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CALIFORNIA AGRICULTURE

DIMENSIONS AND ISSUES



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University of California Giannini Foundation of Agricultural Economics
Division of Agriculture and Natural Resources

CHAPTER 3

The Measure of California Agriculture and its Importance in the State's Economy¹

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California agriculture is large, diverse, complex and dynamic. This chapter documents the industry and its relationship to the rest of the economy. It also provides an overview of unifying forces and trends. Our aim is to supply a convenient compilation of facts and figures from a variety of sources, and to help the reader interpret the wide array of data presented.²

California agriculture is far larger, measured by sales, than that of any other state. California agriculture produces more value than most countries and is larger than, for example, such major agricultural producers as Canada or Australia.

¹ This chapter is updated and adapted from “*The Measure of California Agriculture, 2000*,” by Nicolai V. Kuminoff, and Daniel A. Sumner, with George Goldman, University of California Agricultural Issues Center.

² Data used are the most recent available. Whenever possible, we used preliminary data from the most recent Census of Agriculture, (U.S. Department of Agriculture, National Agriculture Statistics Service, 2002 Census of Agriculture). However the complete 2002 census data were not available at the time this chapter went to press.

DEMAND AND SUPPLY

California is part of the national and international agricultural markets. Californians consume food that is produced in the state, as well as food that is imported from other states and countries. Agriculture in California is the largest among the states, and produces a variety of animals and animal products, fruit, tree-nuts, vegetables, field crops, and nursery and floriculture products. The Central Valley (composed of the Sacramento and San Joaquin Valleys) accounts for more than half of the State's gross value of agricultural production.

Commodity Demand

Between 1970 and 2001 United States per capita consumption of food increased in most categories. In the meat category, decreases in red meat consumption were more than offset by increases in poultry and fish. The largest percentage increases in consumption were in the fresh fruit, tree-nut and processed vegetable categories. Eggs were the only category showing a decrease. (Comparable data by state are not available.)

Table 1. United States Per Capita Consumption of Major Foods, 1970-2001

| Year | Eggs ^a | Meat, Poultry, & Fish | Dairy Products | Fruit, Fresh | Fruit, Processing | Vegetables, Fresh | Vegetables, Processing | Tree- Nuts |
|------------------|-------------------|-----------------------------|-------------------|-----------------|----------------------|----------------------|---------------------------|---------------|
| -----Pounds----- | | | | | | | | |
| 1970 | 40.2 | 177.3 | 563.8 | 101.2 | 136.5 | 152.9 | 182.5 | 1.7 |
| 1975 | 35.9 | 170.9 | 539.1 | 101.8 | 150.3 | 147.1 | 189.9 | 1.9 |
| 1980 | 35.2 | 179.6 | 543.2 | 104.8 | 157.5 | 149.3 | 187.2 | 1.8 |
| 1985 | 33.1 | 185.4 | 593.7 | 110.6 | 158.8 | 156.1 | 201.9 | 2.4 |
| 1990 | 30.5 | 183.5 | 568.4 | 116.3 | 157.1 | 167.2 | 215.6 | 2.4 |
| 1995 | 29.8 | 190.5 | 576.2 | 122.5 | 159.3 | 180.8 | 227.4 | 1.9 |
| 2000 | 32.2 | 195.8 | 593.4 | 126.9 | 153.1 | 201.8 | 226.7 | 2.5 |
| 2001 | 32.4 | 192.2 | 587.2 | 125.8 | 149.9 | 196.6 | 216.3 | 2.2 |

a: From 1970 to 1990, figures are given in dozens and transformed into pounds by a factor of 1.56 lb/dz

Source: 1) Putnam, Judith Jones, and Jane E. Allshouse, *Food Consumption, Prices, and Expenditures, 1970-97*, Food and Rural Economics Division, Economic Research Service, USDA.

2) USDA/ERS Agricultural Outlook, May 2003.

Although California is the nation's largest agricultural producer, Californians still consume many foods shipped in from other states and countries. Almost all of the pork, much of the beef and much of the grain used for baked products, pasta and livestock feed come from midwestern states. Tropical products that don't grow well in the state, such as bananas, are imported from Central and South America, or from Asia and Africa. During the local off-season, California imports commodities, such as winter tomatoes from Florida and Mexico, that are exported in other seasons.

Although overall United States food consumption has increased in recent decades due to population growth and other factors, increasing per capita income and falling relative price of food have led to food taking up a smaller part of Americans' budgets. In 2001, Americans spent 10 percent of their disposable personal income on food, compared with 21 percent in 1952. Meals away from home now represent 40 percent of expenditures on food, compared to 17 percent in 1952.

Leading Commodities and Cash Receipts

California agriculture generated about \$26 billion in cash receipts in 2001, 88 percent higher than cash receipts of the second most important agricultural state, Texas. California has been the nation's top agricultural state in cash receipts every year since 1948. Farmers have gradually increased their share of United States farm cash receipts from 9.5 percent in 1960 to 12.8 percent in 2001. Total agricultural cash receipts in 2001, in nominal terms, were above the last record high of 1997.

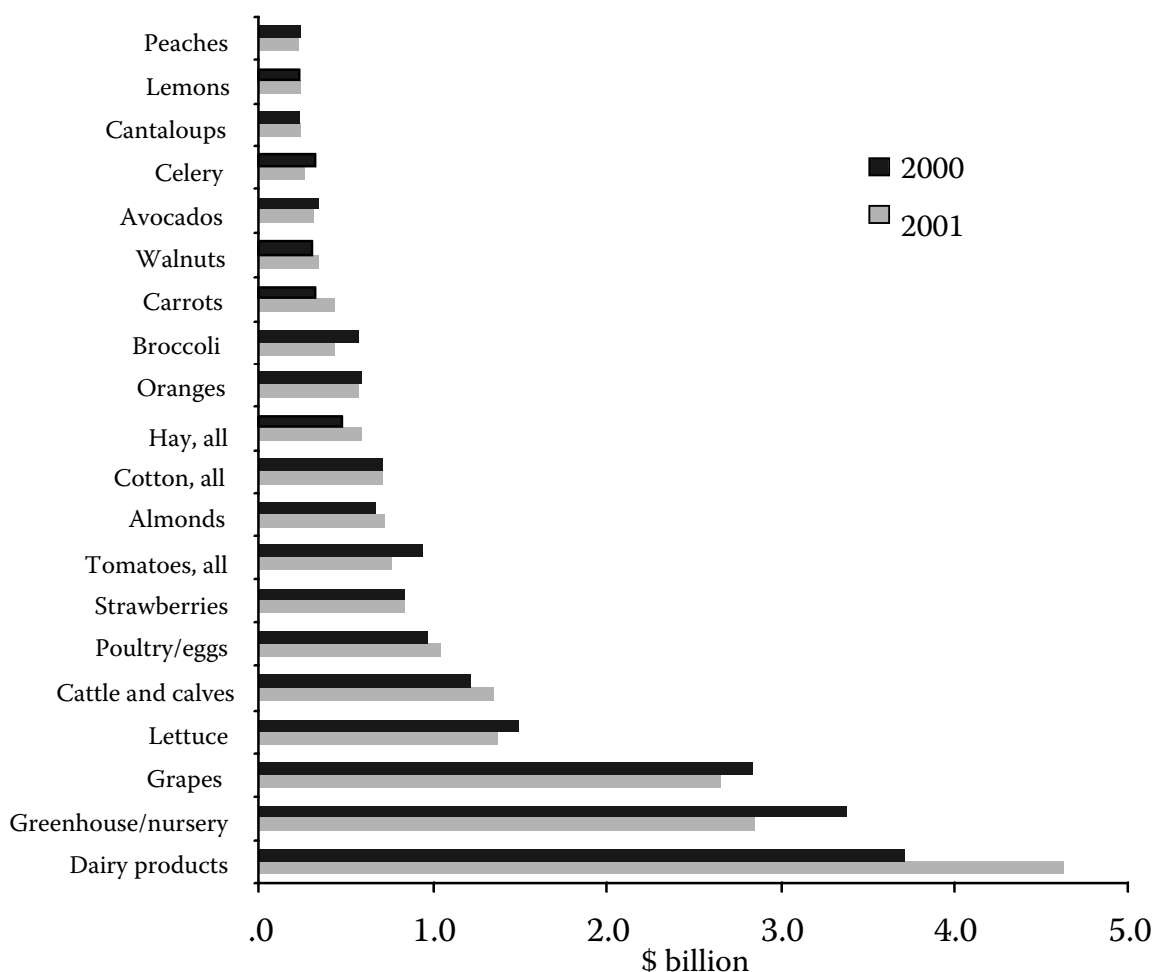
Table 2. California's Leading Commodities by Cash Receipts, 2001

| Rank | Items | Value of Receipts 1,000 Dollars | Percent of Total Receipts | Cumulative Percent | Percent of U.S. Value |
|------|--------------------|---------------------------------------|---------------------------------|-----------------------|-----------------------------|
| | All commodities | 25,892,319 | 100.0 | -- | 12.8 |
| 1 | Dairy products | 4,630,171 | 17.9 | 17.9 | 18.7 |
| 2 | Greenhouse/nursery | 2,851,339 | 11.0 | 28.9 | 20.7 |
| 3 | Grapes | 2,653,623 | 10.2 | 39.1 | 90.8 |
| 4 | Lettuce | 1,370,004 | 5.3 | 44.4 | 71.8 |
| 5 | Cattle and calves | 1,351,500 | 5.2 | 49.6 | 3.3 |
| 6 | Poultry/eggs | 1,040,197 | 4.0 | 53.6 | 4.2 |
| 7 | Strawberries | 841,031 | 3.2 | 56.8 | 77.4 |
| 8 | Tomatoes, all | 766,260 | 3.0 | 59.8 | 46.0 |
| 9 | Almonds | 731,880 | 2.8 | 62.6 | 100.0 |
| 10 | Cotton, all | 706,138 | 2.7 | 65.3 | 14.3 |
| 11 | Hay, all | 588,931 | 2.3 | 67.6 | 12.9 |
| 12 | Oranges | 571,445 | 2.2 | 69.8 | 41.7 |
| 13 | Broccoli | 438,118 | 1.7 | 71.5 | 86.9 |
| 14 | Carrots | 433,919 | 1.7 | 73.2 | 75.2 |
| 15 | Walnuts | 341,600 | 1.3 | 74.5 | 100.0 |
| 16 | Avocados | 313,061 | 1.2 | 75.7 | 95.2 |
| 17 | Celery | 259,865 | 1.0 | 76.7 | 94.0 |
| 18 | Cantaloupes | 252,277 | 1.0 | 77.7 | 60.0 |
| 19 | Lemons | 247,042 | 1.0 | 78.7 | 90.4 |
| 20 | Peaches | 227,554 | 0.9 | 79.6 | 47.7 |

Source: USDA/ERS. Farm Income, online data. URL: <http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm>

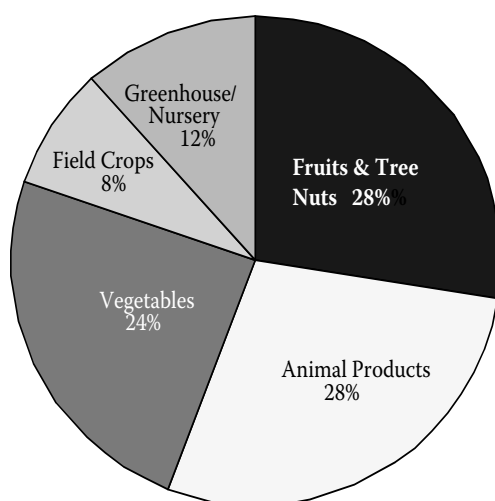
Most agricultural states specialize in production of a few commodities. California is unique in its crop diversity. The top 20 agricultural commodities in California (including some aggregate categories such as greenhouse and nursery products) constitute only about 80 percent of its total agricultural cash receipts, and the top 50 constitute 93 percent. Dairy products, nursery products, and grapes have been the top commodities, ranked by cash receipts from 1995-2001. With the largest gross sales, dairy products represented about 18 percent of the state's total agricultural cash receipts in 2001, while nursery products and grapes accounted for about 11 percent and 10 percent respectively. Winegrape acreage has increased dramatically from 300,000 acres in 1995 to almost 500,000 acres in 2002.

