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# RESEARCH REPORT

## Watershed study results offer strategies for reducing erosion and sedimentation associated with cattle grazing

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### Introduction

**T**he Morro Bay estuary is arguably the most important wetland system on the south central coast of California. It supports commercial fishing industries, numerous recreation activities, and a variety of natural habitats. The estuary and its watershed, representing a diverse biological and economic resource to the people of California, are impacted by various pollutants, with sediment of particular concern. As part of a 10-year national monitoring program funded by the U.S. Environmental Protection Agency (EPA) through California's Regional Water Quality Control Board (Regional Board), a paired watershed study on California Polytechnic State University's Escuela Ranch has shown that Best Management Practices (BMPs) aimed at reducing erosion and sedimentation associated with cattle grazing appear to result in improvement of water quality. The same BMPs have resulted in an increase in residual vegetation that is har-

vested by the cattle during the dry season. The objective of this study was to extend monitoring of hydrology and water quality for an additional year, and to monitor range forage quality (protein and fiber) for three years.



*Certain management strategies  
have been shown to reduce the  
negative impacts of cattle grazing.*



## Executive Summary

In the paired watershed design, BMPs were introduced into one watershed while the other was kept as a control. The BMPs included fencing of two large pastures into 14 smaller pastures, including riparian pastures, development of water resources to provide water for cattle, intensive rotational grazing of cattle through these pastures, rehabilitation of and improvements to dirt access roads to the treatment watershed, and planting of native riparian trees in and on stream banks.

During the sixth year of monitoring, it was noted that the BMPs seemed to have resulted in an increase in residual vegetation and in continuing decreases in supplemental feed costs. This led us to hypothesize that grazing practices in the treatment watershed contributed to increases in available forage for cattle and possibly also to improvements in forage quality. The objective of this ARI project was to continue water quality and range monitoring for an additional year and to measure forage quality (protein and fiber).



We showed statistically significant improvements in storm event-based water quality. Improvements reached a plateau beginning in the 1999-2000 season. The plateau probably occurred because fast-growing stream channel vegetation reached its maximum protective effect, and slower-growing vegetation had not yet reached a stage of maturity where it had a quantifiable effect on water quality. We showed improvements in range and habitat quality, especially decreases in bare ground and proliferation of stream channel vegetation, but these improvements were not statistically significant. Differences between pre- and post-BMP implementation were striking via photodocumentation. Forage quality (protein and fiber) did not differ as a result of management during the monitoring period.

## Major Accomplishments

- ◆ Demonstrated that BMPs accessible to landowners and land managers (assuming availability of cost-sharing) resulted in significant improvements of water quality.
- ◆ Determined that the water quality parameters turbidity and suspended sediment can be used to document water quality improvements without sediment load. This is important because streamflow, needed to calculate sediment load, is difficult to monitor on a continuous basis.
- ◆ Demonstrated that turbidity serves well as a surrogate for suspended sediment concentration, which is important because turbidity is much quicker and less expensive to measure than suspended sediment.



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- ◆ Demonstrated that habitat quality was improved through the management style, and that cattle grazing is compatible with good environmental stewardship.
  - ◆ Demonstrated importance of photodocumentation in a long-term monitoring study. Photodocumentation provided us with our strongest argument for range and habitat improvements.
  - ◆ Provided an outdoor laboratory for many Cal Poly classes dealing with watershed protection and land management.
  - ◆ Effectively demonstrated to students – the land managers of the future – the utility of the management style.

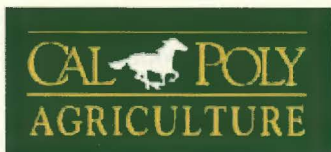
## Impact Statements

- ◆ Demonstrated that cattle grazing can be compatible with good environmental stewardship.
- ◆ Demonstrated several new facets of water quality monitoring which may aid future research efforts:
  - 1) Water quality parameters can be used to demonstrate reductions in sediment, without the necessity of calculating sediment load.
  - 2) Turbidity serves as an effective and less expensive surrogate for suspended sediment concentration.
  - 3) Photodocumentation is important in a long term study, is an effective tool, and should be employed as well as other assessment methods.
- ◆ Ten years of monitoring showed statistically significant improvements in water quality and documented improvements in range and habitat quality. The effort should be continued in some form, as BMPs related to vegetation management mature.
- ◆ Demonstrated that a project of this scope is invaluable as a teaching and learning tool, with important lessons in livestock management, soil and water quality, soil and water conservation, ecology, and field and laboratory techniques in several disciplines.

## Dissemination

- ◆ Web site, currently undergoing review and revision. Coauthored by Cal Poly and Regional Water Quality Control Board staff; major effort by Peter Meertens, graduate student, Landscape Architecture.  
<http://www.swrcb.ca.gov/rwqcb3/WMI/MorroBay/>
  - ◆ Final Report to the EPA, presently under final review and revision. Cal Poly submitted its part to the Regional Board December, 2002. Edited by Lynn Moody. Contributions by Cal Poly staff: Lynn Moody, Brian Dietterick, Jon Beckett, Bob Smidt, Jim Daly, Craig Stubler, former student Allyson Young, and Peter Meertens.
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- ◆ Field tour, "The Morro Bay National Monitoring Program – a 10 year study and watershed characterization." June 27, 2003, open to the public; attended by ranchers, NRCS staff, NEP staff, Regional Board staff, Cal Poly staff and students, and others. Presenters: Lynn Moody, Brian Dietterick, Mike Hall, Craig Stubler, Katie McNeill (Regional Board) and John Davis IV (Regional Board). Sponsored by the National Estuary Program.
- ◆ A "fact sheet" (color brochure) summarizing findings to be distributed to the interested public, authored by Cal Poly and Regional Board staff; main effort by Brian Dietterick and a student, Allyson Aquino. The National Estuary Program has agreed to print this brochure.
- ◆ A journal article to be submitted to Journal of Water Resources, in preparation. Written mainly by Brian Dietterick, coauthored by other members of the Cal Poly team and Regional Board. Estimated submission date, July 31, 2003.
- ◆ Findings were presented at the National Monitoring Workshop in Indianapolis in September 2001 and in Colorado in September 2002, by Brian Dietterick. Brian had also presented results at many previous years' National Monitoring Workshops, in various locations.
- ◆ Findings were presented at the American Society of Agronomy National Meetings in Indianapolis, Indiana, in November 2002, by Lynn Moody. Members of the Cal Poly team and Regional Board coauthored the presentation.

## Acknowledgements

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## For More Information

This research report contains summarized results of Lynn Moody's study entitled "Paired Watershed Monitoring for Water Quality and Sustainable Range Management, Morro Bay Watershed, California," ARI Project No. 00-3-026 (Research Focus Area: *Biodiversity*). To view and/or obtain a copy of the complete final report, or to obtain additional information about this or other research projects, visit the ARI website at [ari.calstate.edu](http://ari.calstate.edu). For information on projects specific to Cal Poly San Luis Obispo, visit the Cal Poly ARI website at [ari.calpoly.edu](http://ari.calpoly.edu).

The Agricultural Research Initiative (ARI) is a California State University (CSU) multiple campus collaborative partnership between the CSU colleges of agriculture and the state's agriculture and natural resources industries and allied business communities. ARI provides public funds that are matched with industry resources to fund high impact applied agricultural and natural resources research, development, and technology transfer, as well as related public and industry education and outreach. ARI projects and programs improve the economic efficiency, productivity, profitability, and sustainability of California agriculture while providing for consumer sensitive and environmentally sound food and agriculture systems and fostering public confidence in food safety and agricultural research and production systems.