This series of 15 AIC white papers outlines many major issues facing California agriculture. They describe the important factual circumstances, policies and economic relationships surrounding each issue. They do not analyze in any detail implications of alternative responses to the issues. These white papers are designed to provide quick readable introductions to major issues that will be useful to industry and stakeholders and analysts, as well as public decision makers and advisors.

Initial drafts of these white papers were prepared in the summer of 2009 to assist the California Board of Food and Agriculture and the California Department of Food and Agriculture (CDFA) in deliberations over a strategic plan and policy agenda meant to tackle the most important issues facing California agriculture today and to position California agriculture favorably for the challenges it will face in the future. The University of California Agricultural Issues Center, in collaboration with the American Farmland Trust (AFT), was asked to prepare a series of very brief reports covering a range of topics of importance for the planning and agenda setting process. In addition to the 15 topics covered here, two others were written by AFT: “Intergenerational Succession and New Farmers” and “Agricultural Land Loss and Conservation.”

These white papers were conceived and prepared by John Thomas Rosen-Molina and Daniel A. Sumner, with help from others at AIC, especially Marcia Kreith, Sebastien Pouliot (now at Iowa State University) and Jonathan Barker. We thank AFT and CDFA, especially Edward Thompson for discussions, comments and suggestions that improved the initial drafts of these papers that were provided to CDFA and the State Board.
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Global Markets and Trade

AIC White Papers on California Agricultural Issues

Access to foreign markets has long been important for U.S. farmers. U.S. agricultural exports totaled about $115 billion in 2008. Agriculture in the United States is almost twice as reliant on overseas markets as the rest of the economy (FAS 2006). In recent years, the gross value of exports has been about one-fourth of farm cash receipts (Shane et al. 2009). Food demand has been rising in developing countries because population and income growth rates have been relatively high in the developing world. Moreover, as incomes rise in developing countries, food demand is shifting from locally produced staples to imported meat, dairy, fruits and vegetables.

California exports agricultural goods to more than 156 countries, and agricultural export earnings totaled about $10.9 billion in 2007. Almonds are the state’s top export and accounted for about 17 percent of total export value. Other significant exports include dairy products (about 8.8 % of export value) wine (about 7.5 %), table grapes (about 5 %), and cotton (about 4.6 %), walnuts (about 4 %), pistachios (about 3.3 %), rice (about 2.9 %), processed tomatoes (about 2.7 %) and strawberries (about 2.7 %) (Matthews and Sumner 2008).

For some products, California is responsible for all or nearly all of U.S exports. Well over half of U.S. vegetable, fruit, and tree nut exports come from California. Indeed, the state accounts for at least 90 percent of strawberry, grape, processed tomato, plum, and lemon exports. California is accountable for all U.S. exports of almonds, walnuts, pistachios, raisins, dried plums, kiwis, dates, figs, olives, and garlic (UC AIC 2009).

In 2007, the top three export destinations for California agricultural goods were Canada, the 27-member European Union and Japan, which together account for 57 percent of 2007 export value, as shown in Figure 1. Mexico and China/Hong Kong each purchased about seven percent and Korea about four percent of California’s agricultural exports. For most California commodities, exports diversify market opportunities and, in general, California agriculture has significant presence in many foreign markets.

Currency exchange rates specify the relative values between different currencies and are therefore an important factor in international trade. Of particular interest are the specific...
exchange rates between the U.S. dollar and currencies in countries which import a significant portion of the California farm output. The commodity-relevant exchange rates for the top twenty California agricultural exports have generally experienced a moderate decline over the past ten years. Starting a decade ago, these exchange rates climbed slowly, generally reaching their peaks in the early months of 2002. After that, the indexes have declined gradually, with most of the commodities ending the period about one-third below their peaks. Thus, part of the recent increases in California agricultural export success can be attributed to a weaker dollar in relevant markets.

In 2007, about 28 percent of California’s agricultural output was exported, compared to about 16 percent in 1999 (Matthews and Sumner 2008). Although the state’s largest trade partners are developed countries, exports to developing markets have shown the most growth in recent years and the current global recession will limit this growth. In fact, large developing country markets important to California agriculture already began to reduce their imports towards the end of 2008 (Shane et al. 2009).

Competition from imports is also important to California agriculture as are access to imported inputs and the contributions to economic growth caused by more open markets. Some California agricultural products, dried fruit or garlic for example, have lost out domestically in competition with imports. Generally, however, California agriculture gains from global market opening as producers shift to those commodities, such as tree nuts, for which California is most competitive. Access to imported inputs is an often overlooked aspect of international trade that is important to agriculture. California agriculture relies on fuel, fertilizer and even farm equipment from international sources and access to those farm inputs is vital for managing costs for some farms. Overall, increased access to growing global markets will help California growers to successfully compete for select export opportunities in world markets.

Important steps towards opening agricultural markets in agriculture were the 1994 North American Free Trade Agreement (NAFTA) and the 1995 Uruguay round of negotiations between members of the World Trade Organization (WTO). U.S. markets are generally already open to imports; therefore freer trade globally mostly means more access to California farm exports. A free trade agreement that would eliminate many tariffs and other trade barriers has been negotiated with South Korea but awaits clearance by legislatures in both countries (Lee and Sumner 2009). The Doha WTO negotiations, designed to eliminate export subsidies and lower tariffs and other trade barriers remain on hold. Thus two major opportunities to further open agricultural markets are currently suspended, while global protection and trade disruption has gradually increased.
Sources:


Local and Regional Markets

AIC White Papers on California Agricultural Issues

Consumers have shown increased interest in local and regional markets, and farmers are paying more attention to marketing their products to meet this market niche. Locally-produced goods can be marketed through traditional retailers, and it appears that this is a growing trend. Another form of local marketing is directly from the farmer to the consumer. Such direct marketing can take such forms as farmers’ markets, direct sales to restaurants, schools and institutions, and community-supported agriculture. Direct marketing has benefits for both consumers and producers. Federal government support for direct marketing efforts such as farmers’ markets expanded with the 2008 Farm Bill, which offers incentives to promote local consumption of locally produced foods and funding for farmers' markets (ERS 2008).

More than seven thousand farms in California (or almost 10 percent of the total) marketed some part of their output directly to consumers, more than in any other state. In fact, the top three U.S. counties for direct marketing were all in California – Fresno ($17.2 million), San Joaquin ($11.8 million) and Tulare ($11.7 million) (NASS 2007). The total value of direct marketing sales in California more than doubled between 1997 and 2007. In 1997, direct marketing sales were worth more than $73 million or about 0.3 percent of the state’s total value of agricultural output. Sales increased to about $114 million in 2002 or about 0.4 percent of total agricultural output. In 2007, sales reached more than $162 million or about 0.5 percent of the state’s total agricultural output by value (NASS 1997, 2002, 2007). (The census data and other information listed here exclude the wine industry where direct marketing to consumers has long been and continues to be a major revenue source.)

California’s level of direct marketing sales is likely a result of a combination of factors: large urban centers spread throughout the state, a climate conducive to many types of crops, long growing and marketing seasons and a large variety of high-value horticultural crops (Hardesty 2003). Many buyers believe that food bought directly from the producer is fresher and that the food is safer. Sometimes producers gain from direct marketing because producers can capture a higher price, but of course costs can also be high. Also direct marketing may allow producers to sell products in smaller lot sizes and to sell fresh produce that might not be suitable for retail stores. Direct marketing may be well suited for small farms with low labor costs or with family members or workers who enjoy interacting with consumers.

Farmer’s markets are the form of direct marketing that is most commonly associated with the local food movement. Starting in 1977, the California Department of Food and Agriculture (CDFA) exempted farmers who sold their good directly to the public from packing and labeling requirements. However, to exercise this exemption, farmers must be certified by their county agricultural commissioner and sell their goods at Certified Farmer’s Markets. California leads the nation in the number of farmers markets with about 500 markets, of which about half are active year-round (NASS 2007).

Direct marketing also includes community-supported agriculture (CSA), in which individuals form a group that pledges to cover in advance the expected costs of a farm and thereby share in
the risks and benefits of food production. Members receive a share of the farm’s output, usually through regular deliveries or pick-ups. The number of CSA farms in the country increased from 60 in 1990 to about 1,700 in 2004, with CSA farms more common in California, New York, Pennsylvania, Wisconsin and Washington (Strochlic and Shelley 2004). However, CSA farms remain a small share of total farms, representing less than 0.1 percent of all U.S. farms. Another important form of direct marketing is roadside stalls or direct from the farm marketing.

As mention above, revenues from direct marketing are still small compared to total agricultural revenues. If consumers shift toward more unprocessed fruits and vegetables and come to appreciate locally grown products for their contribution to the local culture, there may be significant potential for growth in markets for locally produced food, especially in California.

Locally-produced foods are often interpreted to be more environmentally sustainable than other foods. However, there are several reasons why “food miles” (the distance food must travel between stages of production and final consumption) are not a good indicator of embedded energy, life-cycle greenhouse gas emissions, or other measures of environmental impact. Transportation from the producer to the consumer represents only 4 percent of life-cycle emissions for food. Differences in transport distance are easily offset by differences in yields, land use practices, and storage costs necessary to supply locally-produced food through all seasons. Weber and Matthews (2008) suggest that dietary shift can be more effective in reducing emissions than buying locally-produced food, especially when red meats are avoided. Furthermore, the distinction between locally-produced food and organic production must be acknowledged. Although often used synonymously, locally-produced foods are not necessarily organic and vice-versa. Organic production carries its own set of environmental implications, since organic production tends to have lower yields and therefore require more land for similar levels of output.

