

PETER MOYLE

Department of Wildlife, Fish, and
Conservation Biology
University of California
Davis, California

RICHARD KATTELMANN

Sierra Nevada Aquatic Research
Laboratory
University of California
Mammoth Lakes, California

RICHARD ZOMER

Department of Land, Air and Water
University of California
Davis, California

PAUL J. RANDALL

Department of Wildlife, Fish, and
Conservation Biology
University of California
Davis, California

Management of Riparian Areas in the Sierra Nevada

ABSTRACT

Because the ecological importance of riparian areas has long been recognized, many management schemes are in place or have been proposed to protect them. This report (1) reviews riparian management guidelines presently used or recommended for use in the Sierra Nevada, (2) summarizes general management goals for riparian areas presented in the literature, (3) presents some broad management prescriptions offering different levels of protection for riparian areas, for use until more site-specific prescriptions are in place, (4) provides a rating system for prioritizing riparian areas for management, and (5) provides suggestions for the development site-specific prescriptions for riparian protection and management. This report is designed to supplement other SNEP assessments of riparian resources (Kattelman and Embury 1996; Kondolf et al. 1996; Menning et al. 1996).

INTRODUCTION

Riparian areas are usually defined as three-dimensional zones of direct interaction between terrestrial and aquatic ecosystems (Carlson et al., 1991, Gregory et al. 1991, Swanson et al. 1982, Kattelman and Embury 1996). Riparian areas occur along all types of waterways, including streams, meadows, flood plains, peatlands, marshes, springs, and lake shores. Ecologically, each riparian area encompasses the aquatic ecosystem as well as adjacent terrestrial areas directly affecting the aquatic system (Carlson et al., 1991). The width of the riparian area varies with hydrology, geomorphology, vegetation, and upland conditions and processes (Cowardin et al. 1979; Ratliff 1982; Youngblood et al., 1985 a,b; Pierce and Johnson 1986; Hansen et al. 1987; Kovalchik 1987; Padgett et al. 1990; Kovalchik and Chitwood 1990, Belt et al. 1992), so that definitions for the purpose of management also vary (Appendix A). All natural riparian areas are highly sensitive to human-related disturbance, especially the portions closest to water. They often contain some of the most altered habitats in the Sierra Nevada and need special protection and management. Riparian areas also are among the most resilient habitats/ ecosystems in the range and they respond well to recovery programs (Kattelman and Embury 1996; Kondolf et al. 1996).

Because riparian areas are so sensitive to disturbance, their management has to focus not only on the obvious zone of riparian vegetation immediately adjacent to the water body, but on a broader region that has direct influence on the water body. Erman et al (1996) suggest that this broader area can be viewed as having three overlapping zones; these zones are defined in relation to their influence on the adjacent aquatic ecosystem: (1) Community Influence Zone, (2) Energy Influence Zone, and (3) Land Use Influence Zone. The Community Influence Zone is the area usually recognized as clearly riparian, with its distinctive flora and fauna and with many organisms that use both terrestrial and aquatic habitats on a regular basis (e.g., aquatic insects, amphibians, waterfowl). The Energy Influence Zone includes all the riparian area that is likely to contribute energy and structure to the aquatic ecosystem. It usually encompasses the Community Influence Zone plus all the land as far from the stream as the tallest tree (if trees are present) that can contribute snags and leaves to the stream. The Land Use Influence Zone is the region along a stream in which human activity is likely to influence the aquatic ecosystem by increasing nutrient and sediment inputs and other factors. It includes both the other zones and may encompass much of a watershed, especially in smaller drainages. In general, the closer some human activity, such as road building, is to the aquatic ecosystem, the more restrictions have to be placed on that activity if the stream or lake is to continue to maintain its fish, amphibian, and invertebrate productivity and diversity. Likewise, the more such activity concentrates in or near the Community Influence Zone, the more it will alter both riparian and aquatic ecosystems.

Because the ecological importance of riparian areas has long been recognized, many management schemes are in place or have been proposed to protect them. The purpose of this report is to (1) review riparian management guidelines presently used or recommended for use in the Sierra Nevada, (2) present general management goals for riparian systems, (3) provide a rating system for prioritizing riparian areas for management, (4) present some broad management options that offer different levels of protection, and (5) provide suggestions for the development site-specific prescriptions for riparian protection and management.

RIPARIAN MANAGEMENT GUIDELINES

The purpose of this section is to review current policies on the use and management of streamside management zones in the Sierra Nevada Ecosystem Project area. In general, there seems to be a consensus among agencies concerned with riparian management that site-specific guidelines are required for best management but that interim guidelines are needed until site-specific assessments are completed (Appendix B). Interim guidelines are in place in National Forests in the SNEP area because few site-specific studies have been completed. Outside the forests, few guidelines exist, although there are numerous regulations that can be applied to riparian areas (Appendix C).

Present USDA Forest Service policy recognizes the importance and unique values of riparian ecosystems, as well as the importance of classification, inventory, and delineation of riparian ecosystems for land-management planning (Kovalchik and Chitwood 1990, McGuire 1977). Guidelines for establishing riparian and stream management zones emphasize the importance of delineating the zones based on functional characteristics. Generally, a zone or buffer strip based upon a set horizontal distance from the aquatic habitat has been instituted or proposed to define both interim riparian and streamside management zones. In most cases, riparian zones also include meadows, wetlands, seeps, and peatlands. Often the interim guidelines are based on studies of stream recovery rates for macroinvertebrate assemblages following logging. In particular, for small streams, the results of the studies by Erman et al (1977) and Erman and Mahoney (1983) that a 30 meter (minimum) buffer strip on each side was needed to protect the aquatic habitats is used as the basis for interim guidelines.

RIPARIAN MANAGEMENT GOALS

Management goals for riparian areas on national forest lands are imbedded in a complex set of legal directives and administrative procedures (FFRAP 1988), only a few of which can be mentioned here. Historically, national policy (as established by the Organic Act of 1897) caused forests to be managed primarily for timberland protection, despite provisions in the act for maintaining stream flow. The Multiple Use-Sustained Yield Act (1960), a cornerstone of Forest Service management, required federal lands be managed for long-term sustainable production and emphasized a multi-purpose management approach, including managing the forests for outdoor recreation, range, timber, watersheds, wilderness, wildlife and fish. The Wilderness Act of 1964 required that qualified lands be designated as wilderness areas with restrictions on use, although livestock grazing (which heavily impacts riparian areas) was allowed to continue. Under the National Environmental Policy Act (NEPA) of 1970, all federal agencies, including USFS, were required to formally consider the environmental impacts of their actions before decisions were made. A detailed environmental impact statement must be prepared if major environmental effects are anticipated.

The Forest and Rangeland Renewable Resources Planning Act (RPA) and the National Forest Management Act (NFMA), established the mid-1970's a three-level planning process.

Regulations issued under the NFMA required that fish and wildlife habitat should be managed to maintain “viable” populations of existing native and desired nonnative vertebrate species within planning areas (36 CFR Ch.II; 7-1-91 Edition, 219.19). Each national forest is required to prepare an individual forest plan based on the national and regional planning direction, legal requirements, and an assessment of forest conditions and demands. Included in these plans are basic inventory information, analyses of the forests’s management environment, and an examination of management alternatives. NFMA regulations provide for public input on draft and final plans, and an appeals process with recourse to the courts.

