

Economic Contributions of **Napa County** Agriculture





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A Commitment to Service

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Commissioner's Letter

It is a pleasure to share **Economic Contributions of Napa County Agriculture**. This report takes an important step beyond the Agricultural Crop 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 \$8.346 billion to the county economy. This far exceeded the \$1.043 billion figure from our 2018 Agricultural Crop Report. Agriculture also supported 20,843 direct employees, or nearly one out of every five jobs in the county. Adding multiplier effects brought total employment to 25,910 jobs. This report also explores economic diversification within agriculture, which has important implications for countywide economic resiliency.

Agriculture has a long tradition in Napa 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,

A handwritten signature in black ink, appearing to read "H. M. Izquierdo", written over a light background.

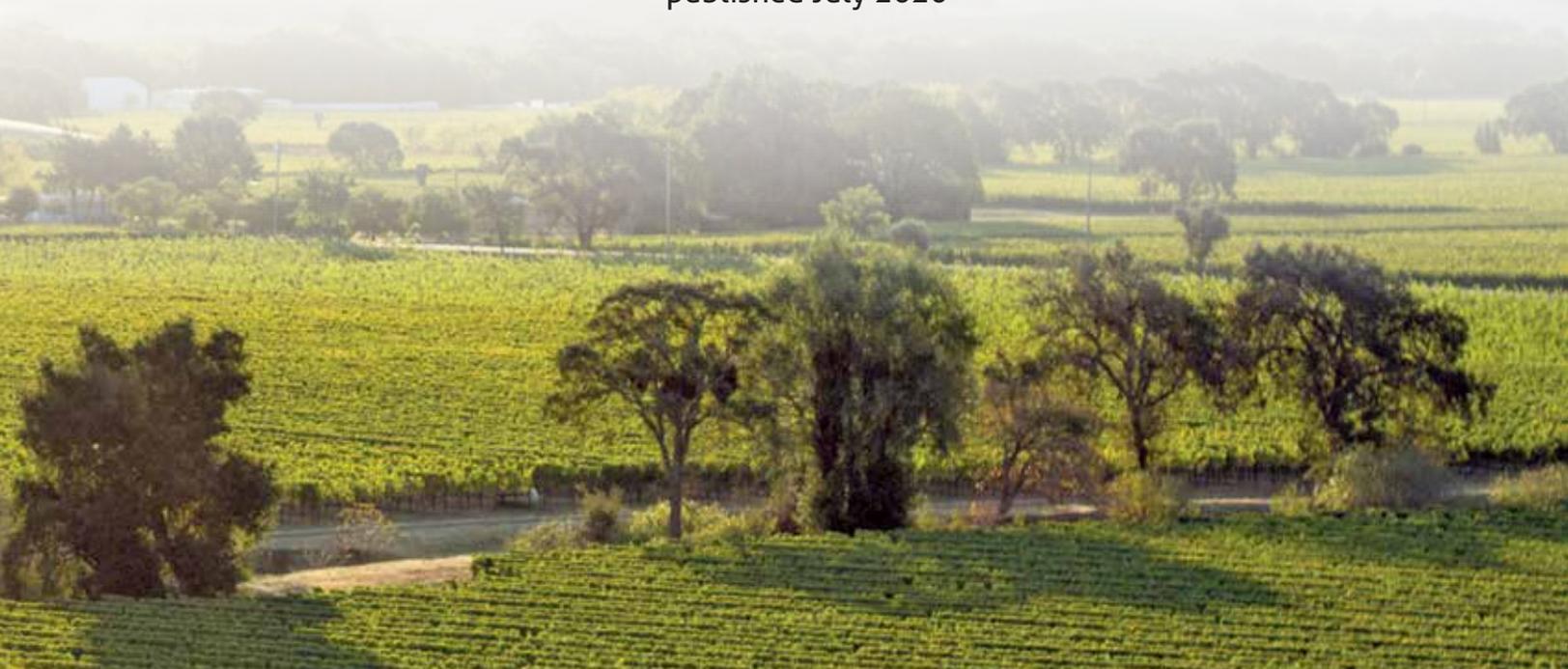
Humberto Izquierdo
Agricultural Commissioner/Sealer



