

# Turning Stumbling Blocks into Stepping Stones in the Analysis of Cumulative Impacts<sup>1</sup>

Leslie M. Reid<sup>2</sup>

Federal and state legislation, such as the National Environmental Policy Act and the California Environmental Quality Act, require that responsible agency staff consider the cumulative impacts of proposed activities before permits are issued for certain kinds of public or private projects. The Council on Environmental Quality (CEQ 1997) defined a cumulative impact as "...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). "Cumulative watershed impacts" are cumulative impacts that involve the generation or transport of water through a watershed and so include impacts arising from changes in hydrology, erosion, in-stream woody debris, channel form, and water quality. Evaluations of impacts on freshwater biota, flooding, and sedimentation thus require analysis of cumulative watershed impacts.

The CEQ (1997) discusses implications of the definition and describes a procedure for cumulative impact analysis. A useful analysis would evaluate existing and potential impacts affecting resources, ecosystems, and human communities of concern, determine how the proposed project would influence those impacts, and evaluate the significance of each relevant impact by determining the extent to which the entities of concern are affected.

Considerable effort is devoted to impact analysis, and efforts are under way to improve the efficiency and effectiveness of analysis procedures. The author examined 14 cumulative impact analyses for forestry-related activities on private lands in northwest California to determine whether they provide the necessary information and to identify opportunities for improving analyses. The reviewed documents include a combined environmental impact statement and environmental impact report, several timber harvest plans, a habitat conservation plan, a watershed analysis, and analyses of sediment source and causes and impacts of flooding. Specific documents are not identified here so that the discussion can remain focused on the content of these analyses. Although these sample analyses are from projects in northwest California, this analysis offer insights that should be relevant to future evaluations of cumulative impacts in the Sierra Nevada.

A variety of problems were found that detracted from the utility of the analyses. These fell into four broad classes: (1) problems involving the definition of cumulative impacts, (2) problems concerning evaluation of impact significance, (3) problems in designing measures to mitigate impacts, and (4) problems involving interpretation of technical information.

---

<sup>1</sup> This paper was presented at the Sierra Nevada Science Symposium, October 7–10, 2002, Kings Beach, California.

<sup>2</sup> USDA Forest Service, Pacific Southwest Research Station, Arcata, CA.

## Definition Problems

The most profound analysis problems arose from misinterpretations of the definition of cumulative impacts. One analysis, for example, simply argues that the plan is more protective than current regulations, so its cumulative effect will be positive, regardless of the plan's impact on the environment. This approach is inconsistent with the definition, which specifies that a cumulative impact is "...the impact *on the environment*..." (emphasis in this and following quotations is added); it is the environmental impact that must be evaluated, not a change relative to a hypothetical alternative. Another document argues that because impacts will be minor from the project in isolation, the project will not contribute significantly to cumulative impacts. This, too, directly conflicts with the definition: "Cumulative impacts can result from *individually minor but collectively significant* actions...." Several analyses imply that because earlier activities originally caused the impacts, contributions from planned activities can be disregarded. However, cumulative impacts result "from the incremental impact of the action *when added to other past, present, and reasonably foreseeable future actions*...."

Many analyses assume that if natural influences dominate, human-induced effects can be ignored. The effect of land use activities on landslides and floods, for example, is argued to be insignificant because landslides and floods occur during large storms, which are natural. However, the impact to be evaluated is the human-induced *change* from natural conditions: "'Cumulative impact' is the impact...*of the action when added to other...actions* regardless of what agency...or person undertakes such other actions." A useful analysis would evaluate the extent to which human activities increase flood severity or landslide incidence when a triggering event occurs.

Analyses also commonly confuse an impact's cause with the impact itself. Several note that planned projects will prolong alteration of conditions that cause a significant impact but argue that the projects will not worsen the impact and so will not contribute to it. However, the cumulative damage experienced by those affected—the severity of the cumulative impact—increases with increasing impact duration. For example, if flood risk increases by 40 percent for 50 years, the excess cost of flood damages will average about 10 times higher than for the same level of increase that lasts only 5 years. The altered conditions remain constant, but the resulting damages—the impacts—accumulate through time.

Decisions from both Federal and state courts indicate that misinterpretation of the definition can lead to cumulative impact analyses that are not legally valid (for example, *Los Angeles Unified School District v. City of Los Angeles* (2d Dist. 1997) 58 Cal.App.4<sup>th</sup> 1019 [68 Cal.Rptr. 2d 367]; *Kings County Farm Bureau and others v. City of Hanford* (5<sup>th</sup> Dist. 1990) 221 Cal.App.3d 692 [270 Cal.Rptr. 650]; *Blue Mountains Biodiversity Project v. Blackwood* (9<sup>th</sup> Cir. 1998) 161 F3d 1208).

