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## **Coastal Environmental Quality Initiative**

### **Title**

Assessing Human Alterations to Fluvial Sediment Delivery and the Impacts to Beach Sustainability, Central California

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**Coastal Environmental Quality Initiative Program**  
**Final Report: *Assessing Human Alterations to Fluvial Sediment Delivery and the Impacts to Beach Sustainability, Central California***

1. Summary of Project Activities:

- *Quantifying the impacts of dams on sediment delivery to the coast.*

Natural (pre-dam) and actual (post-dam) yearly sand delivery to the coast from 4 major coastal streams—Pescadero Creek, San Lorenzo River, Pajaro River, and Salinas River—between San Francisco and the Monterey Peninsula was estimated using records of sediment accumulation in reservoirs and hydrologic modeling.

- *Measuring suspended sediment in sample watersheds to assess the effects of changes in land use on sediment delivery to the coast.*

To examine the influence of the different timber harvesting histories on sediment yield, suspended sediment flux and water discharge was measured within the three sub-basins of the Pescadero-Butano watershed over one winter season (Figure 2). Suspended sediment loads were sampled on Pescadero, Butano, and Little Butano Creeks with a depth integrating sediment sampler during winter floods between December 2000 and March 2002. Each of the watersheds has experienced varying degrees of timber harvesting over the twentieth century. The results of the sediment sampling should provide insight into the long-term impacts of timber harvesting on sediment supply to the coast.

- *Mapping beach changes between 1931-2000 from historical aerial photographs.*

The width and area of seven representative beaches distributed along 150 kilometers of the Santa Cruz littoral cell (Figure 1) were mapped from historical aerial photographs taken between 1931 and 2000. The historical changes in beach size were quantified to delineate long-term (i.e., >50 year) trends in beach erosion along the central California coast (Figures 4 and 5).

2. Accomplishments:

- The project activities described above were successfully carried out.
- These research activities contributed significantly to data for my Ph.D. thesis, completed in September 2002.
- The primary results of this study were presented at the California and the World Ocean Conference in Santa Barbara, CA in October 2002, and a paper will be published in the conference proceeding to be issued in 2003.

3. Principal findings:

- Dams impound about 12% of the total watershed area draining to the Santa Cruz littoral cell (Figure 1), but they have diminished average annual fluvial littoral sediment inputs by only 3%. Thus, dams within the cell have not significantly altered the flood hydrographs that deliver the bulk of the sediment to the coast.