In recent years, the shifts in public perceptions and expectations concerning resource management on federal lands have led to a gradual increase in protection of ecosystems and species, and to an increase in concern for riparian areas. Statutory requirements to protect water quality, wildlife habitat, and endangered species provide significant legislative restrictions on use. For example, states are required under Section 208 of the Federal Clean Water Act to prepare non-point source pollution treatment plans. The Porter-Cologne Water Quality Control Act designates the State Water Resources Control Board (SWRCB) as the state water pollution control agency. It is responsible for certification of the procedures outlined in the Forest Service water quality handbook as best management practices (BMP’s).

The federal Endangered Species Act of 1973 initiates mechanisms which may supersede other planning processes as demonstrated by the Spotted Owl controversy in the Pacific Northwest and in California. Listing by the State of California of an animal or plant species as threatened or endangered requires USFS to provide protection even if the species is not included under the federal ESA. The ESA is especially important in relation to riparian habitat because so many endangered plants and animals are riparian-dependent.

As pressures to manage for environmental values grow, management activities increasingly require coordination between state and federal agencies, in order to address issues such as overlapping jurisdictions and mixed-ownerships. For instance, the California Department of Fish and Game (CDFG) retains the right to manage fish and wildlife game species across ownerships, including on federal and private lands.

Generally, USFS policies for management of riparian areas have become more protective in recent years (Appendix B). In particular, timber harvest has been increasingly limited near water courses and road engineering has improved. Grazing has been identified as a concern, but management changes have not been extensive (Menke 1996). Impacts from water development and recreation have received less attention. Water development and grazing have a greater direct effect on riparian resources than timber harvesting in the Sierra Nevada (Kattelman and Embury 1996; Kondolf et al. 1996). Damage from impacts of the past have been identified, but restoration has been hampered by limited financial resources. Under minimum management requirements of the Forest Service manual:

"national direction is to manage the resources within riparian areas [defined as 100 feet on either side of perennial stream or lake edges] in a manner that is compatible with protection and maintenance of dependent resources, and give preferential treatment to dependent resources in cases of unresolved conflict."

Many more specific goals and management directives, applicable to the Sierra Nevada have appeared in the manuals and reports of various agencies (Appendix D). The goals have been combined and condensed into a single list (Table 1). They assume that self-sustaining riparian and aquatic systems dominated by native elements represent the ideal condition. Additional information about laws and regulations can be found in Menning et al (1996).

Table 1. Some general goals for management of riparian systems. Not listed in order of importance.

Goal 1. Identify and provide special protection for unusual/rare aquatic and riparian habitats and for rare, threatened, and endangered species that require riparian areas.

Goal 2. Maintain and restore wherever possible continuous corridors of riparian and upland habitat along streams for wildlife movement and migration.

Goal 3. Identify riparian areas that are in best condition (i.e., areas dominated by native species, with most natural ecosystem structure and processes intact) and give such areas the highest priority for formal protection and intense management.

Goal 4. Maintain water quality parameters (temperature, sediment load, pH, etc.) in associated water bodies within the natural range of variability for each water body.

Goal 5. Maintain or restore stream channel, pond, lake, and wetland ecological integrity and natural processes to within the natural range of conditions.

Goal 6. Maintain or restore stream channel or subsurface flows to levels that (1) support the natural riparian and aquatic biotic systems and that (2) maintain the natural functions of stream channels and aquifers.

Goal 7. Maintain or restore the natural elevation, size, and lateral extent of subsurface water in meadows and wetlands.

Goal 8. Maintain or restore the natural structure, diversity, and productivity of native riparian plant communities.

Goal 9. Maintain or restore stands of large riparian trees in order to provide large woody debris for instream habitat.

Goal 10. Maintain or restore riparian corridors to support well-distributed populations of plants and animals that depend on riparian and aquatic habitats for their movements and long-term survival.

A PRIORITY RATING SYSTEM FOR MANAGEMENT OF RIPARIAN AREAS

The goals listed in the previous section focus on natural riparian systems, assuming that complex structure and native species are a desirable attribute of riparian systems. Unfortunately, there are many areas where the riparian vegetation has been irreversibly altered or destroyed through major habitat alteration or through removal of the water from the associated aquatic system. Other riparian areas have been severely damaged but can be recovered through varying degrees of effort. Given the limited money and energy available for protection and recovery efforts, priorities must be set for action. The rating system presented below is designed to help set priorities for areas where the main goal is to restore and/or protect natural riparian systems. It may be necessary to develop somewhat different criteria for different riparian areas. Ideally, a more quantitative index of riparian integrity should also be developed for more precise (but still rapid) assessment, based on measurements of factors such as canopy cover, abundance of native species, and degree of disturbance.

Priority 1.

Highest priority for protection and management. Near-pristine and self-sustaining. Very uncommon. Found along waterways where natural hydrology is intact. Potential natural vegetation is present, e.g., full complement of native species expected for the seral stage present and exotic species rare. Human-related disturbance minimal although may have been extensive in past. Associated with healthy, natural aquatic systems. Part of a riparian corridor, although much of corridor may have lower ratings. Provides high level of ecosystem services (protection of water quality, stream bank stabilization, source of organic matter for aquatic system, habitat for wildlife, etc.).

Priority 2.

High quality riparian habitat associated with a fairly continuous corridor or otherwise part of a larger system. Self-sustaining. Potential natural vegetation dominant but some exotics present also, usually integrated into the native plant community. Human-related disturbance minimal in most areas and probably more extensive in past. Aquatic system typically in good condition. Provides high level of ecosystem services (as above).

Priority 3.

Adequate to moderately high quality riparian habitat, which is probably recoverable to the potential natural vegetation with major effort. Exotic species present, often significant part of community. Typically part of extensive riparian corridor which may be fragmented. Aquatic system appears to be functioning naturally, but likely to be altered (exotic species, modified flow regime, etc.). Provides moderately high level of ecosystem services but effects likely to be fairly localized. Shows effects of moderate to high levels of use by humans and livestock. Isolated patches of riparian habitat that would rate "1" or "2" if part of a larger system would be rated here, on the assumption such patches cannot persist without major recovery efforts focussed on associated riparian areas.

Priority 4.

Highly altered riparian systems with natural elements still present but probably not recoverable to potential natural vegetation, or only with tremendous effort. Exotic species major part of community, often dominant. Typically associated with highly altered aquatic system, with highly modified flow regime. Highly altered by use by humans and livestock (crumbling banks, roads, limited understory, etc.). Often in isolated fragments among even more degraded habitats but may be important as part of corridor associated with higher quality habitats. Can provide some ecosystem services, but potential very limited.

Priority 5.