Figure 1. Value of Leading California Farm Products, by Cash Receipts, 2000-2001



Source: USDA/ERS. Farm Income, online data. URL: <http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm>

Figure 2. California Cash receipts by Commodity Group, 2001



Source: USDA/ERS. Farm Income, online data. URL: <http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm>

California provides more than 99 percent of the following agricultural products: almonds, artichokes, dates, figs, raisins, kiwis, olives, pistachios, prunes, and walnuts. It is also the leading state in producing asparagus, broccoli, carrots, grapes, hay, lemons, lettuce, milk, peaches, strawberries, and processing tomatoes, among many others.

Table 3. State Rankings for Cash Receipts and Net Farm Income, 2001

| State | Cash Receipts \$1,000 | State | Net Farm Income \$1,000 |
|-------------------|--------------------------|-------------------|----------------------------|
| California | 25,892,319 | Texas | 4,288,138 |
| Texas | 13,795,618 | California | 3,768,764 |
| Iowa | 11,550,109 | North Carolina | 3,201,148 |
| Nebraska | 9,488,580 | Georgia | 2,298,556 |
| Kansas | 8,121,044 | Florida | 2,166,133 |
| Minnesota | 8,101,875 | Iowa | 1,946,475 |
| North Carolina | 7,730,633 | Nebraska | 1,610,282 |
| Illinois | 7,547,087 | Alabama | 1,581,452 |
| Florida | 6,415,882 | Illinois | 1,418,739 |
| Wisconsin | 5,896,293 | Arkansas | 1,399,823 |

Source: USDA/ERS. Farm Income, online data. URL: <http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm>

California's net farm income was second to Texas in 2001. Net farm income results from subtracting input costs, taxes, depreciation and factor payments from the value of production, and adding direct government payments. California accounts for 12.8 percent of national cash receipts, but receives only about 3 percent of direct

government payments to agriculture. These payments represent 2.1 percent of the state's value of production, compared to an average of 10.2 percent for the other 49 states. California's net farm income is equivalent to 8.2 percent of the U.S. net farm income.

Table 4. Net Farm Income and its Components as Percentages of Value of Production, 2001

| | CA | Other 49 States Average |
|----------------------------|------|----------------------------|
| Purchased inputs | 57.0 | 56.4 |
| Property taxes, fees | 2.3 | 3.5 |
| Capital consumption | 3.8 | 9.8 |
| Payments to stakeholders | 25.3 | 19.3 |
| Direct Government payments | 2.1 | 10.2 |
| Net farm income | 13.7 | 21.2 |

Source: USDA/ERS, Farm Income, online data. URL: <http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm>

Agricultural Commodity Exports

The most important market for California agricultural production is in the rest of the United States. Exports to international markets account for 16 percent to 19 percent of California's agricultural annual production. In 2001, international exports were valued at about \$6.5 billion, in nominal terms. In constant terms, total export value shows a decreasing trend from 1996 to 2001.

Table 5. California Agricultural Exports, 1996-2002, Millions of 2000 constant dollars

| Commodity | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|--------------------|-------|-------|-------|-------|-------|-------|-------|
| Top 10 commodities | 4,209 | 3,957 | 3,782 | 3,126 | 3,485 | 3,422 | 3,415 |
| Other commodities | 3,220 | 3,357 | 3,110 | 3,003 | 3,042 | 2,948 | 2,809 |
| Total Exports | 7,429 | 7,314 | 6,893 | 6,129 | 6,526 | 6,371 | 6,223 |

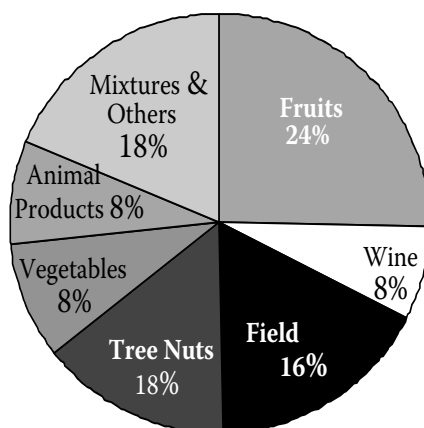
Source: Based on UC Agricultural Issues Center, online data. URL: <http://aic.ucdavis.edu/pub/exports.html>
Values deflated by the GDP Implicit Price Deflator, Bureau of Economic Analysis.

Together, tree-nuts, cotton, wine, table grapes, raisins, dairy products, and citrus accounted for more than 50 percent of exports. The other 50 percent was spread across dozens of commodities. Export markets typically take between one-third and two-

thirds of the almonds, cotton, walnuts, rice, prunes and pistachios. Exports are less important for livestock products, fresh vegetables and ornamental horticulture.

The top six export destinations in 2002 were Canada, the European Union, Japan, China-Hong Kong, Mexico and South Korea. Looking at destinations by commodity group, East Asia received more than 60 percent of animal product exports, 56 percent of field crops exports, and about half of fruit exports. North America accounted for 70 percent of vegetable exports, and Europe almost two-thirds of wine exports and about half of tree-nut exports.

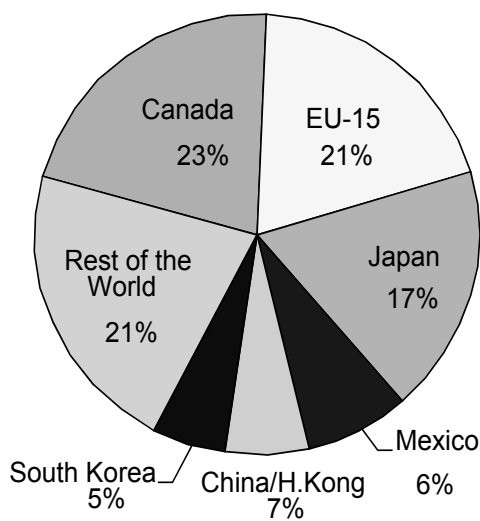
Figure 3. CA Agricultural Exports by Commodity Groups, 2002, Share of total value



Source: UC Agricultural Issues Center, online data.

URL: <http://aic.ucdavis.edu/pub/exports.html>

Figure 4. CA Agricultural Exports by Market Destination, 2002, Share of total value



Source: UC Agricultural Issues Center, online data.

URL: <http://aic.ucdavis.edu/pub/exports.html>

Organic Agriculture

In 1997-98, 1,526 registered organic growers in California reported more than \$155 million in gross sales on about 68,000 acres. In 2002 they reported more than \$263 million in gross sales on about 177,708 acres. Their combined gross sales increased by a factor of 3.5 during the last decade and in 2002 represented 1 percent of the state's total agricultural sales.

Total gross sales in 2002 had more than doubled since 1992-93. Farmers using organic techniques produced over 70 different commodities in 1997-98.

Organic agriculture in California is characterized by the predominance of vegetable, fruit and tree-nut crops, which represented about 91 percent of those farms, 74 percent of acreage and 91 percent of gross sales. Livestock accounted for slightly more than 1 percent of organic farms and sales, and data on acres devoted to organic livestock were not available.

CALIFORNIA FARMS AND FARMERS

More than a quarter of California's landmass is used for agriculture. Just over half of the 27.7 million acres of agricultural land is pasture and range and about 39 percent is cropland. Most California farms are small in terms of area, cash receipts and total sales, and almost all are family owned and operated. California has a greater share of female farm operators and farmers with Hispanic, Asian and Pacific Islander backgrounds than the United States as a whole. As the state's population has grown, a share of agricultural land has been converted to residential, industrial and commercial uses, yet agriculture remains a vibrant industry.

Land Use

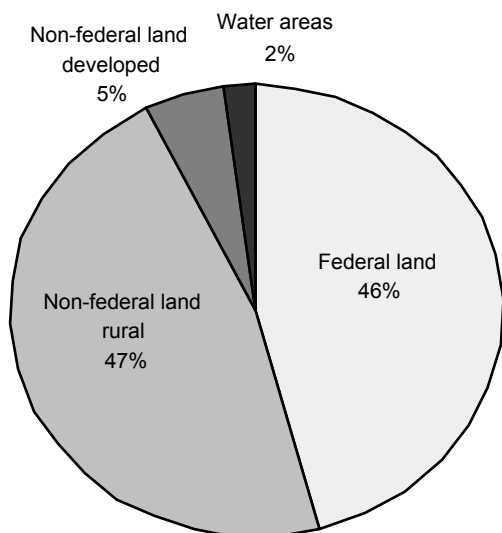
About 93 percent of California's 101.5 million acres is in rural uses. This rural area is divided evenly between federal and non-federal ownership. The federal land mostly includes national forests, national parks and wildlife areas, and "other land," such as marshes, open swamps, and bare rock deserts. Roughly 11 percent (about 5 million acres) of the federal rural land is grassland pasture and range used for agriculture.

Of California's 53 million acres of non-federal land, about 80 percent is grassland pasture and range, forest land, and cropland. About 5.5 million acres of California's non-federal land are defined by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture as "developed" for residential, industrial, and commercial use. However, the intensity of use varies widely, with much of this land relatively unpopulated. The California Department of Conservation Farmland Mapping and Monitoring Program (FMMP) defines 3.1 million acres of California's non-federal land as "urban and built-up," that is, land occupied by structures with a building density of at least one unit to one and one-half acres. This suggests that roughly 2.4 million acres of "developed" land in the NRCS survey are still relatively rural, or not mapped by FMMP.

In total, about 27.7 million acres, including 5 million acres of federal grazing land, are used for agriculture in California. More than half is pasture and range, about 39 percent is cropland, and the remainder is divided between woodland and other land.

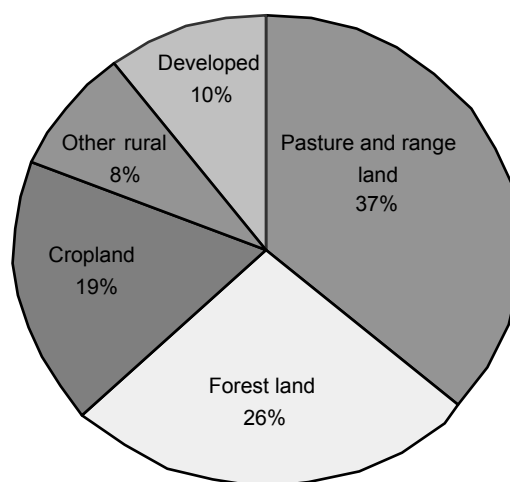
Like the rest of the Western United States, California has a greater ratio of pasture and range to cropland than the United States as a whole.

