the current three years. There were three common themes from these commentators: (1) roads should be maintained throughout their useful life; (2) roads should be designed in such a way as to be nearly maintenance free, except at watercourse crossings (outslope roads where feasible); and (3) roads that are not necessary for long-term use should be appropriately abandoned by heavily outsloping the roads, and pulling all watercourse crossings back to the natural gradient. These same interviewees felt that the lack of road maintenance of old "legacy" roads, as well as more contemporary roads that are not being adequately maintained, were critical sources of sediment.

There was also discussion regarding the requirement for long-term maintenance under the FPRs. Currently, the rules require the Licensed Timber Operator (LTO) to maintain the road until a completion report is filed and accepted by the CDF (CCR1050(c)). The one-year minimum maintenance requirement then becomes effective, and may be extended for up to three years by the Director under the provisions of CCR 1050. This is very rarely done, according to several agency interviewees. There is also a provision in the rules that may extend the maintenance period even longer for consideration of road maintenance during restocking activities. At CCR 923.4, the rules state "In addition, those roads which are used in connection with stocking activities shall be maintained throughout their use even if this is beyond the prescribed maintenance period." This appears to provide some authorization for CDF to inspect and require maintenance beyond the three year prescribed maintenance period, as restocking may occur for several years following completion of harvest activities.

Although road rocking is typically associated with winter road usage, some landowners have elected to apply rock to maintain a stable road surface and prevent the loss of fines. The rocking of these roads also provides better winter management access for planting and road inspections. Several interviewees expressed concerns about the quality of rock used for winter hauling. Some of the rock used was soft, or had too high of content of fines. The result was the pumping and mobilization of fines during hauling.

Recommendations

1. Roads are either permanent, temporary, or abandoned. Permanent roads can be all weather or seasonal. Temporary roads that may last several years should be considered seasonal (i.e., permanent during its lifetime). There are other variations of road types. Tractor roads can be any one of the three types, though most often temporary, then abandoned. Roads that receive light winter use (e.g., for maintenance, fire breaks) should still be considered permanent (seasonal). The FPR needs to have all requirements for the three road types centralized.

2. An abandoned road must not require cross drains or watercourse crossing structures to direct flow from the road surface or pass watercourse runoff. Both are permanent structures requiring long-term maintenance.

3. No road construction shall occur during the winter period. Road construction must be completed by Oct 15 (refer to Section 923.2(s)) or the start of the winter period, whichever is earlier (see Winter Operations).

4. Develop quantitative rocking standards for anticipated hauling on permanent, all weather roads.

5. The upper slope limit for road construction should be no greater than 65% (refer to CCR 923.1 (d)) unless reviewed, and both the location and road design and construction methodology are approved by a CEG.

6. CCR 923.1 (d) only vaguely addresses the effects of steep roads (i.e., what to do with "concentrated" surface runoff and soil mobilization), rather than prevention. This rule uses a 100 ft distance from a WLPZ to trigger additional measures

that do not account for the long, steep continuous slopes over which road and landing failures often travel. Nor does this rule consider Class III watercourses. These "additional measures" are not specified, even generally. For example, endhaul requirements should be triggered by any road construction on slopes greater than 50% above any watercourse or hillslope depression. Another consideration should be no sidecasting on slopes over 55%.

7. In reference to Section CCR 923.1 (e): new or reconstructed roads with a 20% grade for 500 ft or more should be completely rocked; surfaces of these steep roads are easily compromised by winter and wet weather use.

8. Winter road maintenance must not allow blading. The road must be allowed to dry prior to use. If blading is considered needed, the road is improperly designed and/or maintained. If a permanent road is to be used for winter hauling, it should be upgraded to all-weather status before October 15 or the start of the winter period, whichever is earliest. Limited use of season roads may occur early in the winter period under specific conditions (see "Winter Operations" section).

9. Outsloped roads should be the standard for temporary, seasonal (permanent), and abandoned roads. For permanent all weather roads, crowned, insloped, or outsloped roads may be appropriate and acceptable if long-term maintenance is planned. In Santa Cruz County, vegetation as a surface armor on permanent roads has been considered for light (non-hauling) winter use; this should be explored further.

10. The FPR inadequately addresses (CCR 923) the future trend of re-opening abandoned roads and/or rebuilding/improving existing roads, as opposed to decreasing emphasis on new road construction. Road density, not explicitly considered in the FPR, must be factored into this future trend. While a watershed analysis is the convenient, though not yet defined solution, road density can be considered in CR 923. At a minimum, a general threshold density can flag local areas where additional roads (new and reopened) would have a high likelihood of producing unacceptable sediment runoff and flow concentration.

11. Because the road maintenance period is inadequate (refer to other recommendations), road abandonment, as part of the THP, is critical. The commitment, including personnel and financial, for long-term maintenance must be demonstrated; otherwise abandonment should be required. If the road is to receive occasional use, including the winter period, the road must be considered permanent (seasonal).

12. Where roads within WLPZs receive extended and frequent winter log hauling, additional stabilization measures must be considered. Due to the high cost of road rocking, especially where rock sources are limited, alternatives, such as asphalting or the, treatment with heavy road surface treatments, may be a feasible alternative. This is consistent with the requirement of CCR 923.4(h) that states "During timber operations, road running surfaces in the logging area shall be treated as necessary to prevent excessive loss of road surface materials by, but not limited to, rocking, watering, chemically treating, asphalting or oiling. "

13. Watercourse crossings and fill slopes should be stabilized using rocking or other suitable means to prevent the erosion of fill slopes and the direct deposition of sediment into watercourses. This is already required under CCR 923.4(i). It appears that a more strict application of this rule requirement at watercourse crossings would greatly reduce direct sedimentation associated with road watercourse crossings.

14. All permanent forest roads (essentially all rural and wildland roads) must be maintained throughout their useful life. When roads are no longer needed in the near-term, these roads must be temporarily or permanently abandoned by outsloping, and the removal of watercourse crossings back to the natural stream gradient. The rules at CCR 923.8 specifically address road abandonment pro-

cedures. Any rule modifications should consider the partial abandonment of roads that would allow, where feasible, the passage of four-wheel drive vehicles to provide fire suppression access as well as on-going management or ranching.

15. All roads, permanent, temporary, abandoned and legacy roads that are generating, or have the potential to generate, sediment and are in the WLPZ (except at watercourse crossings) should be removed and stabilized. Some state incentive or cost-sharing program should be developed to implement this recommendation.

5. Watercourse Crossing Structures

Background

Watercourse crossings are addressed in the rules at four primary locations. They are specifically addressed in CCR 923.3 Watercourse Crossings, requiring that all "Watercourse crossing drainage structures on logging roads shall be planned, constructed, and maintained or removed', according to the following standards. Exceptions may be provided through application of Fish and Game Code Sections 1601 and 1603 and shall be included in the THP." To locate and describe watercourse crossing structures in the THP document, CCR 923.3(a) states: "The location of all new and permanent watercourse crossing drainage structures and temporary crossings located within the WLPZ shall be shown on the THP map. If the structure is a culvert intended for permanent use, the minimum diameter of the culvert shall be specified in the plan. Extra culverts beyond those shown in the THP map may be installed as necessary," The number of crossings shall be kept to a minimum (CCR 923.3(b)) and structures on watercourses that support fish shall allow unrestricted passage of fish (CCR 923.3(c)). Watercourse crossing structure removal (CCR 923.3(d)) requires that: " (1) fills shall be excavated to form a channel which is as close as feasible to the natural watercourse grade and orientation and is wider than the natural channel, (2) the excavated material and any resulting cut bank shall be sloped back from the channel and stabilized to prevent slumping and to minimize soil erosion. Where needed, this material shall be stabilized by seeding, mulching, rock armoring, or other suitable treatment." The final provision in CCR 923.3 states (e): "Permanent watercourse crossing and associated fills and approaches shall be constructed or maintained to prevent diversion of stream overflow down the road and to minimize fill erosion should the drainage structure become obstructed. The RPF may propose an exception where explained in the THP and shown on the THP map and justified how the protection provided by the proposed practice is at least equal to the protection provided by the standard rule."

Maintenance of watercourse crossing structures (CCR 923.4 Road Maintenance) is intended to "prevent degradation of the quality and beneficial uses of water during timber operations and throughout the prescribed maintenance period. In addition those roads which are used in connection with stocking activities shall be maintained throughout their use even if this is'beyond the prescribed maintenance period." The prescribed maintenance period for watercourse crossing structures can extend up to three years (CCR 923.8 (a)). No maintenance period is required for abandoned watercourse crossing structures. Provision (d) requires unrestricted passage of water (when feasible) and use of trash racks. Culverts not capable of passing the 50-yr floods are to be removed (though exceptions are allowed) and structures that are "properly functioning" prior to timber operations need not be removed (923.4(f)). Provisions (m) and (n) recognize a wide range of practices to keep structures functioning: "Inlet and outlet structures, additional drainage structures (including ditch drains), and other features to provide adequate capacity and to minimize erosion of road and landing fill and sidecast to minimize soil erosion and to minimize slope instability shall be repaired, replaced, or installed wherever such maintenance is needed to protect the quality and

beneficial uses of water." Finally, (p) allows exceptions to CCR 923.4 (b through o) if at least equal to the standard practice.

Another rules section addresses watercourse crossing abandonment (CCR 923.8) which provides "permanent maintenance-free drainage, . . . and protects the quality and beneficial uses of water." Provision (e) states: "Removal of watercourse crossings, other drainage structures, and associated fills in accordance with 14 CCR 923.3(d). Where it is not feasible to remove drainage structures and associated fills, the fill shall be excavated to provide an overflow channel which will minimize erosion of fill and prevent diversion of overflow along the road should the drainage structure become plugged." Exceptions are provided for (e), if at least equal to the standard rule.

Watercourse crossings on tractor roads are addressed in CCR 914.8. Provisions (a) through (c) and (e) are similar to requirements on other road types (listed above). Provision (d) states: "Watercourse crossing facilities not constructed to permanent crossing standards on tractor roads shall be removed before the beginning of the winter period. If a watercourse crossing is to be removed, it shall be removed in accordance with 14 CR 923.3(d)."

Discussion

Watercourse crossings were also considered a key issue affecting salmonids. Several interviewees, including agency representatives, watershed specialists, and fisheries biologists, expressed a need for fish passage at all watercourse crossings for all life stages of fish (as required in the FPR). This includes passage of juvenile salmonids both upstream and downstream. Many landowner representatives supported this requirement. However, several expressed concern that the wholesale removal and replacement of culverts on existing road systems would be very costly. Several interviewees felt that wherever forest roads crossed Class I watercourses, bridges or natural bottom pipe arches should be used in lieu of culverts, One hydrologist interviewed noted that, "The risk of culvert failure depends on its size compared to flood events. Data from FEMAT suggest that the probability of failure for a culvert sized for a 100-yr storm is less than 20% after 20 years, which is the average useful life for a CMP. This compares to probabilities of more than 50% and less than 40% for culverts sized for 25- and 50-yr storms, respectively. Increasing culvert diameters also allows for passage of sediment and debris, and adds a factor of safety. Fish passage, however, may be negatively affected by increased culvert diameters." Several interviewees stated that peak discharge estimates and culvert sizing methods should be clearly documented in all timber harvest plans wherever a watercourse crossing structure is to be installed.

