

THE USE OF ECOLOGICAL PRINCIPLES FOR RIPARIAN ZONE
MANAGEMENT IN FOUR FOREST PLANNING DOCUMENTS

by

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TABLE OF CONTENTS

Text	1
Acknowledgements	22
References	23
Table 1 Streamside Management Activities	24
Figure 1 NEPA Process for Forest Plans	25
Figure 2 Federal Laws Affected by Forest Plans	28
Figure 3 Levels of Use of Ecological Principles	29
Figure 4 Analysis of Forest Planning Process	30
Appendix 1 Forest Document Matrix	31
Appendix S Information from Land and Resource Management Plan, Siskiyou National Forest	39
Appendix W Information from Willamette National Forest Riparian Management Guide	44
Appendix T Information from Recommendations for Managing Late-Seral-Stage Forest and Riparian Habitats, from the Tahoe National Forest	49
Appendix G Information from the "Report of Alternatives for Management of Late-Successional Forests of the Pacific Northwest"	53

I. Objectives and Significance

Declining fish populations in the Pacific Northwest have generated concern over the quality of fish habitat and the conditions of riparian areas. Numerous native anadromous salmonid stocks, which play a critical role in the region's culture, recreation, and commerce, are faced with the threat of extinction due to fishing pressures, loss of habitat, and competition with other activities such as logging, hydropower, and agriculture, etc. (Nehlsen, Williams, and Lichatowich, 1991). Many of the fish-bearing streams and rivers in the Pacific Northwest region have their headwaters within the boundaries of National Forests, so preservation of fish populations may be influenced by riparian management in National Forests. Many forests have in the past been managed with emphasis on timber production and harvest. Ecological research suggests that activities associated with timber harvesting may have had negative impacts on fish habitat, thereby contributing to the reduced fish populations. In response to these factors, National Forest planning increasingly has addressed fish, water, and riparian resources.

The purpose of this paper is to evaluate the extent to which ecological principles were used in four documents of differing scope and intent, that address management of forest resources and riparian zones in three National Forests of the Pacific Northwest. We use the phrase "ecological principles" in a very broad sense, as it has been used in recent judicial interpretations of the forest planning process. Recent court cases, summarized in Figure 1, have challenged management activities in several National Forests, citing them for inadequate consideration of ecological principles in their planning. In a study of three recent court cases testing forest plans and associated Environmental Impact Statements (EIS's) involving fish and watershed management, Craig (1987) found that the court's decisions had hinged on ecological principles governing relationships between cumulative clearcutting, road construction, landsliding and debris flows, stream sedimentation, fish habitat, water

quality, and fish populations. Similarly, in the case of Seattle Audubon Society, et al, v. James R. Moseley, et al, which affected logging sales in spotted owl habitat, (U. S. District Court, 1992), Judge Dwyer found that the requirement "to maintain viable populations of existing native and desired non-native species in the planning area" further required "planning for the entire biological community, not for one species [spotted owl] alone." He found that the EIS was inadequate because it failed to address the consequences of the plan for species, other than the spotted owl, that live in the old growth forests. This wording implies that a future decision on the revised EIS could hinge upon ecological principles describing interdependence among species, including fish, and how they are affected by forest management actions. In summary, recent judicial actions suggest that in the future, management plans will be judged on the strength of the ecological ideas which underlie them.

The significance of this research is that it attempts to identify the ecological ideas related to fish, water, and riparian resources that have been used in the forest planning process. Each of the four planning documents which were selected differ in their scope and intent, but all four appear to have used ecological ideas as their basis. They were:

- (1) the Land and Resource Management Plan for the Siskiyou National Forest,
- (2) a set of recommendations for management of late-seral-stage forests and riparian zones in the Tahoe National Forest,
- (3) the Riparian Guidelines prepared for the Willamette National Forest, and
- (4) the "Alternatives for Management of Late-Successional Forests of the Pacific Northwest," written by the Scientific Panel on Late-Successional Forest Ecosystems.

Obviously each document represents only a fragment of the principles and practices affecting riparian zone management in each forest. Ideally, this study should have considered all of the relevant planning documents for each forest,

including Forest Plans, Environmental Impact Statements, and forest Standards and Guidelines, as well as the ecological knowledge of the authors of these documents, which was not explicitly described in any document. However, such an effort was beyond the scope of this paper. Instead the paper examined the ecological principles explicitly referred to in each document, and compared them. This narrow focus results in a somewhat artificial comparison.

The analysis involved three steps:

- 1) examination of the spatial scales considered by each document, e.g. stream, riparian zone, watershed, landscape, and region;
- 2) construction of a matrix which describes suggested management activities at each of these spatial scales (stream, riparian zone, basin, landscape, and region); and
- 3) evaluation of the level of specificity with which ecological principles were referred to in each of the documents.

It is important to emphasize the limitations to this analysis. First, none of the riparian management plans reviewed stated that the use of ecological principles was an explicit objective. Second, each plan was evaluated purely on the basis of what is stated in the document, not on the basis of the ecological knowledge of the authors. Information contained in sections of Forest Plans or in other planning documents which we did not review may have been unintentionally overlooked. Thus this analysis is not intended as an exhaustive review. Rather, it is intended to stimulate discussion about the use of ecological ideas in forest planning.

In summary, this paper is a response to growing public concern about the preservation of forests and associated terrestrial and aquatic species, which has led to a controversy over appropriate forest management techniques. Scientists increasingly are involved in the political arena where alternative forest management proposals are being evaluated. As scientific knowledge comes to play a

more powerful role in political decisions for resource management, the validity of this knowledge increasingly will be challenged. Therefore this paper is an initial attempt to identify and assess the use of ecological knowledge in some current forest planning documents.

II. Background

A. Forest Planning documents

The forest planning process mandated by the National Forest Management Act (NFMA) triggers clauses in several other federal laws, notably the National Environmental Protection Act (NEPA), the Clean Water Act, and the Endangered Species Act (ESA) (see Figure 2). Moreover, forest planning occurs simultaneously at many different spatial scales; from the national or regional level, down to the National Forest and individual projects within the forest (K. N. Johnson, personal communication). Thus forest planning produces a variety of documents which vary in their conceptual focus and spatial scale.

The most common forest planning document is the Forest Plan, mandated by NFMA, which always has a corresponding Environmental Impact Statement (EIS), mandated by NEPA, for all actions proposed in the Forest Plan. One of the documents evaluated, the Siskiyou National Forest Land and Resource Management Plan (Siskiyou National Forest, 1989), is an arbitrarily selected example of such a planning document. The EIS and the Forest Plan are at the landscape scale, meaning that they include several watersheds and many streams. Recently, however, EIS's have been required by the courts to consider watershed-scale impacts presumed to result from cumulative timber harvest activities in portions of a National Forest (Craig, 1987).

Within the Final Forest Plan, each National Forest may design its own guidelines for riparian management; the Forest Service has not established any overall minimum standards for all forests. One of the most comprehensive of these sets of guidelines is the Willamette National Forest Riparian Management Guide (Gregory and Ashkenas, 1990), which is the second document I chose to evaluate. This document addresses forest riparian management at the most detailed scale, the riparian zone, but includes some watershed level prescriptions. A related proposal, the Tahoe Recommendations for Managing Late-Seral-Stage Forest and Riparian Habitats (Chapel, et al, 1992), provides some generalization of these principles to the watershed and landscape scale, in a context where land ownership is maintained in alternate sections between the Forest Service and private land. This is the third document I chose to evaluate.

Concerns about maintenance of viable populations, a provision mandated by both ESA and NFMA, have led to regional-scale proposals for forest management. An early version of this type of document is the report of the Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl (1990). More recently, the "Report of Alternatives for Management of Late-Successional Forests of the Pacific Northwest," hereafter referred to as the Gang of Four report (Scientific Panel on Late-Successional Forest Ecosystems, 1991) proposed a number of alternatives to manage old growth forests and preserve wildlife and fish populations in the Pacific Northwest. The Gang of Four report, the fourth document evaluated, affects both the Willamette and the Siskiyou National Forests; specifically I considered Option 8-A which includes the Forest Plan, the most significant late seral / old growth forests, the spotted owl additions, and the watershed / fish emphasis.

Each of the documents which I reviewed had a different purpose and objective behind it. The Siskiyou's Plan was the final product of a lengthy process, required by NFMA, to consider and direct all aspects of management within the

forest and describe future desired conditions. The Willamette Riparian Guidelines were designed to assist land managers in understanding the science behind the prescriptions as they follow the established standards and guidelines. The Tahoe Recommendations are an internal forest document, written as one step in the process of creating a revised Forest Plan. Finally the Gang of Four report was written as a request by Congress so that the legislators could have a clearer understanding of the old growth forest and related species issues in the Pacific Northwest. The differences created by their designated purposes are readily apparent in the documents, and this was considered in the choice and evaluation of each one.

III. Methods

The study involved three steps: (1) a comparative description of the four forest planning documents; (2) an evaluation of the use of ecological principles in each document; and (3) an assessment of what these documents indicate about the use of scientific knowledge in the forest planning process.

A. Comparative description

To compare the four documents, a matrix was created which describes the recommended management activities in each report at the scale of streams, riparian zones, watersheds or basins, landscapes, and regions. The following information was extracted from each document:

- 1) the use of spatial concepts and scales (e.g., stream, riparian zone, region, etc.);
- 2) the prescribed management activities corresponding to various scales;

- 3) the present and future characteristics of the riparian zone itself, as described or predicted in the document;
- 4) the desired landscape pattern, including the riparian zone;
- 5) the treatment of endangered species; and
- 6) the description and assessment of cumulative effects.

B. Evaluation of ecological principles

Once the information had been compiled, the matrix was used to evaluate each document according to its use of ecological principles and functional relationships within the forest ecosystem. I designated four different Levels, based on the degree of use and incorporation of ecological knowledge in the document. These are:

- 1) Level One: no mention of ecological principles for justification of recommended practices;
- 2) Level Two: use of ecological terms and concepts such as "natural community," "habitat values," and "habitat capability" without definitions or explanations;
- 3) Level Three: reference to ecological principles or functional relationships without definitions or explanations; and
- 4) Level Four: inclusion of ecological principles or functional relationships which are defined and explained.

C. Use of scientific knowledge in forest planning

The third element of the research involved describing the use of the scientific knowledge available in the forest planning process. This was accomplished by examining the type and nature of information which each document contained.

IV. Results and Discussion

A. Comparison of documents

The matrix which compares the documents (Appendix 1) has six sections. The first section defines the spatial scales which each document emphasizes. The five sections that follow provide the details of relevant information from each document about management activities, riparian zone or stream characteristics, landscape pattern and ecology, endangered species, and cumulative effects.

Each section addresses a different spatial scale within the forest. The **Management Activities** are prescribed either at the project level (e.g., 10^2 - 10^3 acres for timber harvest), or at the National Forest level (10^6 acres). The **Riparian Zone / Stream Characteristics** section describes conditions and characteristics at the smallest scales, streams or riparian areas. The **Landscape Pattern / Landscape Ecology** section corresponds to areas of forested landscape (e.g. 10^4 - 10^5 acres) within the National Forest boundaries. **Endangered Species** may have ranges at the regional scale (e.g., 10^7 - 10^8 acres). By their nature, **Cumulative Effects** should be measured at all spatial scales; in these documents, they were considered most often between the project level (e.g., individual timber sales) to the watershed (10^4 - 10^5 acres). It is evident in what follows that the use of these spatially scaled categories as a basis for comparison reveals that different spatial scales were emphasized in the four documents. The number and letter designations for paragraphs of the text which follow correspond to rows of the matrix (Appendix 1).

A. 1.) Definitions and Descriptions of Spatial Elements Related to the Riparian Zone

The four planning documents address ecological principles and management prescriptions at five spatial scales: the stream, the riparian zone, the basin, the landscape, and the region. The stream scale is relevant to management practices

within the channel itself; the riparian zone is relevant to management practices in the channel and the adjacent floodplain; the basin scale is variable, ranging from 1 to 10^5 acres in these planning documents, but the concept refers to management practices on hillslopes outside the riparian zone which may affect the riparian zone. The landscape scale corresponds to the size of a National Forest ($\sim 10^6$ acres) while the regional scale ($\sim 10^7 - 10^8$ acres) corresponds to the entire Pacific Northwest.

