United States Department of Agriculture | Forest Service Pacific Southwest Research Station | Redwood Sciences Laboratory | 1700 Bayview Dr. Arcata CA 95521

24 May 1999

Hon. Fred Keeley
Speaker pro Tem
Assembly of the California Legislature
State Capitol
P.O. Box 942849
Sacramento, CA 94249-0001

Dear Assemblyman Keeley,

Thank you for your interest in the topic of cumulative watershed impacts. I have been working with this issue for more than a decade as a research geologist with the USDA Forest Service. Some of my research has focused specifically on issues relevant to assessment of cumulative impacts on private and state lands in California, and some of this work has been funded by the California Department of Forestry and Fire Protection. I have also worked with Federal agencies in the development of watershed analysis methods in support of the Northwest Forest Plan, and in doing so I have become familiar with logistic, sociological, and institutional problems involved in cumulative impact analysis. Most recently, I have been asked to advise staffs of the EPA, the Water Quality Control Board, and the National Marine Fisheries Service on provisions of particular Timber Harvest Plans, Sustained Yield Plans, and Habitat Conservation Plans as they relate to cumulative watershed impacts.

You asked me the questions, “As currently implemented, are existing California forest practice rules effective in preventing cumulative watershed impacts, including flooding?” and “What kind of measures might improve the effectiveness of forest practices rules for avoiding forestry-related cumulative watershed impacts?” I have enclosed a brief paper written in response to these questions. My discussion here draws heavily on the reviews of THPs and SYPs that I have prepared for state and federal agencies, on my experiences with development of watershed-scale assessment methods, on my own research, on research published by others, and on numerous discussions with state and federal agency personnel.

I hope the enclosed discussion is useful to you, and please let me know if you have any questions.

Sincerely,

Dr. Leslie M. Reid

cc: Dr. Garland Mason, USDA Forest Service

Forest Practice Rules and cumulative watershed impacts in California

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Summary

1. There is nothing mysterious about cumulative impacts. Most environmental impacts are influenced by multiple land-use activities, so most impacts are cumulative impacts. Projects must be evaluated to understand how they will influence existing or potential future impacts, and this is the essence of a cumulative impact assessment. Examination of recently approved THPs and SYPs indicates that plans are being approved that do not contain technically valid cumulative impact assessments.

2. As currently implemented, California Forest Practice rules have not prevented the cumulative watershed impacts that led to the recent listing of multiple northern California streams as impaired by sediment under section 303(d) of the Clean Water Act.

3. Recent studies demonstrate that current Forest Practice rules are not adequate to prevent forestry-related changes to the production and transport of sediment, water, and woody debris in watersheds. Changes in these "watershed products" are the most common causes for downstream cumulative impacts.

   - *As currently implemented, the Rules are not sufficient to restrict excess sediment production from logging-related activities to levels that will not accelerate reservoir sedimentation, increase flooding by channel sedimentation, and degrade water quality. Several studies have shown excessive landsliding rates on recently logged slopes, and recent monitoring indicates that turbidity levels during and after logging can be out of compliance with water quality regulations.*
   - *The Rules are not sufficient to maintain the composition, size, and quantity of in-stream wood necessary to protect channels from increased disruption by debris flows or gullying or to provide adequate habitat for fish and wildlife.*
   - *The Rules are not sufficient to prevent pervasive hydrologic changes due to the maintenance of immature vegetation cover over large portions of watersheds.*

3. A variety of measures could improve the ability of Forest Practice Rules to avoid cumulative watershed impacts. Of these, the most effective might include:

   - *A provision allowing regulation of the rate of logging in a watershed*
   - *Improvement of cumulative impact assessment methods, including a provision for a preliminary watershed assessment to be done by interagency staff. This assessment would identify issues of concern, the impacts affecting them, and the causes of those impacts. The watershed assessment would provide the background information needed to analyze cumulative impacts of future projects anywhere in the watershed and would provide guidance for carrying out such analyses.*
   - *Giving authority to staff of relevant departments (i.e., Water Quality Control Board, Department of Fish and Game, etc.) for decisions falling within the purview of those departments' areas of expertise.*

Introduction: the nature and cause of cumulative watershed impacts

The concept of "cumulative watershed impacts" is confusing to many because it seems very abstract. However, the word "cumulative" simply indicates that the impact is influenced by multiple activities, as are most environmental impacts. In reality, then, almost all off-site environmental impacts are cumulative impacts. When impacts involve the transport of water, sediment, or woody debris through a watershed, they are referred to as "cumulative watershed impacts." Cumulative watershed impacts are of considerable concern because they are responsible for much of the damage to property and to public-trust resources that occurs away from the site of a land-use activity.

