VISION 3

VISION 3: Healthy Farms and Environment

Background and National Trends

Agriculture is the backbone of the food system and is a major economic force in the United States. America's farms contributed $177.2 billion to the U.S. economy in 2014. Agriculture and related industries account for a growing share of U.S. gross domestic product, up to 5.7 percent in 2014 (See Figure 24).[1] Food systems provide more jobs than any other U.S. industry, accounting for 14 percent of national employment and growing.[2]

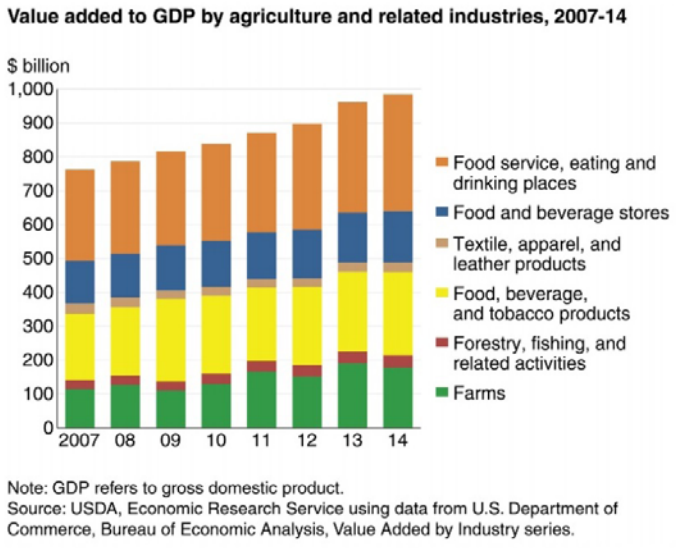


Figure 24: Value added to U.S. GDP by agriculture and related industries (2007–2014)
Source: USDA Economic Research Service.[3]

Nationally, the top crops grown in terms of value are corn, soy, wheat, and alfalfa.[4] The U.S. is a net exporter of food, with approximately 20 percent of production exported each year, primarily to East Asia and North America. The majority of U.S. cotton, tree nuts, and rice are exported, as are approximately 50 percent of wheat and soybeans and 25 percent of fresh fruit. Approximately half of the fresh fruit and fruit juices and 20

1 USDA Economic Research Service. Selected Charts 2016, Ag and Food Statistics: Charting the Essentials. Retrieved March 16, 2017, from https://www.ers.usda.gov/publications/pub-details/?pubid=80341

2 Food Chain Workers Alliance and Solidarity Research Cooperative. (2016). No Piece of the Pie: U.S. Food Workers in 2016. Los Angeles, CA: Food Chain Workers Alliance.

3 USDA Economic Research Service. Selected Charts 2016, Ag and Food Statistics: Charting the Essentials. Retrieved March 16, 2017, from https://www.ers.usda.gov/publications/pub-details/?pubid=80341

4 USDA National Agricultural Statistics Service. (2014). USDA 2012 census of agriculture. Retrieved March 08, 2017, from agcensus.usda.gov.

Immature almonds, Kern County

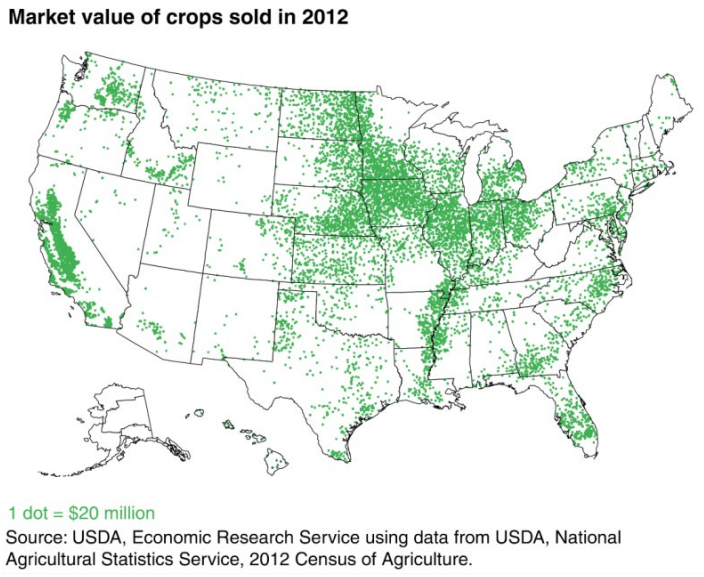
PHOTO CREDIT: SUSAN REEP

percent of the fresh vegetables consumed in the U.S. are imported from other countries.[5]

At a state level, the top five states in terms of value of crop sales (in order) are California, Iowa, Illinois, and Nebraska (see Figure 25).

Figure 25: Market value of crops sold in the United States (2012)

Source: USDA Economic Research Service.[6]



Agriculture is one of the most important industries in California. California's crop value of $30 billion in 2012 was 75 percent higher than the crop value in Iowa, the second ranked state, due to its large and highly valued horticultural sector.[7] By 2015, California's farms and ranches received about $47 billion for their output, remaining the leading U.S. state in cash farm receipts.[8]

The agricultural sector employed almost 350,000 people in 2013 and the agricultural value chain accounts for nearly 3 million jobs in California.[9]

5 Exports expand the market for U.S. agricultural products. (n.d.). Retrieved March 15, 2017, from https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58396

6 Crop production is concentrated in California and the Midwest. (n.d.). Retrieved March 15, 2017, from https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58320

7 Crop production is concentrated in California and the Midwest. (n.d.). Retrieved March 15, 2017, from https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58320

8 California Department of Food and Agriculture. (n.d.). California Department of Food and Agriculture 2015 Crop Year Report. Retrieved March 08, 2017, from https://www.cdfa.ca.gov/statistics/

9 Fast Facts on California's Agricultural Economy. Compiled by Assembly Committee on Jobs, Economic Development, and the Economy, Jose Medina, Chair. http://ajed.assembly.ca.gov/sites/ajed.assembly.ca.gov/files/Fast%20Facts%20on%20California%27s%20Agricultural%20Economy.pdf. Accessed April 1, 2017.

The U.S. agricultural sector has changed dramatically across the last century. The number of farms in the U.S. decreased from a peak of 7 million in 1935 to approximately 2 million today.[10] Today's farms are larger than the farms of previous generations and increasing in average size and value each year. As the characteristics of the average farm have changed, the challenges facing the agriculture sector have shifted as well.

Although it has been enormously successful by many measures, the agriculture sector faces significant economic, social, and ecological challenges. Farmers across the country are aging, and rural landscapes are changing as farmland faces development pressure. Natural resources like water and soil are under stress in many regions, and changing markets, climate conditions, and regulations require farms to constantly innovate and adapt. Agricultural and other food systems workers also face challenges, from low wages and food insecurity to potentially hazardous working conditions.

Farms that are economically, socially, and ecologically sustainable will play a key role in meeting many of the challenges of the future—from supplying healthy food, to protecting natural resources, to fostering leadership and innovation. Farmers and food systems workers are on the frontlines of the food system, and will play a key role in meeting the challenges of maintaining a healthy food system into the future.

This section starts by looking at agricultural diversity both in terms of the characteristics of Kern County's farms (size, sales, types of crops) and of the people who operate these farms (age, race, gender, years farming). Next, it examines two common challenges in California agriculture—safe pest control and the protection of water quality. Last, it describes some of the challenges faced by food systems workers, with a particular focus on farmworkers.

Kern County Trends

Diversity

Agriculture in Kern County is highly diverse in terms of the range of foods produced. Top commodities include grapes, almonds, citrus, and milk. Large farms are common in Kern County, with an average farm size of more than 3 times the state or national average.[11]

Like most of the country, farms in Kern County tend to be operated by individuals who are more likely to be older (average age 60), male (82 percent), and white (82 percent) as compared to the general population.[12] However, despite following these national trends in terms of how farm operators compare to local population demographics, because Kern County itself is exceptionally diverse, Kern County farmers are also more diverse than many other U.S. farming communities. At 18 percent, minority principal farm operators in Kern County are well over the national average of 4 percent, and female farm operators (also 18 percent in Kern County) are above the national average of 13 percent. The percent of women and minority farm operators is also growing, as is the case nationally as well.[13]

California is a top state nationally in terms of number of organic farms and total farm sales. Kern County led the state in organic sales in 2002, though the county's total organic sales have not grown at the same rate as the rest of California since that time, and decreased in 2012.[14]

Safe pest control

Managing pests is an important part of any farm operation, and farmers have a range of options at their disposal, including the use of pesticides. The use of lowest risk pesticides, including microbial

10 USDA Economic Research Service. Selected Charts 2016, Ag and Food Statistics: Charting the Essentials. Retrieved March 16, 2017, from https://www.ers.usda.gov/publications/pub-details/?pubid=80341

11 USDA National Agricultural Statistics Service. (2014). USDA 2012 census of agriculture. Retrieved March 08, 2017, from agcensus.usda.gov.

12 Ibid

13 Ibid

14 Ibid

PHOTO CREDIT: DOUG KESSLER

Almonds in bloom, Kern County.

and pheromone-based pesticides, has increased over the past 10 years, particularly in Kern County. The use of lower risk conventional pesticides has also increased in Kern County, with a corresponding decrease in the use of most higher risk pesticides. The exception to this trend is the use of higher risk fumigants, which has increased in both California and Kern County. Fumigants make up from 1/4 to 1/3 of total pounds of pesticides applied, due to their high rates (lbs/acre) of application. However, they make up only approximately 0.5 percent of total pesticide applications.[15]

Compliance rates with pesticide use regulations have increased since the early 2000s in Kern County, with current compliance levels remaining steady at between 88 and 93 percent compliance each year.[16] The number of individuals impacted by reported pesticide drift incidents has also decreased from a high in the early 2000s.[17]

Water quality

Nitrate is both an important source of plant nutrients and one of the most common groundwater contaminants in the world. Nitrate is a water soluble form of nitrogen that can enter the water system through the use of nitrogen fertilizer and the disposal of animal waste. Nitrate is a regulated drinking water contaminant for which the maximum safe level of human consumption set by the U.S. Environmental Protection Agency is 45 mg/L. This is also known as the Maximum Contaminant Level, or MCL.

Surface water in Kern County, including native rivers and streams as well as water imported from other parts of the state, does not contain nitrate at levels of public health concern.[18]

Average groundwater levels of nitrate in Kern County are consistently below the MCL of 45 mg/L. However, individual samples did test above this level in Kern County in some years. In all cases where public drinking water systems exceeded the MCL for nitrate, the primary water source for that system was groundwater.[19]

15 California Department of Pesticide Regulation. (1990-2014). Annual Pesticide Use Reports. Retrieved from: http://ziram.lawr.ucdavis.edu/PURwebGIS.html

16 This data was provided in summary form by the Kern Co Ag Commissioner's office. It is available in more detail through the Pesticide Regulatory Activities Monthly Report (PRAMR) available at: http://www.cdpr.ca.gov/docs/enforce/report5.htm.

17 California Department of Pesticide Regulation. (2000-2014).California Pesticide Illness Surveillance Program's California Pesticide Illness Query (CalPIQ). Retrieved from http://apps.cdpr.ca.gov/calpiq/.

18 California Department of Water Resources. (1972-2012). Water Data Library. Retrieved from http://www.water.ca.gov/waterdatalibrary/.

19 United States Geological Survey. (1991-2014) National Water Information System (NWIS), queried via the Water Quality Portal (WQP), a collaborative tool of the National Water Quality Monitoring Council, the USGS, and the EPA. Retrieved from: https://www.waterqualitydata.us/portal/

The number of times per year that drinking water samples exceeded the recommended maximum level for nitrate in Kern County has increased, particularly over the past four years, though these samples still represent less than 10 percent of all samples tested. The public drinking water systems that exceeded the MCL for nitrate are typically small systems, and together they serve an average of 1083 individuals per year, less than half of one percent of the population of Kern County.[20]

Farm worker health and safety

Food systems workers represent one out of every three workers in Kern County, which is more than double the national average. The majority of food systems workers in Kern County are farm workers and restaurant workers, two sectors with consistently low wages both locally and nationally. A higher percentage of California farmworkers are undocumented than the national average,[21] which often results in lower wages and may make these workers particularly vulnerable to occupational hazards and labor violations.

In Kern County, the number of non-fatal occupational injuries reported among farmworkers has steadily decreased from a high of 19 in 2011 to zero the past two years (2015 and 2016). The number of fatal accidents among farmworkers ranged from 0 to 3 between 2002 and 2016 and shows no trend of increasing or decreasing over time.

The number of agriculture related pesticide illnesses reported in Kern County has decreased from a high in 2002.[22] These illnesses are those reported by a physician, which are typically acute exposures experienced by farmworkers, though in some years they may include pesticide drift incidents that impacted residents not involved in farm work.

The majority of labor law violations in Kern County's food system involve farm labor contractors, with between zero and 10 cases handled by the U.S. Department of Labor each year. There does not appear to be a trend of increased or decreased cases over time.[23]

GOAL 3.1: The farming sector in Kern County is diverse

Background

An ecosystem is a type of system that is made up of the interaction between both the living and the non-living things in an environment. Ecosystems that are diverse—those that include a wide range of different actors and processes—are typically also most resilient.[24] There are many types of ecosystems, including farms and food systems.

At the farm level, diversity may include growing and selling a mixture of crops, or hosting a broad range of beneficial insects and soil microorganisms.

A diverse food system, on the other hand, will include successful farms of many sizes growing many different crops, as well as farmers that reflect the racial, ethnic, and gender diversity of the local community.

Farms of different sizes serve different markets and make different contributions to local, national, and international economies. Farms that reflect the rich human diversity of California's Central Val-

20 U.S. Environmental Protection Agency. (2000-2014). Safe Drinking Water Information System (SDWIS). Retrieved from: https://www3.epa.gov/enviro/facts/sdwis/search.html.

21 National Agricultural Workers Survey. (2014). Table 1: National Demographic Characteristics, and Table 13: California Demographic Characteristics. Retrieved from https://www.doleta.gov/agworker/naws.cfm.

22 California Department of Pesticide Regulation. (2000-2014).California Pesticide Illness Surveillance Program's California Pesticide Illness Query (CalPIQ). Retrieved from http://apps.cdpr.ca.gov/calpiq/.

23 U.S. Bureau of Labor Statistics. (2000-2014). Wage and Hour Division Enforcement Data for all zip codes in Kern County. Retrieved from https://enforcedata.dol.gov/views/search.php

24 Gunderson, L. H. (2000). Ecological resilience—in theory and application. *Annual review of ecology and systematics*, 31(1), 425-439.

ley[25] can provide a source of exchange, innovation, and creativity[26] that contribute to the health and resilience of the food system.

This section describes trends in Kern County agriculture related to diversity at the food system level, compared to trends in California and the U.S. when appropriate.

INDICATOR 3.1.1 Crop types in Kern County

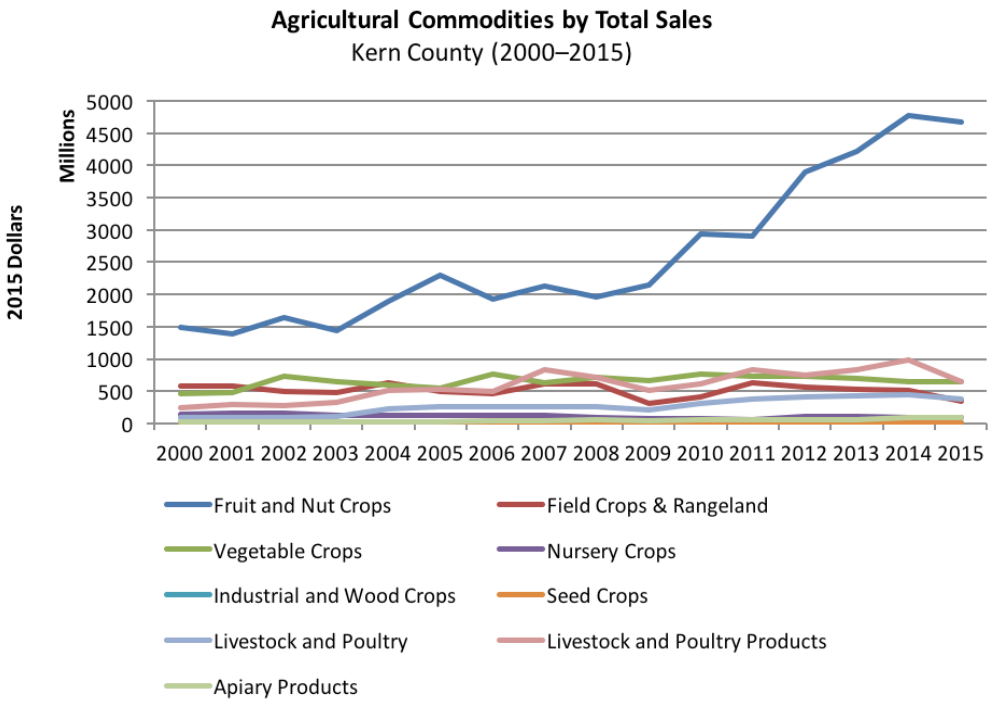
Background

California's agriculture is one of the most diverse in the nation and the world.[27] California produced more than 400 commodities in 2015, including over one third of U.S. vegetables and two thirds of U.S. fruits and nuts.[28] California's top three commodities in 2015 in terms of sales were milk, almonds and grapes.

Kern County Trends

Kern County is one of the most productive agricultural counties in California Figure 26 shows the value of agricultural sales by category from 2000–2015. The category with the highest value in terms of total sales is fruit and nut crops. These crops have experienced particularly high levels of growth over the past decade. The next highest categories in terms of sales are livestock and poultry products (including milk) and vegetable and field crops. Kern County also produces nursery crops, seed crops, wood crops and apiary products.

Figure 26: Kern County Agricultural Commodities Mix by Total Sales
Source: Kern County Agricultural Commissioners' Reports 2004–2015



25 Fujimoto, I. and Sandoval, G. 2007. Tapping into California's Central Valley's Hidden Wealth: Its Rich Cultural Capital. 9 Berkeley J. Afr.-Am. L. & Pol'y 119. Available at: http://scholarship.law.berkeley.edu/bjalp/vol9/iss2/3.

26 The United Nations Educational, Scientific and Cultural Organization. (2001). *Universal Declaration on Cultural Diversity.*

27 Qualset, C.O., McGuire, P.E. & Warburton, M. (1995). In California: 'Agrobiodiversity' key to agricultural productivity. *California Agriculture* 49(6): 45-49.

28 California Department of Food and Agriculture. (n.d.). California Department of Food and Agriculture 2015 Crop Year Report. Retrieved March 08, 2017, from https://www.cdfa.ca.gov/statistics/

Kern County's top 10 agricultural commodities in terms of sales are shown in Table 7. These top products account for more than 80 percent of all agricultural sales in a given year (82 percent in 2015). Although the top commodities vary slightly from year to year, grapes, almonds and milk have consistently been in the top four for the past decade.

Table 7: Top Ten Agricultural Commodities in Kern County by Total Sales (2015)
Source: Kern County Agricultural Commissioner's Crop Report, 2015

Top 10 Agricultural Commodities by Total Sales	
Kern County (2015)	
1	Grapes
2	Almonds
3	Citrus
4	Milk
5	Cattle/calves
6	Carrots
7	Pistachios
8	Pomegranate
9	Alfalfa
10	Silage and Forage

Figure 27 shows all agricultural commodities that appeared in the top five in terms of sales at any point between 2000 and 2015. Grapes, almonds, milk, and citrus have all seen significant growth in Kern County over the past decade.

Figure 27: Top agricultural commodities in Kern County by total sales, 2000–2015
Source: Kern County Agricultural Commissioner's Crop Reports

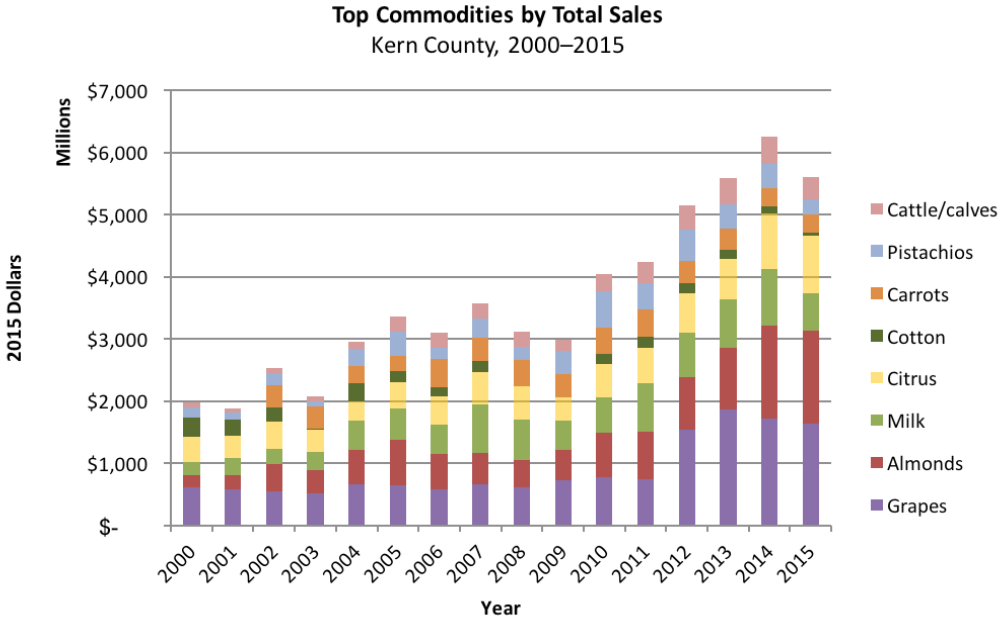


Figure 28 shows the geographic distribution of agricultural production across Kern County. This map is maintained by the Kern County Agricultural Commissioner's Office and is updated daily.

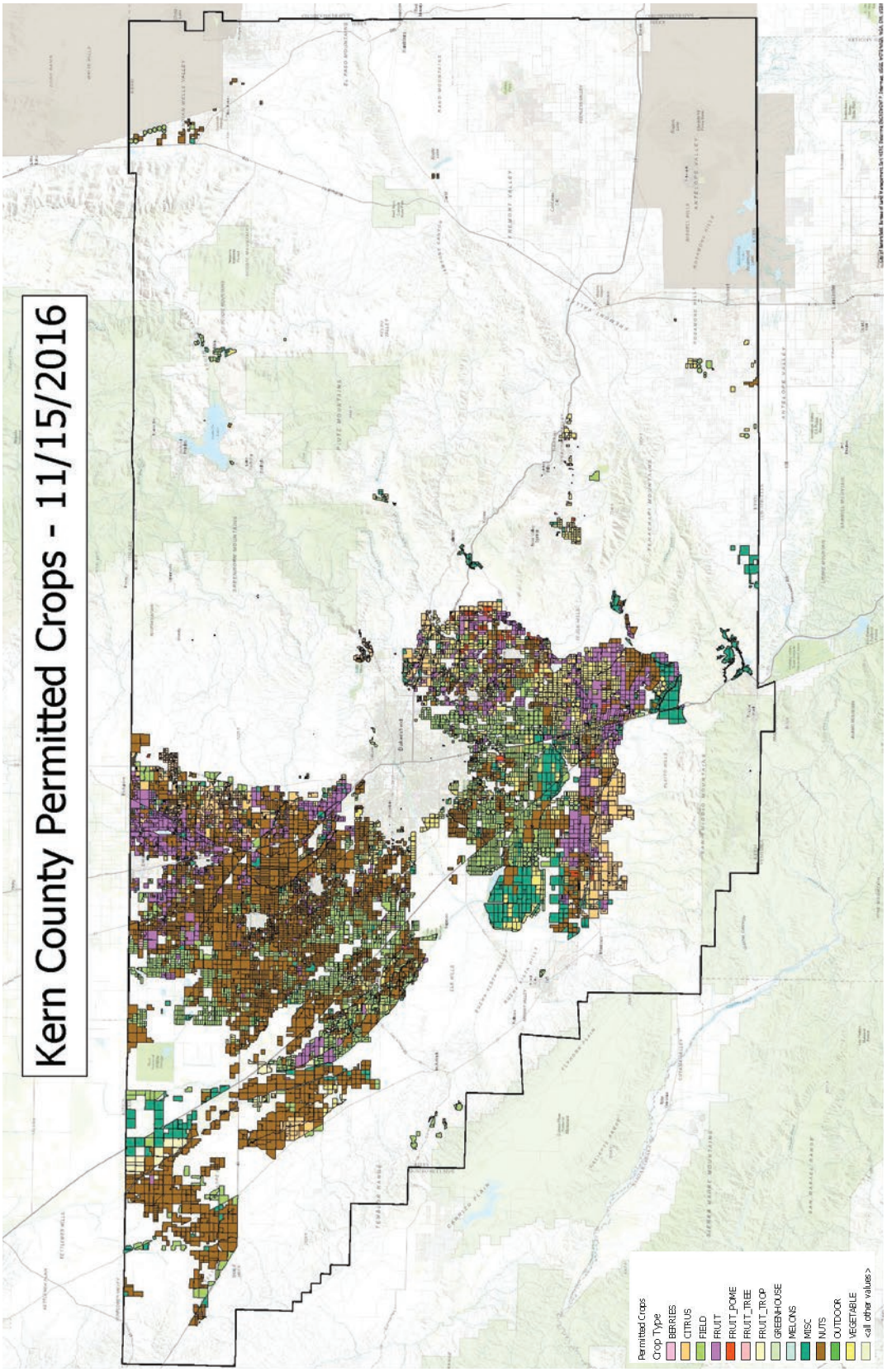


Figure 28: Kern County Crop Map (as of November 15, 2016)
Source: Kern County Agricultural Commissioner's Office. Current map: http://www.kernag.com/cropmap/

INDICATOR 3.1.2 Distribution of farm size

Background

The distribution of farms by size is another measure of the diversity of the agricultural sector. A diverse agricultural sector would include a mix of successful large, mid-scale and small farms, which generally serve different types of markets and impact the environment and rural communities in different ways.

This indicator describes the distribution of farms of different size categories in Kern County and compares this distribution to that of California. Farm size is measured both in acres and in value of sales.

Kern County Trends

Farm Size in Acres

Figures 29a and 29b show the percentage of farms in each size category (in acres) for Kern County and California from 1987 to 2012.

In Kern County (Figure 29a), farms are relatively evenly distributed across the size categories and this distribution has remained more or less stable over time. The average farm size in acres has decreased somewhat from 1,347 acres in 1987 to 1,202 acres in 2012.

Compared to California (Figure 29b), Kern County has a higher number of farms in the largest two acreage categories and a lower number of farms in the smallest two acreage categories. The average farm size in California is much smaller than in Kern County, at 368 acres in 1987 and 328 acres in 2012.