The FPRs require all watercourse crossing structures to pass a 50-year flood, but the rules provide no guidelines for how to size watercourse crossings for the 50-yr flood. CDF (1983) has provided RPFs with a technical memorandum that includes the Rational Method and other culvert sizing methods. Documentation of culvert sizes (CCR 923.3(a)) is of limited usefulness (but important for compliance) without knowledge of the upslope drainage area and/or channel width. For small drainages, sizing for debris (woody and mineral) blockage, rather than hydraulic capacity (e.g., the 100-yr flood), may be the appropriate sizing methodology. However, a sizing methodology similar to sizing floods has not been developed, and can be very site-specific. Flanagan et al. (1998, p. 21) noted that: "In low-order channels of northwest California, 99 percent of transported wood greater than 300 mm long was less than the channel width (Flanagan, in review). These findings suggest that culverts sized equal to the channel width will pass a significant portion of potentially pluggable wood. However, the remaining one percent of the pieces remain a hazard. Thus, wood plugging hazard can be reduced but not eliminated. The woody debris capacity of a crossing can be assessed by taking the ratio of the culvert diameter to the channel width (w*). Crossings with low values of

w* are more prone to debris plugging. Using the Northwest California coast region as an example, sizing culverts equal to the channel width will, in most cases, satisfy a 100-yr design peak flow (Figure 7). However, on wider channels (e.g., > 2 m), the cost of employing this strategy can be prohibitive." For culverts in small drainages, sizing by channel width is preferred over hydraulic/hydrologic sizing (requires drainage area to estimate the 50-yr flood). Hydraulic/hydrologic methods (such as the Rational Method) targeting the FPR for sizing a 50-yr flood are available (e.g., Weaver and Hagans 1994). Other methods are available, (e.g., regional equations), but are often more appropriate for larger drainage areas (Waananen and Crippen 1977). Depending on the method employed, either channel width and/or drainage area should be provided in the THP

Flood stage for a 50-yr flood (the headwall depth, HW) can exceed the culvert diameter (D) and not endanger a culvert's structural integrity. However, floods that exceed HW/D = 1.0 for the design storm (presently the 50-yr flood) risk plugging by woody debris (Flanagan et al. 1998): debris rafts at the inlet during the rising flood stage, then collapses into the culvert inlet during the falling flood stage. The design flood should have a HW/D no greater than 1. A 100-year design flood will reduce plugging failure, minimize channel constriction, and allow a significant portion of the culvert invert to be set below the channelbed elevation thereby creating a natural bottomed bed surface.

Many watercourse crossing structure requirements, including maintenance, depend on road type. For permanent (all weather and seasonal), tractor, temporary, and abandoned roads (as defined in CCR 895.1), there should be only two types of watercourse crossing structures: permanent and temporary. We feel strongly that a permanent watercourse crossing structure cannot be left "in a condition which provides for long-term functioning of erosion controls with little to no continuing maintenance" as defined for the term "abandonment" (CCR 895.1). As noted by Flanagan et al. (1998): "In the absence of maintenance and replacement, all these structures [road stream crossings] will eventually fail as they plug or the culvert invert deteriorates," A fully functional, permanent watercourse crossing structure (including cross drains) must be accompanied by a long-term commitment to its continual maintenance.

A seasonal watercourse crossing structure is only fully functional unless accompanied by a commitment to remove it prior to the winter period. Thus, the maximum lifetime of a seasonal structure spans a single season: from the end of one winter period to the start of the next winter period. Therefore, on temporary roads, used only during timber operations, the provision "that drainage structures be adequate to carry the anticipated flow of water during the period of use" (CCR 895.1, p.15) is insufficient. No one can anticipate next winter's flows, If timber operations extend into the next winter period, watercourse crossing structures must be designed, constructed, and maintained as permanent. Seasonal roads should have permanent watercourse crossings.

Section CCR 923.3(c) of the FPRs states: "Drainage structures on watercourses that support fish shall allow unrestricted passage of fish. "Although this rule is stated clearly, many culverts remain partial or complete barriers to both adult and juvenile salmonids migrating upstream. Recent attention on upstream migration of juvenile salmonids has revised our interpretation of what constitutes a fish barrier. Many culverts that allow unrestricted adult passage are typically partial, if not complete, barriers to juvenile salmonids because of the considerably poorer jumping and swimming abilities of young salmonids.

Culverts that completely block adult migration are often easy to identify. Many of these occur along older county roads. These artery roads frequently follow the larger tributaries (crossing them several times) or cross many tributaries flowing into the mainstem (as the road parallels the valley bottom).

In contrast, culverts that partially block migration are particularly common along established artery logging roads and county roads. These crossings can be extremely difficult to assess: a user-friendly assessment protocol is available (http://www.stream.fs.fed.us/fishxing) for adult salmonids, but not yet fully functional for juvenile salmonids. With the present-day emphasis of new road construction along or near the ridge tops, most new culvert installations cross upper Class II or Class III streams. Therefore, the issue of fish passage will be focused more on existing watercourse crossings than new installations.

There are no watercourse crossing design standards (including retrofitting standards) or practical guidelines for fish passage in the FPRs. All new and replaced watercourse crossings on Class I watercourses must allow unrestricted passage to adult and juvenile salmonids by having a natural bottom to the culvert or the use of a bridge. Existing watercourse crossings on Class I watercourses that do not have a natural bottom, or could not be replaced with a natural bottom, must be evaluated for fish passage. Existing culverts must be retrofitted to allow adult passage. Some will never achieve the even more restrictive juvenile passage no matter what the retrofitting. Juvenile passage may be critical, and thus must be evaluated on a site-by-site basis.

To assist culvert siting and replacement with respect to fish passage, the SRP favors an approach developed by Bates et al. (1999). This protocol is readily available at: www.wa.gov/wdfw/habitat.htm. There are two options. The first is a no-design option that allows a culvert diameter 1.2 times the channel width placed on a flat gradient with (Bates et al. 1999, Appendix B WAC 220-l 10-070 Water Crossing Structures) "the bottom of the culvert placed below the level of the streambed a minimum of twenty percent of the culvert diameter for round culverts, or twenty percent of the vertical rise for elliptical culverts (this depth consideration does not apply within bottomless culverts). The twenty percent placement below the streambed shall be measured at the culvert outlet," The second option specifies a quantitative fish passage analysis. The fish passage design criteria for adult salmonid passage (Table 1 in Bates et al. 1999) are appropriate to Northern California. Bates et al, (1999) specifies the following low flow passage window: the two-year seven-day low flow or 90% exceedence flow for migration months of the fish species of concern. A high flow passage window is "the flow that is not exceeded more than ten percent of the time during the months of adult fish migration" or "the two-year peak flood flow may be used where stream flow data are unavailable." For northern California salmonids, the 10% rule for high flow passage is too low. We strongly recommend using the two-year peak flow as the upper passage flow.

Analysis of existing culverts for fish passage can be implemented using the USDA Forest Service protocol (http://www.stream.fs.fed.us/fishxing). This protocol requires some training in hydrology and hydraulics. A brief workshop would allow RPFs, THP inspectors, DF&G and NMFS staff, and others to use the protocol as a diagnostic tool. For borderline and/or unusual culvert settings, an engineer (or similarly trained professional) may be required, for example, retrofitting would typically involve backwater analysis. We do not recommend baffles.

The FPRs at section CCR 923.3(a) states: "The location of all new and permanent watercourse crossing drainage structures and temporary crossings located within the WLPZ shall be shown on the THP map. If the structure is a culvert intended for permanent use, the minimum diameter of the culvert shall be specified in the plan. Extra culverts beyond those shown in the THP map may be installed as necessary." Insufficient documentation of watercourse crossing locations and sizing make evaluation from the THP documents impossible. Given the last sentence in CCR 923.3(a) above, the final number and sizes of culverts in a particular THP remain uncertain. The unforeseen need for additional watercourse crossings should be limited

to cross drains, when constructing and/or upgrading roads, and small Class III watercourses. Presumably, additional crossings on Class I and II watercourses require DF&G Fish and Game Code Sections 1601 and 1603 permits. The SRP did not discuss with DF&G recent changes, as well as implications of these changes, to the 1600 process. However, these additional, larger crossings should be located and documented (e.g., sizing) in the THP or by amendment.

The FPRs (CCR 923.3(h)) require maintaining or restoring the natural drainage pattern, functionally disconnecting road surface drainage from watercourse drainages. Disconnecting the road drainage from the watercourse drainage prevents overburdening the watercourse with road surface water and helps minimize sediment input from road ditches or from road surface drainage into watercourses. This is also consistent with the requirements of CCR 923.2(h) that requires drainage structures and facilities "to maintain and restore the natural drainage pattern." Insufficient guidelines are provided in the FPR for accomplishing this hydrologic disconnect.

The FPRs at CCR 923.4 state: "(a) The prescribed maintenance period for erosion controls on permanent and seasonal roads and associated landings and drainage structures which are not abandoned in accordance with 14 CCR 923.8 [943.8, 963.81 shall be at least one year." The Director may prescribe a maintenance period extending up to three years in accordance with 14 CCR 1050. This section (CCR 923.4) should become obsolete for watercourse crossings with designating them as either permanent or temporary (as discussed above): there is either continual long-term maintenance or a single seasons. The problem is guaranteeing long-term maintenance beyond the time horizon of the THI? The maintenance period could be extended longer than three years, but the collective administrative oversight by all concerned agencies for such a provision is unlikely. One strategy could be demonstration by the landowner that a particular road is needed, and if so, that the landowner has the resources for its maintenance, Another strategy could utilize Rice's (p.49, in CDF and USFS [1989] Critical Sites Erosion Study, Vol. I) suggestion that monitoring continue until the structure has successfully performed in a prescribed flood event (Rice uses a 4-yr event). For culverts, this event probably should be a higher magnitude, less frequent event, (e.g., a 10-yr flood). We support this process-based approach, but have no mechanism to recommend past responsibilities connected to the individual THP.

The FPRs do not provide a definitive directive for minimizing stream crossing failure for "fail-soft" considerations, Crossings must be built so that they cannot divert a stream if (when) the culvert fails, and must not rely on a structure or maintenance for this guarantee. Critical dips at watercourse crossings prevent the diversion of water resulting from a plugged culvert. CCR 923.2(h) states that these are to be constructed where feasible. Weaver and Hagans (1994) provide numerous guidelines for a "fail-soft" design. As they stress (p.67): "Stream crossings on all newly built or reconstructed roads should not be constructed in a manner that gives any opportunity for future stream diversion." Abandoned roads should be held strictly to a high standard of "fail-soft." An excellent description of the "fail-soft" concept, with examples, can be found in Furniss et al. (1997) (see Figure 8).

The FPRs at 923.4 (f) require drainage structures, if not adequate to carry water from the fifty-year flood level, shall be removed in accordance with 14 CCR 923.3(d) by the first day of the winter period, before the flow of water exceeds their capacity if operations are conducted during the winter period, or by the end of timber operations whichever occurs first. Properly functioning drainage structures on roads that existed before timber operations need not be removed. An RPF may utilize an alternative practice, such as breaching of fill, if the practice is approved by the Director as providing greater or equal protection to water

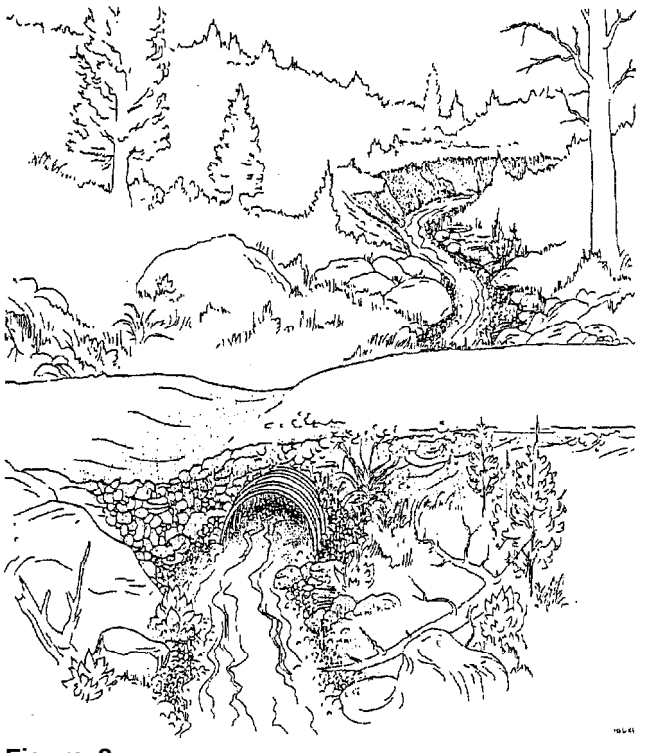

Figure 8.

quality as removal of the drainage structure. The SRP does not consider culvert breaching to provide equal or better protection than culvert removal.