Watershed impacts can accumulate through space, as when sediment from multiple upstream sources begins to fill a reservoir. They can also accumulate through time, as when first-cycle logging depletes streams of large woody debris, allowing mudflows caused by second-cycle logging to travel farther downstream and grow to more destructive sizes. Cumulative impacts can also result when a single resource—a salmon population, for example—is impacted by multiple mechanisms, such as habitat modification, degraded water quality, and construction of dams. In most cases, the severity of an impact increases as its duration increases, so prolonging the duration of an impact is itself a cumulative impact on the affected resources.

An environmental impact cannot be effectively prevented or managed without understanding the variety of influences that contribute to it, and the likely effects of a proposed activity cannot be assessed without understanding existing levels of impact and its causes. The intent of a cumulative impact assessment is to determine how the potential influences of an activity will interact with those of other activities in a watershed. It is not a special kind of assessment; it is simply an environmental impact assessment that places the planned activity in the context of the surrounding activities and existing conditions in the watershed. If the cumulative impact of concern is flooding, for example, a potential project might be evaluated to determine how it will influence storm runoff and downstream sedimentation and to determine whether the resulting changes, *in combination with other past or likely future changes*, will contribute to downstream flood damage. Without a mandate to evaluate cumulative impacts, assessment for such a project would likely conclude that the project, considered in isolation, would have only a small influence on storm runoff and downstream sedimentation. Without a cumulative impact analysis, the project appears to be benign: *by itself*, the project could not cause a flood, even if the combination of similar past projects throughout the watershed has already caused increased flooding, and even if the proposed project would further increase the flood hazard.

Because impacts can accumulate through time and space, they may take a long time to become evident, and they may occur a long distance from the activities that generate them. For example, landslides high in a watershed can introduce gravel into streams, but it may take decades for that gravel to be washed far enough downstream to become a problem at a particular site. By the time the impact becomes evident, it is too late to solve the problem. Land-use management for effective control of cumulative impacts must therefore be proactive: problems must be averted before they become irreversible. Effective oversight of land-use activities therefore requires effective assessment of whether proposed activities will contribute to aggravation of environmental impacts.

Question: As currently implemented, are existing California forest practice rules effective in preventing cumulative watershed impacts, including flooding?

Several studies carried out recently in northwest California have demonstrated that cumulative watershed impacts have occurred despite the continued implementation of California's Forest Practice Rules. In Bear Creek watershed, for example, a survey of recent landslides showed that rates of

landsliding on areas logged in the previous 15 years is about 9.6 times higher than rates on lands with forests older than 30 years (PWA 1998a, Reid 1998, Reid 1999). As currently implemented, modern forest practice rules thus are unable to prevent nearly a 10-fold increase in landsliding rate in this watershed. Results from nearby watersheds show similar increases by factors of 3 to 13 (PWA 1998b, Michlin 1998, PWA 1999). In each case, such landslides were found to be the major source of sediment in the watersheds.

Additional information suggests that even in the absence of major landsliding, the implementation of current forest practice rules can be associated with increased turbidity levels in streams. Results of a monitoring program in northwest California, for example, suggest that logging and associated road use have resulted in a five-fold increase in turbidity over natural levels at some sites (Reid 1999), thus generating turbidity levels that are out of compliance with objectives of the Basin Plans that had been designed to satisfy requirements of the Clean Water Act. Likely sources for this excess sediment include winter traffic on logging roads, minor landsliding, and destabilization of small channels.