The Siskiyou Plan is primarily a basin-based document. Their "Planning Basins" correspond to the twenty drainage basins within the forest, and all management activities are based on these basin units. While some information on stream classes is included, there is no mention of the floodplain. The Willamette Guidelines bridge a number of spatial scales and include "landscape, basin, and harvest units." Elements from each scale are addressed and described within the document, beginning with the channel and extending to the floodplain, the basin, and the forested landscape. The Tahoe addresses the entire range of spatial scales, but it focuses in greatest detail on the landscape scale. The Gang of Four Report is primarily a regional scale document, although information is provided for large watersheds (e.g. $10^4 - 10^5$ acres) as part of the Fish/Watershed Option for the alternatives, and there is some discussion of buffering of riparian zones.

A. 2.) Management Activities

This section considers a variety of actions which occur in forest watersheds that could have a direct or indirect impact on riparian zones.

The **management objectives** for riparian zones were difficult to infer from some of these documents. Because it is a forest-wide document, the objectives of the Siskiyou Land and Resource Management Plan (hereafter Siskiyou) include a variety of multiple uses. In contrast, the Willamette Riparian Management Guide (Willamette) and the Tahoe Recommendations (Tahoe) specifically address

protection of the the riparian resources, and the Gang of Four Watershed/Fish option calls for restoration and improvement of streams.

Road construction should be avoided in riparian areas in the Siskiyou. The document calls for an overall increase in road construction. The Willamette and the Tahoe discourage any roading activities within riparian areas, and the Gang of Four report prescribes a number of strategies for improvement of existing roads.

Management for **timber harvest** in the National Forests has been the norm for many years. The Siskiyou allows limited harvest in riparian areas. The Willamette and the Tahoe prohibit programmed harvest on perennial streams in riparian areas. The Gang of Four precludes harvest in designated riparian areas and includes a number of other minimum guidelines for timber harvesting.

The Siskiyou plan does not address **livestock grazing** specifically within the riparian zones, but overall range practices and wildlife needs are deemed to be compatible. In contrast, the Willamette discourages livestock grazing within riparian areas, and the Gang of Four calls for livestock exclusions from the riparian areas. Grazing is not a significant activity in either the Siskiyou or the Willamette Forests. The Tahoe does not address grazing.

Fire management in the Siskiyou includes a plan for suppression of wildfires and limited use of prescribed fires. According to the Willamette, wildfire suppression "should not affect" other riparian management objectives, and prescribed fires "should not negatively impact" the riparian zone. The Tahoe does not address any type of fire. The Gang of Four suggests an elimination of prescribed fires, and does not address wildfires.

Only the Siskiyou addresses **hunting, fishing, or mining**, which is permitted by forest-wide standards. According to the Willamette, mineral management must be compatible with riparian resource goals. Neither the Tahoe nor the Gang of Four discusses hunting, fishing, or mining.

The Siskiyou contains more extensive information regarding **recreation** than the other documents, in part because the Forest boundaries encompass a number of designated, heavily used Wild and Scenic Rivers. The Willamette states that recreational opportunities "should be compatible with" the riparian dependent resources. Neither the Tahoe nor the Gang of Four addresses recreation.

Of all the Forests, only the Willamette mentions **stream rehabilitation** explicitly, including an entire chapter on the subject. The Siskiyou contains a number of prescriptions for fish habitat which involve stream modifications (see below). The Gang of Four calls for the improvement of degraded stream systems and cites a variety of techniques to achieve this goal.

In summary, management activities prescribed in the Siskiyou Forest Plan tend to reflect management plans for the forest as a whole and do not indicate how management activities will help to achieve the overall goal of maintaining the role of riparian zones in the ecosystem. The Willamette's Riparian Management Guide is the most comprehensive and detailed with respect to management activities and their direct influence on the riparian zone. The Tahoe's Recommendations are limited in the number and type of activities mentioned. The Watershed/Fish option of the Gang of Four report contains specific information for a limited number of activities.

A. 3.) Riparian Zone / Stream Characteristics

This section of the matrix examines the specific guidelines that determine the condition of the streams and their immediate vicinity.

The Siskiyou plan curtails a portion of streamside harvesting in order to either maintain or improve available **shade**. The Willamette and the Tahoe call for maintenance of shade. The Gang of Four does not directly address the issue of shade.

None of the reports directly examines the issue of **nutrients**.

There are some watersheds in the Siskiyou for which a reduction in **stream temperature** is mandated; otherwise the Siskiyou mandates that temperatures "should be maintained," as they should in both the Willamette and the Tahoe. The Gang of Four report does not discuss stream temperature.

Sedimentation caused by management activities in the Siskiyou "should not lead to negative impacts" on fish habitat or water quality. Neither the Willamette nor the Gang of Four report explicitly addresses sediment. The Tahoe calls for providing "natural" sediment loads.

According to the Siskiyou plan, "enough" **large woody debris** should be left to ensure a "healthy ecosystem." The Willamette and Tahoe standards are more specific: in the Tahoe there should be no cleanup or salvage and no programmed timber harvest in the riparian zone, and likewise in the Willamette unless it benefits riparian dependent resources. The Gang of Four does not discuss large woody debris per se.

In the Siskiyou, **riparian vegetation** is mentioned only in terms of its harvestable timber. The Willamette and the Tahoe call for a "natural, mixed" composition of riparian vegetation. The Gang of Four Report does not discuss riparian vegetation.

The Siskiyou has a range of guidelines for **fish habitat** improvement. The Willamette calls for comprehensive protection of riparian zones that would lead to improved fish habitat. The Tahoe does not directly address the issue of fish habitat. The Watershed/Fish Option of the Gang of Four report suggests that large complete watersheds be protected, and includes extensive guidelines to restore and improve fish habitat.

Overall, the Siskiyou Forest plan covers riparian zones in very little detail and with a minimum amount of specific guidelines for protection. This is in line with their emphasis on the basin or forested landscape scale rather than the smaller, riparian spatial scale. The Willamette Riparian Management Guide and the Tahoe

Recommendations are more thorough in their coverage of riparian zones than the Siskiyou, but the Willamette is more specific than the Tahoe in its description of the guidelines for protection. The Gang of Four report covers an area of 25×10^6 acres, not 10^6 acres as do the Forest Plans, and therefore did not aim to provide detailed prescriptions for riparian areas. However, the information contained in the Watershed/Fish Option is relevant to riparian zones.

A. 4.) Landscape pattern and landscape ecology

Riparian zones are parts of larger basins which in turn are elements of the landscape as a whole. Forest management creates new landscape patterns through timber harvesting, road construction and its associated forest fragmentation, and fire suppression. The section on **landscape pattern** and **landscape ecology** considers how the planning documents integrate the riparian zone into the larger forest landscape.

In the Siskiyou, the landscape **design** is considered by dividing the Forest into a number of planning basins, roughly equivalent to drainage basins. The Siskiyou prescribes that harvest patches are to be distributed over "time" and "space." The Willamette partitions the forests into small harvest units and larger basins, but also addresses the overall landscape. The Tahoe includes a pattern of large blocks of mature forest connected through a riparian / old forest network. The Gang of Four Report proposes no harvest of large late seral / old growth blocks and thereby reduces forest fragmentation. This would also be achieved through protected riparian areas which would create greater landscape connectivity.

Corridors, buffer strips, and connectors are often associated with riparian areas and may provide connectivity throughout a landscape. Riparian zones may function as corridors to allow wildlife passage from one area to another, buffer strips can protect the riparian zone from the effects of timber harvesting, and connectors link watersheds and basins across ridgelines and other barriers. Within the forest documents which we reviewed, the purpose for the riparian zone, as a corridor or a

buffer strip, was not made explicitly clear. Riparian zones of variable width are prescribed for protection of riparian resources in the Siskiyou, the Willamette, and the Tahoe. The Gang of Four states that "wider" riparian corridors ought to be established. The Tahoe is the only document that explicitly recommends a system of **connectors** to link riparian areas and wildlife habitat throughout the landscape, crossing over ridges and watershed boundaries. These connectors are zones of no timber harvest.

The **edge effects** created by fragmentation of the forest naturally by streams and artificially by harvests are not mentioned in the Siskiyou or the Willamette documents. The Tahoe recommends that the habitat blocks be "large enough" to minimize edge effects, but the habitat block size is not quantified in deference to an ongoing analysis of the habitat for the California Spotted Owl. The Gang of Four report suggests that the most ecologically significant late seral / old growth forest be reserved to increase the "effective" area of mature and old forest.

Stand diversity is not discussed in great detail at any spatial scale in the forest documents. The Siskiyou calls for the mix of hardwoods and mixed stands for wildlife habitat in the riparian zone.

Guidelines for **structural diversity** vary according to spatial scales, from maintaining snags in the Siskiyou, to achieving a more "complex, natural system" in the Tahoe. The Willamette calls for a composition that provides habitat for riparian dependent species as well as a number of other structural elements. The Gang of Four report contains guidelines and minimum standards for structural diversity, e.g., the "50-11-40 Rule" (see Appendix G-1).

In summary, the Siskiyou deals with forest landscape pattern by prescribing spatial and temporal distribution of patch cuts. The Willamette addresses landscape pattern primarily through prescriptions which create a pattern of riparian zones, surrounded by the existing 10-100 acre patch cuts, but unconnected with adjacent basins. The Tahoe prescribes a landscape pattern of riparian zones connected by

corridors across ridges, producing a reticulate pattern. The Gang of Four Report's Option 8 identifies entire large basins (10^4 - 10^5 acres) as no harvest zones, producing a landscape pattern of large, protected blocks and wide riparian areas, interspersed with large, more intensively fragmented blocks.

A. 5.) Endangered Species

So-called "indicator" animal species often are used to measure the condition of forest, riparian, and stream ecosystems. Many of these indicator animal species are listed federally as threatened or **Endangered Species**. The Siskiyou has guidelines for certain Federally listed species, primarily terrestrial mammals and birds. The Willamette discusses protective measures for several fish species. The Tahoe includes information for a few bird species and anticipates using the information gathered on the Northern Spotted Owl to establish its own California Spotted Owl guidelines. The Gang of Four report has detailed information for the Northern Spotted Owl and many fish species.

A. 6.) Cumulative Effects

Just as it is important to consider the entire landscape when managing the riparian areas, so is it crucial to examine the **cumulative effects** of management activities. The Siskiyou prescribes that the EIS should address cumulative effects of harvesting, but does not elaborate on what these effects might be. The Willamette recognizes the need to consider cumulative effects in the interactions of management activities throughout the Forest, but does not describe any specific analysis procedures. The Tahoe does not address cumulative effects directly, but they do recommend that the Tahoe Forest acquire computer software which could be specifically designed for use in measuring cumulative effects (M. Chapel, personal communication). The Gang of Four report mentions cumulative effects of

timber harvesting and roading on watershed functions, but does not describe how they should be addressed or analyzed.

B. Use of ecological principles

The use of ecological principles in each document was evaluated according to "levels" which I defined. The results of this analysis are summarized in Figure 3. Each document was evaluated for its use of ecological principles on the basis of the publication itself, rather than on what the authors know about ecological principles. One reason for this decision is that if the ecological principles are implicit in a planning document, and that document is challenged in a court, the court will reach a decision primarily on the basis of the written words from the forest. Craig (1987) and Dwyer (1992) have emphasized that legal decisions increasingly have required plans to include explicit and comprehensive justification of predicted impacts of plans based on detailed discussion of ecological principles.

The use of ecological principles for riparian management varies both between the four documents I reviewed and among the management activities which each document describes. Because the four documents were examined in isolation from the larger planning process of which they are a part, and because each document has a different purpose and scope, a direct comparison is somewhat artificial. Many of these differences in the way ecological principles were used are directly a result of differences between the various stages of forest planning to which the documents correspond, i.e. recommendations, forest plans, guidelines for plan implementation, and regional overviews of the accumulated effects of plans. This caveat should be kept in mind in the following discussion.