Figure 5. Federal and Non-Federal Land Use in California, 1997



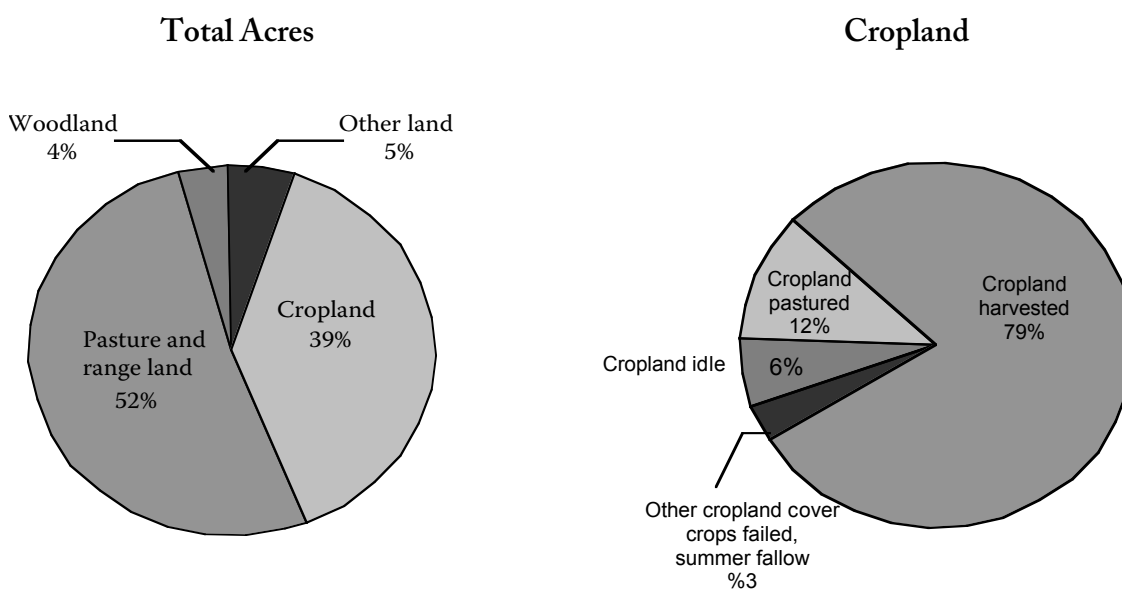
Source: USDA, Natural Resources Conservation Service, *Natural Resources Inventory*, 2000.

Figure 6. Non-Federal Land Use in California, 1997



Source: USDA Natural Resources Conservation Service, *Natural Resources Inventory*, 2000.

Figure 7. Agricultural Land Use in California,



Source: USDA/NASS, 1997 Census of Agriculture.

California's planted cropland has shifted over time toward higher value per acre crops such as fruits, tree-nuts and vegetables, while acres of field crops have decreased. Barley, a major crop in 1964, has declined dramatically since then. Harvested acreage for cotton and wheat increased substantially during the 1960s and 1970s, peaking during the early 1980's, but then declining during the 1990s. Rice acreage surpassed its 1982 acreage by about 600 acres in 2000, but has declined since.

Table 6. Agricultural Land Use, 1982-1997 (1,000 acres)

| Census Year | Pasture and Range Land | Total Cropland ^a | Other Land ^b | Woodland & Woodland Pasture | Total Agricultural Land |
|-------------------|------------------------|-----------------------------|-------------------------|-----------------------------|-------------------------|
| <i>California</i> | | | | | |
| 1982 | 17,980 | 11,257 | 1,437 | 1,483 | 32,157 |
| 1987 | 17,111 | 10,895 | 1,241 | 1,351 | 30,598 |
| 1992 | 16,191 | 10,479 | 1,158 | 1,150 | 28,979 |
| 1997 | 14,385 | 10,804 | 1,394 | 1,116 | 27,669 |
| <i>U.S.</i> | | | | | |
| 1982 | 418,264 | 445,362 | 36,082 | 87,088 | 986,796 |
| 1987 | 410,329 | 443,318 | 30,929 | 79,894 | 964,470 |
| 1992 | 410,835 | 435,366 | 25,369 | 73,962 | 945,532 |
| 1997 | 396,885 | 431,145 | 32,300 | 71,465 | 931,795 |

a) Includes harvested cropland, cropland used only for pastures, and other cropland.

b) Houses and barns, lots, ponds, roads, and wasteland.

Source: USDA/NASS, 1997 Census of Agriculture.

Table 7. California Harvested Cropland by Category, 1964-2001

| Category | 1964 | 1982 | 1992 | 1997 | 2001 |
|-----------------------------|------|------|------|------|------|
| Orchards and Vineyards | 1520 | 2158 | 2246 | 2582 | 2626 |
| Hay, all types ^a | 1702 | 1416 | 1531 | 1699 | 1540 |
| Vegetables and Melons | 626 | 895 | 1017 | 1209 | 1312 |
| Cotton | 759 | 1313 | 1066 | 1036 | 864 |
| Wheat for Grain | 267 | 929 | 569 | 581 | 461 |
| Rice | 343 | 567 | 401 | 514 | 471 |
| Barley for Grain | 1319 | 583 | 204 | 130 | 110 |
| Other Crops ^b | 1310 | 904 | 727 | 792 | 992 |
| Total Harvested Cropland | 7846 | 8765 | 7761 | 8543 | 8376 |

a) Hay includes alfalfa, other tame, small grain, wild grass, silage, and green chop varieties.

b) Acres of other crops were calculated by subtracting all reported categories from Total Harvested Cropland, except for 2001, where other crops such as dry beans and potatoes were added together directly from the CDFA Resource Directory.

Sources: U.S. Bureau of the Census, Census of Agriculture 1964-92; USDA/NASS, 1997 *Census of Agriculture*; CDFA, *Resource Directory 2002*.

Farmland Conversion

Conversion of agricultural land to urban uses continues to be a public policy issue in the United States and in California. In California between 1988 and 2000, according to the California Department of Conservation Farmland Mapping and Monitoring Program (FMMP), about 549,000 acres (approximately one half of 1 percent of California's landmass) were converted to urban and built-up uses. At these conversion rates, about 4.2 million acres would be converted in the next 100 years. Of the total acres converted from 1988-2000, 213,000 were formerly cropland (near 2 percent of total current cropland) and 100,000 were formerly grazing land. Another 235,000 acres were formerly "other land," as classified by the FMMP. A significant portion of the "other land" was idled farmland previously removed from agricultural production in anticipation of development. This indicates that the figures for cropland and grazing land conversion may be understated.

Farmland conversion is a topic of particular interest in the Central Valley, which has over half of the state's agricultural land and 64 percent of the cropland. The Central Valley has had a lower proportion of its cropland and grazing land converted than the rest of the state. The Valley recorded 43 percent of statewide cropland conversion between 1988 and 2000. Similarly, the Central Valley grazing land, about 44 percent of the state total, contributed only 25 percent of the total grazing land conversions.

Table 8. Acres Converted to Urban and Built-up Land by Region, 1988-2000

Sacramento Valley^a

| Cropland ^b | Grazing Land | Other Land ^c | Converted | Total Acres |
|-----------------------|--------------|-------------------------|-----------|-------------|
| 1988-90 | 4,772 | 3,783 | 6,535 | 15,090 |
| 1990-92 | 6,450 | 3,088 | 3,421 | 12,959 |
| 1992-94 | 2,516 | 1,122 | 1,935 | 5,573 |
| 1994-96 | 2,868 | 2,312 | 2,186 | 7,366 |
| 1996-98 | 3,377 | 3,212 | 3,640 | 10,342 |
| 1998-00 | 7,038 | 3,704 | 4,810 | 15,552 |
| Cumulative Total | 27,021 | 17,221 | 22,527 | 66,882 |

San Joaquin Valley^a

| Cropland ^b | Grazing Land | Other Land ^c | Converted | Total Acres |
|-----------------------|--------------|-------------------------|-----------|-------------|
| 1988-90 | 5,347 | 1,807 | 5,373 | 12,527 |
| 1990-92 | 16,940 | 442 | 6,576 | 23,958 |
| 1992-94 | 6,817 | 1,369 | 2,093 | 10,279 |
| 1994-96 | 7,867 | 532 | 2,137 | 10,536 |
| 1996-98 | 16,749 | 2,720 | 6,451 | 25,967 |
| 1998-00 | 11,073 | 1,011 | 5,648 | 17,732 |
| Cumulative Total | 64,793 | 7,881 | 28,278 | 100,999 |

Central Valley^a

| Cropland^b | Grazing Land | Other Land^c | Converted | Total Acres |
|-----------------------------|---------------------|-------------------------------|------------------|--------------------|
| 1988-90 | 10,119 | 5,590 | 11,908 | 27,617 |
| 1990-92 | 23,390 | 3,530 | 9,997 | 36,917 |
| 1992-94 | 9,333 | 2,491 | 4,028 | 15,852 |
| 1994-96 | 10,735 | 2,844 | 4,323 | 17,902 |
| 1996-98 | 20,126 | 5,932 | 10,091 | 36,309 |
| 1998-00 | 18,111 | 4,715 | 10,458 | 33,284 |
| Cumulative Total | 91,814 | 25,102 | 50,805 | 167,881 |

California

| Cropland^b | Grazing Land | Other Land^c | Converted | Total Acres |
|-----------------------------|---------------------|-------------------------------|------------------|--------------------|
| 1988-90 | 40,003 | 20,863 | 57,364 | 118,230 |
| 1990-92 | 39,141 | 14,729 | 45,394 | 99,264 |
| 1992-94 | 23,453 | 10,464 | 20,390 | 54,307 |
| 1994-96 | 25,954 | 13,303 | 19,185 | 58,442 |
| 1996-98 | 37,585 | 17,057 | 34,919 | 89,997 |
| 1998-00 | 46,859 | 24,403 | 57,816 | 129,161 |
| Cumulative Total | 212,995 | 100,819 | 235,068 | 549,401 |

a) Sacramento Valley is Butte, Colusa, Glenn, Sacramento, Shasta, Solano, Sutter, Tehama, Yolo and Yuba counties. San Joaquin Valley is Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare counties. Central Valley is the sum of the Sacramento and the San Joaquin Valleys.

b) Cropland is defined here as all agricultural land that is not classified as grazing land by the FMMP.

c) Other land includes idle land previously removed from agricultural production.