Increased sediment loads are a major influence on downstream cumulative impacts of concern in northwest California and elsewhere. Such impacts include:

- *Harbor sedimentation*
- *Modification of estuary habitat important to chinook salmon*
- *Sedimentation of oyster farms*
- *Reduction of channel conveyance and aggravation of flood hazard*
- *Infilling of channel pool habitat important to coho salmon and steelhead trout*
- *Infilling of reservoirs constructed for flood control, water supply, and power generation*
- *Water quality degradation resulting in constraints on domestic and agricultural use*
- *Water quality degradation resulting in damage to aquatic ecosystems*

Where these or similar problems exist, any additional contribution of sediment above naturally occurring background rates contributes to an already significant cumulative impact. That such cumulative impacts already exist is evident from the recent listing of more than 20 northern California waterways as impaired by excess sediment under section 303 (d) of the Clean Water Act.

Changes in the amount of woody debris in channels also can result in downstream cumulative watershed impacts. Woody debris is a critically important component of streams in forested areas. In the smallest streams, logs act as check-dams that store sediment eroded from hillsides. When landslides occur, the wood catches much of the sediment before it reaches larger channels. Where a landslide triggers a mudflow, abundant woody debris just downstream of the initiation site may halt the debris before it reaches a larger channel. On larger channels, wood also provides an important element in the habitat of aquatic organisms. In addition to creating pool habitat for salmon and trout during the summer, large pieces of wood pond water and create refuges for fish during winter floods. Wood must be of the appropriate distribution of sizes and species if it is to function properly in a stream system. Conifer logs are generally more decay-resistant and so are more effective in channels than riparian hardwoods, and large logs are more effective than small ones. The progressive loss of large pieces of coniferous wood from streams due to continued logging of riparian zones and continued salvage of logs from channels has led to widespread changes in channel form and to impaired aquatic habitat quality.

Current forest practice rules allow these cumulative impacts to increase in severity in part because specified buffer strip widths are too narrow to allow sufficient recruitment of large pieces of wood and because logging is allowed in buffer strips. Further, the lack of any requirement for buffer strips around the smallest, steepest channels will eventually result in the complete loss of full-sized

wood at these locations when the residual old-growth pieces eventually decay. This loss is likely to provoke destabilization of these channels and increase the destructiveness of landslides and mudflows.

A third important mechanism for downstream cumulative watershed impacts is hydrologic alteration. Forests influence runoff by intercepting and evaporating rainfall before it hits the ground, by extracting water from the soil and evaporating it through foliage, and by slowing rates of snow melt. Data from Caspar Creek, California (Ziemer 1998, Reid 1998) show that logging of this second-growth redwood forest has increased flood peaks in completely clearcut watersheds by an average of 27%, and that the effect is proportional to the amount of forest cover removed in the watershed. Work in Oregon suggests that similar effects may occur where removal of forest canopies accelerates snowmelt when warm rain falls onto a snowpack (Harr 1986). Many of the most destructive floods in California have resulted from rain-on-snow events. The presence of roads associated with logging and other activities also affects watershed hydrology by increasing both runoff volume and speed.

In comparison to recently logged land, then, the presence of forest vegetation is expected to decrease overall runoff volumes, decrease average soil moisture levels, and decrease flood peaks in some areas. These conditions are important in controlling the composition and dynamics of downstream aquatic ecosystems. High peak flows and increased runoff volumes increase the depth and duration of scour in stream gravels, thus destroying salmon redds (which are the "nests" that salmon dig in stream channels to protect and nurture their eggs). High peaks and increased runoff also contribute to accelerated bank erosion and pervasive modification of channel forms. Flooding damages downstream properties, lowering property values, and accelerated channel migration provoked by high flows can undermine and destroy structures. The magnitude of the hydrologic changes depends on the proportion of a watershed that is in hydrologically "immature" condition. In timber lands, this proportion is controlled by the rate of cut in the watershed, but there is no provision in the California Forest Practice Rules for regulating the rate of cut or extent of roading in a watershed.

Examples

The mechanisms of change described above—alterations in the production and transport of sediment, wood, and water—interact to cause downstream cumulative impacts. Such impacts are difficult to comprehend in the absence of concrete examples. For illustration, we will consider three kinds of cumulative watershed impacts of concern in California and elsewhere: reservoir siltation, flooding, and degraded water quality.

