July 2010

California Agricultural Water Stewardship Initiative

CAWSI is a collaborative effort by a group of agricultural organizations that are working to develop and implement approaches to agricultural water management that support the viability of agriculture, conserve water, and protect the environment in California. CAWSI promotes on-farm and watershed-scale practices that can enhance farm water security in environmentally-sound ways.

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Why Water Stewardship for Agriculture?

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THOUGH WE OFTEN HEAR IT ARGUED that farmers “waste” water, the reality is that California farmers are producing food with the water they use, which is essential to the quality of life in urban California as well as to the food security of the United States. A permanent, sustainable agriculture in California with a permanent, sustainable water supply is possible if everyone in the state, urban and rural, conserves water. A new urban-rural compact centered on stewardship and smart use by all water users must be a key piece of any workable long-term strategy for California water management.

Just as there is a debate about distributed renewable power sources versus centralized power plants, so too can we think of water in the same way. Too much dependence has been placed on centralized water capture and conveyance, particularly as these opportunities are virtually exhausted. California already has 1,200 major dams, and the Bureau of Reclamation has analyzed many potential new projects and apparently cannot identify any where the social and environmental benefits outweigh the costs.[1] Dam-building has become prohibitively expensive—the proposed dam above Friant at Temperance Flat on the San Joaquin River is now projected to cost $3.5 billion in order to add, in the wettest years, 180,000 acre-feet of water to the system, and nothing in most years. Construction of dams and conveyance facilities must be supplemented by greater distributed water capture and conservation. As farmers shift from flood and furrow irrigation to drip and micro-sprinkler irrigation, in some areas there may be less groundwater recharge as a by-product. It is everyone’s responsibility to make sure that water is captured and infiltrated into the ground. This can be pursued at the farm level, the irrigation district level, or the watershed level, on lands where recharge is feasible, but an effort to expand the “slow it, spread it, sink it”[2] movement is needed.

To maintain our food production, supply a growing population, and restore the environment, we must seek alternative sources of water. As the CA Department of Water Resources (DWR) has acknowledged,[3] the greatest and most inexpensive sources of water lie in conservation and recycling. A Pacific Institute report estimated that urban water use could be reduced by 2.3 million acre feet (maf),[4] and DWR projects that it could be reduced by up to 3 maf.[5] Approximately 40 percent of urban water is used outdoors in California— up to 75 percent in the hottest areas—mostly on landscaping. Since total urban use is currently less than 8 maf, conserving 2-3 maf would be sufficient to sustain further population growth for many decades. Legislation passed in 2009 will require reductions in per capita water use of 20 percent by the end of 2020 in all of California’s urban areas.[6]

Agriculture can also conserve water—up to 1 maf, according to DWR estimates. Just as urban areas can become less water-intensive by changing landscaping, replacing fixtures and appliances, and reducing runoff, so can agriculture contribute to sound water management by adopting a variety of technologies and practices. Some progress has already been made, but much more can be done. Reducing reliance on irrigation water can serve producers by saving production costs and increasing resilience to drought. Agricultural water conservation can be addressed at the farm, irrigation district, or regional level.

At the **farm level**, farmers can adopt a variety of water-saving technologies and practices, some of which are more appropriate in certain regions or soils. Some examples include:[7]

✔ **Building organic matter** in the soil and better soil structure through cover cropping, minimum tillage, and amendments

— Soil organic matter, which can hold 30 times its weight in water, becomes a reservoir for moisture, reducing irrigation requirements— for every 1% increase in soil organic matter, soil water content increases over 4%.[8]

— Helps the soil absorb chemicals and fertilizers and reduce runoff.

✔ **Drip and micro sprinklers**

— Drip can reduce water use—depending on the soils and the need to flush salts—up to 20-50% and boost yields of crops such as tomatoes by as much as 30%

— Micro-sprinklers have become the technology of choice for orchards, estimated to reduce water use in nuts, for example, from 51 inches to 38-42 inches.[9]

— Subsurface drip irrigation, one of the most efficient irrigation technologies, has an estimated 25% or more savings as compared with surface irrigation (although maintenance can be a problem).

✔ **Soil moisture and evapotranspiration (ET) monitoring**

— Simply monitoring soil moisture levels to help determine when to irrigate can significantly improve water and energy conservation, maximize yields, improve water quality, and greatly reduce soil erosion.

— This can be done with inexpensive soil moisture probes or with automated systems.

✔ **Irrigation scheduling and management practices**

— Irrigation scheduling typically relies on actual weather data in conjunction with crop coefficients to estimate crop water demand, and then applies that water.

— Improved irrigation scheduling for flood irrigation systems can reduce water use 25% or more[10]

— Regulated deficit irrigation can reduce water use from any of the systems by as much as 20%; over-watering is more harmful to plants than under-watering.[11]

✔ **Dry farming**

— This method for retaining soil moisture is particularly appropriate for vineyards and orchards in regions that receive over 20″ of rainfall and have water-holding soils, but is also used in high rainfall areas for melons, tomatoes, squash, and field crops.

— Produces fruit that is smaller-sized but more intensely flavored

— Eliminates irrigation water use.

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✔ **Keyline plowing**

— The use of a Yeomans plow on rangeland and crop land redistributes the flow of rainwater to ridges where the land is drier and the water can be more readily absorbed, maximizing water retention in soil and limiting runoff.