The Siskiyou operates primarily on Levels One and Two, which is to say that there is no explicit mention of an ecological basis for riparian management, except

that occasionally there is reference to ecological terms, but without any kind of definition or an explanation of the terms. The Forest Plan calls for the future construction of approximately one thousand miles of new roads, and 40% of the designated riparian zones are considered to be "suitable for timber harvest." The document does not mention effects or impacts of multiple use activities (e.g. timber harvest, grazing, mining, recreation) on the riparian zone. The Siskiyou calls for a reduction in stream temperature of 2 degrees over the next 30 years in some of the planning basins. The plan also calls for an improvement in fish habitat but does not explain how it will be achieved or of what it would consist. There is no discussion of how a multiple use policy in the riparian areas could be compatible with the desired improvement of the riparian zone.

There is a solid ecological foundation to the Willamette Riparian Guidelines, corresponding mostly to Levels Two and Three of our scale, and one or two that meet our criteria for Level Four. However, the Guide does not provide supplementary or background information for some provisions, and the amount of definition and explanation provided to justify the ecological terms underlying the guidelines is somewhat variable. The Willamette Guide provides particularly strong and specific standards and guidelines for the stream and riparian zone itself. For example, the standards and guidelines in the document describe the role and function of large woody debris and propose ecologically sound means to practice stream rehabilitation, thus constituting a Level Four in our analysis. However, the Willamette Riparian Guide also discourages livestock grazing and allows recreation opportunities in riparian zones without providing an ecological explanation for these rules.

There is some similarity between the Tahoe Recommendations and the Willamette Riparian Guide. However, while the Willamette describes specific stream reaches of the riparian zone, the Tahoe refers to the riparian zone as more of a landscape feature. Throughout the Tahoe there is a link, on varying levels,

between the recommendations and their ecological background. This corresponds primarily to Levels Two and Three, although there is one section which merits a Level Four ranking as well. The landscape pattern proposed in the Tahoe is unique and designed to maintain riparian continuity throughout the forest. It is based on a concise ecological justification, including an explicit definition and explanation of population viability and its presumed relationship to corridors and landscape connectivity. This constitutes a Level Four use of ecological principles (see Appendix T-4).

It is difficult to compare the Gang of Four Report with the other documents because the Report was not designed to function as the other documents were. The Watershed/Fish Option and the Owl Protection Option of the Gang of Four Report appear to be based on an implicit knowledge of ecological principles. However, the document itself does not explicitly describe these principles. The Gang of Four document was designed and written at the regional scale, rather than the scale of the riparian zones, and this is reflected by the lack of information in the Riparian Zone Characteristics section of the matrix. Nevertheless, because the Report provides alternatives which would be added to existing Forest Plans, we have evaluated its use of ecological principles using the document as it stands. The Owl Protection and the Fish/Watershed Option provides the greatest amount of detailed information on management activities in the document. Some specific prescriptions are included at the basin level, but partly due to the nature of the document, no ecological background is provided. Primarily the document falls under the Level Two category with a lack of ecological justification.

Only two examples were found of ecological principles used at Level Four, that is, with a complete description and justification. The vast majority of prescriptions were based on either an implicit reference to an ecological principle which was not described, or use of undefined ecological terminology, and in some

cases, no ecological explanation at all. I interpret Craig (1987) and the recent decision by Judge Dwyer (U. S. District Court, 1992) to mean that forest planning documents increasingly will be challenged in court on the validity of the ecological principles on which management prescriptions are made. If court proceedings are based largely on the content of forest planning documents, a lack of Level Four ecological principles may lead the Forest Service or the U. S. government into difficulties in litigation. Level Four use of ecological principles provides a complete description of the ecological principles and a justification for their use. If this is lacking, even when the complete set of forest planning documents is considered, then courts must resort to expert testimony to reveal underlying ecological principles and provide the necessary justification for prescriptions.

There are a number of reasons why detailed ecological justifications are missing in the forest planning literature. The major reason is probably that identification of ecological principles would need to be based on examination of a complete set of all relevant planning documents for that forest, especially the EIS written for the Forest Plan (Craig, 1987; U. S. District Court, 1992). Another probable reason is that forest planning documents have not previously been analyzed for their content of ecological knowledge, and the authors were not attempting to explicitly establish the scientific justification for the guidelines. As stated before, the need for explicit justification based in ecological principles has only recently received greater publicity through the court decisions.

Another reason for the lack of clear ecological justification for management may be that a conflict of agendas and priorities exists within National Forests. The "multiple use, sustained yield" policy produces many potential conflicts between objectives, and the authors of the documents we reviewed may have overlooked or selectively included ecological principles in order to avoid these conflicts.

A third explanation for the lack of ecological justification in the forest plans may be that no consensus among scientists has been articulated regarding the

ecological principles appropriate for riparian management. Available scientific literature and experience would have to be reviewed and interpreted at a rather fundamental level before a set of appropriate ecological principles could be identified and incorporated into forest planning. To date, social factors (a coincidence of public demand, scientific responsibility, and institutional capacity) have not been conducive to allow such a consensus to be reached.

C. Scientific knowledge in the forest planning process

My interpretation of the legal tests of the forest planning process suggests that an ideal forest planning process, based on ecological principles, would follow a path from review of the scientific literature to a final stage of writing ecologically sound standards and guidelines. This review of four forest planning documents indicated that none of the documents appears to have followed all these steps. The documents which we reviewed, in their final published forms, do not contain information about the two crucial steps of 1) interpretation of the literature and 2) clear justification of the guidelines based on the ecological principles found in the literature (see Figure 4). This assessment ignores any implicit knowledge that the document's authors may have used in the preparation of the document which we reviewed. The courts have made it clear that there must be explicit definition and explanation of the ecological principles and functional relationships which form the basis of sound riparian management (Craig, 1987; U. S. District Court, 1992).

V. Conclusion

The most notable feature missing in current forest planning documents is an extensive or explicit interpretation of ecological principles and functional relationships which relate to forested riparian zones. Each of the documents which

we evaluated incorporated ecological knowledge on some level, but it was rare to find the type of thorough justification which has been required by recent court decisions. The next logical step is to introduce into the forest planning process a series of coherent ecological principles. This requires ecologists to first reach a consensus as to what ecological principles should be included. Ideally all management of natural resources will have as its base sound research on ecological functions along a continuum of spatial and temporal scales.

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Table One: Streamside Management Activities

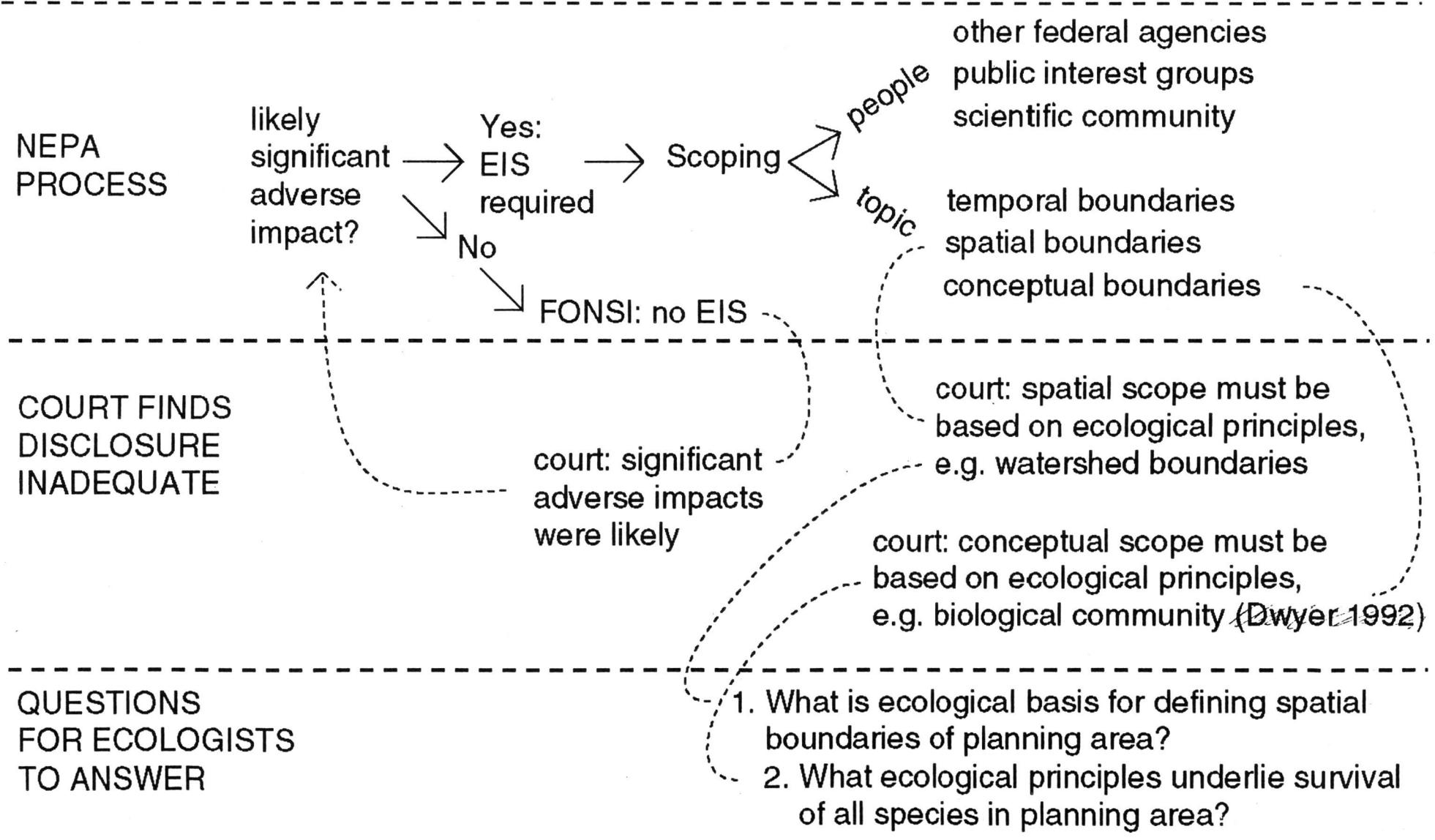
(All distances listed below are for one side of the channel)

	<u>Siskiyou National Forest</u>	<u>Willamette National Forest</u>	<u>Tahoe National Forest</u>	<u>Gang of Four Report Options</u>
<u>buffer strip/corridor width (averages) by stream size</u>	Classes 1-3 have minimum of 100 feet for a "riparian zone" (but this is not necessarily a buffer strip)	Class 1 - 200 feet Class 2 - 100 feet Class 3 Stable - 75 feet Class 3 Moderate & Unstable - 100 feet Class 4 Intermittent - 0-50 feet Class 4 Ephemeral - 0-50 feet	Rivers - 1200 to 1650 feet beginning at edge of 100 yr. floodplain; Large Streams - 1200 to 1650 feet; Small Streams - 300 to 1200 feet; Headwaters - as wide as potential height of tallest trees capable of growing on site	<u>Wild, Scenic & Recreational rivers</u> - 1/4 mile or width of 100 yr. flood plain; <u>major streams</u> - 1/8 mile or width of 100 year floodplain; <u>fish-bearing streams</u> - 300-foot; <u>permanently flowing non-fish streams</u> - 150 feet; <u>seasonally flowing or intermittent streams</u> - 50 feet
<u>timber harvest allowed in riparian zone of designated streams/rivers?</u>	<u>Class 1 and Class 2 - Prescription B</u> (11 basins) - maintain 85% of effective canopy cover and basal area of conifers should be at or above 70%; <u>Prescription C</u> (7 basins) minimum of 90% canopy cover maintain 80% basal area of commercial species; <u>Class 3 - Prescription B</u> - maintain 70% cover and 30% basal area; <u>Prescription C</u> - maintain 80% cover and 60% basal area	Class 1 - no Class 2 - no Class 3 - no Class 4 - varies, see Appendix W-2	no harvest; no distinctions are made according to stream classes	no harvest within a zone of variable width - see above

NEPA process for forest plans affecting riparian zones, as modified by civil litigation, p. 1 of 3

(based on B. Craig, 1987. National forest planning and anadromous fish protection, *Environmental Law and Litigation* 2:255-281;
Seattle Audubon Society et al v. James R. Moseley et al.,
decision recorded May 28, 1992, U.S. District Court, Seattle)

COURT FINDS
LACK OF COMPLIANCE
WITH SUBSTANTIVE
REQUIREMENTS



25

NEPA process for forest plans affecting riparian zones, as modified by civil litigation, p. 2 of 3

COURT FINDS
LACK OF COMPLIANCE
WITH SUBSTANTIVE
REQUIREMENTS

court: must evaluate
whether proposed action
violates specific provisions
of ESA, CWA, NFMA

NEPA
PROCESS,
cont'd.

comments
and questions
from agencies,
public

define
management
alternatives

assess
impact
of each
alternative

select
preferred
alternative

assess
impact of
preferred
alternative

COURT FINDS
DISCLOSURE
INADEQUATE

court: must address
questions raised by
other agencies about
possible impacts

court: must state ecological
basis for expected impact
and acknowledge or
quantify associated risk

QUESTIONS
FOR ECOLOGISTS
TO ANSWER

3. What ecological principles/functional relationships underlie expected impact?
4. What risk is associated with predicted impact?