## Problems in Evaluating Impact Significance

A second set of problems involves evaluation of impact significance. CEQ (1997) notes that significance is to be assessed with respect to those affected: "Each affected resource, ecosystem, and human community must be analyzed in terms of its capacity to accommodate additional effects, based on its own time and space parameters." None of the reviewed analyses takes this approach. Instead, most select significance thresholds arbitrarily and without evaluating impacts generated at the selected threshold level. One simply asserts that a 67 percent increase in flood frequency is insignificant and another that an expected logging-related increase in landslide frequency is "considered acceptable."

Some analyses consider changes insignificant if they fall within the range of natural conditions. However, the distribution of natural conditions is more important than the range: a 100-year flood is within the range of natural conditions, but impacts accrue if floods of that

size begin to recur frequently. Several analyses adopt arbitrary metrics to compare natural and managed conditions. A watershed analysis, for example, simply asserts that the density of trees with diameters of more than 8 inches is a suitable basis for comparing second-growth stand conditions to the “functional needs and old-growth stocking levels” of old-growth coastal redwood forests. No explanation is provided for why an 8-inch-diameter redwood would satisfy the “functional needs” that had previously been fulfilled by 80-inch-diameter trees.

One analyst argues that because an impact is already large, additional contributions from the project will be insignificant, thereby defying the definition of cumulative impact: “...incremental impact of the action *when added to* other...actions.” Additional contributions necessarily contribute to significant impacts if impacts are already significant. Another analysis attempts to evaluate the risk of surpassing a significance threshold for cumulative impacts without considering the existing impact level. However, the *cumulative* impact cannot be evaluated if the existing impact is not considered, and the risk of surpassing a threshold depends on how near the threshold already is.

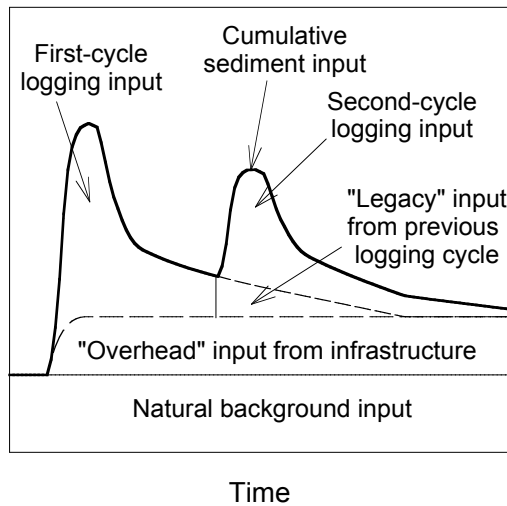
Most problems concerning the identification and significance of cumulative impacts are readily addressed by adopting an analysis approach that reflects the established definition of cumulative impacts, such as that outlined by CEQ (1997). Such an analysis would identify the impacts to which a project might contribute and would evaluate the level of contribution to each. The significance of each impact would be assessed with respect to the effects experienced by those affected.

## Problems in Designing Mitigation Strategies

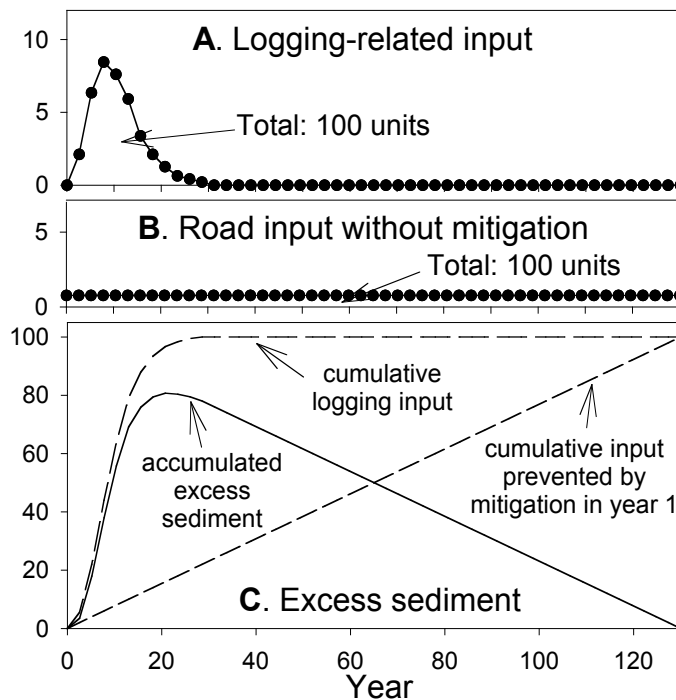
Many plans rely on management strategies to avoid cumulative impacts, and such strategies introduce a third set of problems. For example, plans often incorporate “design mitigations,” whereby activities are modified to lessen their impact. Analyses supporting this strategy would need to evaluate the extent to which the mitigated activities, in combination with past, present, and reasonably foreseeable future activities, would contribute to cumulative impacts. None of the documents examined include this kind of analysis.