The rules do not specify a minimum cross drain culvert size for roads. Most constituency groups interviewed considered 18 inches the minimum acceptable diameter for cross drains. Weaver and Hagans (1994) emphasize that: "In areas of high erosion and/or storm runoff, minimum ditch relief culvert sizes should be 18 inches, but ditch relief culverts should never be less than 12 inches diameter. "

Recommendations

1. A design flood for sizing watercourse crossings must have a HW/D no greater than 1 for a 100-year flood. Specifying the methodology employed for sizing and providing pertinent information (channel width and/or drainage area) must be provided in the THP.

2. A drainage structure left in an abandoned road should be considered permanent and, therefore, the landowner's long-term responsibility. Otherwise, the drainage structure must be removed. For planned abandonment of roads (CCR 923.8), provision (e) should be eliminated: "Where it is not feasible to remove drainage structures and associated fills, the fill shall be excavated to provide an overflow channel which will minimize erosion of fill and prevent diversion of overflow along the road should the drainage structure become plugged." This rule is particularly inappropriate for cross drains. An abandoned road with cross drains (on an insloped or crowned road) cannot meet the intent of CCR 923.8.

3. To allow adult and juvenile salmonid passage, all new and replaced Class I watercourse crossings must have a natural bottom.

4. All permanent and temporary crossings (new and existing) on Class I and II streams must be shown on the THP map or, for existing crossings only, referenced to a specific map and database in the watershed analysis. Watercourse crossings over Class I and II watercourses, not included in the THP, must be included as amendments.

5. Section 923.1 (g)(3): should state that no more than 100 ft of an inside ditch should drain into a stream crossing. Section CCR 923.2 should be modified to state: "Permanent watercourse crossings... shall be constructed to prevent diversion of stream overflow down the road."

6. A permanent culvert requires permanent maintenance: provisions for 1-yr or 3-yr periods are inadequate. A hydrologically-based maintenance period has potential and should be investigated.

7. Require fail-soft road stream crossings that do not rely on structures (e.g., overflow ditches) or maintenance.

8. Breaching is not an alternative to restoring a watercourse crossing's proper function.

9. The minimum cross drain diameter should be *18* inches.

6. Site Preparation

Background

Regulations specifically pertaining to site preparation are found at CCR 915, The regulations require "Site preparation shall be planned and conducted in a manner that encourages maximum timber productivity, minimizes fire hazards, prevents substantial adverse effects to soil resources and to fish and wildlife habitat, and prevents degradation of the quality and beneficial uses of water." Site preparation activities involving tractors are required to follow all of the provisions applicable to "tractor operations" found at CCR 914.2. This section limits the use of tractors on steep slopes and requires tractors not to be operated when soils are saturated. Site preparation cannot be conducted during winter operations unless a winter operating plan is incorporated into the THP and followed, or unless the requirements of the in lieu winter operating plan are met. (CCR 914.7(a))

The slash burning requirements are identified under CCR 915.2. Under provision (b) of this section it states "Broadcast burning shall not fully consume the larger organic debris which retains soil on slopes and stabilizes watercourse banks." Further, during site preparation all activities shall comply with the watercourse and lake protection zone requirements under Article 6, and the wildlife and habitat protection provisions under Article 9 of the Forest Practice Rules. Item CCR 915.3(c) requires site preparation to be performed "in a manner that does not deleteriously affect species that are threatened, endangered, or designated by the Board as species of special concern." Where site preparation will occur in the logging area, all THPs must incorporate a site preparation addendum (CCR 915.4) which describes the general methods of site preparation being used, the types of equipment, the methods for protecting desired residual trees, and explanations and justifications for acceptance alternatives to the standard rules. The current rules allow the treatment of slash by burning except in the WLPZ for Class I and II streams. The restriction of "such burning shall be done only after the first heavy fall rains" may still result in a fairly hot burn because most of the larger diameter LWD will still be dry.

Discussion

Several landowners are reducing sedimentation from slash burning following clearcutting by reducing the amount of broadcast burning. Instead, whole-tree yarding to ridgetop roads was used or slash was lopped and piled and burned. In some operations the slash was chipped or burned at the landing as opposed to on the hillslope. This reduction of slash burning in clearcuts on the steep areas above Class III streams may reduce sediment into these Class III streams. A study should be done to review sediment generated from site preparation and burning.

Most fires, wildfire, prescribed fires and slash burning, increases sediment transport into streams caused by the fire consumption of the slash, litter and other decomposed organic matter on the soil surface and a reduction in infiltration with consequent increase in overland flow (DeBano et al. 1998). An increase in water repellency of soil following broadcast burning of slash has been reported for several locations in Southwest Oregon and Northwest California (McNabb et al. 1989). In the coast range of California the soils with *Ceanothus* and *Arctostaphylos* spp. as early successional species acquire hydrophobic properties that are resistant to wetting (Smith et al. 1997). Fires on these soils may increase sediment transport 30 times above the ambient level with about 70 percent of total sediment resulting from fires (Swanson 1981). Following slash burning in clearcuts, increased solar heating of blackened soils and woody debris can lead to increased soil water temperatures and stream water temperatures

(McMahon and deCalesta 1990). Slash burning has reduced LWD in riparian zones and streams (McMahon and deCalesta 1990).

Several interviewees from agencies and from the environmental community expressed concern regarding site preparation activities. Several comments concerned the use of broadcast burning and potential impacts to Class III watercourses. Others expressed concern that site preparation completed during the prior winter could produce excessive amounts of sediment. On two ownerships visited by the SRP, clearcut-harvesting operations were observed that did not utilize broadcast burning following harvest. On one ownership, the trees had been felled and left tree length, and were then limbed and bucked into log lengths at the landing. On another operation, tops and concentrations of slash were yarded to the landing and decked where they were scheduled to be burned at a later time. The reasons for not utilizing broadcast burning described by landowner representatives included protection of soil resources, and concerns that burning might enhance conditions for undesirable brush species through scarification of seeds. Landowners who utilized broadcast burning stressed concern that the loss of this tool, especially in young-growth redwood, would greatly increase the reforestation costs and would result in poorly stocked future stands due to the limitations on planting. One interviewee suggested that the impact of burning through Class III watercourses once a rotation (every 50-80 years) may be similar to natural fires that occurred at 30-40 year intervals before wide-scale fire suppression efforts became so effective.

One interviewee noted that redwood stands tended to have much heavier and more concentrated slash than those found in Douglas-fir stands following harvest. Several interviewees from state and federal agencies supported the use of spring burning over fall burning because it tended to produce cooler fire temperatures that did not consume the medium to large sized coarse woody debris stored in and near Class III channels. Some large landowner representatives expressed concerns that if they were limited to only spring burning, it would greatly hinder their burning program due to the severe limitations placed upon broadcast burning as a result of air quality standards.

The 2090 Agreement in the southern counties specifically addresses site preparation issues. This agreement requires that all operations must avoid dislodging LWD currently in the channels of Class III's and site preparation cannot occur if it will generate sediment into Class 111s.

Recommendations

1. Limit mechanical site preparation to the initial portion of the winter operating period before soils have become saturated (see Winter Operations for definition of winter period).

2. Limit broadcast burning where feasible.

3. To prevent soil damage and retain LWD in and near Class III watercourses, develop practices to limit burning to cool burns. Rewrite CCR 915.2(b) where it states "Broadcast burning shall not fully consume the larger organic debris which retains soil on slopes and stabilizes watercourse banks," to better define what "fully consume" means. Minimize burning within the ELZ and avoid ignition in the ELZ. The protection of Class III watercourses during broadcast burning must be addressed in the Site Preparation Plan. Where broadcast burning is used and burning through Class 111s cannot be prevented, use only spring burning. Fall burning may only be used where the LWD in the Class III is protected.

4. Require a "Site Preparation Completion Report" to be filed with CDF when site preparations are final and an inspection could occur. This report should include a map of the actual area treated, and be separate from the Work Completion Report so the LTO does not have extended responsibility for road maintenance following the completion of harvesting operations.

7. Winter Operations

Background

The specific regulations pertaining to winter operating rules are contained in CCR 914.7. Other provisions throughout the regulations, including those in tractor operations and road maintenance, also pertain to winter operations.

Subsection 914.7(a) of the Winter Period Timber Operations Requirements states that in a winter operating plan: "mechanical site preparation and timber harvesting, shall not be conducted unless a winter period operating plan is incorporated in the timber harvesting plan and is followed, or unless the requirements of subsection (c) are met. Cable, helicopter and balloon yarding methods are. exempted." Subsection (b) identifies the requirements of a winter operating plan that must be incorporated into the THP This winter operating plan must address: 1) erosion hazard rating: 2) mechanical site preparation methods: 3) yarding system (constructed skid trails); 4) operating period; 5) erosion control facilities timing: 6) consideration of form of precipitation – rain or snow: 7) ground conditions (soil moisture condition, frozen): 8) silvicultural system – ground cover; 9) operations within the WLPZ; 10) equipment use limitations; and 11) no unstable areas.

Subsection (c) provides the following exemption to the winter operating plan: "In lieu of the winter operating plan, the RPF can specify the following measures in the THP: 1) Tractor yarding or the use of tractors for constructing layouts, firebreaks or other tractor roads shall be done only during dry, rainless periods where soils are not saturated; 2) Erosion control structures shall be installed on all constructed skid trails and tractor roads prior to the end of the day if the U.S. Weather Service forecast is a "chance" (30% or more) of rain before the next day, and prior to weekend or other shutdown periods: 3) Site-specific mitigation measures needed to comply with 14 CCR 914 for operations within the WLPZ and unstable areas during the winter period." Provisions of subsection (c) do not apply to the mechanical site preparations; a full winter operating plan must be prepared.

The road construction rules at CCR 923.2(n) require that all permanent drainage structures be installed no later than October 15, before the start of the winter operating period. For construction and reconstruction of roads after October 15, drainage structures shall be installed concurrently with the activity. Subsection (r) states: "No road construction shall occur under saturated soil conditions, except that construction may occur on isolated wet spots arising from localized ground water such as springs, provided measures are taken to prevent material from significantly damaging water quality". The rules also require at subsection (s) that: "Completed road construction shall be drained by outsloping, waterbreaks and/or cross-draining before October 15. If road construction takes place from October 15 to May 1, roads shall be adequately drained concurrent with construction operations." Subsection (t) requires: "Roads to be used for log hauling during the winter period shall be, where necessary, surfaced with rock in depth and quantity sufficient to maintain a stable road surface throughout the period of use." Under the "Road Maintenance" section of the regulations at 923.4(h) requires that "During timber operations, road running surfaces in the logging area shall be treated as necessary to prevent excessive loss of road surface materials by, but not limited to rocking, watering, chemically treating, asphalting or oiling." Subsection (o) states: "Except for emergencies and maintenance needed to protect water quality, use of heavy equipment for maintenance is prohibited during wet weather where roads or landings are within a WLPZ." Provisions similar to requirements of winter road construction are also contained in CCR923.5 "Landing Construction."

Discussion

Several members of the state and federal agency groups, as well as representatives from the envi-

ronmental community and other resource specialists expressed concern regarding winter operations. Many concerns were focused on winter hauling operations where fines generated from roads entered watercourses. Some also expressed concern regarding the use of heavy equipment during the winter operating period and during wet weather outside the winter period.

Several interviewees wanted better and clearer standards for road rocking, The rules require road rock to be placed in sufficient quantities to provide a stable road surface, without specifying bulk density or percent fines requirements. Several agency personnel commented that low quality rock was sometimes used that required constant replacement and generated excessive fme sediment [1].