In the case of reservoir siltation, the impacts fall on those who depend on the functioning of the reservoir. As reservoir capacity decreases, water available for domestic and agricultural use decreases; the level of protection from flooding decreases; and water available for dry-season power generation decreases. If these functions are to be maintained at levels intended by the original design, new reservoirs would need to be constructed. Accelerated reservoir siltation rates (i.e., rates above those expected when the reservoir was constructed) reflect the combined inputs of sediment from land-use activities throughout the upstream watershed. The cost of accelerated erosion is borne by the taxpayers and utility and irrigation district customers who must pay for increased water treatment costs and for development of new water sources. Currently, Forest Practice Rules are designed to ensure that practices are generally used that are known to be less erosive than others. However, the studies cited above indicate that even the less erosive practices can result in significant sediment inputs. Where any increment of accelerated erosion aggravates an already existing impact, adequate regulation would require that a proposed activity not contribute further to the existing problem. This approach is similar to that being conducted under voluntary agreement in the Mattole watershed. In this area, Timber Harvest Plans (THPs) are intended to be conducted according to a "zero net discharge" strategy: the additional

sediment contributed by a THP is intended to be mitigated by rehabilitation of existing erosion problems so that the net effect of the activity is to promote—or at least not prevent—recovery.

Increased flood hazard can result from upstream land use activities in several ways. Decreased storage potential due to siltation in flood-control reservoirs can increase downstream flood risks; increased upland erosion can cause sedimentation in downstream channels, thereby decreasing flow capacity and increasing flood frequency; and altered hillslope hydrology can generate more runoff in a shorter period and so increase flood flows. Costs of increased flood hazard are borne by those impacted by the flooding, by consumers who depend on goods produced from lands impacted by flooding, and by taxpayers who underwrite federal and state provisions for emergency funding. In the case of altered runoff, the size of the change depends on the proportion of the watershed over which runoff has been altered. Currently, the Forest Practice Rules contain no provision for ensuring that the proportion of a watershed's area that is logged in a given period is low enough to ensure that flood hazard is not significantly increased in areas susceptible to such changes.

Increased stream turbidity increases water treatment costs for domestic use, prevents some agricultural and recreational uses, and decreases habitat quality for aquatic biota. Costs are thus borne by utility and irrigation district customers, downstream water users who must find alternative water sources, and those who depend on aquatic resources for their livelihoods, such as recreational service providers and the fishing industry. Current Forest Practice Rules do not provide for maintenance of buffer zones around Class III channels as "filter strips" to keep surface erosion from reaching channels, and existing provisions for road-surfacing standards and winter road use continue to permit significant erosion from road surfaces. In this case, too, provisions for controlling rate of cut in a watershed may be necessary for reducing chronic turbidity to levels that will not impact beneficial uses of water.

Question: What kind of measures might improve the effectiveness of forest practices rules for avoiding forestry-related cumulative watershed impacts?

To identify changes that might be useful for avoiding forestry-related cumulative watershed impacts, it is first necessary to understand what is causing the current problem. Over the past two years I have, at the request of various state and federal agencies, examined two Sustained Yield Plans (SYPs) and portions of six proposed and recently approved THPs. I have also reviewed the California Department of Forestry's official responses to agency comments on several of these plans, I have reviewed numerous supporting documents that provide insight into aspects of the problem, and I have discussed the issues at length with state and federal agency personnel. The material I have reviewed suggests that causes for the problem lie in three general areas. First, in the cases I examined, the standard Forest Practice Rules were not protective enough to avert cumulative impacts. Second, cumulative impact evaluations submitted with the THPs and SYPs I examined did not adequately evaluate the potential cumulative impacts of the plans, so that the standard rules could not be modified effectively to avert cumulative impacts. Third, the expertise available in state and federal agencies did not appear to be appropriately employed during the review process.