A focus on local consumption of locally produced foods raises two important concerns for California agriculture. First, California produces so much that most of its farm output, especially fruits and vegetables, is shipped to other parts of the United States. Because California producers already serve most California consumption, if shipments from California to other regions decline with a shift there towards local produce, overall demand for California produce would decline. Second, because local production and direct marketing is generally more expensive for consumers, fewer low-income consumers choose this marketing channel. One result is that most direct marketing efforts and venues are less available to low-income consumers, especially the urban poor.

An important contribution of direct marketing that may benefit all of agriculture occurs when consumers (and voters) use the experience to learn more about farming and the challenges that farmers face. Bringing more exposure to farmers and farm workers to non-farm people can be a useful contribution of direct marketing that extends beyond the share of production or producers involved.
Sources:


______. 2002 Census of Agriculture. Washington D.C.


Agricultural Infrastructure

AIC White Papers on California Agricultural Issues

Infrastructure includes gas, water, sewer and energy transmission lines, telecommunications and transportation systems, including roads, rails, waterways and ports. Leaving aside irrigation infrastructure, which is a specialized topic, transportation systems are a particularly important form of infrastructure to agriculture because of the role they play in the distribution network. Better transportation infrastructure allows producers to more efficiently obtain inputs, move their commodities over large distances and access the global market. The high productivity of California agriculture is complemented by producers’ ability to quickly bring their perishable and high value goods to market.

Economic growth during the 1990s led to more traffic, and rural traffic and freight transport also increased. As travel demand rose faster than the supply of highways or mass transportation systems, highways have become more congested and infrastructure more challenged (Brown 2005). Maintenance has also lagged. For example, in 2001 more than one-third of California bridges were found to be deficient (Brown 2005). Without additional investment, the U.S. transportation infrastructure, including rail capacity will face significant strains (Brown et al. 2004).

Including agricultural production, farm inputs and processed food products, the food sector uses almost one-third of U.S. freight transport (Brown et al. 2004). Trucks are the most widely used system of transportation for agriculture, accounting for about two-thirds of all agricultural freight transport. Rail transport provides about one-quarter of agricultural freight, and barges and multiple modes of transport make up the remainder of freight shipments. The dairy and meat industries are most reliant on truck transport. Overall, the food sector uses more infrastructure per dollar of domestic consumption than other industries in the United States (Brown et al. 2004).

Several of California’s most productive agricultural regions are located in the center and far southeast of the state. Most agricultural produce is consumed in urban centers along the coast or out-of-state. Therefore, agricultural output must move over long distances, making use of transportation infrastructure. Nationwide, 95 percent of perishables are delivered by truck and in California about 98 percent of fresh fruits and vegetables were delivered by truck in 2004 (Cowan 2005). Almost all California milk is transported by truck from the farm to the processing plant, and most dairy products are shipped by truck again after processing. Truck transport is used for a high share of agricultural products in California because many of the goods produced in the state require controlled temperatures and fast delivery. These facts emphasize the importance of road construction and maintenance for California agriculture.

Funding for highway construction and maintenance comes primarily from the Federal government but is under control of the California Department of Transportation (CalTrans). In 2005, the U.S. Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU; P.L. 109-59) which guaranteed funding of more than $244 billion for highways, highway safety, and public transportation systems. California
received more than $17 billion of the total, with most of the money going towards interstate and highway maintenance and construction, other surface transportation projects, bridge replacement and rehabilitation, and congestion mitigation. The legislation for this large investment in U.S. transportation infrastructure expired in September 2009, and Congress is expected to begin working on a replacement bill during the 2009 session. The American Recovery and Reinvestment Act of 2009 (AARA) apportioned to California $2.57 billion for highways, local streets and roads, freight and passenger rail, and port infrastructure and roughly $1.07 billion for transit projects. In addition to these formulaic funds, the state has applied for $4.7 billion in AARA funds for construction of high speed rail.

SAFETEA-LU designated state route 99 from Bakersfield to Sacramento as a high priority corridor. Termed the “California Farm-to-Market Corridor” in the National Highway System, the route was scheduled to become an interstate highway, making it eligible for funding under highway reauthorization bills. At least $35.5 million was allocated to improving state Route 99 between 2005 and 2009 (FHA 2005). Given the roughly $2.2 million cost to construct a mile of single lane highway in California (WSDOT 2002), a $35.5 million allocation would be enough to construct about 16 lane miles. Nonetheless, increased spending on Route 99 may help agricultural producers by improving the roads that carry their products and lowering transport costs.

About 28 percent of California’s agricultural output was exported in 2007 meaning ports are an important form of infrastructure for the sector (Matthews and Sumner 2008). Nearly 14 percent of perishables produced in the San Joaquin Valley are exported to other countries. A high share of these exports passes through the ports of Oakland, Stockton, Los Angeles, and Long Beach (Cowan 2005). Under SAFETEA-LU, the ports of Los Angeles and Long Beach were allocated about $5 million annually from 2005 to 2009 (FHA 2005). The intermodal container transfer facility that serves the Los Angeles and Long Beach ports is connected by railway to stations in the Central Valley and to the largest rail facility on the west coast, located in Roseville.

Railroads are mainly used in the transport of “hard” products such as grains, nuts, onions, potatoes, and carrots. However, transport by rail is cheaper than transport by truck for long-distances and it is less fuel intensive. A significant increase in freight conveyance by rail would likely require increased investment in railway infrastructure and track upgrades. SAFETEA-LU authorized projects to expand and improve the California railway system. This expansion includes constructing or upgrading intermodal transport centers along the Altamont Commuter Express Corridor, which should alleviate congestion for freight trucks along Route 99.
Sources:


Agricultural Workforce

AIC White Papers on California Agricultural Issues

The agricultural workforce in California includes farmers, managers, consultants and other technical service providers as well as many relatively low-wage seasonal farm workers. The more managerial and technical occupations are well paid and this segment of the labor market is well integrated with the rest of the economy and raise issues of quality of training, reliability of employment and opportunities for advancement. This indicates a demand for availability of post-high school training relevant for specialized agricultural occupations at community colleges and four-year institutions.

Conditions surrounding the low-wage hired farm labor force introduce some complex and specialized social and economic concerns. Hired farm employment in California often entails physically demanding work under difficult conditions for relatively low wages. Partly as a consequence of the low-wage and seasonal nature of much agricultural work, farm communities in California have among the highest rates of poverty and unemployment in the state. Many farm workers lack the education, skills, language and legal documentation to enter higher-earning occupations.

On the demand side, California farms rely on access to a ready supply of labor both for full time and seasonal employment. California is a large producer of labor-intensive crops such as fruits and vegetables. The comparatively low wages of farm work does not draw sufficient labor from the industrial and service sectors of California’s urban centers. The state’s agricultural sector therefore depends on low wage immigrant labor.

Under the federal Fair Labor Standards Act (FLSA), farm laborers are exempt from overtime pay provisions, and young workers with parental consent are also exempt from the child labor provisions (US Dept. of Labor 2008). The Migrant and Seasonal Agricultural Worker Protection Act provides the right to timely remuneration with earnings statements and safe transportation during work hours, but does not provide guarantees available to other workers under federal law. However, the California Agricultural Labor Relations Act (CALRA) established the right for collective bargaining for farm workers in California. CALRA is administered by the California Agricultural Labor Relations Board, which investigates claims of unfair labor practices. In addition, California farm workers must be paid the California minimum wage of $8.00 per hour, significantly higher than the Federal minimum wage rate of $7.25 per hour.

According to a 2005-7 survey, 75 percent of California farm workers were foreign-born and 72 percent were born in Mexico. About half of California crop workers were believed to be unauthorized in 2007 (Carroll, Saltz and Gabbard 2009). Immigration issues and farm labor are closely intertwined. A relative handful of the 2 million farm workers in the United States enter the country and work under the H-2A temporary agricultural worker program. In 2008, the Department of State issued about 65 thousand H-2A visas mainly to Mexicans (Rural Migration News 2009). About 8 thousand farm employers were certified to fill about 95 thousand farm jobs with H-2A workers in fiscal year 2008. H-2A has never been a significant factor in California hired labor supply. However, because of concerns that labor-intensive crops may
become seriously constrained by labor shortages, improved access to immigrant guest workers has long been a policy objective of farm employers in California and elsewhere (Martin 2001).

Annual average farm employment in California decreased from about 412,000 workers in 1997 to about 390,000 in 2008, as shown in Figure 1. Employment fell sharply from about 405,000 in 2000 to about 370,000 in 2004, following the 2001 recession. Employment recovered somewhat over the following years. As shown in Figure 1, the agricultural workforce, as a share of the total civilian workforce, fell from about 3 percent in 1997 to about 2.6 percent in 2002. The share of the workforce engaged in agricultural production or support activities remained relatively flat through 2008. Thus, the agricultural sector employs only a small share of the California workforce.

Many farm workers are hired by farm labor contractors (FLCs), who organize workers into crews for producers. Farm labor contractors must obtain federal and state licenses and register with state and county agricultural commissioners; farm employers must verify that the FLCs they use are licensed (Dept. Industrial Relations 2000). The FLC system means that most seasonal and temporary farm workers in California are not employed directly by farms, but instead by contractors who operate agricultural service firms. In many cases, the contractors not the farms are directly liable for complying with labor and other government regulations.