Figure 29a: Number of farms in Kern County by size in acres (1992-2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (1992-2012)

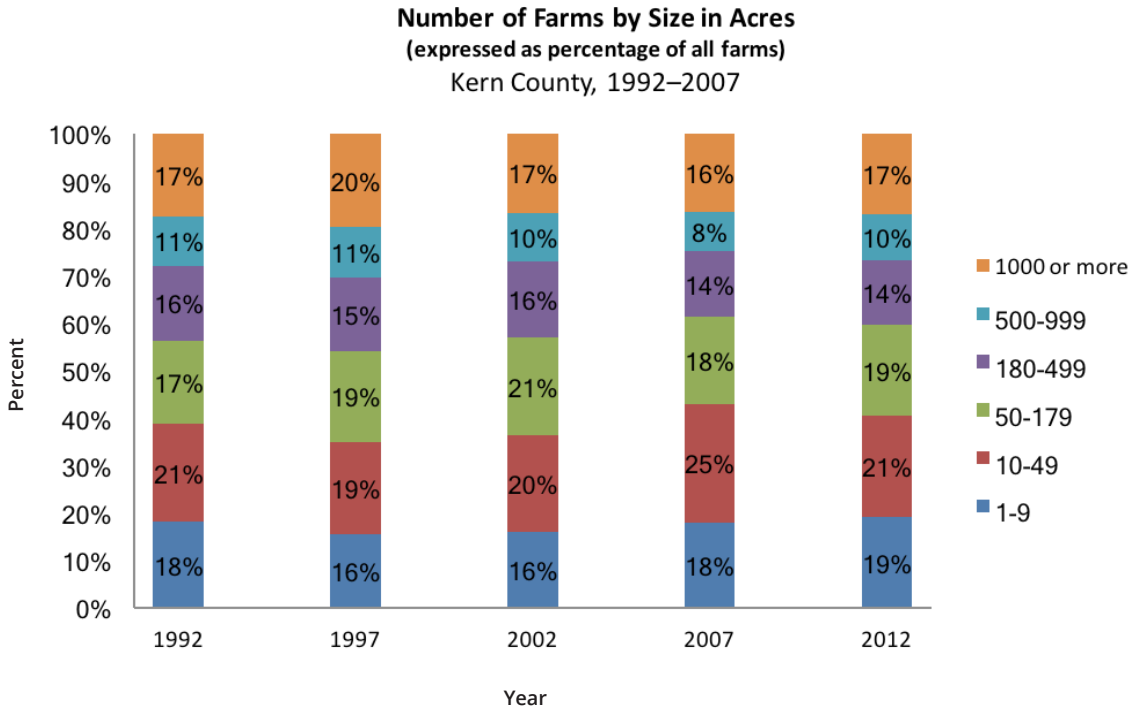
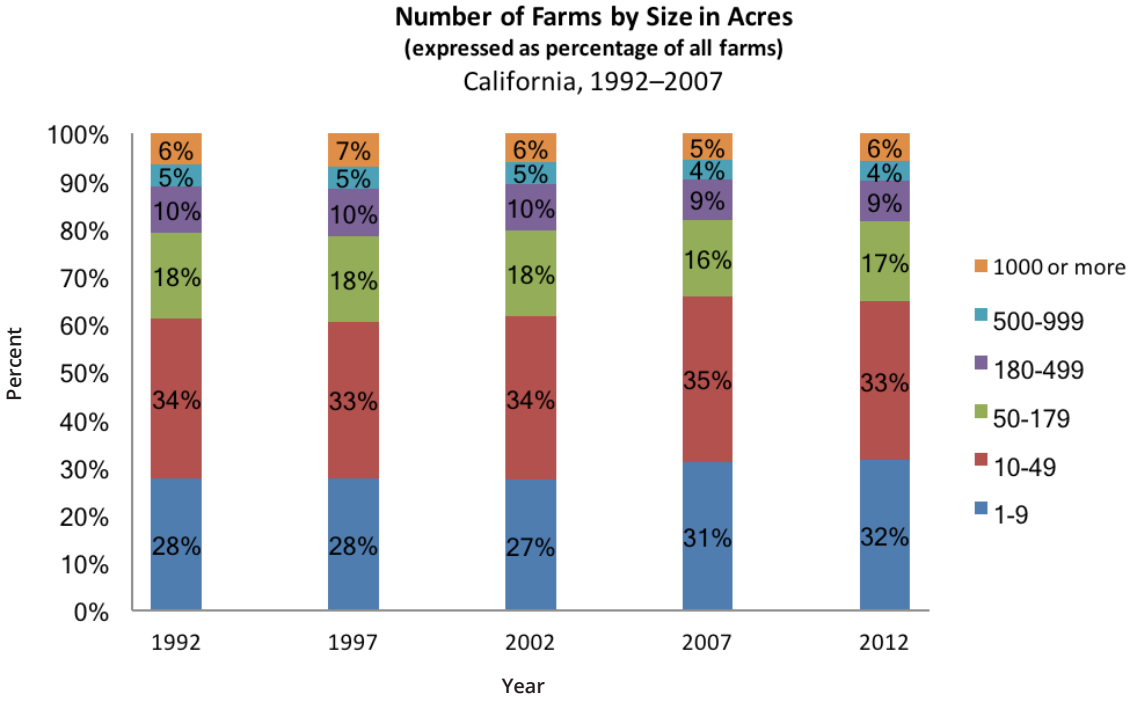


PHOTO CREDIT: DOUG KESSLER

Ewe with young lambs, Kern County.

Figure 29b: Number of farms in California by size in acres (1992-2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (1992-2012)



Farm Size in Sales

Figures 30a and 30b show farm size distribution in Kern County and California, respectively, in terms of total sales per farm. Kern County has a higher percentage of farms with more than $100,000 of sales than California as a whole (44 percent versus 26 percent in 2012), but has a very similar percentage of the smallest farm size of less than $2,500 per year (27 percent versus 26 percent in 2012). Kern County has a lower relative number of farms in the middle categories ($2,500–$99,999 in annual sales).[29]

29 The USDA definition of a small farm is gross sales of less than $250,000, or less than $350,000 after 2015. However, the largest farm size category in the USDA Census of Agriculture is $100,000 or more, meaning this category encompasses both small, medium, and large farms by the USDA definition. This limits the usefulness of the available data to analyze farm size by total sales using USDA definitions.

Figure 30a: Number of farms in Kern County by total value of sales (1992–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (1992-2012)

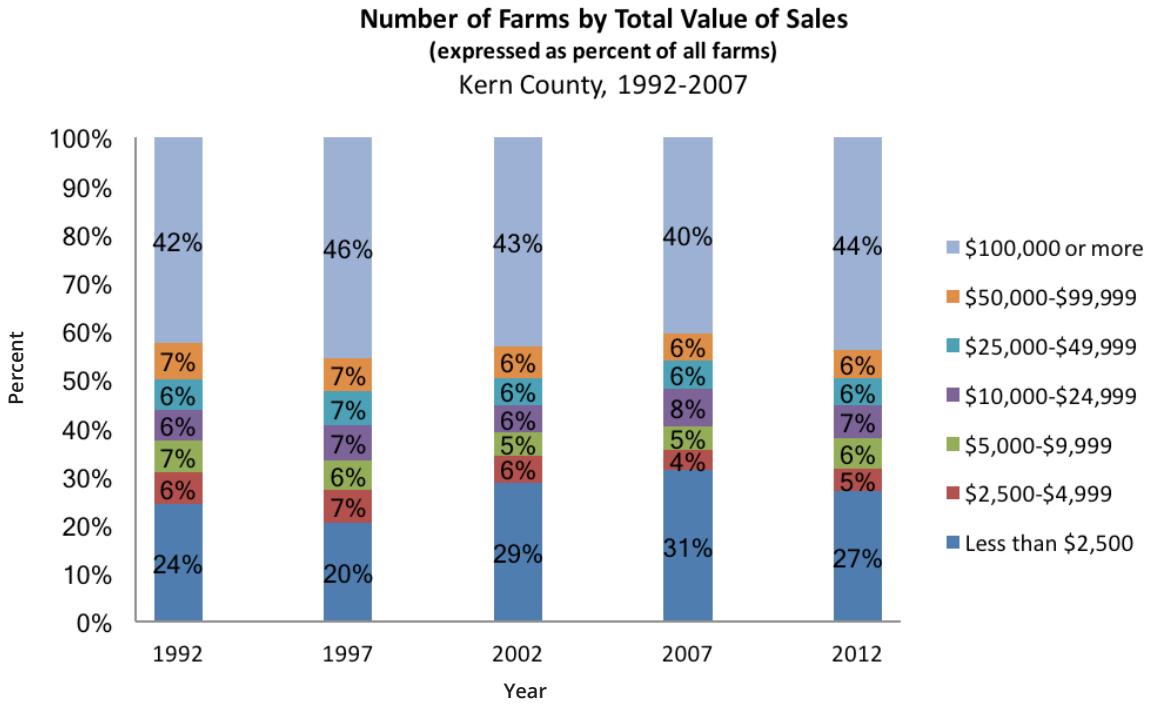
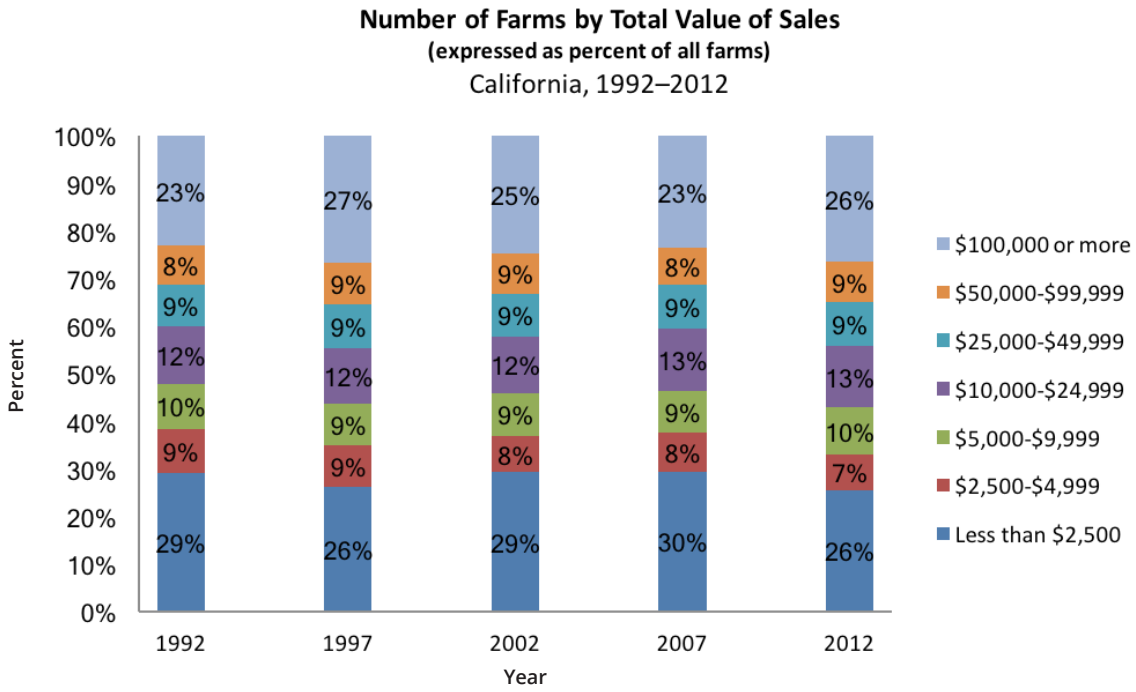


Figure 30b: Number of farms in California by total value of sales (1992–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (1992-2012)



The average market value per farm of products sold in Kern County increased from $1.1 million in 1992 to $2.1 million in 2012. The net cash farm income per farm increased from $176,220 in 1992 to $368,138 in 2012. In California, the average market value per farm increased from $360,055 in 1992 to $547,510 in 2012. The net cash farm income per farm increased from $67,133 in 1992 to $109,355

in 2012.[30] Both average market value per farm and net farm income per farm are much higher in Kern County than the California average.

INDICATOR 3.1.3 Average age of farmers

Background

The average age of farmers in the United States has been increasing for at least the last 40 years. This is in part due to the aging of existing farmers, and in part because many beginning farmers are starting their farming careers later in life. In 2012, 37 percent of beginning farmers were over 55, and only 19 percent were under 35.[31]

The average age of farmers in California and Kern County is also increasing, raising questions about what will happen to the agricultural sector, farmland resources, and rural communities as older farmers retire.

Kern County Trends

Figure 31 shows farmer age trends in Kern County and California from 2002 to 2012. The average age of farmers in Kern County increased from 56 years in 2002 to 59.7 years in 2012. In California, the average age increased from 56.8 years to 60.1 years.

Figure 31: Average age of principal farm operators in Kern County and California (2002–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)

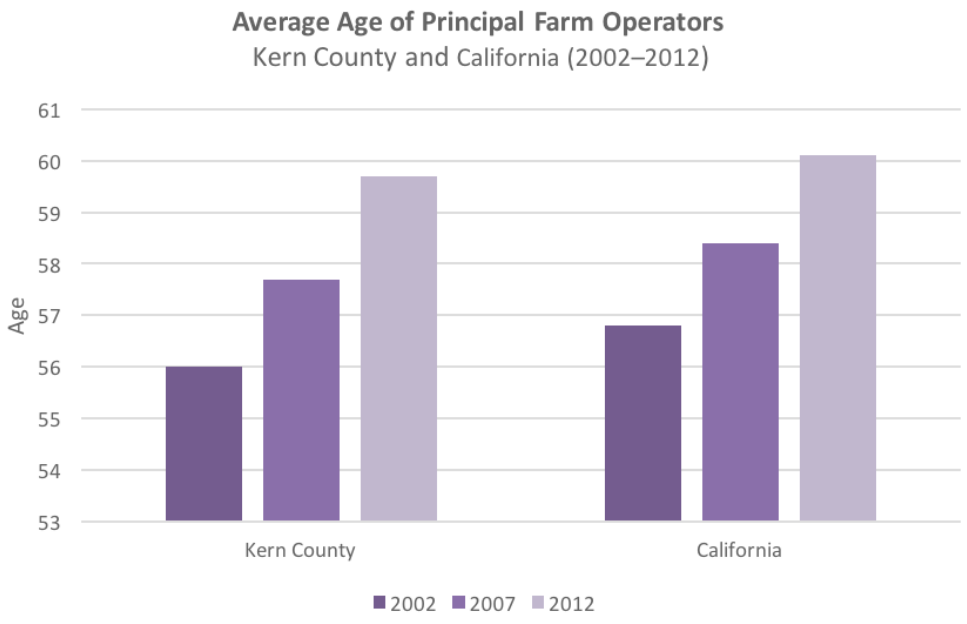
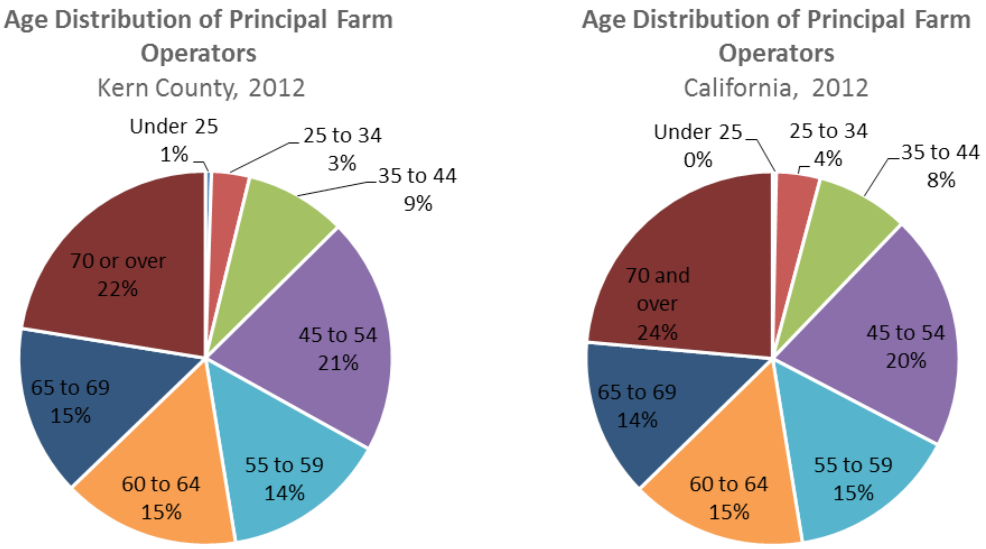


Figure 32 below shows the age distributions of principal operators in Kern County and in California in 2012. The smallest sliver in the pie chart at the top and the thin slice next to it to the right represent farmers under 25 and between 25 and 34, respectively. The largest slice represents farmers 70 and over (about 22 percent of all farmers). Farmers that are 55 and over represent about two thirds of all farmers in Kern County and California.

30 All adjusted for inflation to 2012 dollars

31 Katchova, A., & Ahearn, M. (2015). Farmland Assets and Growth Trends for Young and Beginning Farmers in the US. In *2015 Conference, August 9-14, 2015, Milan, Italy* (No. 211839). International Association of Agricultural Economists.

Figure 32: Age Distribution of Principal Farm Operators in Kern County and California (2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2012)



INDICATOR 3.1.4 Race of principal operator

Background

The U.S. is becoming more racially diverse over time, primarily due to an influx of new immigrants and their descendants.[32] The current population of the U.S. is 62 percent white, 13 percent black, 6 percent Asian, 1.5 percent Native American,[33] 3 percent two or more races, and 18 percent Hispanic of any race.[34]

The principal operators of farms in the U.S. are, however, overwhelmingly white. In 2012, farms with a white principal operator made up 96 percent of all farms, 98 percent of all agricultural sales dollars, and 94 percent of all acres farmed.[35]

Though the number of farms operated by racial minorities in the U.S. is small, it is growing. In 2012, minority-operated farms made up four percent of all farms. This represents an increase from the previous Census of Agriculture in 2007. In 2012, there were 21 percent more Hispanic- and Asian-operated farms and 12 percent more black-operated farms than in 2007. However, the number of minority-operated farms is still small compared to the overall population demographics of the U.S. Sales for minority farms are generally lower compared to all farms, with the exception of Asian-operated farms (see Table 8).

32 Pew Research Center. U.S. Population Projections 2005–2050. Retrieved March 16, 2017, from http://assets.pewresearch.org/wp-content/uploads/sites/3/2010/10/85.pdf

33 American Indian, Native Alaskan, Native Hawaiian, and Other Pacific Islander. US Census 2015.

34 USDA National Agricultural Statistics Service. (2014). USDA 2012 census of agriculture. Retrieved March 08, 2017, from agcensus.usda.gov.

35 Ibid.

Table 8: Total agricultural sales by minority-operated farms in the U.S. in 2012

Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2012)

	Total sales < $10,000/year	Total sales > $100,000/year
All farms	57%	18%
Hispanic-operated	68%	10%
Native American-operated	78%	5%
Black-operated	79%	3%
Asian-operated	43%	27%

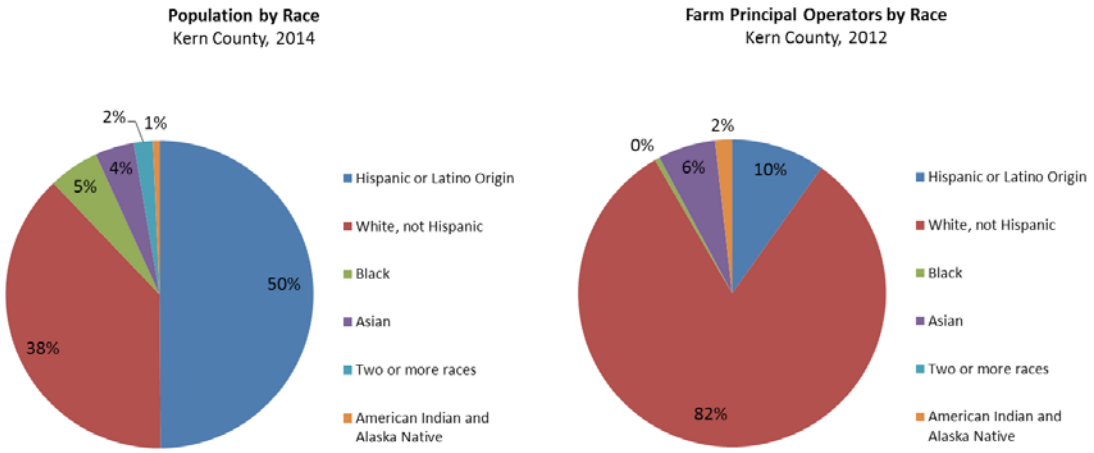
Kern County Trends.

Kern County is unusual relative to the most of the U.S. in that the majority of the population is made up of groups that are racial minorities at the national level. As shown in Figure 33, the general population of Kern County is approximately 50 percent Hispanic, 38 percent white, 5 percent black, 4 percent Asian, 2 percent two or more races, and 1 percent Native American. In this way it closely mirrors the projected future population of the U.S.[36]

Farm principal operators in Kern County are also more diverse than the national average, though minority-operated farms are still underrepresented relative to their share of the population. Figure 33 shows that farm principal operators in Kern County are 82 percent white, 10 percent Hispanic, and 6 percent Asian. All other races make up less than 1 percent each.

Figure 33: Racial demographics of Kern County (2014) and Kern County principal farm operators (2012)

Source for population by race: US Census American Communities Survey (2014) [37]
Source for farm principal operators by race: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2012)



36 Pew Research Center. U.S. Population Projections 2005–2050. Retrieved March 16, 2017, from http://assets.pewresearch.org/wp-content/uploads/sites/3/2010/10/85.pdf

37 U.S. Census Bureau. (2014). 2014 American Community Survey. State and county quick facts: Kern County. Retrieved February 22, 2016, from http://www.census.gov/quickfacts/table/RHI825214/06029,00l.

Figures 34a and 34b show changes to the racial demographics of farm principal operators in Kern County and California over the past decade. The overall number of white principal operators declined in both Kern County and California, while Asian principal operators increased. The number of Hispanic principal operators increased in California and stayed relatively stable in Kern County.

Figure 34a: Principal Farm Operators by Race, Kern County, 2002–2012
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)

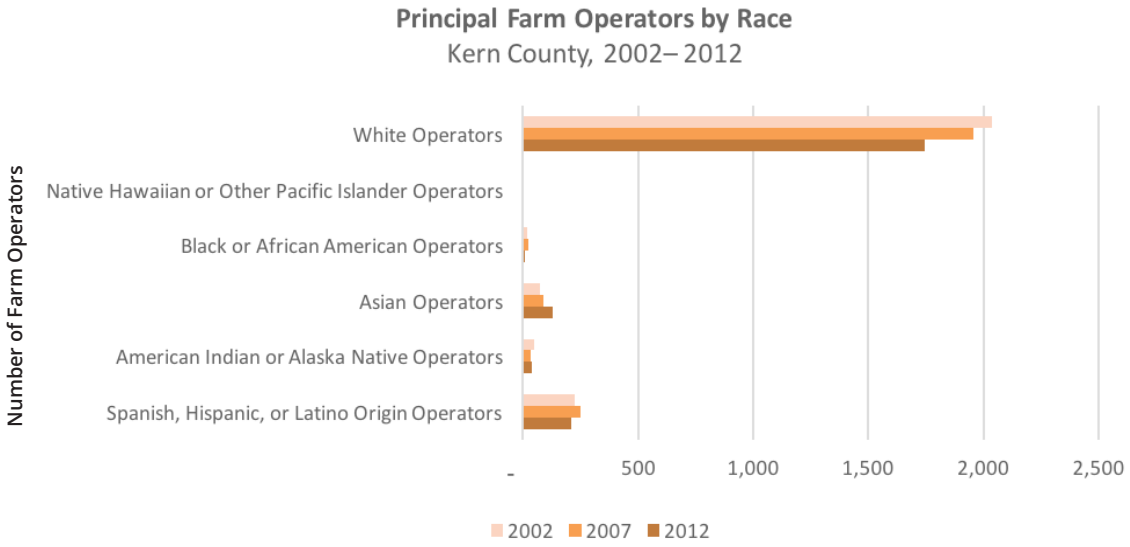
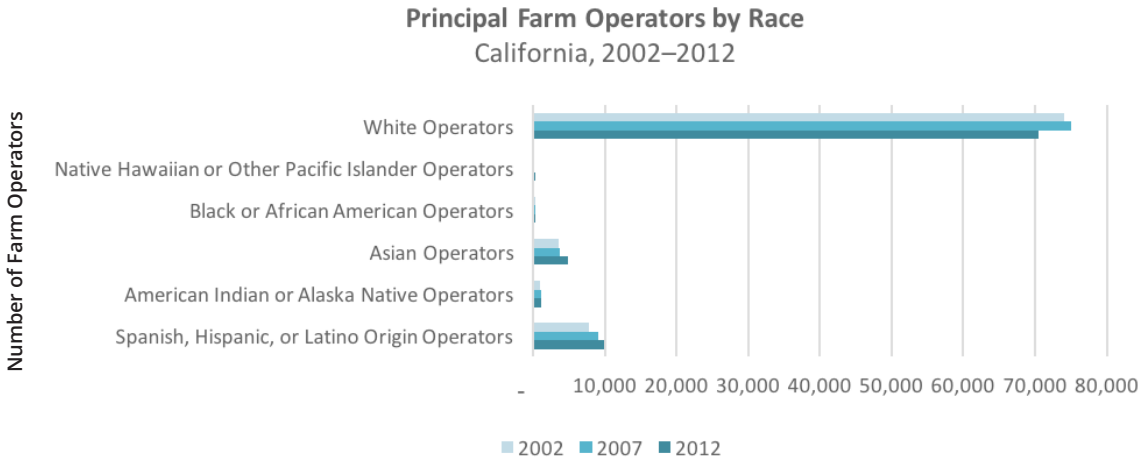


Figure 34b: Principal Farm Operators by Race, California, 2002–2012
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)



INDICATOR 3.1.5 Tenure on farm

Background

Almost 10 percent of farmland in the U.S. is expected change hands over the next five years as older farmers retire, and 70 percent will likely change hands in the next 20 years.[38] Whether this land stays in farming or is converted to other types of development will impact rural communities across the country.

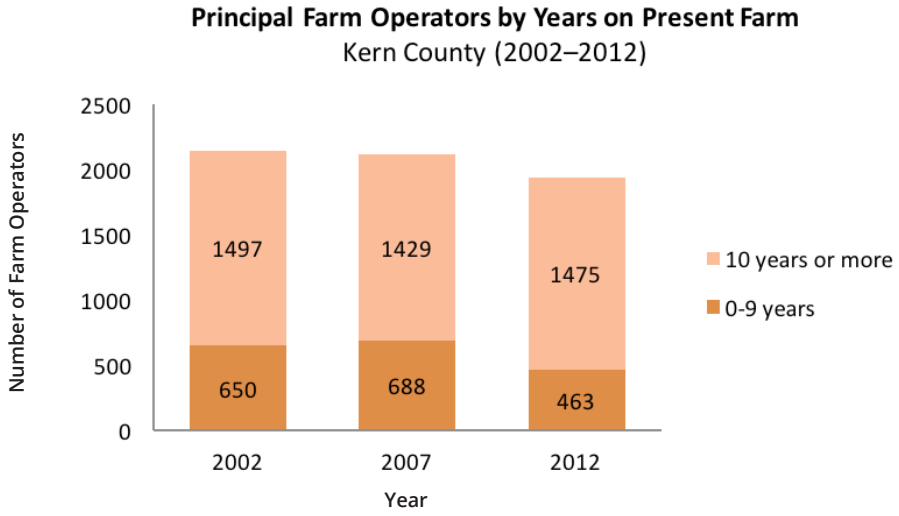
The USDA has provided special supports for beginning farmers for more than 20 years,[39] including technical assistance and assistance accessing land, capital, and markets.[40] Beginning farmers and ranchers are defined by the USDA as those who have been farming for less than 10 years.

Kern County Trends

Approximately one third of all farmers in Kern County in 2002 and 2007 had been farming for less than 10 years on their present farm (see Figure 35a). However, by 2012, the percentage of beginning farmers had dropped to 24 percent. The average number of years on the present farm has increased steadily from 2002 (15.8 years) to 2012 (20.9 years).

Figure 35a: Number of principal farm operators in Kern County by tenure on present farm (2002 –2012)

Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)



These trends are very similar to California (Figure 35b) in which the percentage of beginning farmers decreased significantly from around 30 percent in 2002 and 2007 to 26 percent in 2012. This is slightly higher than the percentage of beginning farmers in Kern County in 2012 (24 percent). Average years on present farm also increased in California from 18.3 years in 2002 to 20.1 years in 2012.

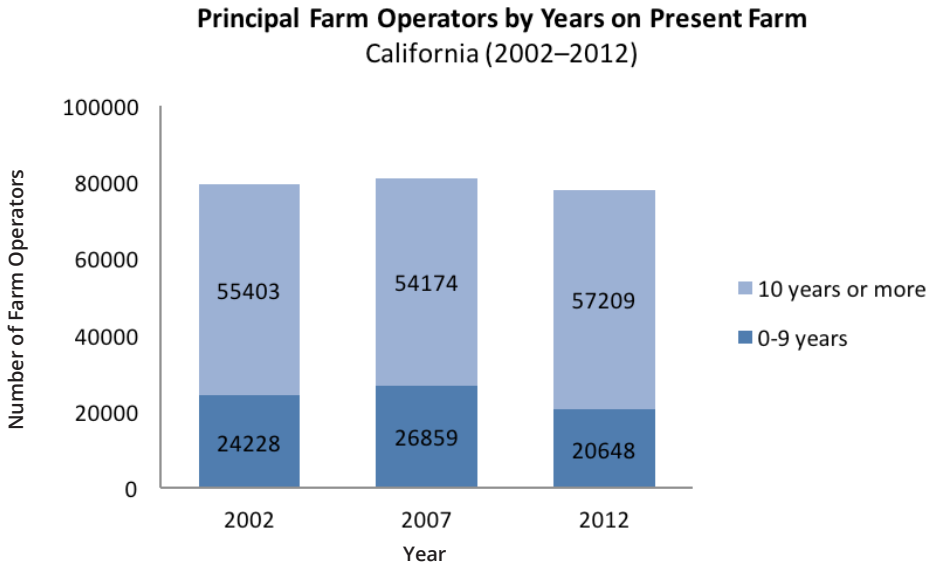
38 Parsons, R., Ruhf, K., Stevenson, G. W., Baker, J., Bell, M., Epley, E., & Keller, J. (2010). Research report and recommendations from the FarmLASTS Project. Retrieved March 16, 2017, from http://www.uvm.edu/farmlasts/FarmLASTSResearchReport.pdf; USDA. 2016. *USDA Results: Beginning Farmers and Ranchers.* Retrieved January 22, 2017, from https://nifa.usda.gov/program/beginning-farmer-and-rancher-development-program-bfrdp

39 Beginning with the 1992 Agricultural Credit Improvement Act and expanding in 2008 and 2014. From Katchova, A., & Ahearn, M. (2015). Farmland Assets and Growth Trends for Young and Beginning Farmers in the US. In *2015 Conference, August 9-14, 2015, Milan, Italy* (No. 211839). International Association of Agricultural Economists.