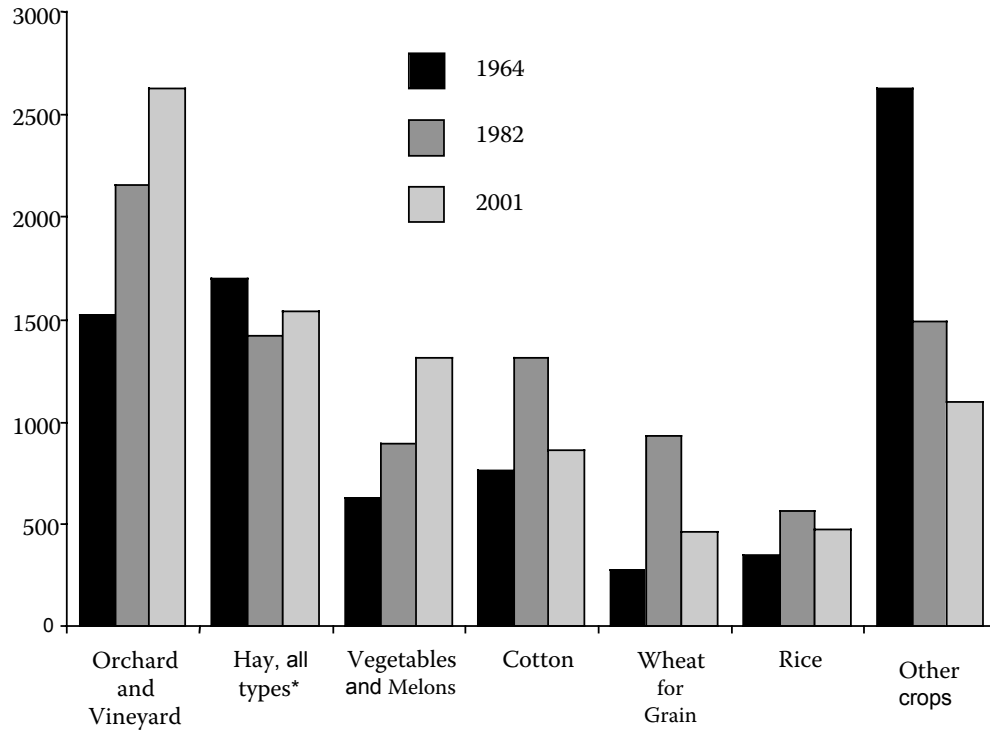
Source: California Department of Conservation, Farmland Mapping and Monitoring Program, 2000, and online data. URL: http://www.consrv.ca.gov/DLRP/fmmp/stats_reports/county_conversion_table.htm.

Farmland conversion to urban uses is associated with population growth. California's population increased by about 76 percent between 1970 and 2002, while the Central Valley's population doubled. There is general agreement that state population growth will continue, but little consensus on precise projections of future growth rates. The Bureau of the Census estimates that the state population will be about 50 million by 2025.

Farm Size

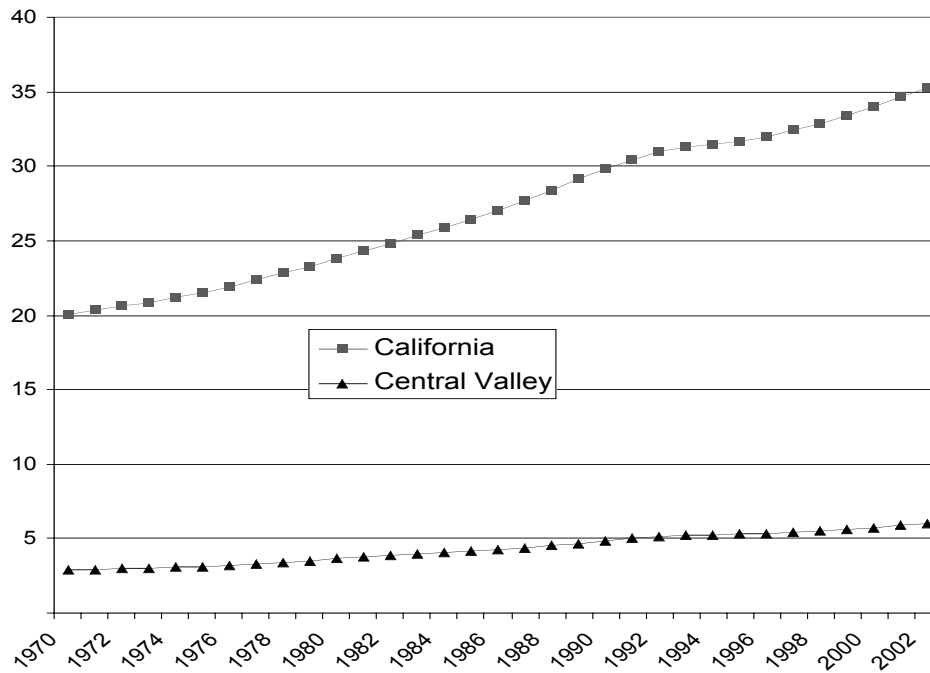
Nationwide, over the last half-century, the number of farms and the total land in farms have decreased, while the size of an average farm has increased. This trend has been less pronounced in California. While the average U.S. farm doubled in acreage between 1954 and 2002, the average California farm increased by about 13 percent. The official definition of a "farm" was changed in 1954, 1959, and 1974, to remove many of the smallest "farms" from census statistics. Each of these definitional changes decreased the reported number of farms and increased the average farm size. Since

Figure 8. California Cropland Harvested by Crop, 1964, 1982, 2001



(Source: Table 7)

Figure 9. California Population, 1970-2002 (Million)



Source: California Department of Finance, Demographic Research Unit. Year 2002 is preliminary.

Table 9. Farm Acreage, Number and Acres per Farm

| Year | Number of farms | Land in Farms (1000 acres) | Average Acreage | Number of farms | Land in Farms (1000 acres) | Average Acreage |
|-------------------|----------------------|----------------------------|-----------------|-------------------------|----------------------------|-----------------|
| | -----California----- | | | -----United States----- | | |
| 1940 | 132,658 | 30,524 | 230 | 6,102,417 | 1,065,114 | 175 |
| 1945 | 138,917 | 35,054 | 252 | 5,859,169 ^a | 1,141,615 ^a | 195 |
| 1950 | 137,168 | 36,613 | 267 | 5,388,437 | 1,161,420 | 216 |
| 1954 | 123,075 | 37,795 | 307 | 4,782,416 ^a | 1,158,192 ^a | 242 |
| 1959 | 99,274 | 36,888 | 372 | 3,710,503 | 1,123,508 | 303 |
| 1964 | 80,852 | 37,011 | 458 | 3,154,857 | 1,110,187 | 352 |
| 1969 | 77,875 | 35,328 | 454 | 2,730,250 | 1,062,893 | 389 |
| 1974 | 67,674 | 33,386 | 493 | 2,314,013 | 1,017,030 | 440 |
| 1978 | 73,194 | 32,727 | 447 | 2,257,775 | 1,014,777 | 449 |
| 1982 | 82,463 | 32,157 | 390 | 2,240,976 | 986,797 | 440 |
| 1987 | 83,217 | 30,598 | 368 | 2,087,759 | 964,471 | 462 |
| 1992 | 77,669 | 28,979 | 373 | 1,925,300 | 945,532 | 491 |
| 1997 | 74,126 | 27,699 | 374 | 1,911,859 | 931,795 | 487 |
| 2002 ^b | 79,709 | 27,627 | 347 | 2,129,226 | 939,507 | 441 |

a) Excludes Hawaii and Alaska. b) USDA/NASS estimate.

Sources: U.S. Bureau of the Census, Census of Agriculture, 1940-1992.

USDA, National Agricultural Statistics Service, 2002 and 1997 *Census of Agriculture*.

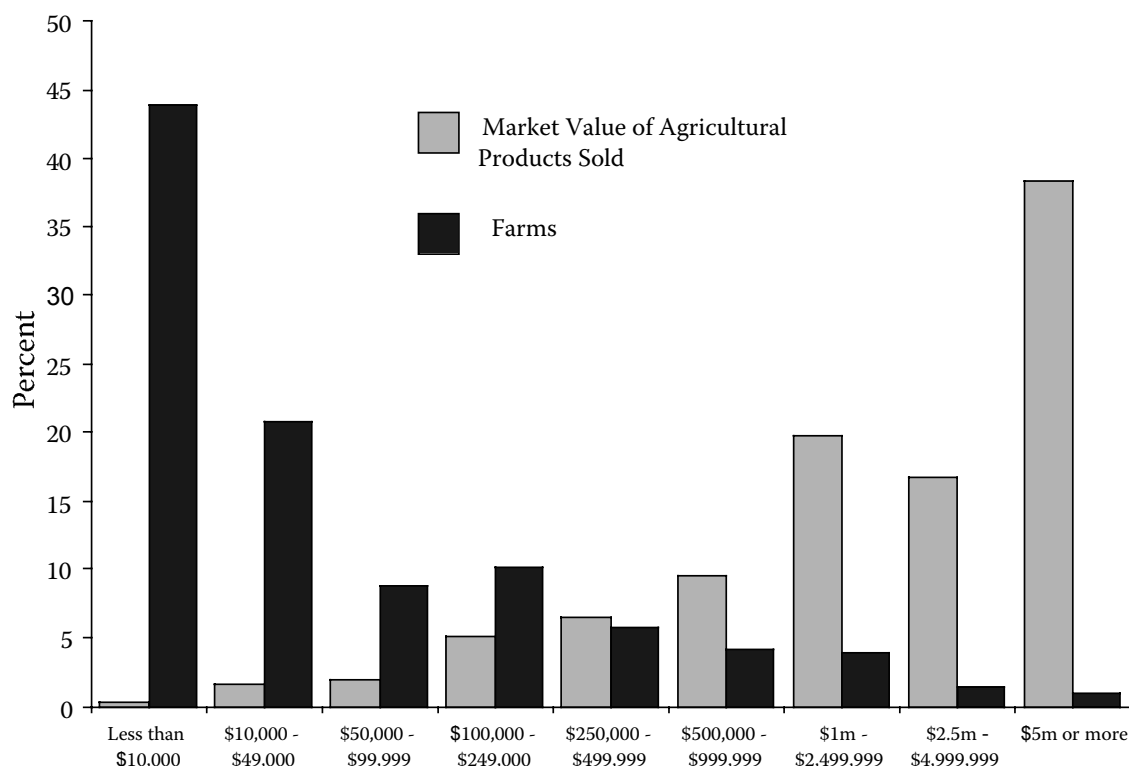
USDA, National Agricultural Statistics Service, *California Agriculture Statistics 1992-2001*.

1974 a “farm” has been defined in the Census of Agriculture as a place that generates agricultural sales of at least \$1,000 annually. Under the current Census of Agriculture definition, the average acreage of California farms decreased by 30 percent between 1974 and 2002. The 2002 Census introduced a new methodology for estimating total number of farms and operators’ demographics. The Census has been conducted via mail returns, and coverage has been always below 100 percent, especially among very small operations. The 2002 methodology accounts for all farms.

In 2002, about 80 percent of California farms were less than 180 acres, yet the “average farm” size was 347 acres. These two statistics highlight the fact that a small percent of large farms account for a large percent of total acreage. These large farms include ranches that graze livestock and may generate relatively little total revenue.