The seasonal and short-term nature of much agricultural employment combined with low wages means that many workers are very poor by California standards. Even when hourly wages are well above the state minimum wage, workers may live in poverty because year-round full-time employment is unavailable. Furthermore, most farm jobs do not provide adequate health insurance and other benefits to give security to workers and their families. High rates of poverty in some agricultural areas lead to social costs such as a small tax base to provide local services, lack of familiarity with or local commitment to local community governance and lack of access to adequate nutrition and healthcare for workers and their families.
Higher wages, increased worker benefits and better working conditions on California farms would increase production costs and raise concerns about competitiveness with produce from other regions or with food products that are less labor intensive. Wage increases would differentially raise crop costs because labor cost shares differ by crop. For example, labor costs are about 60 percent of total operating costs for strawberries (Molinar et al 2004), but only about 4 percent for corn (Frate et al. 2008). Assuming no labor-saving adjustments on farms, a 10 percent rise in wages would therefore raise total operating costs by 6 percent for strawberries but only 0.4 percent for corn.

Under recent market conditions there has been a sufficient farm labor supply, even at relatively low wages, to satisfy most demand except in specific local conditions for a few crops. That has not removed the sense of vulnerability experienced by many growers, so the call for more reliability of farm supply has remained strong. Mechanization could improve working conditions (including worker health and safety) and wages for workers and reduce reliance on seasonal labor and much has been done in that direction. Of course, mechanization may reduce employment possibilities and can cause hardship in the short term for workers caught in the transition. At the same time many tasks required for many California crops are ill suited for mechanization.

Farm labor issues are many and multifaceted, including productivity and food prices, immigration, health policy, minimum pay, work conditions, union status and many social problems that accompany poverty. All of the potential policy suggestions that address the issues have been controversial, but broad goals are generally accepted. This suggests that some progress to resolution may be possible.
Sources:


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 California precipitation—rain and snowfall, not water imported from other regions or from desalinization (UC AIC 2009). Much of the precipitation is stored as surface water in reservoirs or as groundwater. In a normal precipitation year, the state will receive a total of about 200 million-acre-feet of water (maf), including 5 to 10 million maf of imports from Colorado, Oregon and Mexico (DWR 2005). Of the total surface supply, about 60 percent is used directly by native vegetation or cropland, evaporates, or flows to salt sinks like the Pacific Ocean, saline aquifers and the Salton Sea. The remaining 40 percent, or about 80 maf, is referred to as “developed” or “dedicated” and is distributed among agricultural, urban and environmental uses or is stored in surface or groundwater reservoirs (DWR 2005). About 34.2 maf is used for agricultural irrigation and about 8.9 maf is devoted to urban and industrial uses in a normal year (DWR 2005).

Most of the precipitation occurs in the mountains north and east of the Sacramento-San Joaquin Delta. However, irrigation water demand is highest in the state’s valleys and coastal plains south of the Delta so storage and transport systems were 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 conveyance network dependent on rivers, levees, canals and pumping stations (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 snow pack, which serves as a natural reservoir with gradual release, is likely to decrease in the future (Kapnick and Hall 2009).

Recently, increased efficiency in usage has 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 8.9 maf annually and growing (DWR 2005). Environmental and agricultural water usage varies significantly from year to year, depending on drought conditions. In a normal precipitation year, agriculture will irrigate about 9.6 million acres of cropland with 34.2 maf of water, equivalent to 41 percent of total applied surface and groundwater usage (DWR 2005). In particularly dry years, agricultural usage has exceeded 50 percent of total usage (including stream flows for environmental benefits).

As more water has been allocated to urban and environmental uses, agricultural producers have adjusted 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 falling or a shift in land use will follow.

The “Delta”—the confluence of the Sacramento and San Joaquin rivers at the eastern edge of the San Francisco Bay—is central to the current delivery of water from Northern California to the San Joaquin Valley and beyond. However, the water supply through the Delta is not reliable because of fragile levees, variable precipitation, and saline tidal flows. Poor quality means that Delta water has to be treated before being used for urban and industrial purposes. The Delta’s flow is controlled to enable exports. Flows below the minimum needed to sustain the local ecosystem cause severe environmental consequences. As a result, to protect fish species federal court action has restricted water exports from the Delta. The federal Central Valley Project, authorized in 1937 with first deliveries to the San Joaquin Valley in 1951, and the State Water Project, constructed during the 1960s, each export water from the southern end of the Delta (see Figure 1). The Central Valley Project (CVP) typically delivered 7 maf, but 2008 deliveries amounted to 5.7 maf (DWR 2009). The State Water Project originally delivered 2.2 maf (Howitt and Sundiing 2004). Although 2009 deliveries initially amounted to only 15 percent of this amount, after May snow and rains the final allocation was raised to 40 percent (DWR 2009b). Uncertainty about water supply is an important factor in farm decisions.

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 even larger 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. As noted above, groundwater becomes the primary water source during droughts. However, many aquifers are contaminated with metals, nutrients, or salinity due to poor land use practices (See white paper on Water Quality and Agriculture) (SWRCB 2002). Some regions withdraw too much groundwater and do not allocate water such that aquifers recharge fully during wet years. Such overdraft has not been assessed since 1980, but DWR believes that the statewide deficit averages 2 million acre feet each year (DWR 2009a). When properly managed, conjunctive use of ground and surface water enables aquifers to recharge in wet years for withdrawal in dry years.

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 (Howitt et al. 2009). The drought also exacerbated conditions during the worst fire season in the state’s history. In addition the risk of levee failure and catastrophic flooding from earthquakes, rising sea levels and predicted higher flood flows makes the state’s North-South water transfer process vulnerable to failure.

In November 2009, the legislature and Governor agreed on a comprehensive water package consisting of four policy bills and an $11.14 billion general obligation bond proposal, which must be approved by the voters in 2010. The bills establish a Delta Stewardship Council, require local monitoring of groundwater elevations, require statewide water conservation and increase State Water Resources Control Board enforcement of illegal water diversions. Together with local cost sharing, funds from the $11.14 billion bond measure will be used for drought relief, water supply reliability, statewide operational improvement including development of additional storage, groundwater quality protection, water recycling, conservation and watershed restoration projects (DWR 2009c). It is not clear if the state is in a financial position or the voters will agree to make these investments.

Desalinization has been suggested as another possibility to address part of California’s water shortage. However, the reverse osmosis process is expensive because of high energy requirements and yields relatively little water. California’s 24 desalting plants now in operation have a combined capacity of only 79,000 acre-feet (ACWA 2009). With current technology, desalinization costs are more than $1,000 per acre-foot of water plus the 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 an even more significant role in addressing California’s water crisis. Furthermore, restricted water supplies mean that California’s future urban development will likely become denser, with less water demand for landscaping – upwards of 80% of total residential demand. Nonetheless additional water is likely to be transferred from agriculture.
Sources:


Energy and Agriculture

AIC White Papers on California Agricultural Issues

Energy is again at the forefront of agricultural issues in California. Three interconnected concerns dominate the discussion of agricultural energy. First, a spike in oil and other energy prices has highlighted once again the costs of energy-connected agricultural inputs such as fertilizer, electricity and fuels for trucks and tractors. Second, agriculture is a producer of feedstock for bioenergy. Both increased energy prices and government policy have stimulated interest in bioenergy as a substitute for fossil fuels. Third, environmental concerns related to regional air quality and global climate change have encouraged investigation of alternative energy sources and policies to change the energy relationships in the California economy and globally.

Federal government energy policy is only partly under the purview of the U.S. Department of Energy (DOE). The U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Agriculture (USDA) also have strong energy-related policy mandates. USDA has major biofuels programs and the recent Farm Bill adjusted biofuels subsidy rates and trade policy. USEPA has responsibility for determining regulations that reduce the negative environmental impacts of energy production and use and USEPA regulations related to biofuels and climate change are among the most important current policy issues. While the Energy Act of December 2007 set mandates for use of biofuels including from conventional feedstock (corn) and from as yet uncommercialized cellulosic technologies, EPA is charged with deciding which fuels meet the “renewable” fuels standards required for fuels to qualify for the mandates.

In California, the California Energy Commission is the lead agency for energy policy. The California Public Utilities Commission regulates privately owned electric and natural gas companies that generate power. The California Department of Conservation oversees the operations of oil, natural gas and geothermal wells to enforce environmental regulations and ensure public safety. In addition, the California Air Resources Board (CARB) is responsible for setting and enforcing emission standards for energy sources and vehicles that meet California’s low carbon fuel standards.

In 2006, California introduced major legislation on renewable energy. According to Senate Bill 107, electric utilities must increase the share of electricity they provide from renewable sources to 20 percent by 2010. Governor Schwarzenegger expanded on this legislation by signing executive order S-14-08, which requires California utilities to increase this share to 33 percent by 2020. A.B. 32, the Global Warming Solutions Act of 2006, requires that greenhouse gas emissions be reduced to 1990 levels by 2020. CARB has primary responsibility for implementing the A.B. 32 scoping plan, which includes a cap-and-trade system, which will likely raise costs for energy intensive industries but also provide opportunities for industries such as agriculture that may be in a position to sell greenhouse gas emission credits.

