

Economic Contributions of **San Joaquin County** Agriculture

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—COUNTY—

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Commissioner's Letter

I am pleased to share **Economic Contributions of San Joaquin County Agriculture**. This report takes an important step beyond the annual Agricultural Report our department publishes each year. Instead of stopping at crop production values and acreage, it quantifies agriculture's total economic contributions through production, local processing, employment, and economic multiplier effects.

In short, this report uses twenty-first-century economic tools to document agriculture's broader role in sustaining a thriving local economy.

The new study shows that in 2018, agriculture contributed a total of \$5.732 billion to the county economy. This far exceeded the \$2.594 billion figure from our 2018 Agricultural Report. Agriculture also supported 29,986 direct employees, or nearly one out of every eleven jobs in the county. Adding multiplier effects brought total employment to 33,737 jobs. This report also examines economic diversification within agriculture, which has important implications for countywide economic resiliency.

Agriculture has a long tradition in San Joaquin County. For more than a century, it has been a pillar of our economy and culture. With this report, we renew our commitment to sustaining that tradition well into the future.

Respectfully submitted,

Tim Pelican

Agricultural Commissioner/Sealer



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San Joaquin County Agriculture By the Numbers

Economic Contributions

of the Agricultural Industry

FOR 2018

\$5.732 billion

San Joaquin County Agriculture's total contribution to the local economy

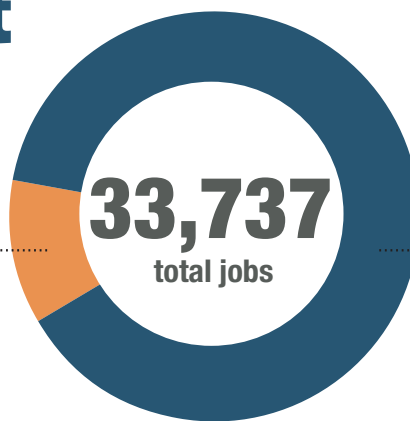


Employment Effects

of the Agricultural Industry

3,751

additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees



29,986

direct employees



ONE in eleven

jobs in San Joaquin County directly attributable to the agricultural industry

Introduction

Residents and visitors alike know and value the contributions agriculture makes to San Joaquin County.

Livestock thrive in local lots and pastures. Well-tended fields stretch for miles. Grapes, almonds, walnuts, cherries, tomatoes, and dozens of other crops grow in deep, fertile soils and help feed the world. It is not difficult to see that agriculture plays a vital role in sustaining a healthy economy in San Joaquin County.

What is not so apparent, however, is the true size of that role. How much money does agriculture pump into the local economy? How many jobs does agriculture support? In other words, just how important is agriculture as a driver of San Joaquin County's economic health?

This report sheds light on these and related questions. Using multiple data sources and advanced economic modeling techniques, it analyzes agriculture's total contribution to the San Joaquin County economy. The report also examines agricultural diversification and its role in supporting economic resilience, including a quantitative measure. Overall, the findings offer important information for policy makers, the public, and anyone who values a thriving local economy.



Our Approach

A *basic industry* is one that sells most of its products beyond the local area and thus brings outside money into local communities. Agriculture easily qualifies as a basic industry in San Joaquin County. Calculating a reasonable range of economic contributions by a basic industry entails quantifying three economic areas: 1) *direct* economic effects; 2) *indirect* economic effects; and 3) *induced* economic effects. This report covers all three.

Direct economic effects include farm production, local processing, and their related employment. *Indirect* effects consist of inter-industry, business-to-business supplier purchases. *Induced* effects reflect consumption spending by employees. The **Multiplier Effects** section on page 6 explains this further.

To understand the furthest economic impacts of agriculture, one would also need to assess agricultural-related costs to society, such as net impacts on water and other natural resources. While important, these impacts lie beyond the scope of this study.

Our calculations draw from local and national data sources. The local sources include industry experts and the annual San Joaquin County Agricultural Report produced by the office of the Agricultural Commissioner and Sealer of Weights and Measures. The main national data source is IMPLAN, a widely used economic modeling program (see www.implan.com).

Originally created for the U.S. Department of Agriculture (USDA), IMPLAN uses econometric modeling to convert data from more than a dozen government sources into local values for every U.S. county and zip code, across 546 industry sectors. Because IMPLAN draws from multiple sources, including the recent USDA Census of Agriculture, its employment and economic output numbers often differ from those reported by individual state and federal agencies.

Except where otherwise noted, all figures are from the year 2018, the most recent IMPLAN dataset available. Where appropriate, we adjusted sector names for clarity and applied coefficients to IMPLAN values to reflect unique San Joaquin County conditions. Please contact the authors for additional details on the methods used.

Direct Effects of San Joaquin County Farm Production

This section focuses on the simplest measures of economic activity: production and employment. It describes total farm production values and the number of agricultural jobs.

PRODUCTION

Figure 1 shows the various categories that made up San Joaquin County's farm production value. At \$1.404 billion, Fruit & Nut Crops was the single largest production category by dollar value, comprising 54.1% of the county total. Almond meats dominated this category at \$536.4 million, followed by grapes at \$430.5 million and walnuts at \$211.3 million.