Irreversibly altered riparian systems, in which riparian vegetation greatly restricted in quality and quantity, if present at all. Exotic species often dominate. Associated with highly altered aquatic systems. Typical example is channelized stream with road along one bank, railroad along another with dams diverting much of the flow of the stream. \

POTENTIAL INTERIM MANAGEMENT PRESCRIPTIONS

Ideally, riparian habitats and streamside zones should be managed on a highly individualistic basis, taking into account terrain, soils, plant communities, fish and wildlife requirements and other factors arising from intimate knowledge of the local situation. Because such site-specific knowledge of the structure and function of Sierra Nevada riparian and aquatic ecosystems is generally limited, broad management prescriptions are generally used until site-specific prescriptions can be developed. Ideally, these broad prescriptions should err on the side of protecting the resource, to make sure that no irreversibly detrimental management actions are taken. With such a constraint, the broad management prescriptions should be based on the following assumptions:

1. The need for riparian protection is just as strong, if not stronger, in intermittent, ephemeral, low order, fishless, and high-gradient streams as it is along other kinds of aquatic environments because such water courses are major sources of sediment, nutrients, and debris for lower stream reaches.
2. Continuous corridors of riparian vegetation are highly desirable for the protection of fish and wildlife.
3. Large woody debris is important in the functioning of most aquatic systems.
4. Many riparian areas are highly altered and are unlikely to be restored to anything approaching a natural condition because of urbanization, roads, and other factors. Nevertheless, riparian habitats in the Sierra Nevada have a remarkable capacity for recovery once destructive influences (roads, grazing, mining, etc.) are removed or reduced.

Working with these assumptions, we present three basic approaches to riparian management, recognizing that these approaches are highly generalized: (1) the low protection

approach, (2) the moderate protection approach, and (3) the high protection approach. We recognize that under almost any circumstances, riparian management for the entire Sierra Nevada, or even for one watershed, is likely to be a mixture of the three approaches.

Low protection approach

Under this approach, the highest value of streamside regions is for direct use: housing, parks, transportation corridors, grazing, logging and other factors. A protection priority system, such as given above, is largely irrelevant. The approach does not recognize the uniqueness and importance of riparian ecosystems, except under special circumstances, and provides minimal recognition of riparian areas as transitional between upstream areas and the water course. Historically, this has been the principal approach to management and accounts for the poor condition of riparian areas along many streams, especially on private land or in areas where riparian areas have become transportation corridors. This approach requires no special, generalized management recommendations, except to recognize that upstream uses for grazing, roads, and recreation may conflict with downstream uses of the water through such factors as decrease in water quality or siltation of reservoirs. This approach is also highly individualistic because conflicts in use (e.g., fishing vs. grazing) have to be worked out on a stream-by-stream basis.

Moderate protection approach

This approach, used today mainly on some public lands, basically operates on the assumption that a 100 foot wide buffer strip on each side of permanent streams will offer adequate protection for riparian and aquatic resources. The buffer concept is usually not applied to intermittent or fishless streams, although occasionally 30 or 50 foot buffer strips may be recommended for them. The 100 foot buffer concept itself is derived from studies showing that effects of logging operations on aquatic invertebrates are minimized if no logging or roads are permitted within 100 feet of the stream. Priority 1 and 2 riparian areas may or may not receive special protection (usually not). The approach is well described in a number of the National Forest Plans with some additional prescriptions added (Appendix B). It is applied mainly to forested lands and not to grasslands or meadows. It also is not used in relation to grazing of livestock. If the 100 foot rule continues to be the main yardstick for protection, then it will continue to offer moderate protection to riparian habitats along permanent streams in forested areas. Presumably, other habitats (such as meadow systems) will continue to receive protection or special management only on an ad hoc basis, such as when an endangered trout species needs protection.

High protection approach

The high protection approach greatly restricts human activity in riparian areas and encourages management activities aimed at maintaining and restoring as much of the biotic integrity (native organisms, natural processes) of riparian ecosystems as possible. It explicitly recognizes that riparian ecosystems are distinct entities with strong ties to both the associated water course and the associated upland areas, as outlined in Erman et al. (1996). This approach requires different management prescriptions for different types of streams; ideally such prescriptions should be fairly site specific or related to the aquatic habitat types of Moyle (1996). However, an interim

approach is give highest priority for management for Priority 1 and 2 riparian areas and to base management on the broad stream types of Rosgen (1994) because of their comparative simplicity. Rosgen stream types can often be determined by quick visual inspection or by viewing aerial photographs but when doubt exists a rapid assessment of gradient, sinuosity, substrates, and other factors may be necessary, using Rosgen's techniques. Under this approach, riparian systems associated with very steep or very unstable channels would receive the most protection.

DEVELOPING SITE-SPECIFIC MANAGEMENT OBJECTIVES

Under the moderate and high protection options, the basic goal of riparian management is to enhance/protect the ability of riparian and aquatic systems to provide ecosystem services to humans, including habitat for increasingly rare riparian-dependent plants and animals. Ideally, each forest or region should have in place a Riparian Management Team of scientists with different specialties to collect the needed information and design management strategies. This information should be collected for each EPA stream reach, as well as individual lakes, ponds, and wetlands. The information the team would need to collect would include:

1. Evaluation of overall condition of riparian and aquatic habitats
 - a. Priority ranking for riparian systems (or similar subjective measure of "health" of biotic community).
 - b. Index of biotic integrity for the aquatic community for stream reach (or if data not available, a subjective rating of "health.")
2. Basic inventory of plants and animals present or historically present
3. Riparian widths needed by riparian dependent animals, especially amphibians
4. Vegetation
 - a. % canopy cover
 - b. distribution and abundance of sensitive plant species
 - c. plant communities/seral stages present
 - d. trees
 1. site potential heights
 2. role as large woody debris in streams etc.
5. Connections to surrounding area
 - a. width of 100 year flood plain
 - b. continuity of corridor (patchiness)
 - c. erodibility of watershed (condition of upland portions)
6. Physical variables
 - a. channel gradient;
 - b. adjacent hillslope gradient;
 - c. pool frequency;
 - d. Pfankuch stability rating;
 - e. width/depth ratio;
 - f. water temperature (range);
 - g. riffle stability index;
 - h. existing large woody debris;
 - i. others
7. Aquatic habitats
 - a. types present
 - b. integrity/health of each type

8. Human impacts

a. number of stream crossings
b. length or percent of each bank that is rip-rapped, channelized, or otherwise severely altered.

c. Equivalent roaded area

d. Subjective or quantitative scales to rate impacts of following activities:

1. mining
2. dwellings/urbanization
3. roads
4. recreation
5. grazing
6. pollution
7. logging
8. others

