“Water is for Fighting Over”: Water and the California Delta as a Theme for a Capstone Seminar

Lydia K. Fox
Department of Earth & Environmental Sciences
University of the Pacific
4 November 2012
lkfox@pacific.edu
GEO 185: Capstone Seminar in Environmental Science

- BS in Environmental Science
  - Core: Geology (5 courses), Biology (5 courses), Chemistry (3 courses)
  - Additional related courses:
    - Humanities (Philosophy, History, or Literature)
    - Policy (US or International)
  - Capstone in Spring semester of Senior year
GEOS 185: Capstone Seminar in Environmental Science

- Designed to integrate all aspects of the major
- Thematic approach
  - Water and the California Delta
    - Local
    - Current
    - Multi-disciplinary
    - Focus of on-going state controversy
“Whiskey is for drinking, water is for fighting over.”
- attributed (falsely) to Mark Twain

“Water flows uphill towards money.”
- Anonymous quote, from Cadillac Dessert
Water in California
California Delta

- Confluence of the Sacramento and San Joaquin Rivers

[Map of the Sacramento-San Joaquin Delta with Stockton marked]
Course Format

- Readings
- Guest Speakers
- Field Trips
- Student-led discussion/debate
- Research Projects
Topics

- California water history
- Water law
- Hydrology
- Fish migration
- Endangered species
- Habitat restoration
- Water quality
- Levee construction
- Agriculture
- Economics
- Water conservation
Readings

- “Cadillac Desert”
- PPIC reports
- Student-generated reading lists
Guest Speakers

- Delta Historian
- Lawyers
- Biologists
- Farmers
- Policy Makers
- Economist
- Delta recreation journalist
California Water History

- Gold Rush and flooding due to hydraulic mining
  - Woodruff v. North Bloomfield Federal decision
California Water History

- Los Angeles Aqueduct (early 1900s)

[Map showing Los Angeles Aqueduct and surrounding areas]
California Water History

- Central Valley Project (Federal – 1930s)
- State Water Project (1960s)
- Promised water deliveries exceed available water
  - Meant to be surplus water
- Significant impact on Delta
California Water History

- Peripheral Canal or Tunnel
  - Ongoing issue
  - HIGHLY controversial
  - On-going focus of CA politics
Water Quality Issues

- Salinity
- Agricultural runoff
- Municipal waste water
Biological Impacts

- Endangered Species
- Invasive Species
Economic Issues

- Farms vs. Fish?
- Delta vs. southern valley farmers
- Water deliveries vs. water transfers
Levees

Subsidence

Seismic stability
Research Projects

- Focus on aspects of Delta water issues
  - Habitat restoration
  - Improved levee construction
  - Water quality improvements

- Written component
  - To inform policy makers
  - To inform public

- Group poster
Abstract
California's Sacramento-San Joaquin Delta is the heart of the state's water supply system and estuarine habitats. Water from the Delta supports California's largest industries such as agriculture and recreation while at the same time providing clean drinking water for municipalities. Human interaction has altered the diverse array of ecosystems within the Delta. Reclamation of the Delta over the past 150 years has resulted in an artificial system of levees and dams to create the current state of islands and channels. Ongoing subaqueous flows such as climate change endanger the Delta's stability. Historical conflicts between water quality and quantity add another layer of complexity to an already complicated system. Future stability and viability are still attainable at the cost of statewide efforts to improve water infrastructure, sustainable agriculture, ecosystem conservation, and urban conservation and planning. A small, well-designed and managed peripheral canal and improved levee design standards will provide adequate natural flows to maintain the Delta's ecosystem while satisfying the needs of Central Valley farmers. Encouraged responsible agricultural practices and crops through subsidies will maximize water efficiency in the central valley. Reexamination of possible beneficial uses for Delta islands in key locations and enhancing habitat for native species will help revitalize local ecosystems. Urban improvements in water consumption and conservation through metering, pricing, and limitations on development will decrease municipal demand. Implied in this collectively, these measures will alleviate pressures on the Delta while balancing the demands of farmers, ecosystems, and Delta residents.

This poster focuses on changes in Delta infrastructure and municipal water usage. The goal of these changes is to reduce the water demand from the Delta while also increasing flow through the Delta. These changes will help improve water quality in the Delta for municipal users as well as ecosystem health.