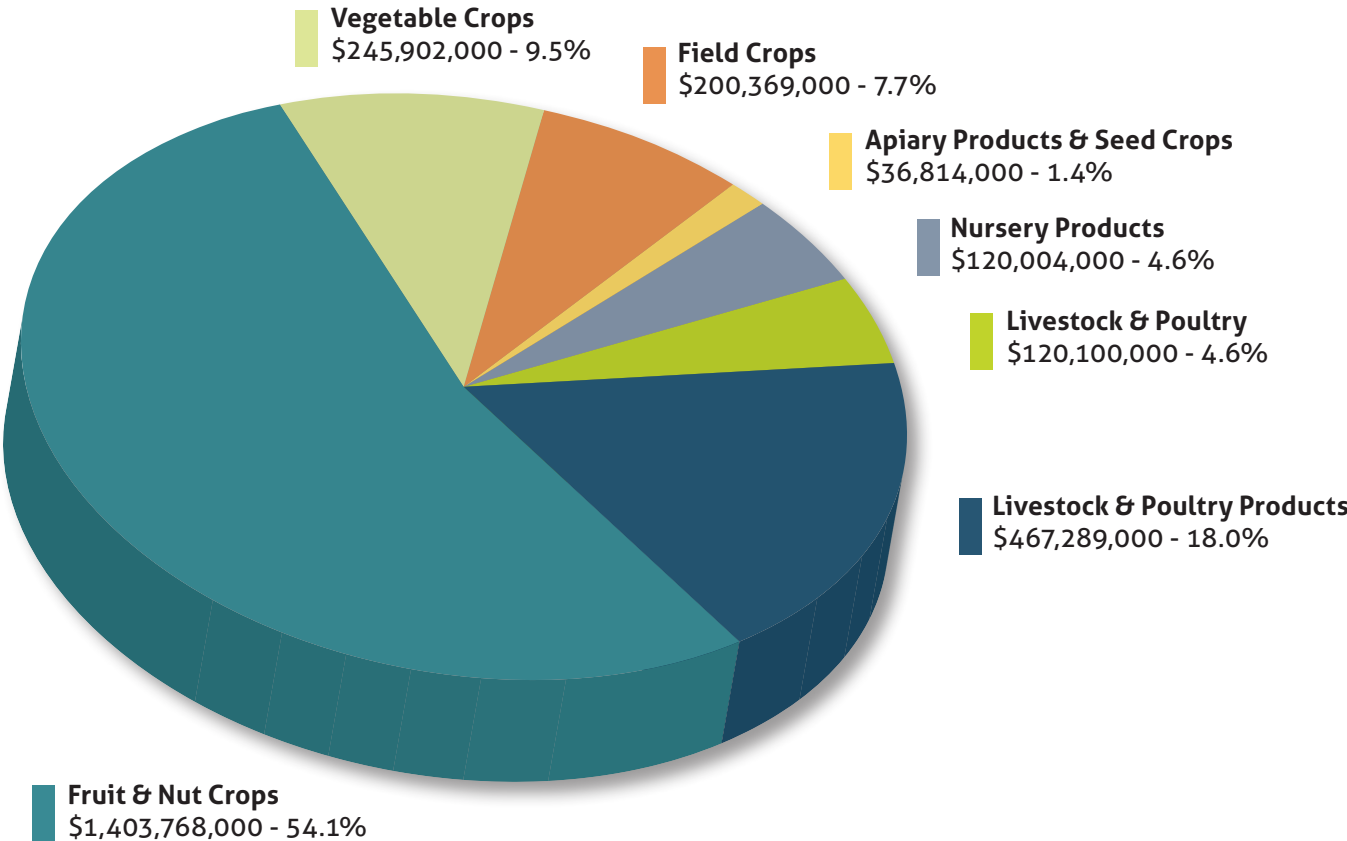


At 18.0%, Livestock & Poultry Products represented the second largest category (\$467.3 million). Milk led this category, with \$360.3 million in production. Vegetable Crops was the third largest category, at 9.5% and \$245.9 million, with the largest contributions coming from tomatoes, potatoes, and melons.

The combined, total dollar value for all products rose \$527.6 million over the previous decade, from \$2.000 billion in 2009 to \$2.528 billion in 2018. Inflation totaled 15.5% during this period, averaging 1.6% per year. Fruit & Nut Crops grew an impressive 27.8% over the past decade even after subtracting inflation. Total values do not reflect net profit or loss experienced by individual growers or by the industry as a whole. Interested readers are encouraged to consult the Office of the Agricultural Commissioner’s 2018 Agricultural Report for additional details on specific products and their value.

Figure 1. Distribution of San Joaquin County Farm Production

Source: 2018 Agricultural Report, Office of the San Joaquin County Agricultural Commissioner/Sealer.



EMPLOYMENT

How many people work in agricultural production? In 2018, IMPLAN data indicate that agricultural production directly employed 21,719 people in San Joaquin County. This figure encompassed a wide range of production-related jobs, including not just growing and harvesting, but also sales, marketing and many other roles. It did not include food processing jobs, which are discussed on page 9. Nor did it include San Joaquin County’s many public sector jobs in agriculture, across a wide range of local, state, and federal agencies.

Multiplier Effects of San Joaquin County Farm Production

This section quantifies the economic ripples that farm production creates in the local economy. These ripples take two forms: *indirect effects* and *induced effects*. The first consists of business-to-business supplier purchases. For example, when a grower buys farm equipment, fertilizer, pesticides, seed, insurance, banking services, and other inputs, the grower creates *indirect effects*.

The second ripple type, *induced effects*, consists of consumption spending by owners and employees of agricultural businesses and their suppliers. They buy groceries, housing, healthcare, leisure activities, and other things for their households. All this spending creates ripples in the economy.

Although agricultural companies and their employees certainly spend money in other counties, this study only reflects those expenditures that occur within San Joaquin County. Quantifying expenditures outside the county would be a complex effort that lies well beyond the scope of this report.