REFERENCES

- Anderson, D.B. 1984 The public trust and riparian systems: a case for preservation. Pp. 257-264. In: *California riparian systems: ecology, conservation, and productive management*. R. E. Warner and K.M. Hendrix, eds. Univ. of Calif. Press, Berkeley.
- Belt, G. H., J. O'Laughlin, and T. Merrill. 1992. Design of forest riparian buffer strips for protection of water quality: analysis of scientific literature. Idaho Forest, Wildlife, and Range Experiment Station Report No. 8, University of Idaho.
- California Office of Planning and Research. 1980. California permit handbook. California Office of Planning and Research, Sacramento. 270 pp.
- Carlson, A., Chapel, M., Colborn, A., et al. 1991. Review of Literature Addressing Wildlife and Fish Habitat Relationships in Riparian and Stream Habitats. Tahoe National Forest, Old Forest and Riparian Habitat Planning Project. 27 pp.
- Chapel, M., Craig, D, Reynolds, M., et al. 1991. Review of Literature Addressing Wildlife and Fish Habitat Relationships in Late-Seral-Stage Coniferous Forests. Tahoe National Forest, Old Forest and Riparian Habitat Planning Project. 22 pp.
- Cowardin, L.M., Carter, V. Golet, F.C., and LaRoe, E.T. 1979. *Classification of wetlands and deep water habitats of the United States*. U.S. Department of Interior, Fish and Wildlife Service, Washington, DC, FWS/OBS-79/31. 103pp.
- Doppelt, B., M. Scurlock, C. Frissell, and J. Karr. 1993. *Entering the Watershed: a new approach to save America's river ecosystems*. Island Press, Washington DC. 462 pp.
- Eldorado National Forest. 1988. Eldorado National Forest: Land Resource Management Plan. Pacific Southwest Region USDA Forest Service.
- Erman, D. C., J. D. Newbold, K. B. Roby. 1977. Evaluation of streamside buffer strips for protecting aquatic organisms.. *University of California Water Resources Center Contribution* 165.
- Erman, D. C., and D. Mahoney. 1983. Recovery after logging in streams with and without bufferstrips in northern California. . *University of California Water Resources Center Contribution* 186. 50 pp.
- Forest Ecosystem Management Team. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment: Report of the Forest Ecosystem Management Assessment Team.
- FRAPP. 1988. California's Forests and Rangelands: Growing Conflict Over Changing Uses. Forest and Rangeland Resources Assessment Program (FRRAP), Calif. Dept. of Forestry and Fire Protection.
- Gebhardt, K., Leonard, S., Staidl, G. and D. Prichard. 1990. Riparian Area Management: Riparian and Wetland Classification Review. US Dept. of the Interior. Bureau of Land Management. Tech. Ref. 1737-5. 55 pp.
- Gregory, S.V., F.J. Swanson, W.A. McKee, and K. Cummins. 1991. An ecosystem perspective of riparian zones. *BioScience*, 41:540-551.
- Hansen, P.L., Chadde, S.W. and Pfister, R.D. 1987. Riparian dominance types of Montana. 1987. Montana Forest and Conservation Station, School of Forestry, University of Montana, Missoula, Miscellaneous Publication 49. 411p.

- Harris, L.D. 1984. *The Fragmented Forest*. University of Chicago Press, Chicago. 211 pp.
- International Conf. of Building Officials. 1979. *Uniform Building Code*. ICBO, Whittier, California. 734 pp.
- Inyo National Forest. 1988. *Inyo National Forest: Land Resource Management Plan*. Pacific Southwest Region USDA Forest Service.
- Johnson, K.N., J. F. Franklin., J. W. Thomas, J. Gordon. 1991. *Alternatives for management of late-successional forests of the Pacific Northwest*. A report to the Agriculture Committee and the Merchant Marine Committee of the U.S. House of Representatives. 59 pp.
- Jones, B. 1983. A state mandate for riparian wetland system preservation. In: *California riparian systems: ecology, conservation, and productive management*. R. E. Warner and K.M. Hendrix, eds. Univ. of Calif. Press.
- Kattelman, R. and M. Embury. *Riparian resources*. Sierra Nevada Ecosystem project (in press).
- Kovalchik, , B.L. 1987. *Riparian zone associations of the Deschutes, Ochoco, Fremont and Winema National Forests*, Portland, OR: USDA Forest Service, Pacific Northwest Region 6 R6 ECOL TP-279-87. 171 pp.
- Kovalchik, B.L., and Chitwood, L.A. 1990. Uses of geomorphology in the classification of riparian plant associations in mountainous landscapes of central Oregon, U.S.A. *Forest Ecology and Management* 33/34: 405-418.
- Lassen National Forest. 1988. *Final Environmental Impact Statement Land Resource Management Plan: Lassen National Forest*. Pacific Southwest Region USDA Forest Service.
- Mahoney, D. and D. C. Erman. 1984. The role of streamside bufferstrips in the ecology of aquatic organisms. Pp. 168-176 In: R. E. Warner and K. W. Hendrix, eds. *California riparian systems: ecology, conservation, and productive management*. University of California Press, Berkeley.
- Maser, C, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, eds. 1988. *From the forest to the sea: the story of fallen trees*. Pacific Northwest Station, USDA Forest Service, General Technical Report PNW-GTR-229.
- McQuire, J.R. 1977. Position paper: a riparian policy for changing times. Pp. 137-145 In: *Strategies for protection and management of floodplain wetlands and riparian ecosystems: a symposium*,. USDA Forest Service., Washington, D. C. General Technical Report 12.
- Menning, K. M. , D. C. Erman, K. N. Johnson, and J. Sessions. 1996. *Aquatic and riparian systems, assessments of cumulative watershed effects and limitations on watershed disturbance*. Sierra Nevada Ecosystem Project (in press).
- Mistch, W.J. and J.G. Gosselink. 1986. *Wetlands*. Van Nostrand Reinhold, New York. 539 pp.
- Moyle, P. B. 1996. *Status of aquatic habitats in the Sierra Nevada*. Sierra Nevada Ecosystem Project (in press).
- Osborne, L. L., and D. A. Kovacic. 1993. *Riparian vegetated buffer strips in water quality restoration and stream management*. *Freshwater Biology* 29: 243-258.
- Pierce, J. and J. Johnson. 1986. *Wetland community type classification for west-central Montana*. USDA Forest Service, Northern Region I, Missoula, MT, Ecosystem Management Report.

- Plumas National Forest. 1988. Plumas National Forest: Land Resource Management Plan. Pacific Southwest Region USDA Forest Service.
- Ratliff, R.D. 1982. A meadow site classification for the Sierra Nevada, California.
- Reeves, G.H., and J. R. Sedell. 1992. An ecosystem approach to the conservation and management of freshwater habitat for anadromous salmonids in the Pacific Northwest. *Proceedings of the 57th North American Wildlife and Natural Resources Conference*: 408-415.
- Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.
- Sequoia National Forest. 1988. Final Environmental Impact Statement: Sequoia National Forest: Land Resource Management Plan. Pacific Southwest Region USDA Forest Service.
- Smith, F.E. 1984. The Clean Water Act and the principles of the Public Trust Doctrine: a discussion. Pp. 265-288 In: R.E. Warner. and K.M. Hendrix, eds. *California Riparian Systems: Ecology, Conservation, and Productive Management*. University of California Press, Berkeley.
- Sommarstrom, S. 1984. Riparian regulations: random, redundant, or rational? Pp. 274-280. In: R.E. Warner. and K.M. Hendrix, eds. *California Riparian Systems: Ecology, Conservation, and Productive Management*. University of California Press, Berkeley.
- Stevens, J. 1984. The state as a public trustee: neutral umpire or activist guardian? Pages 269-273. In: R.E. Warner. and K.M. Hendrix, eds. *California Riparian Systems: Ecology, Conservation, and Productive Management*. University of California Press, Berkeley.
- Swanson, F.J., S.V. Gregory, J.R. Sedell, and A.G. Campbell. 1982. Land water interactions: the riparian zone. In: R.L. Edmunds, editor. *Analysis of Coniferous Forest Ecosystems in the Western United States*. US/IBP Synthesis series 14. Hutchinson Ross Publishing Co., Stroudsburg, PA. p. 267-291.
- USDA Forest Service. 1988. Land and Resource Management Plan. Lake Tahoe Basin Management Unit. Pacific Southwest Region, USDA Forest Service.
- USDA Forest Service. 1990. Tahoe National Forest: Land Resource Management Plan. Pacific Southwest Region, USDA Forest Service.
- Thurow, C., Toner, W., and D. Erley. 1975. Streams and creeks. In: *Performance controls for sensitive lands; a practical guide for local administrators*. Planning Advisory Service Report Nos. 307, 308. American Society of Planning Officials, Chicago, Ill. 156 pp.
- U.S. Army Corps of Engineers, 1987. Corps of Engineers wetlands delineation manual. Waterway Experiment Station Wetlands Research Program technical report Y-87-1.
- Youngblood, A.P., W. G. Paget, and A. H. Winward. 1985 Riparian community type classification for eastern Idaho-western Wyoming. USDA For. Serv. Intermount. For. Range Exp. Stn., Ogden, UT R4-ECOL-85-01, 78pp.

