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September 10, 1996

TO: Steve Morris, Elizabeth Gaar

FROM: Rowan Baker

SUBJECT: Analysis of the Oregon Department of Forestry's (ODF) Most Recent Submission for the State of Oregon's Coastal Salmon Restoration Initiative

For the analysis of ODF's most recent submission, I reviewed 1) our July 2, 1996, letter from Jacqueline V. Wyland to Mr. Jim Martin, The Governor's Salmon Advisor, regarding comments on the State of Oregon's draft proposed measures for the Coastal Salmon Restoration Initiative, 2) ODF's revised proposal which I received on August 19, 1996 from Dan Avery, NMFS, and 3) ODF's original proposal.

There were a number of changes and revisions from the ODF's earlier draft proposal, although on the whole there were few significant changes. The proposal included a new measure to assess road-related risks, and several sub-measures that indicate an increased willingness on the part of ODF to provide additional review for certain high risk activities in CSRI-identified "core areas." Most of NMFS' original concerns were still not addressed, or were only partially addressed in the revisions.

The following draft comments constitute my findings with respect to the ODF submission. Additional supporting analyses and graphical representations of data (referred to in the comments as Appendix 1 and Appendix 2; Figures 2-1 through 2-6) are also attached to these draft comments.

Oregon Department of Forestry

The Department of Forestry (ODF) and NMFS have been discussing the issue of the Oregon Forest Practices Rules (Rules) over the past eight to nine months. The NMFS has communicated six main concerns with the program: mass wasting, small stream protection, potential hydrologic changes, cumulative effects, inadequate long-term wood recruitment to streams, and road-related problems. These issues are presented in considerable detail in an appendix to these comments (see Appendix 1). In this most recent CSRI draft, it appears that only some of these identified concerns are beginning to be addressed in ODF's proposed measures.

Positive Aspects

NMFS is encouraged by the high level of specificity in ODF's most recent submission to the CSRI. ODF is to be commended for taking the initiative to improve many of their earlier measures. In general, ODF proposed more measures and presented them in greater detail than the other State agencies. In response to several of NMFS' concerns, ODF has included several important measures that were not contained in earlier drafts.

In particular, NMFS would like to acknowledge the following new measures which appear to offer significant potential benefits to salmon and their supporting habitats:

Road Erosion and Risk Project (ODF 10). This measure will help identify and address road-related risks to coastal salmon recovery for system roads used in State and non-Federal forest operations since 1973. The measure should be expanded to include older, "legacy" roads. This measure would benefit from a regulatory "backstop" after ten years of initial, voluntary implementation, and increased incentives for landowner participation. Road density, road location (and relocation), and expansion of the stream drainage network due to roads should be addressed in the risk assessments.

Northwest State Forest Lands Management Plan (ODF 14). Although not yet implemented, this measure shows significant potential to improve salmon habitat conditions and overall watershed health through longer harvest rotations and "structure-based management" approaches. This measure could be further improved by emphasizing watershed health as opposed to "forest health." Planning should place paramount importance on protecting and restoring (respectively) the CSRI-identified source and recovery watersheds (including protecting "core areas"). "Site-specific" measures that are emphasized in the proposed measure should be placed in a watershed context to be fully effective. Full coordination with NMFS and the U.S. Fish and Wildlife Service will also be essential to the success of this measure.

Stream Habitat Assessment (ODF 22). This measure will improve understanding of the status and trend of salmon habitats on State and non-Federal forest lands. The measure will focus initially on coastal coho salmon streams. NMFS views this measure as a high priority for funding and implementation. The measure would be improved by inclusion of a schedule for full implementation (for coho), and expansion of the program to include streams and habitats that support all anadromous salmonid species, especially those currently listed or proposed for listing under the ESA (e.g., Umpqua River sea-run cutthroat trout, steelhead).

Increased protection of core areas during hardwood conversions (part of ODF 16). This new management measure will subject hardwood conversions in core areas (which likely include some of the best remaining salmon habitats and source areas for population expansion on State and Non-federal forest lands) to additional review. The measure will require a site-specific plan to be submitted and reviewed for hardwood conversions in core areas. The philosophy behind this proposed measure should be expanded to other high-risk forestry activities that may occur in core areas.

NMFS recognizes that the State's CSRI effort, and ODF, has only a short time in which to make further improvements to the proposed measures. Therefore, NMFS has highlighted the following significant issues (serious inadequacies) that, at a minimum, will need to be addressed for NMFS to be assured that ODF's combined measures will succeed in meeting the recovery needs of coho salmon. Other less significant, but still important, issues are included in a later section of these comments.

Serious Inadequacies:

(Note: Text in parentheses indicates how the issue was described in previous discussions with ODF, or indicates a "New Issue" that has not been discussed previously with ODF)

1. Mass Wasting ("Mass Wasting/Protection of Unstable Areas")

2. Roads/Culverts ("Road Related Problems")

3. Riparian Protection ("Large Wood Recruitment" and "Small Stream Protection")

4. Forest Chemical Application (New Issue)

5. Stream Fish Surveys and Habitat Surveys (New Issue)

6. Hardwood Conversions (New Issue)

7. Protection of Core Areas (New Issue)

8. Cumulative Effects ("Cumulative Effects")

9. Watershed Assessment Protocol (New Issue)

10. Potential Hydrologic Changes ("Potential Hydrologic Changes")

11. Benchmarks are Inadequate (New Issue)

12. NMFS' July 2 Comments Not Addressed

Supporting Detail

1. Mass Wasting ("Mass Wasting/Protection of Unstable Areas")

Other than the proposed measure for assessing risks of roads and culverts on newer (post-1973) roads (ODF 10), there is no measure included in ODF's submission that addresses the potential for mass-wasting (massive, episodic soil movement events) on State and non-Federal forest lands. NMFS was informed previously by ODF staff that a process does exist to identify high and moderately high risk sites on these lands, and that ODF maintains maps showing where these areas are on the landscape. Accurate maps of unstable areas are essential to alert ODF's forest practices staff to the need for individual operators to prepare written plans, prior to initiating roadbuilding activities and other forestry practices on these sites. NMFS has no assurance that such maps exist or are adequate to the task and does not understand how ODF can alert the appropriate operators that a written plan is required, without accurate maps of unstable areas.

NMFS has raised this issue several times, and has not been satisfied with ODF's responses, to date. NMFS would like to see the process whereby ODF identifies unstable areas (including high and moderately high risk sites) explicitly described. NMFS would like to see an example of the maps of unstable areas. The process for identification of unstable areas and any maps that have been produced using it should be peer reviewed by an independent group of soil scientists/geomorphologists. The process used and maps produced should also be field-verified.

See Appendix 1, Issue 1. Mass Wasting, for detailed analysis and additional recommendations.

2. Roads/Culverts ("Road Related Problems"; ODF 1,2,3,10)

The Revised Forest Practice Rules (Rules) have no well-defined process to identify problems with older logging roads and railroad grades constructed under previous forest practices (prior to 1994) that are now considered inadequate to maintain slope stability. ODF's measure 1, which aims to improve fish passage through culverts and stream crossing structures, only applies to roads built after September 1, 1994. ODF's measure 2, which provides for improved design of culverts and stream crossing structures to handle a 50 year storm event, also only applies to newer roads built since September 1, 1994. Similarly, both ODF's measure 3, which upgrades road construction and fill requirements, and ODF's measure 4, which upgrades skid trail construction and fill requirements, only apply to newer roads constructed after September 1, 1994.

At issue are the many miles of roads and the extremely numerous stream crossing structures and culverts that were put in place prior to the adoption of the newer Rules in 1994. These "legacy roads," as well as old railroad grades and skid trails, are not required to be maintained, upgraded, or decommissioned under the revised Rules. As mentioned earlier, under "Positive Aspects," ODF has recently instituted an expedited voluntary process (ODF measure 10) which begins to address this significant concern. ODF measure 10 appears well-conceived, and is based on sound objectives. The measure indicates a clearly defined, logical prioritization process which will help ODF significantly in addressing such a widespread problem. The stated priorities are to begin improvements in CSRI-identified core area watersheds with high risk sites greater than 50 percent of the total watershed area, proceed to other core area watersheds, then to other watersheds (with anadromy) in the Umpqua, Rogue and Tillamook basins, and finally to all other watersheds. NMFS would like to emphasize that this project has the potential to result in significant improvements in road management practices.

However, ODF measure 10 could still be improved significantly. In particular, the measure needs to be expanded to include all legacy roads, railroad grades, and skid trails, not just those built, or used since 1973. The criterion of "built or used since 1973" eliminates many roads skid trails and railroad grades that were built before 1973, or that were abandoned or "not used" since 1973. The risk assessments, as described, do not specifically include a process for identification of those watersheds with high road densities (>2-3 miles/mile^2), and those with a large percentage of valley bottom roads, or other high-risk road locations. The risk assessments should also include a process to address the hydrologic connectivity of the road and skid tail network to the overall stream network, and identify site-specific methods of hydrologically decoupling roads and skid trails from streams.

ODF measure 10 would also be more effective if funding or incentives for this program were developed to ensure landowner participation. Currently, the program is entirely voluntary and lacks adequate incentives or funding. The measure states that "at the end of ten years, landowners will be evaluated on whether substantive progress has been made...and more aggressive application of regulatory options will be **considered**" (emphasis added). This measure would be significantly improved if a regulatory backstop were added. This would best be accomplished by initiating a proposed Rule change, as is currently being done for forest chemical application. Without the addition of a regulatory "backstop," to provide an incentive for voluntary landowner participation during the first ten years, NMFS has no assurance that this measure will result in timely improvements in a significant percentage of the older roads, larger skid trails, and abandoned railroad grades on the landscape, and cannot predict the likelihood of success of this program.

See Appendix 1, Issue 6., Road-Related Problems, for detailed analysis and additional recommendations.

3. Riparian Protection Rules ("Large Wood Recruitment" and "Small Stream Protection"; ODF 5,9,16,18)

Protection of riparian areas for all but one category of streams (larger fish-bearing streams) is inadequate under the revised Rules. Larger fish-bearing streams, while important, are a relatively small percentage of the total stream mileage (less than 10 percent of all fish-bearing streams, and only 2 percent of all streams). The ODF has acknowledged that small- and medium-sized fish-bearing streams receive significantly less protection under the Rules. However the level of protection actually afforded these streams (which together comprise approximately 90 percent of all fish streams and approximately 18 percent of all streams), is never mentioned in any of the CSRI documents.

For this reason, NMFS has conducted a detailed analysis of the revised Riparian Protection Rules using a model that predicts both the amount of large woody debris (LWD) that could potentially enter fish-bearing streams, by stream category. The model also predicts the level of expected coho smolt yield for each category of stream, relative to what the level of smolt yield would be if the riparian area were managed for mature conifer stands.[1] The model was developed by Michael Murphy of NMFS' Science Center, in concert with other cooperators (NMFS, ODFW, WDNR, and Weyerhaeuser) and utilizes data provided to NMFS by the ODFW and ODF. The model outputs are displayed in Appendix 2 (see Figures 2-1 through 2-6). Complete documentation of the input data, assumptions, and model outputs are available from NMFS, upon request.

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[1] By "mature conifer stands" NMFS means stands dominated by 120-year-old conifer trees. NMFS is not comparing the Revised Water Protection Rules to the level of function provided by "old growth" stands, and is not attempting to apply an unfair or economically/ecologically unattainable standard.

a. Large Fish-bearing Streams

ODF Measure 5 states that "inputs of large woody debris on large fish-bearing streams will likely range from 63 to 92 percent of potential over time, depending on the assumptions made." NMFS' model uses the following assumptions: 50 year rotation length, ODF's assumption that stand basal area regrowth is 59 percent at 25 years after harvest, the widths of riparian no-touch and outer managed RMA widths from the Rules, and initial stand basal area equal to the "adjusted normal yield" of a mature (120 year old) conifer stand, or approximately 200 square feet of basal area per acre. The model also uses ODFW data from Lobster Creek in coastal Oregon to predict the smolt production capability (yield) of resulting instream habitat conditions, based upon the amount of LWD inputs or depletion, over time. This portion of the model uses ODFW's data and (Tom Nickelsen's) model results which predict smolt yields based on the changes in pool habitat that are expected from changes in instream LWD.

The model predicts that potential LWD inputs to large fish-bearing streams would be only 64 percent of the potential LWD inputs of a 120 year-old stand after 100 years (see Appendix 2, Figure 2-1), or approximately two timber harvest rotations (this is at the extreme low end of what ODF predicted, but is still consistent with their analysis). The resulting loss in smolt yield is approximately 16 percent. The level of protection given by the Rules to large fish-bearing streams is predicted by the model to result in only 84 percent of potential smolt yield, after 100 years. One could argue that this is an adequate level of smolt productivity for non-Federal forest lands, given the greater share of the burden expected to be borne by Federal lands in coastal salmon recovery efforts. It must be remembered, however, that large fish-bearing streams constitute only 10 percent or less of total fish-bearing stream miles on the landscape. As will be explained below under "Caveats to NMFS Model Results," these model results are extremely optimistic (i.e., the actual level of protection provided by the Rules could be significantly lower than predicted by the model).

b. Medium Fish-bearing Streams

The NMFS model predicts that the level of protection of medium-sized fish-bearing streams provided by the Rules will result in a decline of 50 percent of potential LWD inputs, after 100 years or two timber harvest rotations (See Appendix 2, Figure 2-2). The corresponding drop in potential smolt yield is 22 percent. Thus, only 78 percent of potential smolt yield would be provided, after 100 years. Medium-sized fish-bearing streams comprise the majority of anadromous fish-bearing streams on the landscape (cursory analysis indicates that these streams are approximately 60 percent of all fish-bearing streams and approximately 12 percent of all streams; the actual percentages are probably lower because many small streams have not been mapped or sampled to determine their fish-bearing status).

See Appendix 1, Issue 5., Inadequate Long-Term Wood Recruitment into Streams, for detailed analysis and additional recommendations.

c. Small Fish-bearing Streams

The NMFS model predicts that the level of protection of small fish-bearing streams provided by the Rules will result in a decline of 64 percent of potential LWD inputs, after 100 years or two timber harvest rotations (See Appendix 2, Figure 2-3). The corresponding drop in potential smolt yield for this class of streams is 27 percent. Thus, only 73 percent of potential smolt yield would be provided, after 100 years or two harvest rotations. Small fish-bearing streams are approximately 30 percent of all fish-bearing streams, or approximately 6 percent of all streams on the landscape (very rough analysis; the actual percentage of small fish-bearing streams is probably much higher because many small streams have not yet been mapped, and many that are mapped as "non-fish-bearing streams" have not been sampled efficiently to properly determine fish presence vs. absence).