26

NEPA process for forest plans affecting riparian zones, as modified by civil litigation, p. 3 of 3

27

COURT FINDS
LACK OF COMPLIANCE
WITH SUBSTANTIVE
REQUIREMENTS

court: must evaluate
whether mitigation measure
violates specific provisions
of ESA, CWA, NFMA

NEPA
PROCESS,
cont'd.

propose
mitigation
measures

DEIS submitted
for public
review and
comment

comments
incorporated

FEIS
and record
of decision

accept
forest plan
based on
preferred
alternative

COURT FINDS
DISCLOSURE
INADEQUATE

court: must state ecological
justification for mitigation
and acknowledge or
quantify associated risk

QUESTIONS
FOR ECOLOGISTS
TO ANSWER

- 5. What ecological principles/functional relationships underlie predicted effect of mitigation?
- 6. What risk is associated with prediction?

FEDERAL LAWS TRIGGERED BY PREPARATION AND REVIEW OF FOREST PLAN

Forest plan
(mandated by the **National Forest Management Act** [NFMA], 1976; CFR regulations 1982, 1991)



is a federal action which may have a "significant adverse impact on the environment"
(**National Environmental Policy Act** [NEPA] 1969)



"Does plan have a significant adverse impact?"

Yes

No



Environmental Impact Statement [EIS] required

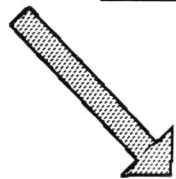
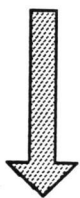
Finding of No Significant Impacts [FONSI]: no EIS required



preparation and review of EIS trigger provisions of the



Endangered Species Act [ESA] 1973: may not contribute to decline of species listed as threatened or endangered



National Forest Management Act [NFMA] 1976: must maintain viable populations of existing native and desired non-native species throughout the planning area (36 CFR 219.19)

Clean Water Act [CWA] 1991: must comply with existing water quality standards

**FIGURE THREE: LEVELS OF USE OF ECOLOGICAL PRINCIPLES
IN THE EVALUATED FOREST DOCUMENTS**

	<u>LEVEL ONE</u>	<u>LEVEL TWO</u>	<u>LEVEL THREE</u>	<u>LEVEL FOUR</u>
Siskiyou National Forest	I-----I	I-----I		
Willamette National Forest		I-----I	I-----I	I-----I*
Tahoe National Forest		I-----I	I-----I	I-----I**
Gang of Four Report		I-----I		

Level One is no mention of ecological principles for justification of guidelines within document

Level Two is reference to ecological terms without definitions or explanations

Level Three is reference to ecological principles or functional relationships without definitions or explanations

Level Four is reference to ecological principles or functional relationships with both definitions and explanations

* woody debris in stream channels

** population viability and corridors in the landscape

FIGURE FOUR: ANALYSIS OF THE FOREST PLANNING PROCESS

	IDEAL PLANNING PROCESS w/ ECOLOGICAL PRINCIPLES	Scientific Literature & Research Experience	-----> Interpretation ----->	Explicit Use of Ecological Principles	----->	Recommended Strategies	----->	Standards & Guidelines	----->	Risks Associated with Standards & Guidelines or Recommendation
Siskiyou National Forest						I-----I		I-----I		
Willamette National Forest		I-----I	???????????	???????????		I-----I		I-----I		
Tahoe National Forest		I-----I	???????????	???????????		I-----I				
Gang of Four Report						I-----I				I-----I

blank space = not present within document

I-----I = present within document

?????????? = use not made explicitly clear

APPENDIX ONE: FOREST DOCUMENT MATRIX

Siskiyou National Forest
(Land and Resource Management Plan)

Willamette National Forest
(Riparian Management Guidelines)

Tahoe National Forest
(Recommendations)

Gang of Four
(Options; Number 8-A considered)

1) DEFINITION & DESCRIPTION OF THE SPATIAL ELEMENTS RELATING TO RIPARIAN ZONE MANAGEMENT

a. <u>Channel</u>	divisions of stream classes 1-4 with some distinctions made by class in stream management; see Appendix S-1 and S-4	divisions of stream classes 1-4; channel consists of all portions of the stream which carry water at normal high flows; includes side channels and backwaters	division of streams by size; channel is center of Old-Forest Zone in order to take advantage of its geomorphic stability; see Appendix T-2	
b. <u>Floodplain</u>		100-year floodplain included entirely in riparian management zone; see Appendix W-3	the topographic break in slope between hillsides and the relatively flat floor of the river valley; 100-year flood plain should be included in riparian zone	within 100-year floodplain some no harvest areas are prescribed; see Appendix G-1
c. <u>Hyporheic Zone</u>				
d. <u>Riparian Area</u>	terrestrial areas where the vegetation and microclimate are influenced by perennial and/or intermittent water, associated high water tables and soils which exhibit some wetness characteristic	starts at edge of active channel & extends horizontally on both sides; includes aquatic ecosystem and terrestrial areas directly affecting aquatic system	consists of the stream channel, floodplain and upland areas that influence the stream environment	the aquatic ecosystem and adjacent upland areas that directly affect it
e. <u>Basin</u> (variable in scale)	planning basins roughly approximate drainage basins within the Forest; see Appendix S-1 and S-2	made up of smaller watersheds linked by corridors	propose a shift of resource planning units from traditional timber compartments to subwatersheds of roughly 2,000 to 10,000 acres	watersheds identified with critical fish habitat; see Appendix G-2
f. <u>Landscape</u> (10 ⁴ - 10 ⁵ acres)	division into planning basins; see section 4 (p.6) of this matrix	riparian areas serve as corridors, providing natural continuity and essential connections between different management areas	large blocks of mature forest and a riparian/old-forest network; see Section 4 of this matrix (p. 6) and Appendix T-3	reserves of late seral / old growth type of forests and riparian zones

Siskiyou Forest PlanWillamette Riparian
GuidelinesTahoe RecommendationsGang of Four Options2) MANAGEMENT
ACTIVITIES

a. <u>Management objectives for riparian zones</u>	protect intrinsic values of ecosystems bordering bodies of water & wetlands while providing limited multiple use development opportunities. Riparian habitat management shall emphasize the role of riparian ecosystems in landscape ecology, vegetation diversity, slope & channel stability, fisheries, wildlife & water quality. See Appendix S-1 and S-2	to provide self - sustaining streamside forests that will ensure desired conditions of riparian resources for the future; maintain the role and function of rivers, streams, wetlands, and lakes in the landscape ecology	to provide a high quality stream environment; maintain key structural & microclimate elements, see Appendix T-1	for Watershed/Fish addition: "maintain & restore ecological functions & processes in streams and habitat" of potentially T&E fish species & stocks of anadromous salmonids; see Appendix G-1
b. <u>Roads</u>	plan on increasing; many currently unroaded areas will be entered; by 5th decade 1000 new miles of Forest development roads; roads should avoid riparian zones when possible	minimize, locate out of riparian areas; put unnecessary roads to bed; see Appendix W-1	prohibit road building and other ground disturbing activities in riparian areas associated with perennial streams	reduce milage; improve road drainage programs; improve existing roads (increase number & size of culverts); leave roadless areas unroaded, see Appendix G-1
c. <u>Timber harvest</u>	<u>Type permitted</u> no harvest in active landslides, where irreversible soil loss is risked, in inner gorge areas with high slide sensitivity, see Appendix S-2	no harvest on stream classes I-III, intermittent class IV in unstable areas, lakes, wetlands; see Appendix W-2	prohibit scheduled harvest in riparian areas associated with perennial streams	LS/OG 1 & 2 (as designated in report) reserved from harvest; commercial thinning limited to once or twice during a rotation; rotation extended in key watersheds on harvested land; see Appendix G-1
<u>Buffer zones</u>	see Riparian Corridors, p. 6	see Riparian Corridors, p. 6	see Riparian Corridors, p. 6	
d. <u>Livestock grazing</u>	range management practices are generally compatible with wildlife needs, but if a conflict occurs, favor protection of riparian areas	domestic livestock grazing should not be permitted		include temporary and permanent exclusion from riparian areas to promote reestablishment of shrubs, hardwoods, and fringe wetlands, and maintenance of stream bank integrity, see Appendix G-1

Siskiyou Forest PlanWillamette Riparian
GuidelinesTahoe RecommendationsGang of Four Optionse. FiresWildfires

all wildfires shall receive an appropriate suppression response

suppression strategies and activities shall have minimal effects on riparian protection objectives

Prescribed

prescribed fires may be used in natural fuels

fuel treatment prescriptions should protect streamside vegetation & maintain the vegetation and woody debris needed for channel stability

eliminate hot burns on steep ground; eliminate burns in riparian management areas, see Appendix G-1

f. Hunting, Fishing, and
Mining

the prospecting, development, and production of mineral and energy commodities shall be facilitated

mineral management shall be compatible with riparian resource management goals. aquifers and downstream resources shall be protected as well as the immediate riparian resources

g. Recreation

new trails to be created and reconstruction of some existing trails; develop and improve recreation sites; develop management plans for the Wild and Scenic Rivers

recreation opportunities should not impair riparian dependent resources

h. Reforestationi. Stream rehabilitation

see Fish Habitat

"treat symptom, not source" of disturbance; manage for the long term; use natural channel materials and follow through with future evaluations

ecologically sound programs using riparian silvicultural techniques, erosion abatement, landscape design, in-channel engineering and planning

Siskiyou Forest PlanWillamette Riparian
GuidelinesTahoe Recommendations Gang of Four Options3) RIPARIAN ZONE /
STREAM
CHARACTERISTICS

- | | | | |
|--|--|---|--|
| a. <u>Shading/Light</u> | see Appendix S-2 | at least 75% of existing shade should be maintained | shade maintained or provided, see Appendix T-1 |
| b. <u>Nutrients</u> | | | |
| c. <u>Stream temperature</u> | see Appendix S-2 | maintain or enhance. Oregon DEQ standards apply, with temperatures less than or equal to 58° F | shade maintained or provided, see Appendix T-1 |
| d. <u>Sediment</u> | no management practices causing detrimental changes in deposits of sediment shall be permitted within riparian areas which seriously & adversely affect water conditions or fish habitat | | provide natural sediment loads in stream channels over time, see Appendix T-1 |
| e. <u>Channel/Reach characteristics</u> | | do not change existing geomorphic structure; maintain width, depth, stream course, channel gradient, streambed topography & bank materials, and LWD | channel should be stable; exclusion of management activities requiring vegetation removal, ground disturbance, heavy equipment |
| f. <u>Role of Large Woody Debris (LWD)</u> | present and future sources of LWD should be provided; see Appendix S-3 | no cleanup; no salvage; maintain through a "no harvest in riparian zone" policy | should be included as part of high quality stream and terrestrial riparian habitat; prohibit timber harvest to adequately conserve; no 'cleaning' of streams |
| g. <u>Riparian Vegetation</u> | mainly referred to in terms of harvest; vegetation in some portions of the riparian area will be harvested to provide timber and wildlife forage | maintain species diversity, age composition, and structural complexity (varying canopy layers, snags, etc.) of riparian forests | provide potential natural composition & arrangement, as wildlife habitat, see Appendix T-1 |