— Keyline design allows the grower or rancher to begin to irrigate from off-farm sources later in the season, and can lead to lower applications in the dry season.

— Keyline systems build soil fertility, further improving moisture-holding capacity.

✔ **Ponds**

— Can capture tailwater and reduce runoff

— Can recharge groundwater if sited in recharge areas and water quality is adequate

— Can be managed to store rainfall or surface water at peak flows allowing for the maintenance of in-stream flows during the dry season, as on the north coast

— Can integrate with regional flood management efforts.

At the **irrigation district, or Rural Conservation District (RCD), level** the opportunities include:

✔ The many possibilities to **improve distribution efficiency**, such as lining canals or improving pumps (although trade-offs exist between groundwater recharge and efficiency, or between pressurizing water delivery for efficiency and its energy use/cost)

✔ **Groundwater can be recharged** at periods of flood flows if sufficient land is devoted to recharge basins and NEPA/CEQA requirements can be met

✔ **Government programs** such as USDA's Agricultural Water Enhancement Program or DWR-managed bond funds are not available to individual farmers and require the irrigation district, RCD, or other entity to apply for, and pass on, the funds.

At the **regional or watershed level**, the state has developed a program of Integrated Regional Watershed Management Plans that:

✔ **Allow for cooperation** across irrigation districts and the urban-rural interface, such as recycling urban water for agricultural use or recharging groundwater

✔ Can **build local infrastructure** to store or convey water

✔ Can **deal with problems of the commons**, i.e. when all users are involved can't avoid taking responsibility for over-drafting groundwater.

The advantages of water efficiency, stewardship, and conservation in agriculture are numerous:

✔ **Lower production costs** (water and energy use) from reduced irrigation water use

✔ **Increased resilience** to potential water scarcity impacts

✔ **Less over-drafting** of groundwater

✔ **Lower nitrous oxide** emissions (a potent greenhouse gas)

✔ **Less runoff** and water quality problems

✔ **Water available for other agricultural operations** or in-stream flow requirements.

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Broadening the Impact

Agricultural producers can maximize the use of local water through conservation, recycling, and recharge, all of which require greater public support. Policy should support regionally appropriate and decentralized approaches, building greater resilience into the system. This will enhance the sustainability of agriculture in California, preserving farmland and the rural economy, and helping to protect groundwater quality for rural residents.

One element that is lacking to make this approach work is sufficient funding for outreach. We can find successful examples of every sort of water-conserving practice, and yet most farmers are not aware of their options. The mobile water labs have been cut, Cooperative Extension has less than half the personnel it once had and has limited focus on water conservation, the Fresno State irrigation program lacks sufficient funding for outreach, and a recent Agricultural Water Management Council survey showed that the use of CIMIS and other water technologies was much lower than expected.[12] Many of the promising alternative conservation techniques listed above, except for drip and sprinklers, have little recognition or support so far.

And just as with the urban areas, where some cities and counties are involved in every sort of conservation program and others do little, so it is with irrigation districts and regional plans. Are farmers being actively encouraged to adopt new practices? Are the districts securing funding from state and federal sources and distributing it to their farmers? Are areas that are overdraft-ing groundwater actively expanding recharge basins?

The other principal missing piece to encourage water conservation in agriculture is incentives to farmers that protect their water rights. Many farmers who could conserve water have relatively low water prices and no financial incentive to invest in technologies or new practices. In fact, there are often disincentives in the way irrigation water is managed: "use it or lose it" does not encourage conservation.

Conserving water must make economic sense for farmers. They must be able to recover the costs of new technologies or the time spent monitoring moisture levels. It is in our state's interest to see that conservation decisions are profitable ones. Increased funding for outreach must be combined with expanded cost-sharing with farmers (e.g. EQIP, AWEP) if we want farmers with inexpensive water to invest in new technology and practices.

Endnotes

1 Peter Gleick blog at www.sfgate.com; Barry Nelson blog at www.NRDC.org; US Bureau of Reclamation, *Temperance Flat*

2 OAEC WATER Institute *Basins of Relations: A Citizen's Guide to Protecting and Restoring Our Watersheds*. 2nd ed. Occidental, CA, 2008.

3 DWR State Water Plan Update 2009. Available at http://www.waterplan.water.ca.gov/cwpu2009/index.cfm

4 Peter H. Gleick, D. Haasz, C. Henges-Jeck, V. Srinivasan, G. Wolff, K. Kao Cushing, A. Mann, *Waste Not,Want Not: The Potential for Urban Water Conservation in California*, Pacific Institute, Oakland, CA, November 2003.

5 DWR, *op cit.*

6 SB X7 7 (2009) establishes multiple ways for urban water districts to reduce per capita water consumption. See http://www.acwa.com/content/conservation/water-conservation

7 More info can be found at CAWSI's Agricultural Water Stewardship Online Resource Center, http://www.agwaterstewards.org

8 Tom G. Huntington, "Available Water Capacity and Soil Organic Matter," Rattan Lal, ed., *Encyclopedia of Soil Science*, 2006

9 Various University of California cost of production studies for walnuts and almonds.

10 See the discussion of this topic at CAWSI's Agricultural Water Stewardship Online Resource Center at http://www.agwaterstewards.org

11 Ibid.

12 Agricultural Water Management Council, forthcoming report.