40 USDA. 2016. *USDA Results: Beginning Farmers and Ranchers.* Retrieved January 22, 2017, from https://nifa.usda.gov/program/beginning-farmer-and-rancher-development-program-bfrdp

Figure 35b: Number of principal farm operators in California by tenure on present farm (2002–2012)

Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)



INDICATOR 3.1.6 Percentage of women farm operators

Background

Women make up approximately half the population of the U.S., and represent a small but growing number of principal farm operators. Women principal farm operators have increased from about 5 percent of all principal farm operators in 1982 to 13 percent in 2012. However, these small percentages may be misleading. When accounting for all farm operators (not only principal farm operators), women make up 31 percent of all farmers in the U.S. and 33 percent of all farmers in California. In addition, women have always been involved in a wide range of support activities for agriculture, including household work, on-farm work, and various forms of off-farm work that helps keep farms viable.[41] The USDA Census of Agriculture only counts one principal farm operator per farm, so women may be underrepresented in official statistics if they are part of a farm family that also includes a male farmer.

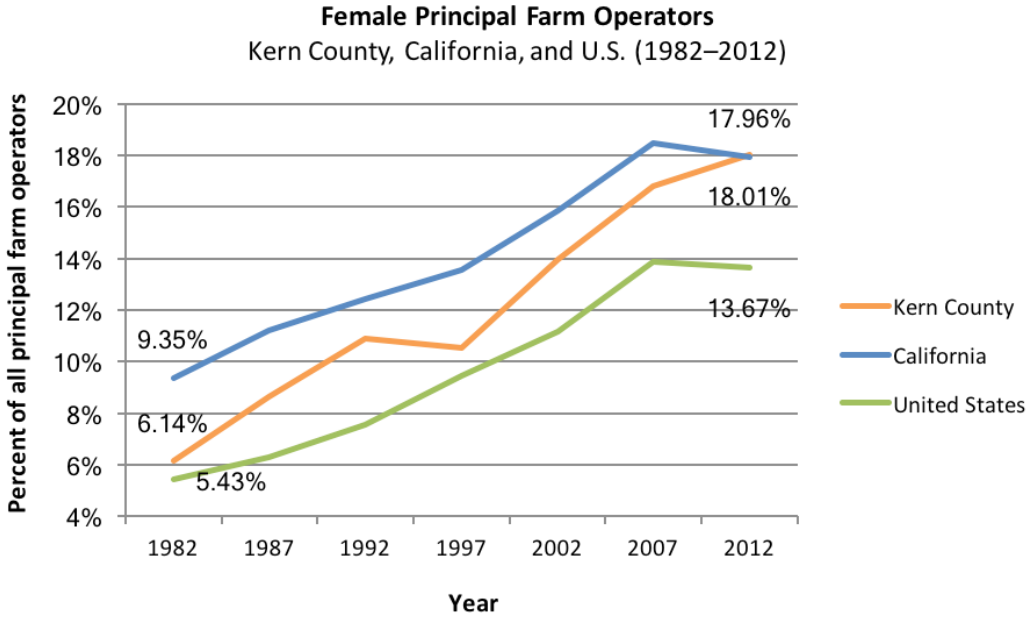
Kern County Trends

Kern County has had a higher percentage of female principal operators than both California and the U.S. since 1982 and continuing through 2012. Figure 36 shows the percentage of female principal farm operators in Kern County, California, and the U.S.

41 Lobao, L., & Meyer, K. (2001). The great agricultural transition: Crisis, change, and social consequences of twentieth century US farming. *Annual review of sociology, 27*(1), 103-124.

Figure 36: Percentage of female principal farm operators in Kern County, California and the U.S. (1982–2012)

Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (1982-2012)



INDICATOR 3.1.7. Number of certified organic farms

Background

The National Organic Program (NOP) of the USDA was established by the 1990 National Organic Foods Act, and has the authority to develop and enforce rules and regulations on agricultural products labeled as "organic" within the U.S.

The USDA defines organic agriculture as:

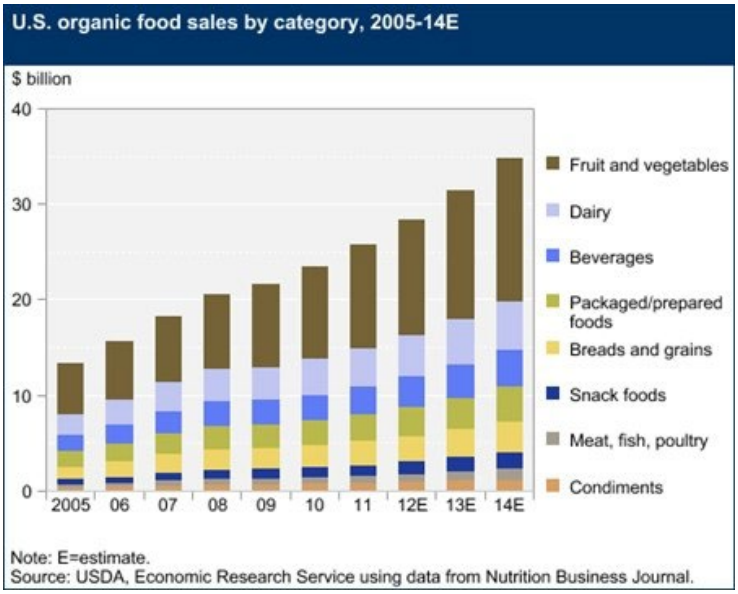
the application of a set of cultural, biological, and mechanical practices that support the cycling of on-farm resources, promote ecological balance, and conserve biodiversity. These include maintaining or enhancing soil and water quality; conserving wetlands, woodlands, and wildlife; and avoiding use of synthetic fertilizers, sewage sludge, irradiation, and genetic engineering.[42]

Consumer demand for organically produced goods has increased dramatically in the last few decades, showing double-digit growth during most years since the 1990s.[43] Total sales of organic products were estimated at $28.4 billion in 2012 and $35 billion in 2014. Organic sales account for more than 4 percent of total U.S. food sales. This demand has provided market incentives for farmers in many product categories, particularly fruits and vegetables, the largest organic segment in organic food sales (Figure 37).

42 USDA Agricultural Marketing Service. (2015). Introduction to Organic Practices. Retrieved March 16, 2017, from https://www.ams.usda.gov/publications/content/introduction-organic-practices

43 USDA Economic Research Service. (2016). Organic Agriculture. Overview. Retrieved January 22, 2017, from https://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/

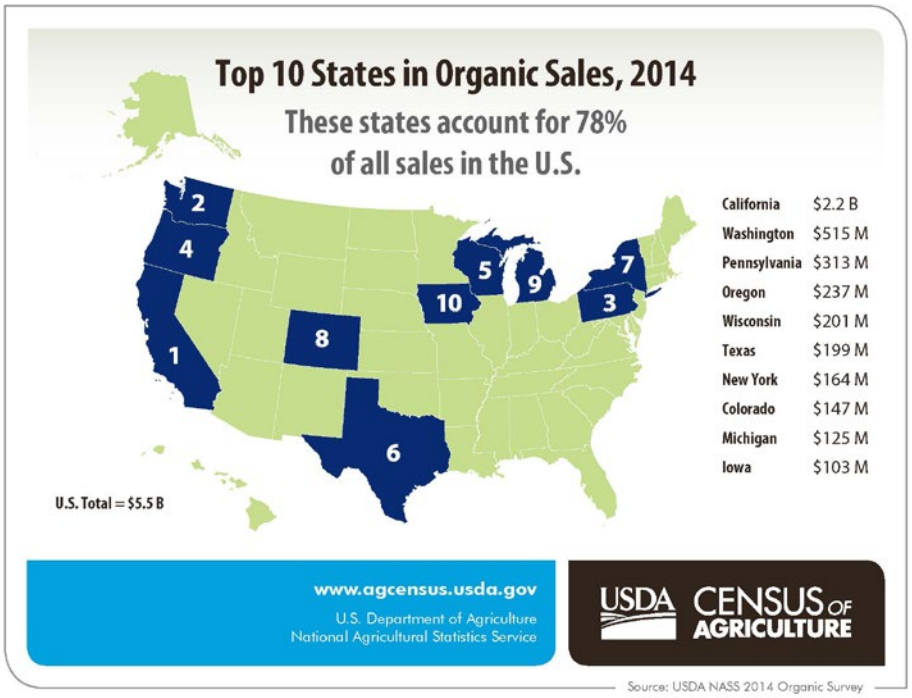
Figure 37: U.S. Organic Food Sales by Category (2005-2014)
Source: USDA Economic Research Service



Organic products can be purchased at farmers markets, restaurants, food co-ops, and 75 percent of conventional grocery stores.[44] These products usually cost more than conventional products due to their higher cost of production. High consumer demand and willingness to pay the organic price premium has resulted in the expansion of certified organic acreage and livestock operations in the U.S. for many years.

California leads the nation in organic sales from farms, with $2.2 billion in sales in 2014 (see Figure 38).[45]

Figure 38: Top 10 States in Organic Sales (2014)
Source: USDA National Agricultural Statistics Service (NASS), 2014 Organic Survey



44 Ibid.

45 USDA National Agricultural Statistics Service. (2016). 2014 Organic Survey. Retrieved January 23, 2017, from https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Organics/

Kern County Trends

The number of certified organic farms in Kern County increased from 23 farms in 2002 to 41 farms in 2012 (Figure 39a). Although this is a small number of farms relative to all the farms in Kern County (only 1–2 percent of all farms and 1–2 percent sales), Kern County farms led the state in organic sales in the early 2000s—in 2002, Kern County organic sales represented 17 percent of all California organic sales (Figure 39b). This dropped to 8 percent in 2007 and 3 percent in 2012, likely due both to decreased total sales in Kern County and to a significant increase in organic sales at the state level over the past decade.

Figure 39a: Total number of USDA certified organic farms, Kern County and California (2002–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)

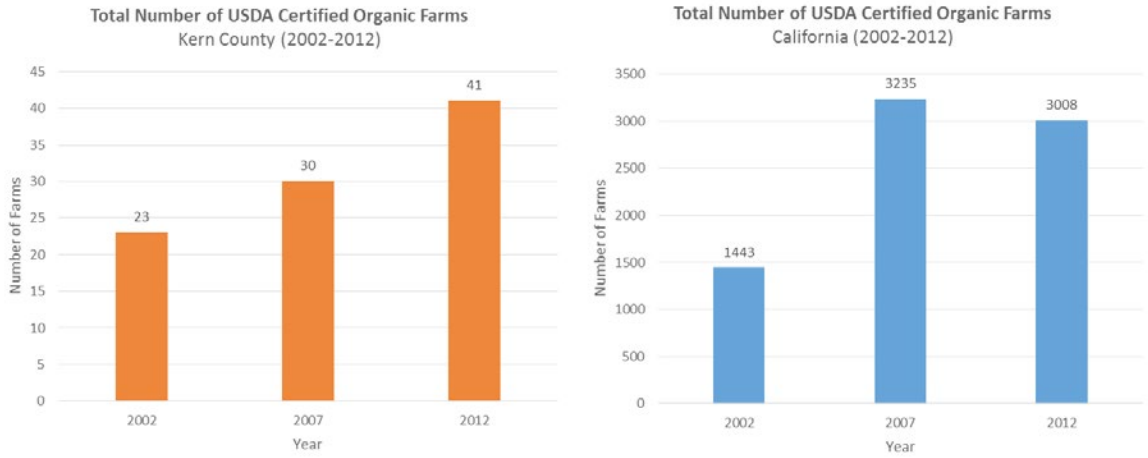
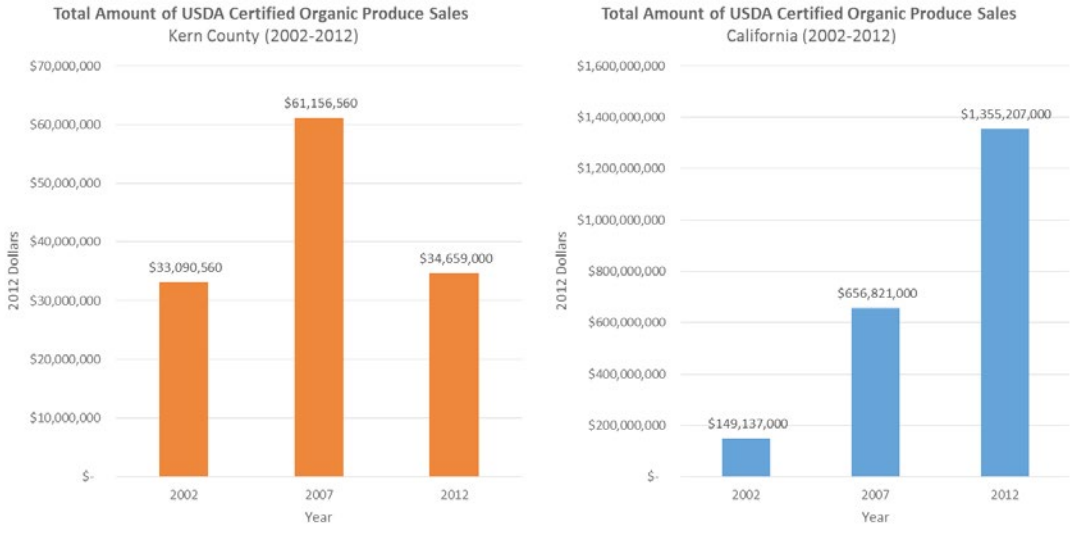


Figure 39b: Total amount of USDA certified organic sales, Kern County and California (2002–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)



As a percentage of the overall agricultural sector in California, the organic sector in Kern County shows slower growth in both the sales (Figure 40a) and number of farms (Figure 40b) compared to the rest of the state. This is particularly true in terms of sales.

Figure 40a: Organic farms as a percentage of total farms in Kern County and California (2002–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)

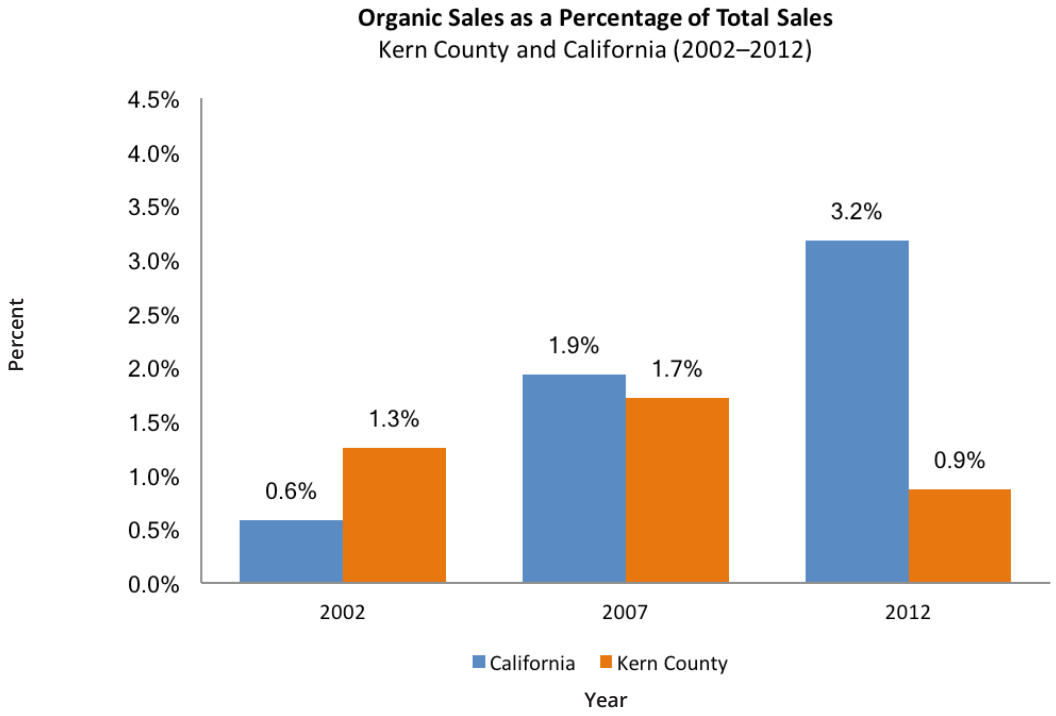
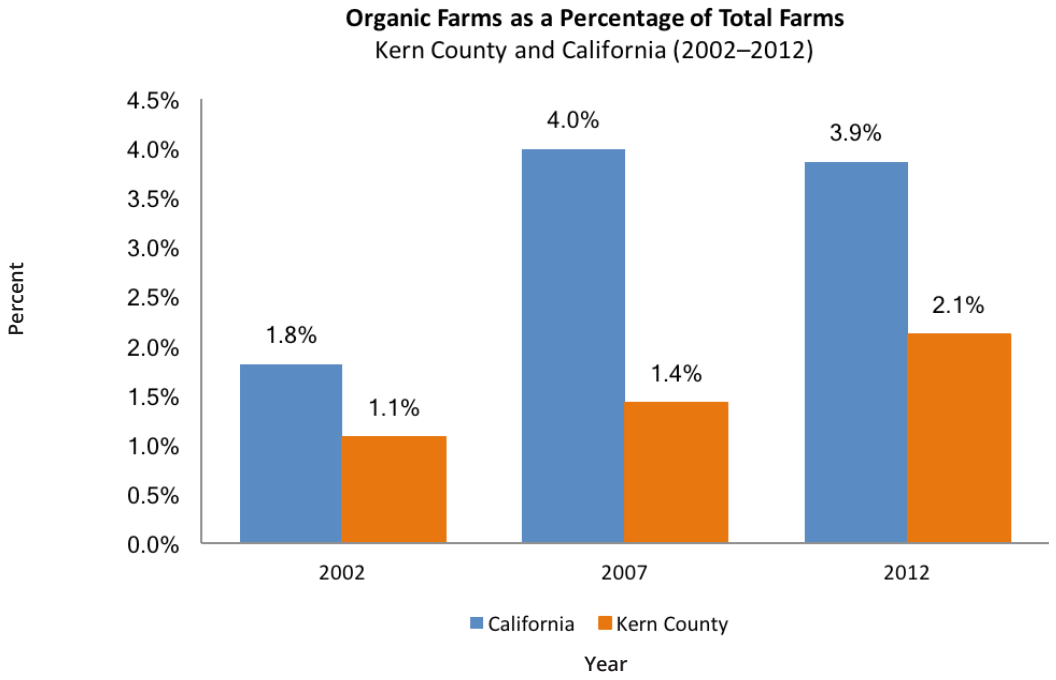


Figure 40b: Organic farms as a percentage of total farms in Kern County and California (2002–2012)
Source: USDA National Agricultural Statistics Service (NASS), Census of Agriculture (2002-2012)



In 2002, the number of organic farms in California amounted to about 2 percent of all farms, increasing to 4 percent in 2007 and 2012. Organic sales grew from less than 1 percent of all farm sales in California in 2002 ($149 million) to more than 3 percent ($1.3 billion) in 2012. Approximately one quarter of U.S. organic farms are located in California,[46] and California organic sales represent a growing percentage of all U.S. organic farm sales—from 10 percent in 2002 to 18 percent in 2012.

Kern County has seen a slower rise in organic farms as a percentage of all farms over the past decade (from 1 percent in 2002 to 2 percent in 2012). Organic sales as a percentage of all agricultural sales in Kern County rose from 1.3 percent in 2002 to 1.7 percent in 2007, but then fell below 2002 levels to 0.9 percent in 2012.

GOAL 3.2: Kern County reduces risks associated with pesticide use

Background

Farmers use many different strategies and tools to manage the risks inherent in running a farm business. One risk that all farmers face is the risk of crop damage or loss due to pests.

Agricultural pests are organisms that damage or interfere with crops or that negatively impact human or animal health. Common agricultural pests include invertebrates (insects, snails), vertebrates (rodents, birds), weeds, nematodes, and pathogens (bacteria, viruses, fungi).

Farmers can manage the risk of pest damage in a variety of ways, including:

1. Biological control: Using a pest's natural enemies to control it—for example, through the introduction of a predator or parasite to that pest.
2. Cultural control: Using crop management practices that make the environment less friendly to pests—for example, by changing irrigation methods.
3. Mechanical and physical control: Physically damaging or blocking a pest's access to a crop—for example, pulling weeds, mulching, or using rodent traps.
4. Chemical control: Using pesticides that either kill pests or harm them in a way that reduces the damage they can do to a crop.[47]

Both conventional and organic farmers may use all four approaches of pest control, though the pesticides allowed in organic agriculture are more limited than in conventional agriculture.

Indicator 3.2.1: Adoption of integrated pest management (IPM) practices

Background

Because most pesticides are designed to kill or harm living organisms, exposure to some pesticides at certain levels may also pose risks to humans, animals, or the environment.[48]

Integrated pest management, commonly referred to as "IPM" is an ecosystem-based strategy of balancing and minimizing both types of risks—the risks associated with crop damage and the risks associated with environmental exposure to pesticides.[49] IPM focuses on long term prevention of pest damage by monitoring and managing the ecosystem in which crops grow. A variety of methods may be used together, including biological, cultural, mechanical, and chemical controls.

46 USDA Economic Research Service. (2016). Organic Production. Retrieved January 23, 2017, from https://www.ers.usda.gov/data-products/organic-production/organic-production/#State-Level Tables

47 Adapted from the University of California Statewide Integrated Pest Management Program's categorization of pest management approaches: http://www2.ipm.ucanr.edu/WhatIsIPM/

48 U.S. Environmental Protection Agency. (n.d.). Pesticides and Public Health. Retrieved March 20, 2017, from https://www.epa.gov/pesticides/pesticides-and-public-health

49 University of California Statewide Integrated Pest Management Program. (n.d.). What is IPM? Retrieved March 20, 2017, from http://www2.ipm.ucanr.edu/WhatIsIPM/

PHOTO CREDIT: SUSAN REEP

Honey bee hives, Kern County.

IPM practices may reduce the use of higher risk pesticides by replacing or supplementing them with lower risk alternatives, including chemical, biological, cultural, and/or mechanical methods of pest control. When practicing IPM, those pesticides that are used should be the safest and most selective pesticides available, applied in a way that minimizes potential harm to people and the environment.[50]

In this section we focus on the use of several different types of pest control associated with IPM—the use of microbial pesticides, the use of pheromone-based pest control products, and the use of lower-risk chemical controls.

MEASURE 1: Use of microbial pesticides

Background

Biopesticides are pesticides that derived from natural materials. These pesticides are usually less toxic than conventional pesticides and may help reduce the use of more toxic pesticides while still keeping crops safe.[51]

Microbial pesticides are one type of biopesticide. This type of pesticide uses a microorganism as the active ingredient, such as a bacterium, fungus, virus or protozoan. The most commonly used microbial pesticides are subspecies and strains of *Bacillus thuringeinsis*, commonly called Bt. Bt is a type of bacterium that produces proteins that kill insect larvae. Different strains are specific to different pests.

The number of acres treated with microbial pesticides has remained relatively steady over the past 25 years in California, though the crops they are applied to have changed over time. The most common crops currently treated with microbial pesticides are table grapes and strawberries. The use of microbial pesticides has increased over time in lettuce and almonds and has decreased in wine grapes.[52]

Kern County Trends

Figure 41a shows that farmers in Kern County have used microbial pest control products like Bt for many years, with particularly high numbers of acres treated in the late 1990s and the early 2010s. The number of acres treated with these products has been increasing steadily over the past decade from a low in 2002, and was at its highest recorded level in 2014. In California, the use of microbial pesticides has been increasing since 2009 (see Figure 41b).

The crops with the largest number of acres treated with microbial products in Kern County are table grapes, pistachios, carrots, and almonds, with a particularly sharp increase since 2011 in pistachios

50 Ibid

51 U.S. Environmental Protection Agency. (n.d.). What are biopesticides? Retrieved March 20, 2017, from https://www.epa.gov/ingredients-used-pesticide-products/what-are-biopesticides

52 California Department of Pesticide Regulation. (1990-2014). Pesticide Use Reports. Retrieved using PUR Web GIS: http://ziram.lawr.ucdavis.edu/PURwebGIS.html

and carrots. The use of microbial products in wine grapes and almonds has decreased in Kern County from a peak in the 1990s and early 2000s.[53]

Figure 41a: Total acres treated with microbial pesticides in Kern County (1990–2014)
Source: California Department of Pesticide Regulation, Pesticide Use Reports 1990–2014[54]

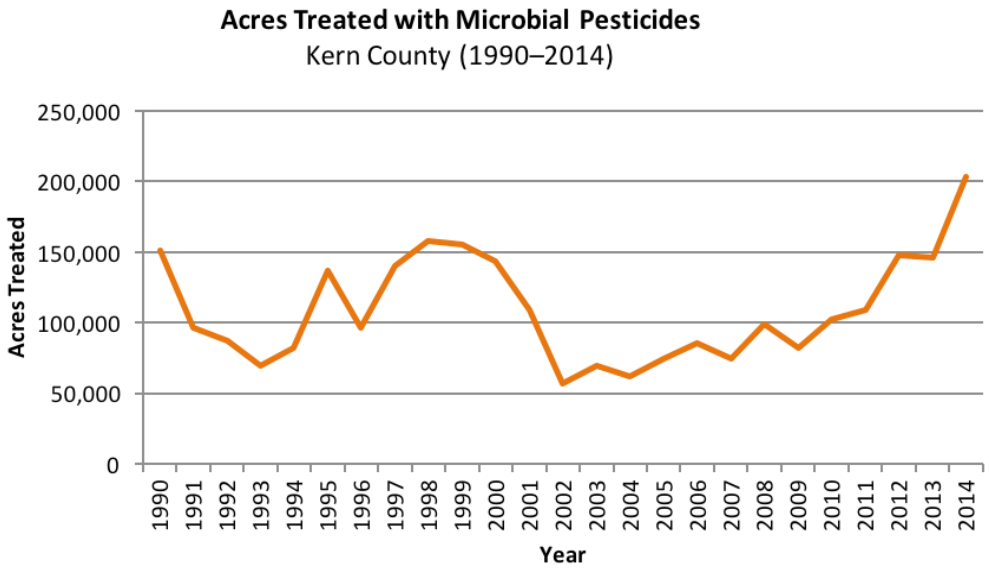
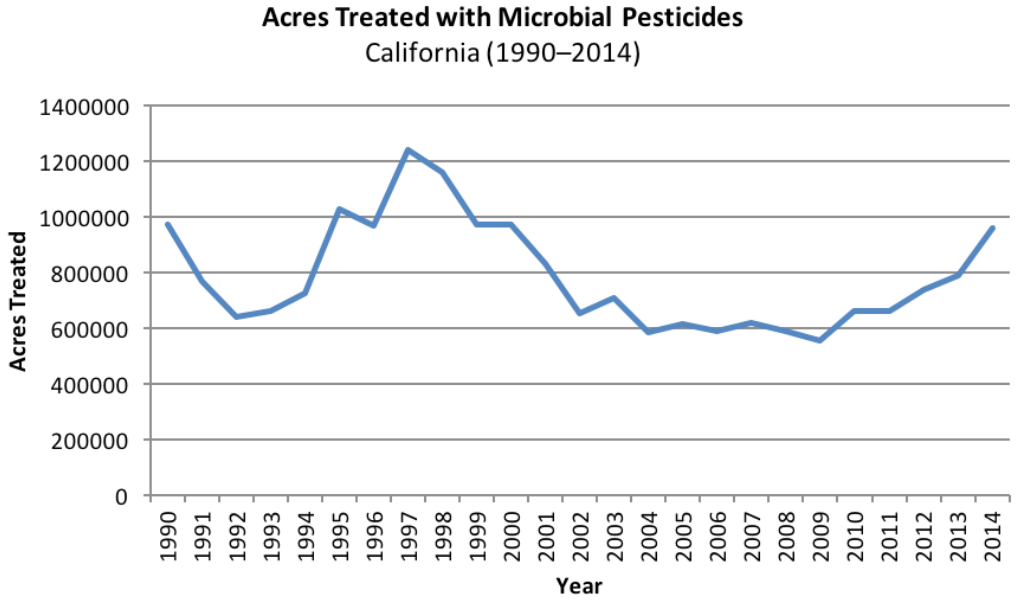


Figure 41b: Total acres treated with microbial pesticides in California (1990–2014)
Source: California Department of Pesticide Regulation, Pesticide Use Reports 1990–2014



53 Ibid

54 See Appendix C for full list of included microbial products

MEASURE 2: Use of pheromone pest control products

Background

Biochemical pesticides are another type of biopesticide. These pesticides control pests by non-toxic mechanisms. One example is the use of pheromone-based products. Pheromones can be used to interfere with insect mating and reproduction, or as bait in traps to help farmers monitor pest populations and decide when control is needed. In both cases, the use of pheromones may reduce the use of higher risk pest control methods.