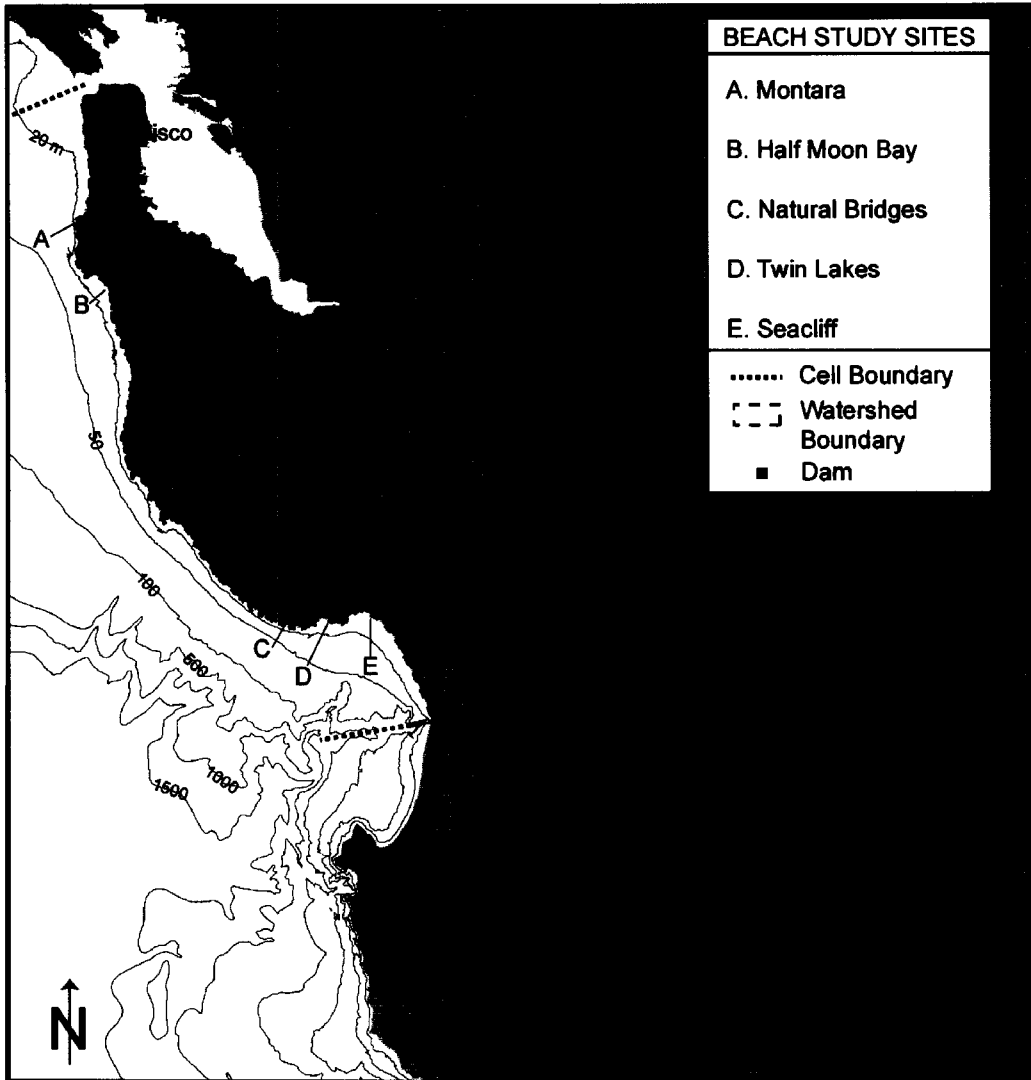
- Suspended sediment concentrations for all 3 sub-basins collected in 2001 fell in the range of measurements made by the USGS between 1970 and 1993 (Figure 3). This suggests that timber-harvesting activities in Pescadero watershed have had only temporary effects on sediment yield, with sediment loads returning to pre-disturbance levels within 20 years.
- A persistent, natural decadal to century scale change in beach size was not present at any of the study sites over the past 70 years (Figure 5). Our research has shown that the primary sediment sources—watershed sediment production, fluvial sediment delivery, and bluff erosion—and sediment sinks—offshore and longshore transport—have not been significantly altered over the twentieth century in the Santa Cruz littoral cell. The Santa Cruz littoral cell beaches appear to be in dynamic equilibrium with the cell's relatively pristine sediment budget.

4. Participants:

- Cope Willis, Graduate student, Earth Science Department, UCSC
- Gary Griggs, Professor, Earth Science Department and Director of the Institute of Marine Sciences, UCSC

5. Titles of publications generated by the project:

- Willis, C.M. and Griggs, G.B., in press. "Delineating Long-Term Trends in Beach Change, Central California." California and the World Ocean 2002 Conference Proceedings.
- Willis, C.M., 2002. Assessing Natural and Human Alterations to Coastal Sediment Supply in California and the Impacts on Regional Beach Sustainability. University of California, Santa Cruz. Unpublished Ph.D. Thesis. 142p.



**Figure 1:** Map of Santa Cruz littoral cell, beach study sites, and dam locations in watershed draining to Santa Cruz littoral cell.