Aspects of the first problem have been outlined above in the discussion of cumulative impact mechanisms. If Forest Practice Rules were more capable of preventing accelerated erosion, modifications to woody debris loads, and watershed-scale hydrologic change, cumulative impacts would be less likely, even in the absence of other measures. Appropriate changes might include requirements for:

- *Increased riparian buffer-strip widths*
- *No-cut zones within buffer strips*

- *Buffer strips on small channels*
- *Long-term maintenance commitments for all parts of the road system*
- *Discontinuing use of certain gravel-surfaced roads during periods of wet weather*
- *Regulation of silvicultural methods on slopes susceptible to landsliding even if the slopes do not already show signs of landsliding*

In the case of both sediment production and hydrologic change, some impact from forest land use is inevitable. In these cases, effective management for cumulative impact prevention would require that the intensity of land use in a watershed be maintained below the level at which the resulting impacts are no longer acceptable. Such an approach would require that the Forest Practice Rules include provisions that:

- *Allow regulation of the rate of logging in a watershed*
- *Allow regulation of the density of roads in a watershed*

Without such provisions, standard rules would need to be excessively protective to ensure that incremental additions are not damaging even when use intensities are high. In other words, some accelerated sediment input and hydrologic change is tolerable from individual plans as long as it is possible to ensure that cumulative inputs are below a damaging level. If no such assurance can be made, then the standard for individual plans must be high enough to assure that a damaging level is not attained even at the maximum intensity of activity. It is interesting to note that regulation of cutting rates in watersheds would also lead to a more stable employment base in timber-based communities by reducing the "boom or bust" fluctuations that now impact them, and would contribute to the goal of producing a sustained yield of forest products.

The second problem is that of cumulative impact analysis. Current rules for THPs require that a registered professional forester (RPF) fill out a checklist that discloses whether the RPF expects a plan, when mitigated, to contribute to a significant cumulative impact, and require the RPF to provide a narrative that explains the RPF's opinion. Examination of recently prepared THPs, however, indicates that the analyses do not adequately identify existing impacts in and downstream of the watershed, do not adequately describe the causes of those impacts, and do not adequately evaluate the potential influence of the plan on those impacts and impact mechanisms. In some cases, plans located in watersheds listed as sediment-impaired under section 303(d) of the Clean Water Act do not even indicate that a significant cumulative impact is already present in the watershed. In other cases the plan's influence is severely underestimated, despite clear evidence of significant impacts from previous, nearby plans. The problem here appears to be four-fold: there is little guidance for what constitutes a valid impact assessment; there is a directive that "no actual measurements are intended" for the analysis, thereby making it impossible for effective analysis to be carried out; the areas of expertise required for carrying out valid analyses are not well represented among the RPFs who prepare the analyses or among the California Department of Forestry and Fire Protection (CDF) staff who review those analyses; and there is no established mechanism for learning from the outcomes of past decisions.

To understand the potential solutions to this problem, it is first necessary to understand what would constitute a useful cumulative impact analysis. The objective of such an analysis is quite simple: we want to know whether a plan will make impacts better or worse. The information needed to make such a judgment is also relatively simple: we need to know what the impacts of concern are, how those impacts are generated, and whether the environmental changes caused by the proposed activities will add to the effects of existing impact mechanisms or will diminish those effects.

Clearly, much of the information required for such an analysis consists of background information that will be the same for any plan in a watershed: 1) identification of the impacts of concern and 2) analysis of how those impacts are generated. The only information that is specific to a project is

3) an analysis of how a proposed project will influence impact mechanisms. This distinction suggests that a fundamental change in the existing approach might make cumulative impact analysis both easier and more effective: a preliminary assessment could be carried out in each watershed by those with appropriate expertise to address the first two tasks, and a later analysis to address the third task could be carried out by an RPF as each subsequent plan is proposed. This approach is similar to that already instituted in Washington State for design of "best management practices," although the Washington approach does not incorporate cumulative impact analysis.