Today, California meets about 73 percent of its electricity demand through in-state production, with the remainder met by imports from neighboring states. California sources meet 13 percent of natural gas demand and almost 40 percent of crude oil demand (CEC 2009). Natural gas
supplies the feedstock for about 46.5 percent of all electricity generated in 2008 followed by 15.5 percent from coal, 15 percent from nuclear facilities and about 9.5 percent from large hydroelectric dams. Another 13.5 percent of electricity comes from other renewable sources, including geothermal (about 5 percent), small hydroelectric facilities (3.5 percent), wind power (2.5 percent), biomass (2.2 percent) and solar power (0.3 percent) (CEC 2009). Electricity usage by the agricultural sector is primarily for pumping water (>70 percent of usage).

Between 1990 and 2007, electricity consumption in California rose at an annual average rate of 1.28 percent, far less than the rate of growth in the economy. Electricity use in agriculture, (primarily for irrigation pumping) was 13 percent higher in 2007 than in 1990. Water pumping is energy intensive and the State Water Project is the single largest user of electricity in the state.

As elsewhere, costs in California agriculture rise with rising oil prices and other energy prices. In agriculture, indirect energy use, including upstream utilization from inputs such as fertilizers, pesticides and water pumps and downstream use for processing, and distribution, exceeds on-farm use for fuel and makes farms particularly vulnerable to price spikes (Roland-Holst and Zilberman 2006). The share of energy costs in producers’ total operating costs depends on the product. For example, fuel and fertilizer costs are about 38.75 percent of total operating costs per acre for corn (Britten et al. 2004), but only about 1.43 percent for strawberries (Molinar et al. 2004).

With rising input costs, production agriculture will adapt to less energy intensive methods of irrigation, product drying and fertilizer use. Off the farm, the industry will shift to less energy demanding modes of input and product distribution. In some cases, such as compared to developing countries with more labor-intensive methods, California agriculture has higher energy cost-shares than competitors. But, in other cases the climate and other environmental factors allow California agriculture to have lower energy intensities, for example, field production versus greenhouse technology for vegetable production. The comparative advantage of California agriculture will shift with higher energy costs and one major factor is the cost of energy inputs here relative to costs among competitors. These relative costs are largely related to infrastructure and environmental policy.

According to Roland-Holst and Zilberman (2006), cattle production is the most susceptible of agricultural industries to rising energy prices because oil and gas costs make up a relatively large share of total costs. The large share of energy costs is due to the cattle industry’s demand for hay and dependence on truck transport. In addition, the livestock industry is vulnerable to policies that shift crop resources from animal feed production to energy feedstock. Crops such as vegetables and nursery products are less vulnerable, since energy comprises a smaller share of their total costs. For example, Roland-Holst and Zilberman estimate a total energy cost-price pass through of five percent for cattle but only 2.8 percent for most vegetables and 0.6 for nursery products.

While agricultural feedstock can be used to generate bioenergy, controversy exists regarding the environmental benefits of commercially feasible U.S. biofuels that use corn that could otherwise feed people or livestock. Cellulosic biofuels that use crop feedstock are not yet commercially feasible and it seems unlikely that California, with only 10 million acres of cropland and most of
it suited for high-revenue crops, will have a comparative advantage in supplying much of this feedstock should the technology mature. Agricultural waste-to-energy sources that use crop residue or cattle methane emissions have been used on a limited scale for decades, but have not yet become economic without substantial subsidy. Nonetheless, Federal mandates and California Executive Order S-06-06, if implemented as written, will continue to stimulate use of agricultural feedstock for bioenergy.

Sources:


Roland-Holst and Zilberman 2006 “How Vulnerable is California Agriculture to Higher Energy Prices?” VOL. 9 NO. 5 MAY/JUNE 2006, Giannini Foundation of Agricultural Economics, University of California
Soil Salinization

AIC White Papers on California Agricultural Issues

Salts occur naturally in the soil and in irrigation water. Additional salts may be introduced through the application of fertilizers. Through irrigation, some of these salts leach to groundwater or are carried away in agricultural wastewater to saline sinks. But if not removed, salts build up in the soil over time. Too high a concentration of salts in soil reduces the ability of crops and plants to take up water and leads to lower yields. Salinization of soil and removal of salt can also damage the ecosystem farther afield. Soil salinity has become a serious issue in California, with damage already occurring in some regions and some of the state’s most productive agricultural regions are in danger of becoming gradually less fertile.

About 4.5 million acres of irrigated cropland in California (more than half the total) are affected to some degree by soil salinization (Letey 2000). Most of the seriously affected acreage is in the Imperial Valley in Southern California and the Western San Joaquin Valley in Central California. A certain level of salinity exists in all imported irrigation water, although this natural salinity tends to be low in California. Most crops take up little salt, so the evapotranspiration process concentrates salts in the soil. A semi-arid climate exacerbates the degree and rate of salinization because the state’s main agricultural areas receive relatively little precipitation and have high evapotranspiration rates. This is especially true in the Imperial Valley, which coincidentally meets its water demand from the Colorado River, the most saline irrigation water in the state (Letey 2000).

Producers have dealt with soil salinization by leaching salts from the soil. Leaching entails applying extra water to carry the salts below the root zone of the crops, so crops are not affected. However, soil leaching means that saline water eventually enters groundwater basins. The salts concentrates in the groundwater, which causes damage if the water table rises or ground water is used for irrigation (Letey 2000). To avoid problems with ground water and contain the salinity problem, producers in the Imperial Valley have been discharging their drain water into the increasingly salty Salton Sea for more than one hundred years.

Salinity levels in the Western San Joaquin Valley have reached a point where the long-term productivity of the area is threatened (Letey 2000). The soil of the San Joaquin Valley is the residue of the coastal mountains’ alluvium from when the area used to be below sea level. Therefore, the soil already contains high concentrations of salts including selenium and irrigation has exacerbated the problem. In the Western San Joaquin Valley, groundwater is of low quality so producers do not use it for irrigation, raising the water table. In contrast, groundwater quality in the Eastern San Joaquin Valley is of high quality, so producers use it for irrigation and keep the water table low. In 1981, the first stage of the San Luis Drain which was to terminate in Suisun Bay was constructed to remove salts from the Western San Joaquin Valley and serve as wildlife habitat. However, construction was halted and drains plugged when it was discovered that high levels of selenium in the drainage water was causing bird deaths and deformities at Kesterson Reservoir.
Federal and state agencies have coordinated their efforts to deal with soil salinity in California. Among the federal agencies involved are the Bureau of Reclamation, the Fish and Wildlife Service, and the Geological Survey. State agencies involved in the effort include the California Department of Water Resources, the Department of Fish and Game, the State Water Resources Control Board and Regional Water Quality Control Boards. The Central Valley Salinity Coalition, a non-profit organization, is also involved in salinity management in the San Joaquin Valley.

Federal and state agencies, and some drainage districts, such as the Tulare Lake Drainage District have both been involved with the construction of artificial bird and wildlife habitats constructed near evaporation ponds. Various means are used to entice the wildlife to the artificial habitats and to discourage settlement at the salt-laden evaporation ponds with some success in preventing bird deaths. The construction of evaporation ponds without the use of compensation habitats may be destructive to bird populations. Although the ponds solve the problem of salinity drainage by allowing salts to accumulate in designated areas, the high selenium levels affect migratory and resident waterfowl primarily by interfering with reproduction. Wastewater can be treated to remove selenium, but the treated water will still have high concentrations of salt. Drainage water could be desalinized through reverse osmosis, however, the desalinization process is expensive and the process creates brine, which must also be disposed.

Knapp and Baerenklau (2006) evaluated efficient use of groundwater reserves by limiting groundwater withdrawals which thereby extend their use over several decades or more. However, they note that even under efficient use, long-term use of groundwater reserves is not sustainable, in the sense that income will generally decline over time. Long-term sustainability requires that the amount of salt going in equals the amount coming out of a system. Producers seeking such a salt balance can implement source controls, including switching to more capital-intensive and efficient irrigation systems and planting more salt-tolerant crops. Compared to flood or furrow systems, sprinkler or micro-irrigation systems provide greater uniformity and low evaporative losses. By reducing the volume of water they use, they reduce the amount of drainage water they create. These systems are expensive and require high revenue per acre to pay off. The options for more salt-tolerant crops are limited. Often source control is not economic and does not completely deal with the problem of salt disposal and high water tables.

Land retirement reduces salty drainage, but is costly. Already at least 100,000 acres have been retired in the Westlands Water District. If producers are unable to dispose of their drainage, the amount of productive land will slowly decrease, with land with high water tables the first to exit. However, even land retirement may also lead to problems of unpredictable ponding with potentially toxic waters. If retired drainage-impacted lands are located down slope from lands with continued irrigation, the down-slope water table will eventually rise to the surface, depositing salts and toxic elements that could present an environmental hazard.

Drainage can make salt-affected land more productive. This effort would entail collecting drainage water via tile drains and reusing it on a reduced land area. Reuse of drainage water, although not an optimal solution, is probably the most economically feasible solution (Knapp 2009). When combined with source controls such as crop switching, increasing irrigation
efficiency and reducing applied water use, reuse of drainage water may cause the least drop in crop yields at the lowest expense to society. There is evidence that drainage water can be reused sustainably (Corwin et al. 2008). Such lower quality water is already reused in the San Joaquin Valley because salt-tolerant crops such as cotton have shown evidence of being able to withstand moderate levels of salinity without significant drops in yield. Notwithstanding its salt tolerance, cotton acreage has fallen by 80 percent in California over the past decade and its future looks dim. There is some evidence that drainwater could be used for biofuels feedstock, but California faces other challenges in being a competitive producer of biofuels feedstock and in biofuels processing.