By sales value, California agriculture is comprised of a large number of small farms, while a small number of large farms represent most of the sales. The 16 percent of California farms with sales of more than \$250,000 in 1997 also represented over 90 percent of total sales value. In 1997, almost 44 percent of California farms sold less than \$10,000 of agricultural products. Retired or part-time farmers operate most of these farms.

Figure 10. Share of California Farms and Market Value of Agricultural Products Sold, by Total Sales Category, 1997



Source: USDA, National Agricultural Statistics Service, *1997 Census of Agriculture*.

Legal Organization

More than three-quarters of all farms in California are individual or family proprietorships, and another 15 percent are partnerships. About 7 percent of all California farms are legally organized as corporations. About 85 percent of these are family held. Non-family held corporations (1 percent of the farms) produce about 6 percent of total agricultural sales both in the United States and in California.

Farmer Demographics

There appears to be a continuing trend toward fewer young people choosing farming as an occupation. Between 1987 and 2002 there were fewer farmers in the younger age categories and an increase in the oldest category. The percent of California farmers over 65 increased from 23 percent to almost 30 percent. Farming is likely a retirement occupation for an increasing number of individuals. Meanwhile, the share of the state population over 65 remained unchanged at about 10.5 percent between 1990 and 2000.

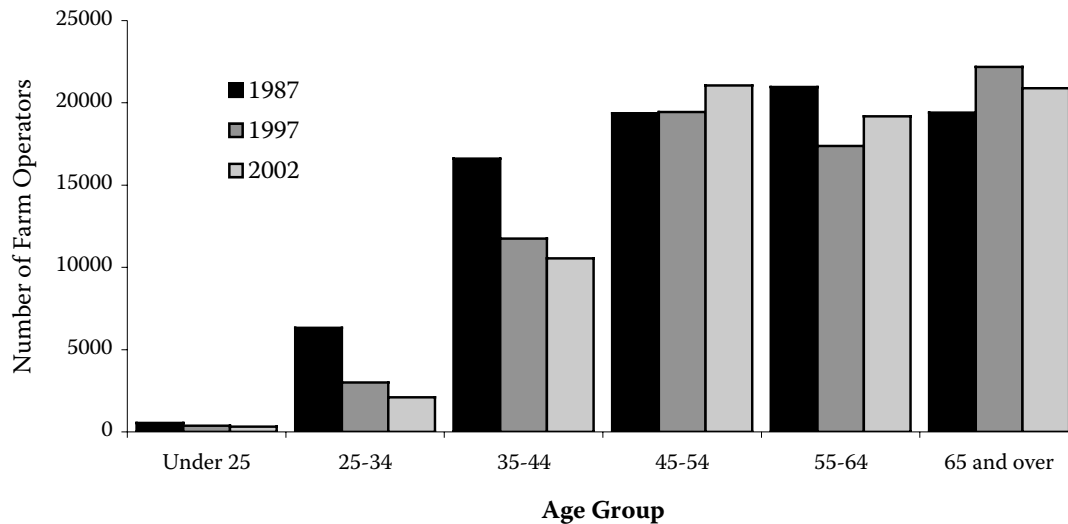
Anecdotal information suggests that many family farms remain in the name of the oldest family members, even if they are less actively involved in farming than younger members. This trend may place an upward bias on age estimates since almost all of California's farms are family owned and operated. In 1997, about 19 percent of U.S. farm operators described themselves as retired.

Table 10. Legal Organization of Farms, 1997

| | | Individual or Family | Partnership | Corp. Family Held | Corp. Not Family Held | Other ^a | All Farms |
|---|----------------|-------------------------|-------------|-------------------------|-----------------------------|--------------------|--------------|
| <i>California</i> | | | | | | | |
| Farms | <i>percent</i> | 76.6 | 14.6 | 6 | 1.1 | 1.8 | 100 |
| Average Area | <i>acres</i> | 249 | 708 | 975 | 1,103 | 529 | 374 |
| Total Area | <i>percent</i> | 51 | 28 | 16 | 3 | 3 | 100 |
| Average Sales | <i>\$1,000</i> | 130 | 655 | 1,541 | 1,770 | 222 | 311 |
| Total Sales | <i>percent</i> | 32 | 31 | 30 | 6 | 1 | 100 |
| Average Value of Land and Buildings | <i>\$1,000</i> | 595 | 1,710 | 3,054 | 3,535 | 1,232 | 941 |
| <i>United States</i> | | | | | | | |
| Farms | <i>percent</i> | 86 | 8.9 | 4 | 0.4 | 0.8 | 100 |
| Average Area | <i>acres</i> | 356 | 881 | 1571 | 1507 | 4,378 | 487 |
| Total Area | <i>percent</i> | 63 | 16 | 13 | 1 | 7 | 100 |
| Average Sales | <i>\$1,000</i> | 62 | 210 | 603 | 1,395 | 117 | 103 |
| Total Sales | <i>percent</i> | 52 | 18 | 23 | 6 | 1 | 100 |
| Average Value of Land and Buildings | <i>\$1,000</i> | 360 | 791 | 1,338 | 1,769 | 1,357 | 450 |
| a) Other includes cooperatives, estates, trusts, and institutionals. | | | | | | | |
| Source: USDA, National Agricultural Statistics Service, <i>1997 Census of Agriculture</i> . | | | | | | | |

One third of California farm operators do not consider farming their principal occupation and many spend more days employed off the farm than on it. In contrast, about 51 percent did not report any days spent employed off the farm, but a significant proportion of those farmers may be retired from off farm occupation or from full-time farming.

Figure 11. California Farm Operators by Age Group



Source: USDA, National Agricultural Statistics Service, 1997 *Census of Agriculture*.

The percent of California farmers who consider farming their principal occupation increased from 50.4 percent to 53 percent between 1987 and 1997, while that ratio for the United States decreased from 54.5 percent to 50.3 percent.

Table 11. Farm Operators by Number of Days Employed off the Farm, 2002 (Percent)

| | None | Less than 100 days | Between 100 and 199 days | 200 days or more |
|------------|------|--------------------|--------------------------|------------------|
| California | 50.6 | 9.8 | 6.9 | 32.9 |
| U.S. | 45.2 | 8.8 | 6.8 | 39.1 |

Source: USDA, National Agricultural Statistics Service, 1997 *Census of Agriculture*.

The number of women reported as the principal farm operator almost doubled in California between 1978 and 1997. This number has been increasing in California and in the United States, though California has consistently had a greater ratio of female to male farm operators than the national average. In 2002, 5.8 percent of California farms and 8.6 percent of U.S. farms reported a female principal operator, compared with 7.6 percent and 5 percent in 1978.

California has a greater share of farm operators of Hispanic origin (10 percent) than the United States as a whole (2.4 percent). Those with Asian or Pacific Islander origins represent 4.8 percent of California farm operators. The biggest change in *Census*

of Agriculture data on ethnicity is the percentage increase in those reporting their ethnicity, although 13 percent of California farmers and 14 percent of U.S. farmers still did not report their ethnic background in the most recent Census. The 1997 and 2002 *Census of Agriculture* reported making "special efforts" to capture the number of minority farmers.

Table 12. CA Farm Production Expenses, 1981, 1991, 2001 (In constant 1996 dollars)

| Item | 1981 | 1991 | 2001 | % Change 1981-2001 |
|---|----------------|----------------|----------------|-----------------------|
| -----Thousand----- | | | | |
| Purchased feed | 3,160,901 | 1,762,840 | 2,374,668 | -25% |
| Purchased Livestock and poultry | 938,818 | 650,528 | 592,093 | -37% |
| Purchased seed | 298,171 | 472,590 | 867,627 | 191% |
| Fertilizers and lime | 825,243 | 672,941 | 743,514 | -10% |
| Pesticides | 720,596 | 729,366 | 951,093 | 32% |
| Petroleum fuel and oils | 842,177 | 458,762 | 557,197 | -34% |
| Electricity | 396,173 | 557,541 | 787,485 | 99% |
| Repair and maintenance of capital items | 450,042 | 671,791 | 721,286 | 60% |
| Machine hire and customwork | 410,380 | 557,682 | 678,506 | 65% |
| Marketing, storage, and transportation expenses | 903,321 | 1,069,988 | 1,944,764 | 115% |
| Contract labor | 571,060 | 887,048 | 1,570,506 | 175% |
| Miscellaneous expenses | 1,059,750 | 1,977,027 | 2,612,494 | 147% |
| Hired labor | 2,634,153 | 3,239,873 | 4,727,557 | 79% |
| Net rent received by nonoperator landlords | 603,062 | 596,260 | 390,571 | -35% |
| Real estate and nonreal estate interest | 2,555,602 | 1,164,775 | 1,269,232 | -50% |
| Property taxes and other fees | 466,328 | 465,461 | 574,811 | 23% |
| Total farm Expenditures | 16,835,777 | 15,934,471 | 21,363,404 | 27% |
| Estimated Number of farms | 83,000 | 83,000 | 85,000 | -- |
| Average per farm | 202,841 | 191,982 | 251,334 | 24% |
| Source: USDA/ERS, Online Farm Income Data. URL: http://www.ers.usda.gov/data/FarmIncome/finfidmu.htm | | | | |
| U.S. Bureau of Economic Analysis. | | | | |

RESOURCES AND FARM PRODUCTIVITY

California farmers use a variety of inputs to produce agricultural products. Financial capital, machinery, fuel, family and hired labor, livestock feed, chemicals and fertilizer, and water are some of the inputs that are commonly associated with agricultural production. Research and development and new technology are also important contributors to California agriculture that, over time, have led to productivity increases and changes in farming practices.

Expenditures by California farmers on production inputs, on a per farm basis, increased by 24 percent between 1981 and 2001 in constant (1996) dollars. The largest increases were in purchased seeds, contract labor, miscellaneous expenses, and marketing and transportation.

Capital

California has about 7.3 percent of the nation's farm assets, 10.1 percent of its debt, and 6.8 percent of its equity. This leaves the aggregate California farming sector with higher debt-to equity and debt-to-asset ratios than the United States as a whole. California has also much higher value of sales to assets or equity than the rest of the United States.

The average value per acre of land and buildings per farm in California is nearly three times the United States average. Half of California's farms have land and building values between \$100,000 and \$499,999.