The logger constituency group, as well as the RPF and landowner groups, stated the need to maintain the opportunity for winter operations. This was, in part, due to additional restrictions placed on the operating season as a result of wildlife survey requirements. An example was given where timber falling and yarding operations often could not commence until after June 1 due to limitations on the northern spotted owl survey requirements. Loggers and landowners noted that this had greatly reduced the tractor operating season: to maintain sufficient log flow to supply their mills, several landowners must now generate more logs during the winter operating period. At least one major landowner voluntarily limits winter hauling operations, and has ceased all hauling during periods of rainfall. Another landowner had reached an agreement with CDF and the RWQCB to not haul logs until at least five days had passed since the most recent measurable rainfall. Another major landowner allows no road construction during the winter period. THPs have contained site-specific agreements that allow tractor yarding and hauling on season roads until a designated amount of rainfall occurs.

"Winter Period" is defined as "the period between November 15 and April 1, except for purposes of installing drainage facilities and structures, waterbreaks and rolling dips, in which case the period shall be October 15 to May 1." A USDA Forest Service research scientist has developed a method that may assist with the identification of winter period from a soil moisture standpoint.

The antecedent precipitation index (API) could be used as an erosion forecast tool (R. Ziemer, 1999, pers. comm.). Cumulative rainfall is countered by a daily recession coefficient to track soil moisture (Saxton and Lenz 1967; Keppeler and Ziemer 1990). Use of such an index has the advantage of objectively determining the start and end of the winter period. Presently, the official beginning and end of the winter period are static dates. County changes to the November 15 and April 1 dates include Marin County (October 1 through April 15 (CCR 927.1)), Santa Clara County (October 1 through April 15 (CCR 925.1)), and Santa Cruz County (October 15 through April 15 (CCR 926.18)). In many years, saturated soil conditions can occur either many days earlier or later than the defined date. The API would allow specific adjustment to these dates annually. Regional daily recession coefficients can be developed and the daily API calculated, then posted on the internet, or easily computed by the RPE Bob Ziemer (pers. comm.) estimated that recession coefficients could be developed within a year, i.e., the API could be available by the beginning of the winter period in 2000.

The rules provide a wide range of winter period and wet weather activities for mechanical site preparation and timber harvesting that may impact water quality. Once initially mobilized, fines will either be stored on the hillslope, in the WLPZ, or will enter a watercourse. This may occur in successive steps associated with storm events. Rules requiring on-site judgement that ongoing activities

1. A member of the watershed specialists constituency group noted that even "good quality" rock could produce significant fines.

are producing fines reaching the watercourse should be taken out of the FPR. For example, section CCR 923.6 Conduct of Operations on Roads and Landings (p. 91) states: "Operations and maintenance shall not occur when sediment discharged from landings or roads will reach watercourses or lakes in amounts deleterious to the quality and beneficial uses of water." The sediment produced by the activity could be entering watercourses throughout the remainder of the winter period, not just during a single event. This provision may therefore not protect beneficial uses of water.

Prevention of initial sediment mobilization should be the focus of allowable activities in the winter period and during wet weather. Erosion control structures constructed one day (or less) before a rainfall event (if accurately forecasted) cannot adequately mitigate soil loss. Surface runoff over a freshly disturbed ground surface risks significant fine sediment production. There should be no tractor road construction in the winter period; erosion control measures on tractor roads must be completed before the winter period.

Winter hauling and tractor yarding must be limited to specifically defined dry periods in the winter. Tractor yarding should require more stringent dry period conditions than cable yarding. The definition of "dry period" is difficult--perhaps too difficult to effectively implement, monitor, and, enforce. Enforcement can best be accomplished by requiring that the RPF supervise the winter operating plan. Supervision would not require continual onsite presence, but the level of supervision should be specified in the plan. It should be the RPF's responsibility for sufficient site visitation and communications with RPF LTD to maintain the objectives of the THP. The API index may be a tool for defining a "dry window" within the winter period. A pre-determined percentage of saturation could define this period: for example, a two week dry period in early December could cause a 25% reduction in the index, signaling a 'dry" period. This percentage would allow limited prediction, as well: If a two-inch rainfall occurred the next day, would significant surface runoff result? The API's potential should be explored, experimentally, for objectively defining "dry weather conditions" as well as objectively defining the winter period.

There-are newer ground yarding technologies that incorporate lower levels of ground disturbance. The newer ground yarding techniques include "track loader yarding" and "feller/buncher forwarder" operations. These machines typically work on lower gradient slopes (<35%) and have wide low-ground pressure tracks on rubber tires. They also typically work across the ground, on top of the slash and may not utilize a prepared skid road. When done properly, this reduces disturbance to the duff layer, and minimizes exposure of mineral soil, and, due to machine limitations, restricts operations to lower gradient slopes.

The FPRs at CCR 914.7 provides the RPF in lieu alternatives to a winter operating plan (except for mechanical site preparation). These include: (1) "Tractor yarding or the use of tractors for constructing layouts, firebreaks or other tractor roads shall be done only during dry, rainless periods where soils are not saturated", (2) "Erosion control structures shall be installed on all constructed skid trails and tractor roads prior to the end of the day if the U.S. Weather Service forecast is a "chance" (30% or more) of rain before the next day, and prior to weekend or other shutdown periods", and (3) "Site-specific mitigation measures needed to comply with 14 CCR 914[934,954] for operations within the WLPZ and unstable areas during the winter period." Also CCR 914.7(a) excludes cable, balloon, and helicopter yarding operations from a winter operations plan.

The SRP believes that the risk of initiating long-lasting erosion problems from preventable activities during the winter is very high. The measures for preventing erosion therefore need to be clearly defined in a winter operating plan.

Recommendations

1. Use the antecedent API index to define the winter period.

2. The RPF must supervise winter operations. Tractor yarding must only be allowed under "dry" conditions more stringent than cable yarding that are clearly defined in the winter operations plan. The API should be investigated for defining "dry" conditions in the winter period and "wet" weather conditions outside the winter period, particularly for objectively assigning "dry" conditions status for tractor logging. Without an objective determination, traditional tractor logging in the winter period should be prohibited or restricted to the early portion of the winter period during extended dry periods (as measured by cumulative rainfall or the API).

3. The use of ground yarding systems, such as "track loader yarding" and "feller/buncher-forwarder" operations, may be allowed during extended dry periods during the winter period under the following conditions: slopes < 35%; no new skid trail construction during winter period; all skid trails used must be out sloped with rolling dips installed before the commencement of the winter period.

4. In lieu alternatives should be eliminated; acceptable winter practices must be addressed in a winter operating plan for all yarding systems (e.g., tractor yarding). Cable, balloon, and helicopter yarding operations should require a winter operations plan. The winter operation plan must specifically address sediment production measures for all aspects of the operation.

5. No road or landing construction during the winter period (as measured by API). This shall not limit road rocking or road maintenance during the winter period.

8. Harvest Limitations

Background

The harvest limitation section is a subset of the cumulative effects analysis consideration, and is intended to specifically address the amount and timeframe over which harvesting could occur before significant cumulative effects occurred.

The current standards for harvest limitations are found within the silvicultural section of the rules. At 913.1, the regulations identify the "Regeneration Methods used in Evenaged Management." These regulations identify the requirements of clearcutting and other "regeneration step harvests." To ensure that trees are harvested under "maximum sustained production of high quality timber products" (PCR 4513), the Board of Forestry established rotation ages for evenage regeneration harvests (clearcuts) that are applied by various site classes (CCR 9 13.1 (a) (1)). For Site Class I, the stand age must be at least 50 years, for Site Classes II and II, stand age must be at least 60 years of age, and on site IV and V lands, stand age must at least 80 years. This same rule section under (2) further limits the size of evenage harvest units to 20 acres per tractor yarding, and 30 acres for aerial (helicopter or balloon) or cable yarding. Tractor yarding may be increased to 30 acres where the erosion hazard rating (EHR) is low and slopes are less than 30%. The RPF may propose increasing these acreage limits to a maximum of 40 acres where there is substantial evidence that the increase in acreage meets at least 1 of 5 tests, including: reducing the overall detrimental effects of erosion thereby providing better protection of soil, water, fish and/or wildlife resources. The RPF may also provide feasible off-site mitigation measures that can be incorporated into the plan to justify the increased harvest acreage.

Section (3) of this rule section requires that logical yarding units be placed between each evenaged regeneration unit that are at least as large as the area being harvested, or 20 acres, whichever is less,

and are separated by at least 300 feet in all directions. Following harvesting of the evenaged regeneration unit, harvesting of the adjacent logical yarding unit cannot occur until the following conditions are met: a report of stocking has been submitted and approved and the dominant and co-dominant trees of the evenaged regeneration unit are at least five years of age, or at least five feet tall and three years of age from the time of establishment on the site by either planting or natural regeneration. If these standards are to be met with trees that were present at the time of the harvest, there shall be an interval of not less than five years following the completion of operations before adjacent evenage management may occur.

Rule section (CCR 913.1 (a) (4) (A)) of the regulations is commonly referred to as the "Adjacency Requirement." This requirement applies within ownerships, but does not transcend ownership boundaries. There are further restrictions placed upon evenaged management operations that are adjacent to public roads and non-timber production zone lands. The rules require that "Special consideration for aesthetic enjoyment shall be given to selection of silvicultural treatments and timber operations within 200 feet of the edge of the traveled surface of any permanent road maintained by the county or the state (6)." And, section (7) of this rule states: "Special consideration for aesthetic enjoyment and protection of adjacent stand vigor shall be given to the selection of silvicultural methods and timber operations within 200 feet of adjacent non-federal lands not zoned TPZ."

The above provisions apply to all "evenage regeneration methods" that include clearcutting, seed tree, seed tree seed step, seed tree removal step, shelterwood seed step and the shelter-wood removal step. There are no specific tree age or area limitations contained within the regulations pertaining to unevenaged (selection) regeneration methods. Rather than addressing area control (as is done in the evenage regeneration methods), the selection silvicultural regulations utilize tree retention standards to ensure tree canopy is retained and a diversity of tree sizes are maintained across the landscape following selection harvesting. The selection system also includes "group selection" where trees are removed individually or in small groups that are sized from 0.25 acres to 2.5 acres.

For standard selection applications, a basal area retention standard is based on site classification (CCR 913.2(a)(2). On Site I lands, at least 125 square feet of basal area per acre must be retained; on Site II and III lands at least 75 square feet per acre of basal area must be retained; and on site IV lands at least 50 square feet per acre of basal area must be retained. For group selection harvesting, no more than 20% of the THP area may be harvested using group selection areas no larger than 2.5 acres in size. Of the 80% of the remaining area not covered by group selection cuts, at least 80% of that area must meet the basal area standards for standard selection harvesting, and on 20% of that area the stocking may be met by point count of trees that are at least 10 years old (CCR 913.2(a)(2)(B)).

The result of the selection and the group selection retention standards is to retain a moderate degree of canopy cover represented by trees of more than two age classes across the THP area. Re-entry periods for selection areas may vary greatly, with some re-entries being as short as five years and others exceeding 15 years, There are no specific re-entry time frame limitations in the rules for section harvesting. For group selections, the requirement that 80% of the area not covered by group selection harvests must meet the basal area stocking requirements of selection (and 20% may be met with small trees at least 10 years old) means that a moderate canopy density of all sized trees must occur across the THP area. This, therefore, limits the return interval and the intensity of group selection harvesting. It is unlikely given these basal area and stocking requirement constraints that group selection could be used in a frequency of fess than a IO- or 15-year return interval. Therefore, if group selection were utilized across the

landscape on a 1 O-year return interval approximately 20% of the watershed (on an area basis) would be harvested per decade.

Other types of silvicultural system that have tree retention requirements are "intermediate treatments." (CCR 913.3.) This includes the practice of commercial thinning. Commercial thinning is the removal of trees in a young-growth stand to maintain or increase average stand diameter of the residual crop trees, promote timber growth, and/or improve forest health. "Residual stands shall consist primarily of healthy and vigorous dominant and co-dominant trees from the preharvest stand." Section (a) of this rule defines the minimum basal area standards for thinning, and are higher than those for selection harvest. The retention requirements are applied by site classification as follows: on site I lands, there must be at least 125 square feet of basal area per acre following harvest; on site II and III lands there must be at least 100 square feet per acre; on site IV lands there must be at least 7.5 square feet per acre: and on site V lands at least 50 square feet per acre post harvest.