Of course, under the current water supply scarcity situation and regulatory environment, and with droughts more likely, land is coming out of production because of a lack of access to irrigation. Thus salinity could become less of a problem simply because another issue dominates.

Sources:

Information provided by agronomist and ecologist Steve Kaffka, UC Davis and resource economist Keith Knapp, UC Riverside was extremely valuable in preparing this brief.


Water Quality and Agriculture

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The quality of a significant portion of the California’s water supplies is impaired, and rising salinity threatens to lower agricultural yields (see the salinity white paper). In addition, lower water quality increases costs for urban water treatment and has the potential to cause substantial harm to human health and ecosystems.

The Federal government regulates water quality through the Clean Water Act (CWA), the Safe Drinking Water Act (SDA), and the Coastal Zone Reauthorization Act (CZARA) which are administered by the Environmental Protection Agency. Generally, states implement the federal framework, but have the choice to implement stricter regulations. In California, the State Water Resources Control Board (SWRCB) has authority to establish water quality guidelines for long range resource planning. This includes management programs for groundwater and surface water and control of recycled water. Water quality standards are determined and enforced by nine Regional Water Quality Control Boards. These regional boards issue waste discharge permits and can mandate the abatement of discharges within their jurisdiction. The standards for water quality apply to both surface and groundwater, and under the Porter-Cologne Act of 1969 the boards have the authority to regulate waste discharges from point and non-point sources.

Over the past four decades, much of the regulatory focus has been on regulating and managing point source pollution. Nonpoint source pollution is now of regulatory interest. Land use practices can be a potential source of nonpoint source pollution. Farming and ranching are significant contributors to nonpoint source water pollution through irrigation return flows, runoff and deep percolation from farmland where fertilizer, pesticides and agricultural waste are applied. Nonpoint source agricultural discharges and runoff have polluted surface water and aquifers with zoonotic disease pathogens, pesticides, salts, nutrients, sediments, elevated water temperature and, in some cases, heavy metals. Global climate change may worsen these effects as higher water temperatures reduce water oxygen levels and more intense rainfall may require more investment in systems to control runoff (DWR 2009).

Pesticides and fertilizers can be toxic to wildlife and humans, and pathogens from various sources, including animal farming, may threaten water quality, human and ecosystem health, and food safety (Cowan 2005). Exclusion zones that prohibit the application of certain chemicals around water supplies can prevent surface water contamination. However, it is much more difficult to mitigate the contamination of groundwater supplies because of the complexity of flows of underground water.

California has approximately 2,400 dairies and 1.3 million cows that generate more than 30 million tons of solid and liquid waste every year (EPA 2009). The majority of these dairies are designated as concentrated animal farming operations (CAFOs), meaning a large number of animals are raised in a confined area and feed is brought to the animals rather than them grazing (EPA 2008). Most California CAFOs are located in the Central Valley, where more than 80 percent of California dairies are located (SWRCB 2009).
Most of the animal waste from CAFOs is applied to croplands, and could potentially contaminate surface water and groundwater with discharges including nitrogen and phosphorous, sediments, pathogens, hormones and ammonia, pesticides and possibly heavy metals (EPA 2008a; CDC 2004). In 2003, the EPA required that all CAFOs obtain a point-source permit and develop plans for waste disposal. The California State Water Resources Control Board and the nine regional boards regulate waste discharges from CAFOs. In California, it is unlawful for CAFOs to discharge waste or storm runoff into surface waters, so dairies of the Central Valley do not require permits under the National Pollutant Discharge Elimination System (NPDES). Instead, Total Maximum Daily Loads (TMDL) waste discharge requirements implemented by the Central Valley Water Board require that dairies pay a scaled fee, employ nutrient management plans, monitor groundwater quality at specified locations and file a report of waste discharge. The design of manure pits and lagoons is also regulated. (SWRCB 2009).

TMDL waste discharge requirements will impose additional costs on California producers that will likely lead to shifts in adopted technologies, changes in the crop mix, and a shift in some farming activities to other regions. Since the dairy industry is mobile in relation to cropland, it is the major farm industry most likely to respond by shifting to regions with less strict waste discharge regulations. The direct cost of implementing a TMDL discharge plan depends on the complexity of the plan. The SWRCB estimated complex plans to cost around $1 million each in 2001 (SWRCB 2001). Ongoing TMDL compliance across the state is therefore likely to involve substantial costs. Waste discharge requirements will reduce emissions by changing farming practices and by discouraging economic activity.

Sources:


_________. 2008a. “National Pollutant Discharge Elimination System (NPDES).” Available at: http://cfpub.epa.gov/npdes/

Climate Change and Agriculture

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Climate scientists project that over the next several decades the accumulation of greenhouse gases (GHG) will continue to raise temperatures and change established precipitation patterns across the world. The Intergovernmental Panel on Climate Change (IPCC) has found that temperature increases and other changes have already occurred and are projected to continue over the next century. Global climate change raise several issues for California agriculture: (a) adaptation to new climate patterns in California, (b) adaptation to new market developments driven by climate change and climate change policy in other regions, (c) responses to policies designed to mitigate climate change by reducing emissions of GHG from agriculture and (d) responses to policies designed to reduce GHG emissions in other sectors.

The United States is developing a climate change mitigation strategy, while California is implementing laws and regulations designed to reduce GHG emissions within the state. Adjustment of agricultural practices has the capacity to contribute to GHG reduction in California and globally. Agricultural production methods can be modified to reduce harmful emissions and sequester carbon that might otherwise contribute to climate change.

Agricultural production releases each of the three main greenhouse gases: carbon dioxide, methane, and nitrous oxide. Carbon dioxide is the main focus of many GHG reduction efforts because it is by far the most pervasive of the gases, but in terms of destructive potential for the ozone layer, methane is 21 times more powerful than carbon dioxide, while nitrous oxide is 300 times more powerful. To quantify global climate change impacts of these gases, emissions are weighted by their impact. According to the California Air Resources Board (2009), agriculture accounts for about six percent of weighted GHG emissions and about one percent of economic output and employment in the state (Jackson et al. 2009).

In 2006, Governor Schwarzenegger signed the California Global Warming Solutions Act (AB32) to address emissions through market incentives and government regulations. Among other policies, AB32 imposes a cap and trade system for GHG emissions in California. Agriculture is not scheduled to be capped under this system, but if farms are able to show that they have reduced emissions they may be in a position to sell GHG reduction credits to firms in other industries. Important issues for agriculture are the emission reduction credits that are attributed to specific agricultural practices and the potential prices for emission reduction credits.

Agriculture releases greenhouse gases in many ways and this suggests several reduction strategies: (a) tilling the soil releases carbon dioxide as soil is exposed to oxidation; employed on less than two percent of California cropland, reduced tillage can reduce GHG emissions (NRCS 2008); (b) carbon can be sequestered by planting cover crops including trees; (c) agriculture accounts for about 70 percent of nitrous oxide emissions (NRCS 2008) in the United States, largely from the application of fertilizers, so reduced use of nitrogen fertilizer use can reduce emissions; (d) nationally, agriculture accounts for one-third of methane emissions (NRCS 2008) and livestock operations contribute substantial methane emissions through animal
digestive processes and decomposition of animal waste; management of animal waste and conversion to energy may reduce greenhouse gas emissions; (e) rice production contributes to methane releases through anaerobic decomposition of underwater biomass, and changes in practices for flooding or post harvest straw handling can reduce methane releases; (f) finally, agriculture can also contribute to climate change mitigation through reduced use of energy such as fuel for transport, tillage equipment and irrigation pumps.

Rising temperatures will greatly impact the agricultural sector, which will likely adapt to changing conditions. As an example of historical trends, figure 1 shows that average minimum temperatures in the San Joaquin Valley have risen by about 2.5 degree Fahrenheit (almost 1.4 °C) from the 1930s to the first years of this century. Climate scientists project California will experience a temperature rise of 3.6 to 5.4 degrees Fahrenheit (2 to 3 °C) through 2050 (Weare 2009) and as much as 8 to 10.4 degrees Fahrenheit (4.4 to 5.8 °C) through 2100 (Cayan et al’ 2006). Warming implies fewer frost days and more heat waves, which will affect crops that require a certain number of chill hours or degree days. Changes in precipitation are more difficult to project, but computer models indicate reductions in precipitation over much of the Western United States. The winter mountain snow pack will be smaller since more precipitation will fall as rain rather than snow. In addition, snowmelt will occur earlier. To counteract potential flooding, lower average reservoir storage will lead to less water available for summer irrigation in the more frequent dry years (Weare 2009). These changes imply increased demands for additional water storage facilities.

Additional concerns include changes in geographic ranges for pests and diseases, shifts in precipitation patterns, including less snow and earlier snow melt, and additional or more severe wildfires. On the positive side, although relationships are complex, increased concentration of carbon dioxide generally stimulates plant growth and is projected to increase yields of many crops.

Agricultural input and output market conditions will be affected by global climate change and climate change policies. For example, energy and fertilizer prices will rise as a part of higher taxes or cap and trade policies and irrigation water may become more scarce and expensive in regions outside California too. On the output side, a multitude of adjustments will determine if prices for important California crops such as grapes, almonds, lettuce and other fruits and
vegetables important here will rise or fall given climate change in competitive regions. Although results of these complex market interactions cannot be well projected now, they have the potential to be among the most important implications of global climate change for California agriculture. Clearly the myriad effects of climate change and associated policies will likely demand substantial innovation by California agriculture over the rest of this century.

