Water Supply and Demand

Agriculture plays an important part in California's economy and irrigation water is an essential factor in agriculture's success. However, California faces serious water supply issues, in which agricultural uses must compete with environmental uses and the demands of a growing population. Several options are open to policymakers regarding the state's supply, demand and transport of water.

California's primary source for water is precipitation - rain and snowfall. In a normal precipitation year, the state will receive about 200 million-acre-feet (maf) in precipitation and imports from Colorado, Oregon and Mexico (DWR 2009, 1-4). Of the total supply, about 60 percent is used directly by vegetation or cropland or flows to salt sinks like saline aquifers or the Salton Sea. The remaining 40 percent, or about 80 maf, enters stream flows or wells and is distributed among agricultural, urban and environmental uses (DWR 2009, 1-4). About 30 maf is used for agricultural irrigation and about 9 maf enters urban and industrial uses.

Most of the precipitation occurs in the north and east of the state. However, irrigation water demand is highest in the state's valleys and coastal plains so a storage and transport system was developed to capture this runoff and deliver it during the dry months. California has more than 1,200 surface water reservoirs, in addition to an extensive network of canals, levees, and treatment plants (see Figure 1). Since most of the urban demand lies in the south and along the coast, a series of pumps must transport water at great expense over mountain ranges. The irrigation provided by this system, together with the Mediterranean climate through much of the state, allows the cultivation of a great variety of crops. However, precipitation varies significantly from year to year and water supplies are therefore unpredictable. Moreover, current climate change models suggest that the Sierra Nevada snowpack is likely to decrease in the future (Kapnick and Hall 2009).

Recently, increased efficiency in usage has also contributed to the state's ability to meet water needs. However, urban and industrial water demand has risen as the population has continued to grow. Urban water usage, including residential, commercial and industrial uses, is about 8.7 million acre feet annually and growing (DWR 2009, 4-10). Environmental and agricultural water usage vary significantly by year, depending on drought conditions. In a typical year, agriculture will irrigate about 9.6 million acres with 34 million acre-feet of water (DWR 2009, 4-10) or about a third of available surface water supplies. In particularly dry years, agricultural usage has exceeded 50 percent of total usage (including stream flows for environmental benefits). As more water is allocated to urban and environmental uses, agricultural producers must adjust by using less water. In many cases, water application is already relatively efficient so further reductions will be difficult. Moreover, decreases in water applications may lead to decreased yields. Yet field efficiency in agriculture can undoubtedly be improved, perhaps at substantial cost, through the widespread adoption of micro-irrigation techniques. In some cases, water savings and the value of crops produced will not justify the added capital or variable costs, and land fallowing or a shift in land use will follow.

The Sacramento-San Joaquin River Delta ("the Delta") forms the core of the water supply and delivery system from Northern California to the San Joaquin Valley and beyond. However, the Delta's water supply is not reliable and its poor water quality means that it has to be treated before being used. The Delta's flow is controlled to enable exports. This means that flow requirements fall below the minimum needed to sustain the local ecosystem. As a result, federal court action has reduced water deliveries from the Delta to protect fish species. The Delta is made up of the Federal Central Valley Project and the State Water Project, constructed during the 1960s and 1970s (see Figure 1). The Central Valley project typically delivered 7 maf, but 2008 deliveries amounted to 5.7 maf. The State Water Project originally delivered 2.2 maf (Howitt and Sunding 2004), but 2009 deliveries amounted to only 15 percent of this amount. (DWR 2009, 4-9)