Sanitation salvage is also included in the intermediate treatment regulations at CCR 913.3(b). "Sanitation salvage is removal of insect attacked or diseased trees in order to maintain or improve the health of the stand. Salvage is the removal of only those trees that are dead, dying, or deteriorating, because of damage from fire, wind insects, disease, flood, or other injurious agent. Salvage provides for the economic recovery of trees prior to a total loss of their wood product value." Stocking standards consistent with 912.7(b) must be met following operations, unless explained and justified in the THP This requires the retention of at least 50 square feet per acre, or a point count of 300 trees per acre following harvest. Trees to be harvested or retained under this method must be marked by, or under the supervision of, an RPF. This method of silviculture is frequently utilized under the sanitation salvage exemption (CCR1038(b)) and the emergency notice (CCR1052). An RPF is required to prepare the emergency notice and, the emergency must be substantiated by an RPF. Both of these types of notices are "ministerial" in nature, and therefore the agencies do not have discretionary authority over approval. Under the 1038(b) exemption an RPF is not required, and less than 10% of the dead and dying trees may be removed utilizing this exemption. The size and nature of an emergency notice is dependent upon the type of emergency for which the notice is filed. These may be small operations that have resulted from minor fires or wind damage, or may be broad scale operations that resulted from catastrophic fires or widespread insect infestation. Although no formal THP is prepared for either the 1038(b) exemption or the emergency notice, all operations must comply with all operational provisions of the Forest Practice Act and the District Forest Practice Rules applicable to "timber harvest plan" (THP), and "plan." This review does not include a formalized cumulative effects analysis prepared either by the submitter or the state.

Discussion

The issue of harvest limitations was the focus of several lengthy discussions between SRP members and various constituency groups, It was commonly agreed that it would be difficult to set specific limitations of percent harvest goal per decade due to the effect of confounding and, in some cases, mitigating factors. Many involved with these discussions felt that any limitation on harvesting over time should be based upon a thorough analysis of the conditions that would include the geology, the road network, the affected hydrology, and numerous other factors. Others interviewed felt that the current system provided sufficient safeguards to prevent cumulative impacts due to the rate or level of harvesting. Although reluctant to do so, some interviewees provided their opinion that the maximum harvest limitation should not exceed 10% per decade at any particular watershed, and admitted this was based on their opinion and not on any scientific study. Other interviewees stated 75-85% could be harvested, but also stated harvesting

could not be done this quickly under the current rules. An industrial landowner indicated that under the current rules the most rapidly that any watershed could be clear-cut was 20-25 years. This was based on actual experience in two isolated ownership blocks of less than 5,000 acres each.

Based on the interviews conducted with various resource specialists, and a review of available research, the SRP has not found any widely accepted methodology or program that quantifies the level of timber harvesting with either cumulative effects or flooding. There were several discussions pertaining to measuring cumulative effects throughout a basin versus the current methodology of analyzing cumulative effects on a 3-5,000 acre planning watershed. Several resource specialists commented that while there might not be significant adverse impacts on the smaller assessment area, minor impacts may accumulate and be additive in nature, resulting in cumulative impacts when measured downstream at a basin level. There clearly needs to be more science and a better understanding of the incremental and additive impacts of land management activities at a basin scale. Several interviewees supported the concept of watershed analyses conducted at a basin level to identify cumulative effects and help develop management practices that would mitigate those adverse impacts.

A study recently completed by CDF and other cooperators in the Caspar Creek watershed on Jackson Demonstration State Forest indicated that there might be some correlation between harvest levels and peak flows. The study was conducted in the North Fork of Caspar Creek, a roadless area with uncut mature second-growth timber before treatment. The study showed that where 100% of a subdrainage watershed had been clearcut, a two-year rainfall event resulted in a 35% increase in peak flow. In areas where clearcutting had occurred on 30-50% of the watershed, there was a 16% increase in peak flows for drainages with flows greater than 4 liters/second/hectar (Ziemer 1998). Studies in Caspar Creek also found that when 50% of the drainage was clearcut in a short period of time, there was a 98% increase in suspended sediment levels, caused primarily by a single landslide (Lewis et al., in, review). Studies in Caspar Creek also demonstrated that, to date, there was no difference in the number of landslides that occurred in areas that had been clearcut compared with uncut areas (Cafferata and Spittler 1998).

Several groups expressed concerns over the lack of rules regulating reentry periods. Their concern was specific to the reentry of stands that had been harvested using thinning or selection and were then reentered within a few years and clear-cut. These individuals felt that there should be some type of reentry limitations that prevented this from occurring. The use of clearcutting on stands that were recently thinned or selection harvested was considered to be counter to the intent for these silvicultural methods and the FPA. There was also concern expressed for increased impacts that could occur under rapid reentry on the same area.

Recommendations

Based on concerns raised by some constituency groups, the SRP believes that the Board should consider whether or not a harvest limitation based on percent of watershed area is warranted pending completion of a watershed analysis. This percentage would initially function as a red flag, rather than as a moratorium, signaling a more scrutinized interagency review and public'disclosure before approving additional THPs. A considerable range in percentage was recommended among interviewees. Predictably, the environmental community advocated 10% to 15% per decade, whereas several timber industry constituencies offered 70% to 85% per decade. This wide range perhaps best defines the prevailing perceptions of cumulative effects. The SRP believes that a more likely value ranges from 30% to 50%. This range depends on site-specificity, type of harvest prescription, and past history of watershed disturbance, etc., but

putting these (and other) qualifiers aside, this range basically reflects the individual group members' perceptions of cumulative effects. The SRP did entirely agree that any proposed percentage, or range in percentage, could not withstand the intense public and scientific scrutiny if based predominantly on professional opinion. Therefore, the SRP recommends that a blue-ribbon scientific panel (composed of industry, agency, and academic specialists in cumulative effects assessment) be commissioned in 1999 to accomplish this interim mission. Having one panel recommend another was done with great reluctance. But we have the responsibility of offering more than opinion: our investigation was not provided with the necessary time to evaluate our proposed (watershed-analysis-based) cumulative effects assessment protocol.

RECOMMENDATIONS REGARDING THE TIMBER HARVESTING PLAN PROCESS

9. Timber Harvesting Plan Preparation

Background

The Forest Practices Act requires that a THP be prepared by an RPF. The RPF is required to prepare a complete and accurate plan based on field conditions, and submit the plan to CDF for review and consideration of approval (CCR1035.1). The regulations also require RPFs to prepare and submit non-industrial timber management plans (NTMPs) (CCR Article 6, Sec. 1090), PTHPs (CCR Article 6.8, Sec1092), minor conversion permits (CCR1104), and emergency notices (CCR1058). The minor conversion permit and the emergency notice are both ministerial permits, while all others listed are discretionary permits subject to the approval of CDF as the lead agency under a functional equivalent program to the California Environmental Quality Act (CEQA) process.

The purpose of the THP is to: " 1) provide information the director needs to determine whether the proposed timber operations conform to the rules of the Board; and, 2) provide information and direction to timber operators so that they comply with the rules of the Board" (CCR1034).

Discussion

Many of the interviewees, including state agency representatives, private landowners, and some members of the environmental community, stated that the THP process had become overly burdensome and cumbersome. Several private landowners and RPFs noted that the creation of a THP had become very expensive (ranging from $8,000 to $25,000+) and often constituted a financial hardship to small landowners managing low timber volumes. One frequently expressed comment from both RPFs and state agency representatives was that the final THP document was more designed to withstand the rigors of judicial review than to serve as an operational document for the LTO and disclosure document to the public. Members of the public complained that THPs were often inaccurate and incomplete upon submission, and go through significant changes during the review process. Due to the time-frames involved in the THP review process, some members of the public felt that they were precluded from commenting on the complete and final document prior to its approval (see "Timber Harvesting Plan Review" section). Many interviewees, including agency staff, landowners, and RPFs, felt that the THP preparation process should be greatly simplified and should include more emphasis on ground review and active field inspections during operations to insure compliance with the intent of the plan and the forest practice rules.

There was general agreement among the constituency groups that the THP process should include less paperwork and more field time for all of those involved in the process. Due to agency understaffing and the large amount of paperwork required under the current FPR's, few THPs (15-20% for

WQ and 2% for DF&G in north coastal California) are reviewed, and field inspections are rarely attended by staff of those agencies whose input may be most needed to protect salmonid habitat. Decisions and conclusions that could affect salmonids are therefore typically made by those who may not have the proper expertise. There was a general consensus that the presence of agency personnel (particularly from DF&G) was lacking, not only at the PHI, but also at subsequent field inspections throughout the THP process. To provide the professional and scientific input necessary for protecting salmonids, there would need to be an increase in staff time, personnel, and budgets for the agencies involved in the THP process.

One suggestion was to create a THP that would primarily be a disclosure document identifying the location of the proposed operations and the site-specific protection measures that would be incorporated in the THP. This document could then be used by both the public and the licensed timber operator (LTO). The abbreviated plan would consist of a minimum number of text pages where the plan submitter identified the location of the plan and the intent to meet the requirements of the regulations, and several maps that would provide the general location of the operation and appurtenant road system, and the specific location of the operation and the locations of watercourses and special protection areas. The emphasis of agency plan review would then be placed upon field inspections during an extended PHI and the preparation of subsequent reports prior to plan approval. This approach could only occur where a watershed analysis had taken place.

The abbreviated THP would reference the watershed analysis document and would incorporate the findings of this analysis in the THP. This is similar to the process that was intended by both the sustained yield plan (CCR913.10) and Program EIR (PTEIR) and PTHP (CCR Article 6.8, 1092). However, the watershed analysis process would be more rigorous and would specifically address watershed conditions and potential factors limiting to salmonid populations that would then be mitigated through the THP process (see Findings and Proposed Strategy).

Another recommendation from members of several groups was the need for accurate, easy to read maps. Several interviewees supported requiring the submittal of larger scale maps and the use of color-coding. All WLPZs and special protection areas would be easily identified on these large-scale maps and could be greatly enhanced by use of color-coding. The quality of the maps currently used by the LTOs was an issue that was raised repeatedly. The rules currently require map scales of "not less than 2" (1 inch = 2640 feet) to the mile" (CCR1034x). This same rule section states that "color coding shall not be used". The RPFs said that the current practice of using small-scale, black-and-white maps made their jobs more difficult, due to the fact that they had difficulty depicting the information that is required on the map for each THP. The RPFs and LTOs recommended the use of maps that were computerized (if available), with standardized legend symbols, color-coded, and in a larger scale than is currently used. Even though it would be more expensive, the LTOs stated that the additional cost would be well worth it, due to the gain in readability and usefulness,

From the standpoint of compiling existing information on salmonids and their habitats (e.g., distribution of habitat, locations of water temperature monitors, results of population surveys), it would be extremely beneficial to be able to use a GIS to integrate the results of relevant surveys from a watershed-based database, with the information required in the THP For example, if the maps were improved considerably with regard to size, quality, and with the addition of colors, relevant biological information (e.g., where and when salmonid spawning occurs, where thermal "hot spots" have been recorded) could be transferred electronically directly to the THP map from these watershed-based databases. This would allow for better integration of the scientific information into

the THP and would help in developing a comprehensive database.

Several of the LTOs interviewed also suggested standardization of flagging and paint colors. They felt that this would help to alleviate some confusion among the equipment operators and timber fallers. They also supported the use of printed flagging that incorporated both color-codes and words such as "stream protection zone" printed on the plastic flagging, The LTOs encouraged liberal use of flagging and paint, and suggested that the WLPZ boundary be both flagged and painted because after timber felling had occurred, it was often difficult to locate the flagging. The use of standardized paint colors for leave trees and cut trees might also help to avoid confusion during felling operations. The USDA Forest Service has recently proposed standardized paint colors for use in the National Forest system.