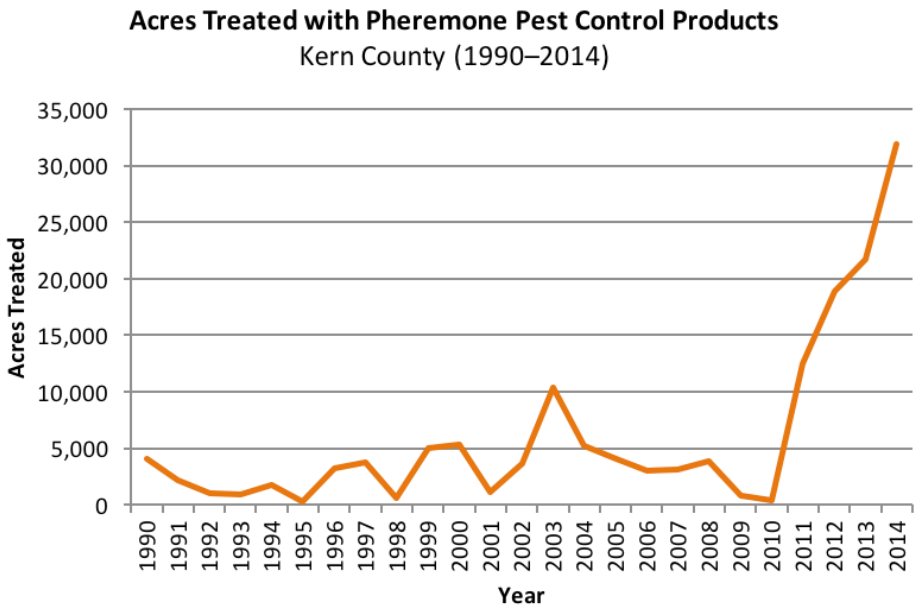
In California, pheromones are most commonly used in orchard crops like nuts (almonds, pistachios) and stone fruit (peaches, nectarines, plums). They are also used in pears and grapes.[55]

Kern County Trends

In Kern County, pheromones are primarily used in almonds and pistachios for mating disruption of Navel Orange Worm. The use of pheromones as bait in traps is also common in many crops in Kern County. However, when used in this way pheromones are not considered pesticides and are not included in pesticide use data.[56]

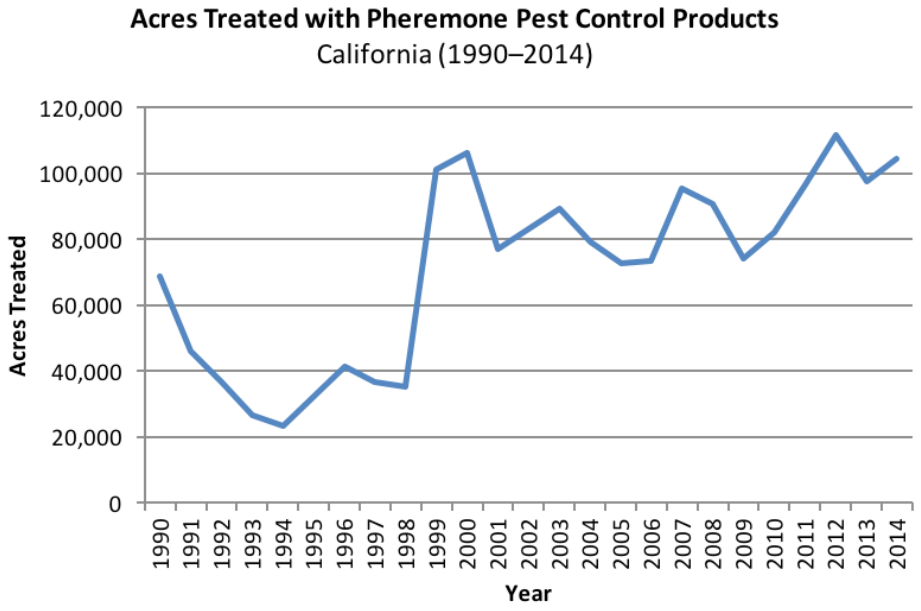
Figures 42a and 42b show trends in the use of pheromone pest control products in Kern County and California over the last 25 years.

Figure 42a: Total acres treated with pheromone pest control products in Kern County (1990–2014)
Source: California Department of Pesticide Regulation, Pesticide Use Reports 1990–2014[57]



55 CDPR Pesticide Use Report (queried by acres treated and crop from 2010–2014)
56 Personal communication with David Haviland, UCCE Kern County
57 See Appendix D for full list of included pheromone products

Figure 42b: Total acres treated with pheromone pest control products in California (1990–2014)
Source: California Department of Pesticide Regulation, Pesticide Use Reports 1990–2014



The use of pheromone pest control products has increased in both California and Kern County. There has been a particularly large increase in Kern County over the last 5 years.

Biocontrol of aflatoxins in pistachio and almond crops

Aflatoxins are carcinogenic mycotoxins produced by two closely related fungi, *Aspergillus flavus* and *Aspergillus parasiticus*. These fungi may grow naturally in many crops, including corn, peanuts, wheat, cottonseed, pistachios, and almonds. Aflatoxin contamination of crops is a food safety concern worldwide.

Among various strategies to control aflatoxins, biological control is currently the most promising.[1] A naturally occurring strain of *Apergillus flavus*, known as AF36, does not produce aflatoxins and can be introduced to fields to compete with toxin-producing strains.

In Kern County, AF36 is introduced to pistachio and almond fields in late spring or early summer and then activated by irrigation. Because it gets a head start on other *Apergillus* strains, it is able to displace them by as much as 95 percent within three years.[2]

Controlling Navel Orange Worm through the use of pheromones can also help prevent aflatoxins from impacting crops, as 90 percent of aflatoxins are found in nuts that were previously damaged by Navel Orange Worm.[3]

In this case, a coordinated effort involving the California pistachio industry, UC Cooperative Extension, and two biological control agents are helping keep California's nut growers and consumers safe.

1 Yin, Y., Yan, L., Jiang, J., & Ma, Z. (2008). Biological control of aflatoxin contamination of crops. *Journal of Zhejiang University.* Science B, 9(10), 787–792. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2565741/

2 Beede, B., & Klein, B. (2013). AF36 How it Works. Retrieved March 20, 2017, from https://www.youtube.com/watch?v=YNUuUDgHMdo

3 Beede, B., & Klein, B. (2013). AF36 How it Works. Retrieved March 20, 2017, from https://www.youtube.com/watch?v=YNUuUDgHMdo

MEASURE 3: Use of pesticides by estimated risk level

Background

The primary role of chemical control (pesticides) in agriculture is to protect the quality of the food supply and the livelihood of farmers. Pesticides reduce a range of risks associated with food production, including crop damage or loss from pests, disease, or contamination. Some of the products used to manage these risks, however, come with risks of their own, including potential harm to human, animal, or environmental health.

California has the most advanced system in the world for tracking how, when, and where pesticides are applied. Though use reporting on some level has been required since the 1950s, today's comprehensive use reporting system was established in 1990 in response to public concerns about the potential risks of pesticide exposure, particularly to agricultural workers.[58]

In this section, we will look at the use of higher and lower risk pesticides over time as an additional indicator of the possible impact of IPM practices in Kern County. Risk level is estimated based on inclusion or exclusion in CalEnviroScreen 2.0's List of Hazardous and Volatile Pesticides. Higher risk pesticides have been further categorized as "fumigants" and "non-fumigants" due to the very different average application rates (pounds per acre) for each type of pesticide. For a full list of pesticides and their risk level designation, see Appendix E.

Kern County Trends

Total pounds of active ingredient applied

One way to measure the use of pesticides is by tracking the total pounds of that pesticide's active ingredient that have been applied.[59] Figures 43a and 43b show trends in pesticide use in Kern County and California by estimated risk level (lower risk, higher risk non-fumigants, higher risk fumigants).

PHOTO CREDIT: GREG IGOR

Aerial application of pesticide, Kern County.

The total pounds of higher risk non-fumigant pesticides applied in Kern County has decreased over the past two decades, mirroring a similar trend in California.[60] Out of the 69 higher risk pesticides included here, 59 are non-fumigants, so this represents a decline in use of the majority of the higher risk pesticides currently registered in California. There has been a corresponding increase in the use of lower risk pesticides in Kern County, though we found the opposite trend statewide, where the use of lower risk pesticides has decreased. The use of higher risk fumigants has increased in both Kern County and California.

58 California Department of Pesticide Regulation. (2000). Overview of Pesticide Use Reporting. Retrieved March 21, 2017, from http://www.cdpr.ca.gov/docs/pur/purovrvw/tabofcon.htm

59 Pesticide formulations often include both active ingredients (the chemicals that do the pest control work) and inert ingredients (for example, oils or liquids to carry the chemical or help it spread appropriately). There may be many different pesticide formulations in use with a given active ingredient, produced for different uses or by different manufacturers. For the purpose of this assessment, we looked at total pounds of active ingredient applied only, rather than tracking the use of entire product formulations.

60 All pesticide use trends statistically significant at 95% confidence level from 1990–2014 unless otherwise noted.

Assessing IPM, not pesticide risk

The purpose of this section is NOT to assess the risks of pesticide use to the people or environment of Kern County.

Each pesticide used in California has a unique profile in regards to its toxicity, how it moves and is dispersed through different mediums (water, air, soil), and the length of time in stays active in the environment. Assessing pesticide risk is a complex process that involves many factors in addition to levels of use—this includes but is not limited to how and where the pesticide is applied, current weather conditions, and the proximity and vulnerability of humans or other living organisms.

Instead, this section looks at how integrated pest management (IPM) practices may be reducing the use of the highest risk pesticides in Kern County.

We determined the risk category for each pesticide using CalEnviroScreen 2.0's list of hazardous and volatile pesticides.[1] All pesticides included on the CalEnviroScreen list were categorized as "higher risk." Pesticides not on the list were categorized as "lower risk." These are broad and relative designations. Lower risk does not mean low risk or no risk, and higher risk does not mean that the pesticide has actually caused harm. California has a complex system of regulations and monitoring systems to help minimize risks associated with pesticide use. In general, pesticides that are known to be highly toxic and/or volatile will be more highly regulated than lower risk pesticides, reducing their inherent risk through more careful use.

Although it is not the only factor and cannot be used to determine risk in isolation, studies have shown correlation between high levels of pesticide use and both pesticide exposure and pesticide-related acute and chronic illness.[2][3][4][5][6][7] Farmworkers and children may be most at risk.[8] For this reason, practicing IPM may improve public and environmental health outcomes by encouraging the use of lower risk pesticides and non-chemical methods of pest control when possible.

1 CalEnviroScreen is an environmental health screening tool developed by the Office of Environmental Health Hazard Assessment (OEHHA) at the request of the California Environmental Protection Agency (CalEPA). This tool identifies communities that face multiple pollution burdens and other vulnerabilities in order to prioritize state assistance. One indicator included in the tool is pesticide use.

2 Bradman A, Eskenazi B, Barr DB, Bravo R, Castorina R, Chevrier J, et al. (2005). Organophosphate urinary metabolite levels during pregnancy and after delivery in women living in an agricultural community. Environ Health Perspect 113(12):1802-7.

3 Bradman, A., Whitaker, D., Quirós, L., Castorina, R., Henn, B. C., Nishioka, M., ... & Sheldon, L. S. (2007). Pesticides and their metabolites in the homes and urine of farmworker children living in the Salinas Valley, CA. *Journal of Exposure Science and Environmental Epidemiology,* 17(4), 331-349.

4 Harnly ME, Bradman A, Nishioka M, McKone TE, Smith D, McLaughlin R, et al. (2009). Pesticides in dust from homes in an agricultural area. *Environ Sci Technol* 43(23):8767-74.

5 Quiros-Alcala L, Bradman A, Nishioka M, Harnly ME, Hubbard A, McKone TE, et al. (2011). Pesticides in house dust from urban and farmworker households in California: an observational measurement study. *Environ Health* 10:19.

6 Koutros S, Beane Freeman LE, Lubin JH, Heltshe SL, Andreotti G, Barry KH, et al. (2013). Risk of total and aggressive prostate cancer and pesticide use in the Agricultural Health Study. *Am J Epidemiol* 177 (1):59-74

7 Lee SJ, Mehler L, Beckman J, Diebolt-Brown B, Prado J, Lackovic M, et al.(2011). Acute Pesticide Illnesses Associated with Off-Target Pesticide Drift from Agricultural Applications: 11 States, 1998–2006. *Environmental health perspectives* 119(8):1162.

8 California Department of Public Health. (2014). Agricultural pesticide use near public schools in California. CDPH Environmental Health Tracking Program.

Figure 43a: Pesticide use in Kern County by estimated risk level (total pounds of active ingredient applied)

Sources: California Department of Pesticide Regulation—Pesticide Use Reports (1990–2014); California Environmental Protection Agency (CalEPA) and Office of Environmental Health Hazard Assessment (OEHHA)—California Communities Environmental Health Screening Tool Report (CalEnviroScreen 2.0, updated October 2014)

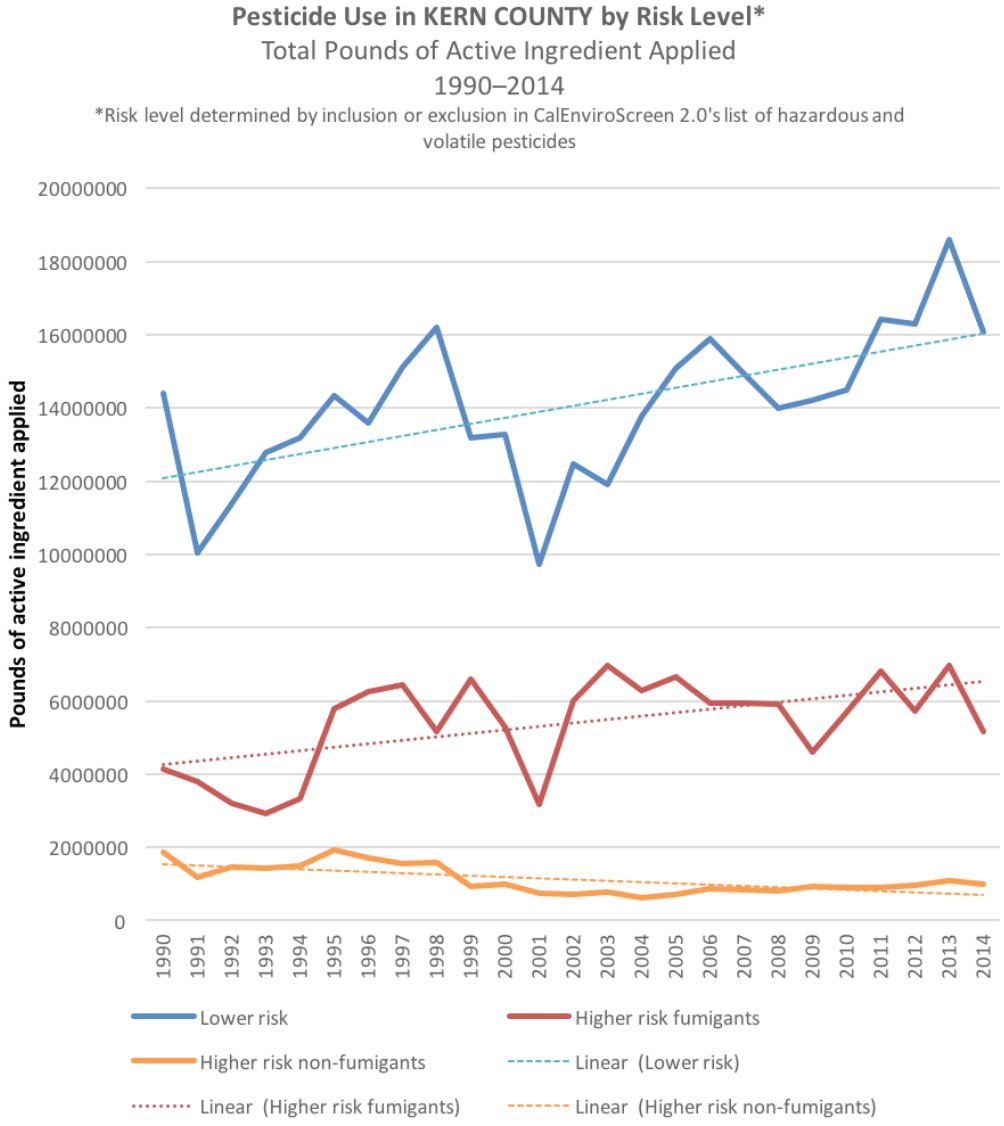
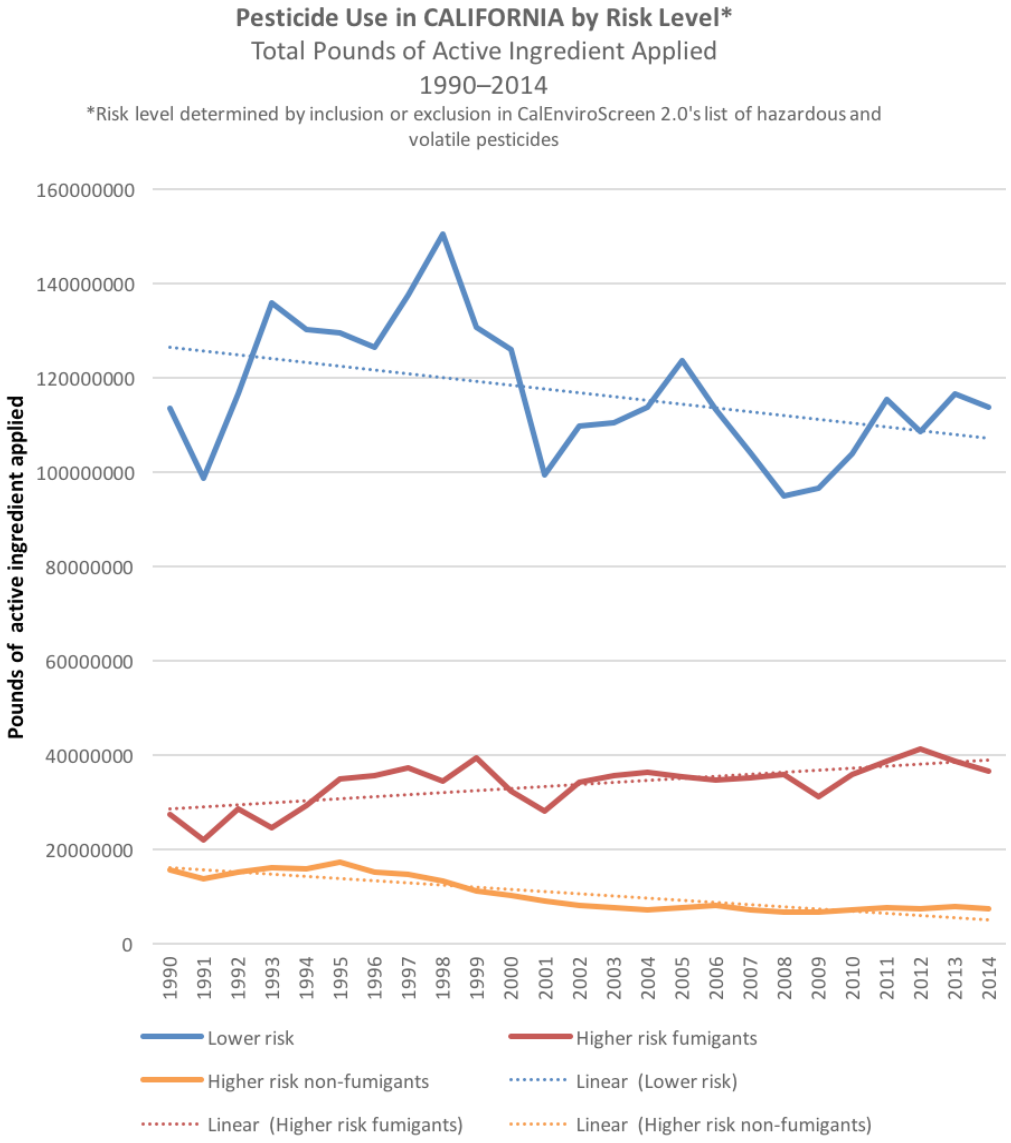


Figure 43b: Pesticide use in California by estimated risk level (total pounds of active ingredient applied)

Sources: California Department of Pesticide Regulation—Pesticide Use Reports (1990–2014); California Environmental Protection Agency (CalEPA) and Office of Environmental Health Hazard Assessment (OEHHA—California Communities Environmental Health Screening Tool Report (CalEnviroScreen 2.0, updated October 2014)



Total acres treated

In addition to pounds of active ingredient applied, pesticide use can also be measured in terms of the number of acres treated. Trends in total acres treated in Kern County mirror trends in pounds applied—the use of lower risk pesticides is increasing while the use of higher risk non-fumigants is decreasing (see Figure 44a).

In California, use of lower risk pesticides has decreased in terms of pounds of active ingredient applied but increased in terms of acres treated, suggesting that at least some of these pesticides are being applied at lower rates (Figure 44b). This could be due to different application methods, formulations, active ingredients, or crops grown.

Figure 44a: Pesticide use in Kern County by risk level (acres treated, 1990–2014)

Sources: California Department of Pesticide Regulation—Pesticide Use Reports (1990–2014); California Environmental Protection Agency (CalEPA) and Office of Environmental Health Hazard Assessment (OEHHA)—California Communities Environmental Health Screening Tool Report (CalEnviroScreen 2.0, updated October 2014)

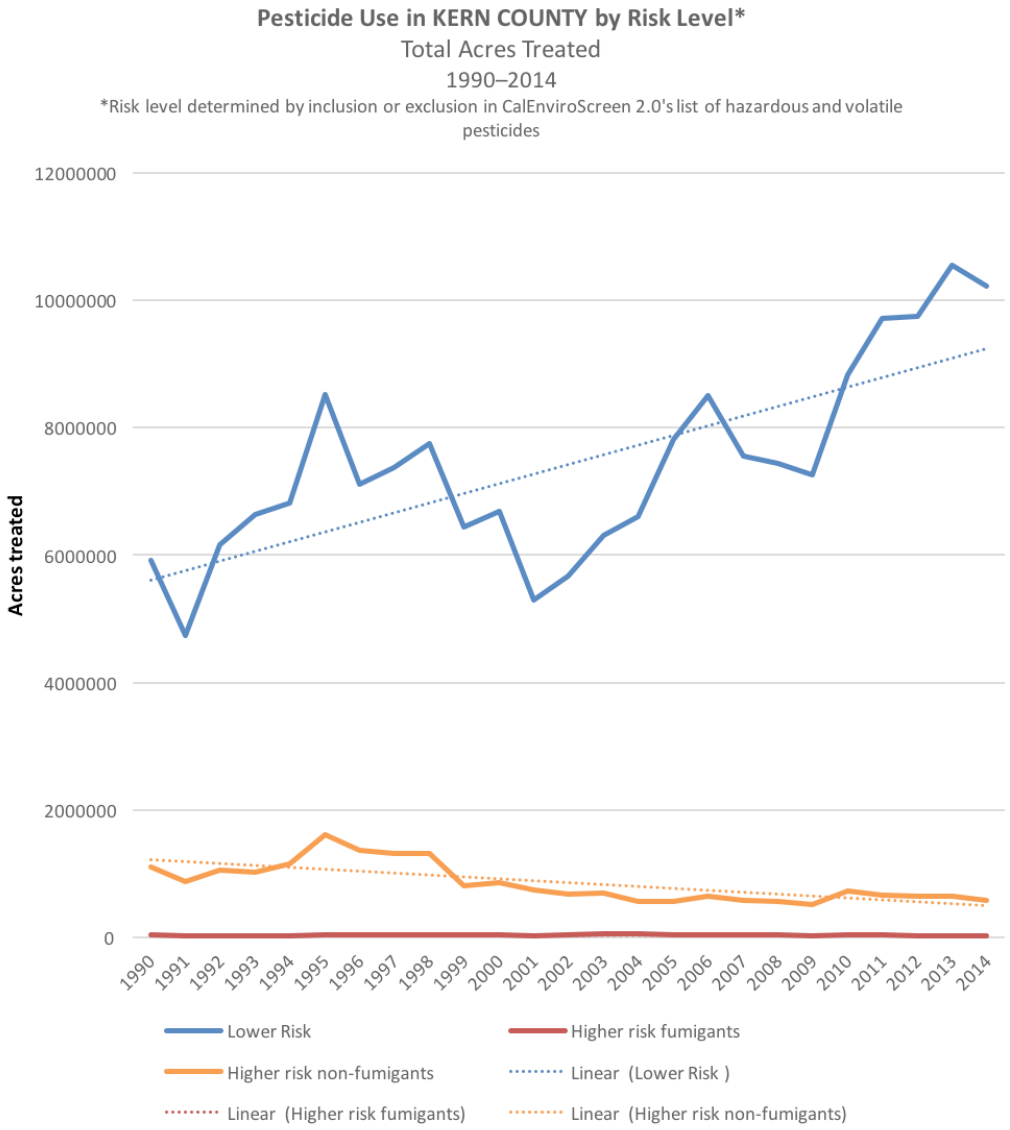
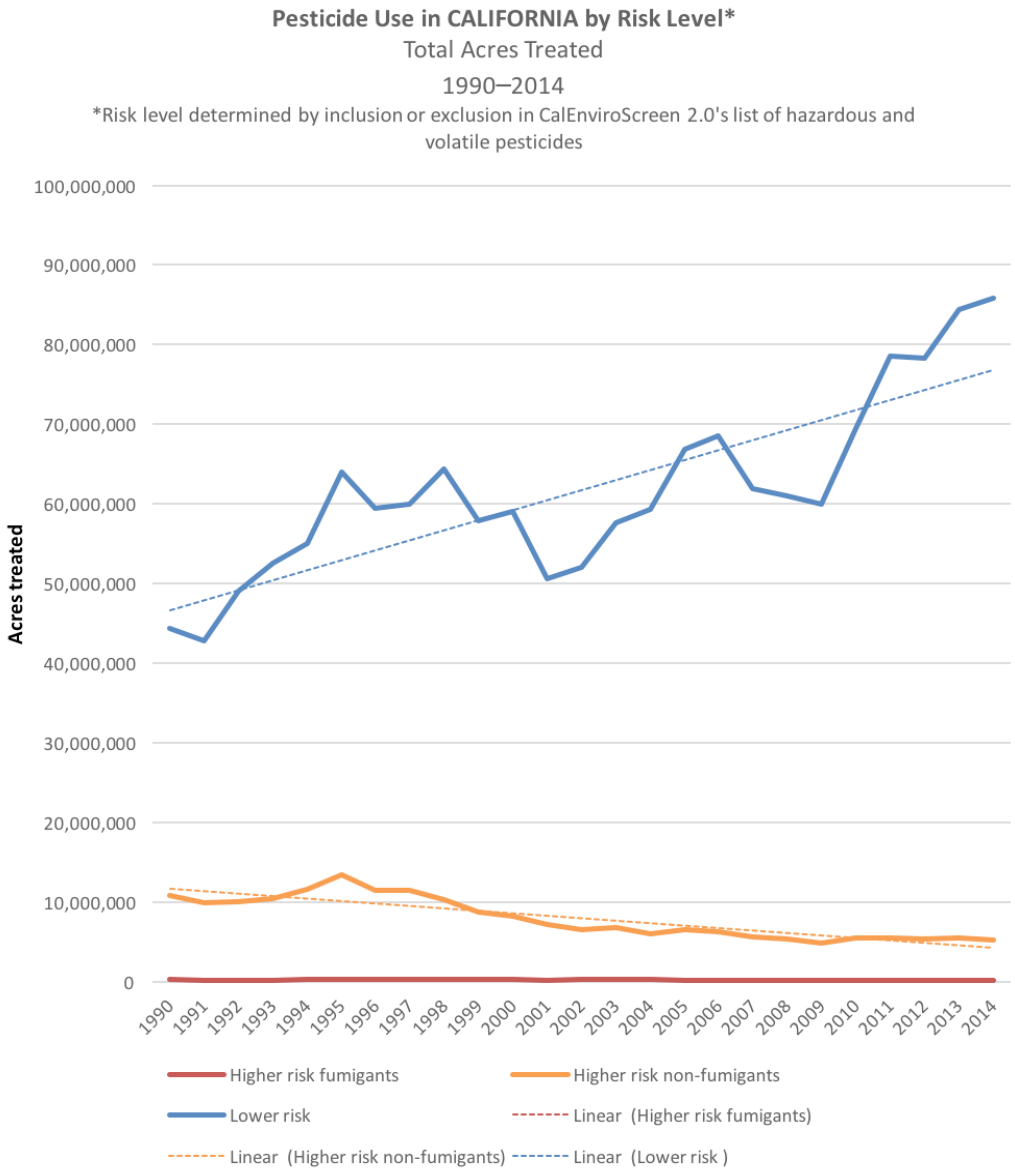


Figure 44b: Pesticide use in California by risk level (acres treated, 1990–2014)

Sources: California Department of Pesticide Regulation—Pesticide Use Reports (1990–2014); California Environmental Protection Agency (CalEPA) and Office of Environmental Health Hazard Assessment (OEHHA)—California Communities Environmental Health Screening Tool Report (CalEnviroScreen 2.0, updated October 2014)



Fumigants

Fumigants are used prior to planting to protect crops from soil borne pathogens like nematodes, bacteria, and fungi. These types of pesticides are generally both highly toxic and highly volatile, and can also be a source of volatile organic compounds (VOCs) and contribute to ozone depletion. The UC Statewide IPM program recommends using fumigants as a last resort when no other methods of control are effective or available.[61]

61 University of California Statewide Integrated Pest Management Program. (2009). Management of Soilborne Pathogens. Retrieved March 21, 2017, from http://ipm.ucanr.edu/PMG/r280190211.html

Fumigants are the only subgroup of higher risk pesticides whose use has increased over the last 25 years in terms of pounds of active ingredient applied. However, Figure 44a and 44b show that only a very small number (less than 0.5 percent) of the total acres treated with pesticides in California are treated with fumigants.