Figure 2 shows agriculture's *direct*, *indirect*, and *induced* economic effects within the county, for major production sectors. The numbers use IMPLAN multipliers for each sector, which are rooted in the most recent U.S. Bureau of Economic Analysis input-output models

Figure 2. Economic Effects of San Joaquin County Farm Production

Dollar values are in \$ millions. Figures are for 2018 and come from IMPLAN and U.S. Bureau of Economic Analysis, with adjustments for local conditions. Not all columns and rows add exactly due to rounding.

FARM PRODUCTION SECTOR	Output Effects (\$ Millions)			TOTAL
	Direct	Indirect	Induced	
Tree Nut Farming	\$784.8	\$187.4	\$297.3	\$1,269.6
Fruit Farming	\$617.3	\$153.7	\$115.8	\$886.9
Dairy Cattle & Milk Production	\$361.8	\$116.6	\$36.1	\$514.4
Vegetable & Melon Farming	\$245.9	\$75.5	\$37.8	\$359.2
Support Activities for Agriculture	\$132.2	\$7.2	\$50.4	\$189.9
Greenhouse, Nursery & Floriculture Production	\$119.0	\$27.4	\$15.1	\$161.5
Poultry & Egg Production	\$111.8	\$30.9	\$7.5	\$150.3
Beef Cattle Ranching & Farming	\$102.4	\$23.0	\$14.2	\$139.6
All Other Crop Farming	\$63.5	\$20.0	\$13.8	\$97.2
Grain Farming	\$47.8	\$8.2	\$12.0	\$68.0
Other Animal Production	\$13.0	\$0.9	\$3.5	\$17.3
Oilseed Farming	\$1.5	\$0.0	\$0.6	\$2.2
TOTAL ECONOMIC OUTPUT	\$2,601.1	\$650.8	\$604.2	\$3,856.1
	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	21,719	1,943	859	24,521



Note that sector names and production values in **Figure 2** differ from the county's annual report. They closely follow a standard classification system used nationwide called the North American Industrial Classification System (NAICS), as adapted by IMPLAN. Each NAICS/IMPLAN category has an explicit definition.

NAICS and IMPLAN also combine familiar products in unfamiliar ways. For example, they put the county's \$54.2 million alfalfa hay crop under "All Other Crop Farming" and the county's \$30.8 million in pollination services under "Support Activities for Agriculture."

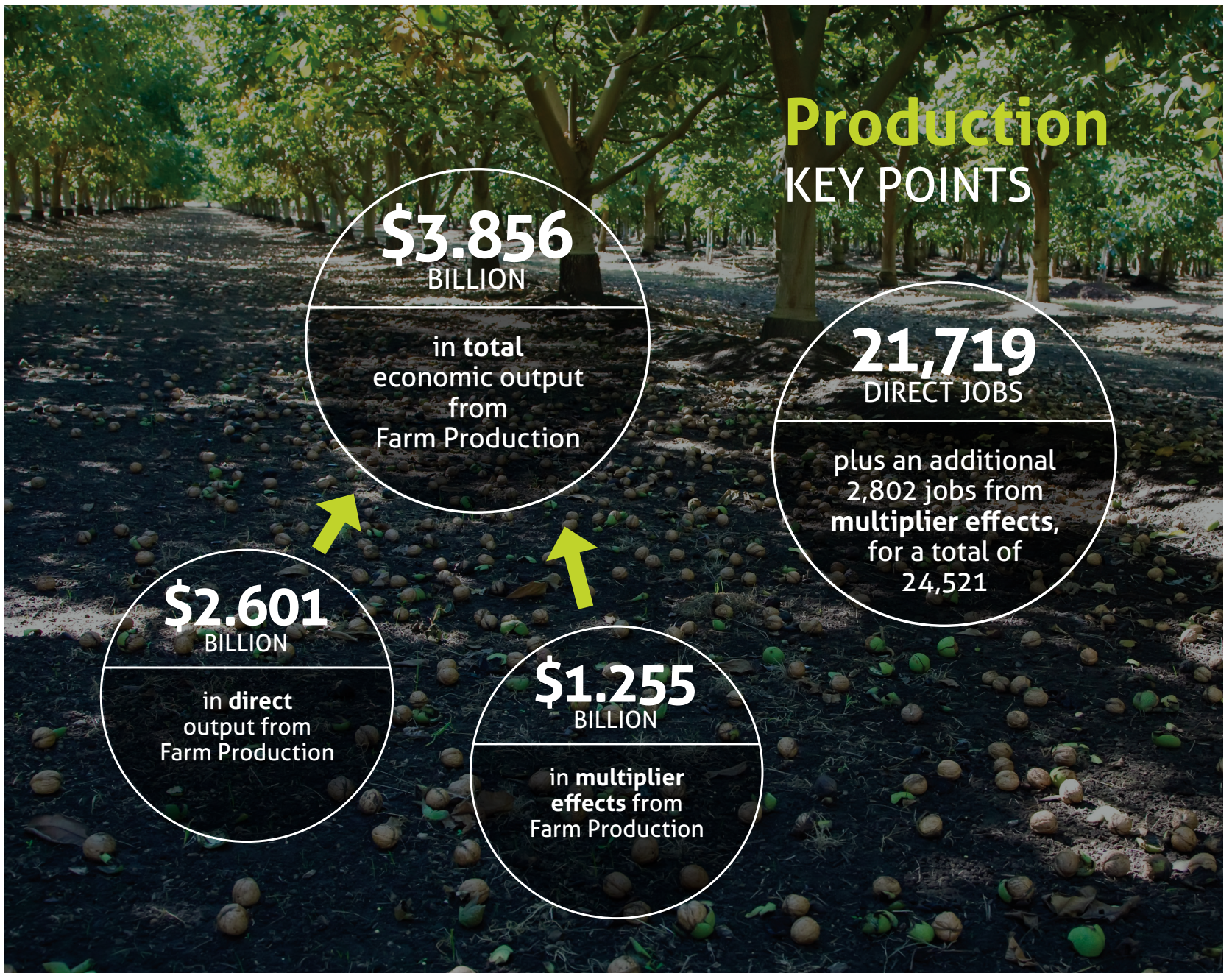
The following list helps bridge familiar San Joaquin County commodities with NAICS and IMPLAN sectors:

- **Tree Nut Farming:** Almond (all), Walnut;
- **Fruit Farming:** Apples, Apricots, Blueberries, Cherries, Grapes, Olives, Peaches, Pears;
- **Dairy Cattle & Milk Production:** Dairy Cattle, Milk (market);
- **Vegetable & Melon Farming:** Asparagus, Corn (sweet), Cucumbers, Melons (all), Onions, Peppers, Potatoes, Squash, Tomatoes (all);
- **Support Activities for Agriculture:** Pollination, Soil Preparation, Planting, Cultivating, Harvesting;
- **Greenhouse, Nursery & Floriculture Production:** Grapevines, Strawberry Plants, Fruit & Nut Trees, Vegetable Plants, Flowering Potted Plants, Foliage Plants, Bedding Plants, Woody Ornamentals, Bulbs, Rhizomes, Turf, Cactus;
- **Poultry & Egg Production:** Broilers, Turkeys, Squab, Ducks, Eggs (all);
- **Beef Cattle Ranching and Farming:** Beef Cattle (feeders & slaughters);
- **All Other Crop Farming:** Hay (all), Rangeland, Pasture (irrigated);
- **Other Animal Production:** Goats, Hogs & Pigs, Sheep & Lambs, Game Birds;
- **Grain Farming:** Beans (dried, all), Corn (silage), Rice;
- **Oilseed Farming:** Safflower.

Each sector has distinct multipliers. San Joaquin County "Vegetable & Melon Farming," for example, had a 2018 *indirect effects* multiplier of 0.3069 and an *induced effects* multiplier of 0.1536. This means that each dollar's worth of direct output generated an extra 30 cents in supplier purchases, plus 15 cents more in consumption spending by owners and employees of agricultural businesses and their suppliers. Multipliers change every year for each sector and county in the entire nation, reflecting where companies and employees spend their money.

Sectors have unique multipliers not just for economic output, but also for employment. San Joaquin County "Tree Nut Farming," for example, supported 2,840 direct jobs plus an additional 416 *indirect effects* jobs and 174 more from *induced effects*. The bottom row of **Figure 2** shows combined employment figures across sectors.

Because IMPLAN's methodology differs from that of the county's annual agriculture survey, the total 2018 direct production value in **Figure 2** (\$2.60 billion), differs slightly from the \$2.59 billion reported in the 2018 San Joaquin County Agricultural Report.



Locally Sourced, Value-added Food Processing

Farm production tells only part of the story. San Joaquin County is home to several food processors that play a key role in the local economy. This section estimates the economic value of local food processing. It is neither an exact science nor a full assessment, but rather gives the reader a basic overview of the topic.

To avoid overstating the numbers, we only include food manufacturers and sectors that fit two strict criteria: 1) they use mostly local agricultural inputs; and 2) they are unlikely to exist here without the presence of the associated agricultural sector. Many processing facilities would not operate in San Joaquin County were it not for the abundant supply of fruits, nuts, livestock, and other raw agricultural products.

Based on our strict criteria, we excluded IMPLAN food and beverage sectors that other studies often include.¹ For example, San Joaquin County produced \$1.373 billion in dog and cat food, mayonnaise, dressing, bread, tortillas, pastries, ice, spices, soft drinks, beer, liquor, tea, coffee, and related food items. Their production supported an estimated 2,390 jobs. Adding these sectors could overstate the value of local agriculture, including its employment and multipliers.

Figure 3 shows the economic effects of locally sourced, value-added food processing. Like the previous section, sector names generally follow the NAICS and IMPLAN classification system, with adjustments for San Joaquin County context.

Figure 3. Economic Effects of Locally Sourced, Value-added Food Processing

Sources: IMPLAN and U.S. Bureau of Economic Analysis data, with input by local industry experts. Columns and rows may not compute exactly due to rounding.

FOOD PROCESSING	Output Effects (\$ Millions)			TOTAL
	Direct	Indirect	Induced	
Wineries	\$709.3	\$169.6	\$84.6	\$963.4
Dried Food Products Manufacturing	\$337.8	\$21.6	\$119.9	\$479.3
Canned Fruits & Vegetables Manufacturing	\$242.7	\$52.4	\$22.4	\$317.4
Frozen Fruits, Juices & Vegetables Manufacturing	\$27.3	\$8.0	\$2.7	\$38.0
Dairy Products Manufacturing	\$20.0	\$4.1	\$1.5	\$25.5
Meat, Poultry & Other Animal Products	\$17.9	\$2.7	\$1.5	\$22.2
Miscellaneous Other Food Manufacturing	\$11.2	\$2.8	\$1.2	\$15.2
Other Animal Food Manufacturing	\$10.3	\$2.2	\$0.6	\$13.1
Breweries	\$1.3	\$0.3	\$0.1	\$1.6
TOTAL ECONOMIC OUTPUT	\$1377.6	\$263.6	\$234.5	\$1,875.8
	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	8,268	574	375	9,216

¹ See, for example: 1) Sexton *et al.* 2015, "The Economic Impact of Food and Beverage Processing in California and Its Cities and Counties"; and 2) "The Measure of California Agriculture, Chapter 5" by the U.C. Davis Agricultural Issues Center (2009).