See Appendix 1, Issue 5., Inadequate Long-Term Wood Recruitment into Streams, and Appendix 1, Issue 2., Small Stream Protection, for detailed analysis and additional recommendations.

d. Non-fish-bearing Streams and Downstream Sediment Impacts

Although the NMFS model only looked at fishbearing streams, the role of LWD in non-fish bearing streams is also extremely important. LWD in these streams (especially larger, stable "key" pieces) stores fine sediment high up in watersheds, and releases it downstream at natural, controlled rates. It is likely that the low levels of protection afforded these smaller streams (e.g., no provision for 20-foot "no-cut" buffers along small type "N" streams) will result, over time, in loss of stable LWD "key pieces," and greater amounts of fine sediment routing directly to downstream, fish-bearing streams. This, in turn, will likely result in loss of downstream habitat quality from filling in of pools, increased cobble embeddedness, and intrusion of fines into gravel interstitial spaces needed for successful egg incubation, fry emergence and juvenile coho salmon overwintering.

See Appendix 1, Issue 2., Small Stream Protection, for detailed analysis and additional recommendations.

e) Caveats to NMFS Model Results

The model results provided above probably represent a "best case" scenario for future supplies of LWD to streams and resulting smolt yield for the following reasons:

1) There are likely few riparian stands that would now meet the assumed initial basal area target of about 200 ft^2/ac. Many riparian areas have been managed intensively for timber harvest for many decades, and it should be noted that the minimum basal area required along fish streams before the 1994 Rule changes was only ten ft^2/ac. For example, a count of the numbers of conifers remaining after logging along 30 fish streams, in 1990 and 1991 in western OR, found an average of only 26 conifer trees/1000 feet of stream. This figure was calculated to be about 40 percent of the pre-logging level for all stands, or about 20 percent of the level for riparian stands that were well stocked with conifers (>80 trees/1000 ft) before logging. The effect of past management has been that the actual (i.e. existing, on-the-ground) RMA basal area is considerably lower than the initial conditions assumed in NMFS' model. The model results, therefore, probably significantly overestimate the potential LWD contributions from RMAs for the first 100 years, or more. Research has shown that, once cut, it takes approximately 80-120 years before riparian conifers can regenerate and mature to provide adequate source of instream LWD, especially larger, stable "key pieces" needed in medium and larger sized streams.

2) Just because the model predicts that a certain amount of LWD will enter streams, based on the basal area of the surrounding RMA, does not mean that it will. Potential LWD source trees in RMAs must be allowed to mature, incur mortality (from fire, disease, blowdown, etc.), and fall into the stream. In fact, it is likely that there will be little natural mortality occurring at the end of each 50-year harvest rotation when the maximum amount of available LWD is present in the RMA (see Appendix 2, Figures 2-4 through 2-6). This is because there is a fairly small window of time in which a natural disturbance event would coincide with the stand's being at or even near the 200 ft^2/acre adjusted basal area target. For large fish-bearing streams, the outer RMA is below 150 ft^2/acre of basal area approximately 50 percent of the time (Appendix 2, Figure 2-4). For medium-sized streams, the outer RMA is below 120 ft^2/acre of basal area approximately 50 percent of the time (Appendix 2, Figure 2-5). For small streams, the outer RMA is below 100 ft^2/acre of basal area **all of the time**, and is below approximately 60 ft^2/acre of basal area **most of the time** (Appendix 2, Figure 2-6).

3) In all cases, the inner portion of the RMA is shown as contributing fully to the 200 ft^2/acre of basal area target

within the RMA 100 percent of the time. However, this is misleading because the inner 20-foot "no-cut" zone can be manipulated during hardwood conversions "to within 10 feet of the high water level" (see ODF Measure 16), to the streambank "where yarding corridors or stream crossings are needed...where a site-specific prescription is approved" (ODF 1994), or for "basal area credit" towards instream restoration. There are in reality a number of ways in which operators can avoid having to leave all trees standing in the inner 20-foot "no cut" zones. For these reasons, the 200 ft^2/acre prediction for the inner 20-foot "no cut zone" in NMFS' model output, and the 200 ft^2/acre target for the entire RMA in general, are both extremely optimistic.

4) Typically, the larger trees in the outside portion of the RMA will not remain standing longer than the 50 year rotation because they can selectively be removed, as long as a "standard" basal area target (which varies by size of stream and geographic region) is still met. Operators are required to leave a minimum of 40 live (minimum 11" Diameter) conifer trees per 1000 feet of large fish-bearing stream, and 30 live (minimum 8" diameter) conifer trees per 1000 feet of medium fish-bearing streams, and must leave standing, already dead trees (snags). However, it is entirely conceivable (and allowable under the Rules) for an operator to remove not only many of the largest trees in the RMA but also many live trees imminently susceptible to mortality (e.g. for "forest health"), leaving mainly younger trees in the 8" to 12" diameter class which do not supply larger, stable "key pieces" of LWD, and/or which are less likely to suffer mortality and enter the stream.

5) Operators that take advantage of the "hardwood conversion" provisions of the Rules (see ODF Measure 16) can remove additional, healthy conifer trees from the RMA as necessary to conduct a hardwood conversion, thus reducing the effective basal area of the RMA, as well as removing the highest value trees both in terms of dollar value and value as potential LWD.

6) The Rules do not allow for a slope correction when measuring and establishing the 20-foot "no-cut" and outer RMA protection widths. This will result in widths that may be inadequate for providing the full complement of potential LWD recruitment. A conversion from slope distance to horizontal distance is necessary particularly for smaller and, typically, steeper streams. The net effect of not doing this is underestimate (relative to their total potential contribution of LWD) the percent contribution of LWD from medium-sized fish-bearing streams and small fish-bearing streams that occur on steeper slopes.

7) The measurement of RMA width does not begin at the outer edge of the floodplain, but rather at the edge of the active stream channel. This means that channels may migrate outside of the RMA

or within the RMA, leaving little potential room for LWD recruitment if the outer edge of the RMA is a clearcut or in an early regenerative stage. The net effect of this measurement protocol is to reduce the potential LWD contribution from larger, lower gradient streams that meander frequently or migrate within their floodplains.

8) Operators taking advantage of the "basal area credit" provisions of the Rules (see ODF measure 18), may remove trees from the RMA and place them in the stream, and count those trees toward meeting the basal area requirement. This practice can remove up to 20 percent of the basal area of the RMA. While providing some short-term benefits, this practice may actually reduce the potential for natural long-term recruitment of LWD from the RMA.

9) Under ODF measure 9, operators can voluntarily leave an additional 1/2 of a tree per acre (25 percent of the prescribed 2 tree per acre in-unit leave tree requirement) in or along the edge of the RMA. These additional leave trees are a small fraction of what would be required to significantly change the fundamental rate of LWD recruitment provided by the Rules' RMA widths and basal area requirements and 20 foot "no-cut" zones. In contrast, an analysis by a large timberland owner found it was necessary to leave 5 in-unit trees per acre in or adjacent to the RMA, in order to meet the basal area target of about 200 ft^2/ac. Note that this figure is ten times what is allowed under the Rules. The practice of leaving 1/2 of an in-unit tree per acre adjacent to the RMA provides only a very minor benefit to overall LWD recruitment. Although it is not included in NMFS model, it probably would not influence NMFS model results in any detectable way. However, all other caveats (items 1-8) are also not included in NMFS' model, and together are likely to result in significantly less potential LWD, and significantly lower smolt yields, than NMFS' model predicts.

NMFS is encouraged to note that ODF measure 9 includes an apparent commitment by Oregon Forest Industry Council (OFIC) landowners to retain additional in-unit leave trees in RMAs associated with CSRI-identified core areas, and "other special areas along specific stream reaches when requested by ODF or ODFW." This appears to be a good-faith effort, and is a very good start toward conserving remaining healthy habitats in critical core areas. The measure should, however, indicate a priority system for allocating the additional leave trees (similar to the priority system developed by ODF for the Road Assessment and Risk Project). The measure will also require coordination between the landowners, ODF, and ODFW for its success.

4. Forest Chemical Application (New Issue, ODF 7)

ODF's measure 7 cites a proposal to change the current chemical application rules. The changes appear to provide greater protection to streams and associated riparian vegetation from direct aerial application of fungicides and non-biological insecticides. Specifically, the "setbacks" for chemical application are increased from 60 feet to 300 feet from fishbearing streams (type "F" streams) and domestic use streams (type "D" streams), and from 0 feet to 60 feet from non-fishbearing (Type "N") streams. The measure claims that it "will also reduce the chances of chemical contamination to fish bearing waters during mixing and loading operations." Specific distances from fish use and domestic use waters are **proposed** within the new rules" (emphasis added).

Although the proposal has tremendous potential benefits to salmon and aquatic health in general, NMFS can not presently evaluate the likely effectiveness of this measure for several reasons:

1) Although the description of this measure states that it "will become effective by Jan. 1, 1997", the measure is still a proposal only, and will require a modification of existing Rules, i.e. a Rule change. The proposal to change the forest chemical application rules must be approved by the State Board of Forestry (BOF). This approval apparently has not yet occurred, and it is possible the Board may not approve the proposal, or may approve it with major modifications.

2) NMFS does not clearly understand how the Rule change could be implemented for non-fish-bearing streams, which are extremely numerous on the landscape, without banning the practice of aerial spraying of these specific types of fungicides and non-biological insecticides. The description of this proposed measure states that "Type N streams containing flowing water must not have direct aerial application within 60 feet of the aquatic areas. All vegetation required to be retained by the water protection rules for type N streams must be protected from chemical damage." This would effectively preclude the practice of aerial spraying over much of the landscape, and NMFS is not convinced that the BOF will approve such a measure.

3) The measure does not state what the "specific distances" from fishbearing and domestic use streams will be during mixing and loading of chemicals.

5. Stream Fish and Habitat Surveys (New Issue; ODF 20,22)

Although NMFS supports both ODF measure 20 and measure 22, we have a number of significant issues regarding implementation and funding of these measures:

a) ODF measure 20, which is to fund and complete an interagency fish presence survey, is critical. As mentioned previously under "Positive Aspects" NMFS believes that this measure offers significant benefits and is a very high priority funding item. However, the description of the measure indicates that it is presently unfunded, and that the agencies involved (ODF and ODFW primarily) have had to seek grant monies to initiate the work. This situation is unacceptable. This measure must be funded and completed on a timely basis. Unless it is funded at much higher levels than at present, NMFS has no assurance that even the basic level of protection specified under the Rules will be provided on a timely basis for streams that are in reality fish-bearing streams but have not yet been surveyed to protocol. The measure description states, "Data indicate fish distribution is currently underestimated by more than 50 percent in much of the range of coho salmon." This statement is extremely alarming, given the severely depressed status of coho salmon and many other at-risk anadromous salmonids.

b) ODF measure 20 should specify what method is used to determine fish presence/absence during the surveys. In general, NMFS is concerned that the practice of electrofishing, or other physical removal methods that require handling of fish, may result in inadvertent mortality of salmonids. Given the depressed status of coho salmon, State-wide, any additional, avoidable mortality of coho salmon is probably unacceptable. If coho are listed, this mortality would constitute "take." NMFS recommends that the ODF and ODFW use electrofishing, seining and other removal methods only to conduct necessary experimental research, or in index areas needed to estimate population abundance. If coho salmon are listed, NMFS would allow only these types of activities under an incidental take permit. NMFS therefore suggests strongly that underwater observation (snorkel surveys) be the primary method of determining fish presence/absence. Underwater surveys should cover a sufficient stream length (100-300 meters), should include preferred habitats, should be of sufficient duration (45 minutes to one hour, per site), and should be conducted when fry or juveniles are likely to be present to ensure positive detection. Extremely shallow streams that can not be snorkeled effectively can be sampled using bait (or bread crumbs) and binoculars. Electrofishing could be used experimentally, i.e. on a limited basis, to validate negative findings from snorkel surveys or other non-removal methods.

c) ODF measure 22, Stream Habitat Assessments, is another high priority funding item. NMFS is encouraged by the fact that individual landowners have contracted ODFW to conduct habitat surveys, and have completed surveys for approximately 3,000 miles of stream. However, this measure belongs in the ODFW package of measures, as it seems that ODF is not directly involved. If ODF is involved, their level of involvement is not described. NMFS suggests that ODFW complete the "benchmarks" portion of this measure, as the "proposed monitoring benchmarks" are inadequate. ODFW should develop results-oriented benchmarks of actual habitat conditions, using the parameters included in the habitat survey protocol. This measure would also benefit from development or explanation of the prioritization process used to select stream habitat survey locations (or conversely if this is completely determined by the locations of willing individual landowners, this should be stated). The prioritization process for stream habitat surveys ideally should resemble the process ODF developed for the "Road Erosion and Risk Project" (ODF 10), i.e., it should focus first on CSRI-identified "core area watersheds" and move outward from there.

6. Hardwood Conversions (New Issue, ODF 16)

ODF measure 10 allows the conversion of conifer sites dominated by brush and hardwoods to conifer dominated stands. Conversions can occur in RMAs to within 10 feet of the stream's high water level.

The intent of this measure is a good one, namely to provide timely reestablishment of conifer stands in riparian areas that are now dominated by alder and will otherwise succeed to salmonberry dominated stands. However, when conducting the conversions, landowners are allowed to cut standing, healthy conifers, not just alder or other hardwoods, that are present in the RMAs. Therefore, the effect of this measure is to reduce further the amount of standing conifer trees in riparian areas in the short and intermediate term. To assure that salmon conservation objectives (and not just commercial logging objectives) are achieved, the ODF needs to put greater limits on the numbers of standing live conifers that can be removed during conversion harvests. Furthermore, all conversions should be managed as experimental treatments, i.e. this measure should be implemented only on a very limited basis until the effectiveness of such treatments in achieving the objectives is demonstrated. It will also be critically important to retain downed conifer logs in the RMAs, since these are nurse logs for conifer seedlings.