The first analysis could be carried out by an interagency, interdisciplinary team. Since many of the areas of expertise most relevant for impact assessment are represented most strongly in departments other than the CDF, and since the results of such assessments would be relevant to many planning and regulatory needs beyond those pertinent to forestry, it would seem that such analyses might best be carried out under the aegis of the California Resources Agency (CRA) itself, rather than by the CDF. The watershed analysis would first identify the issues of concern in the watershed and the mechanisms by which impacts to each issue are likely to occur. Kinds of practices would be identified that have aggravated or ameliorated impacts in the past. Each issue would be evaluated over the temporal and spatial scale relevant to that issue, and the method for evaluation of each issue would be determined by the nature of the issue. Influences of non-forestry land uses would also be evaluated. Measures that would be needed to make such an approach possible include provisions that:

- *A preliminary watershed assessment be done by interagency staff, possibly under the aegis of the California Resources Agency*
- *A document be prepared to provide guidance for watershed assessment*

It is important that each watershed assessment

- *Be carried out by those with expertise in the appropriate disciplines, including geomorphology, hydrology, fisheries biology, and others, as needed*
- *Incorporate analysis of each issue at the appropriate spatial scale for that issue*
- *Incorporate analysis of each issue at the appropriate temporal scale for that issue*
- *Employ appropriate analysis methods for each impact mechanism, including the use of actual measurements where appropriate*
- *Also evaluate the effects of non-forestry land uses in the watershed*

Results of the watershed assessment would then provide both context and guidance for subsequent project-based cumulative impact analyses.

The second stage of cumulative impact analysis would be carried out by RPFs for individual THPs. These analyses would simply show how the proposed plan fits into the context provided by the watershed assessment. For example, if the watershed assessment found that high water temperatures are an issue in downstream reaches and that the current distribution of riparian stand ages is largely responsible for the problem, the analysis for a THP would use methods suggested by the watershed assessment to evaluate how the proposed silvicultural activity would influence riparian cover. Alternatively, if the THP incorporates only those practices determined by the watershed assessment to have no effect on downstream temperatures, no analysis would be needed for that issue. Equivalent approaches would be taken for the other issues determined by the watershed assessment to be of importance in that particular watershed. Such an approach would require a provision that

- *Project-level cumulative impact analyses be guided by the findings of the watershed assessment for the relevant watershed*

Several measures would facilitate such an approach. Currently, some THPs are unnecessarily long (incorporating as many as 600 pages), and some include multiple copies of particular background documents. Copies of THPs can be obtained for review at a price of about 12 cents per page, bringing the total cost for procuring a copy to as much as $70. In addition, there appears to be little linkage between nearby THPs; there is no provision to ensure that measures found necessary for one plan be applied to later, adjacent plans. Benefits arising from outside review of one plan are thus wasted unless the same reviewers make the same effort to make the same comments on each adjacent plan. Further, there is no provision to determine whether the decisions made on a plan turn out to be appropriate, so it is very difficult to improve the decisions being made. These problems could be addressed by provisions that:

- *Electronic copies of THPs and SYPs be made available on an internet web-site. This was done successfully for the recent SYP filed by Pacific Lumber Company.*
- *A library of relevant background materials be established at CDF stations where THP reviews are carried out. Once a document is on file with the station, subsequent plans and comments could incorporate the document into the official record by reference instead of having to provide a copy for each THP. This provision would also make it unnecessary to include a copy of the same watershed assessment for every plan in the watershed.*
- *Any special requirements and concerns identified for past THPs located nearby be described in subsequent THPs*
- *Designated impaired watersheds be recognized to already be undergoing cumulative impact so that the standard for compliance with regulations is necessarily different.*
- *The outcomes of previous decisions be evaluated to determine whether the decisions were appropriate. This might be done by expanding the function of the THP completion inspection to include assessment of particular outcomes identified to have been important. Additional inspections for particular influences could be carried out after large storms.*

Together, these measures would facilitate continuous improvement of decision-making by improving access to outside expertise and by allowing the lessons learned from past plans to be applied to future plans in the area.

The third problem that restricts the ability of the Forest Practice Rules to manage cumulative impacts is the apparent failure of the current system to make adequate use of available expertise. Examination of official responses to comments and to non-lead-agency concerns suggests that sources of information from outside CDF are discounted in the THP approval process: there seems to be a general sense that information contributed concerning likely impacts is to be argued against rather than to be learned from. This problem may well arise from the “cultures” of the agencies involved, wherein some CDF staff members perceive their primary mission to be to facilitate production of maximum sustained yield of high-quality forest products, Water Quality Control Board staff perceive their mission to be protection of water quality, and Department of Fish and Game staff perceive their mission to be maintenance of fish and wildlife populations. Some of these goals conflict with one another.

