Economic Contributions of MARIN *County* AGRICULTURE

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Commissioner's Letter

I am pleased to share the **Economic Contributions of Marin County Agriculture**. This report takes an important step beyond the County of Marin Crop and Livestock Report that we have ublished every year for nearly a century. 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 2023, the most recent year for which comprehensive economic data are available, agriculture contributed a total of $257.2 million to the county economy. This far exceeds the $85.3 million value from our 2023 County of Marin Crop and Livestock Report. Agricultural production and processing also directly supported 750 employees, plus another 331 employees from multiplier effects.

In addition, this report documents noteworthy economic diversification within agriculture, which supports resilience in agriculture and in the greater county economy. Finally, the study explores scenic beauty, wildlife habitat, wildfire protection and more than a dozen other non-market services that agricultural lands provide to society, with a rough 2023 estimated value of $464.8 million to $2.081 billion. Confirming and refining this initial estimate would require significant further research.

Agriculture has a long tradition in Marin 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,

Joe Deviney
Agricultural Commissioner
Director of Weights & Measures

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Published July 2025

Marin County Agriculture at a Glance

Economic Contributions
of the Agricultural Industry for 2023

$257.2 MILLION

Marin County Agriculture's total contributions to the local economy

$191.3
MILLION in direct economic output

$65.9
MILLION in multiplier effects

$704,643
per day

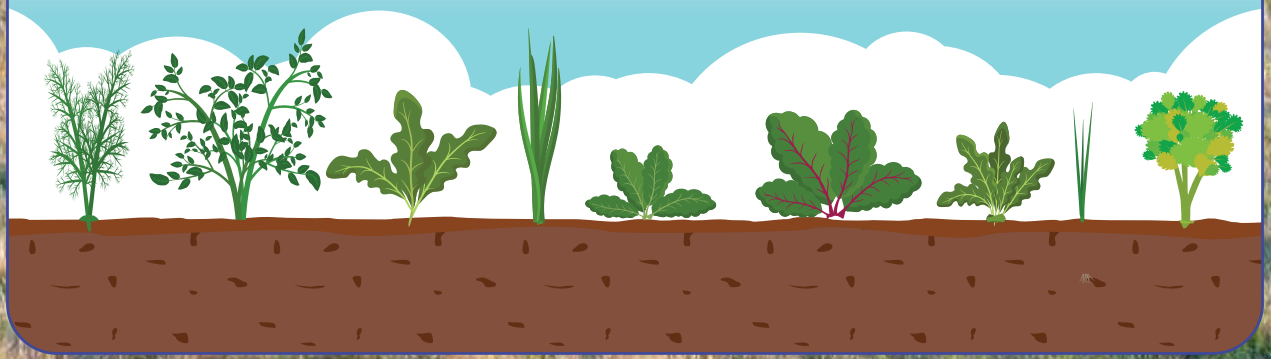
Employment Effects
of the Agricultural Industry

1,081
total jobs

750
direct employees across production & processing

331
additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees

1,081
jobs in Marin County attributable to the agricultural industry



Introduction

Nestled among rolling coastal hills west of the urban corridor along the San Francisco Bay, abutting the sparkling Pacific Ocean, Marin County's farms and ranches produce some of the world's finest foods. Here, generations of passionate farmers craft artisanal cheeses, sustainably raised meats, and vibrant produce bursting with flavor. The cool, salty air and fertile soil create the perfect environment for farm-to-table excellence, fueling a movement that celebrates quality, sustainability, and community.

Clearly, agriculture plays a vital and historic role in the Marin 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 Marin 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 Marin County economy. The report also examines economic diversification in agriculture and its implications for resilience to economic shocks and 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.

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 Marin 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 8 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 County of Marin Crop and Livestock Report produced by the Marin County Department of Agriculture, 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 most recent USDA Census of Agriculture (2022), its employment and economic output numbers often differ from those 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: https://support.implan.com/hc/en-us/articles/115009505787-Data-Sources-for-Select-Industries-Farm-Construction-Railroad-and-Government.

Except where otherwise noted, all figures are from 2023, the most recent IMPLAN dataset available. Where appropriate, we adjusted sector names for clarity and applied coefficients to IMPLAN values to reflect unique Marin County conditions. Please contact the authors for additional details on the methods used.