As mentioned under "Positive Aspects," NMFS is pleased to see language in the proposed measure that would require hardwood conversions in CSRI-identified core areas to undergo additional review and a site specific written plan to be submitted prior to harvest.

7. Protection of Core Areas (New Issue)

NMFS is encouraged by a number of changes made by ODF to improve the protection of CSRI-identified "core areas" in several of their proposed measures, including the Road Erosion and Risk Project (ODF 10), the Riparian Hardwood Conversion measure (ODF 16), and the Additional In-Unit Leave Tree measure (ODF 9). These measures together appear to be well thought out and targeted at conservation and protection of CSRI-identified core areas. However, protection of remaining healthy habitats in critical core areas will require limiting the number and extent of other high-risk forestry related activities, including construction of new roads, skid trails, landings, culverts and stream crossing structures, and short-rotation (50 year) silvicultural treatments with large (120 acre or greater) maximum effective clearcut sizes. NMFS recommends at a minimum that ODF consider requiring a written plan of operation for any of these activities in CSRI-identified core areas, and particularly those with mapped or identifiable unstable or potentially unstable areas (see comments on ODF measure 1).

Silviculturally, a better alternative for CSRI-identified core areas would be to manage adjacent RMAs for one or more of the following:

a) longer rotations (e.g. 120 years) to allow development of mature conifer stands and permit more natural rates of tree mortality and LWD recruitment to streams

b) maintain higher basal area targets within RMAs for longer periods of time, while allowing some early thinning of younger competing growth in overstocked stands

c) retain more trees per acre in RMAs for longer periods of time, while allowing some early thinning of younger competing growth in overstocked stands

d) wider RMA "no cut" widths equalling or exceeding one site-potential (200 year old) conifer tree height, measured horizontally (i.e. corrected for slope), starting at the outer edge of the floodplain.

ODF can, at their discretion and with the approval of the State Board of Forestry, begin to use any of the above alternative RMA management scenarios (or others that are not identified above) by invoking the option of "watershed specific practices," provided for in the Rules. If coho are eventually listed, NMFS expects that this provision of the Rules certainly will apply. However, it is our belief that, in some watersheds (e.g., watersheds in the Umpqua River Basin containing listed Umpqua River sea-run cutthroat trout; watersheds containing a large number of Section

303(d) listed waterbodies; watersheds with a high percentage of CSRI-identified core areas, etc.), it is not too early to begin using that provision of the Rules.

8. Cumulative Effects ("Cumulative Effects")

There is no well-defined process to address potential cumulative effects of forestry activities in the Rules in any of ODF's proposed measures included in their CSRI submission. The ODF's position is that since each Best Management Practice (BMP) will minimize adverse "immediate" effects associated with a specific activity, the overall risk from adverse cumulative effects is likely acceptable.

"Immediate effects" do not include effects that occur later in time (after triggering events such as floods, and fires), and do not include indirect and/or off-site effects of the actions, e.g., blanketing of downstream redds with sediment from activities further upstream in a watershed. The contributions to overall cumulative effects of past and reasonably foreseeable future actions are also not addressed.

The Rules (ORS Section 527.770-15-2), however, do require that "a study of harvest rates and cumulative effects related to forest practices on forest land in Oregon" shall be delivered in a report to the Sixty-eighth Legislative Assembly. NMFS has not yet been able to determine the status of this report. In addition, the Rules (ORS Section 527.710-8) include a provision allowing the Board of Forestry (BOF) to, "based upon the analysis required in section 15(2) [above]...and as the results become available, and [if] the Board determines that additional rules are necessary...the board shall adopt forest practice rules that reduce to the degree practicable the adverse impacts of cumulative effects on air and water quality, soil productivity, fish and wildlife resources and watersheds."

Until that time, the Rules simply require monitoring of selected BMPs, which is intended to point ODF toward changing those BMPs that need improvement. This approach is not adequate to assess cumulative effects on aquatic resources such as salmon. Cumulative effects must include the effects of multiple activities in time and space, and should be evaluated on a watershed-by-watershed basis. Appropriate watershed-specific practices could then be identified and applied to adequately minimize cumulative effects.

Oregon currently does not have a well-established process to assess cumulative effects. Maximum 120-acre clearcut sizes, short (50 year) rotations, and minimal protection of riparian areas and wetlands, all of which apply under the revised rules, may contribute significantly to watershed-scale cumulative effects. Provisions in the Rules to develop a cumulative effects assessment process rely considerably on the discretion of the State Board of Forestry, and the actual development of such a process is apparently pending conclusion of several studies. Only one report has been provided to NMFS, and it consists of an extensive literature review, and is not the study specifically required in the Rules. Based on a review of that report, it appears that there is a process under consideration; however, currently it has not been formalized or subjected to peer review.

See Appendix 1, Issue 4., Cumulative Effects, for detailed analysis and additional recommendations. See also detailed comments under ODF measures 1, 2, 3, 4, 5, 6, 7 and 43, below, as all of these measures have the potential to contribute significantly to watershed scale cumulative effects.

9. Watershed Assessment Protocol (New Issue)

A related issue to the above issue #8 (Cumulative Effects) is the need for ODF to develop a rapid and effective watershed assessment protocol, for use in developing watershed specific practices or prescriptions, or to prioritize restoration efforts in a watershed. NMFS has previously emphasized the value of using a process similar to a draft "Matrix of Pathways and Indicators" (NMFS, 1995, unpublished), that is currently being used in Federal ESA section 7 consultations involving anadromous fish. In general, ODF has resisted this suggestion, and yet ODF has proposed no alternative process to address watershed scale cumulative effects. Advantages of NMFS' matrix approach are that it: (1) helps determine the status of baseline environmental conditions in a watershed (2) helps identify potential limiting factors in a watershed, and (3) standardizes the watershed assessment process, considerably enhancing communication and facilitating agreement on specific project assessments and restoration priorities.

It should be noted that full watershed analysis is far more complicated and costly to implement than NMFS' matrix, takes considerably longer to complete, and does not necessarily result in the above major benefits.

See Appendix 1, Issue 4., Cumulative Effects, for detailed analysis and additional recommendations.

10. Potential Hydrologic Changes ("Potential Hydrologic Changes")

The Rules, and ODF's CSRI submission, lack any measure to address the potential for hydrologic changes as a result of multiple forestry activities occurring in a watershed.

Specific mechanisms of potential adverse hydrologic changes not addressed in the Rules, or in any of ODF's proposed measures include (1) increased peak flows during rain-on-snow events, (2) decreases in low flows in areas dominated by fog-drip, (3) interaction of roads and in-unit soil compaction--contributing to advanced hydrographs and increased peak flow magnitude, (4) altered timing of peak flow events due to accelerated melt in snow-dominated systems, (5) road networks, drainage ditches and soil compaction contributing to increased overland flow, surface erosion, and alteration of drainage patterns. These changes in hydrologic conditions can exacerbate other deleterious changes in salmon habitat occurring through other mechanisms. For example, increased peak flows may accelerate channel scour and bank erosion and may destabilize and reduce instream LWD, both of which may reduce habitat complexity and productivity for salmonids. Loss of wetland functions, due to lack of protection of wetland vegetation, reduction of wetland extent via roads, drainage structures, and road/culvert fills, may also contribute significantly to peak flow increases, accelerated timing of peak flows, and other potential hydrologic changes.

See Appendix 1, Issue 3., Potential Hydrologic Changes, for detailed analysis and additional recommendations. See also detailed comments under ODF measure 6 (wetland protection), below.

11. Benchmarks are Inadequate (New Issue)

In almost all of ODF's measures the "proposed benchmarks" that are provided are poorly tied to the objectives or goals of the measures, are not results-oriented, and are poorly defined. In many cases, proposed monitoring benchmarks are missing entirely. The benchmarks will need to be results-oriented; that is, if the objective is to improve habitat conditions for salmon, specific indicators of the desired habitat conditions to be achieved should be identified and described. The benchmarks will also need to be consistent with the overall CSRI monitoring plan. The ODF should consider setting separate monitoring benchmarks for CSRI identified "core areas" based on a policy that will result in maintaining (at a minimum) their functions through time; i.e. the ODF, as well as other State agencies, should seriously consider a core area "antidegradation policy."

12. NMFS July 2 Comments Not Addressed (New Issue)

Additional Problems

The following comments reference each individual proposed measure by number.

(Note: *** indicates that the measure is included as both a tier

1 and a tier 2 measure.)

Important Caveat: NMFS generally does not know how to evaluate the likelihood of success of tier 2 actions. Funding and implementation assurance may not be forthcoming, or are not entirely predictable.

ODF Measure 1: Improve Fish Passage BMPs on Stream Crossing Structures. The measure states that "compliance on type N streams is assured through the department's inspection program." The ODF's inspection program for culverts and stream crossing structures on type "N" streams should be thoroughly described, including the percentage of these structures on type "N" streams that are actually inspected on the ground, and on what frequency. The measure states that ODF is "encouraging alternatives to culverts...in an upcoming road BMP guide (see ODF 10)." which is an improvement in this measure from earlier drafts. There is no strict limit placed on the number of new culverts and stream crossing structures that will be allowed to be constructed on fish-bearing streams, thus the overall risk of loss of access by fish to upstream spawning and rearing areas is unknown but presumably high (see "Cumulative Effects"). The measure applies mainly to new culverts and crossing structures built or installed since 1994, although ODF measure 10 may result in expedited removal or replacement of older culverts and stream crossings on roads built or used since 1973, in some priority areas. NMFS has no way of assessing what the actual net effects of ODF 1 and ODF 10 are likely to be, in terms of total numbers of culverts and stream crossings allowable in an average watershed, based on this submission. Explicit, results-oriented, benchmarks for monitoring the effectiveness of this measure are lacking. The timeline for implementation and effectiveness monitoring is unclear, although it apparently will "be scheduled over the next 5 years."

ODF Measure 2: Increase Design for Larger Flow Events. This measure increases the design standard for newer culverts and stream crossing structures from a 25-year flood event to a 50-year event, but applies only to culverts and structures built since 1994. The measure does improve the design standard for newer culverts (i.e. built or installed since 1994), but does not protect streams from damage during 100-year and lesser frequency events, such as the flooding that occurred in February of 1996. The measure states that "compliance on type N streams is assured through the department's inspection program." The ODF's inspection program for culverts and stream crossing structures on type "N" streams should be thoroughly described, including the percentage of these structures on type "N" streams that are actually inspected on the ground, and on what frequency. There is no limit placed on the number of new culverts and stream crossing structures that will be allowed to be constructed on fish-bearing streams, thus the risks of habitat damage and potential loss of access by fish to upstream spawning and rearing areas via culvert blockage or failure is unknown but presumably high (see "Cumulative Effects"). Explicit, results-oriented, benchmarks for monitoring the effectiveness of this measure are lacking. The timeline for implementation and effectiveness monitoring is not clear, although it apparently will "be scheduled over the next five years."

ODF Measure 3: Upgraded Road Construction and Fill Requirements. Under this measure a road fill and/or drainage structure fill greater than 15 feet deep requires prior approval by ODF. ODF also "has the authority to require written plans for any fill if there is a risk of material entering waters of the state." ODF has enforcement capability for this measure for non-compliance. It is not clear to NMFS how frequently ODF actually implements their authority under this measure. A clear indication of how frequently ODF enforces this measure would be helpful, as would an assessment of whether complete implementation of this measure can be achieved with current levels of staffing and funding. The new standard applies only to newer roads and road fills (post-1994). The only requirement is for a written plan for a 15 foot deep or deeper fill, and it is not clear how frequently (or even if) ODF utilizes its broader authority to require written plans for fills that are less than 15 feet deep. There is no limit to the amount (i.e. number), height, total volume, or locations of road and culvert fills in a watershed (see "Cumulative Effects"). Explicit, results-oriented, benchmarks for monitoring the effectiveness of this measure are lacking. Monitoring the causes of dam-break floods and debris flows should focus on determining whether this measure is effective, as culvert failures and washouts of older road fills often initiate these extreme events.

ODF Measure 4: Upgraded Skid Trail Construction and Fill Requirement. This measure's sets requirements for temporary fills for skid trails and specifically requires a written plan for any fills greater than 8 feet in depth. NMFS can not evaluate the effectiveness of this measure because we do not know how many temporary skid-trail-related fills less than 8 feet deep may occur in a watershed, or even how many fills greater than 8 feet deep can be allowed under written plans within a watershed, at any given time. The measure states that stream crossings are "minimized", and that "stream crossings are designed to pass flows that are likely to occur during the period of use." However, the word "minimize" does not establish the number, even roughly, that may be allowed (see "Cumulative Effects"). The measure does not state how soon after completion of harvest the temporary skid-trail culverts, stream crossing structures and fills must be removed and the site stabilized. Proposed benchmarks are not results-oriented and are not adequately defined.

ODF Measure 5: Increased Riparian Protection. (See "Serious Inadequacies" Section)

ODF Measure 6: Protection of Significant Wetlands, Including Estuaries. The measure only applies to wetlands 8 acres and larger in size. There are many wetlands that are less than 8 acres that still contribute late season flow, organic matter and nutrients, and hydrologic buffering capacity during peak flow events, to the stream network. These wetlands receive little if any protection under the Rules. The measure states that "Within the wetlands and RMA operators are required to retain approximately 50 percent of all original live trees in each diameter class" but does not state for how long (what time period) such requirement applies. Proposed benchmarks are poorly defined, and not based on sound objectives. An objective based approach would protect significant wetland functions in watersheds, regardless of wetland size. Failure to adequately protect wetlands from disturbance may significantly contribute to watershed scale cumulative effects and potential hydrologic changes. (See "Cumulative Effects" and "Potential Hydrologic Changes" comments in "Serious Inadequacies" section.)

ODF Measure 7: Forest Practices Chemical Protection Rules. (See "Serious Inadequacies" Section). Also, proposed benchmarks are not results-oriented or properly defined. Specific "thresholds" for chemical contamination of waters are alluded to but not explicitly stated. ODF should state clearly what these thresholds are.

ODF Measure 8: Elliot State Forest Habitat Conservation Plan (HCP). The conservation measures for riparian areas developed under this HCP were not sufficient to add salmonids under the terms of the incidental take permit. These measures will not provide adequate protection "for cutthroat trout and other fish species of concern," and are only a small step above the riparian protection provided by the standard (revised) Forest Practice Rules. This HCP was negotiated with the U.S. Fish and Wildlife Service to meet the conservation needs of northern spotted owls; it is not a plan to protect salmonids or salmonid habitat. Consequently the objectives, measures, benchmarks, and monitoring program for the HCP do not address the needs of salmon.

