evaluation of conditions, effectiveness monitoring, and trends. Inadequate to make adjustments in land management needed to protect/restore aquatic habitat.
UGRRP (Anderson et al., 1992)	Requires pre-project monitoring of all habitat conditions set as standards that could be affected by a project. Required monitoring parameters include substrate, water temperature, turbidity, LWD, meadow and riparian vegetation, pool volume and depth, and width-to-depth ratio. Calls for trend monitoring of conditions set as standards in representative reaches for effectiveness monitoring and adaptive management. Also notes key research needs.	Required monitoring is adequate for evaluating watershed status, management effectiveness and trends in important habitat conditions affecting salmon survival, as well as making management adjustments needed to protect and restore habitat.
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Approach not specified; implementation monitoring emphasized. Aquatic parameters for monitoring will be based on results of WA and may include pool and LWD attributes, fine sediment, temperature, and bank stability. Monitoring of these habitat parameters is not required. Linkage between monitoring results and land management activities is not specified. Activities are not contingent on monitoring or its results.	Inadequate for evaluating effectiveness and trend or status of ACSOs and habitat conditions. Inadequate to adjust management to prevent/reduce aquatic degradation.
ESSPR (Henjum et al., 1994)	Requires monitoring of trend and status of grazed areas prior to continuance of grazing. Strongly recommends monitoring of ecological trends and status, but approaches not specified. A major priority of interdisciplinary scientific panels is the development framework for monitoring and assessing ecological trends.	Inadequate to evaluate trends and effectiveness. Direction is adequate to avoid continuing damage from grazing in degraded areas. However, existing detail for all other aspects of monitoring and its linkages to management is too vague to evaluate.

Table R. (cont'd) Comparison and Evaluation Summary: Monitoring

Plan	Standards	**Evaluation**
CSP (Rhodes et al., 1994)	Habitat conditions (substrate and water temperature) set as standards must be monitored annually and prior to continuing or initiating activities. Trend monitoring required for riparian conditions, LWD and pool frequency and volume. Habitat monitoring effort must result in a minimum detectable effect of 10% of initial value at $p<0.4$. Specifies management response depending on results of substrate and water temperature monitoring. Requires implementation and effectiveness monitoring as part of all on-going grazing activities.	Adequate to determine status, trend, and effectiveness, as well as adjusting management as needed to protect/restore habitat. Direction for implementation monitoring for activities other than grazing is vague and inadequate.
Alt 4. of PACFISH (USFS and USBLM, 1995)	None required. Focus on implementation monitoring. Activities are not contingent on monitoring or results. States that effectiveness and validation monitoring unlikely to be completed during implementation.	Inadequate to determine status and trends in habitat. Inadequate to assess management consistency with RMO attainment or make management adjustments as needed to protect/restore aquatic habitat.

Table S. Comparison and Evaluation Summary: Restoration

Plan	Standards	Evaluation
SFSRP (PNF, 1988)	Provides passive restoration of channel substrate via moratoria on major logging-related activities until substrate conditions meet targets. Lists specific active restoration efforts to reduce sediment delivery from roads. Also calls for direct removal of fine sediment.	Inadequate. Although logging moratorium and road closures allowed some limited initial improvement in substrate conditions, failure to constrain mining and grazing allows recovery to be reversed. On-going grazing has contributed to the maintenance of extremely poor habitat conditions in Johnson Cr. on the BNF. Active restoration has not been fully implemented.
BNF LRMP (BNF, 1990)	Emphasis on structural habitat enhancement efforts (e.g., LWD addition). Lists specific active restoration efforts to reduce sediment delivery and instream sediment. Aims to limit damage from grazing via forage utilization standards and management revision. Active restoration focuses on road treatments to reduce sedimentation. Obliteration of roads only pursued where transportation alternatives exist.	Inadequate. Fails to commit to complete passive restoration in degraded systems rendering recovery unlikely. In areas degraded by grazing, recovery is unlikely without some period of rest, which is not required. Allows riparian degradation that precludes restoration. Standard habitat enhancement approaches such as LWD additions are ineffective in treating both the symptoms and causes of degradation. Active restoration unlikely to be effective at aiding recovery since it is aimed at expendable roads that may not necessarily be the most damaging.
UGRRP (Anderson et al., 1992)	Passive restoration required at the watershed scale where monitoring indicates that habitat standards are not met (e.g., suspension of riparian grazing). Calls for active restoration of roads to abate sediment delivery. Requires active restoration in advance of activities to offset sediment delivery expected from new activities in watersheds that do not meet substrate standards. Does not explicitly comment on instream enhancement, but stresses the natural recovery of ecological functions.	Combination of mandatory passive restoration and active restoration approach is adequate and likely to initiate habitat recovery. Passive restoration approach provides incentive to aggressively implement active restoration.
Alt. 9 of FEMAT (USFS and USBLM, 1994)	Passively restores riparian reserves and key watershed via suspension of logging-related activities until WA completed, after which, logging-related activities that may degrade aquatic habitat are allowed. Modify or eliminate grazing that is identified as impeding ACSO attainment. Mining allowed to prevent ACSO attainment. Emphasizes active restoration of road network (obliteration, etc.). Key watersheds prioritized for restoration. Recommends against use of structural habitat enhancement as a surrogate for protection or as mitigation for habitat damage.	Failure to require complete passive restoration in degraded systems until improvement occurs makes it possible that degradation will outpace active restoration benefits, especially given highly degraded watershed conditions. The following are allowed to preclude restoration: mining impacts, continuance of grazing until identified as problem, and management discretion to construct roads and landings in riparian reserves after completion of WA.