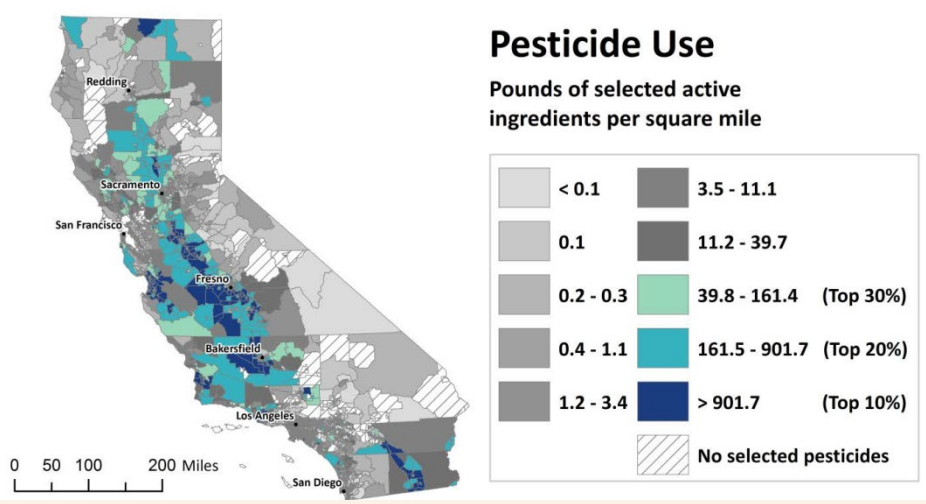
Because of the way CDPR collects and publishes use data, each "acre treated" is better understood as a single treatment of an acre with a given pesticide. This is why the total number of acres treated each year is higher than the total number of acres cropped each year. Each cropped acre may receive multiple pesticide treatments over the course of the year (depending on the crop, environmental conditions, etc.).

There was no statistically significant change in the number of acres treated with fumigants in Kern County between 1990 and 2014, and a very slight decrease over the same time period in California.

Mapping pesticide use

The risk designations in this assessment are based on CalEnviroScreen 2.0's list of hazardous and volatile pesticides. CalEnviroScreen 2.0 includes a mapping tool where applications of this subgroup of higher risk pesticides can be viewed by census tract. This map may be viewed by visiting the CalEnviroScreen website and selecting the "pollution burden maps" for CalEnviroScreen 2.0. One of the 12 pollution burden indicators is the use of higher risk pesticides.

Figure: CalEnviroScreen 2.0 – Pesticide Indicator Maps
Source: California Communities Environmental Health Screen Tool, Version 2.0



CalEnviroScreen was updated on to version 3.0 on January 9, 2017. Version 3.0 includes one additional pesticide, ethylene glycol, which met CalEnviroScreen's hazard and volatility criteria. Due to the timing of its addition, ethylene glycol is not included in this assessment.

CalEnviroScreen 3.0 indicator mapping tools are available at: https://oehha.maps.arcgis.com/apps/MapSeries/index.html?appid=8dad35dcd2274285874e60871c404edc

This, combined with increases in the total pounds of fumigant active ingredient applied, suggests an increase in the rate (pounds per acre treated) of higher risk fumigants used in both Kern County and in California.

INDICATOR 3.2.2: Adherence to pesticide use regulations

Background

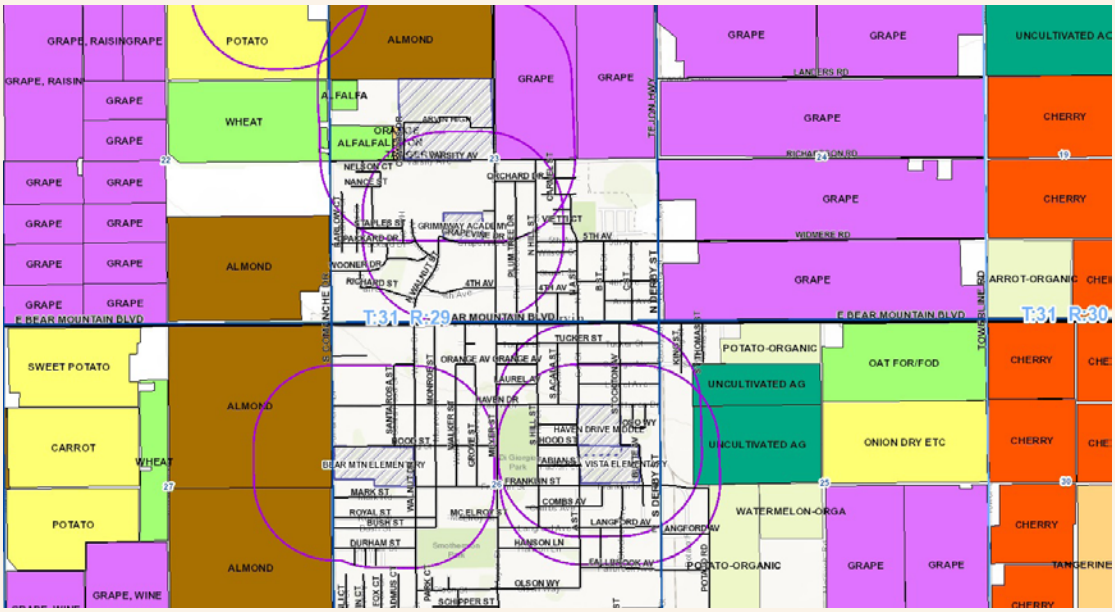
Pesticides are regulated to protect the environment and public health both at the federal and state level. In California, pesticide regulation is the joint responsibility of the California Department of Pesticide Regulation and the County Agricultural Commissioners. County agricultural commissioners collect pesticide use data and enforce pesticide regulations at the county level.

The GIS team at the Kern County Agricultural Commissioner's Office also uses CDPR pesticide use data to create maps and assess the use of higher risk pesticides near more vulnerable populations, like schools. A 2013 report by the Kern County Agricultural Commissioner's Office showed that the use of restricted materials (another subset of higher risk pesticides) near schools in Kern County to be decreasing.

The relationship of schools to agricultural fields can be viewed on the crop map of Kern County that is updated daily by the Agricultural Commissioner's office: http://www.kernag.com/cropmap/

Figure: Kern County Crop Map, zoomed in to several Kern County schools (Arvin High School, Grimmway Academy, Bear Mountain Elementary, Haven Drive Middle School, Sierra Vista Elementary)

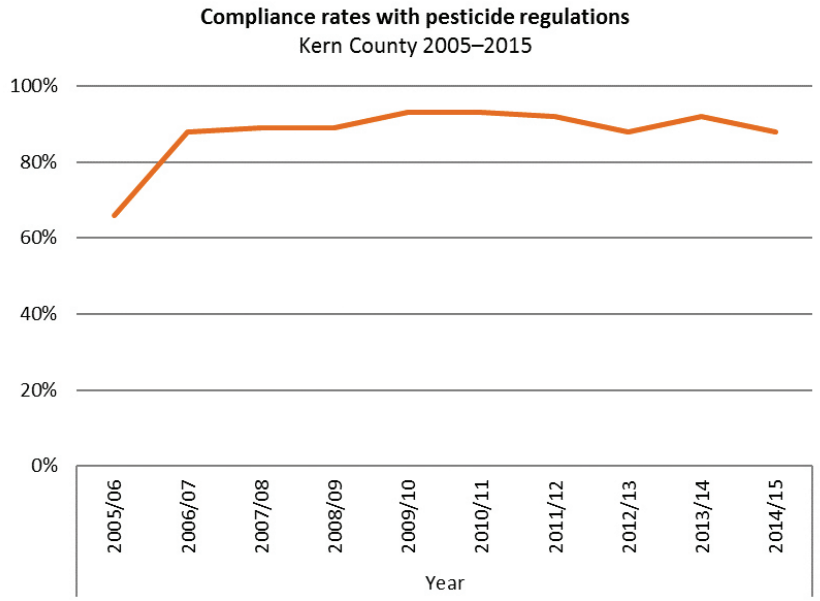
Source: Kern County Agricultural Commissioner's Office, Kern County Crop Map



MEASURE 1: Pesticide regulation compliance rates

County agricultural commissioners conduct regular inspections to ensure that pesticides are applied in compliance with existing pesticide law. Each inspection covers multiple regulations, and any areas where an operation is out of compliance are noted and may be subject to a warning or fine.

Figure 45: Compliance rates[62] with pesticide regulations in Kern County (2005–2015)
Source: Kern County Agricultural Commissioner's Office [63]



In 2005/2006, the compliance rate in Kern County was only 66 percent (Figure 45). At that time, the Kern County Agricultural Commissioner's Office, Kern County UC Cooperative Extension, and Kern County Farm Bureau all stepped up their efforts to help increase compliance through enforcement, education, and farmer organizing.[64] Since then, compliance rates have risen and remained steady at between 88 and 93 percent.

MEASURE 2: Reported pesticide drift incidents

Background

Some pesticides can move through the air. The distance they are able to move may depend on the type of pesticide (fumigants are particularly prone to drift),[65] how the pesticide was applied, and what wind or other weather conditions were like during or after the application. When pesticides move off the site they were originally applied to, this is referred to as drift. Drift incidents can cause human illness and property damage, including to nearby crops. Not all drift is illegal, however. Pesticide law focuses on drift that causes harm or has the potential to do so.[66]

62 The compliance rate is the inverse of the number of non-compliances found over the total number of inspections conducted. For example, if 100 inspections were conducted and two farms were out of compliance with 5 violations each, the compliance rate would be 90 percent. If two farms were out of compliance with only 1 violation each, the compliance rate would be 98 percent.

63 This data was provided in summary form by the Kern Co Ag Commissioner's office. It is available in more detail through the Pesticide Regulatory Activities Monthly Report (PRAMR) available at: http://www.cdpr.ca.gov/docs/enforce/report5.htm

64 Personal communication with staff at Farm Bureau, Kern County Cooperative Extension, and the Kern County Agricultural Commissioner's Office.

65 California Department of Pesticide Regulation. (2013). Pesticide Drift Pocket Guide. Retrieved March 21, 2017, from http://www.cdpr.ca.gov/docs/enforce/cmpliast/pesticide_drift.pdf

66 California Department of Pesticide Regulation. (2013). Pesticide Drift Pocket Guide. Retrieved March 21, 2017, from http://www.cdpr.ca.gov/docs/enforce/cmpliast/pesticide_drift.pdf

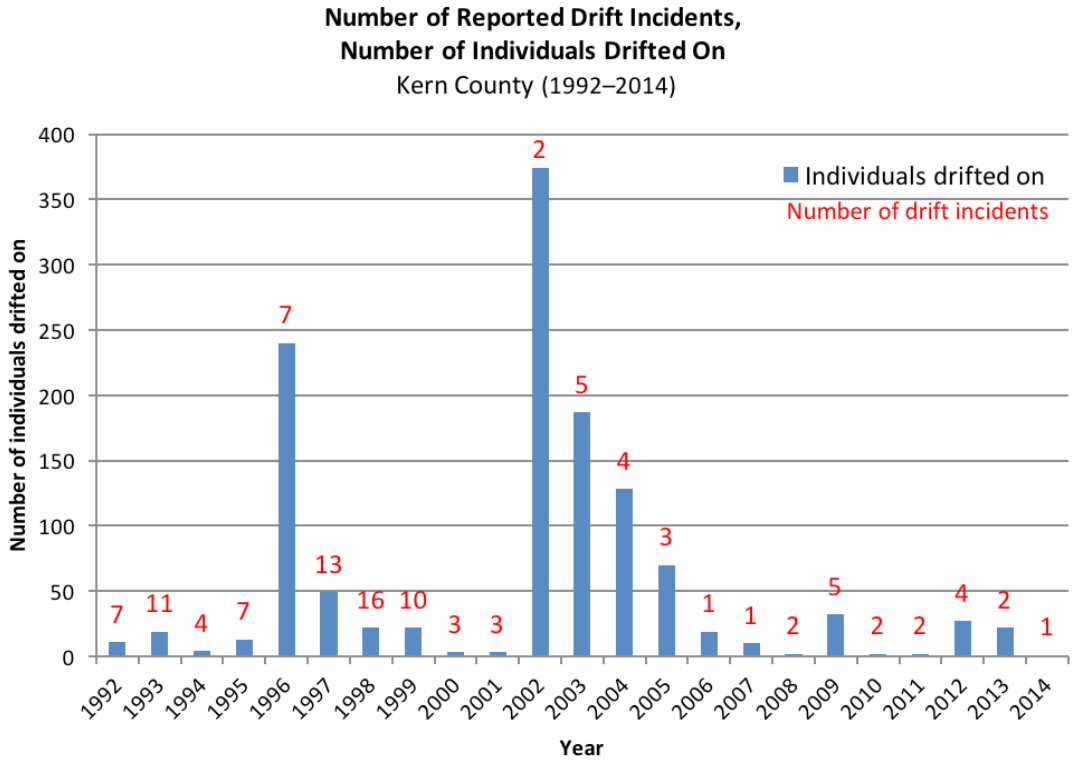
Those applying pesticides have the primary responsibility for preventing drift. The California Department of Pesticide Regulation and county agricultural commissioners are responsible for making sure that pesticide levels in the air do not pose risks to humans or other living organisms by enforcing standards on how, when, and where pesticides can be applied.[67] CDPR also has an Air Quality Initiative, which is a comprehensive effort to improve air quality statewide. This initiative focuses on reducing emissions from fumigants, reformulating pesticide products to reduce emissions, promoting new environmentally friendly technologies, and developing strategic pest management partnerships with industry.[68]

Kern County Trends

Figure 46 shows the total number of reported drift incidents in Kern County from 1992 to 2014 (red numbers), as well as the number of individuals drifted on each year (blue bars). The number of individuals reporting drift incidents annually in Kern County has decreased over the last decade.

Figure 46: Number of reported drift incidents and number of individuals drifted on in Kern County (1992–2014)

Source: California Pesticide Illness Query (CalPIQ)



67 California Department of Pesticide Regulation. (n.d.). Drift. Retrieved March 21, 2017, from http://www.cdpr.ca.gov/docs/enforce/drftinit/drftmenu.htm

68 California Department of Pesticide Regulation. (n.d.). Air Quality Initiative. Retrieved March 21, 2017, from http://www.cdpr.ca.gov/docs/emon/airinit/airinit.htm

MEASURE 3: CDPR enforcement actions related to worker safety

Background

When an incident occurs in which a pesticide law or regulation is violated, county agricultural commissioners (CACs) are responsible for determining an appropriate response. CACs may issue "compliance actions," which document violations and sometimes include public protection actions, but do not impose fines (for example, a warning letter). They may also issue "enforcement actions," which impose a civil penalty (fine) or the loss of a right or privilege.

PHOTO CREDIT: GREG IGOR

Workers harvesting peppers in Kern County.

Enforcement actions are initiated by a Notice of Proposed Action (NOPA), after which defendants have a right to a hearing to contest allegations of violations. The fine level assessed is related both to the seriousness of the violation and any previous history of violations.

A subset of these violations are designated by the California Department of Pesticide Regulation (CDPR) as "citations for worker safety." Most commonly, these involve failure to comply with preventative measures designed to protect workers from pesticide exposure. Most citations for worker safety are classified as Class B or Moderate Violations, with fine levels ranging from $250–$1000.[69]

In some counties, violations may result in compliance actions (warning letters) only. This was identified as a statewide challenge to achieving pesticide regulation compliance in a 2002 report[70] that showed 85 percent of violations in California in fiscal year 2000/2001 resulted in warning letters only.

It is beyond the scope of this assessment to analyze changes in the ratio of compliance to enforcement actions in Kern or other California countries since this 2002 report. However, it is the current policy of the Kern County Agricultural Commissioner that all violations (100 percent) are subject to enforcement actions (fines) rather than compliance actions (warning letters).[71]

Kern County Trends

Figures 47a and 47b show that worker safety violations make up a much larger portion of all fines (enforcement actions) in Kern County than in California as a whole.

Based on previous statewide analysis[72] and the policy of the Kern County Agricultural Commissioner to take enforcement action against all violations, we believe these data suggest that Kern County takes worker safety violations seriously, rather than suggesting there are more worker safety violations in Kern County than in other counties.

69 For a more detailed account of types of actions, violation classes, and fine levels, see Appendix F, California Code of Regulations Title 3, Division 6, Chapter 1, Subchapter 3, Article 1

70 Reeves, M., Katten, A., & Guzmán, M. (2002). Fields of poison 2002: California farmworkers and pesticides. Californians for Pesticide Reform.

71 Personal communication with Kern County Agricultural Commissioner Ruben Arroyo, October 2016

72 Reeves, Katten and Guzman 2000

Figure 47a: CDPR Enforcement Actions related to worker safety in Kern County (2000–2014)

Source: California County Agricultural Commissioner Administrative Civil Penalties Report, accessed through public records request to CDPR, fulfilled by Roy Hirose.

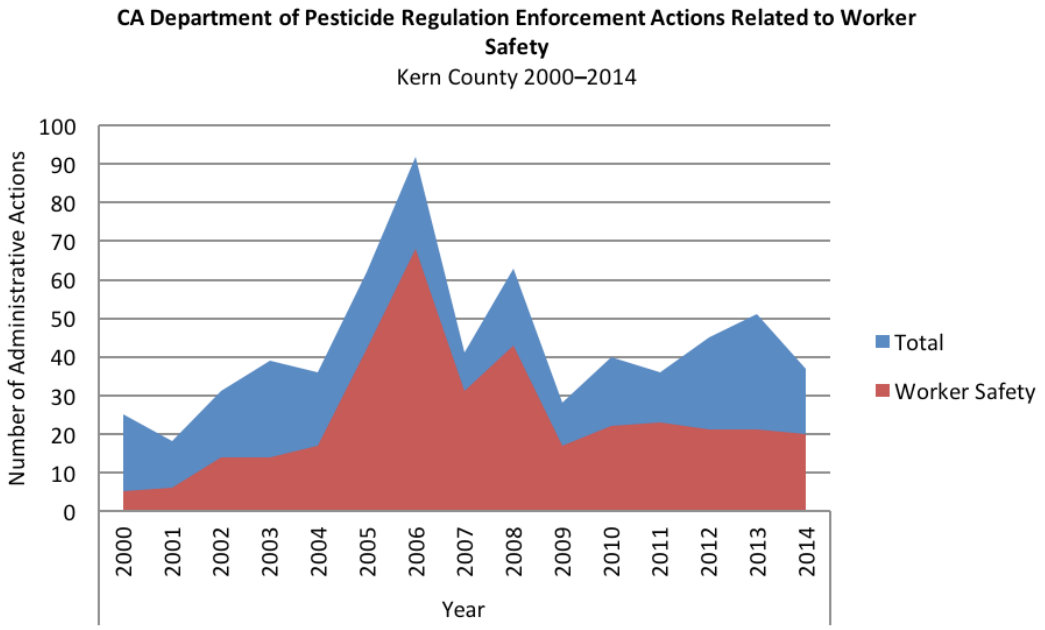
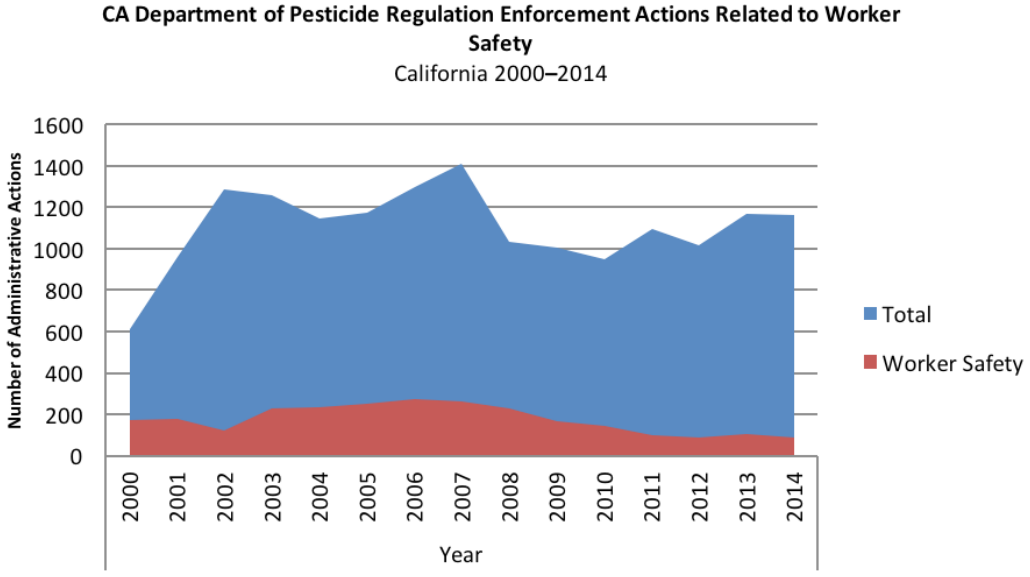


Figure 47b: CDPR Enforcement Actions related to worker safety in Kern County (2000–2014)

Source: California County Agricultural Commissioner Administrative Civil Penalties Report, accessed through public records request to CDPR, fulfilled by Roy Hirose.



Spray Safe – Kern County Farm Bureau

Spray Safe is a program of the Kern County Farm Bureau that encourages the safe application of agricultural chemicals through education and farmer to farmer communication and cooperation.

Pesticide spray drift is a concern because it affects human and animal health, can contaminate drinking water and natural habitats, and can damage crops and soils. Spray Safe was put into place more than a decade ago when current Spray Safe Committee co-chair, Jeff Rasmussen, observed that pesticide spray drift and overspray incidents could be avoided through education. He and others from the Farm Bureau, the Agricultural Commissioner's Office, and UC Cooperative Extension designed Spray Safe to educate farmers, applicators, workers and others in the agricultural industry about the safest practices in pesticide application.

In Kern County, pesticide accidents have decreased since Spray Safe's first conference in 2006. The program offers education in both English and Spanish to reach more farm labor workers.

GOAL 3.3: Kern County's water resources are conserved and support ecosystem health

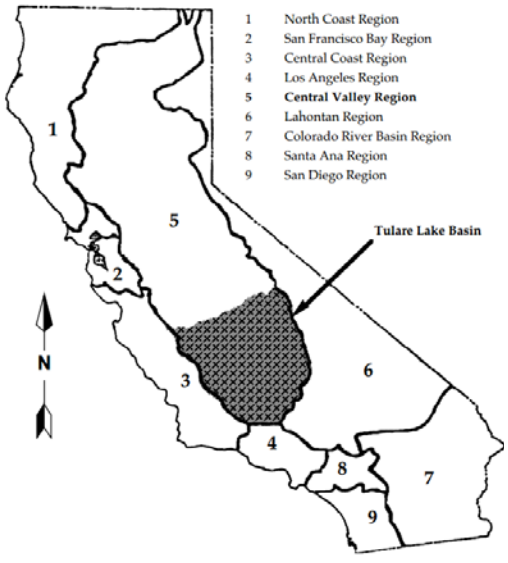
Background

Water Sources and Historical Use

The Tulare Lake Basin is located in the San Joaquin Valley, and is the southernmost water basin in California's Central Valley (See Figure X). Kern County and parts of Tulare, Kings, and Fresno Counties fall within the Tulare Lake Basin.

The majority of the native surface waters in the Tulare Lake Basin come from the Kings, Kaweah, Tule, and Kern Rivers. Rainfall in Kern County is highly variable both over time and across the county, with average precipitation ranging from 4–16 inches annually.[73] Most precipitation falls in the winter months.

Figure 48: Tulare Lake Basin Location, Regional Water Quality Control Boards
Source: California Regional Water Quality Control Board Central Valley Region[74]



Agriculture has been a major driver of the economy in the southern San Joaquin Valley for decades, and irrigated agriculture currently accounts for the majority of water used in the Tulare Lake Basin.[75]

The amount of farmland in production in the Central Valley doubled between the 1940s and 1960s, largely due to two inventions—the turbine pump, which increased access to groundwater in a region with limited surface

73 1981–2010 Prism Climate Group, Oregon State University. http://prism.oregonstate.edu/

74 Map published in the Water Quality Control Plan for the Tulare Lake Basin Second Edition, Revised July 2016. http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/2016july_tlbp.pdf

75 California Central Valley Regional Water Quality Control Board. (2014). Water Quality Control Plan for the Tulare Lake Basin.

water, and the Haber-Bosch process, which made nitrogen fertilizer cheap and readily available.[76]

These changes increased pressure on groundwater reserves, leading to overdraft and land subsidence in some areas as aquifers collapsed. Public water projects were then developed in the 1950s–1970s to help reduce reliance on groundwater resources. These public water projects brought water from other parts of the state to meet the water needs of the agricultural lands in the south.[77]

Today, imported surface water enters the Tulare Lake Basin through the San Luis Canal / California Aqueduct system and the Friant-Kern and Delta Mendota Canals. These water sources are of good quality but are still insufficient to completely meet the current needs of agriculture and development, so groundwater continues to be utilized to provide additional supply.[78] In the Kern River sub-basin, water pumped up with crude oil, commonly known as "produced water," also supplements the irrigation needs[79] in a small area serving the Cawello and North Kern Water Districts.[80]

Challenges

Major challenges to the sustainability of water resources in the Tulare Lake Basin include overdraft of groundwater reserves, accumulation of salts, and water contamination. Irrigated agriculture plays a role in each of these challenges, though it is not the only contributing factor.[81]

- **Overdraft of groundwater** reserves may occur when native and imported surface water supplies are not sufficient to meet the current needs of agriculture, industry, and development. Overdraft may contribute to salt accumulation, land subsidence, and increased costs to pump water as the most accessible groundwater reserves are exhausted.
- **Salt accumulation** occurs in soils and water when irrigation water evaporates or is used by a crop (transpiration), leaving the bulk of any salts in the water behind.[82] Though Kern County's surface waters are good quality and relatively low in salts, all irrigation water contains some dissolved mineral salts.[83] Imported water thus contributes more than a million tons of salt to the Tulare Lake Basin each year due to its high volume of use.[84,85]

  Prior to development, much of the Tulare Lake Basin was made up of shallow lakes and marshlands that evaporated or drained into the Delta through the San Joaquin River. Most of the surface waters that fed those wetlands have been diverted by development, however, and today the Tulare Lake Basin is a mostly closed basin with little outflow.[86]
- **Water contamination** can take a variety of forms and comes from a wide range of sources. Field drainage is the primary source of water contamination from agriculture. Field drainage is excess water not used by crops or evaporated, and may carry salts, nutrients, pesticides, or other agricultural by-products into the water supply.

