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MORE WITH LESS: AGRICULTURAL WATER CONSERVATION AND EFFICIENCY IN CALIFORNIA

A Special Focus on the Delta

Executive Summary

Heather Cooley, Juliet Christian-Smith, Peter H. Gleick

September 2008

Full report available at
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About the Pacific Institute

The Pacific Institute is one of the world's leading independent nonprofits conducting research and advocacy to create a healthier planet and sustainable communities. Based in Oakland, California, we conduct interdisciplinary research and partner with stakeholders to produce solutions that advance environmental protection, economic development, and social equity—in California, nationally, and internationally. We work to change policy and find real-world solutions to problems like water shortages, habitat destruction, global warming, and environmental injustice. Since our founding in 1987, the Pacific Institute has become a locus for independent, innovative thinking that cuts across traditional areas of study, helping us make connections and bring opposing groups together. The result is effective, actionable solutions addressing issues in the fields of freshwater resources, climate change, environmental justice, and globalization. More information about the Institute and our staff, directors, funders, and programs can be found at www.pacinst.org.

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California's agricultural sector faces a number of major challenges, including uncontrolled urbanization, global market pressures, and threats to the reliability and availability of fresh water. This study offers an assessment of the potential to improve agricultural water-use efficiency, with a focus on the Sacramento-San Joaquin Delta, and provides explicit recommendations for the public, growers, and policy makers working to improve that water use.

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Acronyms and Abbreviations

AF – acre-feet
AUM – animal unit months
AWMC – Agricultural Water Management Council
C2VSIM – California Central Valley Groundwater – Surface Water Simulation Model
CCC – Contra Costa Canal
CDFA – California Department of Food and Agriculture
CEDD – California Employment Development Department
CEC – California Energy Commission
CIMIS – California Irrigation Management Information System
CVP – Central Valley Project
CVPIA – Central Valley Project Improvement Act
DWR – California Department of Water Resources
ET – evapotranspiration
EWG – Environmental Working Group
EWMPs – efficient water management practices
EQIP – Environmental Quality Incentives Protocol
FAO – Food and Agriculture Organization
LAEDC – Los Angeles County Economic Development Council
LEPA – Low-energy precision application
LESA – Low elevation spray application
MAF – million acre-feet
NBAQ – North Bay Aqueduct
NRCS – Natural Resources Conservation Service
PPIC – Public Policy Institute of California
RDI – regulated deficit irrigation
SWP – State Water Project
USBR – United States Bureau of Reclamation
USDA – United States Department of Agriculture
USGS – United States Geological Survey

Conversions

1 cubic meter (m^3) = 264 gallons = 0.0008 AF
1,000 gallons (kgal) = 3.79 cubic meters (m^3) = 0.003 acre-feet (AF)
1 million gallons = 3,785 cubic meters (m^3) = 3.1 acre-feet (AF)
1 acre-foot (AF) = 325,853 gallons = 1,233 cubic meters (m^3)

Executive Summary

The Sacramento-San Joaquin Delta is a critical resource. Almost half of the water used for California's agriculture comes from rivers that once flowed to the Delta and more than half of Californians rely on water conveyed through the Delta for at least some of their water supply.[1] The Delta also provides habitat for 700 native plant and animal species. This important region is now in a serious, long-term crisis. Major threats include rapidly declining populations of threatened and endangered fish; increasing risk of levee failure due to earthquakes and decades of neglect; rising seas and changes in frequency and intensity of floods and droughts due to climate changes; and worsening water quality.

A key finding of recent court decisions, scientific assessments, and the Delta Vision Blue Ribbon Task Force is that the absolute volume of water exported from the Delta is too high, or is so at critical times.[2] Given that agriculture accounts for about 80% of Delta water consumption,[3] no economic, environmental, or policy assessment can be complete without a serious examination of agricultural water withdrawals from the Delta.

This report looks at four scenarios for increasing agricultural water-use efficiency. Our central findings show that improving agricultural water-use efficiency through careful planning; adopting existing, cost-effective technologies and management practices; and implementing feasible policy changes can maintain a strong agricultural sector in California while reducing pressures on the Delta. Reducing water use can also create a more resilient agricultural sector by increasing the quantity of water in storage, reducing the risk of drought, and improving the reliability of the available water. In addition, certain water conservation and efficiency improvements actually increase farm productivity and profitability, further bolstering the agricultural sector.