Table S. (cont'd) Comparison and Evaluation Summary: Restoration

Plan	Standards	Evaluation
ESSPR (Henjum et al., 1994)	Employs passive restoration in ADAs and via suspension of riparian grazing in degraded reaches. Restricts logging and road construction, but not mining, in roadless areas and riparian reserves. ADA network is the primary initial step to regional restoration. Calls for active road restoration. Discourages structural habitat enhancement. Recommends restoration efforts proceed from headwaters downstream. Recommends against reliance on forage utilization standards to restore grazed areas. Development of coordinated restoration strategies emphasizing biological systems and ecological processes is a major priority of interdisciplinary scientific panels. Recommends that silvicultural restoration techniques should not be widely applied until approved by the recommended panels.	Adequate to initiate restoration in areas degraded by grazing and ADAs. "Restricted" activities in riparian reserves is too vague to determine compatibility with restoration. Lack of restrictions on mining in riparian and roadless areas outside of ADAs allows degradation, thwarting restoration. Total restoration approach cannot be evaluated, since it is to be developed.
CSP (Rhodes et al., 1994)	Mandates complete passive restoration in watersheds where standards are not met (see summary table). All activities contingent on completion of monitoring indicating habitat standards are met. Documented improvement in watersheds not meeting habitat standards is required prior continuing or implementing activities that can forestall recovery. Recommends active restoration focusing on causes of degradation in watersheds not meeting standards, prioritizing riparian reserves. Prohibits mechanical channel stabilization methods (e.g., riprap, etc), pool excavation, and recommends that LWD addition occur only where ecologically appropriate, degradation has been adequately addressed, and other habitat conditions are amenable to salmon survival. Recommends against silvicultural "restoration" techniques in riparian zones and reliance on forage utilization standards in areas degraded by grazing.	Passive restoration requirements make initiation of recovery extremely likely except in some of the most damaged systems. Moratoria on degrading activities until recovery occurs provides a incentive for land managers to implement effective active restoration measures addressing causes of aquatic damage rather than symptoms. However, active restoration direction is vague.
Alt 4. of PACFISH (USFS and USBLM, 1995)	No palpable guidance given. Regionalize and rely on WA to identify opportunities. Recommends effectiveness monitoring occur with restoration approaches. On-going activities are not contingent on monitoring or condition and are only modified if determined on a case-by-case basis to adversely affect salmon habitat. Mining allowed to degrade RHCAs.	Inadequate. Failure to require passive restoration makes it extremely unlikely that recovery can occur and provides no incentive for implementation of effective active restoration. Ineffective protection from mining and on-going grazing allowed to preclude restoration.

Table T. Numeric Ratings of Likely Effectiveness of Specific Plan Provisions and Composite Plan Scores

Plan Provision	SFSRP	BNF LRMP	UGRRP	FEMAT	ESSPR[1]	CSP	PACFISH
Riparian Reserves	4	1	6	4	5-9	9	3
Habitat Standards	4	1	8	3	4-7	9	2
Logging	7	2	7	5	6-10	8	3
Grazing	2	2	7	5	8	8	3
Roads	3	2	6	4	5-9	9	2
Mining	1	1	6	2	4-9	8	2
Cumulative Effects	4	1	6	3	5-9	8	2
Aquatic Emph. Watersheds	3	1	6	4	7-9	7	3
Roadless Areas	4	1	6	5	6-9	9	3
Monitoring	4	1	8	3	4-6	8	2
Restoration	3	1	7	4	4-9	8	2
Total composite rating	**39**	**14**	**73**	**42**	**58-94**	**90**	**27**

1. Some provisions of the ESSPR are given two ratings that appear as a range. The higher ratings in all cases are based on a scenario where all watersheds with critical habitat are designated as ADAs; the lower ratings are based on a scenario where only some watersheds with critical habitat are designated as ADAs.