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76 Harter, T., & Lund, J. (2012). Addressing nitrate in California's drinking water. With a Focus on Tulare Lake Basin and Salinas Valley Groundwater. *Report for the State Water Resources Control Board Report to the Legislature. Davis, CA: UC Davis Center for Watershed Sciences.* http://groundwaternitrate.ucdavis.edu/files/138956.pdf

77 Ibid

78 California Regional Water Quality Control Board, Central Valley Region. (2016). *Water Quality Control Plan for the Tulare Lake Basin, Second Edition.* Retrieved March 21, 2017, from http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/2016july_tlbp.pdf

79 Ibid

80 Personal communication with Blake Sanden, UCCE Kern County, March 2017

81 California Regional Water Quality Control Board, Central Valley Region. (2016). *Water Quality Control Plan for the Tulare Lake Basin, Second Edition.* Retrieved March 21, 2017, from http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/2016july_tlbp.pdf

82 State Water Resources Control Board. (2016). Groundwater Information Sheet – Salinity. Retrieved March 21, 2017, from http://waterboards.ca.gov/gama/docs/coc_salinity.pdf

83 University of California Agriculture and Natural Resources. (2002). Irrigation, Water Salinity, and Crop Production. Retrieved March 21, 2017, from http://vric.ucdavis.edu/pdf/Irrigation/IrrigationWaterSalinityandCropProduction.pdf

84 Central Valley Regional Water Quality Control Board Watershed Management Initiative. (2002). State of the Watershed Report – Tulare Lake Watershed. Retrieved March 21, 2017 from http://www.waterboards.ca.gov/centralvalley/water_issues/watershed_management/10tulare.pdf

85 California State Water Resources Control Board. (n.d.). Overview of Salinity Issues in the Central Valley. Retrieved March 21, 2017, from http://www.swrcb.ca.gov/rwqcb5/water_issues/basin_plans/cvwb_jt_pub_wkshp/salt_staff_rpt.pdf

86 Sholes, D. (2006). Lithology and Groundwater Conditions in the Tulare Lake Basin. Central Valley Regional Water Board. Retrieved March 21, 2017, from http://www.swrcb.ca.gov/rwqcb5/about_us/tlb_hydrogeology.pdf

INDICATOR 3.3.1 Dissolved nitrate in Kern County water systems

Background

Nitrogen is a natural element that occurs in many forms and is a critical nutrient to living organisms. It is found in the Earth's atmosphere, oceans, soils, and rocks.

Nitrate is a water soluble form of nitrogen that is produced both naturally and through human activities. In the food system, two major sources of nitrates are crop fertilizer and animal manure.

In addition to being one of the most important plant nutrients, nitrate is also one of the most common chemical groundwater contaminants in the world.[87] Nitrate moves easily in water and is then difficult and expensive to remove.[88] At high levels it can cause health problems, particularly in infants, and is regulated by the California Department of Public Health as a drinking water contaminant.

The drinking water standard, or maximum contaminant level (MCL), for nitrates in California is 45 mg/L.[89] Only drinking water is legally required to meet this standard, but it is used as a common reference level when examining nitrate levels in ground and surface water as well.

MEASURE 1: Dissolved nitrate detected in Kern County surface water

Background

Surface waters include native rivers, streams and lakes. In the Southern Central Valley, imported water flowing through canals and aqueducts is another common type of surface water. Surface waters may contain water from precipitation, surface runoff, groundwater discharge, release from watershed storage, and human sources.[90]

Although surface waters can become contaminated with nitrate, this is uncommon in arid regions like Kern County, where natural precipitation is less likely to produce surface runoff from agricultural fields than in other parts of the country.

Surface waters in Kern County are generally of high quality and have low levels of salts and other contaminants, including nitrates.

Kern County Trends

Surface waters in Kern County do not contain nitrate at levels of public health concern.

Figure 49 shows the levels of nitrate detected at California Department of Water Resources surface water monitoring stations between 1972 and 2013. During the almost 40 year period included here, there was never a sample taken that exceeded the California drinking water standard of 45 mg/L. Figure 49 shows both the average level in all samples and the highest level detected that year.

A full list of surface water monitoring stations is included in Appendix G.

87 Spalding, R. F., & Exner, M. E. (1993). Occurrence of nitrate in groundwater—a review. *Journal of environmental quality,* 22(3), 392-402.

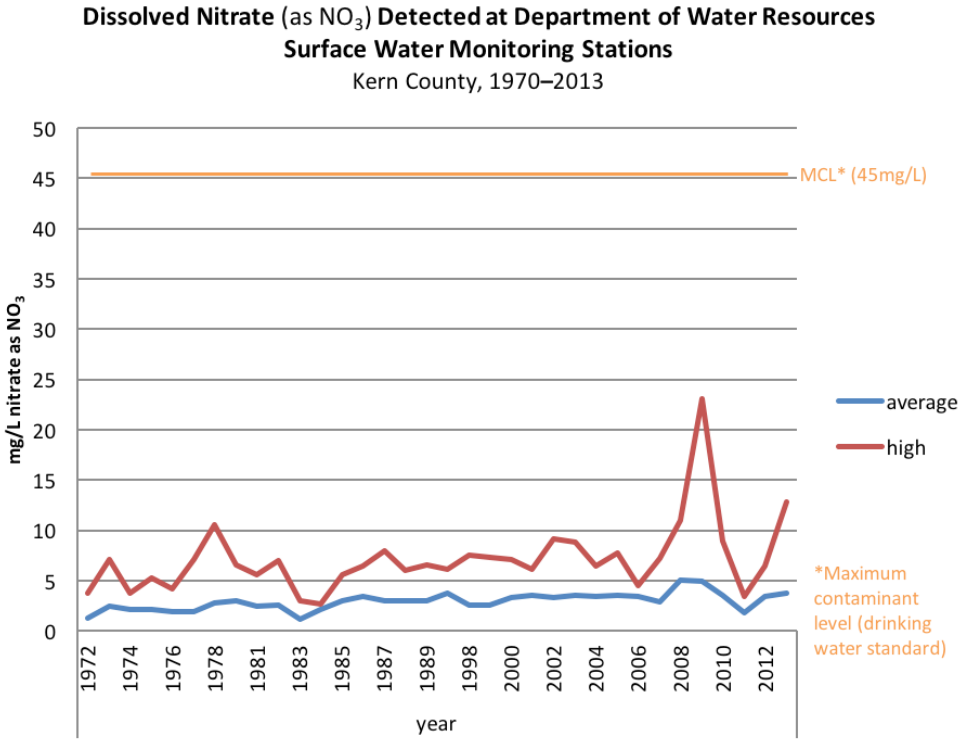
88 California State Water Resources Control Board. (2016). Groundwater Info Sheet – Nitrate. Retrieved March 21, 2017, from http://www.waterboards.ca.gov/gama/docs/coc_nitrate.pdf

89 Nitrate levels may be expressed as either NO_3 or NO_3-N. The MCL for NO_3 is 45 mg/L. The MCL for NO_3-N is 10 mg/L. These levels are equivalent. All NO_3-N samples in this report have been converted to NO_3 for ease of comparison.

90 Spahr, N. E., Dubrovsky, N. M., Gronberg, J. M., Franke, O. L., & Wolock, D. M. (2010). Nitrate loads and concentrations in surface-water base flow and shallow groundwater for selected basins in the United States, water years 1990-2006 (No. 2010-5098). US Geological Survey.

Figure 49: Dissolved nitrate detected at surface water monitoring stations in Kern County (1972–2013) (excluding tile drain samples)[91]

Source: California Department of Water Resources Water Data Library



MEASURE 2: Dissolved nitrate detected in Kern County groundwater

Background

Dissolved nitrate in groundwater is considered the most significant water quality challenge in the United States.[92,93,94] The primary source of nitrate in groundwater is the use of commercial fertilizer in agricultural areas, followed by livestock waste. In developed (urban, suburban) areas, human waste is the third largest contributor.[95]

Nitrate contamination of groundwater depends both on how much nitrate is going into the system and on how susceptible a particular aquifer is to contaminant transport.

Since the 1940s, the amount of nitrogen fertilizer sold in California has increased over 800 percent[96] as agricultural production in the state has grown. This has been largely due to technological advances that made both water and nitrogen fertilizer more accessible, increasing yields and leading to the expansion of irrigated cropland. Nitrogen fertilizer is a relatively low cost input (though its average cost is increasing), particularly when compared to agricultural revenues in the Central Valley.

91 The average number of surface water samples taken per year (excluding tile drain samples) was n=40. This usually represented monthly monitoring of 2–4 locations, plus additional single or double samples at additional locations in some years. The highest number of samples taken was 96 in 2013, and the lowest was 20 in 1990.

92 Ruddy, B. C., Lorenz, D. L., & Mueller, D. K. (2006). County-level estimates of nutrient inputs to the land surface of the conterminous United States, 1982-2001 (No. 2006-5012). US Geological Survey; Scientific Investigations Report 2006-5012;

93 DeSimone, L. A., Hamilton, P. A., & Gilliom, R. J. (2009). Quality of water from domestic wells in principal aquifers of the United States, 1991-2004: overview of major findings. US Department of the Interior, US Geological Survey;

94 Dubrovsky, N. M., Burow, K. R., Clark, G. M., Gronberg, J. M., Hamilton, P. A., Hitt, K. J., ... & Rupert, M. G. (2010). The quality of our Nation's waters-Nutrients in the Nation's streams and groundwater, 1992-2004 (No. 1350). US Geological Survey

95 Central Coast Regional Water Quality Control Board. (2011). Water Quality Conditions in the Central Coast Region Related to Agricultural Discharges.

96 Ibid

PHOTO CREDIT: SUSAN REEP

Young dairy cattle in Kern County.

As a result, it may be over-applied at times to help mitigate risk and ensure high yields.[97] Manure from dairies is another significant source of nitrogen in the Central Valley.

Nitrate gets into groundwater through different mechanisms, but the most common is the leaching of applied fertilizer. When water-soluble fertilizer and irrigation are both applied, excess irrigation water can leach below the root zone of the crops and make its way to the groundwater, carrying nitrates and other contaminants with it. A recent UC report suggests that almost 40 percent of the fertilizer applied in the Central Valley leaches into groundwater as nitrate.[98]

There are approximately 400 square miles in the Tulare Lake Basin that contain groundwater wells with elevated nitrate levels. In Kern County, groundwater is impacted primarily in Delano, McFarland, Wasco-Shafter, Bakersfield, Maricopa, and Taft.[99] The principal sources of nitrates in the Tulare Lake Basin are irrigated agriculture and dairies.[100]

Kern County Trends

Nitrate occurs naturally in groundwater at levels generally less than 8.9 mg/L NO_3.[101]

Figure 50 shows that over the past 23 years, groundwater sample averages in Kern County have ranged from approximately one third of this maximum natural level (2.8 in 2001) to approximately triple this level (26.7 in 2002). These fluctuations may be due to changing levels or to changing sampling locations from year to year.

Average nitrate levels during this time period never exceeded the California maximum contaminant level of 45 mg/L NO_3. The average groundwater nitrate level in 2014 in Kern County was 17.4 mg/L NO_3. There does not appear to have been a change in average annual nitrate levels in groundwater over the past two decades.

Single samples, however, have exceeded the drinking water standard in several years, including 1992, 1995, 2002, 2006, 2008, and 2010. The samples exceeding the California maximum contaminant level in these years ranged from 48.7 to 74.9 mg/L NO_3. Again, there does not appear to be a trend over time in these levels.

97 Ibid

98 Harter, T. (2003). Agricultural Impacts on Groundwater Nitrate, Southwest Hydrology, 8(4): 22–23, 35.

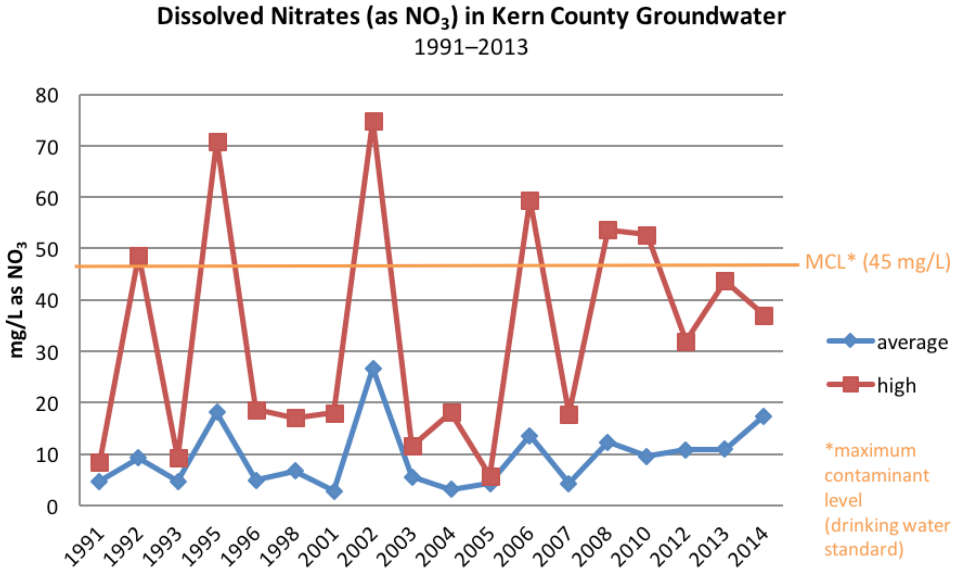
99 Central Valley Regional Water Quality Control Board Watershed Management Initiative. (2002). State of the Watershed Report – Tulare Lake Watershed. Retrieved March 21, 2017 from http://www.waterboards.ca.gov/centralvalley/water_issues/watershed_management/10tulare.pdf

100 Ibid

101 Central Coast Regional Water Quality Control Board. (2011). Water Quality Conditions in the Central Coast Region Related to Agricultural Discharges.

Figure 50: Dissolved nitrates (as NO_3) in Kern County groundwater (1991–2013)[102]

Source: United States Geological Survey (USGS), National Water Information System (NWIS), queried via the Water Quality Portal (WQP), a collaborative tool of the National Water Quality Monitoring Council, the USGS, and the EPA.



Groundwater sampling locations, as well as the number of samples taken each year, can be viewed in Appendix H.

MEASURE 3: Nitrate maximum contaminant level (MCL) violations in Kern County public drinking water systems

Background

Most people living in California get their drinking water through public water systems. About half of this water is sourced from groundwater and half from surface water.[103] Public water systems are tested for over 90 regulated contaminants,[104] and at any given time, 98 percent of consumers receive safe drinking water[105] through these systems.[106] The EPA requires public notification when problems with water quality arise in public water systems.[107]

Approximately 4 percent of Californians—or about 1.5 million people—depend on private domestic wells for drinking water. [108] Figure 51 shows the number of households per census tract that are dependent on private wells in California.

102 Years with fewer than 10 samples omitted from results. Number of samples taken per year ranged from 10 to 140.

103 Shelton, J., Pimentel, I., Fram, M., & Belitz, K. (2006). Groundwater quality data in the Kern County sub-basin study unit, 2016—Results from the California GAMA program. US Geological Survey & California State Water Resources Control Board.

104 Environmental Protection Agency. (n.d.). Public Notification Rule. Retrieved March, 21, 2017, from https://www.epa.gov/dwreginfo/public-notification-rule

105 Water that meets federal and state quality standards

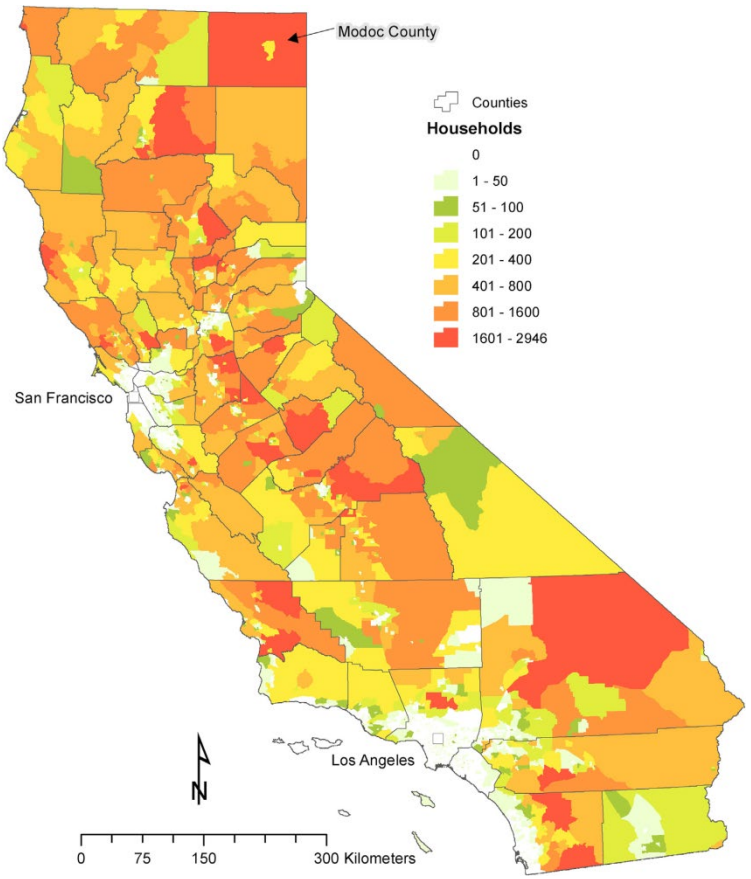
106 California Water Board. (2015). Safe drinking water plan for California: Report to the legislature. Retrieved March 22, 2017, from http://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf

107 Environmental Protection Agency. (n.d.). Public Notification Rule. Retrieved March, 21, 2017, from https://www.epa.gov/dwreginfo/public-notification-rule

108 Johnson, T., & Belitz, K. (2015). Identifying the location and population served by domestic wells in California. *Journal of Hydrology: Regional Studies,* 3, 31–86

Figure 51: Number of households per census tract using a domestic well for drinking water source (Kern County circled)

Source: Johnson, T., & Belitz, K. (2015). Identifying the location and population served by domestic wells in California. Journal of Hydrology: Regional Studies*, 3, 31–86. (1990 US Census question code H023: Source of Water, reported as "Individual Well")*



In the U.S., domestic wells are more than twice as likely as public water systems to exceed public drinking water standards for nitrates. These wells are shallower on average than wells serving public water systems, and are more likely to be in close proximity to agricultural land.[109]

Of the 7,600 public water systems in California, 63 percent are considered small, meaning they include fewer than 200 service connections.[110] Small drinking water systems, like domestic wells, are more likely to be found in rural communities and less likely to meet public drinking water standards—less than 50 percent of small systems meet drinking water standards for all contaminants at all times.[111] This is particularly true of water systems that serve disadvantaged communities.[112] These small water systems are overseen by local county health departments, while larger systems are regulated at the state level.

109 Dubrovsky, N., Burow, K., Clark, G., Gronberg, J., Hamilton, P., Hitt, K., ... & Rupert, M. (2010). Nutrients in the Nation's Streams and Groundwater, 1992–2004, Circular 1350. *US Geological Survey, Reston, VA, USA*.

110 California Water Board. (2015). Safe drinking water plan for California: Report to the legislature. Retrieved March 22, 2017, from http://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf

111 California Department of Health Services–Office of Drinking Water. (1993). Drinking water into the 21st century: safe drinking water plan for California. Retrieved November 7, 2017, from https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/dwdocuments/DrinkingWaterintothe21stCenturySafeDrinkingWaterPlanforCA.pdf

112 California Water Board. (2015). Safe drinking water plan for California: Report to the legislature. Retrieved March 22, 2017, from http://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf

While domestic wells are not regularly monitored for nitrate or other contaminants,[113] drinking water quality data is available for public water systems of all sizes through the EPA's Safe Drinking Water Information System (SDWIS).

Public health guidelines for drinking water quality are expressed in terms of Maximum Contaminant Levels, or MCLs. An MCL is a legally enforceable water quality standard for a given contaminant. The California MCL for nitrate is 45 mg/L.[114] MCLs apply to water that is delivered to consumers, which has typically been treated, disinfected, or sometimes blended with other water sources to achieve acceptable water quality.[115]

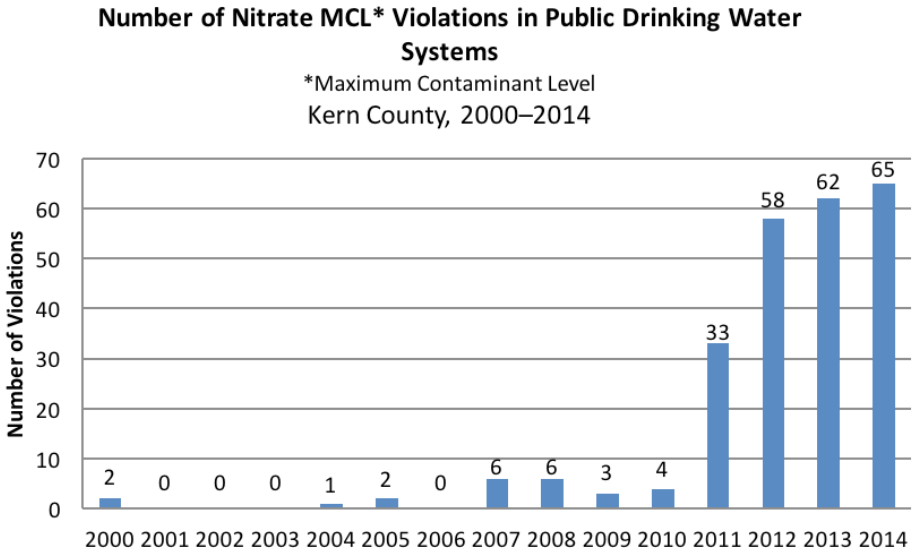
Kern County Trends

In Kern County, the majority of water systems rely primarily on groundwater.[116],[117] There are 342 active water systems in the county,[118] and these systems are monitored regularly[119] for drinking water contaminants, including nitrate.

Figure 52 shows the total number of drinking water samples in Kern County that exceeded the MCL for nitrate each year. In all cases where drinking water tested above the MCL for nitrate, the primary water source for that system was groundwater.[120]

Figure 52: Total number of nitrate maximum contaminant level (MCL) violations in public drinking water systems in Kern County (2000–2014)

Source: U.S. Environmental Protection Agency, Safe Drinking Water Information System (SDWIS)



113 With the exception of a handful of county-level studies, data for nitrate levels in private wells in California are not publicly available. Source: Central Coast Regional Water Quality Control Board. (2011). Water Quality Conditions in the Central Coast Region Related to Agricultural Discharges. Retrieved 11/14/17 from https://www.waterboards.ca.gov/centralcoast/board_info/agendas/2011/march/Item_14/14_att7.pdf

114 Nitrate levels may be expressed as either NO_3 or NO_3-N. The California Department of Public Health expresses the MCL for nitrate as NO_3 (the CA MCL is 45 mg/L). The U.S. Environmental Protection Agency expresses the MCL for nitrate NO_3-N (the U.S. MCL is 10 mg/L). These levels are equivalent, they are just expressed differently. All NO_3-N samples in this report have been converted to NO_3 for ease of comparison.

115 Shelton, J., Pimentel, I., Fram, M., & Belitz, K. (2006). Groundwater quality data in the Kern County sub-basin study unit, 2016—Results from the California GAMA program. US Geological Survey & California State Water Resources Control Board.

116 SDWIS (Safe Drinking Water Information System), data queried March 13, 2017. Query: California, Kern County, All size systems, Active Systems. 92% of systems in Kern County rely primarily on groundwater. However, some systems are very small, so this does not fully describe the origins of drinking water supplies in Kern, either in terms of total flow (in acre feet) or in terms of individuals served.

117 Personal communication with Jason Meadors, City of Bakersfield Water Resources Director, March 13, 2017.

118 The Environmental Protection Agency's Safe Drinking Water Information System (SDWIS) lists 178 community water systems (CWS), 84 non-transient non-community water systems (NTNCWS), and 80 transient non-community water systems (TNCWS) in Kern County. CWS serve the same people year-round (e.g., homes or businesses). NTNCWS serve the same people, but not year round (e.g., schools). TNCWS do not consistently serve the same people (e.g., gas stations, camp grounds).

119 State Water Resources Control Board, Division of Drinking Water. (2015). Annual Compliance Report. Retrieved March 22, 2017, from http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/dwdocuments/2015/2015_acr.pdf

120 SDWIS (Safe Drinking Water Information System), data queried October 28, 2015.

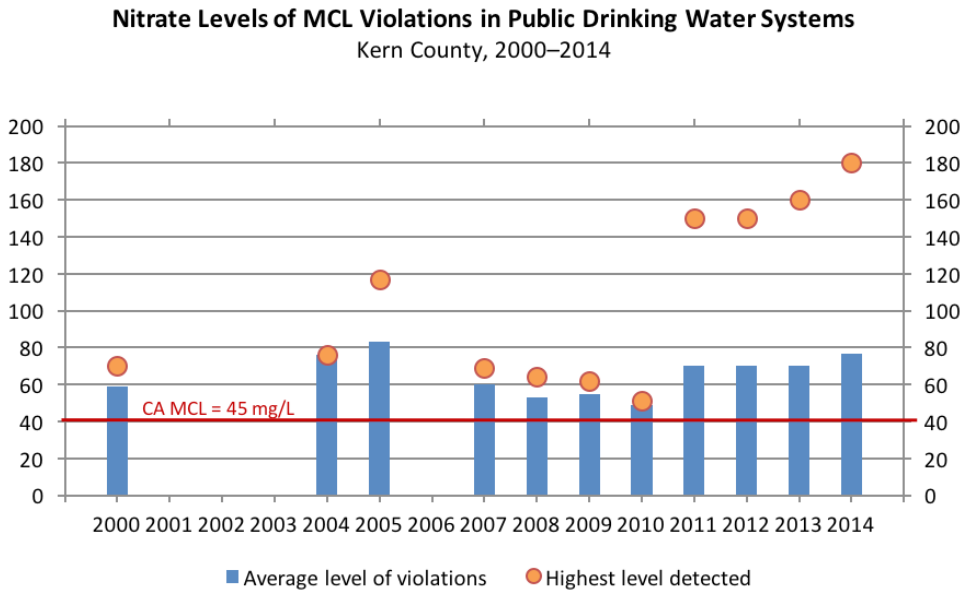
All public water systems are sampled for nitrates annually and the results are uploaded to the EPA's Safe Drinking Water Information System (SDWIS).[121] If a system tests above the MCL it is required to undergo additional quarterly testing until samples are less than 50 percent of the MCL for four consecutive quarters.[122]

There are 342 active water systems in Kern County.[123] Though this number may vary slightly from year to year, this means that approximately between 342 and 1,368 (342 x 4) samples are taken annually to test for nitrate. The actual number of samples is likely closer to the lower end, since most water systems are in compliance with the nitrate MCL each year and would only be tested once annually.

The total number of nitrate MCL violations in Kern County has increased substantially since 2011, from fewer than 10 to more than 50. However, the majority of drinking water samples (between 81–95 percent in 2014, depending on the total number of samples) are still in compliance with the public health standard for nitrate.

Figure 53 shows both the average concentration of nitrate (blue bars) and highest concentration of nitrate (orange dots) found in the MCL violations recorded that year. These are the nitrate levels found only in those water samples that exceeded the MCL, not all water samples. These samples give an idea of how much the MCL is being exceeded when violations take place, and do not represent the average nitrate levels in public water systems.

Figure 53: Concentration of nitrate found in water samples that exceeded the maximum contaminant level (MCL) in Kern County public drinking water systems (2000–2014)
Source: U.S. Environmental Protection Agency, Safe Drinking Water Information System (SDWIS)



121 State Water Resources Control Board, Division of Drinking Water. (2015). Annual Compliance Report. Retrieved March 22, 2017, from http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/dwdocuments/2015/2015_acr.pdf

122 Personal communication with the office of Jesse Dhaliwal (661-335-731) and Carly Ho at the Environmental Protection Agency (415-972-3458)

123 State Water Resources Control Board, Division of Drinking Water. (n.d.). Water Systems List. Retrieved March 22, 2017, from https://sdwis.waterboards.ca.gov/PDWW/JSP/WaterSystems.jsp?PointOfContactType=none&number=&name=&county=Kern

The majority of MCL violations in the last 15 years were recorded in the last three years of available data (2012–2014). During this time period, the average nitrate level of MCL violations ranged from 70 to 77 mg/L. The majority of the MCL violations during these three years occurred in Bakersfield and Weldon.

