The value of manual, event-based sediment sampling in local-scale sediment budget studies

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Abstract

Many contemporary sediment-budget studies lack two things: a first-hand understanding of the behavior of the system, and high-frequency data during storm events. In a study designed to understand sediment source areas, we have approach these deficiencies through manual sampling, almost exclusively during storm events. Manual sampling leads to better understanding. Frequently, the researcher finds oneself standing in streams observing phenomenon that contradict their a priori, desktop, or textbook-based perception of system behavior. The case study we present reflects this in its observations of very high percolation rates, differing levels of land-stream connectivity under different sized events, and landowner intervention in water and sediment flux. In drier regions with episodic rainfall, event sampling is essential. During one season, we sampled 13 sites in an 315.9 km^2 watershed about 50 times each. The sampling times were targeted to observe the start of the rising stage, many points immediately around the hydrograph peak, once or twice during the falling stage, and once after the return to pre-event conditions. The same number of samples spread over the year at regular intervals would lead to a grossly inaccurate representation of the system by the data. For example, event sampling permitted a reasonably accurate characterization of total annual load at each site. A simple, static model was then used to apportion total loads to different land use sources, and in-channel sources.

Objectives

- Quantify sediment source areas in a 316 km2 watershed
- Understand sediment transport dynamics

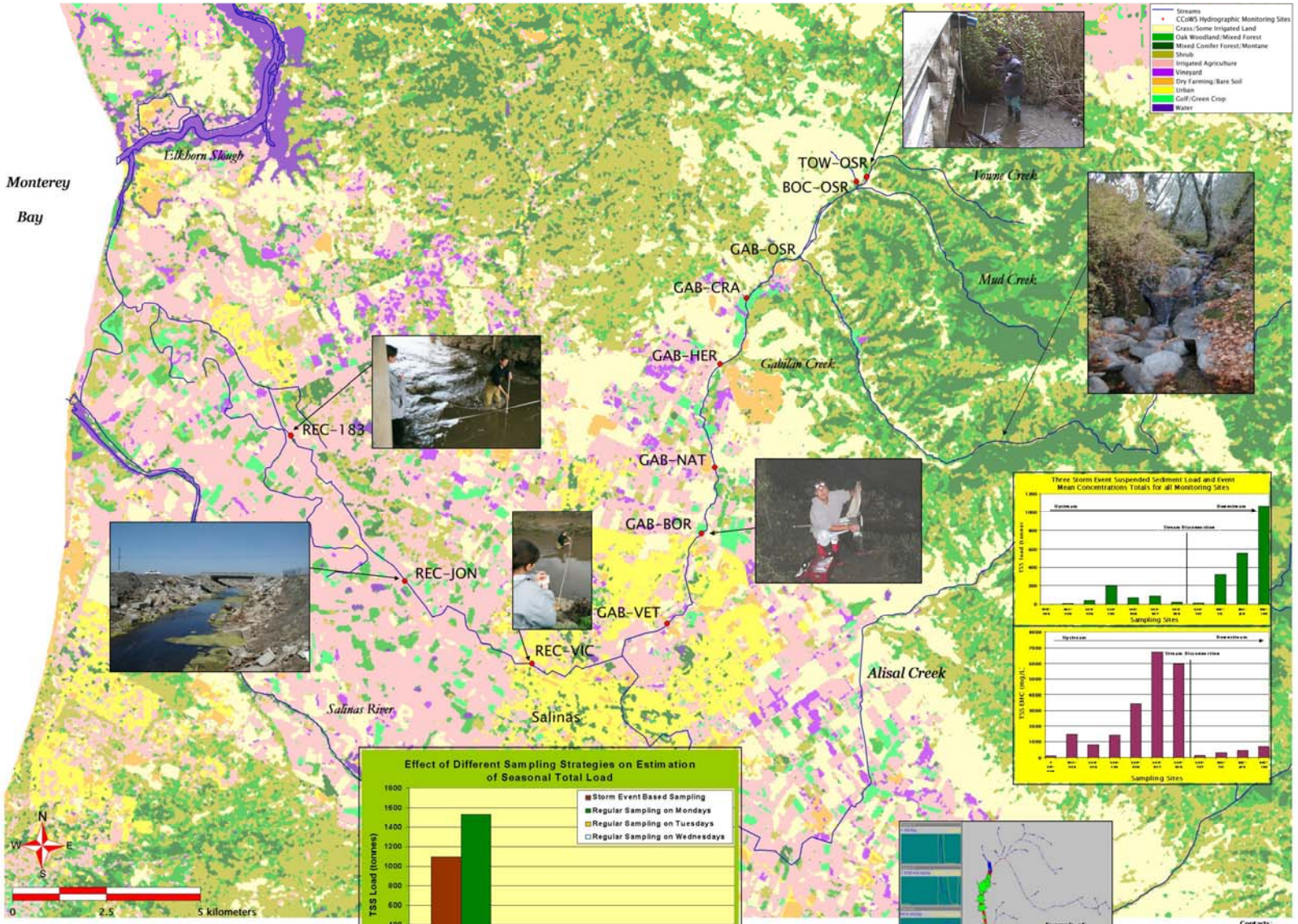
Main points

- Periodic "ambient" monitoring of water quality can lead to unrepresentative and misleading data
- Intensive manual sampling during storm events has the following advantages:
  - A better, hands on understanding of key phenomena
  - More accurate estimates of total loads
  - More accurate measurement of peak concentrations
  - Better sediment budgets
  - Better understanding of adverse conditions experienced by in-stream biota

Methods

- 13 Sites
- 5-10 visits per event
- Visits from site to site are continuous throughout duration of the storm
- Measurements taken at each site:
  - Stage
  - Discharge
  - Total suspended sediment
  - Bedload
- Curves constructed for each site:
  - Stage vs discharge
  - Concentration vs discharge

Compute total loads for each event, and for whole season for each bridge



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