Not all implications of climate change are negative for all agricultural enterprises, but all change demands adaptations. Adaptation will likely involve shifts in many agricultural practices including which crops are grown where. California agriculture has made massive adjustments over the past century and with climate change many more changes are coming.

Sources:


Invasive Species

Plants and animals have been introduced into California since the mid 1700s. “California crops” derive from European, South American and Asian ancestors. Undesirable invasive species have affected agricultural costs and productivity by decreasing yields and quality and acting as vectors of plant and animal diseases. Introducing invasive species can restrict exports and cause economic harm by limiting demand. The spread of invasive species also sometimes threatens the biodiversity of native plants and wildlife and the quality and quantity of water supplies. The term “invasive species” refers to non-native (i.e., exotic) pests and diseases that are likely to cause agricultural, environmental or economic harm or be harmful to food safety and human health. While costs for control of indigenous pests and diseases are generally borne by the private sector, activities to control invasive non-native species have often been an expense for taxpayers and the economy broadly.

The California Department of Agriculture (CDFA) and the U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA, APHIS) cooperate in efforts to exclude, detect, contain, suppress, and eradicate invasive species that threaten agriculture. They also issue pest-free certification for California exports. At international ports of entry, USDA and Homeland Security are responsible for intercepting prohibited plant and animal material and products, while CDFA conducts similar inspections and exclusion measures at its 16 interstate border protection stations. CDFA also establishes interior regional quarantines and requires permits for movement of pest–free or disease–free plant or animal materials, as needed. USDA similarly may establish prohibitions on interstate movement of materials.

California’s waterways are vulnerable to the introduction of invasive species from multiple sources, including the discharge ballast water from ocean freighters, and damage to the water transfer system could impact irrigation and urban water supplies. Invasive plants infest over 20 million acres, or about 20 percent of land in the state (CDFA 2005). The duration, rate of spread and extent of invasion determine the feasible response. Pest control measures include: mechanical removal, depopulation, application of chemical pesticides, introduction of predatory or disease causing “biocontrol” organisms, genetic engineering for pest resistance, or regulatory imposition of quarantines and the requirement of pest-free certification and permits for export, import or local transport. However, a policy of preemptive surveillance and exclusion rather than reactive adaptation would likely minimize the long-run costs associated with invasive species.

Foot and mouth disease (FMD) and bovine spongiform encephalopathy (BSE or mad cow disease) have been among the most costly invasive animal diseases to strike in recent years. Several cases of BSE occurred in the United States between 2004 and 2006. California has avoided outbreaks. This has led to pressure for animal identification and traceability systems, regulation of feed, and increased inspections. State and federal agencies also engage in exclusion, monitoring and planning to prevent outbreaks of FMD which could prove damaging for the California dairy and beef industries, as well as deer and elk. FMD caused billions in
damage in the United Kingdom in the 1990s but has not been found in California since 1929 (Ekboir 1999).

About $450 million including emergency funds was spent by the state and federal governments to control invasive pests and diseases of agricultural plants and animals in California during 2003. The state spent $128.4 million and the federal government spent $321.2 million. The largest share (44 percent) went to emergency activities to contain Pierce’s disease which harms many plants, including crops such as grapes, and is vectored by the glassy-winged sharpshooter and to successfully eradicate exotic Newcastle disease, a fatal disease of poultry and other birds. Not including those two emergency programs, California spent $22.3 million to control invasive pests and diseases affecting livestock and poultry and $85.9 million (primarily on detection and eradication) to control pests and diseases affecting plants(Sumner, Brunke and Kreith 2006; UC Agricultural Issues Center 2009). That year, the federal government spent $1.8 million on detection and exclusion of pests and diseases affecting livestock and poultry and $138.7 million on control of pests and diseases affecting plant crops in California (Sumner, Brunke and Kreith 2006; UC Agricultural Issues Center 2009). According to Sumner, Brunke and Kreith, the benefits of controlling invasive species and diseases greatly outweigh the costs of government outlays in California on control programs.

Sources:


Agriculture, Endangered Species and Habitat

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California is the most biologically diverse state in the country and one of the most diverse areas in the world, with a unique diversity of climates, elevations and landscapes. Moreover, many of the region’s plants and animals evolved in isolation due to rivers, mountain ranges, deserts and other natural barriers that partition the state. California is home to more unique species of plants and animals than any other state and has many endangered species. More than 24 percent of all threatened animal and plant species in the United States are in California (DFG 2009).

Species loss in California is largely a consequence of population growth and income growth. Since many species are adapted to a specific regional habitat, the loss of such habitat can devastate the species. Some species, such as migratory waterfowl, may be seasonally dependent on California habitat. In addition, some species are agricultural pests and their control can disturb the balance within the local ecosystem and lead to further harm to local plant and wildlife. Therefore, there is a natural tension between agricultural practices and species and habitat conservation. Meyer (1995) investigates the tension by examining the trends in state agricultural production and endangered species listings from 1975 to 1990. He found no statistically significant relationship between the number of endangered species in a state and the rate of growth for agriculture in that state. Nonetheless, critical habitat designation and other endangered species remedies have the potential to affect the operations of individual growers in California.

The Federal and California governments both have legislation and extensive regulations to respond to concerns about species preservation and habitat conservation.

At the federal level, vulnerable plants and animals are protected by the Endangered Species Act (ESA) and the Migratory Bird Treaty Act. The ESA is administered by two federal agencies, the United States Fish and Wildlife Service (FWS) in the Department of the Interior and the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce. NOAA oversees the protection of marine species, while the FWS is charged with protecting freshwater fish and all other plants and animals.

The danger to most species results from destruction of their habitats. Therefore, under the Endangered Species Act the responsible federal agencies have designated certain areas as critical habitat zones and restrict development in these zones because they are deemed essential to the conservation of a species (FWS 2009). The National Environmental Policy Act (NEPA) also offers some protection for plants and animals. Under NEPA, federal agencies must prepare an assessment of the environmental impacts of significant federal projects that may have ecological consequences. Since many private industries require federal permits, the law indirectly applies to many projects on private land.

California provides protection to plants and animals through the California Endangered Species Act (CESA), which is enforced by the California Department of Fish and Game (CDFG). Although similar to its federal counterpart, the CESA also protects species that are candidates for
listing, but have not yet been designated as endangered or threatened. The California Environmental Quality Act (CEQA) mirrors the critical habitat provision of the federal ESA. The CEQA gives the CDFG jurisdiction over the conservation of habitats that are deemed necessary for any species to survive in self-sustaining numbers. However, the CEQA does not allow the CDFG to govern land use. It only stipulates that development projects include an environmental impact assessment of the proposed activities (CDFG 2009b). The California Department of Pesticide Regulation regulates the use of pesticides near habitats for endangered species. To protect biodiversity on private lands, development can be limited through conservation easements. Conservation easements are voluntary agreements between landowners and nonprofit land trusts or government agencies that limit the type or amount of development on a property.

Currently, there are 359 species listed or proposed as endangered or threatened in California (DPR 2009b). These plants and animals inhabit about 16 million acres, or about 16 percent of the state’s land area. The San Joaquin kit fox is native to about 10 million of these acres, spread across 14 counties. Its habitat is particularly vulnerable to agricultural activities, especially in the San Joaquin Valley (DPR 2009). In the Sacramento-San Joaquin Delta, the Delta smelt and several other fish species received endangered status and will affect water deliveries to agriculture and other users. Additional species have been listed as endangered or threatened by the state.

Concentrations of endangered and threatened species occur along the Monterey Bay, the San Diego coastline, within the San Bernardino National Forest and in the San Joaquin Valley (Figure 1. Source: DPR 2009b). More than 800 additional species are listed on the CDFG Special Animals List, which includes species that are showing declining numbers, but have not yet been designated as threatened or endangered.

Figure 1: Federally Listed Species in California. Source: Department of Pesticide Regulation 2009b.
Sources:


_________.2009b. “Federally Listed Species in California.” Available at: http://www.cdpr.ca.gov/docs/endspec/index.htm


California has some of the worst air quality in the nation. The costs associated with air pollution have long been recognized, and successful abatement efforts have been underway for decades and yet air quality is still too low in some regions.

As shown in Figure 1, much of California fails to meet federal standards for air quality. In fact, the greater Los Angeles area and the San Joaquin Valley are the only two districts in the country to be classified by the Environmental Protection Agency (EPA) as “extreme nonattainment” areas for ozone. The San Joaquin Valley failed to meet the standard on 104 days in 2004 (Cowan 2005). In the San Joaquin Valley, the number of days exceeding ozone limits has barely changed since the early 1950s. The San Joaquin Valley is also one of only nine areas in the country to be designated as a “serious nonattainment” area for particulate matter which contributes to asthma, emphysema, bronchitis, and pneumonia. To meet the maximum 24-hour standard set by the EPA for PM 2.5 particulate matter (particles with diameter of 2.5 micrometers or less), particulate levels must fall by more than 50 percent, and annual average concentrations must fall by nearly 30 percent.

Cars and trucks, account for the largest source of ozone emissions. Ozone forms in the atmosphere from volatile organic compounds and nitrogen oxides. Like in Los Angeles, ozone is trapped in the San Joaquin Valley by the surrounding mountains. While population growth and increased vehicular traffic are central, agriculture in the San Joaquin Valley also plays a role in why the region has not improved its air quality. The Air Resources Board reports that farm activities directly emit 21 percent of ozone-forming gases in the San Joaquin Valley (ARB
Farm activities account for more than half of direct emissions of particulates in San Joaquin Valley (Cowan 2005).

