# A Conference on Water Quality Monitoring

*Spatial and Temporal Variability In Forest Water Quality Monitoring;*
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## Some Considerations About Monitoring Water Quality

*Robert R. Ziemer, Humboldt State University, Dept. of Geology, Arcata*

### Abstract

A review of past efforts to monitor water quality reveals that success or failure depends on four components: monitoring design (asking the right question); making the right measurements; managing the data; and analyzing the data to answer the question. A failure of any one of these components will doom the monitoring study.

(1) Monitoring design. What is the question or hypothesis that is to be tested?

- A clear and detailed statement of the monitoring objective, including a precise description of what will be measured, where it will be measured, why it will be measured, how it will be measured, and when and how long it will be measured – including a detailed discussion of how these measurements will be used to address (solve) the stated monitoring objective.

(2) Making measurements.

- Selection of appropriate locations, instrumentation, data timing, frequency, and duration required to adequately address the objectives described in (1).
- Ability to successfully collect the appropriate data at the places and times needed.

(3) Managing data.

- Successful completion of required data collection, data validation (error checking and adjustment), and archiving.
- Adequate description of all procedures so that the data analysts can thoroughly understand the data, often years after collection.

(4) Analyzing data and drawing conclusions.

- Analysis staff has sufficient time and analytical skills to work with large and often messy data sets.
- Items (1), (2) and (3) were fully successful and allows for an analysis and final report that fully answers the objectives described in (1).
- The final report successfully addresses issues raised from rigorous external review of objectives, data, methods, analysis, and conclusions.
- There is wide-spread agreement that the monitoring objectives and results clearly meet the expectations and requirements of those, both internally and externally, responsible for judging the success or failure of the program.

that it will be a continuing challenge to establish rigorous criteria for stream channel characteristics in forested areas, and to validate predictive models for cumulative watershed effects.

**References**

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## The Dynamic World of Mountain Drainage Basins

*Dr. Lee Benda, Earth Systems Institute, Seattle, WA/Mt. Shasta, California*

**Abstract**

Sediment budgets constructed in both managed and unmanaged mountain drainage basins across western United States and Canada using field surveys, aerial photography, simulation modeling, and radiocarbon and cosmogenic dating *all* point to mass wasting as being a very significant if not dominant source of sediment to streams and rivers (i.e., 40 to 80%). Moreover, wood budgets constructed primarily in California in both managed and unmanaged mountain drainage basins also have shown that streamside landslides and debris flows can contribute the majority of wood to streams along certain segments. The importance of mass wasting, including landslides, debris flows, earthflows, and flash flood-related gully erosion, stems from the mixture of steep topography, fire-prone vegetation, intense and/or prolonged precipitation, and often mechanically weak lithologies.

To help define the dynamic world of erosion and sediment supply to streams, it is helpful to consider the frequency and magnitude characteristics of both sediment supply and transport and its variation within watersheds. For instance, radiocarbon dating of charcoal in soil indicates that the frequency of shallow

landslides in convergent topography (i.e., swales or bedrock hollows) is on the order of several thousand years (500 to 6000 yrs). The frequency of debris flows in 1st and 2nd order channels has been estimated to range from a few hundred years to a few thousand years. Hence, the occurrence of landslides and debris flows are relatively rare at the scale of individual sites. However, watersheds contain thousands of natural landslide sites and hundreds of debris flow- or gully-prone headwater channels. At the scale of entire watersheds, landslides and debris flows are guaranteed to occur almost every year, even in unmanaged basins. Moreover, during years with large storms or fires, hundreds of landslides and debris flows can be triggered within a single, modest size watershed (order of hundreds of square kilometers).

The characteristic punctuated supply of sediment to streams by mass wasting, subsidized by flood-induced bank erosion, promotes a high degree of spatial and temporal variability in sediment transport, including bedload, suspended load, and turbidity. In addition, storage of sediment in bars, floodplains, terraces, and behind logjams creates lag times (years to decades) that complicate tracking sediment supply from hillslopes to its movement downstream in river networks. Consequently, water quality monitoring aimed at deciphering cause and effect linkages between specific land use practices and sediment transport levels should anticipate difficulties. The same holds true for efforts aimed at estimating natural background levels of erosion or sediment transport. Simulation models of watershed erosion suggest that the most appropriate measure of erosion rates is the probability distribution and measurement times needed to estimate it may range from a few centuries in headwater areas to many decades lower in networks. Because of the inherent inaccuracies involved in measuring a stochastic process, such as erosion or sediment transport (i.e., +/- 100s %), it could be argued that a more contextual and qualitative approach might be better suited to understand the dynamic world of mountain drainage basins.

## The Side-Effects of Road Decommissioning: A Bitter Pill or No Big Deal?

*Randy Klein, Redwood National & State Parks, Arcata*

### Abstract

Road decommissioning has become a common practice over the past decade as the sedimentation threats of poorly designed or maintained roads to downstream resources have become more widely recognized. While road decommissioning reduces the long-term erosional risks from forest roads, short-term erosional responses from stream crossing excavations can occur in the form of surface erosion, rilling, and gullying, channel scour, and minor slumping within excavations. Typically, most erosion and sediment delivery occurs within the first several years following excavation, and diminishes through time as vegetation grows on excavation side slopes and channels find stable grades and armor themselves with rock lag deposits and woody debris.

This presentation describes two projects designed to quantify the effects of stream crossing excavation on sediment delivery and water quality (turbidity): one in the Upper Mattole River for the Sanctuary Forest, Inc. (SFI), and another in Lost Man Creek within Redwood National and State Parks (RNSP). Study objectives in both cases were: 1) to quantify sediment delivery and effects on water quality following excavation stream crossings, and 2) to determine the need for and nature of any modifications to the style or rate of excavations that may be warranted to reduce and/or spread impacts over a longer time period.

Upstream/downstream sample pairs from both studies showed that turbidity increases within recently excavated stream crossings can be very large at times, and negligible at others. In addition, off site samples taken in a pair basin approach indicated elevated turbidity from basins with numerous stream crossing excavations compared to nearby basins where no road decommissioning took place, however, these increases were much smaller than with onsite samples. Also, in both studies, turbidity increases within crossings diminished through the winter runoff season, a phenomenon most likely due to "initial flushing" of easily eroded sediment.