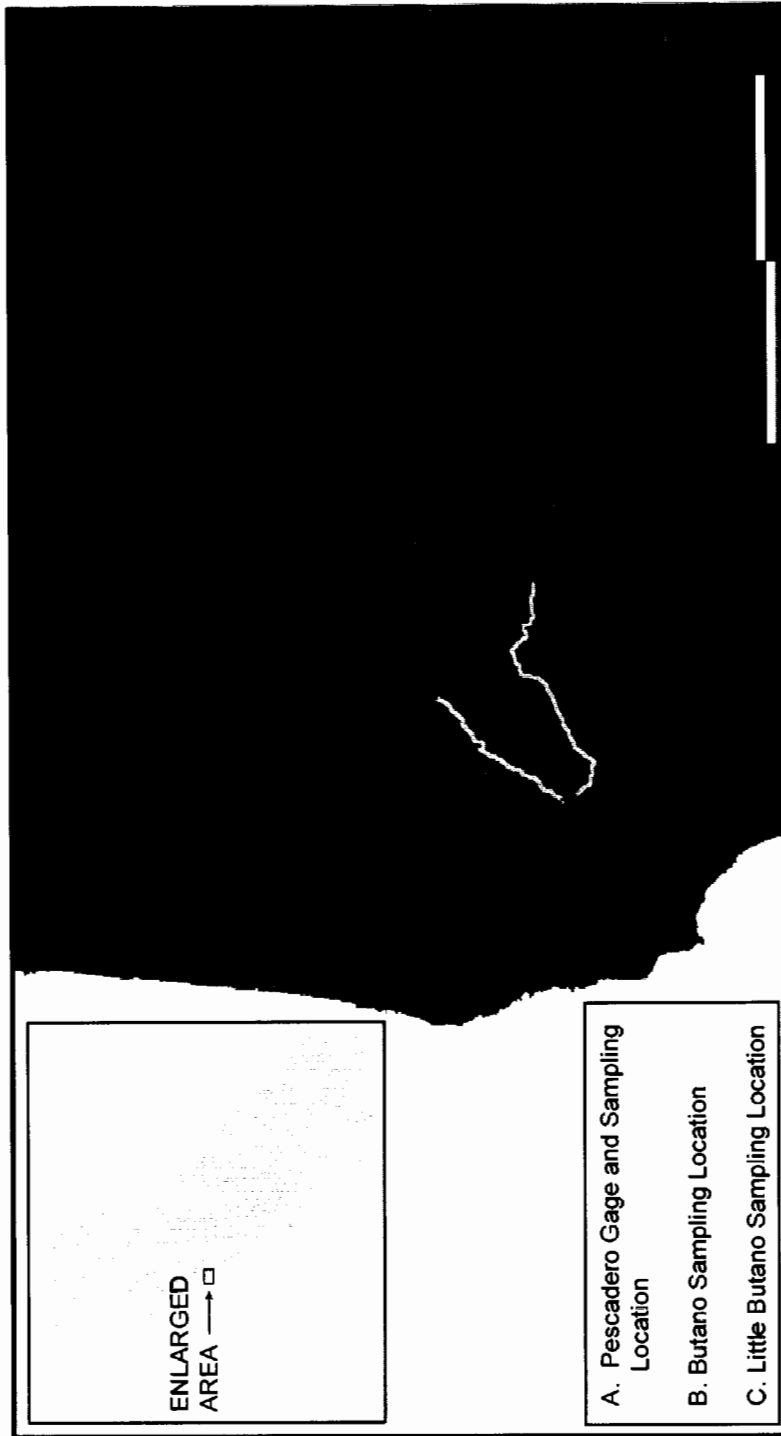


Figure 2: Map of Pescadero sub-basins and locations of suspended sampling.