Decision-making for THPs and SYPs is the responsibility of the CDF, yet the most generally valued and utilized “commodity” produced by California’s forest lands is clean water. The value of this commodity decreases as its quality decreases. The CDF holds most the state’s official expertise in silvicultural issues; the Water Quality Control Board holds much of the expertise in water quality issues; and the Department of Fish and Game holds much of the expertise in fish and wildlife issues. Contention over THP approval generally rests not on the silvicultural aspects of a plan, but on the plan’s influence on public trust resources such as water, fish, and wildlife. Perhaps, then, lead-agency responsibility for

approval of THPs and SYPs lies with the wrong agency. If lead-agency responsibility were shifted to the California Resources Agency itself, the state's technical expertise might be more effectively applied. Such a shift would also free CDF from much of the burden of the "no-win" controversy that currently surrounds the cumulative impacts issue, and would allow department personnel to focus on their other critically important work. Under this framework, staff from the relevant departments would continue to do the preliminary work for which they are currently responsible, but staff from CRA would hold the responsibility for weighing the inputs of the state's technical experts and making the required decisions. Such a change would require that

- *Lead-agency responsibilities for THP and SYP approval be shifted from CDF to CRA*
- *Staff of the relevant departments (i.e., Water Quality Control Board, Department of Fish and Game, etc.) be given authority for decisions falling within the purview of those departments' areas of expertise*

Problems concerning the treatment of outside comments also require consideration in their own right. Examination of the official response to a review of cumulative impact issues in the Pacific Lumber Company HCP/SYP showed that 21% of the responses did not address the issues raised; 9% misrepresented the original comments; and 10% contained technical errors (Reid 1999). Examination of official responses to comments on several THPs showed similar problems: technically valid concerns are being dismissed on technically invalid grounds. Currently, there is no recourse for correcting these errors other than litigation, and the courtroom is not a suitable venue for deciding technical issues. Furthermore, most of these problem could be resolved simply by appeal to an independent authority in the relevant field. This problem could be addressed by

- *Establishment of an independent panel of experts to whom technical disagreements could be referred if the outcome of the decision could have influenced the approval of a plan.*

This provision would increase the level of technical expertise available to support decision making and might diminish the efforts and expense now devoted to litigation.

Context for this review

Considerable commentary on how Forest Practice Rules might be improved has been provided by others in the past. The Little Hoover Report of 1994, for example, describes the need to better incorporate expertise from other agencies into CDF's decision-making process and also describes the need for watershed-scale evaluations. Even before that, the LSA report of 1990 identified the cumulative impact analysis methodology as inadequate, stating that "there is a general recognition within the forestry profession that the process needs to be modified." The LSA report also notes that "Many ORs [official response to public comments] do not compare favorably with the standard of presenting a reasoned meaningful response to environmental comments and of demonstrating the scientific opinion and/or reasoned analysis that supports the THP decision." Meanwhile, several court cases have demonstrated the need to assess the influence of a plan on downstream cumulative impacts even if those impacts occur outside of a designated watershed assessment area.

Unfortunately, conclusions from these reports and decisions have not been reflected in institutional change. It may be useful to determine why previous findings have not been acted upon. If the reason turns out to be that there is an institutional resistance to change or an institutional denial of the need for change, then the need for a fundamental change in agency responsibilities may be even stronger than suggested above. Experience with a variety of institutions suggests that regulations are

ineffectual if staff of the agency responsible for administering and enforcing those regulations do not believe the regulations are necessary or useful.

There once again is widespread recognition that the state's strategy for management of forestry-related cumulative watershed impacts needs to be modified. Three committees established under the auspices of either the CDF or the Board of Forestry are currently compiling reports dealing with aspects of the problem. It remains to be seen whether these reports will be forgotten as quickly as those prepared by LSA and the Little Hoover Commission, or whether effective changes will be made.

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