The Air Resources Board estimates that between 14,000 and 24,000 Californians die prematurely every year due to the state’s air pollution (Cal/EPA, ARB 2008). According to the California Environmental Protection Agency, air pollution also contributes to over 200,000 cases of asthma, and respiratory and cardiac disease every year. The annual health-related costs attributable to air pollution are estimated to be about $70 billion. Ozone also damages crops by interfering with the photosynthesis process, resulting in lower yields (ARS 2009; Heagle 1989). Crow notes that ozone has reduced yields of some crops in the Central Valley by up to 20 percent, including grapes, cotton, oranges, alfalfa, and tomatoes (Crow 2003).

The U.S. Environmental Protection Agency administers the Clean Air Act at the federal level, determining maximum acceptable levels of air pollutants. California has its own Clean Air Act that is administered by the California Air Resources Board, part of the California Environmental Protection Agency. The Air Resources Board focuses on reducing air pollutants by regulating the emissions from passenger vehicles and commercial transportation, including trucks and ocean freighters. Currently, the agency intends to achieve a significant reduction in the Central Valley’s air pollution by requiring older diesel fuel trucks be modified to use diesel particulate filters or replace their engines with newer, cleaner burning engines.

Under California air pollution laws, farms had been exempt until 2004 from the permit requirements that applied to other industries. A series of new regulations stipulate that “concentrated animal feeding operations,” must now apply for pollution permits from the state. Other sources of air pollution that face regulation include agricultural water pumps, open burning, wine fermentation and the use of commercial dryers. Since primary sources of particulate matter pollution in the San Joaquin Valley come from airborne soil particles carbon emissions and ammonium nitrate from fertilizer, reduced fertilizer application and paving rural roads would reduce airborne particulate matter. Regulation imposes costs and the consequence for California agriculture will be a shift in technologies, changes in crop mix and, likely, a shift in some farming activities to other regions. Since cropland is not mobile, the dairy industry is the most likely major farm industry to respond by shifting to regions without such air quality issues and regulations. Regulations can reduce unwanted emissions by changing practices and by discouraging economic activity, thus limiting employment and population growth. Both types of impacts seem to be underway in agricultural areas of California.
Sources:


Food Safety

AIC White Papers on California Agricultural Issues

Recent outbreaks of food-borne *Salmonella* and *E. coli* have reinforced concerns about food safety in the United States. Food-borne diseases are estimated to cause as many as 81 million cases of sickness and up to 9,000 deaths in the U.S. annually (Mead et al. 1999). Food safety incidents and the resultant recalls can also be costly for food producers. In order to address food safety issues, producers can voluntarily implement food safety programs. However, state and federal oversight remains a major tool in ensuring food safety. In the wake of recent food scares, there is increased pressure for stricter enforcement of existing standards and stronger regulation of production methods.

The U.S. food safety regulatory system is complex and involves federal, state and local agencies. Moreover, responsibility for food safety is divided among agriculture, health and environmental agencies. At the federal level, the U.S. Department of Agriculture (USDA) is responsible for overseeing the safety of livestock, poultry and egg products. The Food and Drug Administration (FDA) is accountable for other fresh and processed foods, including shell eggs, fresh produce, and food imports other than meat and poultry. The FDA also oversees the safety of dietary supplements, food additives, and the use of irradiation for preservation.

In California, the California Department of Food and Agriculture (CDFA) also carries out inspections on meat, poultry, eggs, milk and milk products. Milk in California must meet stricter bacteriological standards than federal standards (CDFA 2009). The CDFA cooperates with egg, meat and dairy producers to facilitate adherence to standards through voluntary quality assurance programs (QAPs).

Oversight is also divided among agencies by stages of production. At the production level, the safety of plant and animal products is enforced by the FDA, the California Department of Health Services (CDHS) and the California Department of Food and Agriculture. These agencies also enforce regulations governing the use of medications in food animals and the safety of animal feed. At the processing stage, food safety regulations are enforced by the FDA, USDA’s Food and Inspection Service (FSIS) and CDFA. Pesticide use is regulated by the Environmental Protection Agency (EPA) and the California Department of Pesticide Regulation (CDPR).

Agencies oversee the production of safe food by conducting inspections of food production facilities, testing food for contaminants, and by mandating practices. For instance, the USDA requires that producers of meat, poultry, seafood and juice implement Hazard Analysis and Critical Control Point (HACCP) systems. HACCP plans require that producers monitor and control potential food safety hazards at particular points in the production process and keep records of their activities.

Independent of regulatory requirements, firms have market incentives to produce safe food products. Firms and the industry wish to maintain a reputation for producing safe products because failure to do so will reduce the demand for their products. However, the incentives for firms to deliver safe food are limited by the fact that safety is often unobservable, it is difficult to
identify the food product that causes a food-borne illness and it is difficult to trace the origin of a food safety incident (Pouliot and Sumner 2008). To combat potential aflatoxin problems that could affect the industry, the pistachio industry sponsored a federal marketing order to mandate additional monitoring and testing for all firms selling pistachios in California (Gray et al. 2005).

Nonetheless, private initiatives to improve the safety of food are common. Many industries, through marketing agreements, have adopted conventional work practices, such as HACCP systems, to improve food safety. Large purchasers of food products such as fast-food restaurants and retail supermarkets have considerable influence on the level of food safety. Their high volume of purchases allows them to stipulate stricter requirements for food safety from their suppliers.

California’s Quality Assurance Programs (QAPs) are industry-led efforts to improve food safety. These programs draw upon the knowledge provided by industry leaders, researchers, California regulatory agencies and other experts to develop and disseminate scientifically-based best management practices that aim to reduce pathogenic contamination. Under the California Dairy Quality Assurance Program, dairy producers who certify their production reduce their exposure to regulatory enforcement (CDQAP 2004). After cases of E. coli bacteria on spinach resulted in several deaths, almost 120 handlers, marketing about 99 percent of the volume of California leafy greens, joined to form the California Leafy Green Products Handler Marketing Agreement (LGMA 2009). The agreement would require producers and handlers to adhere to industry best practices, some of which raise concerns about the loss of wildlife habitat. QAPs such as the Leafy Greens Agreement and the Dairy Quality Assurance Program may expand market access, reduce the likelihood of food safety incidents and contribute towards regaining consumers’ confidence in the event of a food safety incident.

Technology improvements have made the use of new techniques economically profitable. Reduction in the cost of recordkeeping has spurred interest in the use of traceability to increase food safety. Traceability systems provide records of the source and channels through which a particular food product must pass on its way to consumers. Private firms may implement traceability systems in order to improve efficiency and product quality, in addition to other actions they take to promote food safety. The ability to trace food products to their source allows the quick withdrawal of unsafe products from the market and it makes food safety claims more credible to consumers. Moreover, traceability provides incentives for firms to ensure food safety because traceability facilitates the allocation of liability costs and other costs related to the discovery of unsafe food to the firm source of contamination.

Antibiotic use in animal husbandry, particularly in pig and poultry production, is due to their growth-promoting effects when added to animal feed in sub-therapeutic doses (FAO/WHO/OIE 2003). About 70 percent of all U.S. antibiotic production is used in animal agriculture for non-therapeutic purposes. The FDA estimates that at least 5,000 Americans each year experience longer bouts of food poisoning caused by bacteria that are resistant to antibiotics passing from poultry to humans (2001). In 1997, the European Union banned sub-therapeutic use of antibiotics in animals, if these same drugs were essential to treating life-threatening diseases in humans. The World Health Organization reports that the ban of non-therapeutic drug use in animal feed was beneficial in reducing microbial resistance in farm animals and had no
significant impact on animal health or food safety (FAO/WHO/OIE 2003). Although proposed, no such regulations apply in the United States.

Sources:

California Department of Food and Agriculture. 2009. “California Milk Standards.” Available at: http://www.cdfa.ca.gov/ahfss/Milk_and_Dairy_Food_Safety/Milk_Standards.html


Food and Drug Administration, Center for Veterinary Medicine, Department of Health and Human Services. 2001. “Proposal to Withdraw Approval of the New Animal Drug Application for Enrofloxacin for Poultry.”


Animal Welfare

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Animals play an important part in California agriculture. Dairy, cattle and calves, poultry and egg production are major industries in the state. As shown in Table 1, these industries account for 30 percent of total California agricultural cash receipts, with dairy alone accounting for about 20 percent. In recent years, lawmakers, industry groups and other non-governmental organizations have focused attention on the treatment and welfare of farm animals. For example, undercover footage released in early 2008 showed the mistreatment of culled dairy cows in Chino, California in violation of state and federal laws. The subsequent investigation led to the largest meat recall in national history.

Table 1: 2007 Cash receipts for selected animal industries in California

<table>
<thead>
<tr>
<th>Product</th>
<th>Cash Receipts ($ thousands)</th>
<th>Share of Total Cash Receipts (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy products</td>
<td>7,328,474</td>
<td>20.1</td>
</tr>
<tr>
<td>Cattle and calves</td>
<td>1,784,101</td>
<td>5.0</td>
</tr>
<tr>
<td>Broilers</td>
<td>712,943</td>
<td>1.9</td>
</tr>
<tr>
<td>Eggs</td>
<td>323,708</td>
<td>0.9</td>
</tr>
<tr>
<td>Turkeys</td>
<td>195,712</td>
<td>0.5</td>
</tr>
<tr>
<td>Hogs and sheep</td>
<td>74,159</td>
<td>0.2</td>
</tr>
<tr>
<td>All commodities</td>
<td>36,574,850</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: ERS 2009.

