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Senator Byron D. Sher
Co-chair, Joint Committee on Headwaters Forest
and Ecosystem Management Planning
State Capitol, rm. 2054
Sacramento, CA 95814

Dear Senator Sher:

Thank you for forwarding me a copy of the proposed Aquatic Strategy and Mitigation component of the Habitat Conservation Plan (HCP) for Pacific Lumber Company lands in northwest California. I have read the document and have noted the significant discrepancy between the riparian management plan outlined in the HCP and those described by the two most widely accepted, scientifically-based sources: the FEMAT plan for Federal lands in the Pacific Northwest, and the ManTech report for non-federal lands in the area. I am particularly familiar with the aquatic and riparian management strategies of the FEMAT report, having assisted in their drafting. I am also conducting research on riparian buffer strip stability in a second-growth redwood forest in northwest California, and am thus familiar both with the studies upon which the FEMAT strategy was based and with more recent research on the subject of riparian buffer strips. My principal areas of research concern the cumulative effects of land-use activities and the influence of vegetation change on hillslope and channel processes.

You have asked for my response to the following questions. In each case, references to the "ROD" indicate the Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, the document published by the USDA and USDI in 1994 that outlines the provisions of the Northwest Forest Plan, and which is based on the 1993 FEMAT report.

1. What did the research and science that went into the FEMAT report of 1993 conclude is needed in terms of "no-cut" stream buffers and limited-entry zones adjacent to Class I streams that contain remnant populations of federally-listed salmon species?

The FEMAT category that would apply here would be "fish-bearing streams". These include all streams, perennial or intermittent, which are used by any species of fish. The outer bounds of the Riparian Reserve for a stream in this category are defined as the

- top of the inner gorge,
- outer edges of the 100-year floodplain,

- outer edges of riparian vegetation,
- distance equal to the height of two site-potential trees,
- 300 feet slope distance (600 feet total),

whichever is greater (ROD p. C-30). “Site potential trees” here refers to “the average maximum height of the tallest dominant trees (200 years or older) for a given site class” (ROD p. C-31). “Inner gorge” refers to “a stream reach bounded by steep valley walls that terminate upslope into a more gentle topography” (defined in the glossary of the 1994 Final Supplemental Environmental Impact Statement, p. 8).

The Riparian Reserves are specified to be areas where land is to be managed for the primary purpose of maintaining the health of aquatic and riparian-dependent ecosystems. Special guidelines apply that “prohibit and regulate activities that retard or prevent attainment of the Aquatic Conservation Strategy Objectives” (ROD p. B-12), and “Standards and guidelines prohibit programmed timber harvest, and manage roads, grazing, mining and recreation to achieve objectives of the Aquatic Conservation Strategy” (ROD p. B-17). FEMAT recognized that, in some cases, modification of riparian stands (e.g. thinning of “dog-hair” stands) may be needed to accelerate restoration of aquatic habitats, and the ROD thus provides Standards and Guidelines to regulate such activities (ROD p. C-31,32).

The specified Riparian Reserve widths are to be applied unless site-specific information concerning aquatic and riparian function and protection needs is available from a completed interdisciplinary watershed analysis and a site analysis. However, even under these conditions “the prescribed widths are considered to approximate those necessary for attaining the Aquatic Conservation Strategy Objectives [on permanently-flowing streams]. Post-watershed analysis riparian reserve boundaries for permanently flowing streams should approximate the boundaries prescribed [by the interim specifications]” (ROD p. B-13).

2. Based on the research results available to FEMAT scientists, did they conclude that only a 30-foot “no-cut” buffer next to Class I streams was sufficient to restore and maintain “functional” riparian habitat that anadromous fish are dependent on for long-term survival?