Economic Contributions of San Joaquin County Agriculture



The largest sector by far, “Wineries” in **Figure 3** reflects value added to the county’s \$430.5 million wine grape crop. San Joaquin County has a long and distinguished wine-making history. Most wineries are in the Lodi area, the self-proclaimed Zinfandel Capital of the World, which produces an estimated 40% of California’s Zinfandel grapes. Wineries crush, ferment, and bottle grapes, then often add extra value by hosting tastings, weddings, and other events. For analysis of broader impacts, including to neighboring Sacramento County, see “The Economic Impact of Wine and Grapes in Lodi 2009” by Stonebridge Research.

“Dried Food Products Manufacturing” includes several facilities that dry and package fruits, nuts, and grains. An estimated 85% of the county’s \$536.4 million almond crop and \$211.3 million walnut crop goes to local facilities for hulling, shelling, and drying. A few operators add extra value by roasting, glazing, and flavoring nuts to sell through various outlets, including online and at farmers’ markets. Others sell dried apples, apricots, peaches, pears, and tomatoes.

“Canned Fruits & Vegetables Manufacturing” in **Figure 3** captures portions of the county’s abundant fresh produce that is processed locally. For example, an estimated 60% of the \$93.5 million tomato crop went to local processing instead of elsewhere or to the fresh market, as did 25% of the \$13.3 million pepper crop and all





of the \$4.9 million cucumber crop. This sector also includes the small portion of the county's \$9.4 million olive crop brined and then sold in cans and jars, instead of being processed into oil.

The county boasts many nationally known processors in Lodi, Lathrop, and Stockton, which draw product not just from San Joaquin County, but also from surrounding counties. San Joaquin County provides a significant portion of these processors' raw product, estimated at 40% on average, with the exact amount depending on the product type and processor. Some processors also freeze a subset of these products, as shown in the "Frozen Fruits, Juices & Vegetables Manufacturing" category.

"Dairy Products Manufacturing" reflects the small percentage of milk processed into local cheeses and related products. Nearly all of the county's \$360.4 million in fluid milk leaves the county for some combination of pasteurization, homogenization, separation, and packaging. A key exception is the Tracy facility operated by the world's largest producer of mozzarella cheese, which buys milk from several counties.

"Meat, Poultry & Other Animal Products" in **Figure 3** reflects local processing of cattle, sheep, swine, game birds, and other animals. The county produced \$102.4 million in cattle & calves but an estimated 99% went elsewhere for finishing and processing, often via auctions in Escalon and Galt. Large meat plants in Manteca, Stockton, and Lathrop use some local meat, while a few custom operations specialize in local products. A family-run butcher in Manteca, for example, processes local cattle, hogs, and sheep into steaks, jerky, sausage, bacon, and other products.

This sector also includes portions of the county's \$3.3 million in turkeys, \$2.4 million in broilers, and other fowl processed at local facilities in Ripon and elsewhere. A facility in Stockton, for example, specializes in chickens while another focuses on ducks and guinea fowl. This category also reflects value added to the county's \$105.8 million in chicken eggs through washing/sanitizing, candling, grading, sorting, and packing into cartons, before shipping.

As the name suggests, "Miscellaneous Other Food Manufacturing" is a catch-all category that includes many niche products. Examples include jams, jellies, pies and cider made from local fruit, often sold at farmers' markets, farm stands, and local stores. This sector also reflects honey production, olives processed into oil, and fruits and vegetables that are peeled and/or sliced.

"Other Animal Food Manufacturing" in **Figure 3** reflects the portion of the county's grains and alfalfa crops that are made into feed, especially for local livestock. Many farms ferment corn into silage. Other operations pelletize alfalfa. San Joaquin County produced an estimated \$629.4 million in food for dogs, cats, livestock, and other animals, but most of the ingredients, especially corn and soy, came by train from the Midwest.

"Breweries" in **Figure 3** reflects the county's nascent beer brewing sector. Most California breweries do not qualify for inclusion in a study like this because they depend on hops imported from the Pacific Northwest and Germany. In San Joaquin County, however, a handful of farms have begun to grow hops for craft breweries, and thus qualify as truly local beer.

In one example, we interviewed the owner of a Lodi farm that grows hops on six acres, manages field trials with fifty hops varieties, and operates a processing unit that serves six other growers with a combined fifty acres. Pelletized hops are sold in five- to forty-pound bags to craft brewers. Brewers, in turn, can offer customers a beer that is truly fresh and local.

Total Economic Contributions of San Joaquin County Agriculture



The previous sections have provided key pieces to an economic puzzle. This section combines those puzzle pieces into a final picture showing the overall economic effect of San Joaquin County agriculture.

As **Figure 4** shows, the total 2018 economic contribution of San Joaquin County agriculture was \$5.732 billion. This consisted of \$3.979 billion in combined, direct output from production and processing, plus \$1.753 billion in multiplier effects.

For perspective, agriculture pumped *over fifteen million dollars per day* into the county economy during 2018 (\$15,703,680 to be exact), or \$654,320 per hour and \$10,905 per minute. The \$3.979 billion in direct output represented 7.1% of the county’s total economic output of \$55.70 billion, or one out of every fourteen dollars.

Total agricultural employment covered in the scope of this study was 33,737. This included 29,986 jobs directly in agriculture and another 3,751 attributable to multiplier effects. The 29,986 direct agricultural jobs represented 9.0% of San Joaquin County’s total employment of 334,717, or one out of every eleven jobs.