*Siskiyou Forest Plan**Willamete Riparian
Guidelines**Tahoe Recommendations**Gang of Four Options*h. Fish Habitat

minimize soil disturbance;
 maintain summer water
 temperatures; fish habitat
 improvement projects:
 construction of
 approximately 480 instream
 structures per year; complete
 detailed habitat and
 population assessments;
 improve spawning, rearing,
 and migration habitats; see
 Appendix S-6

maintain quality of habitat &
 food supply for all
 anadromous and resident fish
 populations in all stages of
 their life cycle; best
 accomplished through
 floodplain, channel, and
 shoreline protection &
 maintenance of LWD sources

protect through buffered
 riparian area

key watersheds identified and
 no-harvest riparian zones
 recommended, see Appendix
 G-2

Siskiyou Forest Plan

Willamette Riparian Guidelines

Tahoe Recommendations

Gang of Four Options

4) BASIN-WIDE LANDSCAPE PATTERN / LANDSCAPE ECOLOGY

a. <u>Design</u>	division into planning basins. distribute harvest patches over time and space. 175,000 acres of rip zone and 70,000 of those are suitable for timber production, see Appendix S-1 and S-2	landscape, basin, harvest; harvest unit layout must maintain riparian continuity within basin	large blocks of mature forest and a riparian/old forest network, see Appendix T-3	LS/OG (w/20 pairs owls) should not be greater than 12 miles apart; smaller blocks should not be greater than 7 miles apart; LS/OG + "owl additions" for compliance with ISC
b. <u>Corridors</u>	riparian zone = minimum 100 feet (class I-III streams); actual width is site specific; not clear whether this is a corridor or not	assess over each basin individually; no picket fences; see Appendix W-4	varies by stream size; minimum width = maximum tree height, see Appendix T-2	establish "wider" riparian corridors on federal lands across the landscape to provide additional protection
c. <u>Connectors (over ridges; between basins)</u>			to link habitats and provide travelways for species associated with older forests, as well as watershed connectivity; measure 300-1200 feet in width; see Appendix T-3	
d. <u>Edge effects</u>			provide large habitat blocks to have "sufficiently" large and unfragmented areas	reserve LS/OG 1 or LS/OG 1 & 2 to increase <i>effective</i> LS/OG
e. <u>Stand (compositional) diversity</u>	wildlife habitat values of hardwood and mixed stands should be considered		vertical and horizontal diversity with both open and closed canopy	see Appendix G-3
f. <u>Stand structural diversity</u>	wildlife tree habitat (snags) should be maintained; habitat capability for woodpeckers, indicators for cavity-nesting species, should be maintained at not less than 60% of potential population levels)	to provide connectivity & dispersion, greater than 10 live, overstory trees/acre and 15 down trees/acre greater than 24" DBH should be maintained	obtain/maintain potential natural composition (large trees, snags, down logs, multi-layered canopies)	50-11-40 rule (see Appendix G-1) with Option A; increased structural retentions: should average at least 6 large green trees per acre that are greater than stand average, 2 large snags per acre, and 2 large down logs per acre

Siskiyou Forest Plan

Willamette Riparian Guidelines

Tahoe Recommendations

Gang of Four Options

5) ENDANGERED SPECIES

a. Terrestrial animals

management indicator species and their associated habitats identified; guidelines for deer, elk, and wolverines among others

Standards & Guidelines of the Forest Plan apply

b. Birds

guidelines for both "listed" and "sensitive" species, including northern spotted owl, osprey, bald eagles, and peregrine falcons; see Appendix S-5

Cal. spotted owl - use northern spotted owl information for now; use minimum corridor widths as determined for Marten and Fisher species

see Appendix G-4

c. Fish

salmon indicator species (fall chinook salmon, winter and summer steelhead, and resident trout) identified for evaluating habitat

streams with spring chinook salmon should have no disruptive activity between July 15 and September 15; bull trout streams should have activities completed before September 1 in reaches used for spawning

see Appendix G-4

d. Aquatic and riparian amphibians, birds, and mammals

Siskiyou Forest PlanWillamette Riparian
GuidelinesTahoe Recommendations Gang of Four Options6) CUMULATIVE
WATERSHED EFFECTS

interactions of landscapes, basin, and harvest units must be considered; small, individual activities can have significant, additive impacts when combined on a basin level

a. Analysis techniques for
cumulative effects

project level environmental analysis will examine cumulative effects of past and future treatments of harvestig under Prescription B. See Appendix S-2

perform systematic analyses for each drainage basin to assess the potential of, and to avoid, cumulative effects

conduct an analysis by NF and BLM Districts to aid in the timing and location of timber harvest & location of roads & landings; see Appendix G-1

MANAGEMENT AREA 11 - RIPARIAN

DESCRIPTION

This prescription applies to the riparian ecosystem along all perennial streams (Class I, II, and III). The minimum area of consideration is 100 feet measured horizontally from each side of the stream. The actual width of the riparian zone is determined on the ground and varies based on site-specific conditions. The expected average distance of consideration for Class I and II streams is 150 feet. Within this Management Area there are three prescription themes that are assigned to individual Planning Basins. Two include multiple uses with the emphasis on watershed and fisheries values and limited timber production. Prescription B is designed to manage vegetation to maintain water temperature. Prescription C manages vegetation to reduce water temperature and improve watershed conditions over time. The third prescription is Minimum Level (M) which programs no timber harvest that would remove stream shade producing vegetation. Of an estimated 175,500 acres of riparian zones Forest-wide, approximately 70,000 acres are suitable for timber production and included in this Management Area. While riparian areas are often overlapped by Management Areas 1 through 10, they are never assigned to Management Areas 12 through 14 since this would not meet the Management Requirements for watershed and fisheries protection. Refer to Figure IV-14 for a map displaying allocated acres within the Management Area.

Table IV-25. Acres Allocated to Riparian

Riparian Prescription: 1/ Planning Basin No. and Name	Acres		
	Management Area 11	Overlap by Management Areas 1-10	Total Area
Prescription B:			
02-South Fork Coquille River	7,902	2,028	9,930
04-Upper Rogue River	5,836	6,058	11,894
08-Galice and Slate Creeks	6,076	974	7,050
09-Lower Illinois River	3,731	6,959	10,690
10-Upper Illinois River	3,587	10,419	14,046
11-Briggs Creek	5,232	997	6,229
15-Rough and Ready/Josephine Creeks	6,809	1,920	8,729
16-Winchuck River	4,971	1,375	6,346
17-North Fork Smith River	4,366	4,717	9,083
19-East and West Fork Illinois River	4,432	1,522	5,954
20-Sucker Creek	6,764	2,492	9,256
Prescription C:			
01-Elk and Sixes Rivers	6,095	6,103	12,198
03-Lobster Creek	3,316	1,297	4,613
05-Lower Rogue River	4,044	2,965	7,009
06-Indigo Creek	6,041	1,810	7,851
07-Silver Creek	3,881	3,046	6,927
12-Pistol River	5,817	1,311	7,128
13-Lower Chetco River	7,723	7,020	14,743
Total	96,623	63,053	159,676

1/ Minimum Level (Prescription M) acres are intermingled within each Planning Basin. The Upper Chetco Planning Basin (15,824 acres, all Prescription M) is not displayed because it is entirely within Wilderness (MA-1).

MANAGEMENT GOAL

The goal is to manage these areas under the principles of multiple use while maintaining the integrity of these riparian ecosystems which includes streambank stability, vegetation, terrestrial and aquatic habitats.

Class I and II stream temperature goals are to maintain or decrease summer temperatures in all Planning Basins. For the Planning Basins managed under Riparian Prescription B, the objectives for canopy cover associated with these goals are to maintain 85 percent of pretreatment effective canopy cover along Class I and II streams, and 70 percent along Class III streams. For Planning Basins managed under Riparian Prescription C, the objective is to maintain a minimum of 90 percent of the pretreatment effective canopy cover along Class I and II streams and 80 percent along Class III streams.

Timber

- MA11-5** Riparian Prescription B Planning Basins. Timber management is programmed at a level that will provide for maintaining the stream temperatures without significant increase in critical summer temperatures. Management activities may include the following: commercial harvest, site preparation, planting, release, and precommercial thinning.

To provide canopy cover for stream shading and large conifers for wildlife and stream habitats; the basal area of conifers should be maintained at or above 70 percent of natural conditions along Class I and II streams, and 30 percent along Class III streams. Harvest shall be done in such a way that damage to remaining streamside vegetation is minimized. Priority should be given to planting vegetation along shade-deficient stream channels. Directional falling and full suspension should be required within the streamside area.

The project level environmental analysis shall examine the cumulative effects of both past and future treatments. No more than 11 percent of the Riparian Area acreage within each planning basin shall be entered on a first entry basis per decade. Harvest units shall be distributed within each basin, and subsequent reentries per site should not occur within 20 years.

- MA11-6** Riparian Prescription C Planning Basins. Timber management is programmed at a level designed to result in up to a 2 degrees Fahrenheit decrease in summer stream temperatures, by the end of the third decade, improving fish habitat capability. Timber management shall include tree removal on a limited basis with the overall direction of retaining at least 80 percent of the basal area of commercial species along Class I and II streams and 60 percent along Class III streams. Harvest shall be done in such a way that damage to remaining streamside vegetation is minimized. Priority should be given to planting vegetation along shade deficient stream channels. Directional falling and full suspension should be required within the streamside area.

No more than 11 percent of the Riparian Area acreage within the planning basin shall be entered per decade. Harvest units shall be distributed within the basin, and subsequent reentries per site should not occur within 20 years.

APPENDIX S-3

LARGE WOODY MATERIAL

- 7-8** Management activities shall be planned to maintain enough large woody material (dead and down) to maintain a healthy forest ecosystem. Site-specific needs shall be considered in environmental analyses. Five to twenty pieces of large woody material per acre should remain on each site where management activities take place. Material should be from a range of decomposition classes; each piece should be at least 20 inches in diameter at the large end and contain at least 40 cubic feet volume. Considerations for achieving desired results are:

1. Leave all class III, IV, and V logs
2. 10-20% of the pieces should be class I or II (most special and utility culls meet the definition of decomposition classes I or II)
3. Conifer logs are preferable, but where unavailable, hardwood logs can be substituted
4. 20 inch diameter or larger pieces are preferred; if not available, leave pieces as close to 20 inches diameter as possible.

Management activities shall be planned and conducted to limit impacts on streams and water quality. Standards and Guidelines for the management of Class I, II, and III streams are found under Management Area 11. Additional direction is found in Siskiyou Riparian Ecosystems Management Policy (FSM 2520.3 Siskiyou Supplement 1).

7-11 Class IV streams shall be managed to minimize adverse downstream impacts on Class I, II, and III streams that could result from movement of soil, debris, or chemicals into perennial stream courses:

- 1. The bank and channel stability of Class IV stream courses should be protected. The minimum area of consideration should be 25 feet horizontal distance on each side of the stream channel. Stream course protection needs will often be met by retaining selected hardwoods or conifer trees directly adjacent to the stream channels.**
- 2. Burning prescriptions should plan to protect streamside vegetation and maintain stream channel stability. In most instances, minimal or no burning would be prescribed within 25 feet horizontal distance on either side of stream channels.**
- 3. Activity created debris should be cleared from stream channels except for large woody material keyed into stream banks that contribute to water quality, stream channel and bank stability, and fish habitat. Clearing should be accomplished prior to fall rains.**
- 4. Efforts should be made to yard away from stream channels. Logs yarded over Class IV streams should be fully suspended where practicable.**

Where the above measures cannot be implemented, appropriate mitigation measures shall be developed in the project environmental analysis, documented in the project record, and implemented prior to fall rains.

7-12 Where domestic water uses occur within small watersheds subject to management activity, an in-depth field evaluation and determination of water quality protection needs should accompany any reclassification of stream Classes I-IV for each tributary. Management prescriptions for the riparian corridor should be tied to site-specific conditions relative to the type and extent of proposed activity and expected impact on water quality.