A second management strategy employs “offsetting mitigations,” which are activities intended to cancel out the impacts of other activities. Offsetting mitigations include the “zero net discharge” approach to sediment control, in which planned sediment inputs are offset by curtailing an equal amount from sources already present. But, as in the case with design mitigations, analyses do not adequately evaluate the effectiveness of planned mitigations. Several errors occur repeatedly. Many sediment sources targeted for offsetting mitigation—such as road-related erosion—would have already healed had forestry activities not continued. Their current levels of sediment input result from on-going activities and so represent the sediment “overhead” cost of those activities (*fig. 1*). Mitigations to reduce these sources do not offset the plan’s sediment input; they simply prevent the plan’s input, when the “overhead” is included, from being even larger.

Analyses also overestimate the effectiveness of offsetting mitigations by assuming that most (usually 80 percent) of the mitigated sediment would have otherwise soon reached a stream. In reality, a much lower proportion of the mitigated sediment is likely to have contributed to stream sedimentation. Furniss and others (1998), for example, show that less than 30 percent of the sediment “saved” by culvert redesign may be effective in offsetting other sources, even during very large storms. If the culverts that will fail cannot be identified beforehand, the potential effectiveness is even lower. Disregard of the timing of impacts also leads to overestimation of mitigation effectiveness. Data in one analysis suggest that sediment curtailed by mitigation would have entered streams gradually over 130 years, if at all; thus, less than 15 percent of the mitigated sediment would offset inputs expected from proposed projects over the next 20 years, allowing sediment-related impacts to accumulate (*fig. 2*).



**Figure 1**— Relation between different categories of sediment inputs. Inputs are represented by characteristic time distributions; actual inputs would vary according to weather conditions.



**Figure 2**— Hypothetical case illustrating the effect of offset timings of project and mitigated sediment inputs. **A.** Timing of sediment inputs from logging in year 1. **B.** Timing of road inputs had sources not been mitigated in year 1—mitigation removed sources contributing an average of 0.77 units per year, so 100 units would be “saved” over 130 years. **C.** The cumulative excess sediment from the project (calculated as cumulative logging input minus cumulative mitigated input) will not be offset until year 130 and may contribute to cumulative impacts until then.

Other mitigations are clearly incapable of offsetting the kind of impact for which they were proposed. For example, road repairs designed to decrease future erosion will not offset immediate increases in flood risk due to increased runoff after logging.

In any case, no amount of offsetting mitigation can prevent cumulative impacts from new activities if the activities themselves can generate the impacts. For example, if a plan needs to reduce sediment input to less than 20 percent over background, control of all pre-existing anthropogenic inputs will not lead to compliance if the planned projects will themselves introduce sediment at 30 percent over background levels. Furthermore, a strategy of offsetting mitigations prolongs existing impacts—and thereby increases impact severity—because activities that reduce impacts are offset by activities that cause them.

An analysis that identifies the impacts to which a project might contribute and evaluates the level of contribution to each would provide the information necessary to design appropriate impact management strategies. No single strategy is useful for all impacts. Design mitigations are appropriate if a particular practice can prevent a problem from developing, and offsetting mitigations can be effective in systems that are not already affected at undesired levels if the mitigations will indeed cancel out expected impacts at the appropriate locations and times. If the desired activities necessarily contribute to potential impacts, the rate of impact-generating activities can be modified to maintain acceptable levels of impact. This rate-based strategy is readily combined with others: higher use intensities are possible if mitigations are effective. Selection of the appropriate strategies for a particular location and project requires a valid analysis of the cumulative impacts of the mitigated projects.

## Technical Errors

The most disquieting problem encountered is the low level of technical expertise exhibited. Most reports incorporate invalid analyses, significant technical errors, and conclusions not supported by the available information. For example, one analysis argues that, despite observations by streamside homeowners that substantial aggradation has occurred, “The marked absence of change in the channel pattern...suggests that the channel has not been aggrading to a significant degree.” However, channels held in place by bedrock-cored terraces cannot migrate, and the analysis itself documents the presence of such terraces.