Direct Effects of Marin 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

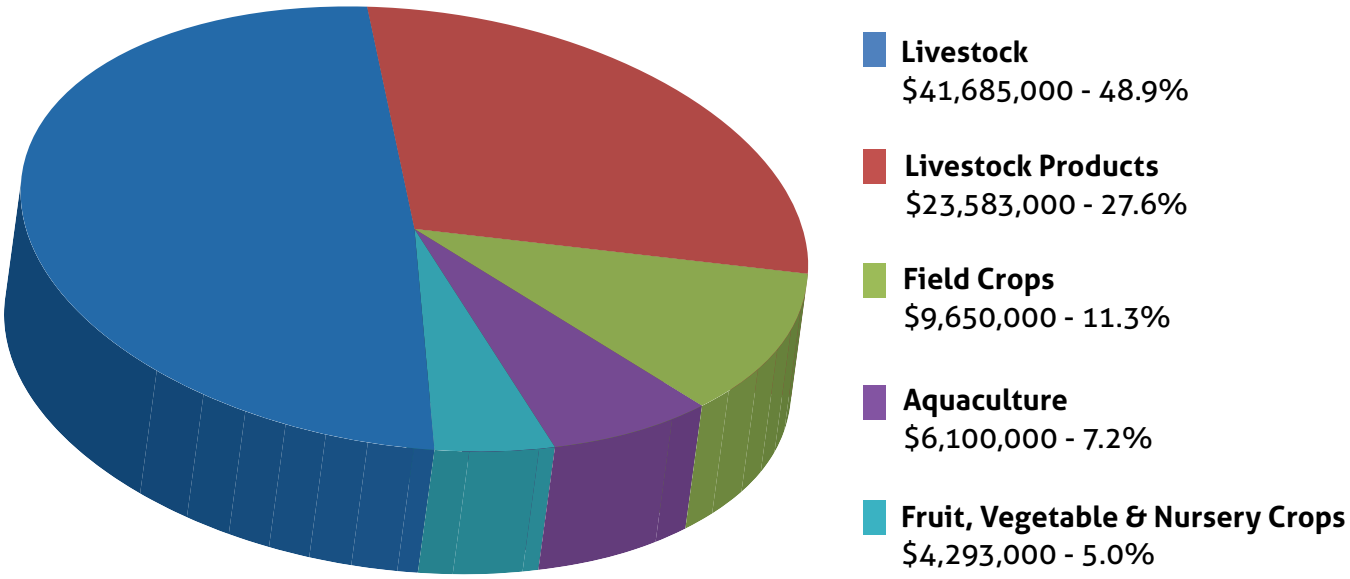
Figure 1 shows the various categories that made up Marin County's farm production value. At $41.7 million, Livestock was the single largest production category by dollar value, comprising 48.9% of the county total. Poultry dominated this category at $24.6 million. Cattle followed ($14.8 million), then sheep ($2.2 million).

At 27.6%, Livestock Products represented the second largest category ($23.6 million). Organic milk led this category with $21.9 million in production, followed by conventional milk at $1.7 million. These two categories, Livestock and Livestock Products, accounted for 76.5% of all production value.

The combined total dollar value for all products dropped $15.6 million over the previous decade (-15.5%), from $100.9 million in 2014 to $85.3 million in 2023. 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 county's 2023 County of Marin Crop and Livestock Report for additional details on specific products and their value.

Figure 1. Distribution of Marin County Farm Production

Source: 2023 Marin County Crop Report, Marin County Department of Agriculture, Weights and Measures



EMPLOYMENT

How many people work in agricultural production? In 2023, IMPLAN data indicate that agricultural production directly employed 586 people in Marin 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 Marin 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 "Data Sources and Procedures Data Sources for Select Industries: Farm, Construction, Railroad, and Government" article referenced earlier. In general, IMPLAN data attempt 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 privacy concerns. Last, IMPLAN counts part-time workers differently than the USDA Census of Agriculture. Imagine a farm with six humans 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 – one job that happens to be filled by six different temporary workers.

Multiplier Effects of Marin 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 Marin County producer buys milking machines, feed, supplements, insurance, banking services, 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.

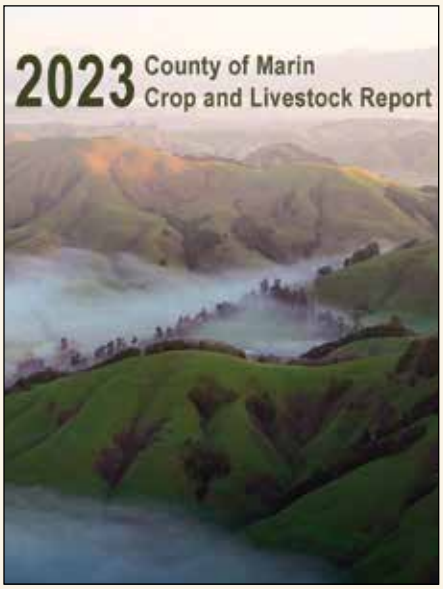
Although agricultural companies, suppliers and their combined employees certainly spend money in other counties, this study only reflects those expenditures within Marin County. Quantifying expenditures outside the county would be an expensive, complex effort that lies well beyond our scope here.