Several agency representatives, as well as members of the geologist constituency group, recommended that the RPF consult with other resource specialists prior to and during the preparation of the plan. To provide insight regarding potential areas of geologic instability, a broad overview of the plan area and the cumulative effects assessment area should be done by a geologist. This would be similar to the current review that is undertaken for archaeology, Several CDF and RWQCB representatives recommended that the RPFs consult with agency resource specialists during plan preparation to discuss areas of concern prior to plan submission. They felt that this would greatly expedite the plan review process, and might provide greater disclosure to the public regarding the areas of concern. This consultation could involve only a phone call prior to submission of the THP, to gain input from agencies such as DF&G prior to submission of the THP, and alert the RPF to any fishery resources issues at the onset of the THP process. This is also consistent with the current FPRs at CCR1034.2 under "Professional Judgment" where it states:

"Where the rules or these regulations, provide for the exercise of professional judgment by the forester (RPF) or the Director, the parties, at the request of either party shall confer on the plan area during the initial pre-harvest inspection provided for by law to reach agreement ifpossible on the conditions and standards to be included in the plan."

It may also be necessary for RPFs to consult with resource specialists other than geologists prior to preparation of the THP. Assuming a watershed analysis has not been completed, the RPF may need to pre-consult with fisheries biologists, watershed specialists, or others to address specific issues related to the THP and its potential impacts to other resources. This would result in site-specific recommendations and mitigations to address items such as key habitat or refugia for salmonids.

Under the current FPRs, there is fragmented responsibility with regard to conducting the THP process. This may make it difficult to hold any one person accountable for their actions. The THP is filed "by a person who owns, leases, or otherwise controls or operates on all or any portion of any timberland" (PRC 458). The landowner, who is not also the timber owner, may or may not know that a THP was submitted on their land until after it has been submitted. The RPF must notify the landowner of the THP submission in writing, but the landowner does not have to sign the THP. Under the current FPRs, although the RPF must prepare the THPs and is usually involved throughout the THP review and approval process, the RPF may not be responsible for, or involved with, the actual implementation (harvesting). Thus, if there is a problem during logging operations, the RPF who prepared the THP is not always available to provide guidance to the LTO. If, however, the landowner and an RPF are held responsible for the THP throughout the THP process, there would be more accountability, the process would be expedited, and the salmonids would be better protected.

Recommendations

1. Revise the THP to focus on operational considerations and serve as a disclosure document for compliance with the applicable regulations. This type of THP could only be used after a comprehensive watershed analysis had been conducted that identified site-specific conditions within the watershed. The THP document would then refer to sections of the watershed analysis to address potential limiting factors, such as sedimentation, temperature, dissolved oxygen, or LWD. Emphasis would be placed upon agency review of the THP, including an in-depth pre-harvest field inspection. The public could then rely on the accuracy of the finding of the watershed analysis, the disclosure of the RPF in the abbreviated THP identifying the resources that may be affected, and a thorough and comprehensive review and reporting by the state agencies. In order for this process to be successful, there would likely need to be an increase in the time available for review by the agencies and the public.

2. To review and discuss areas of concern during the preparation of the plan, the RPF should pre-consult with agency representatives (e.g., CDF, DF&G, RWQCB, NMFS). This may consist of merely a phone conversation, or it may be more elaborate and involve a field visit. The result would be a more concise and accurate plan that already reflects some input from the state agencies upon submission. The three primary reviewing agencies (CDF, DF&G, and RWQCB) would need to recognize that additional time may be required for this pre-consultation, and should budget personnel accordingly.

3. RPF should pre-consult as necessary with other resource specialists, including geologists, fisheries biologists, etc. during plan preparation. Consultation with these specialists will provide insight into site-specific considerations regarding these other resources that the RPF may not otherwise have identified, and will provide the reviewing agencies with a more complete assessment of the THP area. This is also consistent with the requirements of the "Registration of Professional Foresters" at CCR1602 where it states:

"Thus, for an RPF to accomplish a site-specific forestry project where the RPF's prudent level of expertise is surpassed, that RPF may need to utilize the services of other qualified experts including but not limited to geologists, landscape architects, engineers and land surveyors, archaeologists, botanists, ecologists, fisheries biologists, stream restorationists, wildlife biologists, hydrologists, range scientists, soil scientists, and certified specialists established pursuant to PRC772."

4. All THPs should be signed by the landowner when the landowner and timber owner are different parties.

5. The RPF should be involved with THP implementation in a manner similar to that listed in CCR 913.8(b)(5), as applied in Santa Cruz County, California.

10. THP Review and Approval

Background

Upon completion, THPs are submitted to CDF for review and approval. Upon receipt of the THP, CDF is required to place a copy of the plan in a file available for public inspection in the county in which timber operations are proposed. For the purpose of interdisciplinary review, CDF is required to transmit a copy to the DF&G, the RWQCB, and to the county planning agency. CDF shall invite, consider, and respond in writing to comments received from public agencies that have reviewed the plan and shall consult with those agencies at their request. (PRC 4582.6.(a).) Within the public comment period, any responsible agency (as defined in PRC 21069) shall provide CDF with specific comments or recommendations regarding any significant environmental issues or proposed mitigation measures raised by the THP. If any of these agencies fail to respond by the end of the public comment period, the department may assume that the responsible

agency has no comments or recommendations concerning the THP. However, failure of the responsible agency to make comments or recommendations shall not be used as the basis for determining or presuming that the THP has no significant effect on the environment. The director may grant a responsible agency an extension of up to 14 days to comment on the THP. (PRC 4582.6.(b).) The director of CDF has 15 days from the date the initial inspection (pre-harvest inspection) is completed to accept public comments. If the director determines that the field inspection is not necessary, the director has 15 days from the date of filing, or a longer period mutually agreed upon by the director and the plan submitter, to review the plan and receive public comments. After the initial review and public comment period has ended, the director has up to 10 working days, or a longer period mutually agreed upon by the director and the plan submitter, to review the public input, consider the recommendations and mitigation measures proposed by other agencies, respond in writing to the issues raised, and to determine if the plan is in conformance with the rules and the regulations of the Board. (PRC 4582.7.(a).)

THPs are often rejected by CDF and returned to the RPF who prepared the plan. The decision to accept the plan for filing is made at the first review that is held in Santa Rosa for all THPs submitted in the Coast Forest District. Plans in the Northern Forest District undergo first review at the Redding CDF office. If the plan is rejected for filing, it is returned to the RPF accompanied by a letter identifying the reasons for rejection. An RPF may be subject to disciplinary action by Foresters Licensing if they have repeatedly submitted inaccurate or incomplete THPs. The Forest Practices Act requires that the Board of Forestry undertake disciplinary actions against any RPF who has made any material misstatement in the filing of a THP (PCR 4583.5). Under CCR 1035.1, the rules state "The RPF who prepares and signs a plan is responsible for the accuracy and completeness of its contents."

Discussion

The THP review and approval process was the subject of extensive conversations with several of the interviewed groups. Several interviewees expressed concern that the current THP review and approval process did not provide sufficient time and opportunity for the public to review and comment on the THP. Their specific concern was the changes that occur during the plan review. Several interviewees noted that a THP might be substantially different in its final version compared to when it was originally submitted. They noted that substantial changes might occur during or following the second review of the THP, and that the public did not often have the opportunity to review these changes prior to the end of the public comment period. It was suggested that the public review period be extended to 10 to 15 days following the second review. Under the current standards, the director has 15 days following the preharvest inspection (PHI) to review the plan and receive public comment. Members of the CDF Forest Practice Inspectors group suggested that the public comment period should be tied to the date of the second review and not to the date of the PHI. They suggested that the public comment period be extended to 10 days after the second review, rather than 15 days after the PHI. The CDF Forest Practice inspectors group also suggested more time be allowed between the PHI and the second review. This would allow them more time to prepare field reports, as well as to receive the PHI reports from the other agencies involved.

The CDF Forest Practice inspectors also expressed concern that the three agencies assigned to the review teams (CDF, RWQCB, and the DF&G) did not have sufficient budget resources or staff available to adequately review THPs. They noted that the RWQCB attended only 15-20 percent of THP pre-harvest inspections, and that the DF&G only attended approximately 2 percent of the THP pre-harvest inspections in the Humboldt/Del Norte Ranger unit. The CDF inspectors noted that they typically had a caseload of 50

to 100 or more active THPs, and this greatly limited their ability to do on-site operational inspections when timber harvesting was occurring. They recommended that a caseload of no more than 40-50 active plans be assigned to each inspector. There are also no RWQCB THP representatives stationed in Eureka. Inspectors must travel from Santa Rosa to review plans in the north coast area of California.

Another concern raised by CDF and private RPFs was the timing of THP submissions. Due to seasonal constraints on obtaining northern spotted owl data, most THPs (and NTMPs and major amendments) are submitted in the second and third quarters of the year. Based on information from CDF in Santa Rosa, there were 265 submissions in the first and fourth quarters of 1998, versus 347 for the second and third quarters. This represents a 3 1% increase in submissions and creates a substantial burden on the reviewing agencies. The THP submission program should consider measures that help maintain an even flow of THP submittals throughout the year.

To assist in review of THPs, and to reduce the extreme variability in responses from RPFs, the CDF inspectors suggested that Question 2 of the cumulative effects section of the THP be rewritten They also suggested that RPFs need to provide a better description of impacts from the past THPs that were listed in the cumulative effects analysis. They also supported the use of other specialists during THP preparation and encouraged consultation with agency representatives during plan preparation.

Several members of constituency groups, including LTOs, suggested that the LTO should attend the PHI. Several RPFs and landowner representatives noted that the name of the LTO was not always known at the date of submission, and suggested that this might cause some difficulties.

Nearly all groups interviewed agreed that the timber harvesting process has become too cumbersome, creates too much paperwork, and should place more emphasis on site visits. Most agency representatives, as well as many other groups, supported the idea of less requirements for paperwork by the reviewing agencies, more field review during the plan review and approval stage, and more operational and post-harvest inspections. Many were concerned that the paperwork required by the current THP process was designed to address issues that might be raised during a judicial proceeding rather than to create an effective operational document. Several interviewees supported reducing paperwork by conducting more intensive pre-harvest inspections prior to THP approval.

Several large landowner representatives, the environmental community, and at least two agencies supported a more rigorous review of THPs and of active operations. Landowners felt that they conducted good operations that would stand the scrutiny of inspections, and encouraged more severe penalties for landowners who did not follow the regulations, including the institution of civil penalties.

The Board of Forestry rule-making process was not considered by most interviewees to represent true adaptive management. The rule-making relies primarily on political process where rule changes are proposed by CDF, other agencies, or the public, and are usually the result of public pressure. A true adaptive process relies on monitoring as the feedback loop, not politics. The periodic review and modification of the rule does not indicate the adaptive nature of the process. Some may question if the process as sensitive to modification as provided by an adaptive management system driven by monitoring.

To disseminate information more effectively to interested parties, many recommended that CDF post the THPs on an Internet website. Recommended items to post included: (1) a map of the area, including the watershed analysis area: (2) the names of the landowner and RPF in charge of the THP with phone numbers, email, and addresses; (3) the status of the THP (e.g., THP filed or not,

pre-harvest inspection completed, and any reports filed by agency review); (4) the CDF inspector in charge of the review; and (5) the THP. The use of the Internet would provide a central "clearing-house" of information for each THP, thus providing a status report for each THP during the THP process.

Recommendations

1. When known, have the LTO attend the PHI.

2. Extend the agency review period to a minimum of 10 days between the PHI and second review.

3. Increase the time for public comment following the second review to a minimum of 10 days.

4. Increase staff budgets for CDF, DF&G, DMG, and RWQCB to support more frequent attendance at PHIs and provide for periodic operational and post-harvest field inspections.

5. Encourage agencies to conduct more frequent inspections of active operations and conduct post-harvest inspections.

6. Support a THP review system that reduces unnecessary paperwork by reviewing agencies and provides more time for field inspection and reviews.

7. Provide sufficient agency staff time to support pre-consultation with RPFs during the plan preparation.

8. Put key THP information on the Internet that identifies the plan submitter, the RPF, the CDF inspector who is in charge of the plan review, and a copy of the THP.