ODF Measure 9: 25 Percent In-Unit Leave Tree Placement and Additional Voluntary Retention. (See "Serious Inadequacies" Section comments for "Riparian Protection"). The retention of 1/2 of one leave tree/acre is not enough to significantly improve LWD recruitment to streams. NMFS is encouraged by the OFIC commitment to place the required in-unit trees in "core areas" at the request of the ODF or ODFW, but this commitment will result in only minor improvements. Additional "voluntary" contributions, particularly for CSRI-identified "source and/or recovery areas", which are proposed in this measure, are a very good idea, and are strongly encouraged and supported by NMFS. Unfortunately, NMFS has no way to confidently evaluate the likely success or effectiveness of purely voluntary measures. The benchmarks for this effort have been improved from earlier drafts, and appear reasonable for tracking implementation of this measure. However the benchmarks should also include the level/amount of LWD that actually enters streams and the resulting habitat changes that are desired, e.g. number and frequency of large deep pools formed by and containing LWD, or number of larger "key pieces" of LWD per mile (i.e., for sound effectiveness monitoring).

ODF Measure 10: Road Erosion and Risk Reduction Project. (See "Positive Aspects" section, and also "Serious Inadequacies" comments under "Roads/Culverts") This is a high priority funding item, and offers significant potential benefits as long as NMFS' other concerns are addressed.

ODF Measure 11: North Coast Restoration Habitat Initiative/Council. The objectives of this initiative, and of the Council, as stated in the "Action Description" appear to be sound. However, the past emphasis of this effort has been on site-specific restoration projects. These projects typically lack a watershed perspective and could be much more effective if such a perspective were taken. Effectiveness monitoring has usually been an afterthought, and little is being learned about the actual effectiveness of the projects. Future funding may be limited for this effort. Without adequate focus on the watershed context and potential limiting factors, better prioritization of projects, and more carefully designed monitoring plans that are integral to the effort, NMFS would rate this measure as only a low to moderate priority for funding. Benchmarks are inadequate (procedural only). It is not clear what actual role ODF has in this project. Although it is great that ODF took the initiative to write it up, it properly belongs in the ODFW package of measures, or under "Other Efforts."

ODF Measure 12: Mid-Coast Restoration Initiative. The statement of objectives in the "Action Description" is excellent, and includes broader and more specific objectives. However, this measure suffers from many of the same problems as ODF measure 11 (above). The benchmarks section needs significant work. It is not clear what ODF's actual involvement is in this project. This measure might belong in the ODFW package of measures, or under "Other Measures." Kudos to ODF, however, for writing it up!

ODF Measure 13: South Coast Restoration Initiative. (Same comments generally as those for ODF measures 11 and 12.)

ODF Measure 14: Northwest State Forest Lands Management Plan.

(See "Positive Aspects" Section). The benchmarks for this effort are not spelled out, or appear, at this point, to be mainly procedural (e.g., "number of identified restoration projects"). The benchmarks should be improved as this incipient project takes shape. The emphasis on "adaptive management" approaches is sound. The objectives of this process, as stated in the "Action Description" appear to be sound, although they are subject to change. It is difficult for NMFS to approve this project in advance, or predict its effectiveness, as it is only beginning to be developed.

ODF Measure 15: Increase Number of Streams and Stream Miles Protected. Regarding the amount of riparian protection afforded streams, see "Serious Inadequacies" Section, "Riparian Protection." Otherwise this is a good measure. Completing the ODF's fish use inventories is a very high priority funding item. The measure lacks a "full implementation" schedule. More funding and staff are needed for the inspection program, and to complete the inventories. Effectiveness monitoring benchmarks need significant work. More specific, results-oriented benchmarks are needed. NMFS supports additional protection for streams from chemical applications. ODF needs better riparian protection rules, not just better monitoring programs for riparian protection measures.

ODF Measure 16: Riparian Hardwood Conversions. (See "Serious Inadequacies" comments under "Riparian Protection").

ODF Measure 17: Upper Siuslaw Enhancement. This measure should be in the ODFW package of measures. Photo documentation of before/after conditions during habitat enhancement projects is a great idea and should be used for other measures (involving enhancement) as a rapid and inexpensive way to monitor effectiveness of projects.

ODF Measure 18: Large Woody Debris Recruitment Incentives. Placing large woody debris in streams for stream enhancement is still an experimental approach; effectiveness has not been demonstrated. NMFS typically discourages the widespread use of experimental or untested approaches. Short-term benefits of this program come at the expense of long-term natural LWD recruitment, as basal area credit is applied for trees cut down and placed in streams, and resulting RMA basal area is lowered. (See "Serious Inadequacies" Section, especially comments under "Riparian Protection.") NMFS considers the development of incentives for this measure is a low priority, until the effectiveness of this measure is demonstrated on an experimental basis.

ODF Measure 19: Large Woody Debris Placement Guidelines. If LWD is to be placed in streams (preferably as an experiment, with adequate monitoring) these Guidelines generally provide the way to do it. NMFS supports the Guidelines developed by ODFW and ODF with the following exceptions:

a) basal area credit should not be allowed or negotiated for placing rocks, rock dams, boulders, or other non-wood structures, a practice that appears to be allowed in the Guidance.

b) basal area credit should not be allowed for culvert replacement work, a practice that appears to be allowed under the Guidance. Culvert replacement is important but should have other, separate incentive programs and funding sources.

c) the Guidance should more strongly encourage the use of complete tree boles with root-wads, as opposed to bucked logs lacking root wads. The guidance does this to some degree, but the greater value of tree boles with root wads (and branches) in providing full LWD functions can not be overemphasized.

d) the guidance should be stronger in preventing habitat damage and possible mortality of fish during LWD placement. Stronger language to prevent physical habitat disturbance during placement would help. Individual salmon species timing windows should be displayed in the guidance.

e) ODF should more thoroughly evaluate the potential for loss of long-term LWD supply in RMAs via the practice of granting basal area credit for trees removed from the RMA. Monitoring the amounts of potential LWD source trees in the RMA, before and after this practice is essential.

ODF Measure 20***: Fish Presence Survey. This measure is a very high priority for funding. However, see NMFS concerns re: (inadvertent) fish mortality under "Serious Inadequacies" Section.

ODF Measure 21: 1996 Storm Monitoring Project. In general, this is a good measure, with excellent interagency participation. However, the ODF storm monitoring project did not take a "whole watershed perspective," and focused instead on site-specific BMP monitoring. The ODF needs to get beyond their narrow focus on BMPs. Although many of the protocols described look good, the site-specific sampling design simply can not detect downstream and watershed-scale cumulative effects. Instead of a collection of small rectangular monitoring plots, ODF should have conducted the assessments at the basin or watershed scale. A streamlined, targeted watershed assessment (using the same types of protocols described, i.e. focusing on potential hydrologic changes, unstable areas, road densities and locations, and identifying triggering mechanisms for mass failures, channelized landslides and debris flows, and changes to fish habitats) should be used for this purpose. Specific measures could then be taken to avoid future storm damage, once the watershed-specific mechanisms of catastrophic changes are identified. Monitoring benchmarks for this assessment are scheduled completion dates only (i.e. "implementation"). No effectiveness monitoring benchmarks are described. This is highly unusual. Isn't this supposed to be an effectiveness monitoring program?

ODF Measure 22: Stream Habitat Assessments. High priority for funding and implementation. (See "Positive Aspects" Section). The benchmarks need significant improvement.

ODF Measure 23: South Siletz Monitoring. Appears to be a good program. ODF should probably take credit for this measure, which belongs under the ODFW package of measures or "other" measures.

ODF Measure 24: North Fork Coquille Monitoring Assessment. Appears to be a good program, but specific monitoring benchmarks are not described. ODF should probably not take credit for this measure, which belongs under the ODFW package of measures or "other" measures.

ODF Measure 25: South Fork Coos River Monitoring Assessment. (Same comment as ODF measure 24)

ODF Measure 26: Coos River Mainstem Monitoring Assessment. (Same comment as ODF measure 24)

ODF Measure 27: Coquille, Siletz and Sixes Watershed Monitoring. Generally same comment as the above two measures, but appropriate monitoring benchmarks (indicators) are actually included in the "Action Description."

ODF Measure 28: Forest Practices Monitoring Program. The monitoring program emphasizes four areas: sediment, temperature, flood effects and riparian management areas. The monitoring program should focus on downstream, indirect, and cumulative effects of forest land management practices, not simply site-specific, direct effects, which is the major focus of all ODF monitoring plan elements. Adequate benchmarks are not provided.

ODF Measure 29: Monitoring of Riparian Management Areas. Monitoring will determine if any changes in the riparian protection Rules are necessary. This is not quite as strong a measure as fixing the obvious lack of protection afforded many classes of streams right now. The timeframe indicates that the earliest a Rule change could be implemented is 1999, after a final report is prepared. Then new Rules would have to be developed, undergo scientific, public, and State Board of Forestry review, and promulgated. The entire process ensures that no new Rules are likely for another 5-8 years. This is too long for severely depressed salmonid stocks to wait for assured riparian protection. (See "Serious Inadequacies" Section comments under "Riparian Protection.")

Many of the protocols for this effort are placed in the "Predicted Effects of Action" column, where they do not belong. Some of the protocols are good, while others are not. An example of an especially good protocol is protocol "D" for monitoring LWD in streams. Protocol "E" for determining whether stand basal area targets are met in post-managed stands needs improvement. The protocol should determine whether full riparian stand functions are provided, i.e. 100 percent of the conifer basal area of mature conifer reference stands. Reference stands should be identified, and their basal areas for each basin and soil type or site productivity class, or some other scientifically credible standard. In protocol "B", all measurements should be made for the entire distance of one site-potential tree height from the outer edge of the floodplain. This distance likely ranges between 160 and 220 feet. Monitoring benchmarks are not given in the "benchmarks column" -- this column contains timelines only. Useful benchmarks are actually actual given or suggested in the protocols.

ODF Measure 30: Monitoring Water Temperature Protection BMPs. This is a good measure, and should be implemented and fully funded as a high priority. Temperature standards (i.e. thresholds of acceptable temperatures) should be given under benchmarks. The monitoring plan should also establish what a normal (reference, or historical) range of temperatures is for each watershed, by stream order or some other meaningful stratification system. Water temperature monitoring sites should be more thoroughly described.

ODF Measure 31: Evaluation of Road and Timber Harvest BMPs. This is generally a good measure, and the sampling strategy seems to met the objectives of evaluating the direct effects of BMPs. NMFS supports the use of an assessment tool to evaluate the effects of road drainage on stream peak flows and sediment delivery. More emphasis should be given to evaluation of the extent of road systems (total road mileage) in watersheds, the numbers of high risk road locations in watersheds, and extent and rates of watershed disturbance, including soil and vegetation disturbing activities. Road density and watershed equivalent clearcut acreage (ECA) should be evaluated as coarse-filter indicators of watershed cumulative effects. Alternatively, other science-based measures of watershed scale disturbance should be developed to allow accurate assessment of watershed-scale cumulative effects (See "Cumulative Effects").

ODF Measure 32: Fish Presence/Absence Surveys, and Fish Population Surveys. See "Serious Inadequacies" Section. The combined ODF/ODFW stream survey protocol needs to be used but modified to avoid inadvertent fish mortality through use of non-removal sampling methods. Surveys conducted by individual landowners must be quality controlled using appropriate QA/QC methodologies. Landowners should also be trained in fish detection using non-removal fish sampling methods (snorkeling is more fun anyway). Adequate benchmarks are not defined.

ODF Measure 33: Fish Passage Surveys. This is a good measure and deserves wider application. Weyerhauser is the proponent of this measure, which belongs under "other measures." ODF has no direct role. The benchmarks appear to be closer to objectives, than to actual measurable indicators of success (a better benchmark might be "number of miles of previously blocked habitat made available to salmon").

Note: With respect to the following four measures, NMFS has not seen these watershed analyses, and without doing so, can not accurately determine their merits. However, based on the descriptions, it appears that some of these analyses are not as effective as they could have been in understanding key watershed processes, making recommendations, developing watershed-specific prescriptions, and prioritizing restoration projects.

ODF Measure 34: East Fork Millicoma and Upper Siuslaw Rivers Watershed Analysis. ODF has no direct role in this measure. The measure states that the watershed analysis resulted in prescriptions that "generally identify how best to implement existing BMPs." NMFS wonders if this is really a worthwhile use of watershed analysis, or even if any needed restoration activities or priorities were identified. Timber operators should already know how to implement Rule BMPs. Adequate benchmarks are not identified.

ODF Measure 35: South Fork Siletz Watershed Analysis. ODF has no direct role in this measure. The measure states that the watershed analysis resulted in identification of "monitoring needs that have been implemented." NMFS wonders if any actual measures or prescriptions were developed based on the analysis, or if this is really a worthwhile use of watershed analysis. Watershed analysis is fairly useless unless it develops targeted prescriptions for the watershed, including needed restoration activities and priorities. Adequate benchmarks are not identified.

ODF Measure 36: Ecola Creek Watershed Analysis. This appears to be a worthwhile use of watershed analysis, because it resulted in identification of restoration needs/priorities (gravel bar stabilization and creation of pools) and site-specific improvements to reduce risks of road failure (road fill removal and culvert replacement). Benchmarks for monitoring aquatic health are identified, and appear to be useful in tracking watershed condition and health. If this is an accurate portrayal, Cavenham Forest Industries should be applauded for their efforts. ODF has no direct involvement in this measure, which belongs under "other measures."

ODF Measure 37: Kilchis Watershed Analysis. This appears to be a worthwhile use of watershed analysis. The analysis addresses many of NMFS' major issues, including cumulative effects, changes in hydrology and channel morphology, downstream effects (such as sediment routing) and LWD inputs to streams. The analysis should go one step further and propose recommendations concerning locations which are priorities for restoration activities and site- and watershed-specific practices to minimize the above effects. ODF has no direct involvement in this measure, which belongs under "other measures." Adequate benchmarks are not defined (perhaps because few specific prescriptions or activities were identified which would require monitoring). It is apparent that this is a fairly comprehensive analysis, however.

ODF Measure 38: Associated Oregon Logger Education and Certification Program. This appears to be a good (and necessary) program, although it is difficult for NMFS to determine the precise benefits that will accrue from it, based on the limited information provided.