Figure 4. Overall Economic Effects of San Joaquin County Agriculture

Columns and rows may not compute exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects (\$ Millions)	\$2,601.1	\$650.8	\$604.2	\$3,856.1
Employment Effects (# Jobs)	21,719	1,943	859	24,521
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects (\$ Millions)	\$1,377.6	\$263.6	\$234.5	\$1,875.8
Employment Effects (# Jobs)	8,268	574	375	9,216
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects (\$ Millions)	\$3,978.7	\$914.4	\$838.7	\$5,731.8
Employment Effects (# Jobs)	29,986	2,517	1,234	33,737



How Resilient is Agriculture to Economic Shocks?

Like growers and ranchers everywhere, San Joaquin County agricultural producers face a long list of risks. Prominent examples include: droughts, floods, disease outbreaks, new regulations, new competitors, labor availability and cost, price drops, and rising costs for fuel, equipment, and other inputs. Any one of these risks can deal a damaging blow. When combined, they can undermine not just an individual operation, but an entire industry.

What's the best way to lower these risks? Opinions vary, but most emphasize *product diversification*. From the old adage, "don't keep all your eggs in one basket" to the advice that modern financial planners give, diversity tends to create stability.

A growing body of research supports this conventional wisdom. The more diversified a local economy is, the better it protects economic growth and employment during economic shocks. It's a complex topic, though, with many factors in play and much research yet to be done.

This raises the question: How economically diversified is San Joaquin County agriculture? Does the county have low agricultural diversity, likely increasing its risk to economic shocks? Or is agriculture highly diversified, implying a stronger economic buffer?

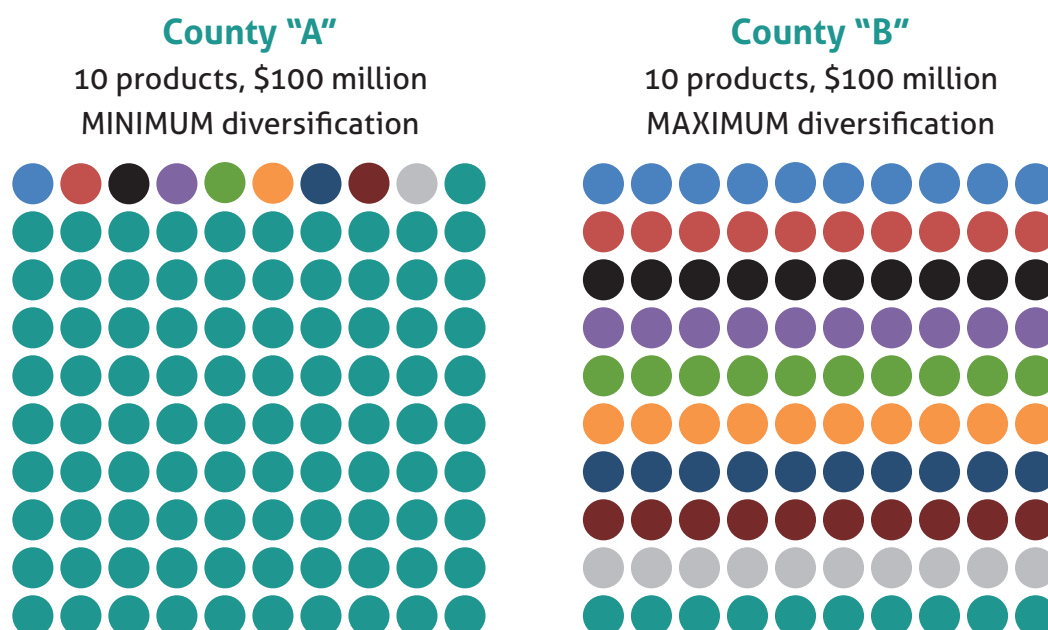
To answer this question, we calculated the Shannon-Weaver Index for San Joaquin County agriculture. Created in 1949 for military code breaking, the Shannon-Weaver index is widely used by economists, ecologists, and others interested in quantifying diversity. Different versions of the basic Shannon-Weaver formula exist. What they all have in common, though, is that they quantify not just the number of different items – such as characters in a coded message, species in a rainforest, or crops grown in a county – but also their relative *evenness* or *abundance*.

Figure 5 portrays this relationship. County "A" and County "B" both grow the same number of crops and have the same total value of that production. But County "A" has a low index, near zero, because 91% of production concentrates in a single crop. Any shock to that crop could devastate the agricultural economy.

County "B" depicts the opposite. Production perfectly balances across all crop categories. Each crop type contributes 10% of the total. This gives County "B" a strong buffer against economic shocks.

Figure 5. Agricultural Diversification is More Than Just the Number of Products

The two fictitious counties have identical agricultural products and total revenues, but diversification gives County "B" a stronger buffer against economic shocks



SHANNON-WEAVER INDEX



How exactly does one calculate the Shannon-Weaver Index for agriculture? The main steps are: 1) create a list of agricultural products and their production values; 2) remove minor, outlier products with production values less than 0.25% of the county total, such as sheep, honey, turkeys, pears, safflower, and sweet corn; 3) enter the data into the Shannon-Weaver formula; and 4) convert to a 1.0 scale. For additional details, please contact the authors.

For 2018, the Shannon-Weaver Index for San Joaquin County's agricultural industry was **0.63**.

What exactly does this number mean? For starters, getting the highest index, a perfect 1.00 on a scale from 0.00 to 1.00, would require the impossible: produce all seventy-two of California's major commodities and have farm gate values equally distributed across them. In such a case, the hypothetical county in **Figure 5** would show seventy-two rows instead of ten, each row a different color and identical length. No single county could accomplish this.

Over the past decade, San Joaquin County has consistently produced thirty-four major commodities. The relative contribution of individual commodities varied during this period from 0.25% of the county's total farm gate value (the minimum threshold for this analysis) to 21.0% of the county total. **Figure 6** depicts their most recent relative contributions.