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Napa County Agriculture by the Numbers

Economic Contributions of the Agricultural Industry for 2018

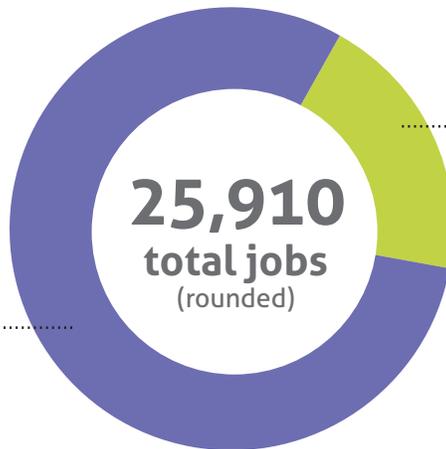
\$8.346 billion

Napa County Agriculture's total contribution to the local economy

\$22.9 million
per day

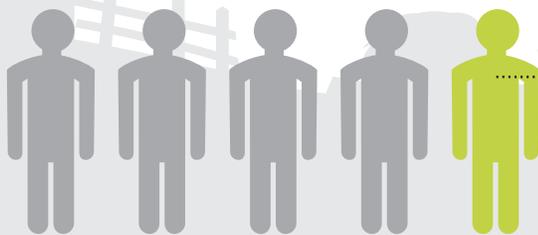


Employment Effects of the Agricultural Industry for 2018



20,843
direct employees

5,066
additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees



jobs in Napa County directly attributable to the agricultural industry



Introduction

Residents and visitors alike know and value the contributions agriculture makes to Napa County. World renowned vineyards thrive in deep, fertile soils. Farmers' markets bustle with local fruits, vegetables, and community pride. It is not difficult to see that agriculture plays a vital role in sustaining a healthy economy in Napa 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 Napa 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 Napa County economy. The report also examines agricultural diversification and its role in supporting economic resilience, including a first-ever 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 Napa 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 5 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 Napa County Agricultural Crop Report produced by the Department of Agriculture and Weights & Measures. The main national data source is IMPLAN, a widely used economic modeling program. Originally created for the U.S. Department of Agriculture (USDA), IMPLAN uses econometric modeling to convert data from more than a dozen federal 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. For details, please see www.implan.com.

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 Napa County conditions. Please contact the authors for additional details on the methods used.



Direct Effects of Napa County Farm Production

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

PRODUCTION

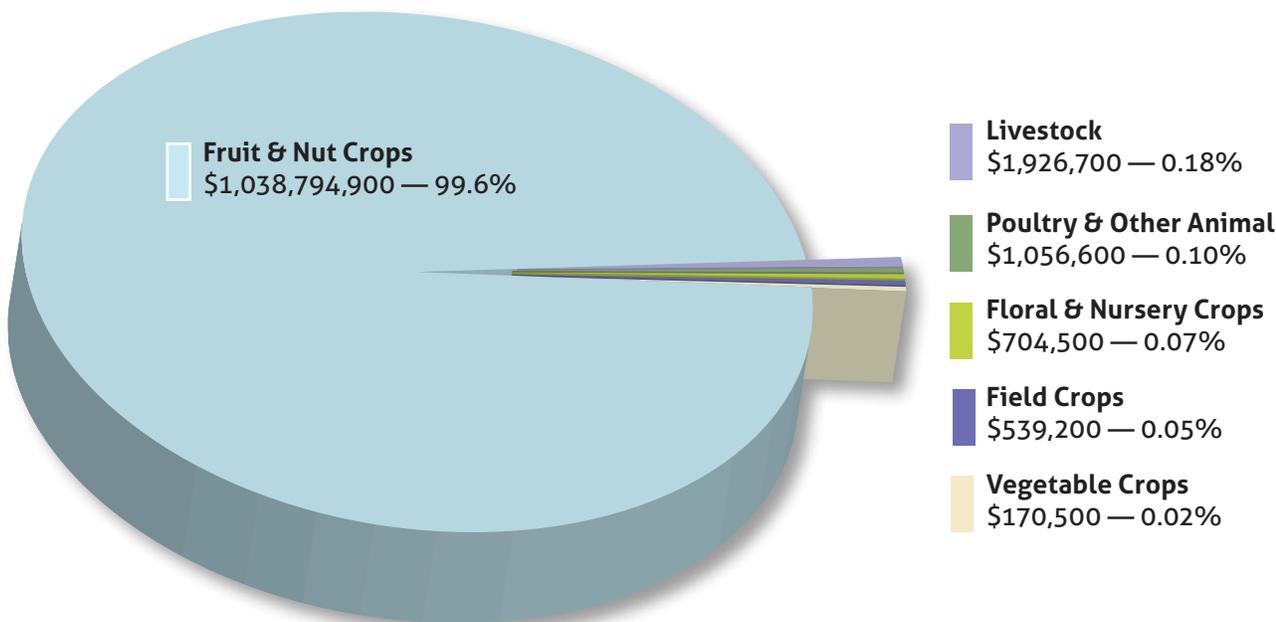
Figure 1 shows the various categories that made up Napa County's farm production value. At \$1.039 billion, Fruit & Nut Crops was the single largest production category by dollar value, comprising 99.6% of the county total. Wine grapes dominated this category at \$1,038,600,100, cracking the billion dollar mark for the first time in history. Olives and other fruit & nut crops accounted for the remaining \$194,800 in this category.

Four small categories rounded out the remaining 0.4% of production. At \$1.9 million (0.18%), Livestock consisted mostly of cattle & calves. Floral & Nursery Crops combined lavender, irises, vegetable starts, cut flowers, trees, and ornamental nursery stock. Field Crops was mostly pasture and rangeland, with a bit of hay. Vegetable Crops included over three dozen vegetables, from beans and beets to turnips and tomatoes.

The combined, total dollar value for all products more than doubled over the previous decade, from \$502.2 million in 2009 to \$1.043 billion in 2018. 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 Department of Agriculture and Weights & Measures 2018 Agricultural Crop Report for additional details on specific products and their value.

Figure 1. Distribution of Napa County Farm Production

Source: 2018 Agricultural Crop Report, Department of Agriculture Weights & Measures



EMPLOYMENT

How many people work in agricultural production? In 2018, IMPLAN data indicate that agricultural production directly employed 8,851 people in Napa 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 8. Nor did it include Napa County's many public sector jobs in agriculture, across a wide range of local, state, and federal agencies.

Multiplier Effects of Napa County Farm Production

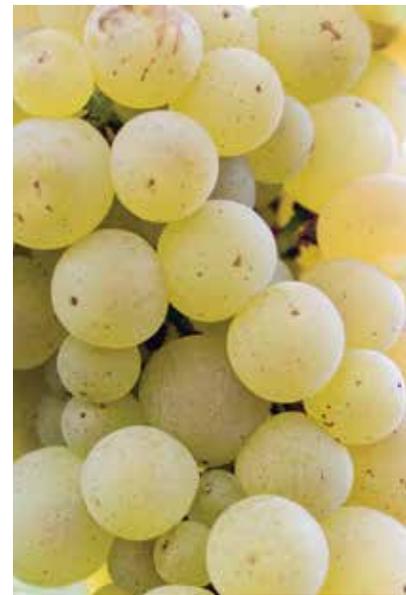
This section quantifies the economic ripples that farm production creates in the local economy. These ripples take two forms: *indirect effects* and *induced effects*. The first consists of business-to-business supplier purchases. For example, when a grower buys farm equipment, fertilizer, pesticides,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

Sector names and production values in **Figure 2** differ from the county's annual report. They 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.



The following list helps bridge NAICS and IMPLAN sectors with familiar commodities mentioned in Napa County's annual Agricultural Crop Report:

- **Fruit Farming:** Wine grapes, Olives, and Miscellaneous others such as: Apples, Apricots, Asian Pears, Blackberries, Blueberries, , Cherries, Citrus, Figs, Guava, Jujubes, Loquats, Nectarines, Peaches, Pears, Persimmons, Plums, Pluots, Pomegranates, Prunes, Quince, Raspberries, Strawberries;
- **Cattle & Other Animal Production:** Cattle & Calves, Poultry, Sheep & Lambs, Miscellaneous Others;
- **Greenhouse, Nursery & Floriculture:** Lavender, Irises, Vegetable Starts, Cut Flowers, Trees, Ornamental Nursery Stock;
- **Grain Farming:** Hay, Pasture, Rangeland;
- **Vegetable & Melon Farming:** Artichokes, Arugula, Asparagus, Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Cantaloupes, Carrots, Cauliflower, Celery, Corn, Cucumbers, Edible Flowers, Eggplants, Endive, Fennel, Garlic, Gourds, Greens, Herbs, Kohlrabi, Leeks, Lettuce, Melons, Okra, Onions, Peas, Peppers, Potatoes, Pumpkins, Radishes, Rhubarb, Spinach, Squash, Tomatillos, Tomatoes, Turnips.



Each sector has distinct multipliers. Napa County "Fruit Farming," for example, had a 2018 *indirect effects* output multiplier of 0.2542 and an *induced effects* multiplier of 0.1994. This means that each dollar's worth of direct output generated an extra 25 cents in supplier purchases, plus 20 cents more in consumption spending by owners and employees of agricultural businesses and their suppliers.

Each sector also has unique multipliers for employment. The bottom row of **Figure 2** shows combined employment figures across sectors. Output and employment multipliers change every year, for each sector and county in the entire nation, reflecting where companies and employees spend their money.

Figure 2. Economic Effects of Napa County Farm Production

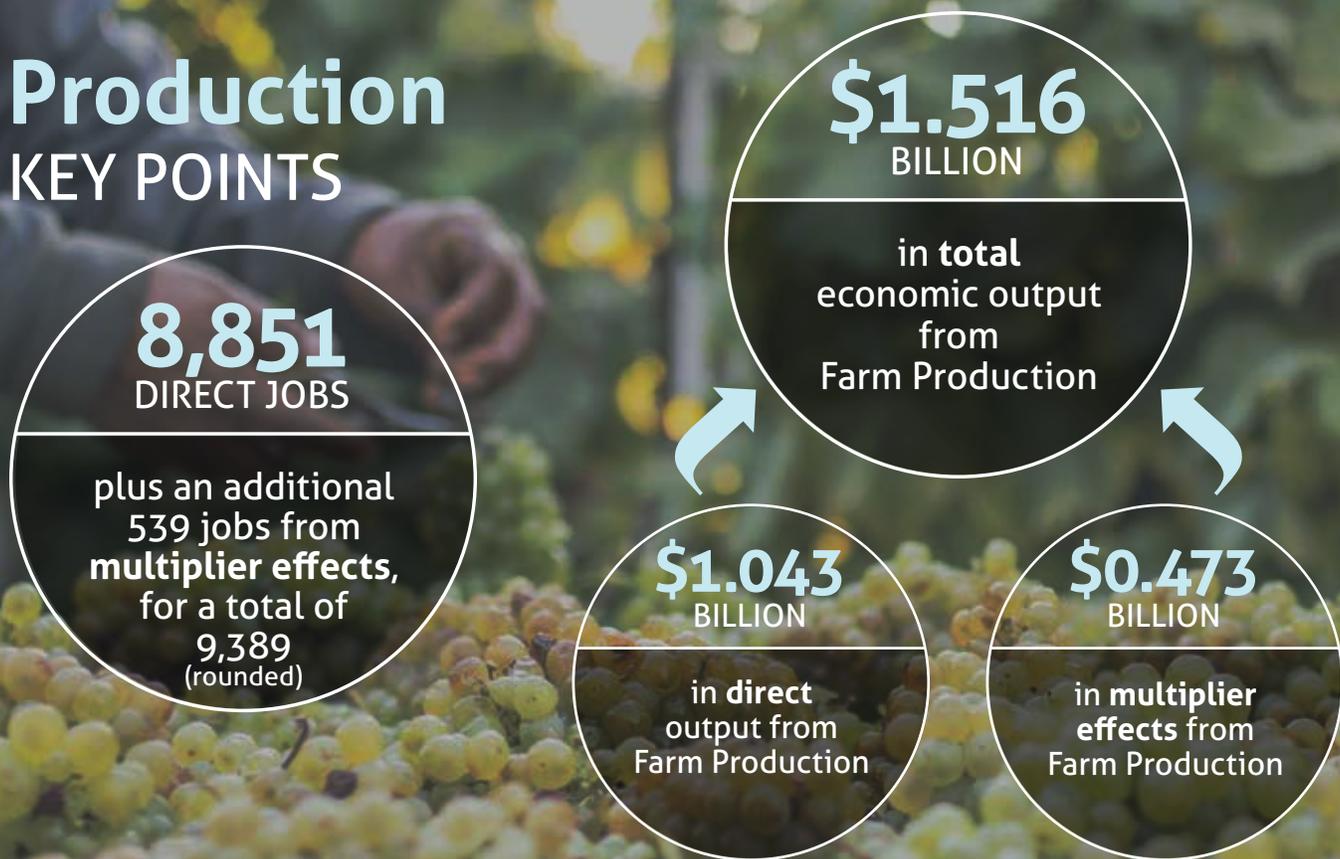
Dollar values are in \$ millions. Figures are for 2018 and come from IMPLAN, with direct output and sector name adjustments for local conditions. Not all columns and rows add exactly due to rounding.

FARM PRODUCTION	Output Effects (\$ Millions)			TOTAL
	Direct	Indirect	Induced	
Fruit Farming	\$1,038.8	\$264.1	\$207.2	\$1,510.1
Cattle & Other Animal Production	\$3.0	\$1.0	\$0.3	\$4.3
Greenhouse, Nursery & Floriculture Production	\$0.7	\$0.2	\$0.1	\$1.0
Grain Farming	\$0.5	\$0.1	\$0.1	\$0.8
Vegetable & Melon Farming	\$0.2	\$0.1	\$0.0	\$0.3
TOTAL ECONOMIC OUTPUT	\$1,043.2	\$265.4	\$207.8	\$1,516.3
TOTAL EMPLOYMENT	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	8,851	380	159	9,389



Production

KEY POINTS



Locally Sourced, Value-added Food Processing

Farm production tells only part of the story. Napa County is home to food and beverage processors that play a key role in the local economy. This section estimates the economic value of local food and beverage 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 Napa County were it not for the abundant supply of raw agricultural products, especially wine grapes.

Based on our strict criteria, we excluded IMPLAN food and beverage sectors that other studies often include.¹ For example, Napa County produced \$470.4 million in bread, coffee, liquor, chocolates, pastries, soft drinks, bottled water, and related food items. Their production directly supported an estimated 571 jobs. Adding these sectors could overstate the value of local agriculture, including its employment and multiplier effects.

We also took precautions to avoid double-counting. For example, we did not factor the county's wine grape production into this section because the Farm Production section already captured the \$1,038,600,100 value of wine grapes. We only calculated the dollar value that wineries add to wine grapes by producing wine.

Figure 3 shows the economic effects of locally sourced, value-added processing. Like the previous section, sector names and direct output figures draw from IMPLAN, customized to the Napa County context.

The largest sector by far, "Wineries" in **Figure 3** reflects the value added to the county's wine grape crop. A unique combination of climate, soils, and other factors supports over five hundred wineries producing grapes on more than forty thousand acres. Local wineries crush, ferment, and bottle grapes, then often add extra value by hosting tastings, weddings, and other events.

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).



For detailed analysis of wineries' economic impact, readers are encouraged to consult studies commissioned by the Napa Valley Vintners. Like this one, those studies used proprietary IMPLAN data and captured economic ripples that wineries create.² The most recent one notes that different methodologies across studies makes comparisons between them difficult. That caveat applies to this study, as well.

As the name suggests, "Miscellaneous Other Food Processing" is a catch-all category that reflects a broad range of niche products. Several farms, for example, produce olive oil from trees grown on site. A few producers grow walnuts, then sell them raw, roasted, and/or flavored. Others make jams, jellies, and other products from local fruit, for sale at farm stands, retail stores, online, and farmers' markets. This category also captures significant bulk shipments of grape juice to destinations outside the county, as well as small amounts of bottled grape juice and grapeseed oil.

"Meat & Other Animal Products" in **Figure 3** reflects meat and other animal products that are processed locally. This includes ranches that produce and process livestock for niche markets, and small-scale processing of sheep, rabbits, and poultry. The category also captures eggs, honey, soap, shampoo, and several other niche products.

Of note, we did not include any of the county's \$33.4 million in "Breweries" output. Hops production is slowly returning to neighboring counties, especially Sonoma, making it possible to brew beers that are truly local. At the time of writing, Napa County's craft brewers still depended overwhelmingly on imported hops.

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

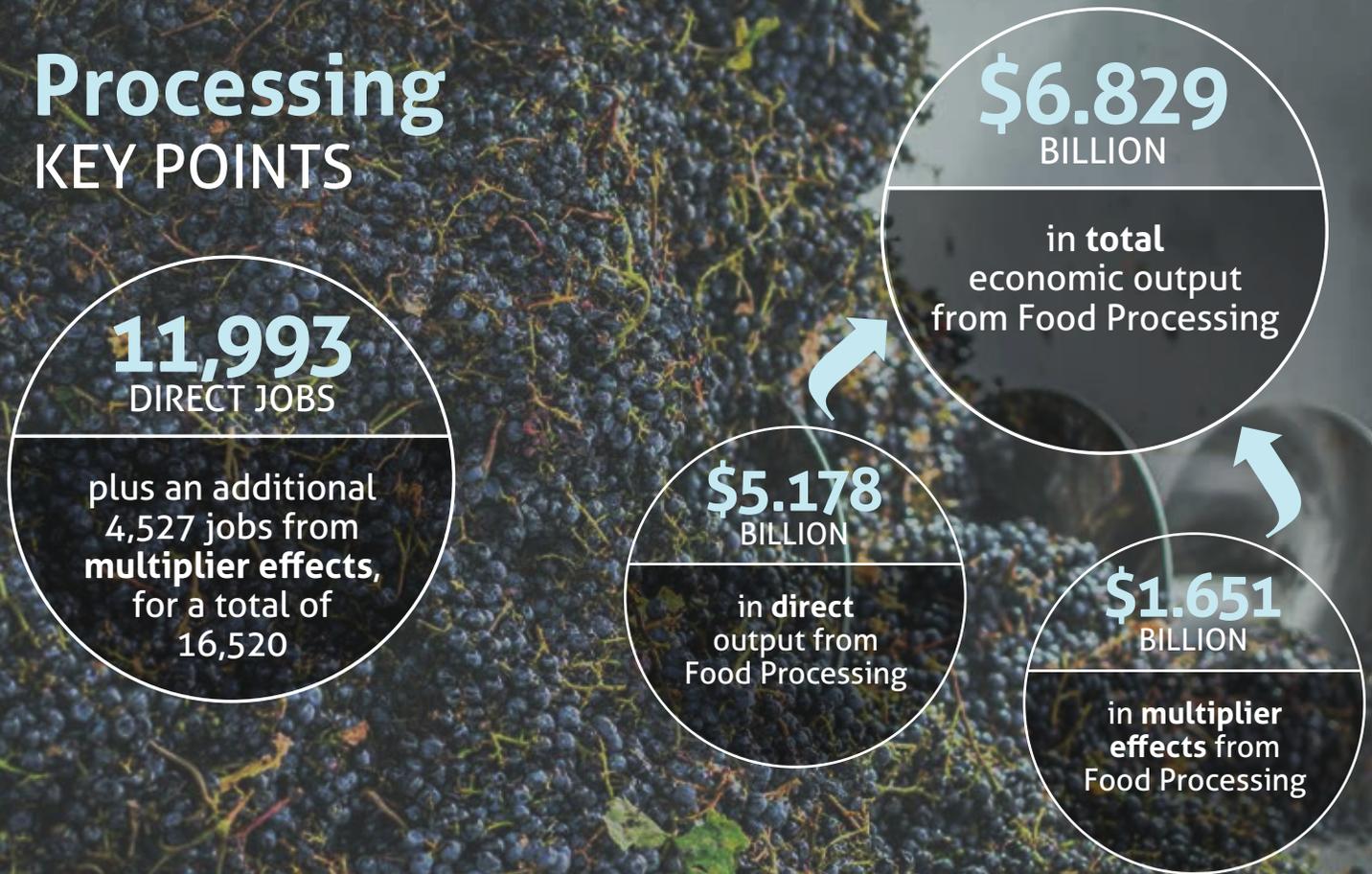
Sources: IMPLAN and U.S. Bureau of Economic Analysis data.
Columns and rows may not compute exactly due to rounding.

FOOD PROCESSING	Output Effects (\$ Millions)			TOTAL
	Direct	Indirect	Induced	
Wineries	\$5,022.5	\$979.3	\$641.1	\$6,642.9
Miscellaneous Other Food Manufacturing	\$154.4	\$16.1	\$13.8	\$184.3
Meat & Other Animal Products	\$1.9	\$0.7	\$0.2	\$2.7
TOTAL ECONOMIC OUTPUT	\$5,178.8	\$996.1	\$655.1	\$6,829.9
TOTAL EMPLOYMENT	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
	11,993	2,692	1,835	16,520

² For the most recent and thorough analysis, see the 27-page report "The Economic Impact of Napa County's Wine and Grapes, 2016," published December 2017 by the Stonebridge Research Group. The same firm authored reports in November 2012 and October 2008. We also consulted the June 2005 study, "Economic Impact of Wine and Vineyards in Napa County" by MFK Research.

Processing

KEY POINTS



Total Economic Contributions of Napa 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 Napa County agriculture.

As **Figure 4** shows, the total 2018 economic contribution of Napa County agriculture was \$8.346 billion. This consisted of \$6.222 billion in combined, direct output from production and processing, plus \$2.124 billion in multiplier effects.

For perspective, agriculture pumped *over twenty-two million dollars per day* into the county economy during 2018 (\$22,866,488 to be exact). This equated to \$952,770 per hour and \$15,880 per minute. The \$6.222 billion in direct output represented 31.3% of the county's total economic output of \$19.875 billion, or nearly *one out of every three dollars*.

Total agricultural employment covered in the scope of this study was 25,910. This included 20,843 jobs directly in agriculture and another 5,066 attributable to multiplier effects. The 20,843 direct agricultural jobs represented 19.4% of Napa County's total employment of 107,411 or *one out of every five jobs*.



Figure 4. Overall Economic Effects of Napa County Agriculture

Columns and rows may not compute exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects (\$ Millions)	\$1,043.2	\$265.4	\$207.8	\$1,516.3
Employment Effects (# Jobs)	8,851	380	159	9,389
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects (\$ Millions)	\$5,178.8	\$996.1	\$655.1	\$6,829.9
Employment Effects (# Jobs)	11,993	2,692	1,835	16,520
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects (\$ Millions)	\$6,222.0	\$1,261.4	\$862.8	\$8,346.3
Employment Effects (# Jobs)	20,843	3,072	1,994	25,910

How Resilient is Agriculture to Economic Shocks?

Like their counterparts everywhere, Napa County agricultural producers face a long list of risks. Prominent examples include droughts, floods, wildfires, disease outbreaks, new regulations, new competitors, labor availability, price drops, and rising costs for fuel, equipment, and other inputs. Any one of these risks could 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 Napa 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?

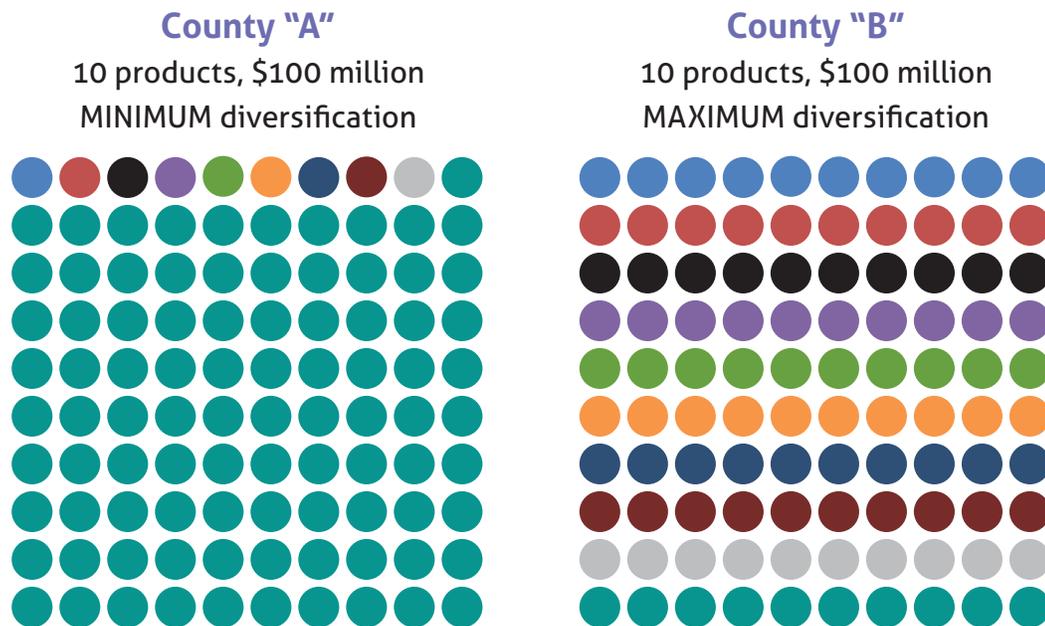
To answer this question, we calculated the Shannon-Weaver Index for Napa County agriculture. Created in 1949 for military code breaking, the Shannon-Weaver index is widely used by economists, ecologists, and others interested in quantifying diversity. Different versions of the basic Shannon-Weaver formula 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 were: 1) created a comprehensive list of agricultural products and their production values; 2) removed ten minor, outlier products that had production values less than 0.25% of the county total, in particular: olives, other fruits & nuts, floral & nursery, pasture & rangeland, hay, cattle & calves, sheep & lambs, other livestock, poultry & other animal products, and vegetables; 3) entered the data into the Shannon-Weaver formula; and 4) converted to a 1.0 scale. For additional details, please contact the authors.

For 2018, the Shannon-Weaver Index for Napa County's agricultural industry was **0.09**.

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.

Napa's **0.09** index is low compared to the twenty other California counties we have analyzed thus far, which have ranged from 0.20 to 0.63, with an average of 0.48. This likely suggests limited protection from economic shocks. Validating that protection would require stress testing, i.e. modeling specific shocks to see how they affect the industry.

The low level of economic diversification, and resulting high economic vulnerability, highlight the importance of partnerships between growers and public agencies to prevent catastrophic events. In one prominent example, growers and the Office of the Agricultural Commissioner operate the Napa County Winegrape Pest and Disease Control District. The collaborative effort works to minimize risk from the glassy-winged sharpshooter, vine mealybug, European Grapevine Moth, and other threats.



Toward the Future

This report has documented the role that Napa County agriculture plays as a local economic driver. Including local food processing and multiplier effects, agriculture contributed \$8.346 billion to the county economy. Agriculture also played an important role in county employment, directly or indirectly supporting 25,910 jobs.

Agriculture is an important pillar of the Napa 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 Napa County agriculture's powerful economic role.

ADDITIONAL QUESTIONS

- **ECONOMIC SHOCKS.** How would potential shocks affect agriculture's economic output, for example significant new regulations, pests, labor policies, water issues, technology breakthroughs, or changes in the price of key inputs? To what extent has the 2020 coronavirus pandemic affected the industry?
- **ECOSYSTEM SERVICES.** What is the annual dollar value of wildlife habitat, scenic beauty, open space, carbon sequestration, and more than a dozen other ecosystem services that Napa County's agricultural lands provide to society? An initial, back-of-the-envelope calculation puts the value at \$198 million to \$975 million per year.
- **CANNABIS AND HEMP.** Commercial cannabis and industrial hemp production continue to gain traction across California, and have received considerable policy attention in Napa County. What economic opportunities and risks do they pose for the agricultural industry? For the county economy?

Acknowledgments

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Napa County Department of Agriculture

www.countyofnapa.org/agcom

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