Table IV-22. Summary of Habitat Needs for Pine Marten, Pileated Woodpecker, and Northern Spotted Owl

Habitat Parameter	Pine Marten	Pileated Woodpecker	Northern Spotted Owl
Successional stages required	Mature or Old Growth	Mature or Old Growth	Old Growth or Mature
Acres/Habitat Area in mature/old-growth forest	160 acre/Habitat Area (represents territory of 1 female and part of territory of 1 male)	300 acres/Pair (within a 1,000 acre unit, which also includes 300 acres of feeding habitat)	1,000 acres/Pair (habitat must be within 1 1/2 miles of core center)
Canopy closure	50% or greater	---	Moderate to high
Minimum habitat block size (habitat within each area should be as contiguous as possible)	160 acres	50 acres (blocks maximum 1/4 mile apart)	300 acres in nesting core, 60 acres in other habitat
Maximum dispersal distance between habitat areas	One habitat area for every 4,000 to 5,000 acres (area of circle with diameter of 3 miles)	One habitat area for every 12,000 to 13,000 acres (area of circle with diameter of 5 miles)	6 miles between single pairs, 12 miles between groups of 3 or more pairs, edge to edge
Snag maintenance requirements in habitat areas	Maintain minimum average of 2 hard snags/acre > 12" DBH; 24 of the 320 snags should be > 20" DBH	Maintain minimum average of 2 hard snags/acre > 12" DBH, within the 300 M/OG area; 45 of the 600 snags should be > 25" DBH; within the 300 acres for feeding, maintain minimum average of 2 hard snags/acre > 10" DBH	Must meet requirements for pileated woodpecker; should have dead standing trees and fallen decayed trees to support abundant populations of prey species, especially n. flying squirrel and woodrat
Down timber requirements	Minimum average of 6 down logs/acre > 12" DBH and 20' long.	Must meet requirements for marten	Must meet requirements for marten

Fish Habitats

The Forest's fisheries program focuses on both administrative and improvement goals. There are currently two Basin Plans (Chetco and Winchuck Rivers) in effect which guide management activities. Priority is being given to writing such plans for the rest of the Forest's streams. Central to this effort will be the completion of detailed habitat and population assessments using survey methods adopted for the Region (Hankin and Reeves 1986). The Forest will coordinate its efforts with the Oregon Department of Fish and Wildlife, who is also in the process of generating fisheries basin plans.

Maintenance of present fish habitat capability focuses on protecting existing high quality salmonid habitat by minimizing adverse impacts from proposed management activities or mitigating effects from past activities. Habitat capability information is utilized in planning road construction, timber harvest, and other projects in order to reduce the potential impacts from excess sedimentation, or water temperature increases. A key factor in the maintenance of Forest salmonid resources is management of riparian areas to benefit fish. Coordinating with other Forest resource uses will continue to be a priority for Siskiyou fish biologists. Management direction supporting the maintenance of fish habitat is contained in the Soil and Water section of the Standards and Guidelines, and in Management Areas 7 and 11.

An aggressive fish habitat improvement program is in response to public desires and realization that National fishing demand is expected to nearly double in the next five decades. Increased National, Regional and Forest emphasis on the fisheries program was realized in 1987 with development of the "Rise to the Future Fisheries Program." Through this program a strengthening of partnerships with States, other Federal agencies, Tribal governments, conservation groups and publics is occurring in fish habitat management.

Fish habitat improvement project work will continue with construction of approximately 480 instream structures per year. Most of the work will be performed in areas where access is available, hydrological conditions are favorable, and preliminary surveys have identified good potential for enhancement benefits. Few or no structures will be installed in areas that have minimal anticipated benefits (because of excellent pre-existing habitat conditions, or poor water quality condition from off-Forest activities). This work should result in an overall net increase in adult fish available for both sport and commercial harvest, an anticipated increase of 13,360 Wildlife/Fish User Days (WFUD's) and 164,000 commercial pounds annually.

The prime emphasis for fish habitat will continue to be good land management practices that will not degrade from existing fish habitat capability. The monitoring requirements for fish habitat are outlined in Chapter V and Appendix D.

Road Design and Location

Road failures and road-associated landslides contribute more sediment to riparian areas than any other management activity. Road failure has been a major cause of debris torrents in streams of the WNF. Sound construction methods and road locations can significantly reduce potential for long-term cumulative effects. Roads with high use during rainy portions of the year should be constructed and maintained to minimize sedimentation increases. Proper location of roads adjacent to riparian management areas and on hillslopes is a crucial component of effective riparian management.

- ◆ Minimize road construction on floodplains.
- ◆ Locate roads outside the riparian area.
- ◆ Limit stream crossings to areas where no practical alternative is available.
- ◆ Put temporary spur roads to bed be after harvest.
- ◆ Limit use of equipment in the stream channel and riparian areas.
- ◆ Consider additional surface, fill, and drainage stabilization measures for roads that contribute sediment to Class I or II streams.
- ◆ Consider closure or putting existing roads to bed in areas of unstable soils.
- ◆ Construct and maintain all roads and structures to minimize direct or indirect additions of sediment to streams.
- ◆ Sidecast and end haul material should not enter the riparian management zone, except where road entry is intended.
- ◆ Use water bars and other erosion control structures to prevent sediment delivery.
- ◆ Design culverts and other stream crossings to maintain fish passage on fish-bearing streams.
- ◆ Restrict in-stream construction activities to specified flow periods.
- ◆ Schedule dust oil application to minimize direct or indirect delivery into streams, lakes, and wetlands.

Timber Harvest

The levels of timber harvest programmed within riparian management zones differ by aquatic habitat type. Programmed timber harvest and other practices in riparian management zones are summarized in Tables 5a, b, and c.

No timber harvest is programmed from riparian management zones along Class I, II and III streams, intermittent Class IV streams in unstable watersheds, lakes, or wetlands (Fig. 36). This policy is designed to ensure that management objectives for riparian-dependent resources will be achieved.

Partial harvest of vegetation (<50% of the stand in the riparian management zone) is permitted on the following stream classes: 1) intermittent Class IV channels in moderately stable watersheds; 2) ephemeral Class IV streams in unstable watersheds. Trees should not be harvested in the immediate vicinity of locally unstable areas, and trees in riparian areas can be partially harvested in downstream reaches (Fig. 37). Trees left within areas of partial harvest should be distributed along the reach in locations that maximize the resistance to debris flows and floods.

Complete harvest of overstory vegetation is permitted in: 1) intermittent Class IV streams in watersheds with stable soils; 2) ephemeral Class IV streams in watersheds with stable or moderately stable soils.

Table 5a. Perennial Streams and Rivers: Summary of standards and guidelines for riparian management zones.

Riparian Management Guidelines	Class I	Class II	Class III	
			Stable ¹	Moderate ¹ & Unstable
Location				
Range of width from active channel ²	150-400 ft	100-200 ft	50-100 ft	75-125 ft
Average width ³	200 ft	100 ft	75 ft	100 ft
Objectives				
Extent of 100-yr floodplain within RMZ ⁴	100%	100%	100%	100%
Temperature ⁵	M & E	M & E	M & E	M & E
Input of woody debris	100%	90%	75%	90%
Input of terrestrial food resources	100%	100%	100%	100%
Bank stability	100%	100%	100%	100%
Operations				
Overstory vegetation remaining within RMZ	100%	100%	100%	100%
Understory vegetation remaining within RMZ	100%	100%	100%	100%
Directional falling along RMZ	Yes	Yes	Yes	Yes
Yarding suspension over banks	Full	Full	Full	Full
Yarding and line corridors	Yes	Yes	Yes	Yes
Stream cleanout ⁶	No	No	No	No
Salvage within RMZ ⁷	No	No	No	No

¹ Stability ratings. See Appendix II for soil types and slope stability analysis.

² These riparian widths represent the horizontal distances commonly required to meet management objectives.

³ These widths represent the expected averages and were used in the FORPLAN model for the Forest and Resource Management Plan.

⁴ 100-yr floodplains are assumed to be less than 400 ft wide on a single bank. Where floodplains extend beyond 400 ft, specific site conditions will be evaluated relative to the Executive Order on Floodplain Development.

⁵ Objectives for shade are to maintain or enhance water temperatures. At a minimum, 80% of the existing shade will be maintained.

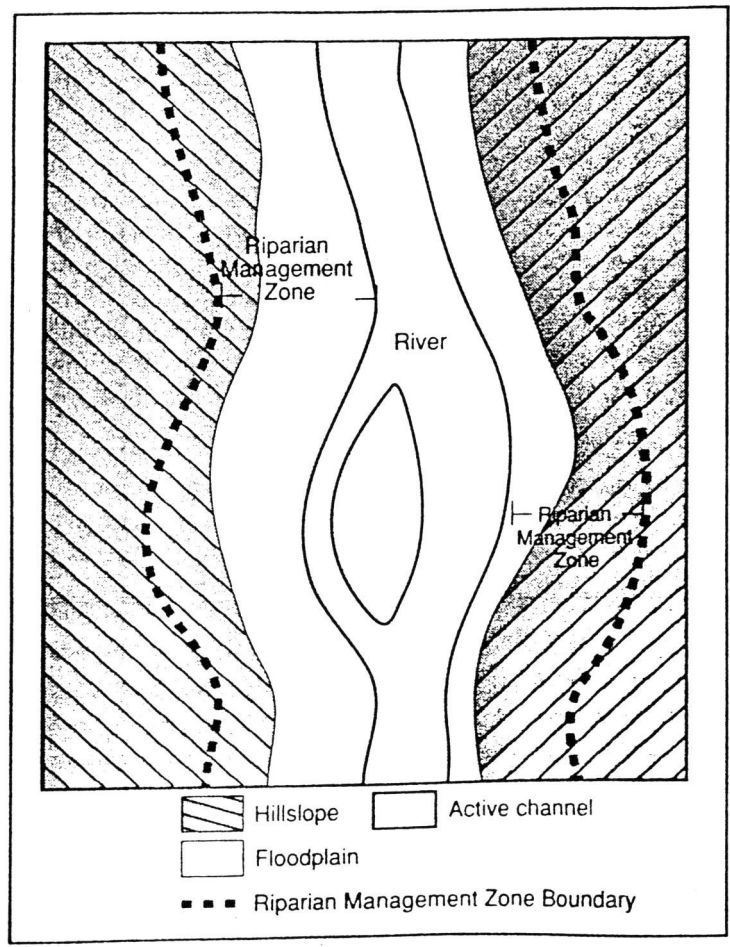
⁶ Stream cleanout is permitted immediately upstream of culverts.

⁷ Salvage within an RMZ after catastrophic events should be considered only to restore degraded riparian habitat and benefit riparian-dependent resources. Evaluate specific site conditions.

Table 5b. Intermittent and Ephemeral Streams: Summary of standards and guidelines for riparian management zones.

Riparian Management Guidelines	Class IV				
	Intermittent			Ephemeral	
	Stable ¹	Moderate ¹	Unstable ¹	Stable ¹ & Moderate	Unstable ¹
Location					
Range of width from active channel ²	0 ft	25-50 ft	25-100 ft	0 ft	25-100 ft
Average width ³	0 ft	30 ft	50 ft	0 ft	50 ft
Objectives					
Provide floodplain functions ⁴	No	No	No	No	No
Temperature ⁵	M & E	M & E	M & E	No	No
Input of woody debris	0%	20-40%	30-50%	0%	0%
Input of terrestrial food resources	None	Partial	Partial	None	Partial
Bank stability	Locally Reduced	100%	100%	Locally Reduced	100%
Operations					
Overstory vegetation remaining within RMZ	None	Partial	All	None	Partial
Understory vegetation remaining within RMZ	Partial	Partial	All	Partial	Partial
Directional falling along RMZ	Yes	Yes	Yes	No	Yes
Yarding suspension over banks	Full-Partial	Full-Partial	Full	Partial	Partial
Yarding and line corridors	Yes	Yes	Yes	Yes	Yes
Stream cleanout ⁶	No	No	No	No	No
Salvage within RMZ ⁷	No	No	No	No	No