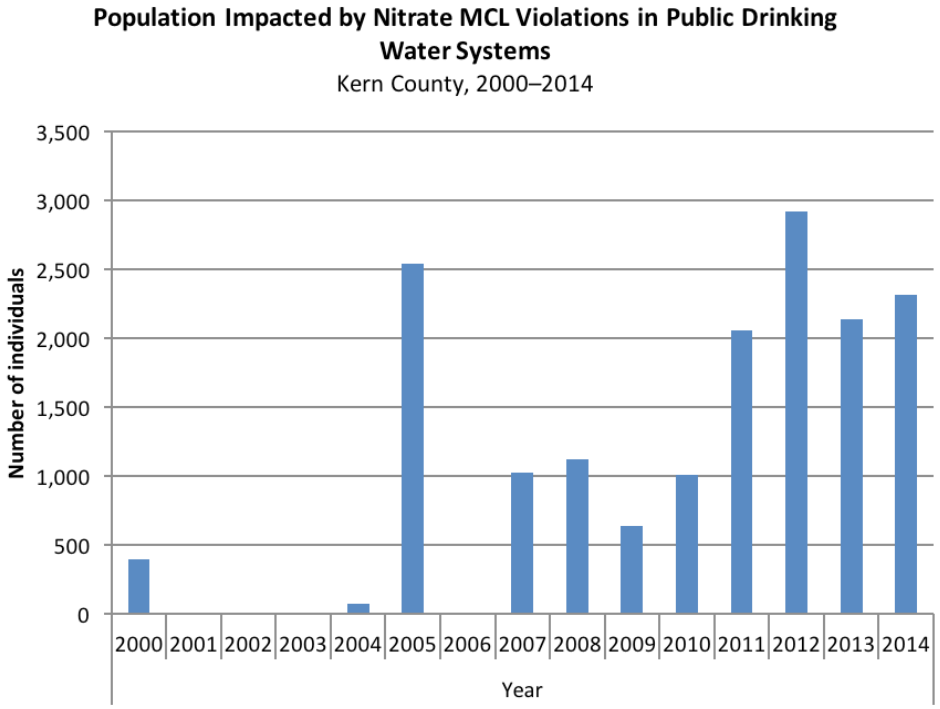
In each of these three years, there were multiple individual samples in which the nitrate level that was detected was double or triple the MCL. The majority of the MCL violations in which nitrate was detected at above 100 mg/L were in Bakersfield, Inyokern, Lamont, and Weldon.

Out of 342 active water stations in Kern County, 15 regularly exceeded the MCL for nitrate (more than 10 violations in the last 15 years). Of these systems with regular violations, all are small (fewer than 200 connections). Most serve fewer than 200 individuals and all serve fewer than 500 individuals. Approximately half of the 15 were residential water supplies and half were institutions, businesses, recreation areas, or industrial/agricultural sites.

Figure 54 shows the number of individuals each year served by drinking water systems with nitrate levels over the MCL in Kern County.

Figure 54: Population impacted by nitrate Maximum Contaminant Level (MCL) violations in Kern County public drinking water systems (2000–2014)

Source: U.S. Environmental Protection Agency, Safe Drinking Water Information System (SDWIS)



An average of 1,083 individuals per year have been served by public water systems that exceed the MCL for nitrate in Kern County over the last 15 years. This represents approximately a tenth of one percent (0.1 percent) of the total population of Kern County. The number of people impacted has been roughly double that average in the last five years (an average of 2,089 individuals per year 2010–2014), but this still represents a fraction of a percent of the total population.

INDICATOR 3.3.2 Agricultural water use in Kern County

Background

The natural rainfall in the Tulare Lake Basin falls primarily in the winter months, and is insufficient to meet the current needs of agriculture in the region. As a result, most of the region's crops are irrigated.

Irrigation is the application of water to crops by various methods. Common methods include drip, sprinkler, flood, and furrow. Irrigation has multiple beneficial uses in agriculture in addition to meeting the direct water needs of a crop. Irrigation water can be used to control soil salinity in the root zone, to protect crops from frost damage, and provide for groundwater recharge.[124] Irrigation application rates vary depending on geology, climate, crop, and irrigation method, and also take into account expected losses to evaporation or runoff. In the Central Valley, irrigation water may come from ground or surface water resources (native or imported).

The California Water Code (CWC) defines water conservation as "the efficient management of water resources for beneficial uses, preventing waste, or accomplishing additional benefits with the same amount of water."[125] In the context of agriculture, this often means increasing water productivity, which is usually expressed as the crop yields produced by each unit of water, or in the common vernacular, "crop per drop."

Over the past four decades, California has improved water delivery and management practices, increasing yields and economic returns while reducing the total water applied to crops by more than 5 percent.[126] The economic return on agricultural water use has nearly doubled during the same time period, from $651 per acre-foot in 1967 to $1280 per acre-foot in 2010.[127] Many factors impact agricultural productivity and value, including plant breeding for improvement, fertility management, pest control, crop selection, and market conditions. Each of these factors may have contributed to rising economic returns on water use in addition to improvements in efficiency.

Efficient management of water resources is rarely as simple as reducing the amount of irrigation water applied at the field level. Though higher efficiency irrigation methods (like drip and micro-sprinkler) may reduce the water applied to a field, efficiency can also mean producing higher yields with the same amount of water.

Also, farming cannot be isolated from the environment in which it takes place. A prominent characteristic of California agriculture is the reuse of water for multiple beneficial purposes, both on and off-farm.[128] Water that is "lost" at the field level may be used for a different purpose at another level. For example, water that runs off of one field may be collected and reused on another field or at another farm. Also, water that is "lost" to agricultural use may benefit the regional water basin by recharging groundwater or feeding into wildlife habitat.

In this context, protecting water quality may be more important than reducing the amount that is used, particularly in agricultural systems where water is often reused many times.

Although there are clear benefits associated with agricultural water use, there are also costs. Irrigation contributes to several of the water quality challenges in the Central Valley, including overdraft of groundwater, land subsidence, salt accumulation, and water contamination. In this section we will look at trends in agricultural water use in Kern County over time.

124 Hanson, B. (2009). California Agriculture, Water, and You. Davis, California: University of California, Davis. Retrieved March 22, 2017, from http://www.pge.com/includes/docs/pdfs/shared/edusafety/training/pec/water/blaine-hanson_water_forum_complete.pdf

125 California Water Code, Section 10817

126 California Department of Water Resources. (2016). Agricultural Water Use Efficiency: A Resource Management Strategy of the California Water Plan.

127 Adjusted to 2010 dollars. "Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2010" contained in the Update 2013 Water Plan Update Volume 4 Reference Guide

128 California Department of Water Resources. (2016). Agricultural Water Use Efficiency: A Resource Management Strategy of the California Water Plan. Retrieved March 22, 2017, from http://www.water.ca.gov/waterplan/docs/rms/2016/01_Ag_Water_Efficiency_July2016.pdf

California Almond Sustainability Program (CASP)

The California Almond Sustainability Program (CASP), led by the Almond Board of California, is an online education portal dedicated to helping growers improve efficiencies and to demonstrate sustainable almond-production practices to buyers, regulators, and consumers. Through the CASP portal, almond growers and handlers can complete self-assessment modules, use decision support tools, and learn about alternative practices and best practices to help them optimize their environmental, economic, and social performance.

Kern County almond growers are showing good levels of participation in CASP. Since the creation of the CASP SustainableAlmondGrowing.org website in 2009, 130 Kern County almond orchards — totaling 51,007 bearing acres, or about 15% of all Kern County almond acreage — has been assessed online. These Kern County growers are using many of CASP's key practices, with over 90% using recommended practices promoting bee health and pollination, over 84% using key recommended air stewardship practices, and over 70% using key water stewardship practices, including deficit irrigation.

Almonds in bloom, Kern County.

PHOTO CREDIT: SUSAN REEP

MEASURE 1: Acreage of irrigated agriculture in Kern County

Background

Approximately 800,000 acres of cropland are irrigated in Kern County, or approximately one third of all agricultural lands.[129] The majority of non-irrigated farmland is in rangeland use.[130] Depending on the year, Kern County crops require between 200,000 and 1 million more acre feet of water than is available through surface waters (native and imported). This deficit is supplied by groundwater pumping.[131]

Water for irrigation is the most expensive component of Kern County agriculture, costing from $80 to $1500 per acre-foot, depending on the water district, depth to groundwater and the need to buy "emergency pool" water through the CA Department of Water Resources during the last five years of drought.[132] Recent studies have shown that irrigation in Kern County is highly efficient at the field level, with efficiency levels averaging 95 percent.[133]

Water use depends on multiple factors, including crop type and growth stage, irrigation type, and geologic and climate conditions.

129 USDA Census of Agriculture

130 Kern County Crop Reports, Kern County Agricultural Commissioner

131 Sanden, B. (2008). How Good Is Water Use Efficiency in California Agriculture? Kern County University of California Cooperative Extension.

132 Personal communication, B. Sanden, March 2017

133 Sanden, B., Hockett, B., & Enzweller, R. (2003). Soil moisture sensors and grower "sense" abilities: 3 years of irrigation scheduling demonstrations in Kern County. In *Proc. Tech. Conf. of the Irrigation Assoc., San Diego, CA* (pp. 242-250).

Kern County Trends

Figures 55a and 55b show trends in the total acres of irrigated and non-irrigated farmland in Kern County and California, respectively. At both the county and state level, total acres of farmland are decreasing while acres of irrigated agriculture have remained relatively stable. As a result, irrigated farmland as a percentage of all farmland is increasing, as shown in Figure 55c.

Figure 55a: Total acres of irrigated and non-irrigated farmland in Kern County (1982–2012)
Source: USDA Census of Agriculture

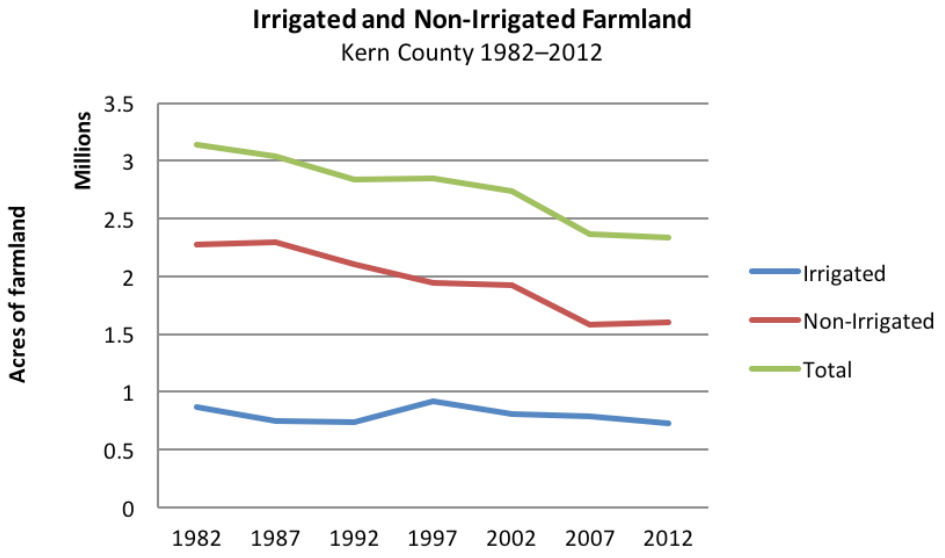


Figure 55b: Total acres of irrigated and non-irrigated farmland in California (1982–2012)
Source: USDA Census of Agriculture

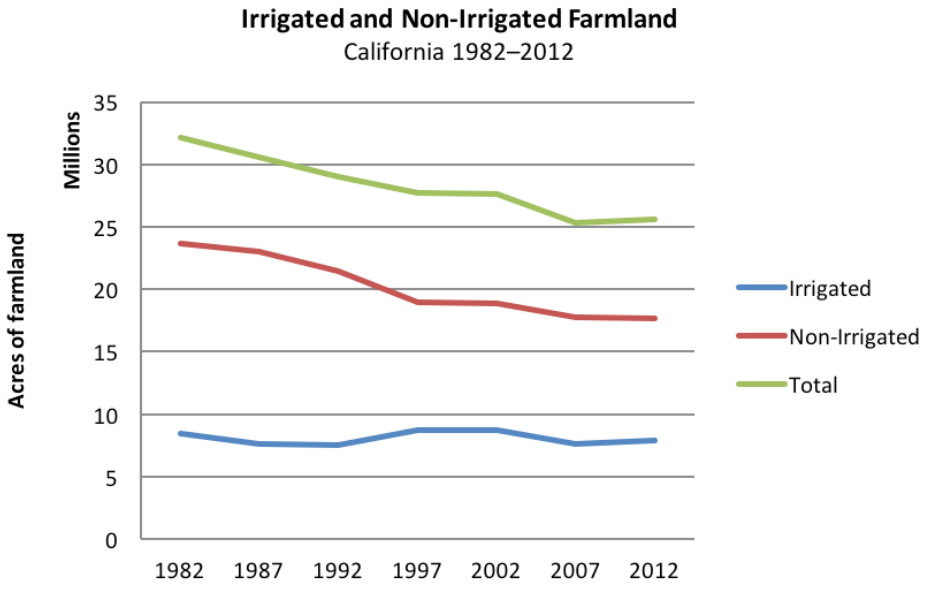
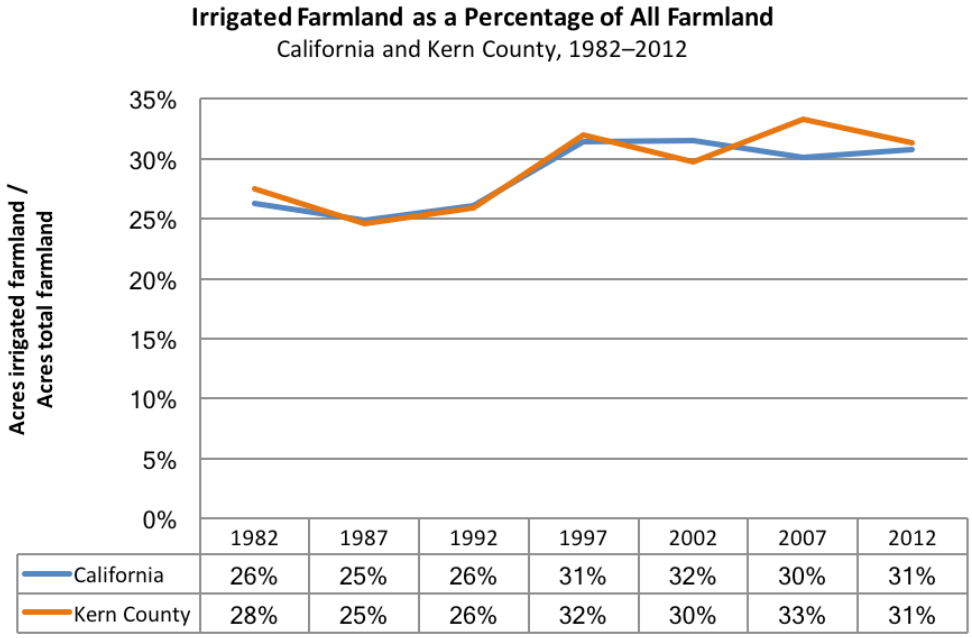


Figure 55c: Irrigated farmland as a percentage of all farmland in California and Kern County (1982–2012)

Source: USDA Census of Agriculture



	1982	1987	1992	1997	2002	2007	2012
California	26%	25%	26%	31%	32%	30%	31%
Kern County	28%	25%	26%	32%	30%	33%	31%

MEASURE 2: Average water requirements of harvested crops in Kern County

Background

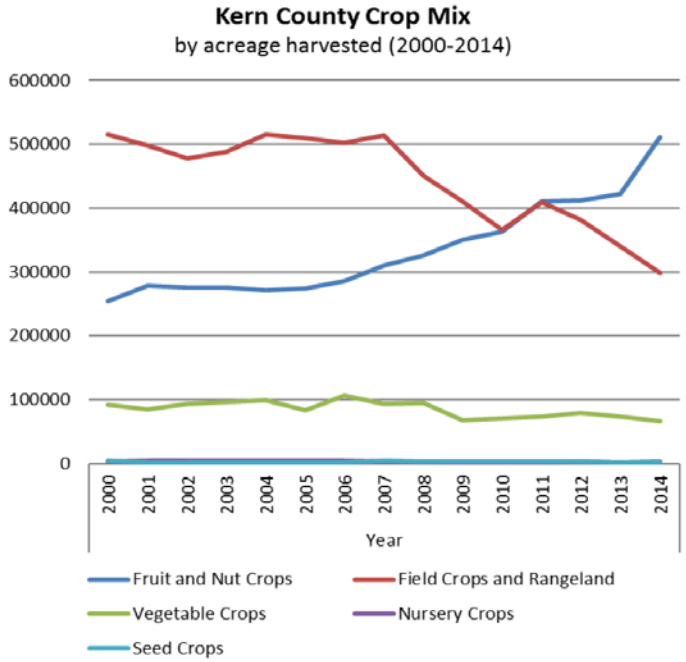
A common method of estimating the water requirement of a crop is to look at that crop's theoretical annual evapotranspiration (ETc). This is the amount of water the crop needs to live and grow. This does not take into account other beneficial uses of irrigation, like flushing salts from the crop root zone, and it does not take into account different methods of irrigation. For example, a crop's water needs could be met by flooding a field, in which case a large amount of water is applied every 10 to 14 days, or by precision drip irrigation applied every one to four days.

Cropping patterns have changed in Kern County over time. Figure 56 shows a sharp increase in the acres harvested of fruit and nut crops in Kern County over the last 15 years, accompanied by a decrease in field and rangeland crops and a slight decrease in vegetable crops.

PHOTO CREDIT: SUSAN REEP

PHOTO CREDIT: DOUG KESSLER

Figure 56: Kern County crop mix by acres harvested (2000–2014)
Source: Kern County Agricultural Commissioner's Annual Crop Reports



Although there is evidence that irrigation efficiency in the Central Valley is high and increasing,[134] particularly in the high value orchard crops that are expanding in Kern County,[135] concerns are still sometimes raised that changing crop patterns may lead to increased or unsustainable demands on the water system. Analyzing Kern County's overall water system sustainability is beyond the scope of this assessment, but we can look at the average theoretical water needs of the crops in Kern County over time.

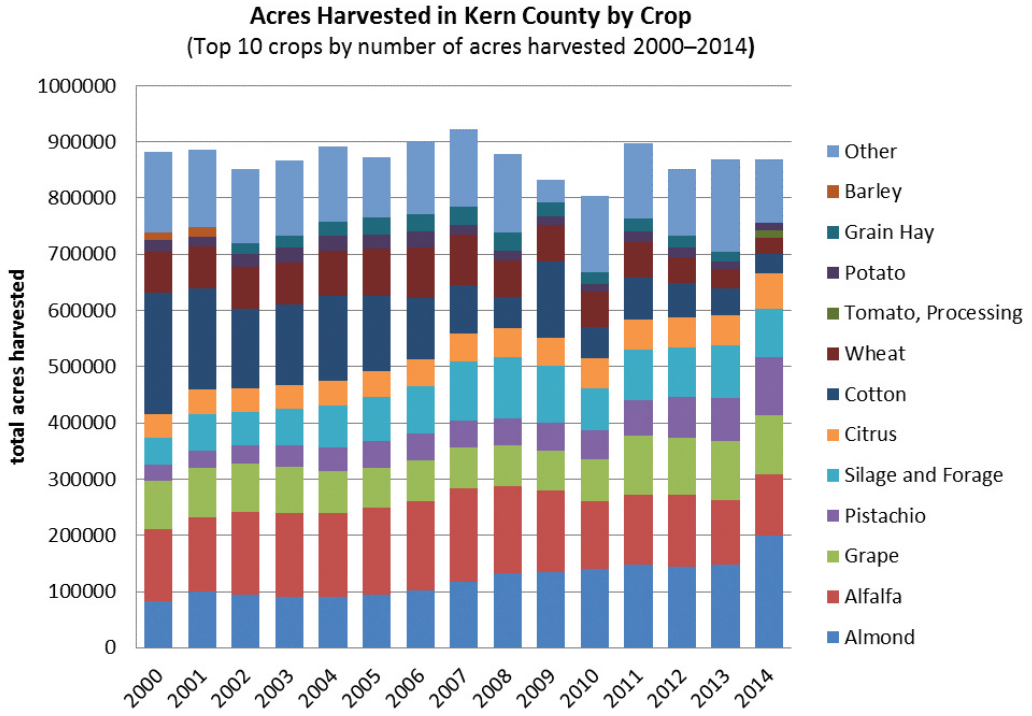
134 Sanden, B., Hockett, B., & Enzweller, R. (2003). Soil moisture sensors and grower "sense" abilities: 3 years of irrigation scheduling demonstrations in Kern County. In *Proc. Tech. Conf. of the Irrigation Assoc., San Diego, CA* (pp. 242-250).

135 Hanson, B. (2009). California Agriculture, Water, and You. Davis, California: University of California, Davis. Retrieved March 22, 2017, from http://www.pge.com/includes/docs/pdfs/shared/edusafety/training/pec/water/blaine-hanson_water_forum_complete.pdf

Kern County Trends

Figure 57 shows the top 10 crops by number of acres harvested over the past 15 years in Kern County.[136] The crops make up more than 80 percent of the crops harvested in Kern County in any given year.

Figure 57: Top crops in Kern County by acres harvested (2000–2014)
Source: Kern County Agricultural Commissioner's Annual Crop Reports



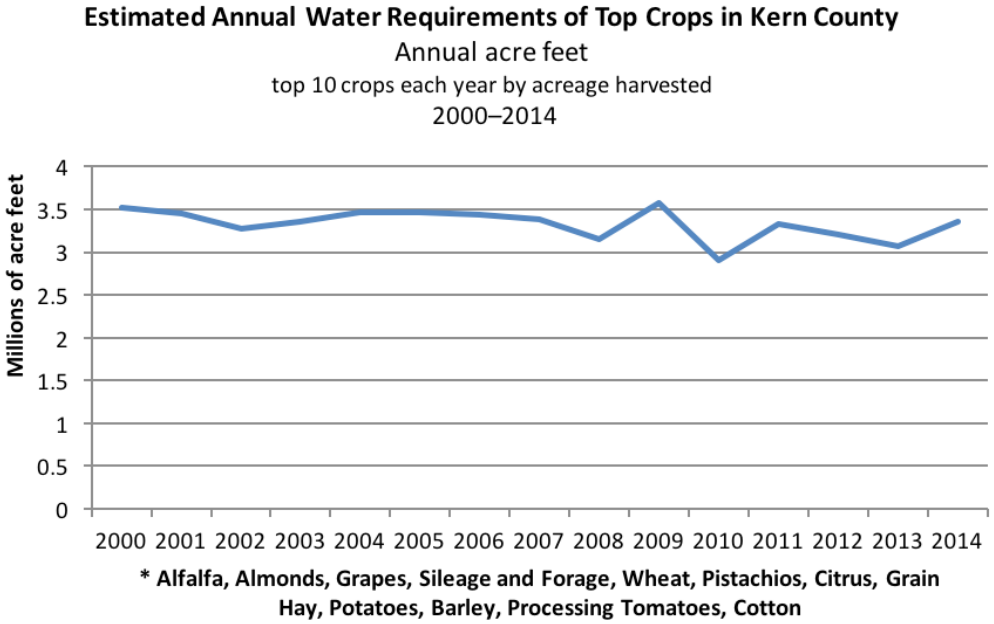
In order to estimate the water requirements of these top crops, we used ETc values (expressed in acre-inches per year) for each crop, multiplied by the number of harvested acres of that crop. The ETc values used for each crop can be found in Appendix I. Figure 58 shows the estimated water requirements of the top 10 crops in Kern County over time.[137]

136 Rangeland harvested acreage is excluded, as it represents a large number of acres but is not typically irrigated.

137 Limitations of this method of estimating water requirements include: (1) it is a theoretical calculation, not a measured observation; (2) it does not account for efficient versus inefficient water delivery; (3) it does not account for acres that are irrigated but not harvested (for example, young orchard crops).

Figure 58: Estimated annual water requirements in acre feet[138] of the top 10 crops in Kern County (2010–2014)

Source for top crops by acres harvested: Kern County Agricultural Commissioner's Annual Crop Reports
Source for crop annual evapotranspiration: California Polytechnic State University's Irrigation Training and Research Center, Report NO. R 03-001[139]



There has been no statistically significant change in the estimated water required to grow Kern County's top crops over the past 15 years even though cropping patterns have changed.

ET models typically overestimate water use[140] (3–3.5 million acre-feet annually using our calculation, which was based on dry year estimates), but because this overestimation is consistent over time, it can be used to establish trends. The Kern Water Agency and UC Cooperative Extension office in Kern County estimates that Kern County actually uses 2–2.4 million acre-feet of water per year for agriculture.[141]

GOAL 3.4 Kern County's food systems workers are part of a safe and fair work environment

Background

In addition to providing food to local, national, and international markets, the U.S. food system is also the largest source of jobs in the country, employing one in seven workers nationally.[142] In Kern County, the food system employs one out of every three workers, more than double the national average (See Vision 2, Goal 2.3).

138 Annual acre feet = total acres harvested for each crop x crop annual evapotranspiration (converted from acre inches to acre feet)

139 Estimates based on crop dry year evapotranspiration, average of Zones 14 and 15. Kern County contains Zones 10, 12, 14, 15, 16, 17, but the majority of agricultural activity is in Zones 14 and 15.

140 California Department of Water Resources. (2016). Agricultural Water Use Efficiency: A Resource Management Strategy of the California Water Plan.

141 UC Cooperative Extension, Kern County. (n.d.). Irrigation Management and Agronomy. Retrieved March 22, 2017, from http://cekern.ucanr.edu/Irrigation_Management/

142 Food Chain Workers Alliance and Solidarity Research Cooperative. (2016). No Piece of the Pie: U.S. Food Workers in 2016. Los Angeles, CA: Food Chain Workers Alliance.

Food systems workers include farmers and farmworkers, restaurant workers, packers and distributors, food manufacturing workers, food retails workers, and others. Although employment in the food system is growing, wages remain low and food systems workers are twice as likely as workers in other industries to be food insecure.[143] There are also greater race and gender disparities in pay in the food system than in the broader economy, with women of color earning less than half the wages of their white male counterparts (see Table 9).

Table 9: Gender and race wage ratio in the U.S. food system and U.S. economy

Sources: Food systems ratios from No Piece of the Pie, Food Chain Workers Alliance 2016
U.S. economy ratios from U.S. Census Bureau American Community Survey 2015
Ratios based on median household income. Each ratio is relative to earnings by white male workers in the food system and the U.S. economy, respectively.[144]

Wage Ratio (based on median household income)		
	Food system	**U.S. Economy**
Native women	0.36	0.59
Black women	0.42	0.63
Native men	0.44	0.65
Latina women	0.45	0.54
White women	0.47	0.75
Asian women	0.58	0.90
Black men	0.60	0.72
Latino men	0.76	0.62
Asian men	0.81	1.08
White men	1.00	1.00

See *Vision 2, Goal 2.3: The Kern County food system provides job opportunities*, for details on food systems wages in Kern County.

In addition to low wages, food systems workers face a number of occupational hazards, particularly those workers that are involved in the production of food.

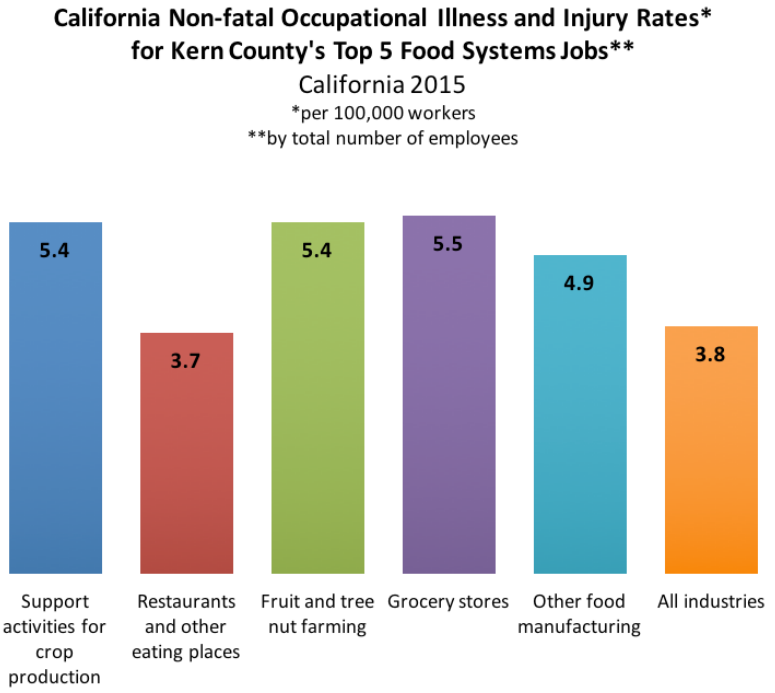
Figure 59 shows the California rates of occupational illness and injury per 100,000 workers in the top five food systems jobs types in Kern County by total number of workers. With the exception of restaurant workers, rates in these food systems jobs are substantially higher than California's all-industry average. For context, the 2015 rate for construction was 3.3, transportation and warehousing was 5.7, and mining, quarrying, and oil and gas extraction was 0.7.