Table 13. Farm Balance Sheet, December 31, 2001

| | California | United States |
|---|-----------------------------------|---------------|
| <i>Farm assets</i> | <i>-----Thousand Dollars-----</i> | |
| Real estate | 78,197,670 | 998,704,964 |
| Non Real Estate | 13,124,534 | 252,302,719 |
| Livestock and poultry | 4,601,836 | 73,157,850 |
| Machinery and motor vehicles | 4,513,580 | 90,730,928 |
| Crops | 465,908 | 25,238,754 |
| Purchased inputs | 471,375 | 4,212,374 |
| Financial | 3,071,835 | 58,962,813 |
| Total | 91,322,204 | 1,251,007,683 |
| <i>Farm debt</i> | | |
| Real estate | 11,852,086 | 103,009,801 |
| Non Real Estate | 7,588,162 | 89,017,129 |
| Total | 19,440,248 | 192,026,930 |
| <i>Equity</i> | 71,881,956 | 1,058,980,753 |
| Debt/equity | 27.0 | 18.1 |
| Debt/assets | 21.3 | 15.4 |
| Source: USDA/ERS, Farm Balance Sheet data online. URL: http://www.ers.usda.gov/Data/FarmBalanceSheet/Fbsdmu.htm | | |

Table 14. Value of Land and Buildings, 1982-1997 (current dollars)

| Census Year | Total Value ^a \$1,000,000 | Average Value Per Farm(\$) | Average Value Per Acre(\$) | Total Value ^a \$1,000,000 | Average Value Per Farm(\$) | Average Value Per Acre(\$) |
|----------------------|---|----------------------------|----------------------------|---|----------------------------|----------------------------|
| -----California----- | | | -----United States----- | | | |
| 1982 | 61,565 | 746,577 | 1,918 | 775,084 | 345,869 | 784 |
| 1987 | 48,571 | 583,668 | 1,575 | 604,170 | 289,387 | 627 |
| 1992 | 63,693 | 820,063 | 2,213 | 687,432 | 357,056 | 727 |
| 1997 | 69,765 | 941,170 | 2,605 | 859,855 | 449,748 | 933 |

a) Computed as the product of the average value per farm and the total number of farms.
 Sources: U.S. Bureau of the Census, *Census of Agriculture*, 1982-1992;
 USDA, National Agricultural Statistics Service, *1997 Census of Agriculture*.

Hired Farm labor

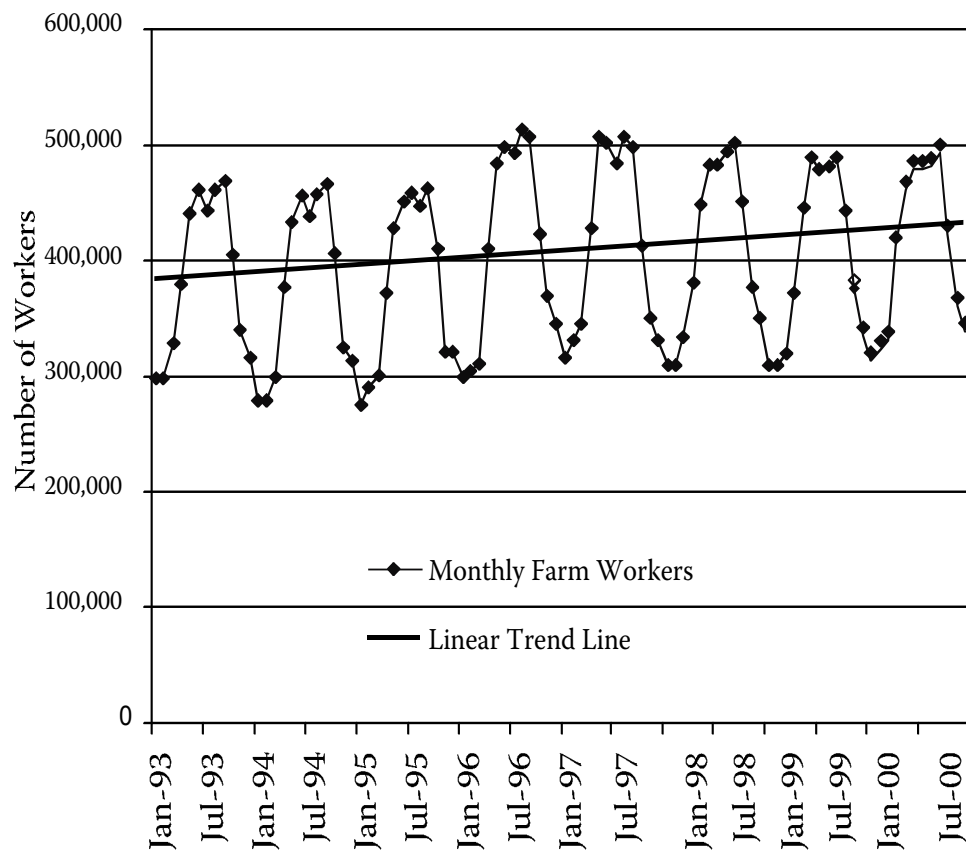
In 1997, the Central Valley had about 58 percent of California's 549,265 hired farm laborers, according to census data. Most worked in the San Joaquin Valley. Monthly data in Figure 12 displays the cyclical nature of the farm labor employment market, and an upward trend in average annual employment between 1993 and 2000. The number of employed workers rises in the summer months and drops in the winter. The higher employment total for the *Census of Agriculture* data in 1997 (549,265 compared to the Employment Development Department's monthly high of about 500,000) suggests that different definitions or sampling methods are employed in the two data sources.

Table 15. Hired Farm Workers by Region, 1997

| | Sacramento Valley | S. Joaquin Valley | Central Valley ^a | California |
|----------------------------------|-------------------|-------------------|-----------------------------|------------|
| Farms with Hired Workers | 5,130 | 14,947 | 20,077 | 36,450 |
| Total Hired Workers | 57,657 | 264,575 | 322,232 | 549,265 |
| Workers Hired 150 days or more | 16,308 | 80,469 | 96,777 | 186,358 |
| Workers Hired less than 150 days | 41,349 | 184,106 | 225,455 | 362,907 |
| Payroll (\$1,000) | 313,519 | 1,383,042 | 1,696,561 | 3,392,577 |

a) Central Valley is the sum of the San Joaquin and Sacramento Valleys.
 Source: USDA, National Agricultural Statistics Service, *1997 Census of Agriculture*.

Figure 12. California Hired Farm Workers, 1993-2000



Source: California Employment Development Department.

Table 16. Characteristics of California Crop Workers, 1995-97

| | Percent of Workers |
|------------------------------------|--------------------|
| Foreign Born | 95 |
| Male | 82 |
| Under 34 | 63 |
| Married | 61 |
| Family in United States | 60 |
| In United States Less than 5 Years | 53 |
| 2 to 4 Farm Jobs per Year | 53 |
| Unauthorized | 42 |

Source: Martin, Philip, and J. Edward Taylor, "For California Farm workers, Future Holds Little Prospect for Change," *California Agriculture* 2000.

The California agricultural labor market is characterized by (1) an almost entirely foreign-born (mostly Hispanic) workforce, and (2) relatively low annual average earnings compared to other occupations. Low earnings are the result of relatively low hourly wages and less than full-time employment.

Table 17. Pesticide use in California, selected years

| Category | Pounds of Active Ingredient applied: | | |
|---|--------------------------------------|-------------|-------------|
| | 1992 | 1997 | 2000 |
| 1 Reproductive Toxin ^a | 30,393,943 | 34,483,130 | 26,227,436 |
| 2 Carcinogens ^b | 14,218,972 | 24,543,280 | 22,889,829 |
| 3 Cholinesterase inhibitor ^c | 14,352,300 | 16,153,697 | 11,570,792 |
| 4 Groundwater Contaminant ^d | 2,143,420 | 2,347,882 | 2,432,815 |
| 5 Air Contaminant ^e | 24,170,357 | 25,561,393 | 21,651,013 |
| 6 Oil based | 24,355,035 | 33,089,845 | 27,634,736 |
| 7 Reduced Risk | 0 | 72,838 | 553,268 |
| 8 Biopesticides | 64,674 | 188,180 | 332,851 |
| Total | 109,698,701 | 136,440,245 | 113,292,740 |

| Category | Cumulated acres treated: | | |
|---|--------------------------|------------|------------|
| | 1992 | 1997 | 2000 |
| 1 Reproductive Toxin ^a | 3,868,087 | 4,170,939 | 3,890,210 |
| 2 Carcinogens ^b | 3,406,238 | 4,285,583 | 5,899,480 |
| 3 Cholinesterase inhibitor ^c | 10,236,375 | 12,135,586 | 8,479,224 |
| 4 Groundwater Contaminant ^d | 1,179,383 | 1,651,236 | 1,757,983 |
| 5 Air Contaminant ^e | 3,584,293 | 4,137,785 | 4,342,186 |
| 6 Oil based | 2,250,273 | 2,494,361 | 2,370,087 |
| 7 Reduced Risk | 0 | 399,715 | 2,509,530 |
| 8 Biopesticides | 659,894 | 1,272,516 | 1,066,648 |
| Total | 25,184,543 | 30,547,721 | 30,315,348 |

Categories of pesticides:

- a) Proposition 65 list (known to cause reproductive toxicity).
- b) B2 carcinogens, or Proposition 65 list (known to cause cancer).
- c) Cholinesterase inhibitors (organophosphate or carbamate).
- d) Materials on the DPR's groundwater protection list.
- e) Materials on the DPR's toxic air contaminants list.

Source: California Environmental Protection Agency, Department of Pesticide Regulation (DPR), Pesticide Use Reporting.

Chemicals and Fertilizer

Total pesticide use in California agriculture shows an upward trend, with total reported pounds applied fluctuating from year to year depending on pest problems, weather, and acreage and types of crop planted. Also, the types and forms of the pesticides have changed to meet new pests and environmental demands. In 2000, more than 550,000 pounds of chemicals defined by the United States Environmental Protection Agency as “reduced risk” were applied by commercial agriculture in California. This was equivalent to about one half of one percent of total pounds of pesticides applied to California crops.

In 1990, California became the first state to require reporting of the agricultural use of all pesticides: insecticides, herbicides, rodenticides, fungicides, and sanitizers. In contrast, much of the non-agricultural uses such as chlorine for swimming pools and home and garden pesticides are not reported.

About one-third of all California farms (22,300) did not report using any chemicals or fertilizer in the 1997 Census of Agriculture. California has about 1,526 registered organic farmers, only a tiny portion of those farms that did not report using any chemicals or fertilizer. Therefore, care is needed in interpreting these Census of Agriculture figures. Many farmers may have failed to respond to this particular question or were small livestock growers or other operators whose farms used no chemicals or fertilizer without being defined explicitly as “organic.”

Table 18. Agricultural Chemical and Fertilizer Use Reported by California Farmers

| | | 1969 | 1974 | 1978 | 1982 | 1987 | 1992 | 1997 |
|---|-------------------------------|---------|---------|---------|---------|---------|---------|---------|
| <i>Chemicals or Fertilizer</i> | Number of Farms | 43,656 | 37,627 | 52,746 | 51,435 | 57,579 | 52,917 | 51,819 |
| <i>Commercial Fertilizer</i> | Number of Farms | 36,337 | 32,865 | 42,857 | 41,909 | 44,683 | 42,602 | 42,312 |
| | Expenditures (\$1,000) | 121,905 | 290,455 | 335,444 | 427,823 | 427,924 | 568,772 | 746,325 |
| <i>Agricultural Chemicals</i> | Number of Farms | N/a | N/a | 46,449 | 43,142 | 52,614 | 45,721 | 44,327 |
| | Expenditures (\$1,000) | N/a | N/a | 288,968 | 468,604 | 544,779 | 694,549 | 957,006 |
| <i>Number of Farms on which Chemicals were Used to Treat:</i> | Insects | 23,617 | 19,297 | 24,706 | 30,460 | 32,959 | 30,022 | 28,451 |
| | Nematodes | 2,995 | 2,512 | 3,325 | 3,526 | 3,603 | 3,520 | 3,553 |
| | Diseases | 8,042 | 6,802 | 17,553 | 15,280 | 17,446 | 14,693 | 16,207 |
| | Weeds | 12,602 | 14,106 | 22,385 | 28,192 | 35,003 | 28,292 | 28,807 |
| | Growth, fruits or Defoliation | 3,748 | 2,761 | 5,461 | 5,483 | 6,173 | 4,673 | 5,231 |
| Sources: U.S. Bureau of the Census, Census of Agriculture, 1969-1992. | | | | | | | | |
| USDA, National Agricultural Statistics Service, 1997 Census of Agriculture. | | | | | | | | |

Water

California receives about 200 million acre-feet (maf) of precipitation in a normal non-drought year. Roughly 65 percent of this is lost to evaporation or vegetation. The remaining 71 maf of average runoff, plus imported water, supplies the state's water "budget," traveling through California's complex water distribution system to environmental, agricultural, and urban uses. Groundwater is an additional important source.