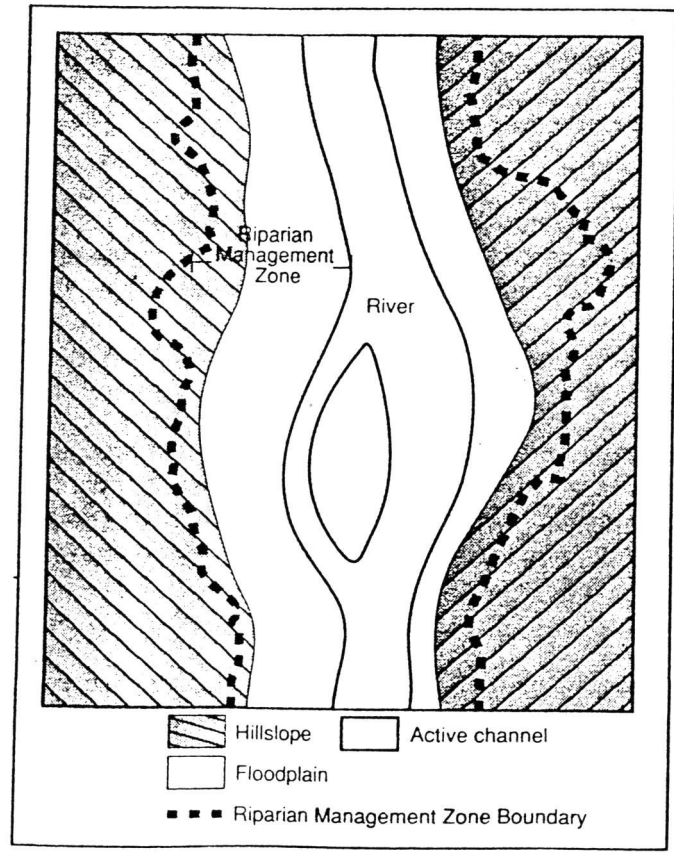
1 Stability ratings. See Appendix II for soil types and slope stability analysis
 2 These riparian widths represent the horizontal distances commonly required to meet management objectives
 3 These widths represent the expected averages and were used in the FORPLAN model for the Forest and Resource Management Plan.
 4 Intermittent and ephemeral channels are assumed to have no floodplains.
 5 Intermittent channels may flow during summer when stream temperatures are critical. Consider retention of vegetation for shade.
 6 Stream cleanout is permitted immediately upstream of culverts.
 7 Salvage within an RMZ after catastrophic events should be considered only to restore degraded riparian habitat and benefit riparian-dependent resources. Evaluate specific site conditions.



MODEL

Layout of a riparian management zone along a stream with complex channel and floodplain.

A riparian management zone with boundaries of variable widths. Note that the floodplain is entirely contained within the riparian management zone.



ACTUAL

Table 4a. Corridor types used to maintain connectivity within. Note that types V, VI, and VII are riparian areas.

Corridor Type	Width	Management Areas
I	Variable: 1 mile +	Most no-harvest areas
II	1/2 - 1 mile	Middleground visual
III	1/4 - 1/2 mile	Foreground visual, Wild & Scenic Rivers
IV	100 - 800 feet	Trails
V	400 feet	Class I Riparian
VI	200 feet	Class II Riparian
VII	175 feet	Class III Riparian
VIII	Variable: 50 - 500+ feet	Unsuitable Lands

Table 4b. Forest functions dependent on corridor connectivity.

Corridor/Access Needs	Corridor Type							
	I	II	III	IV	V	VI	VII	VIII
Motorized Access: Non-destination & Developed		X	X					
Non-Motorized Access: Dispersed & Wilderness	X			X	X	X	X	X
Big Game: Optimal Cover	X	X	X	X	X			X
Travel & Forage	X	X	X	X	X	X	X	X
Mobile Interior Stand Species: Dispersal & Forage	X	X	X	X	X	X	X	X
Breeding	X	P/M	P/M		P/M	P		
Immobile Interior Stand Species: Animals & Plants	X	X	X	?	X	X	X	X
Water Dependent Species Animals & Plants				X	X	X		

* Mobile interior species are Spotted Owls, Pileated Woodpecker (P) & Pine Marten (M).

Table 2. Objectives for Desired Future Conditions in Riparian Zones

<i>Objective</i>	<i>Recommendations</i>
Provide natural (presettlement**) stream temperatures through time.	Provide natural composition and arrangement of adjacent forest canopy and understory vegetation (herbs, shrubs, and small trees).
Provide the potential natural arrangement of large-woody debris in all time periods.	Establish upland areas to protect all existing and natural and potential sources of large dead wood. Upland areas should be at least as wide as the potential maximum height of the tallest tree capable of growing on the site.
Provide the potential natural sources of organic and inorganic material to the stream environment through time.	Provide the potential natural composition and arrangements of riparian vegetation and adjacent forest canopy and understory vegetation.
Provide natural (presettlement**) sediment loads in stream channels over time.	Provide adequate ground cover and vegetation in the upland areas as sediment buffers. Rehabilitate disturbed sites. Eliminate ground-disturbing activities in the zones.
Provide undisturbed surface and subsurface water flow processes over time.	Prevent ground-disturbing activities in the riparian zones. Maintain stability in sensitive upslope areas.
Provide watershed connectivity for movement of aquatic organisms in all time periods.	Provide adequate flows and fish passage structures. Regulate activities that drain or reduce stream flows to provide adequate watershed connectivity.
Provide potential natural composition and arrangements of riparian trees and shrubs for wildlife through time.	Use best professional judgement to establish estimates of potential natural communities. Restore native tree and shrub assemblages, where they have been degraded or eliminated. Maintain natural conditions where they exist.
Protect riparian and associated upslope microclimatic conditions through time.	Determine zone widths needed over and above all other recommendations to provide adequate buffering of sensitive microclimatic conditions (See discussion under Late-Seral-Stage Habitats, P. XX).

** *Management should attempt to provide conditions which existed during presettlement periods where possible. Where not possible, management should provide conditions that are as close to presettlement conditions as possible.*

Table 5. Objectives for the Old-Forest Zone of the Riparian/Old-Forest Network.

Objectives

Recommendations

Headwaters

Provide potential natural arrangements of large trees, logs, and snags for amphibians and small mammals.

Establish upland areas to protect all existing and potential sources of large dead wood. Upland areas should be at least as wide as the potential height of the tallest trees capable of growing on site (Same as determined for the riparian zone).

Provide forest floor microclimate that resembles natural conditions.

Provide for the potential natural community in the of forest canopy and understory vegetation in the upland zone.

Small Streams

Provide travelways for the full range of species associated with old-forest and riparian habitats. Assume free movement across the channel.

Establish old-forest zones that measure 300 to 1200 feet from edge to edge. The riparian zone (stream channel, floodplain, and upland areas) is included within the old forest zone (Figure 2). Use Table 4 to determine appropriate widths.

Large Streams

Provide yearlong and seasonal habitat for species associated with older forests. The stream channel may be a barrier to movement for many species inhabiting the adjacent forest in the lower reaches.

Establish old-forest zones that measure 1200-1650 feet. The 1650 foot zone guideline is recommended (See Appendix A for explanation and other useful data). Where the stream channel is not a barrier, the riparian zone channel, floodplain, and upland habitat should be included within the old-forest zone. Where the channel or floodplain are barriers to movement, establish old-forest zones on both sides of the floodplain, beginning at the interface of the 100 year floodplain and adjacent upland.

Provide travelways for the entire range of vertebrates assoc. with old-forest and riparian habitats

The guideline for yearlong habitat above will provide adequate conditions for free movement of vertebrates associated with old-forest and riparian habitats.

Rivers

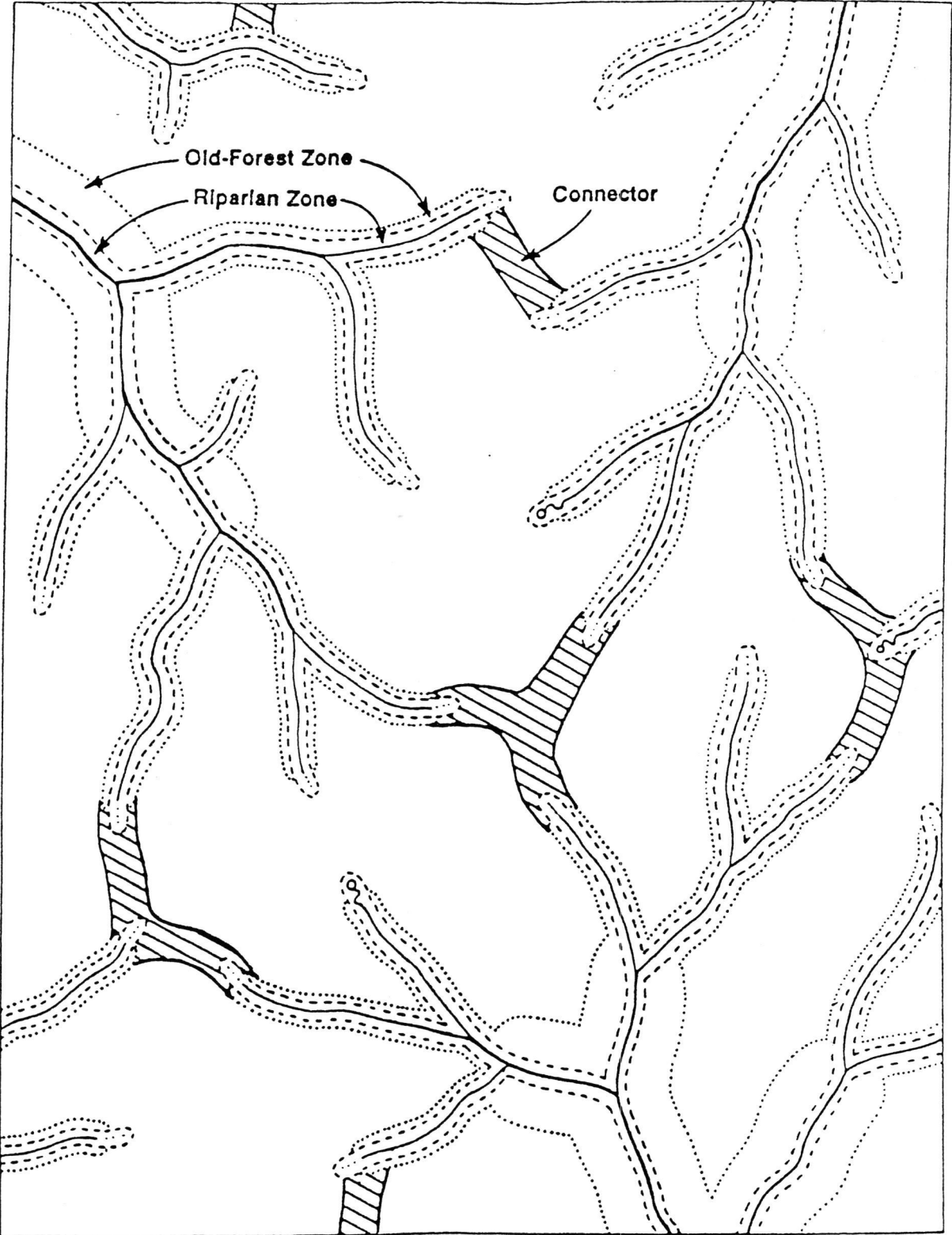
Provide yearlong and seasonal habitat for species associated with older forests. The stream channel is a barrier to movement of many species inhabiting the adjacent forest.

Establish old-forest zones that measure 1200 to 1650 feet wide on each side of the stream channel beginning at the edge of the 100-year floodplain. The 1650 foot zone guideline is recommended (See Appendix A for explanation and other useful data).

Provide travelways for the entire range of vertebrates assoc. with old-forest and riparian habitats.

The guideline for yearlong habitat under large streams will provide adequate conditions for free movement of vertebrates associated with older forests and riparian habitats.

FIGURE 3. PLACEMENT OF CONNECTORS.



A. DESIRED LANDSCAPE CONFIGURATION

The recommended landscape design for late-seral-stage-forest and riparian habitats (Old-Forest/Riparian System) consists of scattered, large, old-forest-habitat blocks connected by a Riparian/Old-Forest Network (Figure 1). The design is intended to provide a completely connected system of habitats for associated vertebrate species. The system was designed to combine the advantages of a large block strategy and a habitat network. It reflects the principles of conservation biology that relate to species associated with old-forest and riparian habitats described by others as follows:

- * Species that are well-distributed across their range are less prone to extinction than those that are restricted to a portion of their former range.
- * Large blocks containing many pairs of each species will sustain species better than small blocks with few individuals.
- * Blocks of habitat that are close together are better than those that are far apart.
- * Contiguous, unfragmented habitats are better than fragmented areas.
- * Habitat is generally more useful for dispersal, daily movements, and migration if it closely resembles suitable habitat for a species in question.
- * Connected blocks of habitat are better than unconnected blocks of habitat.
- * Management strategies that provide habitat throughout the landscape are more able to withstand large disturbances than those that concentrate habitat.