ODF Measure 39***: Forest Resources Trust. This is an interesting program, and appears to offer some benefits for afforestation and culvert replacement in downstream (lower gradient) areas not covered by other programs. NMFS would need more information concerning the number and types of projects that are funded under this program to determine what level of actual benefits will accrue. Future funding is not secured. Benchmarks seem appropriate but could be improved. It is not clear exactly how ODF is directly involved.

ODF Measure 40: Stewardship Incentive Program. A good incentive program. NMFS supports the idea of improved wetland, soil, and water protection. The types of other fisheries and habitat enhancement projects funded are not described. The program appears to offer benefits to downstream (lower gradient) areas not covered by other programs. Benchmarks need work. Based on limited information the priority for funding would be moderate.

ODF Measure 41: Palmer Creek Acclimation Ponds. No comment.

ODF Measure 42: State Forestry Land Road Assessment and Expedited Remediation. The majority of this work is in the Tillamook Basin. The target for funding dropped by over 50 percent between this draft and the last, however as the Tillamook is a priority basin this is a high priority for funding.

ODF Measure 43: Clearcut Limitations. Maximum clearcut sizes of 120 acres have no scientifically proven positive value to fisheries. In some cases this size clearcut could encompass an entire first order stream drainage. Even greater effective clearcut sizes are created and allowable under the Rules, provided intermediate stands (300 feet wide) are given four years of regeneration time. Over a longer timeframe, many significantly larger clearcuts may be created, perhaps encompassing a second or third order stream drainage, or even an entire fourth- or fifth-order watershed. This can only result in extremely large ECA values and high levels of watershed-scale disturbance and significant cumulative effects to fisheries and other aquatic resources. (See "Serious Inadequacies" Section, under "Cumulative Effects".)

ODF Measure 44: State Forest Land Stream Habitat Assessment and Instream Projects. NMFS does not know enough to assess the effectiveness of this program, primarily because we do not know whether the types of instream habitat enhancement projects identified during steam surveys are really needed, i.e. if they address actual limiting factors in watersheds. Until the effectiveness of the projects is demonstrated, NMFS would suggest that this measure remain a low to moderate priority for funding. Monitoring benchmarks are inadequate and do not convince us that the effectiveness of projects will be demonstrated.

ODF Measure 45: Implement Landowner Stewardship Award Program. A good public relations idea with, unfortunately, unknown benefits to fish.

(Note: ** indicates that the measure is a tier 2 measure.)

Important Caveat: NMFS generally does not know how to evaluate the likelihood of success of tier 2 actions. Funding and implementation assurance may not be forthcoming, or are not predictable.

ODF Measure 46**: Enhancement of ODF Monitoring Effort. NMFS raised six initial major concerns with the Rules. Four of these have been relegated to an enhancement of the ODF's monitoring program that is not even funded. This raises the question of whether ODF can or will respond to our issues. In the event of limited or no funding for this measure, ODF will not be able to address our issues, even in the form of questions to be used for monitoring efforts. These four identified issues (small stream protection, mass wasting, potential hydrologic changes and cumulative effects) need to be addressed as tier 1 **measures**, not tier 2 monitoring issues. (See "Serious Inadequacies" comments under "NMFS July 2 Comments Not Addressed."

ODF Measure 47**: Planned Stewardship Assistance. NMFS is pleased to see a shift in the emphasis of this program from "forest health" (in an earlier draft) to a broader educational message that includes aquatic and watershed health. This change indicates that the program has a higher potential for providing educational and technical assistance that includes providing a basic understanding of fisheries and aquatic issues. The Program should be a moderate priority for funding.

ODF Measure 48**: Public Benefit Trust Account. No comment.

ODF Measure 49**: Fish Habitat Improvement Tax Credit. This tax credit would be used primarily to help remove older culverts that no longer allow passage by anadromous fish. This is a good incentive based on tax credits. Data presented from Washington and Oregon clearly indicate the need for this type of incentive. NMFS wonders why the percentage of culverts in Washington state (60 percent) that do not pass fish appears so much higher than the figures from Oregon (around 15 percent). We hope this is not because of greater detection rates in Washington (perhaps via watershed analyses) but instead is due to better management in Oregon. Adequate benchmarks are included.

ODF Measure 50**: Riparian Tax Incentive. Seems like a good incentive program.

ODF Measure 51**: Liability Limits for Fish Enhancement Projects. No comment.

ODF Measure 52**: Integration of Technical and Financial Assistance. A good idea that needs more work.. Most of the columns are not filled out, indicating that this measure is still under development.

ODF Measure 53**: Geographic Information System (GIS). This measure will provide a GIS hydrological data layer for the coastal coho. It is not clear who would manage and maintain the database and hydrological data layer. There are many possible and some competing proposals. The need for this is clearly high. Would ODF manage this? NRCS? EPA? The Pacific States Marine Fisheries Commission?

ODF Measure 54**: State Forest Land Research. Depending on the types of research conducted NMFS would rate this a low or moderate priority for funding. GIS development and resource (fish stream and habitat survey) inventory items would probably rate the highest.

ODF Measure 55**: Watershed Assessments. This measure is an extremely high priority and should be in tier 1, not tier 2 of ODF's measures. Streamlined, targeted watershed Assessments would help ODF begin to address many of NMFS concerns that have otherwise been relegated to monitoring.

ODF Measure 56**: Elimination of the 25,000 BF Exemption Tax. Sounds like a good way to raise funds for the stewardship program.

Incorporation of NMFS July 2 Comments

In general, it appears that the ODF attempted to address two of NMFS' major issues, namely "Road-Related Problems" and "Inadequate Long-Term Wood Recruitment into Streams" (for "core areas" only). ODF placed an emphasis on NMFS' other major issues only in their BMP effectiveness monitoring plan. NMFS was hoping to see improvements in ODF's actual measures that would help address each of the six major areas of NMFS's original concerns. Without addressing these concerns in improved or newer measures, ODF seems to be assuring that future monitoring results will reveal only further degradation of salmon habitat (or maintenance of habitat in currently degraded conditions), disruption of normal watershed processes, and continued salmon declines.

References:

ODF 1994. The Oregon Forest Practices Act Water Protection Rules, Scientific and Policy Considerations. Prepared by the Forest Practices Policy Unit, Oregon Department of Forestry, December 1994. 39 pp.

NMFS 1995. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. Prepared by the National Marine Fisheries Service Environmental and Technical Service Division, Habitat Conservation Branch, Portland, OR. 29 pp.

Attachments:

Appendix 1
Appendix 2

cc: F/NW03 - D. Avery

bc: F/NW03 - File Copy
- R. Clapp

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(Note to Admin. Staff: file under Oregon, Forestry Department, or Oregon State Forest Rules)

APPENDIX 1.

APPENDIX 1: NMFS' INITIAL CONCERNS WITH REVISED OREGON FOREST PRACTICE RULES

The following six major issues of concern were identified by NMFS during initial discussions with ODF: Mass Wasting (Protection of Unstable Areas), Small Stream Protection, Potential Hydrologic Changes, Cumulative Effects, Inadequate Long-Term Wood Recruitment, and Road Related Problems.

Note: The Issue of Cumulative Effects embraces all other issues, and relates to the need for an assessment tool/protocol, or a set of assessment tools/protocols, to analyze watershed-scale cumulative effects.

Issue 1. Mass Wasting (Protection of Unstable Areas)

The ODF uses a process that is not spelled out in the Rules to identify both general areas and specific sites that may be high risk for future landslides. There are specific rules to minimize erosion and soil-surface disturbance associated with timber harvest, but these are associated only with roads constructed or in use since 1972. There are also rules that govern logging and road construction located directly on high-risk sites. However, there are no provisions to avoid logging or road construction on high-risk sites. This is a serious deficiency in the Rules, because landslides can add significant amounts of fine sediment to streams and can result in increased direct mortality to salmon through burial of redds and eggs. In extreme cases, landslides can also cause other significant effects to salmon such as blocking upstream spawning migration or severely damaging instream rearing habitat.

The Rules do not address the fact that soil shear strength decreases as tree roots decay following logging. This is a major factor controlling slope stability and it is largely affected by logging. Several syntheses of research (Swanston 1969, Burroughs and Thomas 1977, Krogstad 1995) found that lateral root reinforcement provides the only available reinforcement in deeper soils where most roots cannot reach to bedrock. These deep soils areas tend to be located in areas of convergent topography which feed directly into the stream channel network. Deep forest soils are widespread in coastal Oregon.

It may take several decades to recover soil shear strength after logging, depending on the local vegetation species and many other variables (Ziemer 1981). In general soil instability due to logging peaks at about nine years. Selective harvest is the only logging method that is likely to avoid substantially diminishing root reinforcement in conifer forests (Kragstad 1995). Both clear-cut and shelterwood harvest are likely to prevent sites from recovering 80% of the root reinforcement for at least 15 to

20 years, even assuming prompt reforestation (Burroughs and Thomas 1977, Ziemer and Swanston 1977).

The Rules for minimizing slope disturbance lack specificity, and the likely outcomes of Best Management Practices (BMPs) are difficult to evaluate. ODF has not yet demonstrated that the Rules can effectively prevent or minimize soil and debris delivery into streams.

The ODF claims that the overall result of implementing all the Rules "should be a relatively small increase over background in landslide impacts for a short time after tree removal and a somewhat larger increase over background in landslide impacts associated with road management," (ODF issues paper, December 1995).

Given the high rate of documented landslides after logging in the Klamath, Coast, and Cascade mountains of Oregon (100%-1800% increase in landslides occurring in clear cuts as compared to those in unmanaged forests (Benda et al. 1991)), any increase in landslide impacts on streams and fish habitats is a serious concern. Furthermore, the rules do not address how the expected increases will affect channel morphologies and fish habitat.

<u>Headwall Harvest Study</u>

The ODF claims that harvested areas with leave-tree areas had higher rates of slope failures than clearcuts without leave-tree areas. However, the ODF used the results from a study that only examined harvested areas on very steep concave slopes at the tops of small drainages, called headwalls, to defend this point. This study also appeared to support the contention that root strength is an insignificant cause of slope failure. In fact, Skaugest et al. (1993), found that slope failures were about 50% for harvested headwalls with leave trees (n=26), 38% for clear-cut headwalls (n=69), and 25% for forested headwalls (n=180). Thus, any harvest of forested headwalls substantially increases the number of slope failures on these inherently unstable sites.

Nonetheless, the ODF's implied conclusion is that slope failures in certain high-risk sites will not be diminished by leaving trees during clear cutting, therefore, it is just as logical, and considerably more expedient to clear cut an entire headwall as long as ground disturbance can be avoided. This begs the question of whether there are some high-risk sites that should even be logged at all. Since the only way that lateral root reinforcement can be maintained is by retaining most trees, then the only reasonable prescription is no clear cutting or, at most, only selective tree removal from certain high-risk sites. Simply minimizing ground disturbance will not sufficiently protect slope stability in many of the highly, or even moderately unstable sites.

As discussed above, even when there is virtually no soil disturbance due to timber harvest on a high risk site, merely removing the trees would still be expected to increase the number of landslides as the root strength decreases over a period of two to 10 years (Swanston and Swanson 1976, Ziemer 1981). The ODF apparently dismisses the documented relationships among root reinforcement, soil strength, and landslide initiation, while offering no specific data to justify timber harvest on unstable slopes. They also fail to consider slope gradient, soil depth, and degree of saturation when determining slope stability.

Rules Lack Specificity

The Rules for harvesting high risk sites lack specificity, e.g., "minimize risk of mass soil movement while maintaining forest productivity," and cannot be evaluated in a measurable way. Lacking a measurable standard, how can these BMPs be thoroughly monitored?

Landslide Delivery to Streams

Lacking a specific method to determine landslide run-out, how can the "risk of material entering waters of the state" be adequately evaluated? There are published methods for determining landslide run-out paths (e.g., Benda and Cundy 1990, for debris flows--summarized in Collins et al. 1994). This is an example of a BMP that needs to be developed.

Landslide Assessment Methodology

ODF is to be commended for developing a process for identifying high-risk areas, and specific sites within those areas, that is based on commonly accepted determinants of slope stability. In order to ensure that the process includes all of the necessary components and is universally followed across the state, it would be helpful to formalize that methodology with peer review.

Although high-risk areas are fairly well described in the ODF issues paper of December, 1995, in terms of general landform characteristics, specific high risk sites cannot be accurately located without field inspection. For example, such a process would need to identify small-scale features indicative of slope movements, locate incised channels, and measure specific slope landforms and gradients. The inaccuracy entailed in simply using maps to determine slope gradients is discussed by Dragovich et al. (1993) when they state "topographic maps average out the important steep slope segments that control the location of slide initiation."

It is not clear when geo-technical specialists would be expected to assist foresters in locating high-risk sites. Areas of high risk can be screened by foresters using an objective process, but specific identification of those sites may require trained staff. The current approach reflects the one used in Washington before a method was developed, under Watershed Analysis, to systematically evaluate landslide hazards from forestry activities over an entire sub-basin.

Moderately Unstable Sites Become Highly Unstable.

By protecting only high-risk sites (no moderate risk sites are discussed), it is not clear that all the sites with a high potential for delivering sediment to streams are actually identified. Many factors influenced by forest operations, especially when combined with decreased soil strength during storms, effectively change moderately stable sites into highly unstable sites (Chatwin et al. 1994): "Landslides are rarely triggered during the actual logging operation. Rather, they occur on sites that are naturally moderately stable, but become unstable following tree root deterioration."

Storm flows channeled and delivered by road ditches, cut-slopes, and cross-drains are also common triggers that can saturate soils and change moderately unstable ones into highly unstable sites (Chatwin et al. 1994). (See the section on Road-Related Problems for a discussion of the concerns with older roads.) Proper road design, construction, and maintenance can greatly reduce, but not eliminate, the adverse effects of roads on slope stability. Furthermore it is not clear that all the active and inactive roads regulated by ODF (estimated at about 3 mi/mi^2) are adequately maintained.

Channel Changes from Landslides

Any increase in landslide rates may potentially have a very serious impact on many fish habitats that are currently in a degraded condition due to decades of unrestrained road building and timber harvest.