In 1998 the California Department of Water Resources released a normalized water budget showing the state's supply and use of applied water in an "average" non-drought year. Figures in the "average" year budget were based on the distribution infrastructure in place in 1995. The 1.6 maf shortage is largely accounted for by groundwater overdraft that was not included in the budget.

More than 70 percent of the average annual runoff occurs north of Sacramento, but about 75 percent of the state's water demand is south of Sacramento. California uses a combination of federal, state, and local water projects to capture, store, transport, and import surface water to meet demand around the state. The largest water projects are the federal Central Valley Project and the State Water Project.

Table 19: California Water Budget and Supplies

| California Annual Average Water Budget ^a | | California Annual Average Water Supplies ^a | |
|--|------------------------------|--|------------------------------|
| <i>Water Use</i> | <i>Million Acre-Feet</i> | <i>Surface Water</i> | <i>Million Acre-Feet</i> |
| | 8.8 | Central Valley Project | 7 |
| Agricultural | 33.8 | Other federal Projects | 0.9 |
| Environmental | 36.9 | State Water Project | 3.1 |
| Total | 79.5 | Colorado River | 5.2 |
| <i>Supplies</i> | | Local | 11.1 |
| Surface Water | 65.1 | Required Environmental Flow | 31.4 |
| Groundwater ^b | 12.5 | Reapplied | 6.4 |
| Recycled & Desalted | 0.3 | <i>Groundwater^b</i> | 12.5 |
| | | <i>Recycled & Desalted</i> | 0.3 |
| Total | 77.9 | | |
| Shortage | 1.6 | Total | 77.9 |

a) Normalized date for a non-drought year.

b) Excludes overdraft.

Source: California Department of Water Resources, The California Water Plan Update, Bulletin 160-98.

The amount of water per acre used by urban areas varies according to land use, population density and water use efficiency. In some areas agriculture may use less water per acre than nearby urban development while in other areas the opposite case may be true.

Groundwater provides 30 percent of the supply used by agriculture and the urban sector in a normal non-drought year. Agriculture accounts for over 90 percent of the groundwater used in the San Joaquin, Tulare Lake, and Central Coast hydrologic regions. Only a portion of the applied water is actually used by the crop. The remainder percolates through the soil, flows downstream to other uses, or is irrecoverably lost due to other factors. Crop water use is measured as evapotranspiration of applied water (ETAW). The ratio of ETAW to applied water is an indication of irrigation efficiency.

The amount of water applied to a particular crop depends on many factors including plant evapotranspiration, soil properties, irrigation efficiency, and weather. Plant intake is the primary purpose of water application, but water is also applied to crops for cultural purposes such as frost control, facilitating cultivation and leaching of salts out of the crop root zone. There is a wide range in water application rates among crops and hydrologic regions. For example, depending on the hydrologic region, anywhere between 2 and 10-acre-feet/acre are applied to alfalfa annually. Hay production, including alfalfa, accounts for almost 15 percent of total irrigation water used in agriculture. Cotton accounts for about 12.5 percent. The top 12 commodities, those that represent 60 percent of the total value of California agriculture, account for about 48 percent of the water used for irrigation in the state.

Agricultural surface water costs differ greatly by hydrologic region and source of supply. According to the Department of Water Resources, the 2003 Central Valley Project contract rates range from \$2 per acre-foot in the Sacramento Valley to \$27 in the county of Tulare and almost \$30 in some areas of the Delta.

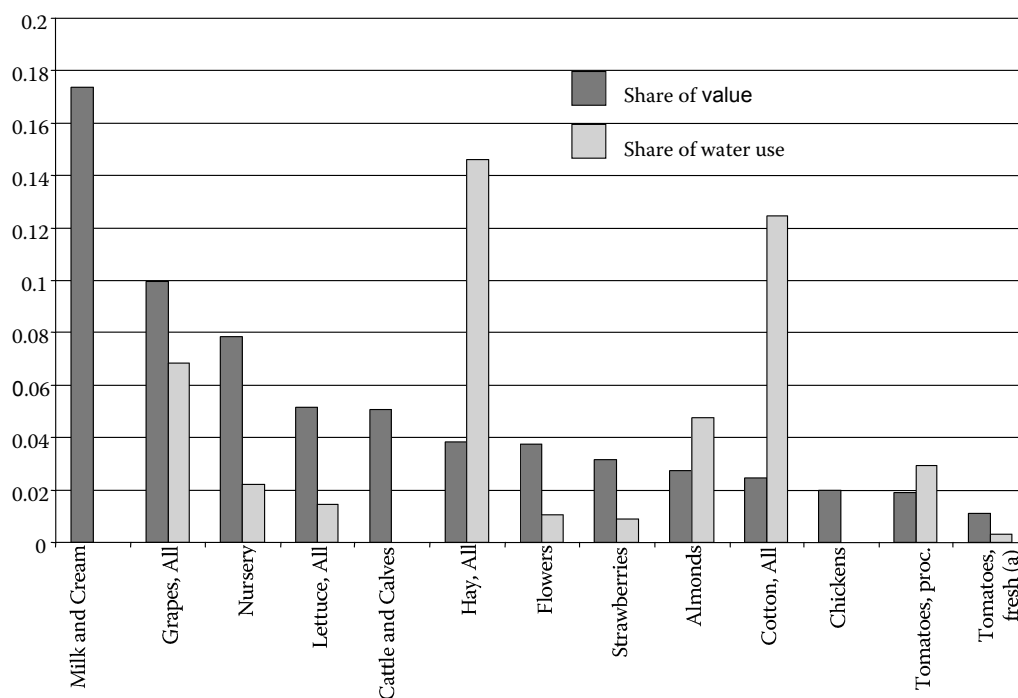
Almost one-third of California's irrigated acreage used sprinkler, drip or trickle systems in 1998. The rest used gravity flow systems such as furrows. More than one method was used on some acreage.

Table 20. California Land Irrigated by Water Distribution Method, 1998

| | Gravity Flow Systems | Sprinkler Systems | Drip or Trickle Systems | Subirrigation | All Irrigation |
|---------------------------|-------------------------|----------------------|----------------------------|---------------|-------------------|
| Farms | 19,575 | 7,870 | 14,697 | 2,710 | 40,121 |
| Acres Irrigated (1,000) | 5,820 | 1,528 | 1,022 | 55 | 8,140 |
| Acres Irrigated (percent) | 71 | 19 | 13 | 1 | -- |

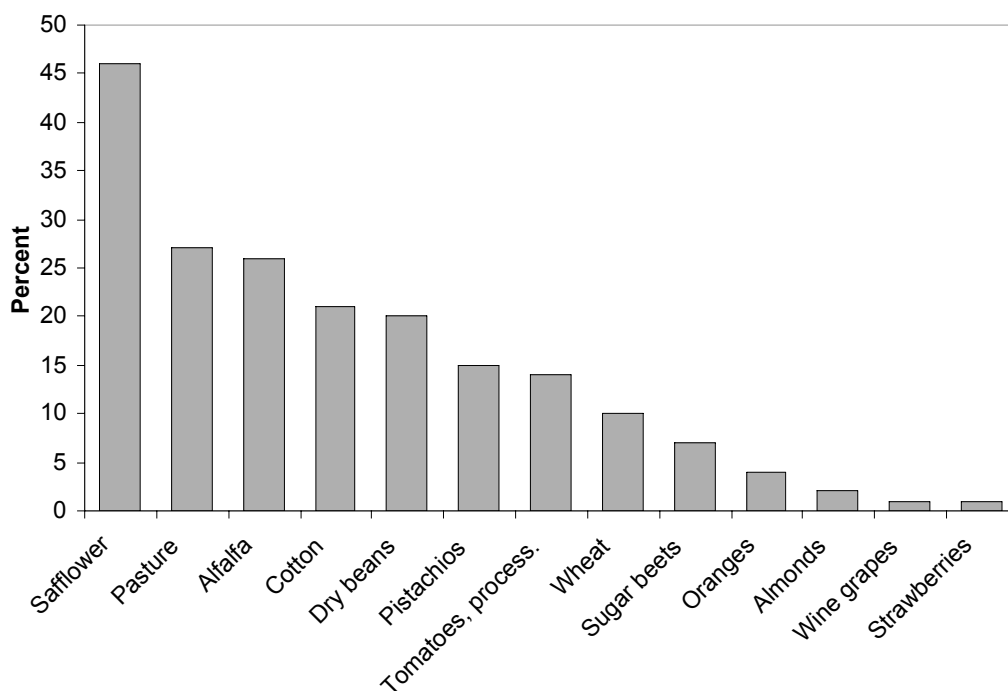
Source: USDA, National Agricultural Statistics Service, Census of Agriculture, Farm and Ranch Irrigation Survey, 1998.

Figure 13. Distribution of Water Use Among the Top 12 Commodities, CA, 2002



a) Fresh tomatoes are listed here for comparison purposes; Source: California Department of Water Resources.

Figure 14. Water Costs as a Percent of Operating Costs for Selected Crops



Source: UC Davis, Department of Agricultural and Resource Economics. Costs and Returns Studies. URL: <http://www.agecon.ucdavis.edu/outreach/crop/crop.htm>.

Table 21. California Irrigated Acreage, 1995^a (Thousand acres)

| Crop | 1995 |
|---|-------|
| Rice | 517 |
| Grain | 900 |
| Cotton | 1,244 |
| Sugar Beets | 178 |
| Corn | 438 |
| Other Field | 467 |
| Alfalfa | 1,094 |
| Pasture | 933 |
| Tomatoes | 357 |
| Almond/Pistachios | 534 |
| Other Deciduous | 602 |
| Subtropical | 455 |
| Grapes | 736 |
| Other | 1,060 |
| Total Irrigated Crop Area | 9,515 |
| Multiple Crop | 447 |
| Irrigated Land Area | 9,068 |
| a) Normalized data. | |
| Source: Department of Water Resources, <i>The California Water Plan Update</i> , Bulletin 160-98. | |

Technology

Technological innovation, fueled by research and entrepreneurship, has been a driving force in U.S. agriculture during the past century, leading to both higher yields and lower prices. In California, technological change has facilitated significant yield increases for many crops as well as other changes. Inputs have been used more efficiently to produce greater quantities of output. For instance, cash receipts (in constant 1996 dollars) per irrigated acre increased by 35 percent between 1960 and 1995. This can be attributed partially to the development and implementation of more efficient irrigation, such as drip systems, and partially to a change in the type of crops produced.