Table 5. Standards and guidelines for the two watershed and fish options.

Option	Description
Current option	Riparian standards and guidelines and best management practices to minimize cumulative effects in watersheds, as defined in current FS and BLM Plans.
Watershed and fish habitat emphasis option	<p>Reserve areas: Wilderness, National Parks, Wild and Scenic Rivers, LS/OG1, and owl additions.</p> <p>Riparian management areas on all FS and BLM lands:</p> <ol style="list-style-type: none"> (1) Wild, Scenic, and Recreational rivers designated or under study: no-harvest area 1/4 mile on each side of the stream or the width of the 100-year flood plain, whichever is larger, where water quality, fish, or other ecological values are described as part of the stream's outstandingly remarkable features. (2) No-harvest area 1/8 mile on each side of the stream or the width of the 100-year flood plain, whichever is larger, on major streams draining at least 30 square miles. (3) Fish-bearing streams: 300-foot no-harvest area on each side of the stream. (4) Permanently flowing non-fish-bearing streams: 150-foot no-harvest area on each side of the stream. (5) Seasonally flowing or intermittent streams: 50-foot no-harvest area on each side of streams in areas of moderate and high soil instability. <p>No-harvest areas will vary with topographic and on-site conditions, but the horizontal width of such areas, implemented in practice, should reach the objectives expressed as averages here.</p> <p>Key watersheds identified as having high-quality fisheries, water, or ecological values (Appendix D): Augment the Forest Plan standards and guidelines with the 50-11-40 rule and rotations approaching 200 years (management option C as described in "Lands Outside of Reserves," under "Forest Management").</p> <p>Forest road systems and related road-drainage problems:</p> <ol style="list-style-type: none"> (1) Reduce and minimize forest road-system mileage: <ol style="list-style-type: none"> (a) Minimize construction of new roads, and construct no new roads in current roadless areas identified in the Forest Plans. (b) Remove (return to a natural condition) spur roads and other nonessential roads. (2) Conduct a forest road-system analysis by National Forest and BLM District to identify road locations and practices which will reduce impacts to riparian areas of existing and new roads. (3) Road drainage: <ol style="list-style-type: none"> (a) Increase maintenance of road network during the rainy season. (b) Upgrade culverts to larger sizes on existing and planned roads. (c) Increase frequency of culverts on new and existing roads. <p>Logging slash treatment/prescribed fire:</p> <ol style="list-style-type: none"> (1) Eliminate hot burns on steep grounds. (2) Eliminate burns in riparian management areas. <p>Livestock grazing: Include temporary and permanent exclusion from riparian areas to promote the reestablishment of shrubs, hardwoods, and fringe wetlands, and maintenance of stream-bank integrity.</p> <p>Riparian and fish-habitat restoration: Establish a program that will ensure long-term stream-habitat stability.</p> <p>Cumulative effects: Conduct an analysis by National Forest and BLM District to aid in the timing and location of timber harvest and location of roads and landings.</p>

Stream/watershed ¹	Steelhead trout		Salmon				Sea-run cutthroat trout	Resident trout	Bull trout	Other
	Sum	Win	Coho	Chinook						
				Spr	Sum	Fal				

Washington (continued)

09 Elwha R.			X	X						X(6,8)40
10 Soleduck R.	X	X								P(9)
11 Cook Cr./McCalla Cr.										X(10)
Wenatchee NF										
12 Tieton R.										X
2 Rattlesnake Cr.	P			P						X
3 Bumping-American R.				P						X
4 Cle Elum R.										X P(9)
5 Ingalls Cr.	X							P		X
6 Mission Cr.	X							P		X
7 Icicle Cr.								P		X C1
3 Upper Wenatchee R. ³	X			P						X P(9)
8 Entiat R.	X			P						X

Oregon

14 You NF										
15 Winchuck R.		P	X		X			X		
16 Chetco R.										
03 Emily Cr.		P	X		X			X		
04 Rogue R.										
06 Taylor Cr.			X							
07 Quosatana Cr.	X	P			X			X	P	
08 Shasta Costa Cr.	X	P	X		X			X	P	
09 Illinois R.										
05 Grayback Cr.		P	X		P				P	C1
05 Cave Cr.		P			P				P	C1
04 Upper Sucker Cr.		P								C1
01 Upper E. Fork Illinois R.		P	X		P				P	
09 Lawson Cr.		P			X			X	P	
10 Silver Cr.		P			X			X	P	
11 Indigo Cr.		P			X			X	P	
Elk R.		P	X		P			X	P	X(6)
Sixes R.										
13 Dry Cr.			X		P					
S. Fork Coquille R.	P	X	X	P	P			X	P	

Key to appendix abbreviations.

- P Present in streams of watershed
- X Identified as at risk or declining by the Endangered Fish Committee of the American Fisheries Society
- C1 High-quality water source
- C2 High-value fishery
- Sum Summer race
- Win Winter race
- Spr Spring race
- Fal Fall race
- 5 Redband trout
- 6 Chum salmon
- 7 Oregon chub
- 8 Pink salmon
- 9 Sockeye salmon
- 10 Olympic mud minnow

¹ Numbers reference the watersheds for each state on 1/2 inch to the mile base maps delivered to the Agriculture Committee.

² 1/4 mile no-harvest area on each side of stream.

³ Includes Wenatchee R., White R., Napeequa R., and Chiwawa R.

⁴ Includes Kink Cr., Sweetwater Cr., Anderson Cr., Olallie Cr., Deer Cr. to Fritz Cr. Confluence

⁵ Includes Rock Cr., Badger Cr., Tygh Cr., and Jordan Cr.

Table 2. Factors used in classifying the ecological significance of LS/OG.

Factor	Characteristics contributing to higher ecological significance
Block size	Larger blocks of forest
Fragmentation	Little or no fragmentation
Location	Location critical in network
Stand attributes	Classic old growth ¹
Age	Age 250-750 years
Productivity	Higher site productivity
Elevation	Lower elevation (relatively rare)
Occurrence of spotted owls	Known/likely occurrence of spotted owls
Occurrence of marbled murrelets	Known/likely occurrence of marbled murrelets
Occurrence of other species	Known/likely occurrence of other late-successional species

¹As defined in Forest Service publication PNW-447 (see text footnote 2 for citation).

PROVISION FOR THE NORTHERN SPOTTED OWL

LS/OG1 areas were reviewed by members of the ISC to see if the network of such areas met the standards and guidelines set forth in the ISC strategy. In this analysis, ISC members made the following assumptions:

- (1) Areas designated LS/OG1 would be protected by the same standards as habitat conservation areas (HCAs) described in the ISC strategy: HCAs are reserved from timber harvest until alternative management methods for maintaining viable populations of owls are demonstrated. HCAs are blocks of forest ideally containing habitat suitable to maintain 20 or more pairs of spotted owls; smaller habitat blocks are acceptable when the ideal size cannot be found. Generally, the 20-pair HCAs should be not more than 12 miles apart and the smaller HCAs not more than 7 miles apart.
- (2) Areas between LS/OG1 reserves would, at a minimum, be managed to meet the standards of the "50-11-40" rule developed by the ISC. This rule requires that 50 percent of the forested area in each quarter township be in a condition wherein the average diameter of trees at breast height (DBH) is at least 11 inches and canopy closure is at least 40 percent.

Where the ISC criteria were not met by an LS/OG1 reserve, ISC members added areas, hereafter called "spotted owl additions," to bring the LS/OG1 reserves into full compliance with the ISC strategy. Map overlays showing the location of these owl additions were prepared at the same scale as those made for the LS/OG analysis. The owl additions for each state are shown on overlay #1 of Appendix B.

The ISC concluded that the LS/OG1 areas, with modest owl additions, would fully meet the standards and guidelines of the ISC strategy. Out of this effort, a network of late-successional forest reserves consisting of LS/OG1 areas and owl additions was identified which contained approximately 25 percent more known spotted owl pairs than the HCAs managed as part of the ISC strategy.

PROVISION FOR WATERSHEDS AND FISH

Two watershed and fish options were considered (Table 5):

Current option: This option implements the standards and guidelines in the Forest Plans.

Watershed and fish habitat emphasis option (hereafter also called the "watershed/fish emphasis" option): This option was specifically developed to maintain and restore (1) ecological functions and processes in streams and (2) habitat of potential threatened and endangered fish species and stocks of anadromous salmonids.

The elements described in the watershed/fish emphasis option in Table 5 are aimed at protecting watersheds and fish habitat from disturbance. Congressionally designated areas of Wilderness, National Parks, and Wild and Scenic Rivers form one set of protection. The LS/OG areas and owl additions provide more extensive landscape and watershed protection from harvest-related disturbances. Establishing wider riparian corridors on federal lands across the landscape will provide additional protection from disturbance and help initiate recovery of degraded areas.

Disturbance to watersheds and fish habitat will be further minimized under the watershed/fish emphasis option by two methods: (1) major reductions in road mileage and road-drainage improvement programs across the forests, and (2) extended rotations in key watersheds on land suitable for timber production.

Tens of thousands of miles of roads cover the owl forests. Avalanches and debris torrents on the forests are exacerbated by road drainage problems associated with small culverts, too few culverts, and poor road design and maintenance. Although most current road building is undertaken with higher stan-

continued on back
→

dards than in the past, a legacy of roads built to lower standards exists. The watershed/fish emphasis option calls for these "problem" roads to be either improved (by, for instance, increasing the number and size of culverts) or removed (that is, the land returned to a natural condition) on federal lands across the landscape to prevent further watershed and fish-habitat degradation.

Roadless areas that remain on the National Forests often contain moderately unstable to unstable soils—which is one reason why they have not been roaded. The watershed/fish emphasis option calls for roadless areas to be left unroaded as timber harvest and other activities (e.g., hunting, fishing) occur.

Intensive timber management on the National Forests often assumes a number of commercial thinnings followed by final harvest at a relatively early age (e.g., 60-90 years). Under the watershed/fish emphasis option, a longer rotation age would be prescribed for key watersheds (see Appendix D). In addition, commercial thinning would be limited to one, or at most two, entries over that time. Fewer entries will help reduce erosion rates and the prevalence of altered streamflows associated with extensive clearcuts.

On numerous federal lands, many watersheds and riparian zones and much of the fish habitat have been degraded. Ecologically sound restoration programs utilizing riparian silvicultural techniques, erosion abatement, landscape design, and in-channel engineering and planning must be undertaken in degraded areas to recover fish habitat. Such programs will complement changes in land-management strategies mentioned previously. Any recovery program for sensitive fish species and stocks will require habitat restoration in both the short and longer term.

To define "key watersheds," National Forest and BLM District fish biologists identified watersheds that (1) contained habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) were greater than 6 square miles and had high-quality water and fish habitat. In addition, key riparian areas and wetlands in watersheds not meeting (1) or (2) were noted. These watersheds and related areas could form the nuclei of any broad-scale effort to recover potentially threatened fish species and stocks. Map overlays showing the location of these key watersheds and other riparian habitat corridors and wetlands were prepared at the same scale as those made for the LS/OG analysis. The key watersheds for each state, identified in Appendix D, are shown on overlay #3 of Appendix B.

Included in these key watersheds were 90 stocks (genetically distinct populations) of anadromous salmon and trout that were recently identified by the Endangered Species Committee of the American Fisheries Society (AFS) as in need of special concern because of low or declining population numbers.⁴ Changes in management of federal forests can directly affect the habitat and recovery of these stocks (see Table 5 and Appendix D). An additional 85 stocks listed by AFS were found in watersheds of National Forests and BLM Districts addressed by this report; however, fish habitat in such watersheds was primarily affected by activities off of federal lands, including water withdrawal, agricultural practices, and private forest management. Such activities are outside the purview of this study.

Also note that the contribution of the watershed/fish emphasis option to maintaining potentially threatened fish species and stocks is highly variable. For example, this option will contribute significantly to the recovery of sea-run cutthroat trout and bull trout but is only part of the strategy required for some spring chinook stocks. In addition, conditions between watersheds and administrative units vary considerably.