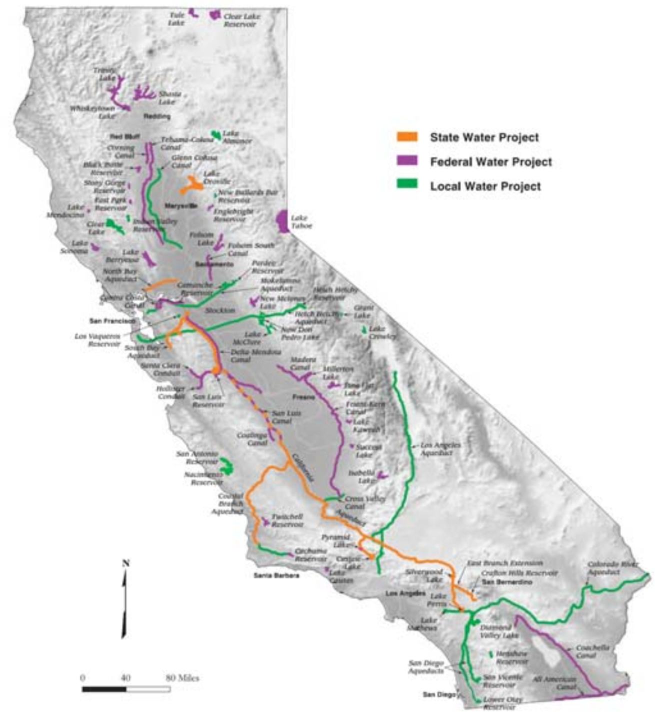

Figure 1: California Water Projects. Source: California Department of Water Resources 2003.

The state has sufficient surface and groundwater storage capacity to withstand one or two dry years. However, long droughts – projected to become increasingly common due to climate change – will have significant consequences. Droughts cause economic harm and the loss of crops. They lead to lower water quality, and raise the risk of fires and species loss. Groundwater becomes the primary water source during droughts, but many aquifers are contaminated due to poor land use practices. In a non-drought year, groundwater extraction supplies about a third of the state's urban and agricultural water demand. However, in a drought year, this amount will increase to about 40 percent and 60 percent or more in certain regions (DWR 2003). Some regions withdraw too much groundwater and don't allocate water such that aquifers recharge fully during wet years. Such overdraft hasn't been assessed since 1980, but it is believed that the statewide deficit is between 1 and 2 million acre feet each year (DWR 2009, 4-10). The 2007-9 drought is causing significant economic harm in agriculture and the rest of the economy. Water shortages are projected to lead to the loss of crop value of about one billion dollars in 2009. The drought also exacerbated conditions during the worst fire season in the state's history.

Clearly, the state's water problems require urgent attention, a fact reflected in the governor's 2006 Strategic Growth Plan (SGP) which calls for a 20 percent reduction in per capita water use by 2020. In addition, the SGP proposes almost $6 billion to ensure reliable water supplies, of which $4.5 billion would go towards additional storage capacity. New surface storage would be constructed in the Sacramento Valley and on the San Joaquin River east of Fresno, and would yield up to 0.5 maf of water per year and better drinking water quality. The SGP would allocate another $1 billion towards improving the Delta's sustainability by upgrading water conveyance infrastructure and $250 million towards improving water resources stewardship. It is not clear if the state is in a financial position or will to make these investments. Desalinization has been suggested as another possibility to address part of California's water shortage. However, the necessary reverse osmosis process is expensive and yields relatively little water. California has 24 desalting plants operating and they only have a combined capacity of about 79,000 acre-feet. (ACWA 2009). With current technology, desalinization costs are more than $1,000 per acre food plus costs of brine disposal.

Public-works projects of the scale that made large-scale irrigated agriculture feasible in California have largely fallen out of favor. Therefore, conservation must play a significant role in addressing California's water crisis. Furthermore, restricted water supplies mean that California's future urban development will likely become more dense, with less water demand for landscaping – upwards of 80 percent of total residential demand. Nonetheless additional water is likely to be transferred from agriculture.

– University of California Agricultural Issues Center, July 2009

Sources:

Association of California Water Agencies. 2009. "General Facts About California's Water" Available at: http://www.acwa.com/issues/general_water_facts/index.asp

California Department of Water Resources. 2009. *California Water Plan Update 2009, Public Review Draft*. Vols. 1 and 4.

California Department of Water Resources, 2005. *California Water Plan Update 2005.* Vol. 1.

California Department of Water Resources, 2003. "BULLETIN 118: Chapter 1, Groundwater – California's Hidden Resource."

Howitt, Richard and Dave Sunding. 2003. "Water Infrastructure and Water Allocation in California" in Jerry Siebert's (ed.) *California Agriculture: Dimensions and Issues*. Berkeley, Calif.: University of California, Giannini Foundation of Agricultural Economics, Division of Agriculture and Natural Resources.

Kapnick, Sarah and Alex Hall. 2009. *Observed Changes In The Sierra Nevada Snowpack: Potential Causes and Concerns.* Berkeley, Calif.: University of California, California Climate Change Center, March 2009.