Reductions in the amount of Delta water available to the agricultural sector are already occurring. Despite record production in counties throughout the Central Valley in 2007,[4] recent water shortages resulting from the drought and legally-mandated Delta pumping restrictions have resulted in total farm losses that some estimate to be as high as $245 million as of mid-summer 2008.[5] The consequences of future sudden shortages or disruptions in water supplies from the Delta on local economies and the state can be far less severe if focused efforts to improve efficiency are implemented early and intentionally.

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[1] Isenberg, P., M. Florian, R.M. Frank, T. McKernan, S.W. McPeak, W.K. Reilly, and R. Seed. (2008). Blue Ribbon Task Force Delta Vision: Our Vision for the California Delta. State of California Resources Agency, Sacramento, California.
[2] Isenberg, P., M. Florian, R.M. Frank, T. McKernan, S.W. McPeak, W.K. Reilly, and R. Seed. (2008). Blue Ribbon Task Force Delta Vision: Our Vision for the California Delta. State of California Resources Agency, Sacramento, California.; Natural Resources Defense Council v. Kempthorne, E.D.Cal, (2007); Pacific Coast Federation of Fisherman's Associations, Institute for Fishery Resources v. Gutierrez, E.D.Cal., (2007).
[3] Lund, J., E. Hanak, W. Fleenor, R. Howitt, J. Mount, P. Moyle. (2007). Envisioning Futures for the Sacramento-San Joaquin Delta. Public Policy Institute of California. San Francisco, California.
[4] Kern County. (2008). 2007 Kern County Agricultural Crop Report. Department of Agriculture and Measurement Standards, Bakersfield, California.; Fresno County 2008. 2007 Annual Crop Report. Fresno, California.
[5] Schultz, E.J. (2008, July 24). Rally Demands State Face Up to Water Crisis. *Sacramento Bee*.

Scenarios

Previous research from the Pacific Institute evaluated the potential for urban water-use efficiency improvements[6] and developed a high-efficiency scenario for the year 2030 that explores how to reduce water use while maintaining a healthy economy and strong agricultural sector.[7] This analysis expands on that work by evaluating scenarios for improving agricultural water-use efficiency, with a focus on the Delta.

Four scenarios for improving the water-use efficiency of the agricultural sector are evaluated:

- **Modest Crop Shifting –** shifting a small percentage of lower-value, water-intensive crops to higher-value, water-efficient crops
- **Smart Irrigation Scheduling –** using irrigation scheduling information that helps farmers more precisely irrigate to meet crop water needs and boost production
- **Advanced Irrigation Management –** applying advanced management methods that save water, such as regulated deficit irrigation
- **Efficient Irrigation Technology –** shifting a fraction of the crops irrigated using flood irrigation to sprinkler and drip systems

Results

Each scenario identifies substantial potential to improve the efficiency of agricultural water use in regions supplied by the Sacramento-San Joaquin Delta. Annual water savings from the four scenarios ranged from 0.6 to 3.4 million acre-feet (Figure ES-1). These scenarios, by themselves and in combination with one another, can help satisfy the legal restrictions on Delta withdrawals, reduce groundwater overdraft in the region, and help restore the health of the ecosystems, while still maintaining a strong agricultural economy.

Water savings achieved through conservation and efficiency improvements are just as effective as new, centralized water storage and are often far less expensive.[8] For example, the savings we find in these scenarios can be compared using "dam equivalents." Assuming that a dam yields 174,000 acre-feet of "new" water,[9] our efficiency scenarios save as much water as provided by 3 to 20 dams of this size. Furthermore, these savings could be achieved without adversely affecting the economic productivity of the agricultural sector.