The FEMAT team concluded that a distance equal to the height of two site-potential trees was the minimum distance required to restore and maintain the required habitat on fish-bearing streams. Only one (alternative 7) of the 10 alternatives outlined by the Final Supplemental Environmental Impact Statement (1994) considered a zone potentially narrower than two site-potential tree heights:

FSEIS alternative number:	1	2	3	4	5	6	7	8	9**	10
Minimum Riparian Reserve width (in number of tree heights):										
Fish-bearing streams (perennial and intermittent)	2	2	2	2	2	2	varies	2	2	2
Perennial, non-fish-bearing	1	1	1	1	1	1	varies	1/2	1	1
Intermittent, non-fish-bearing*	1	1, 1/2	1, 1/2	1	1, 1/2	1, 1/2	varies	1/6	1	1, 1/2

* Double entries for intermittent, non-fish-bearing streams indicate different prescriptions are used for certain types of “Key Watersheds”

** Option 9 was selected as the basis for the Northwest Forest Plan, as described in the ROD.

Of the alternatives proposed, options 7 and 8 were determined by a panel of experts to be insufficient to “reverse the trend of degradation and begin recovery of aquatic ecosystems and habitat on Federal lands within the range of the northern spotted owl” (FSEIS p. S-13).

3. What kinds of effects would the prescriptions outlined in the aquatic component of the headwaters HCP agreement have on the aquatic habitat of adjacent streams? In what ways would those changes affect the suitability of habitat for coho?

I will defer answering this question until after question number 4.

4. What was the basis for selecting the criteria for designing buffer widths for fish-bearing streams in the FEMAT study?

The overall FEMAT strategy for “reversing the trend of degradation of aquatic ecosystems and habitat on Federal lands” recognized the complicated nature of habitat requirements for sustainable aquatic ecosystems: the more a system is studied, the more we discover about critical habitat needs that had not been recognized before. We can thus assume that we do not yet know everything about the habitat characteristics a species such as coho salmon requires for survival. Given this level of uncertainty, it is necessary to maintain a habitat system that functions similarly to the conditions under which the species evolved. Riparian Reserves were thus designed to protect the functioning of the habitat system to ensure that both known and as-yet-unknown habitat requirements for coho and other aquatic species are met.

Particular roles of riparian forests in sustaining aquatic ecosystems capable of supporting Pacific salmonids include:

- maintenance of appropriate water temperature regime through provision of shade
- maintenance of appropriate water temperature regime through regulation of air temperature and humidity
- maintenance of aquatic food web through provision of leaves, branches, and insects
- maintenance of bank stability through provision of root cohesion on banks and floodplains
- maintenance of water quality through filtering of sediment from upslope sources
- maintenance of water quality through filtering of chemicals and nutrients from upslope sources
- maintenance of channel form and in-stream habitat through provision of appropriate large woody debris
- maintenance of channel form and in-stream habitat through restriction of sediment input
- moderation of downstream flood peaks through temporary upstream storage of water
- maintenance of downstream channel form and in-stream habitat through maintenance of an appropriate sediment regime

In particular, it is important for both adjacent and downstream aquatic environments that the size distribution and species distribution of woody debris be similar to those that pertained when the ecosystem was functioning appropriately. If stem diameters are too small, woody debris is readily mobilized, depleting wood from moderately-sized streams and contributing to downstream damage to bridges and floodplain infrastructure during floods. If the tree species shift from conifers to hardwoods, introduced woody debris decays rapidly, also depleting streams of the required wood and changing an important element of the aquatic food web.

With these points in mind, the rationale for selection of Riparian Reserve width criteria can be described:

top of the inner gorge: Inner gorges are very prone to landsliding. Maintenance of tree cover on such slopes is necessary both to prevent accelerated landsliding and to ensure that any slides that do occur carry the appropriate size and species distribution of woody debris into the stream.

outer edges of the 100-year floodplain: Anything on a floodplain potentially can be incorporated into a stream channel during floods or as the channel migrates; floodplains thus function as an integral component of aquatic habitat. Maintenance of appropriate floodplain vegetation thus is necessary to fulfill all functions listed above.

outer edges of riparian vegetation: Aquatic ecosystems are intimately intertwined with adjacent riparian ecosystems, so changes in the functioning of riparian ecosystems will modify food availability, energy exchange, predation, and competition in the adjacent aquatic ecosystem. Modification of riparian vegetation would strongly modify the functioning of riparian ecosystems, and thus would modify the functioning of adjacent and downstream aquatic ecosystems.

distance equal to the height of two site-potential trees: Studies of the microclimatic influences at forest edges show that the effects on air temperature and relative humidity persist for a distance of up to 3 tree-heights into the forest from the edge. Stream temperatures depend partially on air temperature and relative humidity. Maintenance of appropriate riparian microclimate thus is important for maintenance of appropriate stream temperatures as well as for maintenance of riparian-dependent ecosystems, which, as described above, are inextricably linked with aquatic ecosystems. FEMAT decided that two tree heights would be selected instead of three tree heights in recognition of the potential economic impact of a three-tree-height-wide buffer.