APPENDIX A: RIPARIAN ZONE DEFINITIONS

The following collection of definitions is not meant to be complete but only to give good sample of definitions that have been or can be applied to Sierra Nevada riparian and wetland habitats.

1. USDA Forest Service

"Geographically delineated areas, with distinctive resource values and characteristics, that area comprised of the aquatic and riparian ecosystems, flood plains, and wetlands. Includes all areas within a horizontal distance of 100 ft. from the edge of perennial streams and other water bodies . One-hundred year flood plains included in definition of riparian, include both wetland and irregularly flooded, drier sites. These drier sites generally do not meet the NWI definition of wetland." (Forest Service Manual 2526)

2. Inyo National Forest

"Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems." (Inyo NF LRMP)

3. Stanislaus National Forest

"The transition between aquatic and terrestrial ecosystems, characterized by distinctive vegetation which requires free or unbound water." (Stanislaus NF LRMP).

4. Eldorado National Forest

"Riparian areas: consist of streamside ecosystems, aquatic ecosystems, wetlands and flood plains. Riparian encompasses all areas within a horizontal distance of 100 feet from both edges of perennial streams or other water bodies. Wet meadows are included in the riparian zone. Wetlands: included in total riparian area. Defined as: those areas inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Includes marshes, wet meadows, alpine meadows, springs, seeps, potholes, river overflows and natural ponds, and may or may not be associated with Streamside Management Zone." (Eldorado NF LRMP)

4. Sequoia National Forest

"Riparian area: includes the aquatic ecosystem, riparian vegetation, 100-year floodplain and Streamside Management Zone (see Fig 3.4, p. 3-107). The extent of riparian areas is directly affected by the steepness of stream side slopes, with the steeper slopes having the narrower habitat. (Sequoia NF LRMP)

Aquatic ecosystem: extends to the normal bank high water mark.

Riparian vegetation: defined as vegetation communities that require free or unbound water.

100-year floodplain: “has a one percent chance of being flooded in any one year”. This floodplain provides storage for flood flows, helps reduce the velocity and peak flow, moderates downstream flooding, reduces deposition of sediment in stream channels. The floodplain and the vegetation associated with it help reduce flood intensities.” (Sequoia NF LRMP).

5. Tahoe National Forest

Riparian areas: “As a **minimum**, riparian areas are defined to be (1) areas a 100-foot horizontal distance from the edge of standing bodies of water; (2) areas a horizontal distance of 100 feet on each side of perennial stream channels; and (3) all wetlands.” (emphasis added) (from PSW Planning Direction; also, direction in 36 CFR 219.27 (e) and in FSM 2526 3/86 AMEND 48).

Riparian vegetation: riparian vegetation includes the following characteristic species::

<i>Acer macrophyllum</i>	bigleaf maple
<i>Alnus species</i>	alders
<i>Carex species</i>	sedges
<i>Deschampsia species</i>	hairgrasses
<i>Equisetum species</i>	horsetails
<i>Juncus species</i>	rushes
<i>Populus species</i>	aspen, cottonwood, poplars
<i>Salix species</i>	wills
<i>Taxus brevifolia</i>	Pacific yew
<i>Trifolium species</i>	clovers
<i>Veratrum californica</i>	corn lily

Riparian-dependent resources - “Those natural, intrinsic resources directly dependent upon the riparian area for their existence, including: water, fish, certain wildlife species, riparian related aesthetics, and riparian related vegetation” (FSM 2526 11/86 R-5 SUPP 41)

Streamside management zones: These are administratively designated zones adjacent to perennial, intermittent, and in some cases ephemeral streams, and are designed to call attention to the need for special management practices aimed at the maintenance and/or improvement of watershed resources (e.g. water quality, channel stability). They may include wetlands, flood plains, riparian areas, inner gorges, perennial streams, intermittent streams, ephemeral streams, and the terrestrial ecosystem adjacent to these areas.

6. Forest Ecosystem Management Team (FEMAT)

"Riparian Zone: Refers to those areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. The zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs and wet meadow.

Riparian Reserves: Designated riparian areas intended to address the habitat requirements for fish and aquatic and riparian species."

APPENDIX B. RIPARIAN PROTECTION ON FEDERAL LANDS

The following is a survey of riparian management zone delineations for Federal lands

1. U.S. Fish and Wildlife Service

A report by Brinson (1981) recommended the following widths of riparian buffer strips:

Protection function	Width
water quality	8 m + 0.6 m per 1% of slope
water quality in municipal ws	16 m + 1.2 m per 1% of slope
aquatic life	30 m
water quality and fish	25 m + riparian vegetation

2. HR6013: Sierra Nevada Forests Ecosystem Study Act of 1992:

2HR6013 (Congressional Record-House, Sept. 30, 1992) which is part of SNEP's genesis, included the following language for interim protection in Section 5 - C:

"No management practices causing detrimental changes in water temperature, chemical composition, blockages of water courses, or deposits of sediments, which would adversely affect water conditions or fish habitat, and no logging may be conducted within 100' of either side of all permanent streams and 50' on either side of all seasonally flowing and intermittent streams."

3. Forest Ecosystem Management Team

The Watershed/Fish Element (Reeves and Sedell 1992) of the FEMAT report (Johnson et al. 1991) recommended riparian management areas as:

300' on each side of fish-bearing streams;
150' on each side of non-fish bearing but perennial streams;
50' on each side of intermittent streams in unstable terrain; and
660' or 100-year floodplain on rivers draining > 30 square miles.

The riparian portion of the FEMAT aquatic conservation strategy based interim (until locally established by watershed analyses and site-specific evaluations) widths of riparian reserves on height of site-potential trees (110-250') and distances along slopes. Several criteria were

developed (see Table V-5 [pg V-37] in FEMAT report) for width on each side of active channel and can be summarized as follows:

Fish-bearing streams -- top of inner gorge, 100-year floodplain, perimeter of riparian vegetation, twice height of site-potential trees, or 300' slope distance (whichever is greatest).