It would be very helpful if ODF were to develop a process for estimating the sediment delivery of specific landslides into streams. There are tested models that can be used to determine the downstream extent of a particular landslide, and thus make some estimate of the potential damage to fish habitats (Benda and Cundy 1990). Use of such a model would enable ODF to develop a way to link the upslope processes to conditions within fish streams.

We understand that a landslide inventory will be updated for at least six areas because preliminary assessments suggest that the low-frequency floods of February 1996 have resulted in widespread road washouts, channel changes, and further degradation of anadromous fish habitat. An analysis of the causes and effects of each landslide would improve future management of slopes and channels and may dictate a review of the Rules.

The ODF's ongoing watershed analysis of mass erosion in the Kilchis River is particularly important in light of the anticipated Habitat Conservation Plan (HCP) being developed with ODF, focusing on the state forest lands. However, it would also be helpful to monitor a representative basin within each geologic type of the anticipated HCP. Such a study could accomplish the important task of establishing a quantitative relationship among forestry activities, slope stability determinants, sediment delivery, and channel conditions with respect to anadromous fish habitats. The results would be of great utility to the extent that it would then be possible to extrapolate and apply the data to areas with similar geology and thereby estimate channel responses to management.

A single, channelized landslide can disturb many kilometers of stream. Degrees of disturbance range from displacement of LWD and resorting of spawning gravels to removal of many mature riparian trees and down-cutting streambeds by several meters, or even cutting an entirely new channel. Channels with extensive sediment deposits often lack surface flow during summer. Unstable road segments, whether old or new, constitute a high risk if they have the potential to initiate channelized landslides.

Geologists differentiate several types of landslides and related peak flows, e.g., deep-seated failures, shallow-rapid landslides that may either stop at a channel or become debris flows when channelized, and dam-break floods. The last mentioned are the most destructive and occur when either floating organic debris or landslide debris plugs a channel during a storm.

Dam-break floods occur when a temporary pond forms above a channel constriction and then releases with terrific force. Resulting peak flows can be many times greater than the maximum predicted for even a 100-year flood. Dam-break floods extend the adverse impacts of slope failures further downstream (and upslope) into low gradient anadromous fish habitats than do debris flows (Johnson 1991). Streams that have had dam-break floods are considered by researchers to be susceptible to recurring dam-break floods if sufficient organic material, e.g., from logging slash or landslide debris, has been re-deposited (Coho and Burges 1994).

Channel morphologies in many anadromous fish habitats are now influenced by large amounts of sediments that have been delivered by a variety of sources over the past century (Swanson et al. 1988, Sullivan et al. 1987). Researchers have found that a slug of sediment, once introduced into a low to moderate gradient stream, will move downstream at rates of about 200 to 1000 m/yr

(Madej 1982, Kelsy 1980). The long residence times of coarse sediments within many fish streams suggests that the relative risks of watershed-level channel morphology alteration will continue to be high to moderate for many more decades.

Summary of Recommendations for Mass-Wasting

- Develop a peer-reviewed process for identifying high-risk areas and unstable slopes based on field review by trained staff.
- Institute a rule to avoid clearcut logging on certain unstable slopes, recognizing the role of tree roots in maintaining slope stability.
- Monitor BMP application for both compliance with the Rules and effectiveness in reducing the potential for slope failures.
- Establish a link between landslide risk and the possible effects on anadromous fish habitats. Specifically, there needs to be an initial, watershed scale assessment to identify locations with high risk of landslides or slope failure. Then, the likely impacts of a landslide (e.g. probable increases in sediment inputs) need to determined for specific segments of anadromous fish streams.
- Ensure that roads are designed, constructed, and maintained in such a manner that the risk of triggering slope failures is minimized.
- Assure that the ongoing monitoring of the February 1996 flood damage adequately assesses cause and effects of recent landslides and has specific recommendations for future management. In particular, look for ways to reduce the occurrence of channelized landslides.
- Monitor slope failures within a representative basin, or within each major geologic type, within the area of the anticipated HCP on Oregon State forest lands.

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Issue 2. Small Stream Protection

There are a number of Rules intended to protect small, non-fish-bearing streams. Because these streams are so prevalent on the landscape, especially in the wet mountains of western Oregon, fully adequate protection for streambanks, shade, and large wood
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recruitment would greatly reduce the area dedicated to industrial forestry.

Upper Limits of Fish Distribution

These small, mostly non-fish-bearing streams typically constitute more than 80% of the total stream network in a fifth-order size basin (Chamberlin et al. 1991).

There is a well-documented method of surveying small streams to establish fish distribution in Oregon. It is entitled *Surveying Forest Streams* (ODF and ODFW, 1995). According to the ODFW, doing this task on every stream statewide is an enormous task that has no identified schedule for completion. Any HCP that addresses anadromous fish habitat would need to include a schedule for doing this work throughout the plan area.

The reason for doing this is that some recent surveys of the upstream limits of anadromous fish have found coho rearing in small- to medium- sized streams at gradients near 20% (Jill Silver, Hoh Indian Tribe, personal communication, 1995). Previously, areas such as this were thought to be outside the coho's range.

Increase of Stream Network Due to Roads

A study by Montgomery (1994) in western Oregon investigated the integration of road drainage structures with the existing stream network. Increases in stream networks occurred in areas where wide spacing of cross drains (shallow ditches used to channel and redirect surface water from roads) allowed too much water to collect, causing these ditches to erode headward up to the road drainage structures. In addition to increasing the effective stream channel network, this resulted in substantial erosion and delivery of fine sediment to streams. Further, a network of roads with densities common for forest operations (e.g., three to five mi/mi^2) can be expected to increase the overall stream network of small watersheds by 12% to 35%, according to several Federal watershed analyses (Upper and Middle Lewis River Watershed Analyses, Gifford Pinchot National Forest, 1995).

Cross-stream Log Yarding Allowed on Smallest Non-fish Streams

The Rules do not make clear what extent of disturbance is to be tolerated during cable yarding across small Type N streams. The rules simply discuss "minimizing" disturbances in the stream channel and retaining stream-side vegetation. Also, merely stating that introduction of sediments to any stream will be minimized provides no assurance that a given action will actually avoid damaging aquatic habitats.

Provision for Properly Functioning Riparian Areas

In order to fully meet the Rules' intent to maintain the morphology and function of these small streams, it is necessary to fully protect streambanks and ensure long-term recruitment of large woody debris (LWD) from riparian areas. Since there is no requirement to retain riparian trees along small Type N streams, the Rules are not likely to provide either streambank protection (reinforcement of banks by tree root systems) or sufficient long-term recruitment of LWD to store fine sediment and prevent it from routing directly to downstream fish-bearing streams. Mature standing conifers in riparian areas also appear to moderate the effects of channelized landslides. For Type N streams, the list of riparian functions requiring protection therefore must include sediment storage, streambank stability, and reducing the effects of channelized landslides.

Megahan (1982) surveyed 1,715 in-channel obstructions in small, steep streams on the Idaho batholith, and found that wood obstructions trapped 49% of the stored sediment. Additionally, "15 times more sediment was stored behind obstructions than was delivered to the mouth of the drainage as average sediment yield."

Streambank stability is maintained by a live root mass that is half as wide as the tree-crown diameter (Burroughs and Thomas 1977). Another way to state this is that the minimum riparian buffer width necessary to maintain root strength is about 25-30% of the height of a site-potential tree (FEMAT 1993). Based on a range of site potential tree heights in western Oregon, these riparian widths range from 20-60 feet.

Regarding channelized landslides, Coho and Burgess (1994) discuss the buttressing effect of mature riparian conifers, i.e., large trees standing within the flow path can cause rapid deposition and substantially limit landslide run-out. The width of streamside buffers necessary to retain this function was not described.

The lack of a long-term ability to recruit large wood in small non-fish-bearing streams places the important sediment storage function of these headwater channels at risk. The timing, rate, and amounts of sediment delivered to fish habitats are greatly influenced by LWD in small streams providing upstream sediment storage capacity (Swanson and Fredriksen 1988, Bisson et al. 1992). If sufficient instream structures providing sediment storage are not maintained in headwater streams over the long-term, then increased amounts of fine and coarse sediments are expected to be transported to anadromous fish streams, further damaging habitats that have already been severely degraded.

<u>Recommendations for Small Stream Protection</u>

- Schedule statewide surveys of fish distribution to confirm distinction between fish-bearing and non-fish-bearing streams.

- Develop measures that will decouple roads from streams, reduce road densities, and maintain natural hydrologic regimes. Minimize adverse influences of road operations on the stream network and on anadromous fish habitats through regularly scheduled site visits and road maintenance.

- Require full-suspension cross-stream yarding at small, non-fish-bearing streams in order to maintain bank stability.

- Provide for future recruitment of LWD by retaining riparian trees. This will hep maintain properly functioning riparian areas in the headwaters of anadromous fish streams.

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Issue 3. Potential Hydrologic Changes

The Rules do not directly address potential changes in hydrology that may result from forestry operations. According to an issues paper prepared by ODF technical staff in December of 1995, the Rules intended to minimize the extent of surface soil disturbance will indirectly maintain surface water hydrology. Also, the Rules that require prompt reforestation and minimize disturbance from slash burns are expected to prevent hydrologic changes. Watercourses and wetlands are protected by a 20-foot no-touch zone and hydrologic connectivity is maintained between streams and wetlands.

ODF states that there is no need for explicit Rules that assess and address potential changes in hydrology as well as associated changes in fish habitat. Evidence to the contrary is dismissed as being either conflicting or insignificant.

The ODF acknowledges that older logging roads are potential sources of continued detrimental channel change. But unless a particular road is (or becomes) active under current forest operations, there is no rule requiring that erosion or drainage problems be corrected. This is a serious deficiency in the Oregon Forest Practice Rules, since landslides and adverse channel changes often are triggered by roads that were constructed some time ago under less restrictive standards. (See the discussion of this issue under the section on Road-Related Problems.)

Because there are no Rules that limit the extent or severity of harvest operations within a given watershed, changes in hydrology resulting from forestry activities are not adequately addressed.
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The rules simply attempt to minimize soil surface disturbances; this cannot begin to address the many ways that hydrologic changes are triggered by roads and logging.

In order to build links between forest operations and their effects on anadromous fish habitat, it is necessary to focus on aspects of channel morphology and dynamics that are sensitive indicators of perturbation and to consider the affected channel's specific type and position in the channel network. The ODF needs to establish a process for assessing channel morphologies and a way to link these studies with riparian and upslope management. A recently published approach for classifying stream reaches based on response to changes in the hydrologic and sediment regimes may be a useful model upon which to build these processes (Montgomery and Buffington 1993).

Following is a brief summary of flow changes in various hydrologic regimes.

(1) Extensive clear-cutting results in short term increases in low flows.

(2) In areas dominated by fog-drip, clear-cutting can cause decreases in low flows.

(3) There may be a decrease in low flows as clear-cut areas become revegetated.

(4) In areas susceptible to rain-on-snow storms, there is an increase in peak flows for many years (decades) after clear-cutting.

(5) In areas dominated by either snow or rain alone, peak flow increases after clear-cutting are usually slight.

(6) Roads and compacted soils act synergistically with clear-cuts to increase peak flows.

(7) Water yields increase after about 20% of the forest cover in a basin has been removed.

(8) In snow-dominated systems, vegetation removal advances the timing of spring melt and peak flows.

(9) All of the above changes are usually most evident in relatively small basins.

<u>Rain-dominated Hydrology</u>

Peak flows can be increased via (1) soil compaction which reduces both infiltration rates and infiltration capacity leading to increased magnitude of overland flow (Gardner and Chong 1990, Purser and Cundy 1992); (2) reduced evapo-transpiration leading to higher soil moisture and water tables (Ruprecht and Schofield 1989); (3) increased drainage density, especially through road building (Montgomery 1994); and (4) interception of subsurface flow at road cuts with subsequent conversion to surface flow (Megahan 1972).

The changes in peak flow in rain-dominated watersheds tend to be smaller and more variable than in systems with both snow and rain (MacDonald and Ritland 1989). However, it must be kept in mind that flows in rain-dominated systems are much more variable than those in snowmelt-dominated areas (Fountain and Tangborn 1985).

<u>Rain-on-snow Hydrology</u>

Logging operations have the same effects on soil, vegetation, and topography listed above, but they also create additional effects that can increase peak flows. First, timber harvest decreases snow interception and increases the accumulation of snowpack (Berris and Harr 1987). Second, openings increase melt rates, especially via increases in convective energy transfer to the snow-packs (Berris and Harr 1987). Several studies indicate that increases in peak flow resulting from clear cuts and roads are both large and long-lasting (Harr 1986; Coffin and Harr 1992). Notably, there is a great deal of private timberland in Oregon and Washington in the transient snow zone (roughly 1600-3000 feet elevation), where changes in hydrology from roads and harvest are most pronounced. The most damaging flood events in the Northwest typically occur during rain-on-snow events; these events are also associated with the greatest mass failure magnitudes, possibly due to high levels of soil saturation and attendant high pore pressures (e.g., Iverson and Major 1986).

<u>Snow-melt Hydrology</u>

Logging-related activities increase peak flows via the effects discussed above but also by greatly increasing snow accumulation (Megahan 1984, Reid 1993) and melt rates (Megahan 1984) via increased solar and convective transfers (Megahan 1984, Harr 1986, and MacDonald and Ritland 1989). Increased snowpack depth increases melt duration and, therefore, amplifies the magnitude of saturated areas by elevating water tables (Megahan 1984). This leads to increased peak flow (Rhodes 1985). When larger areas are saturated for longer periods of time, overland flows increase, as well as annual water yields (Rhodes 1985, Ruprecht and Schofield 1989), and peak flows (Moore et al. 1986). Watershed-level studies have consistently found that logging increases peak flows in a statistically detectable manner in snow-dominated regions (Harr 1986, MacDonald and Ritland 1989, King and Tennyson 1984, King 1989, Cheng 1989, Coffin and Harr 1990, Chamberlin et al. 1991) though there are some exceptions (generally due to poor study design). Researchers have noted that increased snowmelt due to logging and roads can increase sediment transport significantly (King 1989, MacDonald and Ritland 1989). Heede (1991) found that ephemeral channels expanded significantly in the high-elevation forested region of Arizona after logging and inferred that increased peak discharge was the cause.