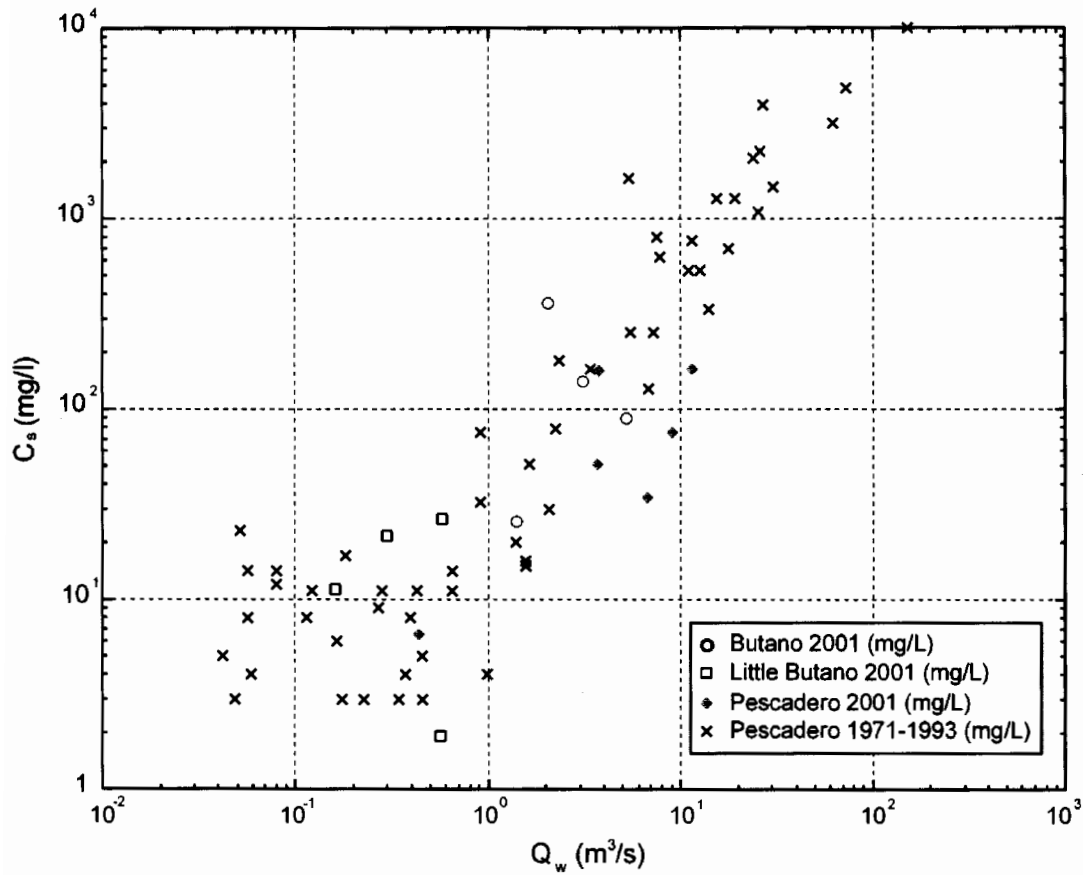


Figure 3: Suspended sediment results for Little Butano, Butano, and Pescadero sub-basins.



**Figure 4:** Example of beach morphology mapping methods for Montara State Beach, CA (1985 orthophoto).

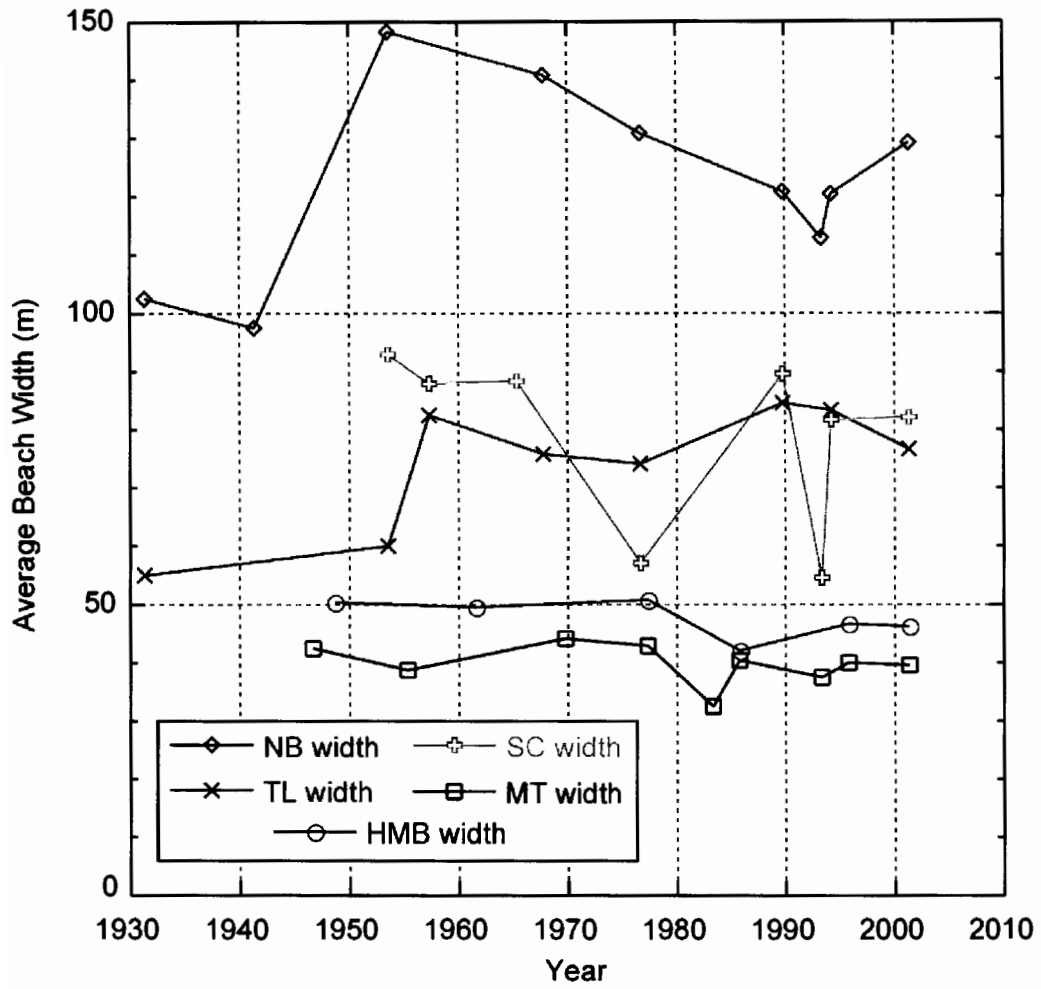


Figure 5: Comparison of beach change at all study sites.