The most recent analysis available finds that the productivity index for California agriculture (the index of total farm production outputs divided by the index of total farm production inputs) doubled between 1949 and 1991.

During the 1990s, particularly toward the end of the decade, computers were increasingly incorporated into farming operations. In only two years, between 1997

and 1999, the number of California farms with Internet access doubled to 46 percent, and reached 51 percent in 2001. Overall, about 36 percent of California farms reported using computers in their business operations in 2001, compared to 29 percent for the United States as a whole, although there are several states with higher usage than California.

Table 22. Three-Year Average Yield per Harvested Acre, Representative Crops

| Crop | Units/Acre | Average 1976-78 | | Average 2000-02 | |
|----------------------|---------------|----------------------------|-------------------|----------------------------|-------------------|
| | | <i>Other 49 States</i> | <i>California</i> | <i>Other 49 States</i> | <i>California</i> |
| Corn for grain | bushels | 93 | 117 | 135 | 170 |
| Cotton, upland | pounds | 393 | 880 | 619 | 1,392 |
| Lettuce, head | hundredweight | 204 | 266 | 360 | 382 |
| Rice, medium grain | pounds | 4,111 | 5,483 | 6,349 | 8,200 |
| Strawberries | hundredweight | 60 | 405 | 150 | 562 |
| Sugar Beets | short tons | 19 | 26 | 21 | 36 |
| Tomatoes, Processing | short tons | 17 | 23 | 30 | 37 |
| Wheat, winter | bushels | 26 | 52 | 42 | 72 |

Source: USDA, NASS, selected years.

In 1998, California farmers invested \$2.4 million in computers to operate irrigation systems on 273,047 acres. About 675 farms reported using computer simulation models to decide when to irrigate.

Research and Development

In 2001, U.S. agricultural experiment stations (mainly associated with land grant universities) collectively spent \$2.3 billion on scientists' agricultural research. The University of California Division of Agriculture and Natural Resources (DANR) accounted for about 10 percent of those resources. The DANR includes scientists with the UC Berkeley College of Natural Resources, the UC Davis College of Agricultural and Environmental Sciences, the Division of Biological Sciences, and the School of Veterinary Medicine; and the UC Riverside College of Natural and Agricultural Sciences.

The DANR's two major organizational units are the Agricultural Experimental Station (AES) and the Cooperative Extension (CE). The AES is basically a multi-campus research organization, with a staff of near 700 academics distributed in more than 50 different departments. The CE constitutes the main outreach program, with about 400 specialists and advisors dispersed throughout the state.

During the 1990s DANR aggregate funding stayed approximately constant at an average of \$235 million per year. From 1999 to 2002, total funding increased in constant terms by 25 percent. The three campuses (Berkeley, Davis, and Riverside),

accounted for 72 percent of the 2002 annual DANR expenditures, while regionally based units accounted for 14 percent of the budget, and statewide academic programs and their support 12 percent.

In 2002, about 80 percent of total funding came from government sources (state and federal); 13 percent came from private gifts, grants and contracts, and 7 percent from other sources, such as county government, endowments, sales, services, etc.

Table 23. University of California Division of Agriculture and Natural Resources Annual Expenditures, 1993-2002, in constant 1996 dollars

| Year | Cooperative Extension | Agricultural Experimental Station | Other ^a | Total |
|------|--------------------------|---|--------------------|---------|
| 1993 | 68,510 | 157,789 | 2,234 | 228,534 |
| 1994 | 65,693 | 159,182 | 2,329 | 227,204 |
| 1995 | 68,530 | 163,779 | 2,058 | 234,367 |
| 1996 | 69,079 | 165,392 | 2,117 | 236,588 |
| 1997 | 68,223 | 168,763 | 2,167 | 239,153 |
| 1998 | 67,823 | 170,257 | 2,258 | 240,337 |
| 1999 | 70,961 | 168,885 | 2,922 | 242,768 |
| 2000 | 73,042 | 187,403 | 2,909 | 263,354 |
| 2001 | 80,785 | 200,812 | 3,194 | 284,791 |
| 2002 | 83,167 | 217,416 | 3,372 | 303,954 |

a) Other includes Research and Extension Centers, Farming income, Operation and Maintenance Plant, and International Agricultural Visitors Program.

Source: Based on UC DANR, Office of the Controller and Business Services, *Annual Report of Expenditures, 2001-2002*. Values deflated by the GDP Implicit Price Deflator, Bureau of Economic Analysis.

The number of CE County Advisors decreased by about 18 percent between 1990 and 1999, from 326 to 265, and their distribution among program areas has changed. Agriculture Program Area now accounts for 60 percent of the UC Cooperative Extension County Advisors, up from 55 percent in 1990, while Human Resources (Youth Development, Nutrition, Food & Consumer Sciences, and Community Development) decreased from 34 to 30 percent. Natural Resources program changed slightly from 11 to 10 percent of the CE County Advisors.

BROAD ECONOMIC IMPACTS³

Agriculture creates significant ripple effects throughout California's economy. Each dollar earned within agriculture fuels a more vigorous economy by stimulating additional activity in the form of jobs, income and output. In general, the greater the interdependence in the economy, the greater the additional activity, or multiplier effects. These multipliers may be applied to the county, state and regional levels using

³ This section is based on MOCA 2000 and, in particular, chapter 5 which relied on the work of George Goldman.

the IMPLAN⁴ model. Multiplier effects can be represented by four measures that reflect the impact that agriculture has on the state.

The first measure, *sales impact*, records how agricultural purchases influence total private sector sales. A second measure is the amount of *personal income* produced directly and indirectly by the economic output of agriculture and agricultural processing. The third measure calculates the total *value-added* linked to agriculture. "Value added" in this case is equal to the value of goods and services sold by a firm or sector of the economy, minus the cost of inputs and services (but not labor) used to produce those goods. A final measure is the number of *jobs* in agriculture, agricultural processing and other sectors of the economy related to agriculture in the state.

These multiplier effects may be demonstrated by tracing the activity of an individual farm. A farm's *sales impact* would include all the inputs used on that farm, such as machinery, fertilizer, electricity—anything farm dollars buy. The *personal income* from the farm would include the farm's income and a portion of the income of those from whom the farm purchased inputs. The farm's *value added* would be equal to the cash receipts from sales of farm products less the costs of inputs (excluding labor) that went into producing those goods. The *jobs* related to the farm's efforts would include labor on that farm as well as in input and output industries that rely on business from that farm. For example, agricultural machinery manufacturers, chemical manufacturers, processors, and people working in retail food trade have jobs that are related to agriculture.

The economic impacts shown in Table 22 can be interpreted as an indication of how the state would be affected if agricultural production and processing were to cease, and the associated inputs (such as capital and labor) were not reemployed in any other economic use.

Multiplier effects differ by commodity since some commodities may be related to more input and processing industries than others. For example, dairy production is related to a relatively extensive processing sector, for which a wide range of inputs and specialized machinery has been developed. Hence, the dairy industry may have a greater effect on the economy in terms of multiplier effects than some other commodities.

Multiplier effects may differ by region due to geographic dispersion of industries related to agriculture, aggregate size of agriculture and type of commodities produced in that region. Some industries have more local impacts, while others have impacts that are spread farther afield. For example, county or multi-county multiplier effects do not include input and processing industries located outside of that region, even if those industries are located elsewhere in the state. Similarly, state multiplier effects do not include input and processing industries located outside of the state. Thus, multiplier effects for commodity groups with geographically diffuse input and processing sectors may be underestimated.

Through multiplier effects, agricultural production and processing account for about 6 percent or 7 percent of the state's total income, value-added, and jobs. Fruits,

⁴ The IMPLAN (Impact analysis for PLANning) system was designed by the U.S. Forest Service/United States Department of Agriculture, to be able to estimate economic input-output models for any county, or group of counties, in the United States. It does this with a huge data base, and software and algorithms to estimate regional input-output models from secondary published data. An input-output model provides detailed economic multipliers for all sectors of the economy.

tree-nuts, and vegetables represent about half of these totals, while dairy and poultry products, and grains are also major contributors.

Table 24. Economic Impacts of CA's Agricultural Production and Processing, 1998

| Major Commodity Group | Direct Sales | Sales | Total Income | Value Added | Number of Jobs ^a |
|---|-------------------|--------------------|-------------------|-------------------|-----------------------------|
| | (\$1,000) | (\$1,000) | (\$1,000) | (\$1,000) | |
| Dairy/Poultry Products And Processing | 10,086,973 | 24,176,605 | 8,596,001 | 9,191,304 | 153,385 |
| Livestock, Processed Meats | 3,479,492 | 7,222,525 | 2,223,538 | 2,426,778 | 60,531 |
| Cotton, Fabric/Yarn/Thread Mills | 1,747,026 | 3,657,114 | 1,518,524 | 1,645,278 | 30,876 |
| Food/Feed Grains, Hay and Flour/Grain Mill Products | 11,399,212 | 24,118,097 | 9,771,929 | 10,569,063 | 192,422 |
| Fruits, Tree-nuts, Vegetables, Processed Fruits/Vegetables, And Beverages | 33,367,903 | 70,076,737 | 30,378,455 | 33,909,883 | 567,388 |
| Sugar/Misc. Crops and Confectionery Products | 3,942,442 | 8,953,166 | 3,357,571 | 3,644,463 | 60,522 |
| Greenhouse/Nursery Products | 1,749,356 | 3,006,458 | 2,088,240 | 2,173,433 | 40,382 |
| Other ^b | 1,877,847 | 4,191,248 | 1,553,260 | 1,710,400 | 26,576 |
| Total | 67,650,251 | 145,401,951 | 59,487,518 | 65,270,601 | 1,132,083 |
| California State Total (agricultural and non-agricultural) | -- | -- | 900,900,000 | 1,098,962,275 | 15,360,600 |
| Agriculture as a Percent of California State Total | -- | -- | 6.60% | 5.94% | 7.37% |

a) Adjusted for inflation to 1998.

b) Includes vegetable oil mills, shortening/cooking oils, roasted coffee, and manufactured ice.

Sources: California Personal Income, 1998: U.S. Bureau of Economic Analysis, Released: July 27, 1999.

California Estimated Gross State Product, 1998: Estimated applying 1997 Ratio of Gross State Product/Personal Income to 1998 Personal Income.

California Employment, 1998: Labor Market Information Division, EDD, Sacramento, Website Data File.

1997 Economic Census, Manufacturing, Geographic Area Series, U.S. Census Bureau.

In 1998, fresh and processed fruits, tree-nuts, and vegetables had the greatest impact of any commodity group on California's economy, generating about half the direct and indirect sales, total income, value added and jobs related to agriculture. About one third of the \$33 billion in direct sales in this category was attributable to sales of alcoholic and non-alcoholic beverages. Examples of beverages linked to fruit, tree-nut and vegetable production include wine and juice. Some of the beverages included in this category (beer and spirits for example) may reflect processing of grain products rather than fruit, tree-nuts and vegetables.

Dairy and poultry products and grains also had significant economic contributions, accounting for between 10 percent and 20 percent of the total income, value added, and jobs related to agriculture.