Annual Water Yield and Low Flows

Deforestation increases annual water yields by decreasing evapo-transpiration; this is done by shunting water from storage into surface runoff (Ruprecht and Schofield 1989), and by decreased infiltration capacity from soil compaction. Generally, increases in low flows also occur when evapo-transpiration is reduced, especially during the summer where this factor makes up a large portion of the hydrologic budget. Many studies indicate that low flows do not appear to increase until a substantial proportion of a watershed is deforested (Bosch and Hewlett 1982).

However, the increase in low flows may be short-lived when forests are regenerated because the initial stages of second growth have higher evapo-transpiration than late-seral forests. Some investigations indicate that as clearcuts become revegetated, low flows decrease to a point below pre-logging levels (Chamberlin et al. 1991). Losses in base flow caused by road cuts likely last as long as the road exists. Systems dominated by fog drip may undergo some flow reduction until the stands are reestablished (Harr 1982).

Recommendations for Potential Hydrologic Changes

- The ODF needs to recognize the preponderance of studies demonstrating that logging and roadbuilding cause changes in hydrologic function. Further, the ODF needs to develop watershed-scale methodologies for assessing the likely effects of proposed forest operations.

- The ODF should delineate the areas in Oregon where the various hydrologic regimes prevail (e.g., fog-drip, rain dominated, rain-on-snow zone, and snow melt).

- Establish a process for assessing channel morphologies, and linking them to riparian and upslope management considerations.

- Manage road design, construction, and maintenance to minimize both the interception of sub-surface water and the altered routing of surface waters. Road altered flows commonly trigger slope failures as well as cause adverse changes in anadromous fish habitat.

Issue 4. Cumulative Effects

There is no well-defined process to address cumulative effects of forestry activities in the State of Oregon's Revised Forest Practice Rules. The ODF's position is that since each Best Management Practice (BMP) will minimize adverse "immediate" effects associated with a specific activity, the overall risk from adverse cumulative effects of all the BMPs associated with a particular project is likely acceptable.

"Immediate effects" do not include effects that occur later in time (after triggering events such as floods, and fires), and also do not include indirect and/or off-site effects of the actions, e.g., blanketing of downstream redds with sediment from activities further upstream in a watershed. The contributions to overall cumulative effects of past and reasonably foreseeable future actions are also not addressed.

The Rules (ORS Section 527.770-15-2), however, do require that "a study of harvest rates and cumulative effects related to forest practices on forest land in Oregon" shall be delivered in a report to the Sixty-eighth Legislative Assembly. In addition, the Rules (ORS Section 527.710-8) include a provision allowing the Board of Forestry (Board) to, "based upon the analysis required in section 15(2) [above]...and as the results become available, and [if] the Board determines that additional rules are necessary...the board shall adopt forest practice rules that reduce to the degree practicable the adverse impacts of cumulative effects on air and water quality, soil productivity, fish and wildlife resources and watersheds."

Until that time, the Rules simply require monitoring of selected BMPs, which is intended to point ODF toward changing those BMPs that need improvement. This approach is not adequate to assess cumulative effects on aquatic resources such as salmon. Cumulative effects must include the effects of multiple activities in time and space, and should be evaluated on a watershed-by-watershed basis. Appropriate watershed-specific practices could then be identified and applied to adequately minimize cumulative effects.

It is important to note that the provisions in the Rules to develop a cumulative effects assessment process rely considerably on the discretion of the State Board of Forestry. The Rules do not address the appropriate scale at which such an assessment should be conducted (the watershed). Furthermore, the actual development of such a process is apparently pending conclusion of several studies. Only one study report has been provided to NMFS, and it consists of an extensive literature review (Beschta et al. 1995); it appears that this is not the study specifically required in the Rules. Based on a review of that report, however, it appears that there is a process under consideration; however, currently it has not been formalized or subjected to peer review.

Although there are provisions under the rules for watershed specific practices for watersheds that either are water quality limited or have listed (Threatened or Endangered) species, there are no examples of watersheds that have had special rules established. There is apparently no other process to either analyze or explicitly address watershed scale cumulative effects in the rules.

The rules require monitoring of selected BMPs, which is intended to point ODF toward changing those BMPs that need improvement. This approach is simply inadequate to assess cumulative effects to aquatic resources such as salmon. Cumulative effects must include the effects of multiple activities in time and space, and should be evaluated on a watershed-by-watershed basis. Appropriate watershed-specific practices could then be identified and applied to adequately minimize cumulative effects.

Commissioned Report and Suggested Approach

ODF recently commissioned a lengthy report that is summarized in a 39 page executive summary (Beschta et al. 1995). In that summary, a reasonable process to analyze cumulative effects of forest practices on aquatic biota or water quality is apparently dismissed as much too complicated. The dynamic nature of forest ecosystems, along both spatial and temporal scales, combined with the stochastic nature of natural processes, uncertain knowledge of current conditions relative to historic (or reference) conditions, and complex interactions of effects and competing resource needs are all considered overwhelming, and would result in such a complicated and demanding process that ODF simply could not commit to such a vast undertaking.

Therefore, a simple approach is described in the executive summary that "is not a quantitative methodology but rather... provides a framework for identifying state, regional, and basinwide cumulative effects and a landscape level inventory." The intention is to clearly state goals, objectives, and assessment criteria, conduct the assessment, and finally specify "forest practices that are designed to fit the goals and objectives for the area." The hypothetical example presents very general prescriptions that give only vague direction to watershed managers: e.g., "Minimize roading and sedimentation that destroy fish habitat . . . Removal of dead or down material will not be permitted from existing intermittent channels . . . Due to slope gradients and erosion hazard, uphill cable yarding would be advisable."

The above approach has not been compared to other models of cumulative effects assessment and management, and appears to be generally inconsistent with both the CEQ definition of cumulative effects, and regional salmon conservation needs.

Best Management Practices

The method or approach to managing cumulative effects on Oregon's lands is to use BMPs which (by definition) are applied on a site-specific basis. Cumulative effects of forest practices may include changes in sediment, temperature, and hydrologic regimes, resulting in direct, indirect or eventual loss of key habitat components (e.g., clean gravel interstices, large woody debris (LWD), low temperature holding pools, and protected off-channel rearing areas) necessary for spawning and rearing of anadromous salmonids. These changes often are not expressed "immediately" at the project site, but instead may occur subsequent to triggering events (fire, floods, storms) or are manifested off-site (downstream) of where the effects are initiated.

Pitfalls of Depending on BMPs

The prevention of potentially adverse impacts at the project site is indeed necessary, but not sufficient, to avoid adverse cumulative effects under the CEQ definition of cumulative effects (CEQ 1971). As Reid (1993) states: "The BMP approach is based on the premise that if on-site effects of a project are held to an acceptable level, then the project is acceptable, regardless of activities going on around it. Interactions between projects are beyond the scope of BMP analysis, and operational controls are applied only to individual projects."

In summary, however useful site specific BMPs are in minimizing effects of individual actions, they still do not address the cumulative effects of multiple actions occurring in the watershed which, though individually "minimized" through application of the site-specific BMPs, may still be significant, in their totality, and have undesirable consequences for beneficial uses such as salmon populations and salmon habitat.

It should be stated that the entire approach of the Revised Oregon Forest Practices Rules to cumulative effects relies upon an untested assumption that minimizing site specific actions by application of site specific BMPs somehow avoids adverse cumulative effects to important beneficial uses of streams and watersheds, such as salmon. In many cases this is an unreasonable assumption. Because it is sometimes unreasonable, and has yet to be tested, there are significant risks in its application across large portions of the landscape.

The argument that applying a BMP while conducting a specific forest practice minimizes site specific effects and thus also minimizes cumulative effects is logically flawed. Every BMP is an action and has an effect (ODF maintains that some actions have "neutral," "subtractive," or "decrementally synergistic" effects; however, to our knowledge these are unproven in the scientific literature) thus, generally, the more the BMPs are applied, the greater the cumulative effect. Only by minimizing the number of actions, i.e., the number of individual applications of BMPs, would cumulative effects be minimized. This is precisely why a cumulative effects assessment is needed -- to establish the watershed-specific limits and excesses of BMP application.

Even if present practices (i.e., revised forest practice rules) meet some "standard" of minimizing *future* contributions to cumulative effects, the legacy of past practices, and of the implementation of older rules, or "no rules" (i.e., actions prior to the adoption of forest practice rules) still exists. The best example is so called "legacy roads," many of which are still present on the landscape, unmaintained, prone to sudden failure, and currently supplying chronic, non-point source sediment pollution to forested streams and downstream habitats.

<u>Examples of Cumulative Effects</u>

Although individual management activities by themselves may not cause significant harm to salmonid habitats, incrementally and collectively they may degrade habitat and cause long-term declines in fish abundance (Bisson et al. 1992). Changes in sediment dynamics, streamflow, and water temperature are not just local problems restricted to a particular reach of a stream, but problems that can have adverse cumulative effects throughout the entire downstream basin (Sedell and Swanson 1984; Grant 1988). For example, increased erosion in headwaters, combined with reduced sediment storage capacity in small streams, from loss of stable instream LWD, can overwhelm larger streams with sediment (Bisson et al. 1992). Likewise, increased water temperature in headwater streams may not harm salmonids there but can make water too warm downstream (Bjornn and Reiser 1991).

Cumulative effects on sediment and hydrology worsen as the area affected by timber harvest increases (Rhodes and McCullough 1994). The amount of sediment delivered to streams and fine sediment in pools increases with increasing timber harvest and road construction (Chen 1992; Lisle and Hilton 1992). Water yield increases in proportion to the areas devegetated (Haar 1983), and peak flows increase in proportion to roads and soil compaction (Haar et al. 1979). Pool depth and frequency, LWD, and channel complexity decrease with increased logging (Bisson et al. 1992; Reeves et al. 1993; Murphy 1995).

Habitat disturbances that are anthropogenic in origin combine with natural disturbance events to create cumulative effects. Habitat disturbances can be cumulative in the sense that different factors acting sequentially or concurrently can limit population size or growth during different phases of the freshwater and estuarine rearing cycles of anadromous salmonids (Elliott 1985). Habitat disturbances may also be cumulative in the sense that more than one important physical habitat factor or component (i.e., those components necessary for salmon survival and reproduction) may be altered at the same time, or over a period of time (Bisson et al. 1992; Reeves et al. 1993; Ralph et al. 1994; Murphy 1995).

Cumulative Loss of Habitat Complexity

The most pervasive cumulative effect of past forest practices on habitats for anadromous salmonids has been an overall reduction in habitat complexity (Bisson et al. 1992), from loss of multiple habitat components. Habitat complexity has declined principally because of reduced size and frequency of pools due to filling with sediment and loss of LWD (Reeves et al. 1993; Ralph et al. 1994). However, there has also been a significant loss of off-channel rearing habitats (e.g., side channels, riverine ponds, backwater sloughs) important for juvenile salmon production, particularly coho salmon (Peterson 1982). Cumulative habitat simplification has caused a widespread reduction in salmonid diversity throughout the state of Oregon, and throughout the region.

Cumulative effects of individual, dispersed timber-harvest and road-related activities commonly increase system-wide risks of habitat damage, recovery times, and susceptibility to large runoff events and related disturbances (Peterson et al. 1992). Depending on the physiographic characteristics of a watershed, such events can adversely affect not only water quality but also riparian and aquatic habitats (Wissmar et al. 1994). Common hillslope, floodplain, riparian, and stream responses include mass wasting, streambank erosion, and changes in channel geomorphology (Wissmar et al. 1994). When adverse effects occur, they are usually in violation of Section 319 of the Federal Clean Water Act (Wissmar et al. 1994).

Cumulative effects of land and water uses over the past century have greatly altered the health of river basins in eastern Washington and Oregon (Wissmar et al. 1994). Environmental effects resulting from timber harvest, fire management, livestock grazing, mining, and irrigation and other factors over long periods of time have become significant collectively. Cumulative effects induced by upland forest practices include changes in hydrology, temporary and long-term sediment production, transport and storage, and off-site or downstream effects (Swanson 1986).

Of specific concern is the pathway for creating significant cumulative effects through reduction of future supplies of LWD to fish bearing streams. Large woody debris is a critical component of salmonid habitat, and is the major pool forming and sediment storing element in many streams in Oregon. Beschta et al. (1995) cite a study done by the ODF (OFIC 1993) that indicated that logging practices at that time reduced streamside conifers by 61 percent in western Oregon. The remaining conifers represented, on average, only 50 percent of the potential large conifer debris that would have come from the undisturbed stand. In eastern Oregon, streamside conifers were reduced by 33 percent after harvest using current logging practices. Beschta et al. (1995) conclude that "[t]hough instream loadings of large woody debris present prior to harvest were not affected by current harvesting practices, future supplies of large wood are significantly reduced by current practices in western Oregon. This reduction in large wood recruitment has the potential to continue a state of diminished fish habitat quality and quantity."

Need for Watershed Scale Assessment

The amount of cumulative effects to anadromous fish populations and their supporting habitats cannot be successfully evaluated, controlled, or mitigated at a site-specific level. The effects of individual actions, such as dispersed, separate harvest units and road building, should be considered in the context of all other previous and ongoing activities in the watershed (Murphy 1995). This is not to say that specific BMPs applied at a particular time and place do not have an important role, merely that they need to be tailored to a watershed or basin scale context to be effective. As the National Academy of Sciences, the so called "Supreme Court of Science," states: "There is an increasing need to understand cumulative effects not only on a site-specific basis, but also across entire watersheds. Only through a broad geographic perspective can the unique qualities of each watershed and their spatial and temporal effects of aquatic habitats be effectively understood." (NRC 1995)

As an example, non-point source pollution by sediment, i.e., erosion from unstable hillslopes and roads and subsequent transport and deposition of sediment in streams, should be analyzed at a watershed or basin scale. Sediment produced on hillslopes, or from channel migration and other streambank erosional processes, moves though a stream network in a downstream direction. Evaluation at a watershed scale is particularly necessary because effects may be generated in one place within a watershed and felt in another. A key component of effective cumulative effects management is identification of sediment sources that are beyond what the watershed's stream network can manage, i.e., that are in excess of expected sediment input rates from natural events, or that exceed the channel's storage capacity. This excess sediment can have tremendous on-site and off-site (downstream) impacts, including damage to tributary and mainstem spawning habitats and rearing areas, blockage of culverts and road failures, filling in of reservoirs, siltation of bays and estuaries, increased dredging and spoil disposal costs, and reduced water quality for downstream agricultural, recreational, and municipal uses.