Nonfish-bearing, perennial -- as above except one tree height or 150'

Reservoirs and wetlands -- outer edges of riparian vegetation, extent of seasonally saturated soil or unstable areas, one tree height, or 150.

Lakes and natural ponds -- as above except two tree heights or 300'.

Intermittent, small wetlands -- outer edge of riparian vegetation, extent of unstable areas, top of inner gorge or 25 feet.

A detailed set of standards and guidelines is presented in Appendix V-F of the FEMAT report.

4. PACFISH Environmental Analysis

The PACFISH EA (March 1994) Alternative 4 (pages C-3 to C-17) uses essentially the same criteria for interim widths of Riparian Habitat Conservation Areas as FEMAT and nearly identical standards and guidelines as well. In rangelands, the interim riparian width is the 100-year floodplain for perennial streams.

5. CALOWL

Current CALOWL considerations for riparian zones distinguish the following habitats :

- seeps/springs
- ephemerals and intermittent streams
- small order perennials
- large order perennials
- bogs/fens/wetlands
- vernal pools
- wet meadows
- lakes
- ponds
- reservoirs

6. Pacific Rivers Council

The Pacific Rivers Council's aquatic conservation strategy (Doppelt et al. 1993) includes a similar list of habitats and the following criteria for interim width of riparian zones (from edge of active or braided channel):

- top of inner gorge
- 100-year floodplain
- outer edge of zone of control of stream microclimate
- outer edge of habitat areas of semi-aquatic, and riparian-dependent terrestrial or avian species
- adjacent unstable slopes

7. Eldorado National Forest

Riparian areas encompass all areas within a horizontal distance of 100 feet from both edges of perennial streams or other water bodies. Wet meadows are included in the riparian zone. (Eldorado NF LRMP EIS)

8. Inyo National Forest

Riparian areas consist of

- (1) as a minimum, areas that are a 100-foot horizontal distance from the edge of standing bodies of water, lakes, and perennial streams, and
- (2) all wetlands, including all ephemeral or intermittent streams which support riparian vegetation, wet meadows, springs, seeps, and bogs.

9. Tahoe National Forest

In the 1988 LRMP, identification and mapping of the stream environment zone includes determination of:

- a). wetlands, meadows, and other areas of riparian vegetation;
- b.) one-hundred year flood plain;
- c.) ephemeral stream courses and soil areas associated with high runoff or high water tables;
- d.) areas within 25 feet of first order stream, 50 feet of second order stream, and 100 feet of third order stream.

Chapel et al. (1992) recommended that Tahoe National Forest establish a minimum riparian width of one site-potential tree (125-200') on each side of the stream for combined old-growth and riparian reserves. Riparian zones include the 100-year floodplain, riparian vegetation, and upland areas influencing the stream environment.

10. Stanislaus National Forest

Riparian Areas:

Perennial streams: approx. 100 feet on either side of the stream, plus an average of 25 feet for the water surface itself.

Standing bodies of water: includes 100 ft. from the shore, plus 25 ft. of the water surface.

Intermittent streams: within 50 ft. on each side of the channel.

11. Sequoia National Forest

Streamside Management Zones (SMZ's): Management zone width is determined on a individual project basis using "appropriate Standards and Guidelines", developed locally in consultation with CDFG. Average distance from the stream given special treatment is 100 feet. Timber equipment is prohibited from entering this zone except at designated stream crossings.

12. Plumas National Forest

(Appendix Table M)

APPENDIX C. RIPARIAN REGULATIONS ON PRIVATE LANDS

Local, state, and federal governments have a variety of means of influencing conservation and development of privately-owned riparian lands. Overviews of various aspects of this regulatory legal framework are provided by Sommarstrom (1984), Stevens (1984), Anderson (1984), Smith (1984), Jones (1983) and Kramer (1983). Sommarstrom (1984), in a review of primary local, state and federal regulations points out that the term “riparian” need not be explicit for a law to include riparian areas. A wide range of activities and concerns associated with riparian areas are regulated according to (1) project location, (2) project activities, and (3) resources affected by the project (California Office of Planning and Research 1980, Table C-1).

Table C-1: Scope of riparian regulations (from Sommarstrom 1984)

Location

Navigable water	Coastal Zone
Wild and scenic rivers	Central Valley
Floodplain	

Project Activities:

Timber harvesting	Water diversion
Timberland conversion	Channelization
Dredging/filling	Grazing
Grading/excavating	Road construction
Gravel extraction	Road maintenance
Stream bed alteration	Dam construction
Vegetation removal	Subdivision
Stream crossing	bank alteration
Riprapping	Groundwater extraction

Affected Resources:

Endangered species	Commercial timber
Fish habitat	Vegetation
Wildlife habitat	Aesthetics
Water quality	Open space
Water supply	Land use
Stream flow	Land stability
Soils	Aquatic habitat

Local Regulations

Local governments have several mechanisms available which can be applied to streamside areas (Sommarstorm 1988). In most cases the planning agency is responsible for administering applicable ordinances. However, many cases also involve public works, building, flood control, or water departments. Zoning ordinances are the most common form of local land-use regulations influencing riparian zones. Each zoning district establishes a list of uses permitted on all private land within its borders, as well as listing prohibited uses and conditional procedures in conformity with general plan procedures. Floodplain regulations may be administered as a floodplain planning overlay zone. Grading ordinances are used to minimize or prevent disturbance of stream and riparian areas. Minimal excavation and grading regulations, established by Chapter 70 of the Uniform Building Code (International Conference of Building Officials 1979), have been adopted by most local governments. Some local governments have amended zoning or subdivision ordinances to minimize erosion or sedimentation from projects (Thurow et al. 1975). The California surface Mining and Reclamation Act of 1975 (SMARA - Section 2710-1793 Public Resources Code) required counties to adopt ordinances requiring reclamation of mining lands. Extraction of gravel is the most common mining operation potentially affecting riparian resources. The California Department of Fish and Game (1980) developed the "Model Riparian Ordinance" as an example watercourse or stream environment protection ordinance. Specifically designed to protect riparian vegetation, this site-specific regulation is not widely used.

State regulations

Several state agencies may require permits for projects affecting riparian resources (Sommarstrom 1984; Calif. Office of Planning and Research 1980), notably the Department of Fish and Game (CDFG), Department of Forestry (CDF), State Water Resources Control Board (SWRCB), regional water quality control boards, and agencies functioning under the California Environmental Quality Act.

A Stream Alteration Agreement is required by the CDFG Code Sections 1601-1603 for any work undertaken below the mean high water mark of a body of water containing or wildlife resources, or where the project will use material from the Stream bed. Specific conditions for mitigation of potential problems must be met by applicants.

CDF requires a Timber Harvest Plan conforming to the rules and regulations of the Board of Forestry, the Forest District, and the Z'berg-Nejedly Forest Practice Act of 1973 (as amended, Section 4511-4628 Public resources Code) to be approved before any harvesting of commercial timber species. Several riparian forest trees are included as "commercial species", such as red alder, white alder, pepperwood, and others. Minimum width for special protection measures are established in rules requiring a "Watercourse and Lake Protection Zone". Timber operations on less than 1.2 ha. (3 ac.) require no approval. A Timberland Conversion Permit is required for conversion of private commercial timberland to other uses.