Other important functions of the near-channel environment can be satisfied by narrower buffer zones. Woody debris rarely reaches a stream channel from distances beyond one tree height, for example, unless carried by a landslide; a tree-height's width of appropriate species composition and age distribution would thus be sufficient to maintain channel structure. However, additional width is required to assure that the appropriate species composition and age distribution are sustained within this zone. Without such additional buffering, stand edges would soon be depleted by accelerated blowdown due to exposure of non-wind-firm trees by modification of the adjacent stand.

300 feet slope distance (600 feet total): The further from a stream that erosion occurs, the lower the likelihood of the sediment reaching the stream. In addition, undisturbed land can function as a filter for chemicals and nutrients introduced by land-use activities upslope. A minimum width was thus considered necessary to ensure that this filtering capacity would be retained if the other criteria indicated that narrower widths would be sufficient for sustaining other riparian influences on the aquatic ecosystem.

3. What kinds of effects would the prescriptions outlined in the aquatic component of the headwaters HCP agreement have on the aquatic habitat of adjacent streams? In what ways would those changes affect the suitability of habitat for coho?

Now that the reasoning behind the FEMAT criteria has been described, it is possible to describe the potential effects of the proposed HCP on aquatic habitat of adjacent streams. The principal areas in which forest management activities will influence aquatic habitats are those in bands 2 and 3, in which selective harvest is allowed under specified guidelines. If these areas are managed for even a low rate of timber harvest, the age- and size-composition of the stands will change, some level of ground disturbance will be sustained, and stability of the remaining trees will be compromised due to thinning of the wind-firm canopy. As this area is completely within a

distance of one site-potential tree height of the channels, any changes within this area will affect the capability of the riparian system to adequately fulfill each of the roles listed above. In particular, periodic removal of selected trees from within the zone capable of contributing woody debris to channels will lead to uncharacteristically low volumes and small sizes of woody debris in channels, thus altering channel form, in-stream habitat, sediment transport regimes, and flood hydraulics.

In addition, thinning of the canopy may lead to a decrease in the overall wind-firmness of the stands, thus introducing the possibility that woody debris inputs may begin to result from pulses of widespread blowdown rather than from more dispersed instances of individual tree mortality. Under such a regime, debris sizes are likely to be smaller than appropriate, and the channel may shift between phases of severe overloading of debris and phases of depletion after the pulsed input has decayed and before the new stand is old enough to begin contributing significant wood. Excessive rates of sediment input would accompany such pulsed inputs of woody debris.

FEMAT recognized that Pacific salmonid species developed in the context of the vegetation, climate, and topography that are naturally present in the region; the species are, in essence, finely tuned to be sustained by the conditions present before land-use activities changed so radically during the last century. Any change away from those habitat conditions thus represents an alteration away from the conditions for which the species are adapted. Such changes are expected to decrease the species' ability to survive.

5. Is there some reason that habitat requirements for coho salmon would be different on private versus public lands?

There is nothing about the biology of the fish that recognizes property boundaries. Habitat needs would differ only if private lands were distributed in such a way that a different portion of the habitat were being used on private lands than on public lands. For example, if estuaries or downstream reaches were consistently owned privately rather than publicly, habitat requirements on those lands would reflect the particular usages (migration, for example) specific to those environments. For a species such as coho, different habitats are used sequentially through the life-cycle of the fish. Survival of the species thus depends on the presence of suitable habitat to support each life-cycle stage, and removal of any one link in the chain of required habitats could lead to the species' extinction.

I realize that the above comments are not as detailed as would be necessary to do full justice to the subject, and I would be happy to provide further information on any of these topics if it would be of use to you. I can also provide citations to the published research literature concerning riparian buffer widths, if it would be useful. Thank you for your interest.

Sincerely,

Dr. Leslie M. Reid
Research Geologist

cc: Dr. Hal Salwasser, Station Director
Dr. Garland Mason, Assistant Station Director