Need for Watershed-Specific Prescriptions

To continue to use sediment as an example, the cumulative effects assessment for a particular watershed should result in prescription or application of watershed specific practices that reduce or minimize sediment production in the watershed. This will avoid both on-site and off-site cumulative effects. An assortment of watershed specific practices are possible. However, they generally should include the following types of actions:

-- identifying high risk roads and road segments within a watershed (those prone to immediate failure causing massive inputs of sediment) and putting these roads to bed

-- identifying other roads and road segments in a watershed that supply chronic sediment inputs to streams, in excess of natural erosion rates, and implementing appropriate road maintenance, on a regular basis, to control those inputs

-- identifying and replacing improperly installed culverts and road crossings, whose failure would deliver large amounts of fine sediment to the stream

-- identifying and relocating valley bottom roads that deliver fine sediment at greater rates due to proximity of these roads to the stream channel

-- protecting unstable and potentially unstable hillslopes and prohibiting timber harvest or road building on the most unstable of these sites (i.e., those with slopes greater than 65% (33 degrees) and one or more of the following: soils less than 10 feet in depth and lying on uniform slopes, soils with low cohesiveness, and/or landforms with known potential for mass wasting; see section of these comments on "mass wasting").

Several Methodologies Available

Although the ODF argues that cumulative effects of forestry activities are too complex to manage effectively, there are a quite a number of methodologies already in use that are field tested, peer reviewed, and reasonably effective in capturing the major pathways and mechanisms of cumulative effects to aquatic systems.

Reid (1993, page 27-36) provides a comparison of eight different cumulative effects methodologies that could be used, at least six of which may be useful in evaluating cumulative sediment effects from logging and roading. Reid (1993) also recommends using a coarse screening procedure (similar to the method used by the California Department of Forestry) to identify the mechanisms for cumulative effects within watersheds, followed by more specific analysis of identified mechanisms, as necessary, using appropriate modular assessment tools. Many of the needed tools already exist as "modules" of both the Federal and Washington State Watershed Analysis guides. The National Marine Fisheries Service has recently developed a "matrix" of factors and indicators (NMFS 1995) that would provide a rapid screening procedure to identify pathways for effects where more in depth analysis may be needed.

In addition to methods to evaluate the effects of logging and roading on sediment input dynamics, similar cumulative effects analysis procedures and watershed specific practices are needed to address (1) small stream protection (i.e., for temperature control/shading, LWD recruitment, energy inputs to streams, in-channel sediment storage, and other pathways for on-site and off-site cumulative effects), and (2) potential changes in hydrology (see other sections of this analysis).

Any method to assess cumulative effects should address downstream effects, for example, the violation of water quality standards downstream of where the effects may originate -- i.e., upstream forested watersheds. A cumulative effects methodology should incorporate this concern and address downstream changes not only to *water quality parameters*, such as temperature, pH, and turbidity, but also to *habitat related parameters* important to anadromous fish, such as pools, percentage of fine sediment in gravels (or cobble embeddedness), volume of fine sediment in pools (Lisle and Hilton 1992), and amount or presence of off-channel rearing areas in mainstem habitats of salmon producing rivers (Peterson 1982). Ideally, a process should also consider the contribution of upstream forest practices to social and economic costs, such as flood relocations and reparations, dredging costs to remedy sedimentation and infilling of bays and estuaries, and water treatment costs to ensure healthy recreational and consumptive uses of water.

The revised Oregon Forest Practice Rules contain no mechanism whereby cumulative effects on a watershed scale can be determined and the appropriate "watershed specific practices," which are a provision of the revised rules, can be applied. The State of Idaho has developed a cumulative effects methodology, and the State of Washington's Timber, Fish, and Wildlife program addresses cumulative effects through completion of watershed analysis. We are not suggesting that ODF adopt either of these state-specific approaches, however we do recommend that ODF develop an effective method or process for cumulative effects assessment.

Recommendations

The ODF needs to develop a reasonable process for cumulative effects assessment at the watershed scale that is both consistent with the CEQ definition of cumulative effects and regional salmon conservation objectives. The assessment process should be applied to evaluate cumulative effects both on State Forest lands and on private lands regulated by the State's Forest Practice Rules. NMFS suggests that ODF consider using or adapting the NMFS "matrix" of factors and indicators (NMFS 1995) as a rapid and readily adaptable screening process for determining watershed scale (direct, indirect and) cumulative effects. The advantage of this method over other available screening procedures is that it allows the watershed's current environmental baseline to be established, and allows adjustment of target values of key parameters (ecological pathways and indicators affecting salmon and their essential habitats) for unique watersheds or ecoregions. Appropriate watershed specific practices and prescriptions can then be developed to adequately minimize watershed scale cumulative effects. Note: additional, watershed specific Rules may need to be developed if necessary practices and prescriptions are different than those allowed under the Rules. Alternatively, NMFS suggests that ODF utilize currently available, peer reviewed and field tested watershed analysis and cumulative effects methodologies.

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Issue 5. Inadequate Long-Term Wood Recruitment into Streams

When ODF developed the latest Forest Practice Rules (which were enacted in September 1994), several scientists from academia and industry assisted in the process of modeling woody debris inputs and tree growth in the riparian areas. The rationale for the approach the ODF used is well documented in *The Oregon Forest Practices Act Water Protection Rules, Scientific and Policy Considerations, December 1994* (Lorenson et al. 1994).

The overall strategy is good, but the widths of the riparian management areas (RMAs) are too narrow and the tree densities to be retained after logging are too low to provide optimal riparian function. Only fish-bearing streams are managed to provide large wood.
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Fish-bearing streams are classed according to channel size, with 100-foot RMAs on both sides of the streams larger than about 50 feet wide, 70-foot RMAs on medium-sized streams, and 50-foot RMAs on small streams. The inner 20 feet are "no-touch" zones where all trees are retained. Trees within the outer (managed) area of each RMA are managed under the Rules to supply both commercial harvest and large-sized conifers that could someday contribute to instream structure. The ODF assumes that in managed forests, the inner 20 feet are dominated by hardwoods.

Mature stands provide most riparian functions and inputs in greater quality and quantity than do young stands. In streams bordered by young stands, shortages of large, persistent woody debris are particularly noticeable. Conifer stands with large trees are the best suppliers of this large, persistent woody debris (Murphy 1995).

Historically, the forest landscape contained riparian stands of all ages and species compositions, ranging from early successional to old-growth. Wildfire, windstorms, floods, insects, disease, and beaver activity were the agents of periodic disturbance. Nevertheless, across the forest landscape and at any given time, a large portion of all riparian areas supported stands of mature forests. In contrast, the riparian areas on private lands in Oregon now primarily support younger age classes -- very little is left of the mature age classes (Lorenson et al. 1994).

Tree densities within the managed portions of the RMAs are to be managed as fixed basal area targets (i.e. targets are measured as total cross-sectional ft^2/acre). Part of the logic behind the establishment of basal area targets was that these targets would encourage retention and growth of larger-sized trees, adjacent to the inner "no-touch" zones. In reality, basal area targets can be met by lots of small diameter trees, a few very large diameter trees, or some combination of both. There is therefore no assurance that a significant number of larger diameter trees will be available to provide LWD recruitment from the outer managed RMA zone.

Tree species used to meet basal area targets are intended to include conifers primarily. Larger coniferous species do not deteriorate as fast, and provide significantly greater benefits in terms of both habitat function and channel stability and integrity, than smaller hardwood species. However, hardwood species may be included in the basal area targets under certain conditions, and in fact it is found that the inner 40 feet of RMAs is presently dominated by hardwoods in many streams in Oregon (This is documented by ODF themselves). Also the rotation of these stands is assumed to be 50 years. Typically 60 to 90 year rotations are required for large conifer growth and recruitment. There is therefore no assurance that management of the outer portion of RMAs can presently supply, or will likely supply in the future, adequate quantities of larger coniferous tree pieces, particularly mature or defective conifer boles that could readily fall into streams. Large conifer boles with intact root wads are the most stable and long-lasting form of instream LWD. These stable "key pieces" of woody debris remain in place for a significantly longer period of time, often even during extreme flood events, and are more effective at trapping other smaller woody debris pieces, and sediment.

Specifically, the goal of the Rules is to meet a desired future condition of mature streamside trees, dominated by conifers between 80 and 200 years old. We agree with this goal, but we do not agree that the prescribed basal area targets, and the assumed rotation length (50 years), will achieve that goal within the desired time period, which is stated in the Rules to be the next 25 years. This is largely because the of the currently low baseline conditions of riparian forest stands, which contain mostly hardwoods and young conifers. This current species composition will not allow 100 percent of the desired future complement of mature (80-200 year old) conifer trees. The rotation length (50 years) is also not long enough to allow riparian conifers to grow to maturity (80-200 years) throughout multiple rotations.

Amounts of Future Large Wood

The Rules generally do not provide for sufficient LWD recruitment in any but the largest fish-bearing streams. According to an analysis of the figures for riparian basal area targets for each stream size, the Rules would eventually provide a maximum of no more than 92% of the potential sources of LWD along large fish streams, 83% along medium-sized fish streams, and only 56% along small fish streams. In addition, virtually none of the necessary large wood would be retained along non-fish-bearing streams. After 25 years of growth (mid-rotation age for many clearcuts), only 73% to 83% of the potential sources of large wood would remain next to large, fish-bearing streams in five forest types in western Oregon. The medium-sized fish streams would have 66% to 75% of the potential sources of large wood, and small fish-bearing streams would only have 24% to 30%.

We have discussed this analysis with ODF policy staff, who informally concur that the Rules may meet only 30-80% of the necessary large wood, but the political climate at the time the Rules were developed in 1994 dictated this level of riparian tree retention.

Optional Placing LWD for Stream Restoration

It is not known how much LWD exists in anadromous fish habitats in Western Oregon, but it is generally considered to be deficient throughout Oregon on non-Federal lands. Restoring the proper levels of LWD in streams largely depends on natural inputs from windthrow or other mortality. Natural inputs of LWD are minimal for young riparian stands until hardwoods are 40 to 65 years old and conifers are more than 80 years old (Grette 1985, and Heimann 1988).

Under the Rules, landowners have the option of placing some large wood in fish-bearing streams (under the ODF and ODFW guidelines for proper instream placement) and counting that as part of the riparian tree retention. We like this approach to encouraging instream restoration where suitable. However, even under this option, a specified minimum basal area must be maintained.

In practice, some small landowners often retain all trees within an entire RMA because (1) tree sizes do not allow harvest until a basal area minimum is attained, and (2) even when tree sizes and numbers approach maturity and would thereby enable some harvest, it is far simpler to measure the full width of the RMA and not measure basal areas. Of course, industrial timber growers are expected to manage for maximum economic gain.

According to a study of the sizes of LWD observed to be functioning in various stream sizes, large fish-bearing streams (about 50 feet wide) need trees at least 20 inches in diameter (Bilby and Ward 1989). Tree lengths greater than the channel width tend to be stable during transport flows. Medium-sized fish-bearing streams (about 25 feet wide) need trees at least 14 inches in diameter. Small streams (about 10 feet wide) need trees at least 10 inches in diameter.

Conifers are generally preferred to hardwoods for instream function because they have greater strength and last much longer in water. Fallen alders tend to decompose entirely after five to ten years in a stream, while many conifer species remain solid for decades. A few species of cedar and redwood will last for centuries.

<u>Recommendations for Inadequate Long-Term Wood Recruitment</u>

- Manage for RMAs as wide as a site-potential tree height (about 120 to 170 feet) to ensure the potential supply of future large wood.

- Basal area targets need to be increased to provide 100% of the necessary wood recruitment at mid-rotation.

- A wider no-touch zone would better maintain streambank protection and shade. This should be 25-30% of the site-potential tree height.

- Trees growing within the inner no-touch zone should not be counted toward the basal area target.
- An approach to placing large wood in streams that takes into account the specific channel type would be much more likely to actually improve fish habitats.
- Riparian trees need to be provided along all non-fish-bearing streams. This will ensure a long-term supply of structural elements that will store sediments and maintain riparian functions in these headwater channels.

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Issue 6. Road-Related Problems

Over the last century, forest practices have left many older roads and railroad grades, i.e., "legacy roads." Only roads that have been used since 1971 (when the Forest Practice Act was first developed) are addressed by the Rules. According to the ODF, there is no process for any state agency to inspect or address the potential slope failures associated with these legacy roads. Monitoring done in 1988 found these older roads were major sources of landslides.

There is very little information available on the density or sediment delivery potential of the legacy roads. One rough estimate of their density is one mi/mi^2, compared to an estimated three mi/mi^2 for newer roads that are regulated by the ODF (K. Mills, ODF geologist, pers. comm. 1996).

The ODF admits that older roads, which were constructed under different standards, "have in some cases created a legacy of potential instability. Many landslides over the last few years occurred as the result of construction practices of many decades ago. Over-steepened fill and decomposing debris in fills can fail years after construction. Maintenance activities can reduce, but not eliminate, the potential for landslides on these older roads," (ODF issues paper, December 1995).

The latter statement assumes that maintenance may be conducted on some older roads, but these roads are entirely ignored unless needed for ongoing forest operations. Water that saturates unstable fills or is diverted by older roads onto sensitive slopes during storms is a leading cause of slope failures (Chatwin et al. 1994).

Regarding the risks of channel morphology alteration, the ODF stated in their December 1995 issues paper that "in western Oregon the risk may be moderate for watersheds with many old and abandoned roads, and/or old railroad grades." There is actually a high risk that older roads or railroad grades will trigger
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slope failures that will deliver large amounts of sediments into anadromous fish streams.

In light of the recent floods of February, 1996, the ODF will be conducting a landslide inventory of six areas in western Oregon. It is expected that affected channels will also be examined in order to determine what changes resulted from sediment delivery and debris flows. The range of effects has been well documented for anadromous fish streams, but the ODF must still establish a clear link between landslides and the changes in fish habitats on lands regulated by the Forest Practice Act and Rules.

Recommendations for Road-Related Problems

- There needs to be a process for identifying and correcting potential erosion from older roads and railroad grades.
- Newer roads that the ODF regulates need to be adequately maintained to avoid potential erosion problems and sediment delivery to anadromous fish habitats.
- It is necessary to monitor for compliance all activities conducted under the Rules and report on their effectiveness.
- Establish a clear link between landslides and changes in fish habitats.

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