Some analyses employ technical arguments that conflict with fundamental principles. A geological report for one logging plan, for example, argues that a study showing that earthflows move faster without a forest cover does not apply to the site in question because the active earthflow on the project site is on a steeper slope— therefore is asserted to be “more stable”—than the studied earthflows. On this basis, the report concludes that logging the steep, active earthflow will not significantly affect it.

Many analyses use the existence of “conflicting information” to argue that no impacts are discernible. In each case examined, though, either the conclusion is not supported by the conflict or the apparent conflict is an artifact of invalid analysis. One report, for example, reports that recent fine-sediment aggradation had caused a 15 percent reduction in the area of a channel cross section, but that a nearby cross section had been reduced by 44 percent. On the basis of this variability, aggradation is concluded to be “uncertain” and is completely disregarded. In reality, even a change of less than 15 percent would significantly increase flood severity and ordinarily would be carefully evaluated.

The problem of technical inadequacy is the most difficult to address. Ordinarily, the solution would be increase technical review, but each problem discussed above had been identified by reviewers and none of the errors were corrected in final documents. Review comments, if addressed at all, were often rebutted by simply restating the original argument or conclusion.

That technical review is so easily disregarded suggests that standards for technical adequacy differ between research and land management settings. Researchers consider technical review

indispensable for producing high-quality, technically valid publications, and journal editors—whose primary concern is the technical validity of the documents—act as independent and technically astute arbiters in weighing the quality of opposing technical arguments.

In contrast, arbiters for environmental planning documents usually are the governmental agency staff responsible for overseeing or preparing the documents. The primary goals in this case often are approval of the desired project and avoidance of legal challenges. Both Federal and state courts provide agency staff with considerable discretion for decisions based on technical information. A Federal Circuit Court stated, for example, that “When, as here, the issue of procedure relates to the sufficiency of the presentation in the statement, the court is not to rule on the relative merits of competing scientific opinion” (Committee For Nuclear Responsibility, Inc., and others, v. Glenn T. Seaborg and others [1971] 149 U.S. App. D.C. 380 [463 F.2d 783]). At the State of California level, courts found that “Determinations in an EIR must be upheld if they are supported by substantial evidence; the mere presence of conflicting evidence in the administrative record does not invalidate them” (Barthelemy v. Chino Basin Municipal Water District [4th Dist. 1995] 38 Cal.App.4th 1609 [45 Cal.Rptr.2d 688]). Agency staff may choose between conflicting bodies of substantial evidence or technical arguments without regard for their relative strength (Browning-Ferris Industries of California, Inc. v. City Council of the City of San Jose [6th Dist. 1986] 181 Cal.App.3d 852 [226 Cal.Rptr. 575]); the presence of other substantial evidence that would lead more strongly to other conclusions is essentially irrelevant (Remy and others 1999). Because courts look primarily for the *existence* of a technical argument to support a decision, a simple restatement of the original argument is usually sufficient legally to rebut a technically valid review comment.

Technical adequacy might be improved if independent technical arbiters were assigned to documents or if technical validity was made a priority within the relevant agencies. However, as long as technical errors do not influence the acceptability of planning documents and do not detract from their legal adequacy, there appears to be little motivation to address the problem.

## Conclusions

Examination of a series of cumulative impact analyses revealed a variety of problems that prevented the analyses from providing technically valid foundations for land use planning. Recent court decisions suggest that problems arising from invalid definitions of cumulative impacts need to be addressed to ensure that documents are legally adequate. Other problems concerning technical inadequacies and strategies for managing cumulative impacts would also need to be addressed if management decisions are to be based on technically valid information, if stated management objectives are to be achieved, and if the agencies’ technical credibility is to be sustained.

## References

- CEQ (Council on Environmental Quality). 1997. **Considering cumulative effects under the National Environmental Policy Act**. Washington, DC: Council on Environmental Quality; 119 p.
- Furniss, M.J.; Ledwith, T.S.; Love, M.A.; McFadin, B.C.; Flanagan, S.A. 1998. **Response of road-stream crossings to large flood events in Washington, Oregon, and northern California**. Water/Road Interaction Technology Series. Publication 9877 1806-SDTDC. USDA Forest Service Technology & Development Program; 14 p.
- Remy, M.H., Thomas, T.A.; Moose, J.G.; Manley, W.F. 1999. **Guide to the California Environmental Quality Act**. 10th edition. Point Arena, CA: Solano Press; 1023 p.