Figure 6. Relative Distribution of San Joaquin County Agricultural Commodities

Colored circles represent approximately \$10 million each and depict major agricultural commodities' relative contributions to San Joaquin County's total 2018 farm gate value. Commodities less than \$10 million in value are depicted with a single dot (Source: 2018 San Joaquin County Agricultural Report)



At first glance, San Joaquin County's resulting index of 0.63 seems near the middle of 0.00 to 1.00 range. But the Shannon-Weaver formula includes a logarithmic function, which complicates interpretation. The logarithm makes the scale exponential, like the Richter Scale that measures earthquakes. Many Californians understand that a 7.4 earthquake releases twice the energy of a 7.2 earthquake even though the numbers are not far apart. The same principle applies here.

The 0.63 index is quite high compared to other California counties analyzed thus far. It likely suggests exceptional protection from economic shocks. Validating that protection would require stress testing, i.e. modeling specific shocks to see how they affect the industry. For now, suffice it to say that San Joaquin County agricultural production is both diverse and well distributed across types.

How has the Shannon-Weaver Index changed over time? Has agriculture become more diversified, or less so? **Figure 7** shows the Shannon-Weaver Index for the past decade. The main thing to note is consistent, high diversification across years. Despite a dip around 2014, agriculture's economic resiliency has held steady for ten years. This contrasts with the downward trend in many California counties that have become dependent on one or two major products.

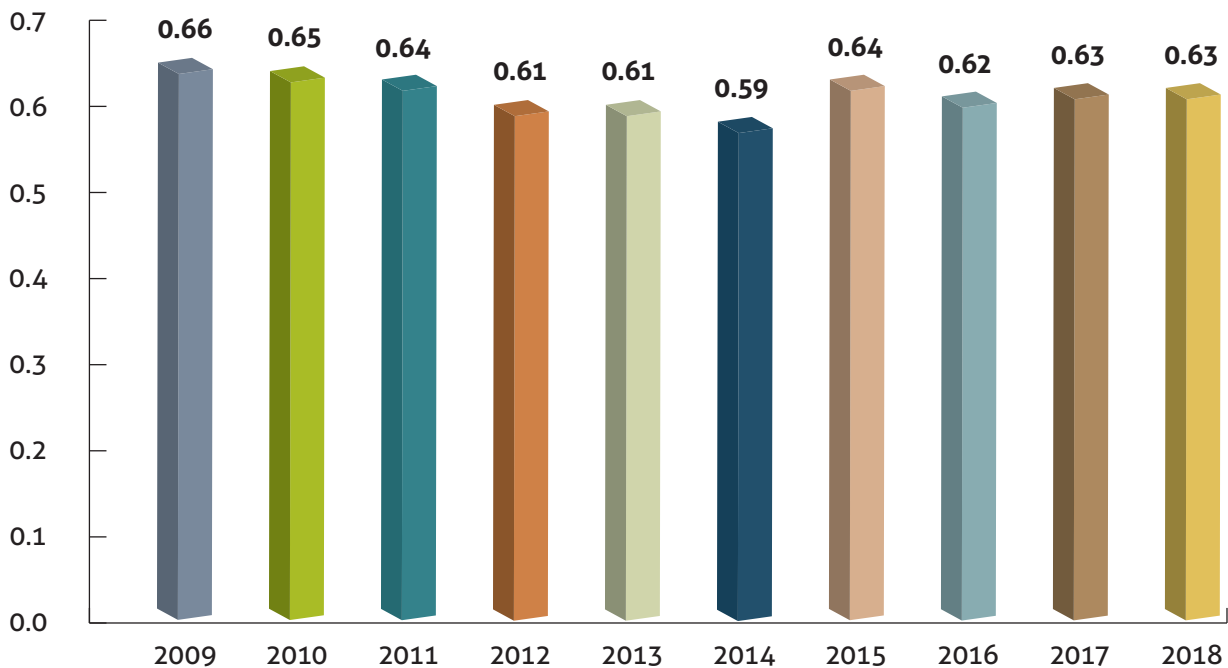
Again, the logarithmic scale means that what might look like small shift in **Figure 7** is actually a big one. Going from 0.59 to 0.63, for example, represents exponential change.

Changes over time underscore the value of a strong, diversified production base. For example, from 2014 to 2015, the county's four largest product categories saw sharp, one-year declines. Almonds, milk, walnuts, and grapes dropped a combined average of 29.9%. Tomatoes and hay also dropped. But the county's strong diversification mitigated the negative effects. Cherries, eggs, cattle & calves, potatoes, asparagus, silage (non-corn), and other commodities increased for 2015. This cushioned the impact by nearly half, to an overall 15.5% decline.



Figure 7. Ten-year Trend in San Joaquin County Agriculture's Economic Diversification

An indicator of economic resilience, the **Shannon-Weaver Index** quantifies diversification by combining the number of different commodities produced and their relative economic value.



Toward the Future

This report has documented the role that San Joaquin County agriculture plays as a local economic driver. Including local production, processing and multiplier effects, agriculture contributed \$5.732 billion to the county economy. Agriculture also played an important role in county employment, directly or indirectly supporting 33,737 jobs. Finally, agriculture's highly diversified production has provided critical economic stability not just to the agricultural industry, but to the larger county economy. The economic value of this stability is certainly high, albeit hard to quantify.