Any person or public agency proposing to divert water from any surface stream for use on non-riparian land must obtain a Permit to Appropriate Water from SWRCB, according to the

California Water Code. Diversion of water under a riparian claim requires only an informational Statement of Water Diversion and Use to be filed. The SWRCB has a jurisdiction for subterranean water, limited to underground streams flowing through known and definite water channels and applied to non-overlying lands. Most groundwater use does not require this type of permit.

There are nine regional water quality control boards (RWQCB) that are delegated permit-issuing authority by the SWRCB for waste discharge into any surface waters or groundwater. Logging, construction, and other associated activities in riparian zones may be affected by regulations governing discharge of both point and non-point sources of pollution. Permits are issued based upon conformity with water quality standards adopted in the regional board's Basin Plan.

Under the California Environmental Quality Act (CEQU) referral process, agencies other than those mentioned above may be required to review proposed projects. It is the responsibility of the lead agency to determine significant effects on the environment, including riparian concerns. Minor alterations to land are exempted from CEQA requirements.

Federal Regulations

Federal law pertaining to riparian systems on private lands is generally administered at the state or local level. The US Army Corps of Engineers, however, under the authority of Section 404 of the Clean Water Act (as amended), may require a permit for projects involving the location of structures in or on, or the excavation or discharge of dredge or fill material in "navigable waters", including wetlands, rivers, and intermittent streams below the ordinary high-water mark. Although the riparian zone is not specifically included, certain activities affecting riparian resources are covered by the permit process (e.g. riprap, levees).

APPENDIX D. MANAGEMENT GOALS FOR RIPARIAN AREAS

The following is a representative selection of management goals extracted from various forest plans and other federal documents.

1. General management directives

Executive Order (E.O.) 11988 on Floodplain Management and E.O. 11990 on Protection of Wetlands: Directs government agencies to avoid adverse impacts on, protect, preserve and enhance wetlands and flood plains.

Rules implementing RPA and NFMA in 36 CFR 219.13 (e): “Special attention will be given to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water and will correspond to at least the recognizable area dominated by the riparian vegetation. No management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, and deposits of sediment will be permitted within these areas which seriously and adversely affect water conditions or fish habitat. Topography, vegetation type, soil, climatic conditions, management objectives and other factors will be considered in determining what management practices may be performed within these areas or the constraints to be placed upon their performance”

Public Law 92-500, Section 208: Required the Forest Service to develop Best Management Practices (BMP's) to protect water quality. BMP 1.8 (riparian areas) requires designation of Streamside Management Zones (SMZ's) along streams and wetlands to minimize the effects of nearby logging and related land disturbing activities.

2. Forest Ecosystem Management Team:

The FEMAT report recommends detailed standards and guidelines for riparian reserves, in their appendix V-F. In general, these standards and guidelines prohibit activities in Riparian Reserves that retard or prevent attainment of the Aquatic Conservation Strategy Objectives. Detailed guidance is delineated for the following management areas: timber, roads, grazing, recreation, minerals, fire/fuels, lands, general riparian area, watershed and habitat restoration, and fish and wildlife habitat. Timber harvest is prohibited in SMZ's, including firewood cutting. SMZ's are not included in the land base used to determine Allowable Sale Quantity, with some exceptions.

3. Sequoia National Forest

Forest-wide Standards and Guidelines, Riparian Areas (LRMP):

Delineate, manage, and monitor riparian areas using the “Riparian Standards and Guidelines for the Sequoia National Forest.”

Prevent adverse riparian areas changes in water temperature, chemistry, and sedimentation; and maintain a balance of woody debris.

Give emphasis to riparian dependent resources.

4. Tahoe National Forest

Tahoe National Forest LRMP has the most complete guidelines for riparian management in the SNEP region. The general guidelines presented in the LTBMU Forest Plan (1988) and in Carlson et al. (1992) are presented here.

Lake Tahoe Basin Management Unit Forest Plan

Riparian Area Goal: Riparian areas are able to perform their natural function in the environment, such as providing habitat for dependent species and for watershed protection.

Predicted Condition: Riparian areas will be protected from new disturbance. Where new disturbance does occur, there will be off-setting mitigation to replace the loss. Damaged riparian areas will be restored through the watershed restoration program, adjustments in management practices, and natural rehabilitation over time.

Nonstructural Wildlife Habitat Management: protect or improve habitat through coordination with other management activities; require non-degradation of existing deciduous tree types, wetlands, and meadow habitat; increase the acreage in these riparian associations where opportunities are present.

Nonstructural Fish Habitat Management: obtain water availability assurance for instream flows sufficient to meet fisheries needs; remove debris from streams in order to stabilize the channel in a manner to maximize improvement for fish habitat; maintain shaded conditions on rainbow trout streams by maintaining at least 50% of the stream bank site potential for herbaceous and shrub cover and at least 25% of the site potential for tree cover. Where natural tree cover is less than 20%, 80% of the potential should be retained. Thirty five to 70% of the stream should be shaded from 11:00 AM to 4:00 PM.

Water Quality: Manage existing naturally functioning stream environment zones (SEZ) lands in their natural hydrologic condition with few exceptions; Permit outdoor recreation facilities in SEZ where they are a part of long range development plans, where the nature of the activity must be so sited, where there is no feasible alternative, where it is fully mitigated, and where disturbed SEZ beyond allowed coverage is restored at 150% of the amount disturbed.

Tahoe National Forest

Primary goals for managing riparian areas: 1) provide high quality stream environments and 2) provide all the key structural elements of streamside areas that are important for wildlife and aquatic resources. The Tahoe NF LRMP presents detailed guidelines which are recommended for riparian zones. These prohibit management activities to occur within the stream management zone, except for activities which directly benefit riparian dependent resources.

5. Inyo National Forest

Forest-wide Standards and Guidelines: Riparian Areas:

Give emphasis to riparian-dependent resources in the management of riparian areas.

Protect streams, stream banks, shorelines, lakes, wetlands, and the plants and animals.

Prevent significant adverse riparian area changes in water temperature, chemistry, sedimentation , and channel blockages.

Use Allotment Management Plans as the vehicle for ensuring protection of riparian areas from unacceptable impacts from grazing. Institute positive measures such as salting, herding, water developments, fencing, rest rotation, deferred rotation, and other grazing systems as mitigation measures. If mitigation is unsuccessful in preventing unacceptable resource damage to the riparian habitat, as a last resort, livestock grazing will be reduced or eliminated in the affected areas.

Rehabilitate and/or fence riparian areas that consistently show resource damage from any cause if conflicts cannot be resolved.

Relocate existing roads, trails, and campsites outside riparian areas where necessary to eliminate or reduce unacceptable deterioration of riparian-dependent resources.

Allow new developments and surface disturbance in riparian areas only after on-site evaluations have determined that riparian-dependent resources are not adversely affected, or mitigation of adverse impacts is identified and incorporated in project design and implementation specifications.

Apply earth disturbance standards to each zone within each stream type. Earth disturbance is defined as complete removal of vegetation or a percentage of bare ground resulting for the disturbance.