9. Limit the case load for CDF inspectors to 40-50 active THPs.

10. The CDF should be allowed to impose civil penalties on the RPF, LTO, or landowner, similar to those imposed by the RWQCB.

11. Involvement of RPF in Implementation of THP

Background

Under the current FPRs for the Coast Forest District, the RPF is not required to be involved in the actual implementation of the THP except in some of the Southern Subdistrict counties. These counties have special rules that require the forester to be involved after the plan preparation and with the actual implementation of the plan.

There are typically three parties involved with THP planning, preparation and implementation. These are the plan submitter, who is usually the landowner or the timber owner; the RPF who prepares the plan on behalf of the plan submitter: and the LTO, who actually implements the plan on the ground and conducts the logging operations. For most large landowners, the LTO is either a direct employee of the landowner (or timber owner), or is a contractor hired by the landowner. In either case, a landowner's representative typically administers the THP through a contract to conduct the logging operation. This person may or may not be a RPF. Where "company loggers" are used by large landowners, these administrators often have direct control over the employees that give them the right to hire and fire, and to directly instruct logging personnel on how to conduct operations. In the case of a logging contractor, the person administering the logging contract and the THP for the landowner typically does not have the right to hire or fire the contractor's personnel. They would put themselves in jeopardy of liability laws if they attempted to directly instruct any of the contractor's employees on how to conduct the operations. These administrators typically review the conduct of operations to insure that they are in compliance with the contract and the provisions of the THP and required rules. They may have the right to tell a contractor's employee to stop what they are doing if it is in violation of the contract or the THP; however, these types of actions are generally taken through the chain of command by

reporting any concerns directly to the contractor or his or her foreman.

The regulations specifically require interactions between the plan submitter, the RPF, and the LTO. At CCR 1035, "Plan Submitter Responsibility," the plan submitter is required to insure that the RPF conducts any activities that require an RPF, and the plan submitter is required to provide the RPF preparing the plan with complete and correct information pertaining to legal rights, interest in and responsibilities for land, timber, and access at these affect the planning and conduct of timber operations. (CCR 1035, (a) and (b)) The plan submitter is also required to provide a copy of portions of the approved THP and approved operational amendments to the LTO that contain the general information, plan of operations, THP map, yarding system map, erosion hazard rating map, and other information deemed by the RPF to be necessary for timber operations (e). The submitter is required to disclose to the LTO through an on the ground meeting prior to start of any operations the location and protection measures for any archaeological or historic sites (g). It is the responsibility of the RPF who prepared the plan for the accuracy and completeness of its contents. (CCR 1035.1) The RPF must also, in writing, "inform the plan submitter(s) of their responsibility pursuant to Section 1035 of this Article, and the timberland owner(s) of their responsibility for compliance with the requirements of the Act and where applicable, Board rules regarding site preparation, stocking, and maintenance of roads, landings, and erosion control facilities." (CCR1035.1(b).)

The rules at Section CCR 1035.2 also specifically identify the interaction that must occur between the RPF and the LTO. This regulation requires that after the start of the plan preparation process, but before the commencement of operation, the responsible RPF or supervised designee familiar with on-site conditions must meet the LTO or their supervised designee, who will be on the ground and directly responsible for the harvesting operation, If requested by either the RPF or the LTO, this meeting is required to be on-site. The intent of an on-site meeting is to assure that the LTO is: (1) advised of any sensitive on-site conditions requiring special care during operations; and, (2) advised regarding the intent and applicable provisions of the approved plan including amendments.

At section 1035.3, "Licensed Timber Operator Responsibilities" are identified. The LTO is responsible for the work of his or her employees and to familiarize all employees with the intent and details of the operational and protection measures of the plan and amendments that apply to their work (b). The LTO is required to keep a copy of the applicable approved plan and amendments available for reference at the site of the active timber operations (c). The operator also must comply with the provisions of the Act, the Board rules and regulations, the applicable approved plan, and any approved amendments to the plan (d).

In addition to the regulations identified above, the Southern Subdistrict of the coast has special provisions for the involvement of the RPF during operations. Under CCR 913.8(b) (5) the rule states:

"The timber operator is responsible for carrying out timber operations as described in the plan. The plan submitter is responsible for retaining an RPF to provide professional advice to the timber operator and timberland owner on a continuing basis throughout the timber operations. The RPF or the designee of the RPF works closely with the timber operator to help assure compliance with the approved alternative prescription and the terms and specifications of the approved plan. The RPF or designee of the RPF is present on the harvest area sufficient hours each week to know the operations' progress and advise the timber operator. The RPF informs the timber operator of potential environmental impacts and the mitigation measures to be taken to minimize such impacts. The timber operator shall sign the plan and major amendments thereto, or shall sign and file with the Director a facsimile thereof prior to commencemen t or continuation of operation thereunder agreeing to abide by the terms and specifications of the plan. An RPF

may be responsible for the conduct of timber operations under contractual arrangements with the timber owner."

Under the requirements of this rule section, all operations conducted in Santa Cruz County require the advice and monitoring of the THP by an RPF. In the remainder of the Coast Subdistrict, an RPF must be directly involved with the implementation of the THP only when an "alternative regeneration method" is used as described under CCR9 13.8 (b). The RPF involvement identified above under CCR9 13.8 (b) (5) also applies in Marin County.

Discussion

Several interviewees stated that, in their opinion, a critical issue for effective application of the rules was active administration during THP operations. Several agency representatives, as well as representatives of the Monitoring Study Group, noted that problems on THPs were more common when RPFs were not actively involved with the administration of the plan as compared to operations where an RPF or other qualified administrator was directly involved. On larger industrial ownerships RPFs (or other qualified administrators) typically administered the plan and interacted on a frequent basis with the LTO. The LTOs, and most major landowners, supported the involvement of the RPF being involved during the operational phase of the THP. The LTO constituency group noted that when RPFs were involved in the administration of the THP, they typically monitored the plan once a week or more frequently, depending upon the conditions and the status of the operations. Typically, RPFs are more involved during the "start-up" phase of the plan. This is a critical time to identify the issues involved in the plan and to educate the timber fallers and equipment operators about these issues and other operational considerations.

Licensed Timber Operators (LTOs) are required to complete a training course before they can be issued a license to conduct timber harvesting and road construction activities. The Associated Loggers of California (ALC), a loggers trade association, assisted the state with the development of this training program and has initiated a training program of their own. Individual landowners have also initiated training programs. At least one company conducts training for their equipment operators using experienced erosion control specialists. Another company has initiated the "Pro-Logger" program for their logging contractors. This program, developed by the American Forest and Paper Association, is intended to improve the skills of the members' logging personnel.

The South of San Francisco constituency group indicated that there did not seem to be a high degree of resistance to the involvement of the RPF working with the LTO during operations. Both the agency representatives and the RPFs interviewed indicated that landowners felt this was a necessary cost to insure adequate and effective administration of the THP. These state agencies also indicated that this provided very effective application of the THP and rule requirements and that it increased their level of confidence that the provisions of the plan would be achieved. Small landowners interviewed by the SRP expressed concern that the THP plan process was already extremely costly, and the required involvement of an RPF during operations would just add to an already expensive process. Several small landowners also noted that they typically had the RPF administer the THP during the operational phase. Several of the state and federal agency representative's interviews supported a "cradle to the grave" concept, where the RPF would prepare the plan and then be actively involved in the administration of the plan during harvesting operations. This administration would be general oversight to provide advice to the LTO and to review the operations on behalf of the landowner or plan submitter to insure that the provisions of the plan and the regulations are being met. The logger's constituency group pointed out potential issues that might arise if the RPF was put in a direct supervisory role over any of the LTO's employees and

expressed concerns regarding liability and insurance issues.

Recommendations

1. The RPF (or an RPF) should be involved with the operational implementation of the THP. The RPF should visit the plan area frequently enough during plan implementation to insure the provisions of the plan and the rules are being adequately achieved.

2. The meeting between the RPF and the LTO, as required under CCR1035.2, should always be on site rather than just a paper review. This would insure better transfer of plan contents, and allow the RPF and the LTO to visit any critical or sensitive sites that might be present on the plan area. It would also allow the LTO and the RPF to review the flagging and painting designations so there is a clear understanding as to the requirements for protection measures,

3. When identified in the THP, the LTO should attend the preharvest inspection. LTOs should also be required to sign the final approved copy of the THP and all major amendments.

12. Involvement of Other Resource Professionals in THP Review and Implementation

The current rules and the THP review and approval process has several opportunities for the involvement of professionals other than the Registered Professional Forest (RPF) who is charged with the preparation and submission of the THP Under the current standards, the RPF (or his or her designee) is required to review the plan area for archaeological concerns. This must be done by an RPF or a qualified person who has been certified under an archaeological training course. This does not make the RPF an archaeologist, but allows the RPF to identify archaeological features and search for archaeologist and historic artifacts or other evidence. If the RPF discovers a significant site, a qualified archaeologist is then called in to assess, map and record the site. The RPFs may also map and record minor archaeological sites, There is no similar formal process for the involvement of outside geologists, watershed specialists, fisheries biologists, wildlife biologists, or botanists. (Although private consulting biologists are often used by RPFs for northern spotted owl consultation.) These professionals are usually called in on a site-specific basis depending upon the specific concernsrelative to the THP area and its surroundings. The foresters licensing law requires foresters to utilize the services of other resource specialists when the area of concern is outside the RPF's specialty. (PRC 752(b)) Under the current THP preparation, review and approval process, other specialists are often involved.

THPs are reviewed by a multi-disciplinary review team composed of CDF, DF&G, and RWQCB personnel. Representatives from the Parks & Recreation Department, and representatives from the county in which the THP was submitted, may also be involved in the review team upon request. The Division of Mines and Geology (DMG) serves as a consultant to CDF, is often involved in the review team, and reviews all THPs that are identified as having geologic concerns by the CDF following initial screening (First Review). Currently, there is uneven involvement of DF&G and RWQCB in the THP review process. DFG has stated they review less than 5% of the THPs submitted, and RWQCB reviews approximately 10-15% of the THPs submitted in north coastal California. CDF reviews all of the plans submitted, and requires field inspection for over 95% of all THPs submitted in the north coast area.

Resource specialists from the various state agencies are usually not actively involved in the preparation of the THP. Based on input from the agency representatives during the review, THPs are often modified (sometime significantly) to address issues that are raised during the plan review process. Currently there is no formalized process to involve agency representatives in a pre-

submission consultation. However, CCR 1033 requires that all THPs be complete and accurate to be accepted for filing. If a THP has significant geologic issues that are not identified by the RPF, the THP will be most likely be rejected for filing and CDF will require a geologic review by a consulting geologist before the THP may be resubmitted. Similar concerns may be raised for biological or botanical issues,

Discussion

Several constituency groups interviewed, including the environmental group, commented that RPFs needed to involve more outside resource professionals more frequently in plan preparation. Some interviewees were very critical of RPFs working under the assumption that they had sufficient knowledge to address all of the THP issues, when the plans reviewed by a multidisciplinary panel identified several significant issues that were not addressed in the submitted THP. Several interviewees also expressed concern that the state was often put in a position of being the RPF's and plan submitter's expert in the fields of fisheries, biology, geology, and botany, They felt these issues should have been addressed by the RPF prior to plan submission, and the lack of this information frequently resulted in extensive first review questions or plan rejection. While some interviewees felt that the state should not be wasting taxpayer's money by rewriting adequate THPs, some CDF representatives suggested that THPs would be better prepared if RPFs consulted with the state agencies (including CDF) about significant issues during plan preparation and prior to submission, This had mixed support from other interviewees, but seemed to have general (but not unanimous) support from the RPFs interviewed. Several RPFs noted that they already pre-consult with different state agencies prior to submission. This includes pre-consultation for northern spotted owls and other wildlife issues.