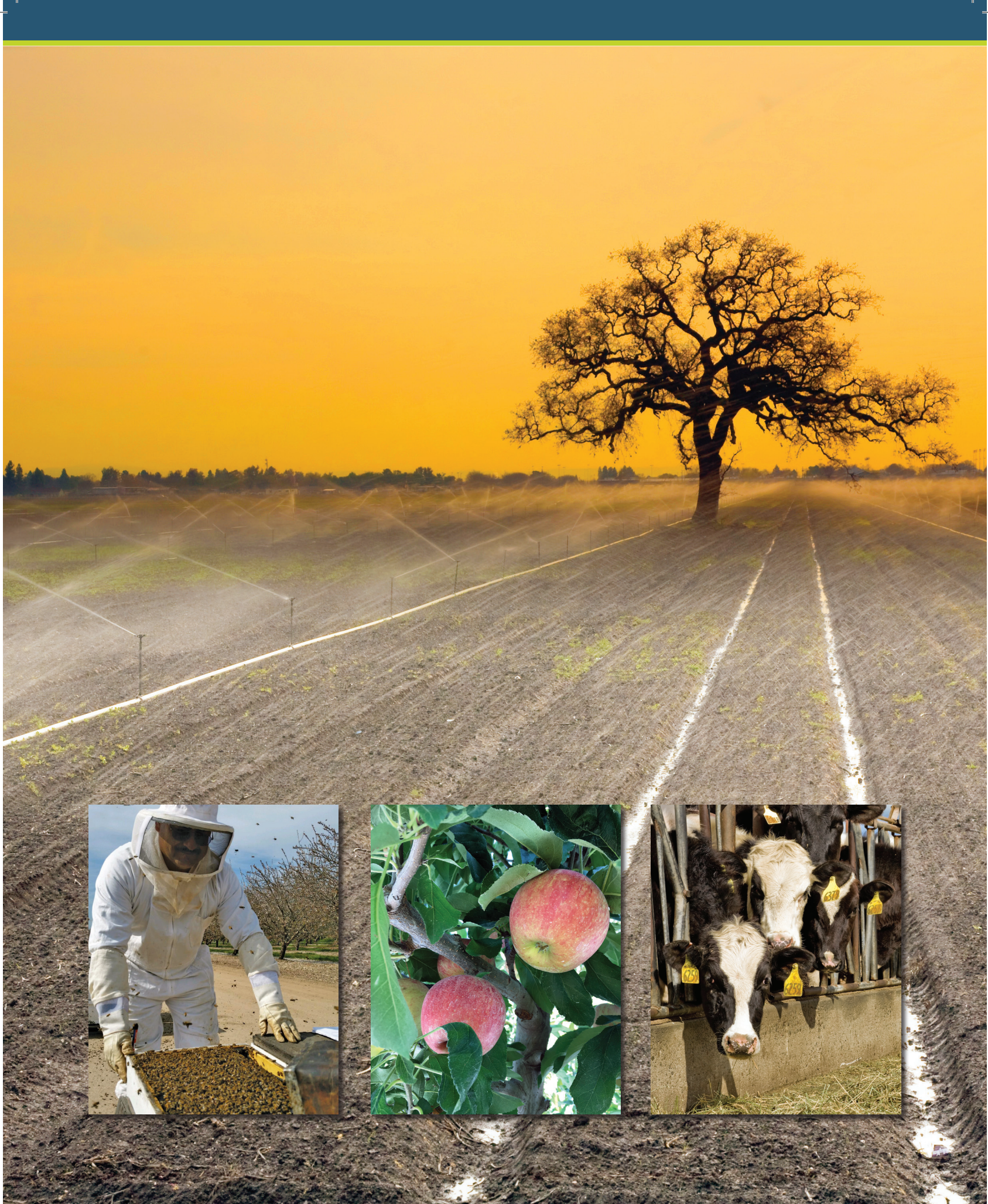
Agriculture is an important pillar of the San Joaquin County economy and represents a vital link to both the county's cultural past and competitive future. Although this report has presented many facts and figures, it has barely begun to fill key information gaps about agriculture's role. Several additional questions that lie beyond the scope of this report may warrant future research (see below). In the meantime, the findings herein provide the clearest picture yet of San Joaquin County agriculture's powerful economic role.

Additional Questions

- **ADDING VALUE LOCALLY.** As this report has shown, much processing of San Joaquin County's raw agricultural products occurs outside the county. What new policies, programs, and other initiatives, if implemented, could expand locally sourced, value-added food processing within the county?
- **PROCESSING OF IMPORTED RAW PRODUCT.** As noted earlier, many processors handle raw agricultural product brought from other Central Valley counties and beyond. What economic output and employment effects does this create for San Joaquin County?
- **TAX IMPLICATIONS.** What contribution do agricultural businesses make to county tax revenues? Including production and local processing, and after subtracting farm subsidies, our initial estimate puts agriculture's net 2018 tax contribution at \$20.46 million. This included excise, sales and property taxes, as well as fees, licenses and permits. Further research could firm up this number and also tailor it to specific urban areas.
- **ECOSYSTEM SERVICES.** What is the annual dollar value of wildlife habitat, scenic beauty, carbon sequestration, and more than twenty other ecosystem services that San Joaquin County's agricultural lands provide to society?
- **DIVERSIFICATION.** How is the county's economic diversification trending not just in terms of production across commodities, but also in terms of farm sizes, geographical markets, and organic/conventional?
- **ECONOMIC SHOCKS.** How would potential shocks affect agriculture's economic results, for example significant new regulations, pests, labor policies, water issues, or changes in the price of key inputs?
- **CANNABIS AND HEMP.** Commercial cannabis and industrial hemp production continue to gain momentum in California. What potential economic opportunities and risks do they pose for San Joaquin County agriculture?
- **PORT OF STOCKTON.** A major economic engine, the Port of Stockton handled two dozen different commodities in 2018, including significant rice, corn, and beef. To what extent does local farm production and food processing contribute to the port's annual economic output and employment?

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