Fish, Fields, or Front Yards: A Capstone Seminar's Plan for Balancing Uses of the Sacramento-San Joaquin Delta
Carly A. Hirokawa, Christopher J. Brown, Kaitlin C. Celestino, We N. McLaughlin

Infrastructure: Peripheral Canal
Issue: Water exports from the Delta lead to abnormal flow direction and decreased flow throughout the area. In 2005, 8.3,000,000 cubic feet per second were exported through the pumping plants in the South Delta.
Solution: Small Peripheral Canal
1. Total capacity will not exceed 70% of 2005 exports
2. Canals will take from the Sacramento River and shunt water around to the pumping plants in the South Delta
3. Use existing pumping facilities
4. Increased regulation of exported water

Background
Water is a precious commodity, especially since the demand usually results in a short supply. California, with its ever-increasing population has been in a drought for the past three years which has caused more strife over the water crisis. As of 2006, the Sacramento-San Joaquin Delta exports 83 million acre-feet of water to the Delta which is currently being exported for agriculture, only 20% is used for municipalities. The sheer volume of the water that travels through this system on a daily basis takes a toll on the infrastructure and the physical structure of the Delta. To limit further degradation of the Delta, other water alternatives like water recycling and desalination are being considered. In addition urban improvements, a change in infrastructure can reduce the amount of water used by the Delta. The presence of a proposed Peripheral Canal will cut exports to a set volume to maintain a stable Delta and preserve the ecological integrity of the Delta. The instability of the Delta is a consequence of a number of variables including climate change, subsidence, and the levees. The aging infrastructure and lack of maintenance of the Delta's engineered anatomy is a growing concern. The urgency of this situation makes it apparent that new mandatory improvements in the infrastructure need to be implemented to ensure future stability of the heart of California's water system.

Urban Water Management
Issue: California is a naturally arid region.
Description: California has a desert climate so water use is scarce to begin with, therefore water needs to be conserved.
Solution 1: Implement pumping taxes and subsidies. This solution will decrease water use and promote groundwater recharge. This will be similar to the subsidies we propose for agricultural water conservation. East Stockton can be used as a model for rates and enforcement.
Solution 2: Also implement statewide metering, especially in highly unsustainable areas like Los Angeles and San Diego. The hindered water tax would be determined based on land use, distribution and climate/latitude (rainfall).
Solution 3: Institute landscaping incentives. Xeriscaping is an alternative to traditional landscaping; “water conservation through creative landscaping.” Base incentives on climate/latitude (average annual rainfall).
Solution 4: Limit urban development in the Delta and areas that cannot provide for their water demands.

References

Summary
Reducing the strain on the Delta will require major changes to California's water infrastructure and a change in how much water is used and managed. This plan revolves around the use of a small, managed peripheral canal to shunt water from the Sacramento River to the pumping stations that supply water to the Castaic Water Project. A reduction in water usage is achievable through the use of direct piped water for agricultural use and water management based on a dynamic minimum water level for the Delta will increase the volume of water traveling through the area.

In order for municipalities in the Southern part of the state to subsist on a decreased amount of water, changes are necessary in the way the general public uses water. Statewide reduction of water use is a major step towards conservation. A reduction in water use and a tax based on water use would help decrease municipal use. Initiatives or regulations that will reduce urban water use, such as xeriscaping and thoughtful land use planning, will further decrease demand. Another solution to ensure adequate water supplies is to invest in water recycling or desalination technology and employ that where possible and environmentally safe.

The purpose of these proposed changes is to reduce the amount of water that is being pulled out of the Delta. By increasing and stabilizing the volume of water flowing through the Delta, water quality will improve throughout the Central Valley. By promoting water management changes, the proposal facilitates the improvement of the Delta ecosystem without forcing unbearable hardships on municipalities or farmers.
Student Feedback

- “most intensive science writing I had while at Pacific” (2010)
- “Trying to write a science document, yet making it still understandable to lawmakers and the public has been exactly what I've now been doing to get funding in grad school.” (2010)
Student Feedback

- “I think the capstone class helped to make me a more informed voter with a better understanding of how environmental issues are actually handled.” (2011)

- “As a foreigner, it helped me learn more of the history of the region.” (2012)
Student Feedback

- “this class offered a purposeful real world experience and gave us a true sense of what environmental science is by synthesizing the classes we had previously taken together.” (2010)

- “I can say this is the project I learned the most from in my entire University life.” (2012)
Conclusions

- Ideal topic for capstone
- Connects to current issues
- Integrates multiple disciplines
- Very rewarding to teach
- Students are excited about it