The constituency groups of other resource specialists encouraged RPFs to utilize other specialists prior to and during plan preparation. This included a recommendation from the geologist constituency group to have a geologist provide a broad, extensive overview of the area that will be included in the THP to identify any geologic hazards of instability. They felt that this would prevent the RPF from completing extensive fieldwork before a geologist was involved who might identify areas of geologic concerns after the THP was completed. Fisheries biologists also suggested that their involvement early in the THP preparation process could help identify any fisheries concerns on either a watershed level or on a site-specific basis. Watershed specialists expressed the need for a broad overview that would identify basin-wide concerns. This group was critical of the current cumulative effects analysis in that it only provided assessment for small (3-5,000 acres) areas, and did not consider the basin-wide issues. They felt a comprehensive watershed analysis was necessary in order to identify potential basin-wide issues such as sedimentation, LWD, temperature, etc.

Representatives from the state and federal agencies indicated that the RPF's should have continuing education so they have a basic understanding of other resources, and know when to contact other resource specialists. Independent and industrial RPFs stated that they often used other resource professionals, and that workshops were helpful, but should not be mandatory, Some interviewees felt that RPFs did not understand the complexity of riparian – stream ecosystems and some felt that RPFs did not seem to care how their THP affected ecosystems. The small landowners indicated that the more professionals are involved, the higher the cost of harvesting timber.

All of the constituency groups involving other resource specialists supported the concept of providing more continuing education and workshops to foresters regarding other resources. While it is not intended that foresters who take geology short courses will become geologists, RPFs will become more cognizant of the geologic processes. They then have a better understanding of when it may

be appropriate to call in a geologist to assist with THP preparation. An existing program to educate RPFs and other resource professionals on the watershed processes is the "Watershed Academy." This has been a joint effort of CDF and DF&G. There was support from interviewees to develop similar programs for geology and fisheries issues. Emphasis was placed on minimizing classroom-type lectures and emphasizing field oriented workshops.

Recommendations

1. Formalized programs should be developed between CDF, DMG, and professional organizations such as California Licensed Foresters Association (CLFA) and Society of American Foresters (SAF) to help develop more intensive training programs for geologic issues, fisheries issues, and watershed considerations. The Board of Forestry or Foresters Licensing could act as a coordinator for this program.

2. RPFs need to become more aware when other resource specialists are required in the THP process. This is currently required by the licensing regulations at CCR 1602 (b), but there may be a need to place more emphasis on this requirement. To insure an adequate review of resource issues, agency specialists should monitor the involvement of other resource specialists.

3. Although there may be numerous resource specialists involved in the preparation of a THP, the RPF should maintain the role of the coordinator and principal author of the THP document. It is the RPF who is typically hired by the landowner, or employed by the company to be the principal resource manager of a forested property. The RPF usually has a long-term relationship with the property Thus, he or she is in the best position to coordinate and implement plans and practices on the ground in coordination with the other resource professionals, as well as with the LTO and the landowner.

4. Develop some type of incentives for RPFs to attend different types of workshops; free tuition, certificate of attendance, published list of attendees, etc. Do not make them these programs mandatory. Improve the quality of the workshops, so that all RPFs would enjoy benefit from going to them.

OTHER PANEL RECOMMENDATIONS

13. Rule Organization

Background

The current Forest Practices Act was passed in 1973 as the "Z'berg-Nejedley Forest Practices Act of 1993." Rules were then promulgated in 1974. Since their creation, the Forest Practices Act and the FPRs have undergone continuous change. Various sections of the rules have been changed annually, based on input to the Board of Forestry, and at times, to legislative and judicial requirements. The rules have also witnessed substantial changes in response to significant events such as the release of the 208 Forest Practice Review report in 1987. Another set of significant rule changes occurred in the early 1990s following the adoption of the sustained yield requirements. As a result, these rule modifications have resulted in a set of regulations that are often very difficult to understand, and are disorganized.

Discussion

Numerous constituency groups commented on the difficulties using the FPRs and said that the rules needed to be reorganized to make them more user-friendly. One recommendation was to incorporate all the rules that pertained to a particular title or heading even though the rule might exist elsewhere in the regulations. While this may create some redundancy, it would make the rules easier to use and better identify all pertinent rule

sections without searching through seemingly unrelated rules.

An example of needed rule reorganization is the requirement in the county rules for the Southern Subdistrict of the Coastal Forest District that requires RPF interaction with the LTO during operations. Instead of being listed under the section for county regulations (or under RPF responsibility at 1035.1), this is listed at 913.8 within the Silvicultural Rules. Another example is the requirement for designing culverts to withstand a 50-year return interval storm. This requirement is not included under the section entitled "Watercourse Crossings" at CCR923.3, but instead is included at CCR 923.4 under "Road Maintenance." While there may be good reason to include this requirement under the "Road Maintenance" section, it should also be listed under the "Watercourse Crossings" section.

Recommendations

1. Make the current Forest Practice Rule organization more efficient and user-friendly. For example, reorganize and condense the exemptions, e.g., centralize all road construction and maintenance requirements by each road type (permanent, temporary, and abandoned). The "standard practice" must be made clear, again separating out and centralizing the exemption language.

14. Additional Research Needs

The investigations of the SRP demonstrated the need for more in-depth research. This includes the following issues:

- Sediment study of Class III watercourses: this should include an analysis of post-harvest condition of Class IIIs that are included in units that have been clearcut and burned, and clearcut units that were not burned.
- LWD recruitment mechanisms in young-growth stands: most studies to date are based on old-growth standards. No analysis of recruitment or the functionality of mature young-growth as LWD has been done.
- Review of temperature and humidity regimes pre- and post-harvest: to monitor the effectiveness of the rule standards, monitoring should be established to monitor the effectiveness of the WLPZs for temperature and humidity.
- Water Temperature Studies: physiologically-based site-specific water temperature studies are needed for each watershed area. Knowledge of temperature tolerance and sublethal stress responses of salmonids is far from adequate to define safe thermal limits and determine potential thermal impacts for each THP. Key factors that affect thermal requirements and stress include food availability, DO, previous exposures to stressful situations, innate metabolic rate (i.e., hatchery fish have lower metabolic rates that their wild counterparts). Until a more site-specific physiological approach is used in conjunction with a watershed analysis, determining site-specific thermal requirements and impacts on salmonids as a result of timber harvesting will remain in the realm of conjecture.
- Sediment and Salmonid Habitat: We currently lack a solid quantitative understanding of the relationships between anthropogenic increases in sediment delivery to streams and changes in biologically significant channel characteristics. Such relationships must be understood before an accurate assessment can be made about the effects on salmonid populations of increased sediment delivery to stream channels. We propose a research program that combines hillslope and fluvial geomorphology with salmonid population biology and modeling to link sediment loading, salmonid habitat, and salmonid population response. This regional research program, which would be conducted in a variety of watersheds in the MOA area (see Figure 1), is needed to determine the following: (1)

for each type of channel used by salmonids, those indicators or metrics of salmonid habitat (e.g., V*, pool frequency, permeability) that are both sensitive to sediment supply and clearly related to salmonid survival at one or more life stages: (2) what degree of change in habitat indicators from a reference or pristine state will result in an unhealthy population (in terms of population size, stability, and resilience to disturbance); and (3) what level of anthropogenic (relative to natural) sediment delivery will produce changes in channel conditions that would be expected to result in an unhealthy salmonid population.

15. Social and Economic Impacts

The results of successful salmonid rehabilitation are obvious. Healthy salmon runs mean a return of commercial and sport fishing and the secondary support jobs that support a diverse economy. Many consider salmon to be the symbol of the coastal west and an indicator of the health of the overall ecosystem.

When species are listed under the ESA, economic issues cannot be considered. However, under both CEQA and the FPRs the economic and social implications of a project must be considered. In the FPRs under PRC 4513 (c) it states:

"The legislature declares that it is the policy of this state to encourage prudent and responsible forest resource management calculated to serve the publics need for timber and other forest products, while giving consideration to the publics need for watershed protection, fisheries and wildlife, and recreational opportunities alike in this and future generation,"

This section also states at (d):

"It is not the intent of the Legislator by enactment of this chapter to take private property for public use without payment for just compensation in violation of the California and United States Constitutions."

Landowners expressed concern over the cost of implementing the FPRs and the potential loss of the trees and land to over-regulation. Members of the fishing community, as well as the environmental groups, stated that they felt as though the impacts to salmon had essentially caused a taking of the fishermen's livelihood and had nearly extirpated salmon from their native habitat. They believe impacts from logging are at least partially to blame.

Regardless of blame, there is currently a reduction in the number of salmon and steelhead on the north coast and the state and federal governments are spending millions to restore the runs. The SB 271-grant fund program is to spend up to $8 million per year for six years for salmon restoration, and the federal government is considering spending $25 million/year for one to several years for salmon restoration.

The impacts to landowners resulting from the proposed rules contained herein will be variable, depending upon how many stream zones they have on their property. There will be additional costs associated with upgrading roads that will most likely be realized during harvesting operations. If our proposed WLPZ rules are enacted, there will be additional cost from deferred harvest of timber, especially in Zone A of the WLPZ for Class I watercourses. The largest impact to landowners will be from the retention of ten large recruitment trees per acre and the retention of all the downed trees in Zone A of both Class I and II watercourses. Assuming retention of ten 32-in DBH trees per 100 m of stream channel, a 1,000-ft section of a Class I watercourse would have approximately 36.4 MBF of LWD recruitment trees. Using $500 as the average stumpage value, the timber retained on this 1,000 ft of stream would have a value of $18,200.

There will also be other costs the landowners will experience over time. The water quality attainment strategy for the Redwood Creek TMDL by the North Coast RWQCB for the 107,000 acres of

private lands in the Redwood Creek basin requires treatments to roads, increased road maintenance, and reduced timber harvesting in the Class I and II watercourses. They estimated the assessment cost for road construction and road maintenance for the Redwood Creek Basin at $18.6 million, and the lost revenue for timber harvesting at $16.4 million, These are the net present values of costs, discounted over a 25-year period for road maintenance and lost timber revenue, and a 12-year discount period for road construction (NCR-WQCB 1998). This represents a cost of $327 per acre.

Several of the landowners interviewed urged the development of incentive-based regulations that would reward the good land stewards and establish penalties to penalize the bad with civil or administrative fines. The small landowners noted that there was no incentive in the regulations to encourage the development or maintenance of habitat for threatened species. All the rules currently in place penalize a forest landowner for maintaining habitat and attracting species to their property. There should be some incentive (such as more regulatory certainty) for these land owners that maintain good habitat condition.

It is also important to consider the impacts to the diversity of ownerships. Small, non-industrial landowners represent approximately 40% of the private land in the north coast region, and often have different land management objectives than the larger industrial owners. The smaller owners do not have to supply a mill with logs, so they may be under no pressure to harvest; however, to some small owners their property is their sole source of annual income. The variability in management approaches between the large and small landowners manifests in a diversity of forest structures across the landscape.

One thing that is consistent among landowners is the desire to protect their investment. Large landowners expressed the need to support continued timberland investment in California. One small landowner was more blunt. He had purchased his property about ten years ago and had an NTMP completed a few years ago. He said he wanted to be a good land steward but he had to protect his investment, and would do whatever was necessary This might include subdivision or sale to a large industrial owner. Several other small owners expressed similar concerns.

Recommendation

Nearly all the constituency groups interviewed supported incentives to landowners to improve and maintain salmonid habitat. This included the use of tax deductions, conservation easements, and restructuring of the federal tax codes to allow expensing rather than amortizing capital road expenditures such as culvert replacements. A program of incentives must be developed to allow the value of the permanently designated standing and downed trees to be deducted from the timber owner's yield or other state taxes. The valuation of these trees could be based on the yield tax value schedules, and would be claimed when harvesting is completed for the associated harvest unit adjacent to the WLPZ. This may also help encourage landowners to include watercourse protection zones in conservation easements. The benefit of providing landowners tax credits against the retained recruitment trees will encourage the retention of important habitat features and is likely to prevent legal proceedings for property taking. If the state and federal governments are going to pay millions for salmonid rehabilitation, then tax credits for the retention of key habitat features may be a reasonable step.

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