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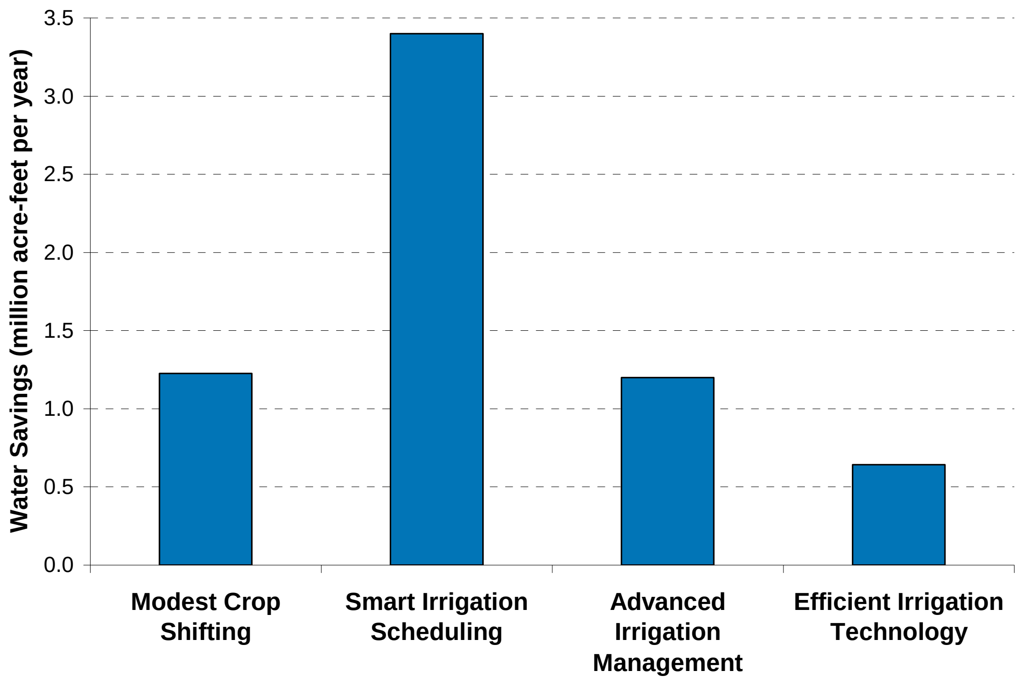
[6] Gleick, P.H. (2003). Water Use. *Annual Review of Environment and Resources*, 28: 275-314.
[7] Gleick, P.H., H. Cooley, and D. Groves. (2005). California Water 2030: An Efficient Future. Pacific Institute. Oakland, California.
[8] According to LACEDC 2008, conservation would be the least costly water supply alternative for Southern California at $210 per acre-foot of treated water as compared to water recycling at about $1,000 per acre-foot, ocean desalination at more than $1,000 per acre-foot (depending on energy prices), and surface storage options – including proposals such as the Sites Reservoir in Northern California and the Temperance Flat dam near Fresno – that would cost $760 to $1,400 per acre-foot.
[9] This is the average estimated yield of water from recent proposals to build Temperance Flat Dam (Department of Water Resources. 2007. Temperance Flat: Frequently Asked Questions. Retrieved on July 28, 2008 from http://www.storage.water.ca.gov/docs/Temperance_FAQ.pdf).

Figure ES-1. Water Savings by Scenario



While we do not consider land fallowing to be a water-efficiency measure, planned short-term fallowing could produce significant water savings during a drought or supply disruption. Planned short-term fallowing of 10% of the field crop acreage would save 1.7 million acre-feet of water and provide revenue for capital and other needed improvements. Furthermore, permanently retiring 1.3 million acres of drainage-impaired lands in the San Joaquin Valley would save 3.9 million acre-feet of water per year, while also reducing clean-up costs and minimizing the social and environmental impacts associated with polluted surface and groundwater.[10,11] However, impacts on agricultural workers and the local community, referred to as third party impacts, should be mitigated in any land fallowing or retirement agreement.

Our report provides a new vision of the Delta's future—one in which a profitable and sustainable agricultural sector thrives, while water withdrawals from the Delta are significantly reduced. Each scenario has risks and tradeoffs, and implementation details will be critical to the success of these measures. We do not address the question of how water is withdrawn from the Delta, i.e., whether a peripheral canal, "dual conveyance system," continued pumping, or no pumping from the south Delta is best. Independent of a decision to change how water is taken from the Delta, we show that it is possible, indeed preferable, to take *less* water and improve the Delta's environmental and economic conditions. Certainly, no decision about new or modified infrastructure should be made without evaluating the ability to reduce its size and cost through water-use efficiency improvements.

[10] Department of Water Resources (DWR). (2007). San Joaquin Valley Drainage Monitoring Program: 2002. Sacramento, California.
[11] Drainage-impaired lands are those areas where the water table is within 20 feet of the ground surface. To estimate the water savings, we multiplied estimates of the drainage-impaired land by the weighted average of applied water in the San Joaquin and Tulare Lake hydrologic regions from 1998 to 2003, which was 3.11 acre-feet per acre (DWR 2008b).

We conclude that with existing technologies, improved management practices, and changes in educational and institutional policies, agricultural withdrawals from the Delta can be reduced substantially, lessening pressure on endangered fish, mitigating groundwater overdraft, and easing political tensions over water allocations. By significantly reducing water withdrawals, and by encouraging a more drought-tolerant and resilient agricultural sector, our vision for the future of the Delta moves us toward more sustainable water management while maintaining a healthy and profitable agricultural sector. We recommend several key political, legal, and economic initiatives below that would support such a vision and move toward capturing these potential savings.