143 Ibid

144 The wage ratios in this table can only be used to compare gender and race-based wage gaps within the food system to gender and race-based wage gaps in the economy overall, NOT average wages between the food system and the wider economy.

Figure 59: California non-fatal occupational illness and injury rates for Kern County's top five food systems jobs by number of employees (rate per 100,000 workers)

Source: Bureau of Labor Statistics, California Nonfatal occupational injuries and illnesses data by industry (SOII)



At the national level, rates of injury and illness in the food system have risen, even as they have decreased across most other industries.[145]

A 2012 national survey of food systems workers found that 57 percent of food systems workers were born outside the U.S., and up to 20 percent are undocumented.[146]

Among farmworkers, approximately two thirds are immigrants and 50 percent are not legally authorized to work in the United States.[147] In California, more than 90 percent of farmworkers were born outside the U.S., primarily in Mexico. A lower percentage of California farmworkers are authorized to work in the U.S. compared to the national average (44 percent versus 54 percent).[148] (See Figures 60 and 61)

145 Food Chain Workers Alliance and Solidarity Research Cooperative. (2016). No Piece of the Pie: U.S. Food Workers in 2016. Los Angeles, CA: Food Chain Workers Alliance.

146 Food Chain Workers Alliance. (2012). The Hands That Feed Us. Los Angeles, CA: Food Chain Workers Alliance.

147 United States Department of Agriculture, Economic Research Service. (2016). Farm Labor Background. Retrieved March 29, 2017, from https://www.ers.usda.gov/topics/farm-economy/farm-labor/background.aspx

148 National Agricultural Workers Survey (NAWS). Retrieved March 29, 2017, from https://www.doleta.gov/agworker/naws.cfm

Figure 60: Farmworkers in California and the U.S. by place of birth (1989–2014)
Source: National Agricultural Workers Survey (NAWS), Table 1: National Demographic Characteristics and Table 2: California Demographic Characteristics

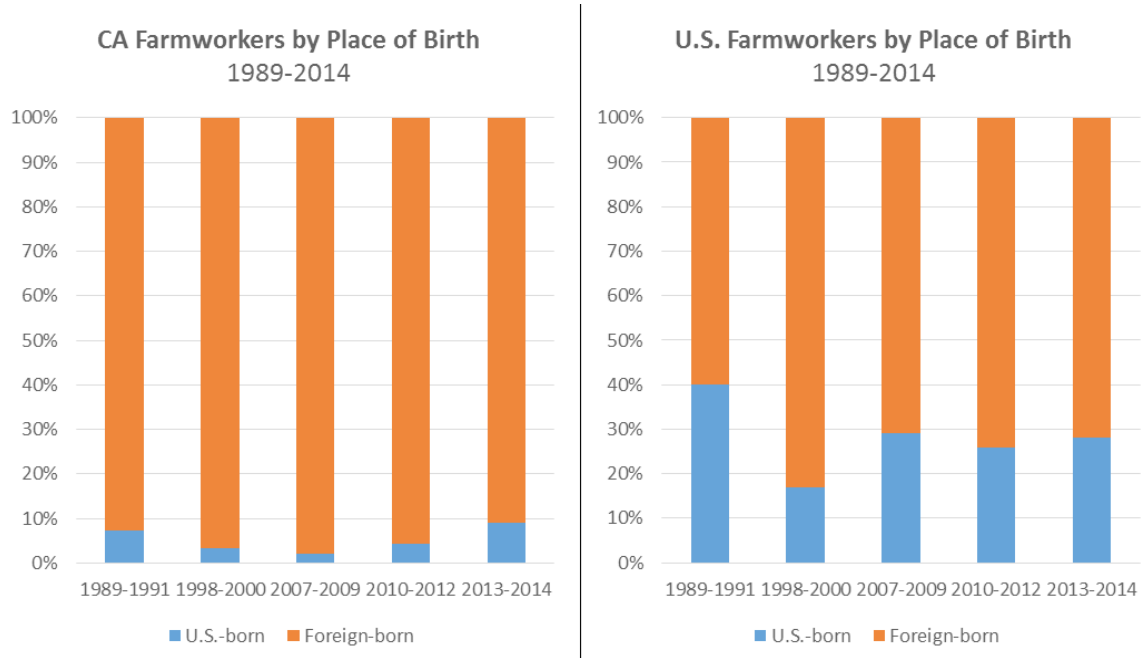
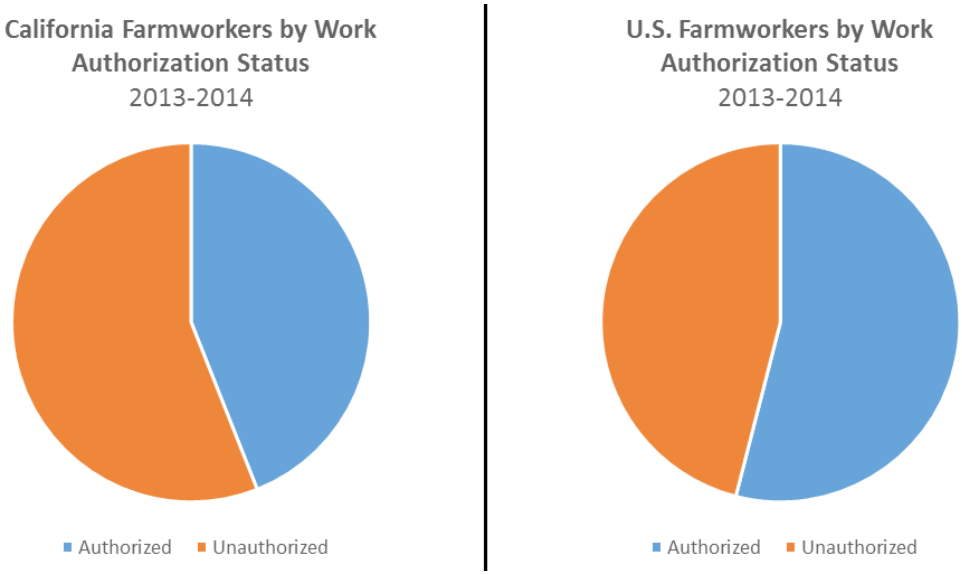


Figure 61: Farmworkers in California and the U.S. by work authorization status (1989–2014)
Source: National Agricultural Workers Survey (NAWS), Table 1: National Demographic Characteristics and Table 2: California Demographic Characteristics



Immigrant and undocumented farmworkers are particularly vulnerable in the workplace. Undocumented workers earn lower wages on average than other workers, and are more than twice as likely to experience wage theft.[149] They are also more likely to be injured on the job and less likely to have

149 Food Chain Workers Alliance. (2012). The Hands That Feed Us. Los Angeles, CA: Food Chain Workers Alliance.

any form of insurance, including health or unemployment insurance, to help mitigate risk.[150] Undocumented workers may have limited English or even Spanish language skills, fewer alternative job options, and lower levels of education or social support. As a result, they may be more likely to take risks and less likely to complain about treatment or conditions.[151] They are also less likely to report injuries or accidents when they do occur.[152] Additional occupational risks of farm work include those associated with low food security, like diabetes, and risks associated with substandard housing and close proximity to agricultural hazards like pesticides or nitrates in drinking water.

Statistics of farmworker demographics and working conditions are collected by the U.S. Bureau of Labor Statistics through the National Agricultural Workers Survey (NAWS), but are not currently available by county. Workplace injuries and illnesses are monitored by the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA). OSHA enforcement data includes the number of inspections, violations, and accidents and can be queried by state or by zip code. Rates of non-fatal occupational injuries and illnesses by industry are available at the state and national level through the Survey of Occupational Illness and Injury (SOII). Rates of fatal occupational injuries are available at the state and national level through the Census of Fatal Occupational Injuries (CFOI). Pesticide related illnesses are monitored in California by the California Pesticide Illness Surveillance Program. The U.S. Department of Labor's Wage and Hour Division (WHD) monitors and enforces compliance with the Fair Labor Standards act, including minimum wage, overtime pay, recordkeeping, and child labor law.

INDICATOR 3.4.1 Injuries, illnesses, and fatalities among agricultural workers in Kern County

Background

Agricultural workers face a range of hazards in the workplace. These may include working with heavy machinery or above the ground, working outdoors in extreme weather, or handling hazardous materials.

Common health and safety issues for farmworkers include:

- **Vehicle hazards.** Half of workplace injuries on farms are the result of an accident involving a vehicle.[153] This includes tractor incidents, which are the leading source of farm injuries and deaths.[154]
- **Heat illness.** Working outdoors in hot and humid conditions can lead to heat related illness and fatalities. Workers most at risk are those doing heavy tasks, wearing bulky protective equipment, and new workers who have not yet acclimated to the heat.
- **Ladders and falls.** Falls are a common source of injury in many industries, however rates among agricultural workers are particularly high.[155]
- **Musculoskeletal injuries.** These can be caused by repetitive motions, prolonged awkward positions, or heavy lifting. Exposure to cold and vibration (such as from heavy machinery) may worsen these risks.[156] Injuries may be acute or chronic.

150 Schenker, M. (2017). The health of immigrant farmworkers. Campus Community Book Project Public Lecture, University of California Davis.

151 Ibid

152 U.S. House of Representatives, Committee on Education and Labor. (2008). Hidden Tragedy: Underreporting of Workplace Injuries and Illnesses. Retrieved May 1, 2017 from https://www.bls.gov/iif/laborcommreport061908.pdf

153 United States Department of Labor, Occupational Safety and Health Administration. (n.d.). Safety and Health Topics – Agricultural Operations – Vehicle Hazards. Retrieved March 29, 2017, from https://www.osha.gov/dsg/topics/agriculturaloperations/vehiclehazards.html

154 Myers, M. L., Cole, H. P., & Westneat, S. C. (2008). Projected incidence and cost of tractor overturn-related injuries in the United States. *Journal of agricultural safety and health, 14*(1), 93. Centers for Disease Control and Prevention. (2004). Focus on Agriculture. In *Worker Health Chartbook,* (pp. 193–222).

155 United States Department of Labor, Occupational Safety and Health Administration. (n.d.). Safety and health topics – agricultural operations – hazards and controls. Retrieved March 29, 2017, from https://www.osha.gov/dsg/topics/agriculturaloperations/hazards_controls.html

156 Ibid

- **Hazardous equipment and machinery.** Tools that have potential to be hazardous are common in farm work, including knives, hoes, ladders, and power tools.
- **Grain bins and silos.** Suffocation is the most common hazard related to grain bins and silos, although dust exposure and explosions are also potential risks.
- **Unsanitary conditions.** Lack of sanitation facilities, including lack of clean drinking water, handwashing stations, and bathrooms, can have adverse health effects on workers.
- **Pesticide exposure.** Workers who handle pesticides directly, those who work in fields that have been treated, and the families of workers can all potentially be exposed to pesticides. Exposure to some pesticides can lead to acute or chronic illness.

PHOTO CREDIT: SUSAN REEP

Orange tree shaping, Kern County.

MEASURE 1: Occupational accidents reported to OSHA – Support activities for crop production (NAICS 1151)

Employers are required by OSHA to report any injuries that involve lost worktime, medical treatment other than first aid, restriction of work or motion, loss of consciousness, or transfer to another job through the Survey of Occupational Injuries and Illnesses (SOII).

Only those illnesses and injuries which can be easily attributed to the workplace are reported, so acute cases are included far more often than chronic ones. Farms with fewer than 11 employees are also exempt from reporting.[157] As a result, it is estimated that as many as three quarters of agricultural illnesses and injuries may go unreported, a significantly higher rate than in other industries.[158]

Kern County Trends

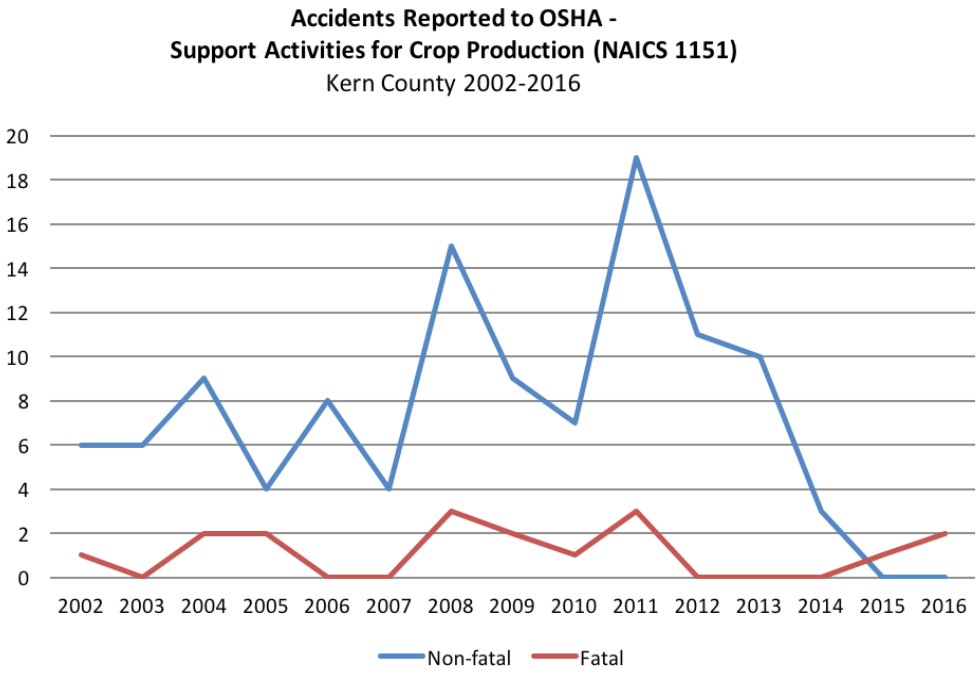
Figure 62 shows the total number of accidents reported to OSHA in Kern County from 2002 to 2016.[159] OSHA descriptions of each accident are found in Appendix J. As is typical of farm work, the majority were injuries related to the use of vehicles and heavy machinery, followed by injuries due to falls and heat exposure. The majority of injuries were non-fatal. The number of non-fatal accidents reported each year has decreased from a high of 19 in 2011 to zero for the past two years (2015 and 2016). The number of fatal accidents ranges from 0 to 3 per year and does not appear to be increasing or decreasing over time.

157 Bureau of Labor Statistics. (2016). Injuries, Illnesses, and Fatalities – Nonfatal occupational injuries and Illnesses by industry. Retrieved March 29, 2017, from https://www.bls.gov/iif/oshsum1.htm

158 Leigh, J. P., Du, J., & McCurdy, S. A. (2014). An estimate of the US government's undercount of nonfatal occupational injuries and illnesses in agriculture. *Annals of epidemiology,* 24(4), 254-259.

159 This data is available by industry code and either state or zip code. Each zip code in Kern County had to be queried individually and then combined for county-level results.

Figure 62: U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) accidents for support activities for crop production (NAICS 1151) in Kern County (2000–2013)
Source: U.S. Bureau of Labor Statistics, OSHA Enforcement Data



The California rate of non-fatal injury and illness for farm workers[160] was 5.4 per 100,000 workers in 2015,[161] slightly below the national rate of 5.6.[162] The California rate of fatal injury and illness in 2015 was 17.1 per 100,000 workers in "agriculture, forestry, fishing, and hunting" (NAICS 11, which includes NAICS 1151), again below the national rate of 22.8.[163]

Comparable rates for Kern County cannot be calculated for a number of reasons,[164] the primary of which is a lack of sufficiently accurate data on the number of farmworkers at the county level. The data collection methods used by the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) likely undercount farmworkers,[165] and farm labor contractors, which employ many of Kern County's farmworkers, may be registered in one county but supply workers to others.[166] Thus, a worker count accurate enough at the county level to determine valid county level injury rates is not publically available at this time.

160 NAICS 1151, Support Activities for Crop Production

161 U.S. Bureau of Labor Statistics. (2015). California Nonfatal occupational injuries and illnesses data by industry (SOII), NAICS 1151.

162 Bureau of Labor Statistics. (2015). National Injury and Illness Data. Table 1: Incidents rates of non-fatal occupational injuries and illnesses by industry and case types, 2015. Retrieved May 1, 2017 from https://www.bls.gov/iif/oshwc/osh/os/ostb4732.pdf

163 Bureau of Labor Statistics. (2015). Fatal Occupational Injuries in Charts, 2015. Number and rate of fatal work injuries by industry sector, 2015. Retrieved May 16, 2017 from https://www.bls.gov/iif/oshwc/cfoi/cfch0014.pdf

164 In addition to the primary reason detailed in the main text, others include (a) OSHA data is for injuries only, while BLS national/state data includes injuries and illnesses, (b) BLS national/state data is based on a surveyed subsample of all establishments, (c) fatal injuries are not reported at the same level of industry detail as non-fatal injuries, (d) the hours data used at the state/federal level to calculate hours-based rates is not available at the county level.

165 Martin, P. & Costa, D. (2017). Farmworker wages in California: Large gap between full-time equivalent and actual earnings. Economic Policy Institute, Working Economics Blog. Posted March 21, 2017. Retrieved May 10, 2017 from http://www.epi.org/blog/farmworker-wages-in-california-large-gap-between-full-time-equivalent-and-actual-earnings/

166 Personal communication with Don Villarejo, May 15, 2017.

MEASURE 2: Agricultural pesticide related illnesses reported through the California Pesticide Illness Surveillance Program

Background

Agricultural workers experience the vast majority of agriculture-related pesticide illnesses in California, with the exception of some drift incidents.[167] Pesticide related illnesses are reported by physicians through the California Pesticide Illness Surveillance Program. Those physician reports classified by the California Department of Pesticide Regulation as *definitely*, *probably*, or *possibly* related to pesticide exposure can be queried by the public using the California Pesticide Illness Query (CalPIQ). Like OSHA injury and illness data, the vast majority of reported pesticide illnesses are acute rather than chronic. Only farmworkers who seek and receive professional medical care in California will show up in CalPIQ. Undocumented workers are less likely to have health insurance and to seek health services than other workers,[168] and so may be underrepresented in this data.

Figure 63 shows the number of agriculture related pesticide illness in Kern County from 2000–2014. The number of reported illnesses has decreased from the early 2000s, and was at its lowest recorded level (three illnesses) in 2014.

Figure 63: Agriculture related pesticide illnesses in Kern County (2000–2014)
Source: California Pesticide Illness Query (CalPIQ)

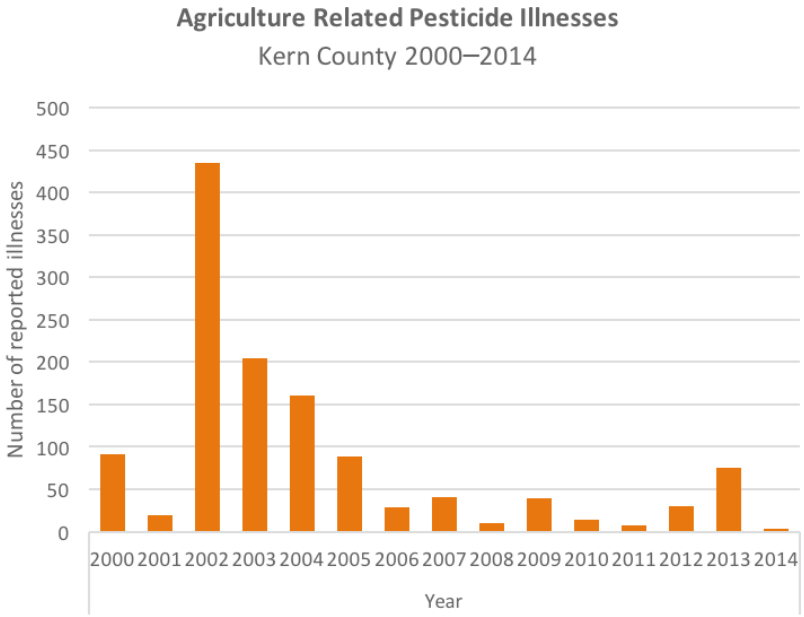
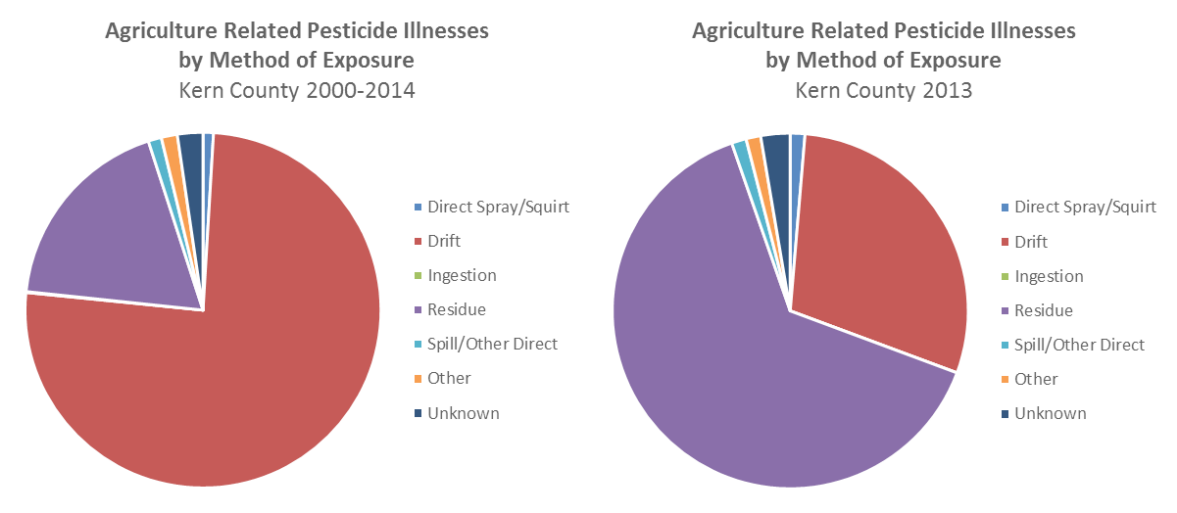


Figure 64 shows the method of exposure for agriculture related pesticide illnesses in Kern County from 2000–2014, and in 2013.[169] Drift was the method of exposure for 79 percent of illnesses over the last 15 years, followed by residue (19 percent). This is reversed in years with few or no drift incidents. Residue was the most common method of exposure in 2013 and 2014.

167 Data presented here include all agriculture-related pesticide illnesses, the majority of which involve field workers.
168 Schenker, M. (2017). The health of immigrant farmworkers. Campus Community Book Project Public Lecture, University of California Davis.
169 The year 2013 was chosen to visualize instead of 2014 because there were only three illnesses reported in 2014.

Figure 64: Agriculture related pesticide illnesses in Kern County by method of exposure (2000–2014)

Source: California Pesticide Illness Query (CalPIQ)



INDICATOR 3.4.2 Labor law violations among farm labor contractors

Background

The U.S. Department of Labor's Wage and Hour Division (WHD) is responsible for monitoring and enforcing compliance with the U.S. labor law, in particular the Fair Labor Standards Act (FLSA), which deals with minimum wage, overtime, and youth employment.[170] The WHD has collected more than $1.2 billion in back wages on behalf of workers nationally over the last five years,[171] including $27 million for agricultural workers.[172]

The WHD also enforces the Migrant and Seasonal Agricultural Worker Protection Act (MSPA), which protects migrant and seasonal agricultural workers by establishing employment standards related to wages, housing, transportation, disclosures and recordkeeping, and requires farm labor contractors to register with the U.S. Department of Labor.[173]

Kern County Trends

In Kern County, four of the 10 job categories with the highest number of WHD cases between 2003–2014 were in the food system, including farm labor contractors, full service restaurants, limited service restaurants, and grocery stores. Of these, 72 percent of the WHD cases were farm labor contractors, 27 percent were restaurants, and one percent were grocery stores. Each case may have any number of violations associated with it. More than 99 percent of all WHD violations in Kern County's food system were farm labor contractors. For this reason, only trends in farm labor contractors are shown here.[174]

The majority (89 percent) of violations among farm labor contractors were violations of the Migrant and Seasonal Agricultural Worker Protection Act (MSPA). The remainder (11 percent) were violations

170 United States Department of Labor. (2009). Wage and hour division. General information on the Fair Labor Standards Act (FLSA). Retrieved March 29, 2017, from https://www.dol.gov/whd/regs/compliance/mwposter.htm

171 United States Department of Labor. (n.d.). Wage and hour division (WHD)—data. Retrieved March 29, 2017, from https://www.dol.gov/whd/data/

172 United States Department of Labor. (2016). Wage and hour division table: Agriculture – all acts. Retrieved March 29, 2017, from https://www.dol.gov/whd/data/datatables.htm#panel6

173 United States Department of Labor, Wage and Hour Division. (2008). Fact sheet #49: The Migrant and Seasonal Agricultural Worker Protection Act. Retrieved March 29, 2017, from https://www.dol.gov/whd/regs/compliance/whdfs49.pdf

174 Department of Labor enforcement data queries for WHD cases were run using Standard Industrial Classification (SIC) industry codes, rather than North American Industrial Classification System (NAICS) codes.

of the Fair Labor Standards Act (FLSA).

Figure 65a shows the total number of WHD violations in Kern County from 2003 to 2014. There are usually multiple violations per each case. The violations shown in Figure 65a represent from one to 10 individual cases each year (Figure 65b). There is no statistically significant trend in the number of cases or violations over this time.

Figure 65a: U.S. Department of Labor Wage and Hour Division violations in Kern County—Farm Labor Contractors and Crew Leaders (2003–2014)[175]
Source: U.S. Bureau of Labor Statistics, WHD Enforcement Data

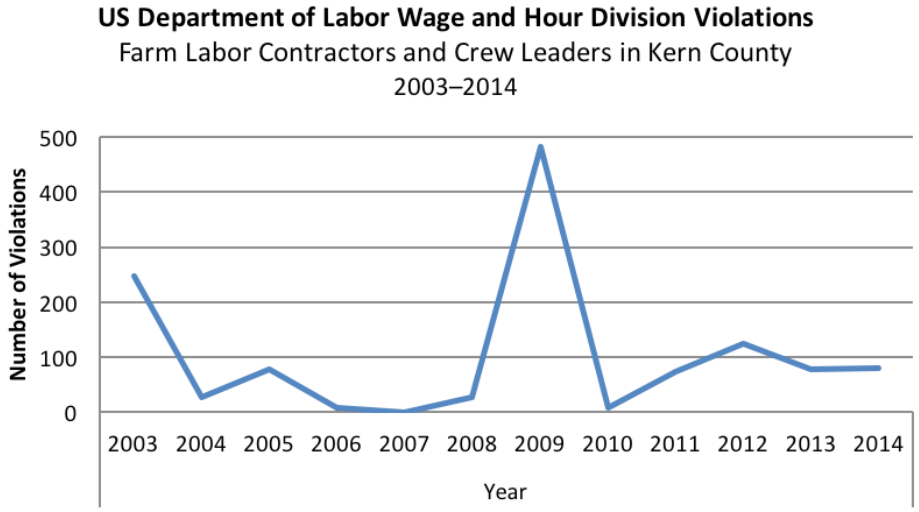
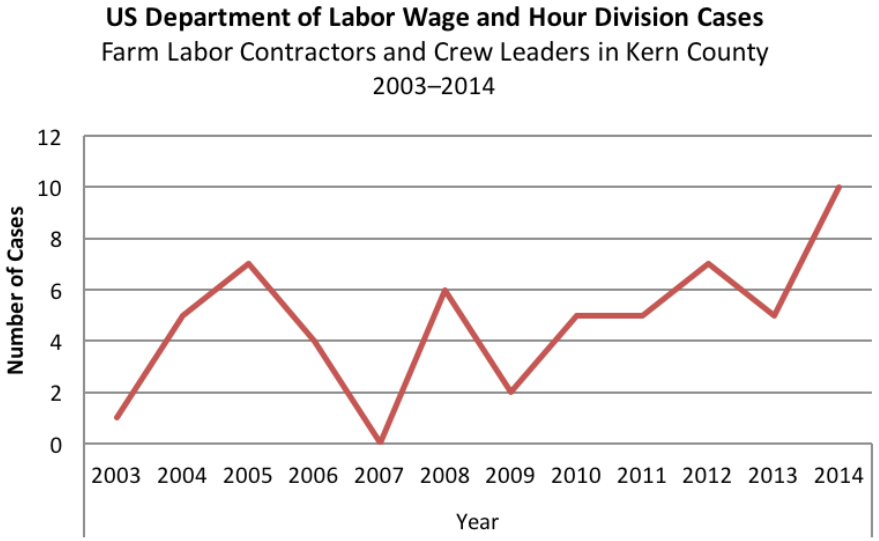


Figure 65b: U.S. Department of Labor Wage and Hour Division cases in Kern County—Farm Labor Contractors and Crew Leaders (2003–2014)
Source: U.S. Bureau of Labor Statistics, WHD Enforcement Data



175 SIC 0761