The public has always supported the humane treatment of animals. However, views about the treatment of farm animals seem to have changed. Many advocates view self-guided behavior of the animal industry and current federal and state laws governing the treatment of animals as insufficient to ensure their welfare, and these advocates have embarked upon campaigns to enact more stringent laws. At the same time, animal production industries, such as the egg industry, have developed new industry guidelines meant to improve treatment of farm animals. The United Egg Producers, a trade association, has developed its own set of guidelines for augmented cage and non-cage egg production. Restaurant buyers have expressed interest in developing private standards. For example, Wendy’s announced that at least two percent of its eggs will come from hens raised in non-cage systems, and McDonald's announced plans to work with a panel of scientists, egg producers and academics to study the feasibility of non-cage systems.

The federal Animal Welfare Act specifically exempts farm animals used for food production. The only federal statutes that deal with the treatment of farm animals regulate their slaughter and transport (Appleby, Hughes and Elson p.95; Tomaselli). State anti-cruelty statutes forbid the intentional abuse of farm animals. However, most such statutes exclude common husbandry practices for farm animals. California’s anti-cruelty statute is formalized in California penal
code §597. A new approach was undertaken in November 2008, when California voters approved a ballot initiative, the Treatment of Farm Animals Statute (Prop 2), that prohibits the confinement of pregnant sows, veal calves and egg-laying hens in a manner that prevents them from freely turning around, lying down, standing up, and fully extending their limbs.

The Treatment of Farm Animals statute is scheduled to take effect on January 1, 2015. Similar laws on treatment of veal calves and sows have been passed in Florida, Arizona, Colorado and Oregon. However, veal production in California is virtually non-existent, hog production is very small and sow gestation crates are not known to be used in California. Therefore, the statute is important only to regulate the housing conditions for egg-laying chickens that are kept in cages in California. The cages used to house laying hens have been viewed by some as detrimental to hens’ welfare because they restrict the hens’ natural behaviors. The share of “non-cage” production is quite small, about five percent of the total, including the non-cage eggs that also qualify as organic (Sumner et al.) (Eggs that meet organic standards necessarily also meet the welfare standards of non-cage egg production, since organic production requires hens to have access to the outdoors.)

Adopting mandated housing standards for hens raise costs at the farm. Hen welfare is a multifaceted concept and mandating standards beyond what farms now do will involve increased costs. Sumner et al. found that the Treatment of Farm Animals Statute would raise farm costs of egg production by at least 30 percent. Since the cage ban applies only in California and would require substantial new housing investment, it would disadvantage California producers relative to out-of-state producers. With higher production costs in California, out of state producers would replace California eggs with little or no added cost to consumers. Therefore the statute will eliminate egg production in California, except for a small residual of specialty producers that would partially supply the small market for non-cage eggs. Furthermore, since the eggs would continue to be produced in cages in other states, hen welfare would not be improved.

Products from animals raised under mandated treatment standards are available now and some buyers (a relatively small share) are willing to pay the necessary price premium. Little data is available on the willingness to pay for enhanced treatment standards by the average consumer.

As table 1 makes clear, the most important issue for California farms would be treatment mandates for dairy cows. Any regulations that substantially raised the cost of milk production in California relative to costs in other states would almost surely encourage more dairy products to be shipped in and would cause a reduction in the size of the California industry. This would lead to upstream effects on the hay and silage industries and downstream effects on milk processing industries. Milk used to make such readily transportable products as butter, milk powder and cheese would likely shift out of state. Milk for fluid beverage products, which are more costly to transport, would face increased competition from border regions but some California producers would likely remain and retail prices would rise.

The pressure to change animal treatment on farms is not limited to California. Many regulations under consideration restrict farm management options and impose added costs. No simple summary can analyze implications or even review all the proposals. States, including Ohio, Arizona, Maine and several others have either passed or are considering legislation or ballot
initiatives. As the analysis above makes clear, national standards would likely be required to affect the treatment of animals significantly, given the potential for interstate trade. However, costly standards would also raise consumer prices of animal-based foods. Depending on how much the new standards raised costs, one result would be less consumption of animal products and consequently less demand for animal feed and other associated inputs. The other consequence would be increased demand for direct human consumption of plant-based foods, especially those that provide proteins and other nutrients now derived from animal products in the human diet.

Sources:


A significant portion of the U.S. population is at risk of malnutrition and hunger because they are poor. The U.S. Department of Agriculture reported that 14.6 percent of U.S. households were food insecure in 2008, up from 11.1 percent in 2007 and the highest observation on record (Nord, Andrews and Carlson 2009). Of those households that can afford enough food, the broad trend has been towards less healthy diets. While diets of all income groups have shown increased fat intake, this has been especially true among lower income groups. Concerns about hunger and poor nutrition are important social and agricultural issues for California.

Federal and state policies have addressed food and nutrition for many decades. Recently, these policies have also begun to pay more attention to encouraging healthy diets. In most cases, reduced rates of hunger can be achieved through government food programs or income transfers. Shifting diets towards more nutritious meals may be possible through these food programs when combined with educational outreach programs that emphasize nutrition.

The U.S. Department of Agriculture has several programs to assist those most prone to nutrition deficiencies. Almost two thirds of federal food assistance is provided through the food stamp program now known as the Supplemental Nutrition Assistance Program (SNAP). As of August 2009, about 36.5 million people received assistance through SNAP (FNS 2009). SNAP also acts as an automatic economic stabilizer. For every 1 percent rise in the unemployment rate, it is estimated that 700,000 people seek SNAP assistance in the short run and 1.3 million in the long-run (ERS 2009).

The USDA developed a new “Thrifty Food Plan,” a low-cost food market-basket meant to meet the needs of a healthy diet. Under the new plan, SNAP benefits were expanded due to a greater emphasis on fresh produce, with 40-50 percent of food dollars meant to be spent on fruits and vegetables. The actual range for most families is 16-18 percent. Meats, fish, eggs and poultry make up about a quarter of the average family budget for food (ERS 2009).

Other large federal food programs include the Special Supplemental Nutrition Program for Women, Infants and Children (known as WIC) and the National School Lunch Program, which have significantly easier eligibility requirements than SNAP. Over half of the infant formula purchased in the United States is through WIC. In 2007, 55 percent of schoolchildren participated in the National School Lunch Program and most meals provided through the program were provided free-of-charge (FNS 2008).

In 2007, more than four million Californians (about 17 percent of the total population) lived on incomes of less than 130 percent of the Federal poverty level and were therefore eligible for SNAP assistance (Cunningham, Castner and Schirm 2009). However, only about two million Californians actually participated in SNAP in 2007 (Kaiser and Lamp 2007). In California, about 60 percent of recipients are children, a higher share than the national average (CDPH 2007). California’s SNAP food program is supervised by the California Department of Social Services and is administered by each County Welfare Department. Through the California
Department of Education, the state also administers a small Child and Adult Care Food Program using mostly federal funds. In fiscal year 2007-8, California served only about 190 million meals through the program. Through the much larger National School Lunch Program, the state also served an average of almost 4.3 million school meals per day, or about 800 million meals per year.

Federal dietary guidelines, another policy instrument, have been shown to influence buyers’ decisions and to increase consumption of nutritious foods (ERS 2009). In general, increased dietary knowledge leads to better food choices (ERS 2009). Targeting schoolchildren may prove particularly effective because it may influence life-long dietary behavior. Expanded efforts to enroll eligible beneficiaries and increased SNAP benefits may help reduce the share of the population suffering from hunger.

Nonetheless, diets of most Americans, but especially the poor, fail to meet government dietary recommendations (ERS 2009). Compared to decades past, more families today have two working parents, who tend to work longer hours. Furthermore, the share of food budgets devoted to food away from home has increased, especially for fast-food, high-calorie items. Since foods dense in calories tend to be less nutritious, these households have diets high in fat intake and low in calcium and vitamin A intake (Townsend et al. 2009).

Unhealthy diets have contributed to high rates of obesity, a serious health issue in the United States and California. According to the Center for Disease Control, 37.1 percent of Californians were classified as overweight, 24.2 percent as obese, and about 36.6 as neither obese nor overweight, as measured by body mass index (CDC 2009). Agricultural subsidies have sometimes been fingered as a major cause of the obesity epidemic, but, as Alston, Sumner and Vosti (2007) demonstrate, subsidies affect retail prices of calorie-dense foods only slightly and subsidy elimination would not significantly affect obesity.

Among major diet concerns is that average consumption of fruits and vegetables in the United States is far below recommended levels. For example, to meet minimum recommendations, average fruit consumption in California would need to rise by about 62 percent and vegetable consumption by about 113 percent (Jetter, Chalfant and Sumner 2001).

California producers would benefit substantially if consumption of fruits and vegetables rises. Shifts in U.S. demand for horticultural products would expand California production and increase sales of California produce. According to Jetter, Chalfant and Sumner (2004), such a shift in California consumption would lead to increased sales for California growers of at least $316 million. Producers of lettuce, processed tomatoes, broccoli, spinach and carrots would likely particularly benefit. Given its comparative advantage in producing healthy foods, California producers would gain strongly with attention to improved diets in general and among food program participants.
Sources:


