





Economic Contributions of SONOMA *County* Agriculture



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Commissioner's Letter

I am pleased to share the **Economic Contributions of Sonoma County Agriculture**. This report takes an important step beyond the Sonoma County Crop Report that we have published every year since 1928. 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.

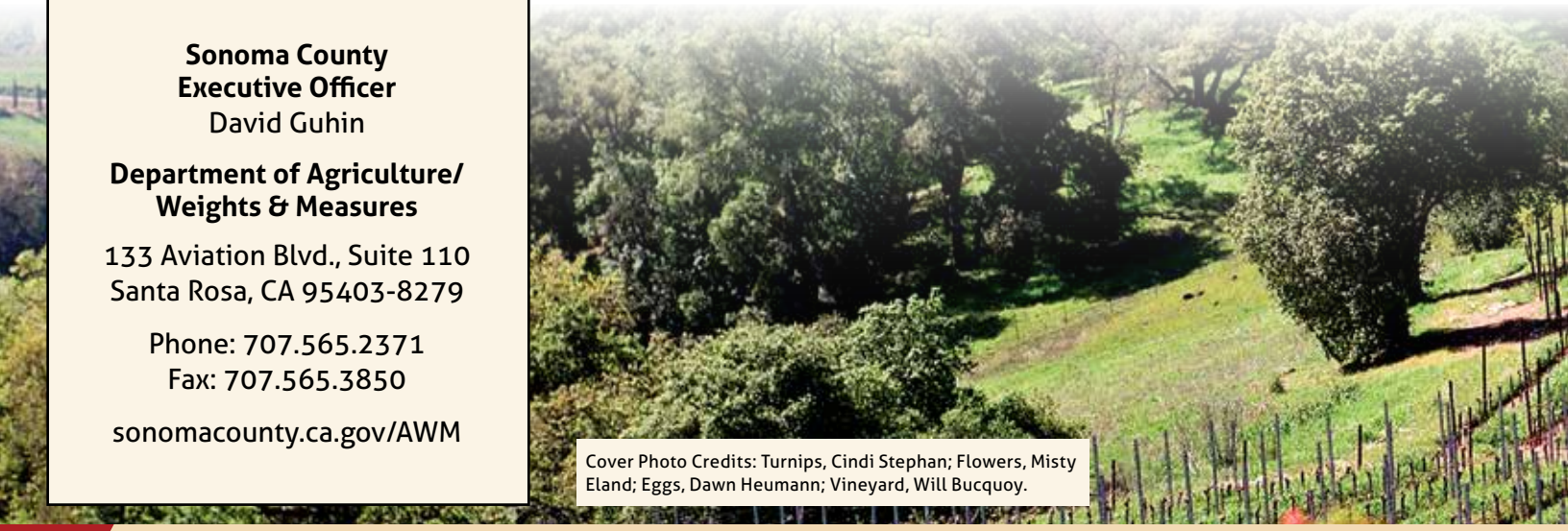
This new study shows that in 2024, agriculture contributed a total of $5.758 billion to the county economy. This far exceeds the $857.6 million farm gate value from our 2024 Sonoma County Crop Report. Agricultural production and processing also directly supported 14,791 jobs, plus another 11,066 employees that agricultural companies and their employees indirectly supported through local spending.

In addition, this report documents the level of economic diversification within agriculture, which effectively scores the industry's resiliency to variables impacting the market. Finally, the study explores scenic beauty, wildlife habitat, wildfire mitigation and more than a dozen other nonmarket ecosystem services that agricultural lands provide to society, with a 2024 estimated value of $1.258 billion to $5.229 billion.

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

Respectfully submitted,

Andrew Smith
Agricultural Commissioner/Sealer of Weights & Measures



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Photo by Jackson Family Wines

Sonoma County Agriculture at a Glance

Economic Contributions
of the Agricultural Industry for 2024

$5.758 BILLION

Sonoma County Agriculture's total contributions to the local economy

$3.772
BILLION in direct economic output

$1.986
BILLION in multiplier effects

$15,774,954
per day

Employment Effects
of the Agricultural Industry

25,857
total jobs (rounded)

14,791
direct employees across production & processing

11,066
additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees

1 in 21
jobs in Sonoma County attributable to the agricultural industry

Photo by Maggie Furlong

Introduction

Nestled between rugged coastal ridges and sunlit inland valleys north of the San Francisco Bay, Sonoma County is a world-renowned leader in sustainable agriculture and fine wine. Generations of dedicated farmers and vintners steward the land, producing premium wine grapes, organic vegetables, dairy, and pasture-raised livestock. The county's diverse microclimates—from warm inland valleys to fog-kissed coastal hills—foster an extraordinary range of crops while preserving the region's natural harmony. Rooted in innovation and community, Sonoma County's farms embody a legacy of quality, stewardship, and farm-to-table excellence.

Clearly, agriculture plays a vital and historic role in the Sonoma County economy. What's not so clear, 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 Sonoma 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 Sonoma County economy. The report also examines economic diversification in agriculture and its implications for resilience to economic shocks. Finally, the report provides an estimated value of non-market ecosystem services provided by agricultural lands. On the whole, the findings offer important information for policymakers, the public and anyone who values a vibrant and resilient local economy.



Photo by Cindi Stephan

Our Approach

A *basic industry* 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 Sonoma 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, the latter two of which are known as *multiplier effects*.

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 7 explains this further.

To understand the furthest economic impacts of agriculture, one would also need to assess agricultural-related costs to society through, for example, net impacts on water and other natural resources. While important, a full assessment of these impacts lies beyond the scope of this study.

Our calculations draw from local and national data sources. The local sources include industry experts and the annual Sonoma County Crop Report produced by the Sonoma County Department of Agriculture/Weights & 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 528 industry sectors. Because IMPLAN draws from multiple sources, including the most recent USDA Census of Agriculture, its employment and economic output numbers often differ from ones reported by individual state and federal agencies. For details, please see "Data Sources for Select Industries: Farm, Construction, Railroad, and Government" on the company website: http://bit.ly/4e0if2Z. Except where otherwise noted, all figures are from 2024, the most recent IMPLAN dataset available. Where appropriate, we adjusted sector names for clarity and applied coefficients to IMPLAN values to reflect unique Sonoma County conditions. Please contact the authors for additional details on the methods used.

Direct Effects of Sonoma 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 Sonoma County's farm production value. At $631.6 million, Fruit and Nut Crops was the single largest production category by dollar value, comprising 73.6% of the county total. Wine grapes dominated this category at $626.6 million. Apples followed at $3.90 million.

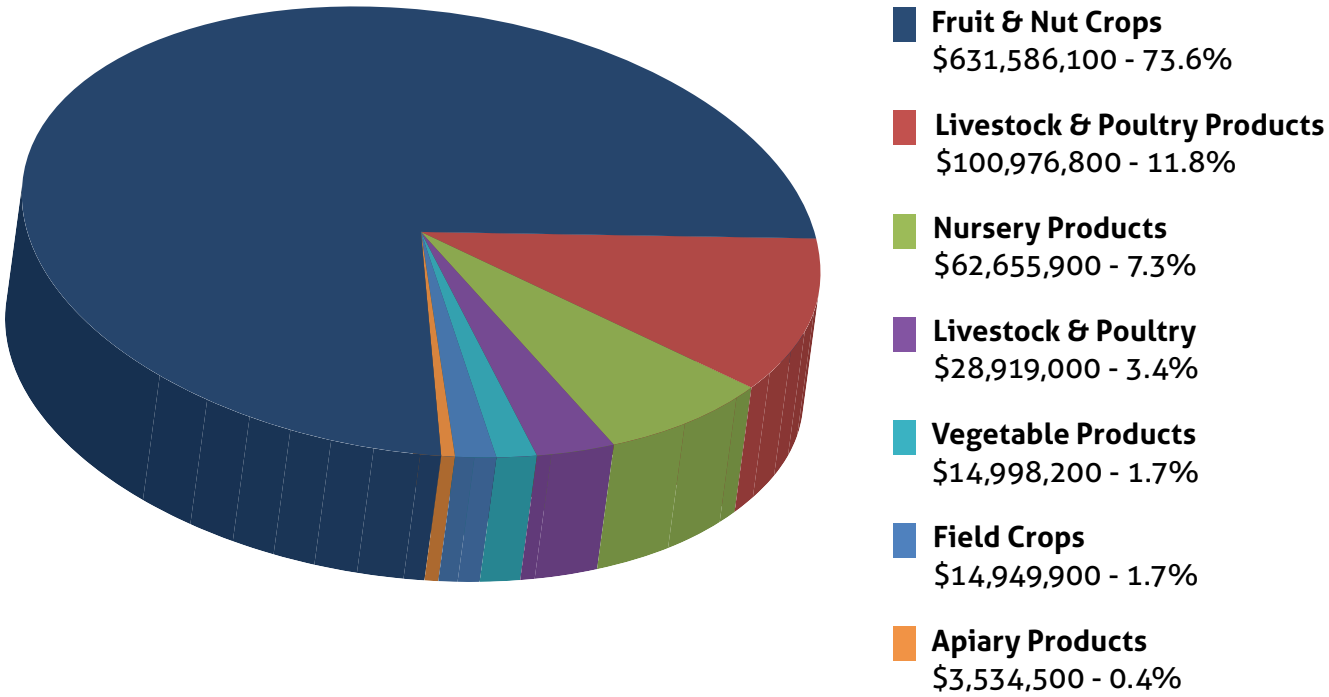
At 11.8%, Livestock and Poultry Products represented the second largest category ($101.0 million). Milk topped this grouping at $80.2 million, including both organic ($71.9 million) and conventional ($8.3 million). Miscellaneous products followed at $20.8 million.

Nursery Products was the third largest category at $62.7 million (7.3%), led by ornamentals ($31.5 million), miscellaneous products ($15.9 million), and bedding plants ($8.5 million). At $28.9 million, Livestock and Poultry was the fourth largest grouping, followed closely by Vegetable Products ($15.0 million) and Field Crops ($14.9 million).

The combined total dollar value for all agricultural products increased by $91.3 million (11.9%) over the previous decade, from $766.3 million in 2015 to $857.6 million in 2024. Inflation totaled 28.4% during the period. Total values represent gross output and do not reflect the net profit or financial performance of individual producers or the industry as a whole. Interested readers are encouraged to consult the 2024 Sonoma County Crop Report for additional details on specific products and their value.

Figure 1. Distribution of Sonoma County Farm Production

2024 Sonoma County Crop Report, Sonoma County Department of Agriculture/Weights & Measures



EMPLOYMENT

How many people work in agricultural production? In 2024, IMPLAN data indicate that agricultural production directly employed 6,003 people in Sonoma 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 10. Nor did it include Sonoma County's public sector jobs in agriculture across a range of local, state, and federal agencies.

Readers who want to know more about employment estimates are encouraged to consult IMPLAN's technical article referenced earlier: "Data Sources for Select Industries: Farm, Construction, Railroad, and Government." In general, IMPLAN data attempts to correct for omissions and inconsistencies among other sources. For example, IMPLAN counts farm owners (proprietors) even though other sources do not. IMPLAN also corrects for certain crops with low production levels not being reported by other sources due to disclosure laws that protect the privacy of individual producer data. Last, IMPLAN counts part-time workers differently than the USDA Census of Agriculture. Imagine a farm with six people who work two months each, sequentially in a year. The Census of Agriculture would report that as six jobs, whereas IMPLAN would consider it to be just one job – a position that happens to be filled by six different temporary workers.

Multiplier Effects of Sonoma 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 Sonoma County producer buys milking machines, feed, supplements, insurance, banking services, chemicals, veterinary supplies and other inputs, the producer creates *indirect effects*.

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

Although agricultural companies, suppliers and their combined employees certainly spend money in other counties, this study only reflects those expenditures within Sonoma County. Quantifying expenditures outside the county would be an expensive, complex effort that lies well beyond our scope here.

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

The following list helps bridge NAICS and IMPLAN sectors in **Figure 2** with familiar commodities listed in the 2024 Sonoma County Crop Report:

- **Fruit and Nut Crops:** Apples (All), Grapes (Wine), Olives, Misc. Fruits & Nuts.
- **Livestock and Poultry Products:** Milk (Organic & Conventional), Milk (Manufacturing), Wool, Misc. Livestock & Poultry Products.
- **Nursery Products:** Ornamentals, Bedding Plants, Christmas Trees, Cut Flowers, Misc. Nursery Products.
- **Vegetable, Apiary and Field Crop Production:** Misc. Vegetables, Misc. Apiary Products, Hay (Rye & Oat), Hay (Volunteer), Green Chop, Oats (Grain), Silage (Corn), Silage (Rye & Oat), Silage (All - Corn, Rye & Oat), Hemp, Straw, Misc. Field Crops, Pasture, Rangeland.
- **Livestock and Poultry:** Cattle & Calves, Sheep & Lambs, Hogs, Misc. Livestock & Poultry.

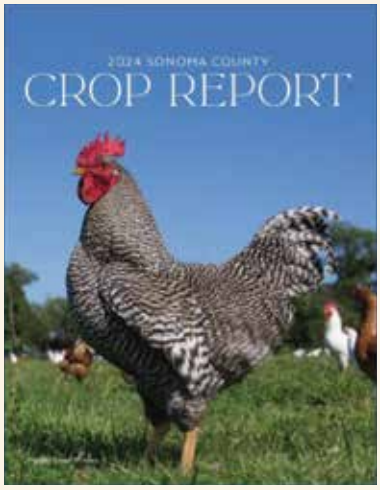



Photo by Misty Eland


Photo by Maggie Furlong

Note that sector names and production values in **Figure 2** differ slightly from the county's annual report. They combine elements from a standard classification system used nationwide called the North American Industrial Classification System (NAICS), as adapted by IMPLAN. Each year, agricultural producers in Sonoma County and nationwide use the NAICS categories on Schedule F of their federal tax returns ("Profit or Loss from Farming"), which requires them to designate the NAICS category that best fits their operation. Producers also use NAICS categories when completing the USDA Census of Agriculture, most recently for 2022.

Each sector has distinct multipliers. For example, Sonoma County's "Fruit Farming" sector, included in **Figure 2** as part of "Fruit and Nut Crops," had a 2024 *indirect effects* multiplier of 0.2952 and an *induced effects* multiplier of 0.1588. This means that each dollar's worth of direct output generated an extra 29 cents in supplier purchases, plus 15 cents more in consumption spending by the owners and employees of agricultural businesses and their suppliers.

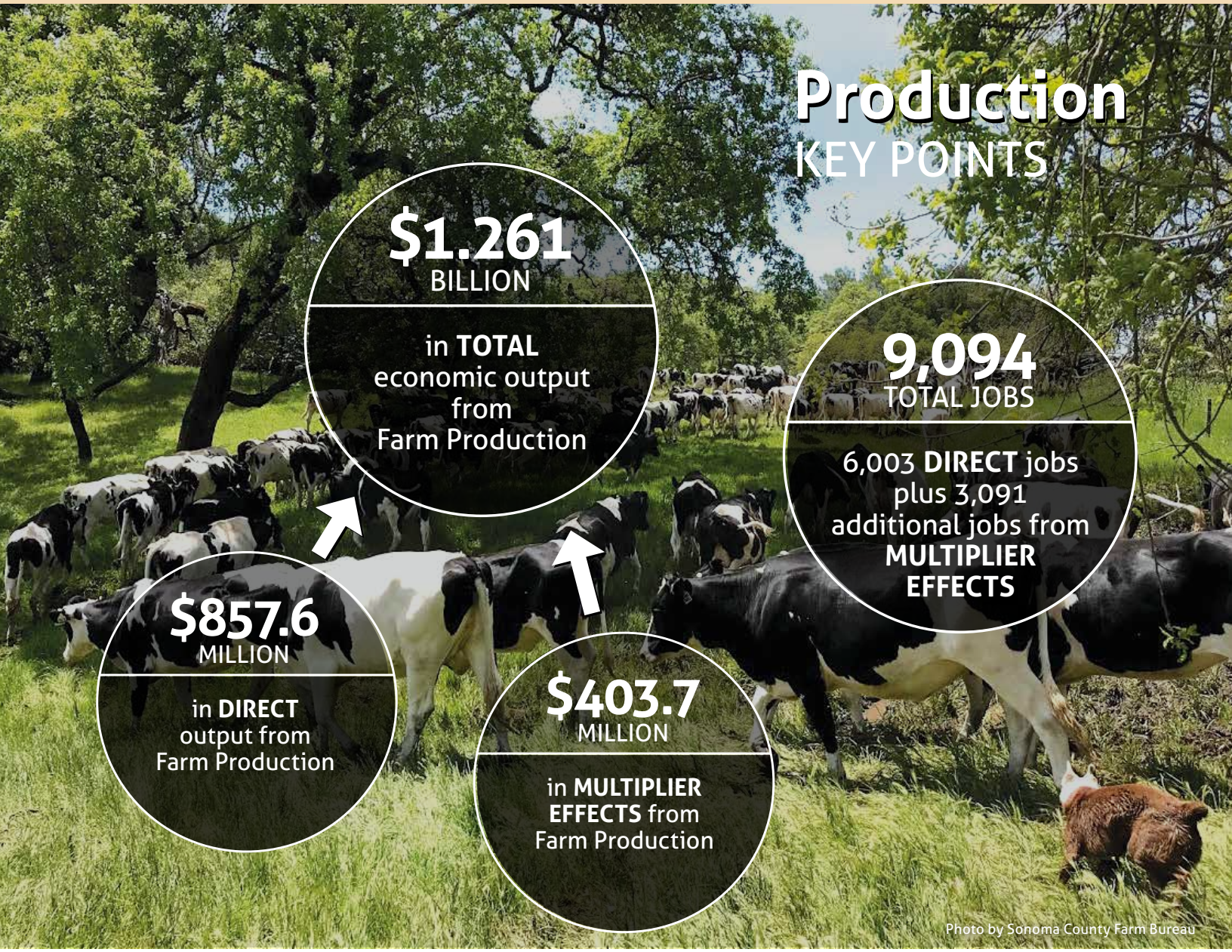
Multipliers change every year for each sector and county nationwide. The multipliers update to reflect where companies and employees spent their money. For example, Sonoma County's *induced effects* multiplier for the IMPLAN sector "Greenhouse, Nursery, and Floriculture Production," which is included in **Figure 2** under "Nursery Products," was 0.0813 in 2014, then more than doubled 0.2042 for 2024.

Sectors have unique multipliers not just for economic output but also for employment. For example, Sonoma County "Fruit and Nut Crops" in **Figure 2** supported 4,529 *direct* jobs plus an additional 1,892 *indirect effects* jobs and 537 more from *induced effects*. The bottom row of **Figure 2** shows combined employment figures across sectors.

Figure 2. Economic Effects of Sonoma County Farm Production

Dollar values are in $ millions. Figures are for 2024 and come from IMPLAN and U.S. Bureau of Economic Analysis, with adjustments for local conditions. Columns and rows may not compute exactly due to rounding.

FARM PRODUCTION SECTOR	Output Effects ($ Millions)			TOTAL
	Direct	Indirect	Induced	
Fruit and Nut Crops	$631.6	$186.3	$100.3	$918.2
Livestock and Poultry Products	$101.0	$40.4	$7.0	$148.3
Nursery Products	$62.7	$22.9	$12.8	$98.4
Vegetable, Apiary and Field Crop Production	$33.5	$14.0	$6.8	$54.3
Livestock and Poultry	$28.9	$11.5	$1.6	$42.1
TOTAL ECONOMIC OUTPUT	$857.6	$275.2	$128.5	$1,261.3
	Employment Effects (# of Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	6,003	2,413	678	9,094



Locally Sourced, Value-Added Food Processing

Farm production tells only part of the story. This section captures the economic value of local food processing, which plays a vital role in the Sonoma County economy. 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, i.e., Sonoma County's abundant supply of animals, fruits, vegetables and other raw agricultural products.

We also took precautions to avoid double-counting. For example, we did not factor wine grape production into this section because **Figure 2** already captured the $626,550,200 direct dollar value of wine grapes in its "Fruit and Nut Crops" row. We only calculated the value created by converting wine grapes into wine.

Nor did we include the county's $80,151,300 in organic and conventional milk production since the "Livestock and Poultry Products" row in **Figure 2** already includes that value. We only calculated the value created by processing raw milk into cream, cheese and other dairy products.

Based on these strict criteria, we excluded several IMPLAN food and beverage sectors that other studies often include. Adding these sectors could overstate the value of local agriculture, including its employment and

multiplier effects. For example, we did not include Sonoma County's $178.8 million bread and bakery products sector because most raw ingredients such as flour and yeast came from outside the county. Nor did we include the county's manufacturing of coffee and tea ($177.4 million), cookies and crackers ($65.6 million), spices and extracts ($64.3 million), tortillas ($56.6 million) and flavoring syrups ($18.5 million).

Figure 3 shows the economic effects of locally sourced, value-added food processing. As with **Figure 2**, the sector names incorporate elements from IMPLAN and NAICS, which lump and split products according to a national classification system for tracking economic output.

The largest sector by far, **"Wineries"** in **Figure 3** reflects Sonoma County's stature as a world-class wine producer. A unique combination of climate, soils, and other factors supports over 425 wineries across 19 distinct growing regions. For 2024, local vineyards produced 211,512 tons of wine grapes on 57,020 bearing acres, with a total value of $626.6 million. An estimated 80% to 90% of wine grapes stayed in Sonoma County for wine production. Wineries added value to the wine grape crop through crushing, fermentation, clarification, aging, blending and bottling.

The Wineries value in **Figure 3** especially reflects wine from local, estate-grown grapes. Viticulturalists (experts who grow grapes) collaborate with winemakers to convert high-quality wine grapes into premium wines, paying attention to terroir—the combination of soils, topography, and other physical factors that can affect the wine's character. Many wineries add extra value by hosting events such as tastings, tours, weddings, meals, wellness activities, meetings and conferences.

Several publicly-available studies have analyzed various aspects of Sonoma County's wine industry. These publications tend to focus on economic impacts beyond the scope of this study. They include, for example, economic impacts from the estimated 25% to 35% of Sonoma County wine made from grapes that were imported from other California counties. They also count economic impacts that occur outside Sonoma County.

"Cheese & Other Dairy Products" in **Figure 3** reflects production by Sonoma County's remarkable artisanal dairy industry. Many producers are multi-generational family farms. Several maintain fully integrated farmstead operations where they raise their own animals and process milk on-site. Others have developed cooperative relationships with neighboring Sonoma County dairies to ensure consistent and fresh local supply.

Figure 3: Economic Effects of Locally Sourced, Value-Added Food Processing

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

FOOD PROCESSING	Output Effects ($ Millions) Direct	Indirect	Induced	TOTAL
Wineries	$2,197.6	$803.8	$428.3	$3,429.8
Cheese & Other Dairy Products	$260.1	$93.9	$21.7	$375.7
Miscellaneous Other Food Manufacturing	$180.0	$39.9	$20.0	$239.9
Light Processing of Fruit, Vegetable & Nursery Products	$146.7	$7.8	$71.8	$226.3
Meat, Poultry & Other Animal Products	$129.8	$76.2	$18.9	$224.9
TOTAL ECONOMIC OUTPUT	$2,914.3	$1,021.6	$560.7	$4,496.6
	Employment Effects (# Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	8,788	4,972	3,003	16,763

Producers add value to raw milk in myriad ways. Examples include pasteurization into drinking milk, separation into cream, churning into butter and buttermilk, culturing and fermenting into sour cream and yogurt. One local business is the nation's leading producer of sheep milk yogurt. At least three operations produce organic ice cream through a combination of mixing, pasteurizing, homogenizing, aging, freezing, and hardening. A creamery with operations in Sebastopol and Windsor uses an innovative liquid nitrogen flash-freezing process to create unusually smooth and dense ice cream.


Photo by Dawn Heumann

Artisan cheeses are especially prominent. Sonoma County produces large quantities of jack cheeses (e.g., Jack, dry, pepper, aged), as well as cheddar, chèvre, feta, brie, camembert, ricotta, blue, Swiss and many others. Multiple creameries make cheese curds. A few produce cream cheese and fresh spreads. At least four operations have diversified into value-added skincare products, especially goat milk soaps, salves, balms, and lotions.

"Meat & Other Animal Products" captures the portion of the county's cattle, sheep, poultry and miscellaneous other animals that are processed within Sonoma County. Nearly all of the county's $15.3 million in cattle/calves and $5.3 million in sheep/lambs leave the county for slaughter. An estimated 5% to 10% return to Sonoma County for processing at one of a handful of local meat shops. More than a dozen farms and ranches produce and sell meat directly to consumers through farm pick-ups, deliveries, retail outlets, and online sales.



Photo by Straus Family Creamery

An estimated 80% to 90% of poultry stays within the county for processing. Almost 100% of the 600-plus cattle, poultry, hogs, rabbits, pigs, goats and lambs sold at the annual Livestock Auction at the Sonoma County Fair stay within Sonoma County for slaughter and processing. Once known as the "Egg Basket of the World," the county has 73 registered egg producers as well as two commercial egg processing facilities that wash, candle, grade, and pack fresh eggs for distribution across northern California.

This category also includes apiary operations. Companies in Sebastopol, Fulton, Forestville and elsewhere produce and sell a wide variety of honey varietals, as well as beeswax products such as candles, sheets and cosmetics. Other products include bee pollen, propolis tincture (medicinal), and mead (honey wine). A limited amount of commercial pollination also occurs.


Photo by Straus Family Creamery

"Light Processing of Fruit, Vegetable & Nursery Products" in Figure 3 captures post-harvest value added to the county's 200-plus acres of fruits and vegetables, as well as to nursery stock and flowers. This sector includes portions of the NAICS/IMPLAN "Support Activities for Agriculture" sector that involve the sorting, grading, cleaning, and packaging fruits, vegetables, and other products.

Producers add value to the county's $62.7 million nursery products sector by putting plants into suitable containers ranging from inexpensive flats and trays to decorative clay and wooden pots. They prune, trim and shape product, and add labels as appropriate for retail markets. A niche nursery in Sebastopol, for example, specializes in carnivorous plants. One near Santa Rosa sells over 250 types of Japanese maple trees. Others focus on natives, succulents, and other niches. A few nurseries offer destination experiences for visitors by functioning as botanic gardens and providing educational resources.

Producers add similar value to floriculture products. After harvest, they trim, cool, arrange, and package flowers, then add labels. A vibrant "farm-to-vase" movement exists in Sonoma County whereby farms host visitors for hands-on creative workshops in wreath-making, dried flower arrangements, and floral design. Several serve as wedding and event venues, including an historical Petaluma farm with over 8,000 rose plants.

The catchall category **"Miscellaneous Other Food Manufacturing"** category in **Figure 3** encompasses a wide range of boutique-scale processing. Farms in Bloomfield, Forestville, Glen Ellen and Sebastopol, for example, support Sonoma County's thriving "field-to-jar" movement. They process fresh produce into jams, jellies, marmalades, preserves and other jarred products with extended shelf life and easy storage. Farms often sell these products—as well as chutney, salsa, pesto, butter and even pickles—online, at farm stands and farmers' markets. A few operations specialize in fruit pies. A Geyserville farm grows hazelnut trees, but mainly for their symbiotic relationship with the main commercial crop, black truffles (*Tuber melanosporum*).

Several apple farms in Fulton, Occidental, Sebastopol and elsewhere convert portions of their harvest into products such as apple cider, juice, cider vinegar, fruit leather, balsamic vinegar, cider syrup, and apple sauce. Multiple farms—including ones in Geyserville, Glen Ellen, Healdsburg, and Sebastopol—produce bottled olive oils from estate-grown olives. Other olive-based products include olive soaps, spa products, dipping oils, tapenades, and even dog bones made with olive oil. A farm in Sebastopol with over 5,000 lavender plants produces lavender body care products, lavender soaps, essential oils, and lavender-infused honey and olive oil. Farmers' markets and online stores offer direct outlets for many of these niche products.

This category also includes a tiny portion (2%) of the county's thriving beer brewing sector, worth $259.4 million in 2024. Many craft brewers flavor beer with local fruits, but they still depend on outside grains, especially hops grown in the Pacific Northwest or Germany. A handful of farms in Alexander Valley, Healdsburg, Rohnert Park and Sebastopol produce hops that provide an essential ingredient for beer brewing that is truly 'local.' At the time of writing, eight Sonoma County breweries mentioned sourcing hops from local farms.

Overall, Sonoma County's agricultural industry stands as a remarkable hub of locally-sourced, value added food processing. A combination of collaboration, innovation and vertical integration—deeply grounded in history and regenerative, sustainable agriculture—transforms raw agricultural commodities into premium value-added products that generate significant economic impacts.



Photo by Rodney Strong Vineyards

Total Economic Contributions of Sonoma 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 effects of Sonoma County agriculture.

As **Figure 4** shows, the total 2024 economic contribution of Sonoma County agriculture was $5.758 billion. This consisted of $3.772 billion in combined direct output from production and processing, plus $1.986 billion in multiplier effects.

The $3.772 billion in direct output represented 5.6% of Sonoma County's total 2024 output of $67.154 billion across all industries, or about one out of every 18 dollars.

For perspective, agriculture pumped over *fifteen million dollars per day* into the county economy during 2024 ($15,774,954 to be exact). This translates to $657,290 per hour and $10,955 per minute.

Total agricultural employment covered in the scope of this study was 25,857. Of these, 14,791 jobs were directly in agricultural production and processing, with the remaining 11,066 from multiplier effects. The 14,791 direct agricultural jobs represented 4.7% of Sonoma County's total employment of 313,364, roughly one out of every 21 jobs.


Photo by Merriam Vineyards

Figure 4. Overall Economic Effects of Sonoma County Agriculture

Columns and rows may not compute exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects ($ Millions)	$857.6	$275.2	$128.5	$1,261.3
Employment Effects (# Jobs)	6,003	2,413	678	9,094
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects ($ Millions)	$2,914.3	$1,021.6	$560.7	$4,496.6
Employment Effects (# of Jobs)	8,788	4,972	3,003	16,763
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects ($ Millions)	$3,771.9	$1,296.8	$689.2	$5,757.9
Employment Effects (# of Jobs)	14,791	7,385	3,681	25,857

How Resilient is Agriculture to Economic Shocks?

We have all heard the old saying "don't keep all your eggs in one basket." If the basket drops, then you might lose everything. This section takes a deep dive into that concept and focuses on three questions: 1) Why is economic diversification important? 2) How economically diversified is Sonoma County agriculture? and 3) How has agriculture's level of economic diversification trended over time?

Answers to these questions can shed important light on the agricultural industry's economic resilience, with implications for the wider county economy and beyond.

WHY IS ECONOMIC DIVERSIFICATION IMPORTANT?

Like growers and ranchers everywhere, Sonoma County's agricultural producers face a long list of risks. Examples include: wildfires, droughts, floods, pandemics, crop pests and diseases, food safety-related outbreaks, new regulations, new competitors, labor availability and cost, price drops, tariffs and other trade policies, and spikes in costs for inputs such as fuel, equipment and water. Any one of these risks can deal a damaging blow. When combined, they can undermine not just an individual operation but an entire industry.

Take Napa County, for example, where wine grapes account for 99% of the annual agricultural value. When wildfires and a pandemic caused a 51% decline in wine grapes for 2020, the county's overall agricultural value declined by that same percent. Contrast that with Sonoma County, where wine grapes also faced a dramatic decline – down 46.3% in 2020 – but stronger economic diversification reduced the county's overall loss to 29.0%.

HOW DIVERSIFIED IS SONOMA COUNTY AGRICULTURE?

If economic diversification is like an "insurance policy" against risks, then that raises the question: how economically diversified is Sonoma County agriculture?

To answer this question, we calculated the Shannon index for Sonoma County agriculture. Created in 1949 for military code breaking, the Shannon index is widely used by economists and others interested in quantifying diversification. Different versions of the basic Shannon formula exist, as well as different names. 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 or crops grown in a county – but also their relative *evenness* or *abundance*.

How exactly does one calculate the Shannon index for agriculture? The main steps are: 1) create a list of agricultural products and their production values over the past decade; 2) remove hogs, wool, olives and eleven other outliers products that had average production value less than one-fourth of one percent (0.25%) of the county's total; 3) enter the data into the Shannon formula; and 4) convert to scale from 0.0 to 1.0. For additional details, please contact the authors.

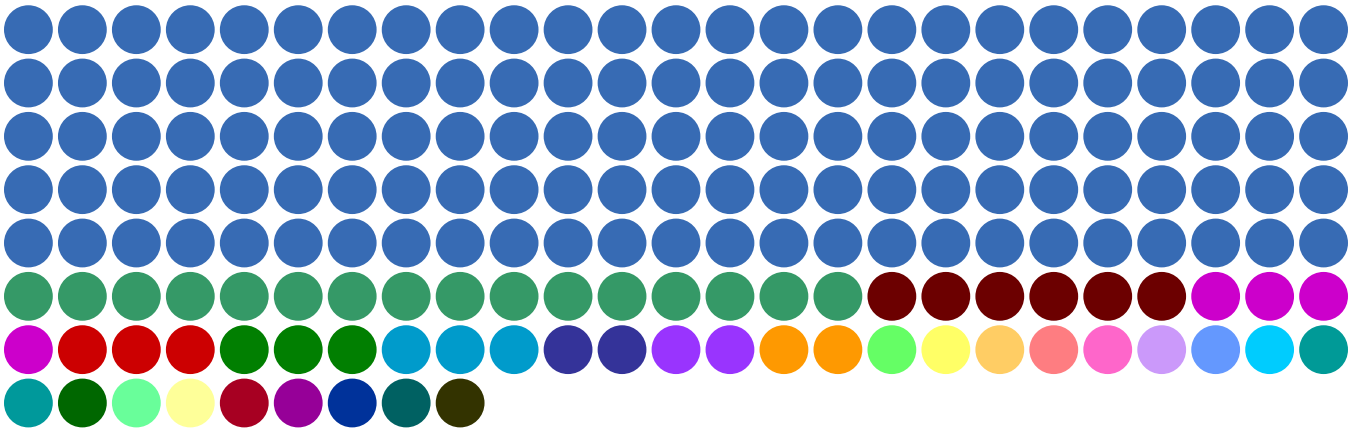
Over the past decade, Sonoma County has consistently produced and reported 15 major commodities. The relative contribution of each major commodity varied during this period from 0.25% of the county's total gross production value (the minimum threshold for this analysis) to 75.8% of the county total (wine grapes in 2023). **Figure 5** depicts their most recent relative contributions.



Photo by Mary Halasz

Figure 5. Relative Distribution of Sonoma County Agricultural Commodities

Each circle below represents approximately $5,000,000 in gross sales. Each of the 28 colors represents a unique agricultural commodity, starting with blue for wine grapes. Combined, the circles and colors visually portray major agricultural commodities' relative contributions to Sonoma County's total 2024 gross production value. Commodities less than $5,000,000 in value are depicted with a single dot. The number of commodities produced, and their relative evenness, influences the industry's economic diversification score and its resilience to economic shocks. (Source: 2024 Sonoma County Crop Report)



For 2024, the Shannon index for Sonoma County's agricultural industry was **0.27**.

What exactly does this number mean? To begin with, 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 gross production values equally distributed across them. No single county could accomplish this.

At first glance, Sonoma County's index of 0.27 seems near the lower quarter of the 0.00 to 1.00 range. But the Shannon 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 0.27 index is average compared to typical U.S. counties, many of which focus on a just one or two crops such as corn, soybeans or wheat. The index is quite low by California standards, based on the twenty-three counties analyzed thus far. Overall, Sonoma County's low economic diversification suggests limited protection from economic shocks.

On the upside, the presence of a livestock sector alongside crops gives Sonoma County "shock absorbers" when markets or weather swing. California's cattle and specialty-crop sectors have low to negative correlations. Their revenue highs and lows rarely coincide due to different biological clocks, price drivers and weather sensitivities. Sonoma County's pasture-raised cattle and calf enterprises, therefore, create portfolio-level risk reduction for the county.

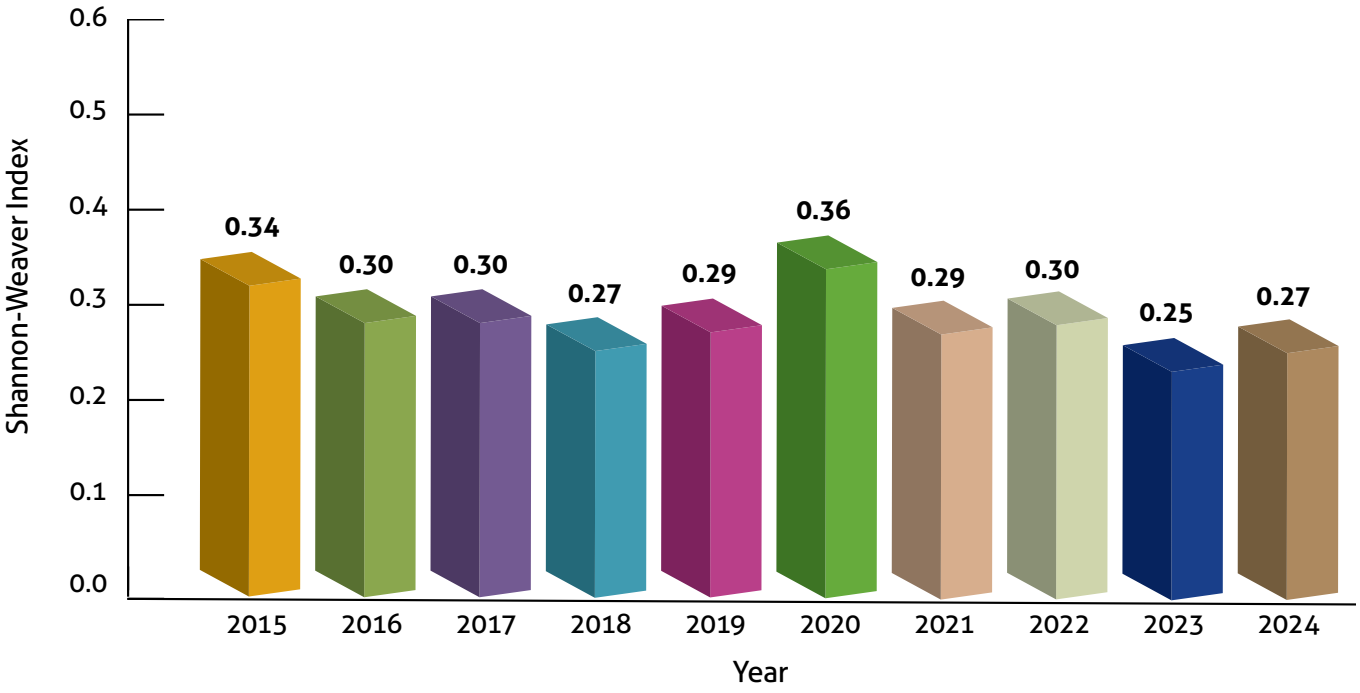
Strong diversification within animal agriculture likely adds an extra layer of resilience. The county produces not just cattle and calves, but also dairy, poultry, eggs, lambs, goats, and hogs—each with distinct market dynamics, production cycles, and price drivers. When plant agriculture commodity markets face downturns from oversupply, pest pressures, weather events or demand shifts, Sonoma County's diverse animal enterprises often maintain stability or even experience countercyclical gains.

HOW HAS AGRICULTURE'S LEVEL OF ECONOMIC DIVERSIFICATION TRENDED OVER TIME?

Has agriculture become more diversified in Sonoma County, or less? **Figure 6** shows the Shannon index for the past decade. The main thing to note is consistent and low economic diversification across the years. The index has held somewhat steady over time, always within the narrow 0.25 to 0.36 range. Further, the slight downward trend over the past decade – from 0.34 in 2015 to a low of 0.25 in 2023 – contrasts with the flat trendline occurring in California counties that are not dependent on one or two major products.

Figure 6. Ten-Year Trend in Sonoma County Agriculture's Economic Diversification

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



The Covid-19 pandemic underscored the importance of a strong, diversified agricultural production base. The pandemic disrupted supply chains, farm labor, production costs, exports, prices and other factors. Many crops went unharvested, and grocery store shelves sat empty across much of the Northern Hemisphere.

Not surprisingly, several Sonoma County products declined in value when the Covid-19 pandemic hit. Among 27 commodities consistently tracked over the past decade, the majority experienced declines for 2020. Examples of decliners include wine grapes (-46.3%), miscellaneous fruits & nuts (-44.7%), miscellaneous vegetables (-37.2%), miscellaneous nursery products (-25.4%), cut flowers (-13.3%), ornamentals (-11.2%), and apples (-3.1%).

Gains in other areas partially offset these losses. Ten commodities increased for 2020, with a 17.1% median gain in value. Most gainers were livestock and livestock products or feed. Examples include miscellaneous field crops (+74.3%), silage (+49.2%), rye and oat hay (+27.7%), milk (+24.2%), hogs (+10.0%) and cattle/calves (+7.4%). Sonoma County's overall production value declined by $277.9 million (-29.0%) for the year, then rebounded by $130.8 million (+19.2%) during the pandemic's peak in 2021.

BOTTOM LINE

The discussion here supports three key points: 1) economic diversification helps buffer against economic shocks such as wildfires, droughts, trade policies and even pandemics; 2) Sonoma County agriculture has a low level of economic diversification across crops, which certainly impaired the industry during the recent Covid-19 pandemic; and 3) agriculture's low level of economic diversification is trending further downward over time.

All of this raises concerns about the future. In an era of rapid change and rising risks, the agricultural community may not have "all of its eggs in one basket" but it does face significant concentration.

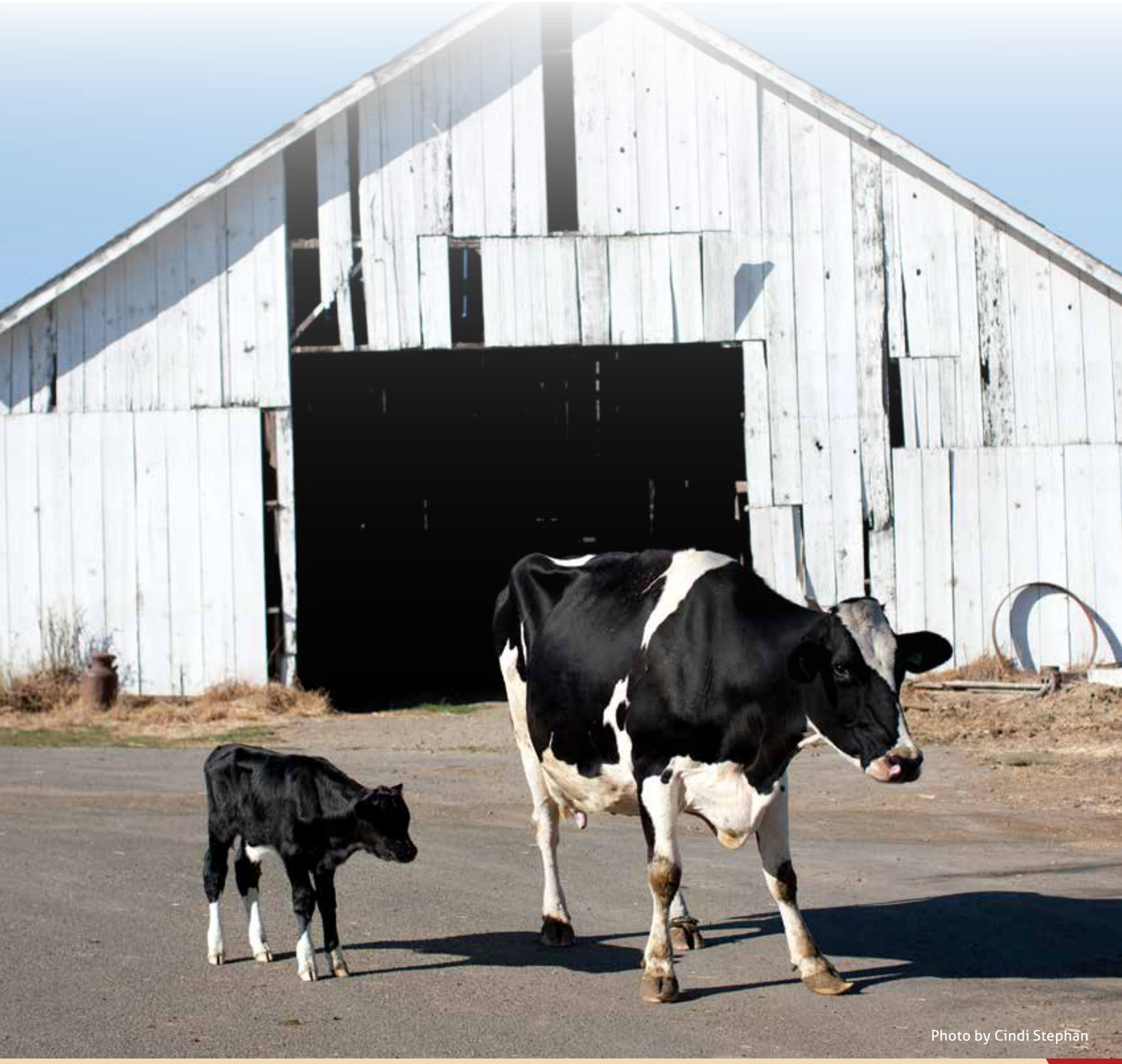


Photo by Cindi Stephan

Ecosystem Services from Agricultural Lands

Sonoma County agricultural lands produce more than the items people can easily buy or sell. Local growers and ranchers also provide open space, wildlife habitat, carbon storage and many other benefits to society, including protection from wildfires. Often called ecosystem services, these benefits have significant value but are poorly understood and rarely counted..

This section helps raise awareness about the topic. It provides a general overview of ecosystem services, then explores three main questions:

- What types of ecosystem services occur on Sonoma County agricultural lands?
- How can we best quantify the dollar value of these ecosystem services?
- What is an initial estimated range of their annual value in Sonoma County?

WHY IS THIS IMPORTANT?

In recent decades, thousands of articles and books have described ecosystem services and their importance. The term generally refers to goods and services provided by natural and modified ecosystems that benefit, sustain, and support the well-being of people.

As one might expect, protected natural areas—for example, Armstrong Redwoods State Natural Reserve, Sugarloaf Ridge State Park, and Tolay Lake Regional Park—tend to provide the highest value. But even city parks and highly modified agricultural landscapes deliver nature-related benefits to people.

PAYMENTS FOR ECOSYSTEM SERVICES

A key challenge is that most ecosystem services are hard to see and measure. Thus, their contribution to economic and social well-being rarely factors into management decisions. A growing number of efforts are trying to address this, including through economic markets and public policies.

Many Sonoma County producers already participate in various state and federal programs that pay for ecosystem services. The Williamson Act, U.S. Farm Bill programs, and the California Department of Food and Agriculture's (CDFA) Healthy Soils Initiative are especially popular. Organizations such as the Natural Resources Conservation Service, Farm Services Agency, CDFA, Sonoma Resource Conservation District, Gold Ridge Resource Conservation District, and the Sonoma County Agricultural Preservation & Open Space District play key roles in implementing these and other programs.

Current trends suggest the number and types of opportunities will increase in coming years. New private sector markets have emerged for water, biodiversity, and greenhouse gases. The Ecosystem Services Market Consortium (ESMC), for example, is an industry-led non-profit organization that compensates farmers and ranchers who improve the environment through their agricultural practices (See: https://ecosystemservicesmarket.org/). Others are under development. In fact, some experts believe that market-based ecosystem services could become a major economic driver for rural America.

CALIFORNIA AGRICULTURE: LEADING AGAIN

California agriculture has emerged as a national leader in documenting and valuing ecosystem services. A key early milestone occurred in 2011 when CDFA created the Office of Environmental Farming and Innovation, which later evolved into the Office of Agricultural Resilience & Sustainability (OARS). The OARS mission is to: *"use the best available science and knowledge from the agricultural community to design and implement practical solutions to California's natural resource challenges that improve the environmental and economic sustainability of producing nutritious food, fiber, and energy."*

Among many other innovations, CDFA created the first typology of specific ecosystem services that California's agricultural lands provide **(Figure 7)**. CDFA also launched a project to document, recognize, and incentivize them. Note that we added "Wildfire Mitigation" to CDFA's list in **Figure 7**. For an overview of the critical role California's agricultural producers play in wildfire risk management and response, see Pinzón, N. *et al.* 2025 "Farming and Ranching through Wildfire: Producers' Critical Role in Fire Risk Management and Emergency Response." *California Agriculture*, Vol. 79, Issue 1.

Figure 7. Typical Ecosystem Services Provided by California Agricultural Lands

Source: California Department of Food and Agriculture. See, for example: https://www.cdfa.ca.gov/oars/ecosystemservices/

Wildlife Habitats



Providing food, water, shelter and space to support resident and transient wildlife, especially through riparian areas and perennial vegetation.

Nutrient Cycling



Managing plant nutrients and soil amendments in ways that help store, transform, and cycle important nutrients in the soil, such as carbon, nitrogen, and phosphorus.

Food Production



Nourishing a growing global population with nutrients and energy, the primary product of agricultural production.

Fiber Production



Clothing people by producing cotton, wool, and other fibers that can be processed into thread, yarn and cloth.

Fuel Production



Meeting energy needs by producing plant-based biofuels, and through mechanized production of renewables such as wind, solar, hydro, and geothermal.

Recreation and Cultural



Improving quality of life by providing places for wildlife viewing, nature walks, outdoor recreation, entertainment, and educational experiences.

Soil Structure, Formation and Fertility



Sustaining healthy soils, the foundation of all life, by managing them in ways that not only support plant growth, but also reduce erosion, prevent landslides, suppress pathogens, sequester carbon, and purify water.

Biodiversity Conservation



Promoting ecosystem productivity, beauty, pest control, and other benefits by managing on-farm streams, trees, shrubs, wetlands, and cropped areas in ways that support diverse plants and animals.

Water Cycling



Maintaining or improving soil moisture and water storage, while minimizing runoff, through cover crops, tillage, residue management, and dozens of related practices.

Atmospheric Gas & Climate Regulation



Reducing greenhouse gas levels through practices that make farm operations more energy efficient, and by building capacity to store carbon.

Pest Control



Controlling pests and weeds through many management practices that support their natural enemies, such as raptors, beneficial insects, and other wildlife.

Water Quality



Improving and protecting water quality through vegetative buffers, stream bank protection, prescribed grazing, grassed waterways, and dozens of other management practices.

Pollination Services



Supporting agricultural production and healthy ecosystems by providing nesting habitat and floral resources for wild pollinators such as bees, bats, and birds.

Wildfire Mitigation*



Crops, orchards, grasslands, and other agricultural areas can help protect people and property from wildfires.

**This new category, Wildfire Mitigation, does not occur on CDFA's original list.*

ASSIGNING DOLLAR VALUES TO ECOSYSTEM SERVICES

Economists have tried with varying success to assign monetary values to ecosystem services. They use more than a dozen methodologies, for example, Travel Cost Method, Hedonic Pricing, Replacement Cost Method and Contingent Valuation.

This raises an important question: **what is the annual dollar value of ecosystem services provided by Sonoma County agricultural lands?**

Answering this question thoroughly would require primary data collection, likely taking several years and costing over a million dollars. Fortunately, economists have developed a cost-effective approach to estimate such values that takes full advantage of existing research. Called the Benefit Transfer Methodology, the approach estimates economic values by transferring existing benefit estimates from studies already completed for another location.

For example, researchers have used the Benefit Transfer Methodology to estimate the value of ecosystem services in Sonoma and two other San Francisco Bay Area counties. The philanthropic foundations that commissioned these expensive pilot studies hoped the results would prove useful for other counties, too.[1]

Figure 8 summarizes relevant results from the three pilot studies. It shows average dollar value per acre for ecosystem services provided by four specific land use types that are common in agricultural settings, adjusted for compounding inflation through 2024. Sonoma County's presence among these three pilot studies is especially opportune for the current analysis.

Figure 8. Annual Average Value of Select Ecosystem Services in Three California Counties

	Santa Cruz County[2]		Santa Clara County[3]		Sonoma County[4]	
Land Cover Type	Low	High	Low	High	Low	High
Grassland	$5,308	$11,310	$4,552	$9,722	$3,093	$13,735
Pasture	$674	$14,458	$1,398	$13,778	$661	$10,672
Evergreen Forest	$4,492	$11,899	$4,568	$11,882	$3,793	$9,112
Cultivated	$168	$3,481	$168	$3,481	$168	$3,481

Figure 9 lists acreages for Sonoma County agricultural land use types based on the county's 2024 Crop Report and local experts, then multiplies those acreages by the 2024 inflation-adjusted Sonoma County per-acre values from **Figure 8**. As the final column shows, this puts the 2024 estimated total value of ecosystem services provided by Sonoma County agricultural lands at $1.258 billion to $5.229 billion per year.

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[1] See: Santa Clara Valley Open Space Authority, Resource Conservation District of Santa Cruz County, Sonoma County Ag + Open Space. (2018). *Healthy Lands & Healthy Economies: Natural Capital in Santa Clara, Santa Cruz, and Sonoma Counties.*

[2] 2024 inflation-adjusted averages calculated from Table 7 (pp. 27-30) in R. Schmidt *et al.*, 2015, *Nature's Value in Santa Cruz County*. Earth Economics, Tacoma, WA & the Resource Conservation District of Santa Cruz County, Capitola, CA.

[3] 2024 inflation-adjusted averages calculated from Table 7 (pp. 30-33) in D. Batker *et al.*, 2014. *Nature's Value in Santa Clara County*. Earth Economics, Tacoma, WA & the Santa Clara Valley Open Space Authority, San Jose, CA.

[4] 2024 inflation-adjusted averages calculated from Table 8 (pp. 33-37) in R. Schmidt *et al.*, 2015, *Nature's Value in Sonoma County*. Earth Economics, Tacoma, WA & Sonoma County Agricultural Preservation and Open Space District, Santa Rosa, CA.

Figure 9. Estimated Value of Ecosystem Services Provided by Sonoma County Agricultural Lands in 2024

Agricultural Land Cover Type	# of Acres	Value per Acre ($)		Total Value ($)	
		Low	High	Low	High
Rangeland [Grassland]	299,790	$3,093	$13,735	$927,363,280	$4,117,762,342
Timber [Forests]	81,909	$3,793	$9,112	$310,677,369	$746,326,295
Fruit, Vegetable Nut & Nursery [Cultivated]	60,916	$168	$3,481	$10,220,821	$212,038,366
Field Crops [Pasture/Hay]	7,788	$661	$10,672	$5,145,969	$83,117,035
Pasture [Grassland]	6,502	$661	$10,672	$4,296,236	$69,392,265
TOTALS	456,905			$1,257,703,674	$5,228,636,303

Please see text for details and important caveats. "Value per Acre" derived from a detailed Sonoma County study. Acreages were drawn from the 2024 Sonoma County Crop Report and local experts.

We would like to highlight two key points from **Figure 9**. First, the total value, $1.258 billion to $5.229 billion per year, may be higher than some readers expected. It might come as a surprise that for 2024, Sonoma County's agricultural industry likely produced far more economic value in ecosystem services than in direct production of commodities ($857.6 million), and perhaps more than *six times* as much.

Second, grasslands delivered nearly all of the value. The county's 2024 Crop Report lists 299,790 acres of rangeland and 6,502 acres of pasture, which we categorized as grasslands for the purposes of this study. That annual report also specifies a value of $30.45 per acre of rangeland and $89.75 per acre of pasture. Their combined value of $9,712,200 represents just 1.1% of the county's total agricultural production value.

Because grasslands produce so many invisible benefits for people, however, their total 2024 economic contribution through ecosystem services alone was likely $931.7 million to $4.187 billion. This represents 74.1% to 80.1% of the total value of all ecosystem services provided by Sonoma County's agricultural lands in 2024.

The county's grazing livestock play an essential role in delivering that $931.7 million to $4.187 billion per year. Managed grazing maintains and enhances the county's valuable grassland ecosystems. Grazing supports biodiversity, reduces wildfire fuel loads, controls invasive species, and maintains the ecological integrity of these working landscapes. Perhaps most significantly, well-managed grazing augments carbon sequestration in grassland soils. Research demonstrates that properly managed grazing can increase soil organic carbon through stimulated root growth, improved plant vigor, and enhanced soil microbial activity.

In sum, the maintenance of healthy, productive grassland ecosystems through livestock grazing represents an irreplaceable ecological and economic function that plant agriculture alone cannot provide. The presence of grazing -dependent ecosystem services underscore that livestock agriculture's contribution reaches far beyond conventional market metrics.

LIMITATIONS

We want to underscore the limitations of this analysis and the many caveats that are in order. The most important caveat is that estimates in this report are for illustrative purposes only. They provide some indication of magnitude but are by no means definitive. Any mention of specific dollar values from this section should make clear they are initial, imprecise estimates, not verified with actual data collection. Getting robust numbers would require conducting a follow-up study to the detailed Sonoma County study mentioned earlier. For additional discussions of methods and limitations, please consult the studies cited above.

FINAL THOUGHTS ON THE VALUE OF WORKING LANDS

This section has explored the non-market economic benefits that Sonoma County's farms and ranches provide to society. The county's agricultural lands clean water, control floods and erosion, recharge aquifers, provide fire breaks, supply habitat for wildlife and pollinators, control pests, sequester carbon, remove pollutants from the air, create space for outdoor recreation, attracts tourists, and offer beautiful views and scenery.

Until recently, we have taken these services for granted. But now, modern economics allows us to attach dollar values to the many non-market benefits agricultural lands provide to society. Documenting the true value of Sonoma County's agricultural lands, while challenging, reminds us that protecting them is a smart investment—one that pays dividends today and into the future.



Photo by Dawn Haumann

Toward the Future

This report has documented the fuller contributions that Sonoma County agriculture makes to the local economy. Key points for 2024 are:

- Including farm production, local food processing and their multiplier effects, agriculture contributed $5.758 billion to the county economy. This represents over fifteen million dollars per day ($15,774,954 to be exact), $657,290 per hour and $10,955 per minute.
- Agriculture also played a vital role in county employment, supporting 14,791 jobs directly in agricultural production and processing, plus another 11,066 jobs from multiplier effects, for a total employment of 25,857.
- With a Shannon index of 0.27, agricultural production has a low level of economic diversification, which provides limited protection from economic shocks.
- Sonoma County agricultural lands delivered an estimated $1.258 billion to $5.229 billion to society in the form of scenic beauty, wildlife habitat, wildfire mitigation and more than a dozen other non-market services.

Agriculture is an important pillar of the Sonoma County economy and represents a vital link to 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 page 23). In the meantime, the findings herein provide the most complete view to date of Sonoma County agriculture's vital economic role.

Additional Questions

- ADDING VALUE LOCALLY. Sonoma County agriculture already exhibits exceptional vertical integration compared to other California counties, especially for wine grapes and dairy products, but further improvement may be desirable and feasible. What new policies, programs, and other initiatives, if implemented, could further support locally sourced, value-added food processing within the county?
- ECOSYSTEM SERVICES. This report has provided an initial estimated dollar value of open space, scenic beauty, wildlife habitat and other non-market benefits that Sonoma County's working lands provide to society. Future work could refine and update the estimate. In one example highlighted in the 2024 Sonoma County Crop Report, local producers have made significant investments into on-farm practices that increase carbon sequestration and storage, the dollar value of which has yet to be quantified.
- AGRITOURISM. A large percentage of Sonoma County tourism focuses on working lands. Visitors and residents alike go to wineries, breweries, farm-to-table restaurants, farm trails, ranch stays, pumpkin patches and lavender farms. They attend annual events such as the Sonoma County Harvest Fair, Gravenstein Apple Fair, Great Sonoma Crab & Wine Fest, Cloverdale Citrus Fair, Farm Trails Spring & Fall Tours and the California Artisan Cheese Festival. They follow specific 'trails' focused on apples, cheeses, and wines. No study has attempted to capture the full economic value of this phenomenon in Sonoma County. What is the annual economic value of agritourism?
- CANNABIS. Sonoma County continues to refine its Cannabis Program in ways that support industry growth in tandem with thoughtful regulation. What economic impact are cannabis operations having on the Sonoma County economy, both direct and in terms of multiplier effects?
- FOREST PRODUCTS. Sonoma County has an estimated 81,909 acres zoned for timber production, yet the 2024 Crop Report only specified $5.7 million in timber product sales. Innovative projects like "Timbershed" are attempting to forge new economic opportunities that improve forest health and mitigate wildfire risk (see https://www.timbershed.earth/). How can Sonoma County best support these and related forest-based projects?



Photo by Straus Family Creamery



Photo by Sonoma County Farm Bureau

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SONOMA COUNTY DEPARTMENT OF AGRICULTURE/WEIGHTS & MEASURES

Sonoma County Department of Agriculture/Weights & Measures

www.sonomacounty.co.gov/awm

June 2026

EDC economic development collaborative SONOMA COUNTY

Agricultural Impact Associates



Photo by Straus Family Creamery