Conclusions and Recommendations

Agriculture is important to our economy, culture, and environment but is subject to mounting pressure from uncontrolled urbanization, global market pressures, and threats to the reliability and availability of fresh water. Actions are needed to both ensure a sustainable agricultural sector and to reduce the amount of water required for it.

- Better combined land and water planning is needed. For example, strengthen recent legislation, such as the Costa and Kuehl Acts (SB 610 and SB 221) to ensure all new developments have an adequate water supply for at least 100 years. In addition, the number of new housing units required to trigger implementation of these acts should be reduced.

- Modify and expand the Williamson Act to encourage protection of prime agricultural land from urban and suburban development.

Water conservation and efficiency improvements can reduce water use and improve water quality while maintaining or increasing crop yield. Yet these improvements often entail significant investment which can be a barrier to implementation. Smart policies can reduce this barrier.

- Provide sales tax exemptions or rebates on efficient irrigation equipment to help offset capital investments for these systems.

- Provide property tax exemptions for farmers who upgrade to more water-efficient irrigation systems. Exemptions should apply to the value added to a property by the irrigation system and be valid for 5 to 10 years.

- Develop new legal mechanisms by which municipal water or state or local wildlife agencies could invest in farmers’ irrigation systems in exchange for some portion of the water conserved.

- The state, federal government, and/or energy providers should offer rebates or incentives to farmers who implement on-farm conservation measures that may increase on-farm energy use but result in a net energy savings.

- The state and/or federal government should investigate and establish other mechanisms that encourage water-use efficiency if they achieve broader social or environmental benefits.

Agricultural commodity-support programs typically subsidize field crops, inadvertently encouraging the production of low-value, water-intensive crops. These programs should be refocused on the potential to save water.

- Reduce or realign subsidies from low-value, water-intensive crops to higher-value, less water-intensive crops.

- Provide greater emphasis on water conservation and efficiency improvements within the federal Environmental Quality Incentives Program and expand funding for these initiatives.

- Implement new water rate structures that encourage efficient use of water.

Federal and state government has invested substantially in the construction of irrigation systems, without full repayment. By creating an artificially inexpensive supply of water, these indirect water subsidies provide a disincentive for water conservation and efficiency improvements. Eliminate programs that encourage inefficient use.

- Ensure federal contracts for the Central Valley Project achieve full repayment by 2030 or sooner.

- Avoid inappropriate public subsidies for new water-supply options that are more expensive than efficiency improvements.

The existing water rights system in California provides disincentives for water conservation and efficiency improvements. More aggressive efforts are needed to apply the constitutionally mandated concepts of reasonable and beneficial use in ways that encourage improvements in water-use efficiency.

- Give legislative, regulatory, and administrative support to developing a more rational water rights system. In particular, the State Water Resources Control Board's authority and funding should be expanded to include groundwater and to challenge inefficient use as neither reasonable nor beneficial.

- Establish groundwater management areas in regions where overdraft is most severe as an immediate stop-gap measure.

- Define instream flow as a beneficial use in California.

Many proven technologies and practices can improve water-use efficiency. Strengthen and expand efforts to promote the use of these technologies and practices.

- Revise and expand "Efficient Water Management Practices" for agricultural water agencies.

- Make agricultural "Efficient Water Management Practices" mandatory and enforceable by the State Water Resources Control Board.

- Develop institutional mechanisms to increase the reliability of agricultural water deliveries to users meeting high standards of water-use efficiency.

One of the many challenges to studying water issues in California is the lack of a consistent, comprehensive, and accurate estimate of actual water use. The failure to accurately account for water use contributes directly to the failure to manage it sustainably. Efforts should be implemented immediately to improve our understanding of actual water use in the agricultural sector.

- Create a statewide system of data monitoring and data exchange available to all users, especially for water use.

- Use satellite and other technology to improve data collection and analysis, particularly for annual assessments of crop area.

- Design and implement comprehensive local groundwater monitoring and management programs statewide.

Education and technical assistance programs are important to encourage the widespread adoption of these technologies. Existing programs should be expanded and new ones implemented.

- Expand water-efficiency information, evaluation programs, and on-site technical assistance provided through Agricultural Extension Services and other agricultural outreach efforts.

- Improve online data collection and dissemination networks to provide farmers with immediate meteorological and hydrological information on climate, soil conditions, and crop water needs.