Limit wildfire control methods and activities that would adversely affect the riparian zone. Avoid dozer-built lines in this zone where possible. Require the following water bar spacing on trails in

riparian areas unless specifically determined otherwise by on-site project evaluations:

Trail Gradient (%)	Spacing (feet)
1-5	200
6-10	150
11-15	100
> 15	50

Prohibit new locations of equipment staging areas in riparian zones. Phase out existing staging areas that have adverse effects on these zones.

Maintain the integrity of desert springs to conserve plant and wildlife habitat.

Recognize the important and distinctive values of riparian areas when implementing management activities. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

Delineate and evaluate riparian areas before implementing any planned management activity.

Design range, fish and wildlife habitat improvement projects and/or silvicultural prescriptions to maintain or enhance riparian area dependent resources.

Give priority to the rehabilitation of riparian areas when planning range, wildlife habitat, and watershed improvement projects.

Move existing livestock watering locations out of riparian areas when and where feasible.

6. Lassen National Forest

Forest-wide Standards and Guidelines Common to all EIS Alternatives:

Aquatic and riparian areas:

Provide water of sufficient quality and quantity to meet current needs. Meet additional future demand where compatible with other resource needs.

Limit individual project impacts as needed to avoid significant, adverse cumulative effects on water quality and fisheries.

Comply with Federal, State, Regional and local water quality regulations, requirements, and standards.

Maintain or improve riparian-dependent resources in and around wetlands, stream corridors (including ephemeral and intermittent streams), lakes, seeps, springs, and wet meadows.

Evaluate riparian zones forest-wide and manage to reach natural or achievable site potential and desirable future conditions. Desired future conditions, where site potential exists, are late seral communities in good or better condition.

7. Plumas National Forest

General direction

Standards and guidelines

Riparian Areas

Favor riparian dependent resources and limit disturbance in all riparian are including riparian and aquatic ecosystems, wetlands, stream banks, and flood plains.

Favor riparian resources over other resources, except cultural resources in cases of conflict. Apply Rx-9, Riparian Areas Prescription. Also see standards and guidelines for “Water”.

Streamside Management Zones (SMZ)

Limit disturbance in Streamside Management Zones.

Establish Streamside Management Zones (SMZ's) according to the guidelines shown in Appendix M, Guidelines for Width of Streamside Management Zones.

Prepare and adhere to a Streamside Management Zone plan for any activity within an SMZ. This plan shall establish site specific resource objective and include at least the following:

- objectives for vegetation management based upon the needs of riparian-dependent resources, and objectives to maintain or enhance water quality.
- manipulation practices and maximum amount of vegetation manipulation allowable to meet the stated objectives, while maintaining at least 75% effective organic ground cover. This cover includes humus, duff, litter, and vegetation in contact with the ground and at least 2" thick (or the existing thickness if less than 2" in the area), interwoven with sticks, branches, limbs, and logs.
- an analysis of project areas within the SMZ having over-steepened slopes (over 60%) with a very high erosion potential or a very high erosion potential or high instability, and procedures to limit soil disturbance to no more than 5% of these areas per decade. procedures for restoration of any deteriorated areas.
- prescription for roads, skid trails, landings, and other harvesting facilities.

Plumas National Forest LRMP (Rx-9. Riparian Area Prescription)

The purpose of this prescription is to manage riparian areas as unique ecosystems and to protect and improve them while implementing land and resource management activities. Riparian areas are to be managed in relation to various legal mandates, including those associated with flood plains, wetlands, rivers, and cultural resources. Emphasis will be given to protection and improvement of soil, water, vegetation, and riparian-dependent resources when conflicts occur among land use activities. Riparian areas consist of riparian ecosystems, aquatic ecosystems, and wetlands,. This prescription applies to approximately 45,000 acres scattered throughout the Forest. The Water Forestwide Standards and Guidelines are especially applicable to the riparian areas and provide an important supplement to this prescription.

General direction

Standards and guidelines

Recreation

Protect riparian areas while providing developed facilities.

Locate any new developed recreation sites outside of riparian areas unless an analysis shows that overall impacts would be minimized by locating the site in a riparian area.

Wildlife and Fish

Assure adequate protection for wildlife and fish resources.

See Forestwide Standards and Guidelines.

Range

Improve ranges and implement grazing systems to protect riparian areas, and restore them where needed

Develop objectives and utilization standards in Allotment Management Plans for vegetation management based on the needs of riparian-dependent resources and water quality.

Select and implement grazing systems that allow for the maintenance of riparian vegetation now in good condition and the improvement of riparian vegetation in unsatisfactory condition. Favor riparian-dependent resources and water quality over livestock grazing when conflicts arise.

Monitor the condition and trend of streamside areas as an integral part of each allotment management plan.

Timber

Manage timber to ensure protection of riparian areas.

Allow only vegetation removal within riparian areas that benefits riparian-dependent resources, controls insects and diseases, protects public safety, or facilitates timber harvest activities on adjacent land (i.e. cable corridors or designated stream crossings).

Water

Assure an adequate water supply for PNF and instream needs

Manage flows and/or reservoir storage to maintain or enhance riparian plant communities and habitat for all life stages of fish. Cooperate with local, State, and other Federal water management agencies.

Protect life and property from flooding and stream channel degradation where threat is moderate to high.

Preserve natural riparian flood control abilities. Remove only those log jams or major debris accumulations that have a high potential of causing channel damage, block fish passage, or could be transported down stream by high flows and cause loss of property.

Through cooperation with the State Department of Fish & Game insure that stream alterations restore the original flow capacity while preserving the existing channel alignment.

Comply with Executive Orders 11988, Floodplain Management, and 1190, Protection of Wetlands.

Protect riparian resources during storage and use of fuels and hazardous materials.

Prohibit the use, handling, or storage of any hazardous material within riparian areas unless no other alternative is available and suitable containment structures and spill cleanup contingency plans have been approved by the Forest Service.

Protect riparian resources from activities not directly related to Forest Service management activities.

Require riparian area protective measures in all applicable special use permits for non-PNF activities.

Minerals and Materials

Promote only mineral and common variety materials operations that protect riparian resources.

Ensure that Notices of Intent and Plans of Operations fully address riparian values.

Minimize adverse impacts to riparian resources through appropriate mitigation stipulations in operating plans, permits, and leases coordinated with applicable State and Federal agencies.

Energy

Facilitate hydroelectric development that provides protection of riparian resources.

Require proponents to coordinate with the PNF in analysis of in stream flow needs for all potentially affected riparian-dependent resources.

Lands

Assure protection of riparian areas during land exchanges.

Meet land exchange requirements of Executive Orders 11988, Floodplain Management, and 11990, Protection of Wetlands.

Facilities

Minimize the impact of roads on water quality and riparian areas.

Adjust road design and location, or use permanent or seasonal closures, to avoid or minimize impacts to riparian-dependent resources.

Manage roads at the standards necessary to provide riparian resource protection.

Provide for fish passage and maintain natural channel character at stream crossing. On Class I and II streams, use abridges, open bottom arches, and low water crossings unless an analysis shows that another structure is best.

Design cofferdams to minimize sedimentation to watercourses.

Take care during construction and removal of cribs, cofferdams, sheet pilings, etc. to minimize sedimentation to streams.