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

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

The following list draws from the 2023 Marin County Crop and Livestock Report to clarify specific commodities that appear in Figure 2 categories:

- **Livestock:** Cattle, Sheep, Poultry (e.g., poultry fryers, pigeons, and chicken and duck eggs for consumption).
- **Livestock Products:** Milk (Organic), Milk (Conventional), Wool.
- **Field Crops:** Hay, Silage, Pasture.
- Aquaculture: Oysters, Mussels, Clams.
- **Fruit, Vegetable & Nursery Crops:** Fruits & Vegetables, Wine Grapes, Nursery Products (e.g., nursery stock & cut flowers).
- **Misc. Other Products:** Forestry (e.g., portable sawmilling and tree removal for salvage & fire safety).



Each sector has distinct multipliers. For example, Marin County "Vegetable & Melon Farming" sector, included in **Figure 2** as part of "Fruit, Vegetable & Nursery Crops," had a 2023 *indirect effects* multiplier of 0.2037 and an *induced effects* multiplier of 0.3224. This means that each dollar's worth of direct output generated an extra 20 cents in supplier purchases, plus 32 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, the *induced effects* multiplier for Marin County "Dairy Cattle & Milk Production," which is included in **Figure 2** under "Livestock Products," was 0.0966 in 2019, then nearly doubled to 0.1753 for 2023.

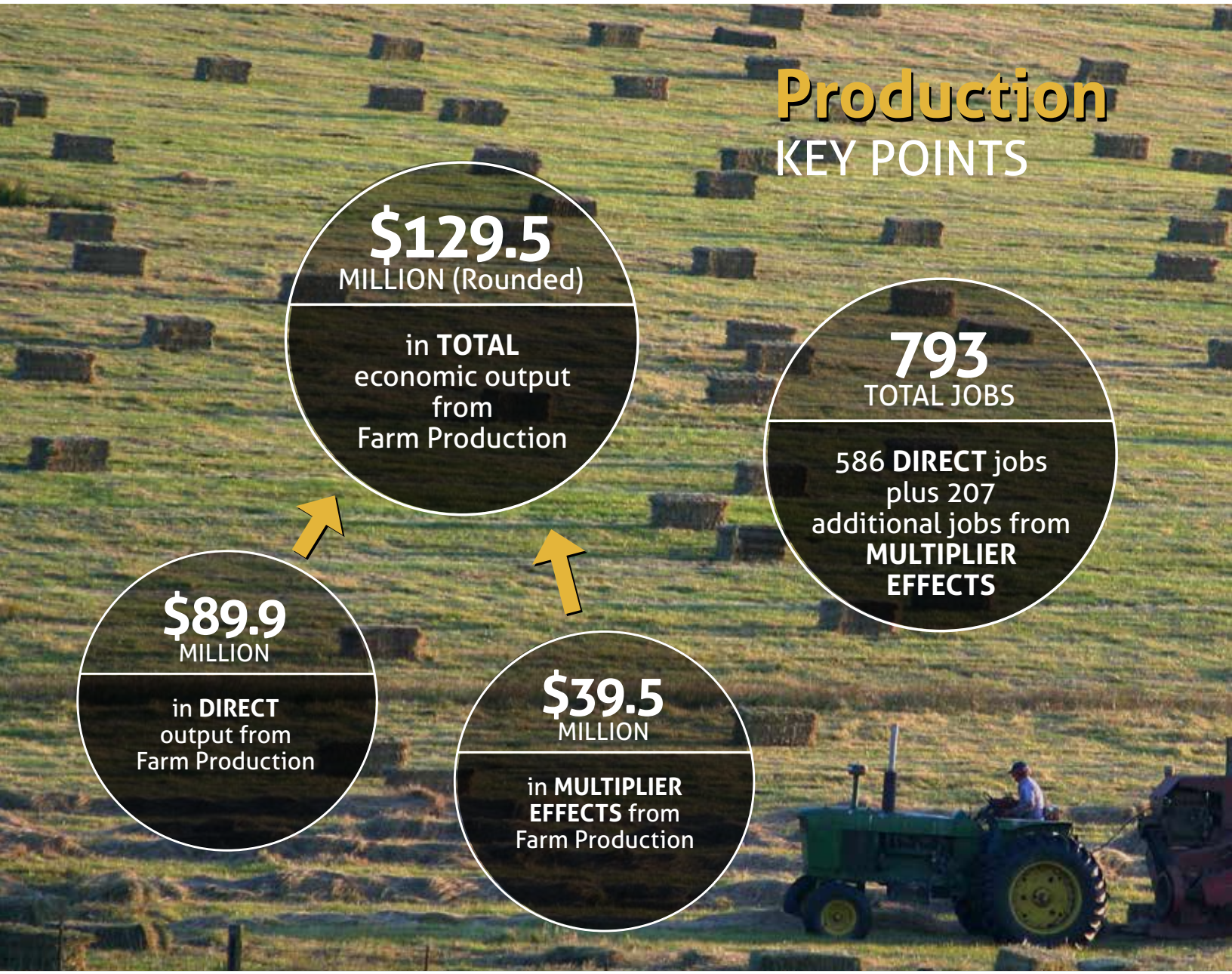
Sectors have unique multipliers not just for economic output but also for employment. For example, Marin County "Beef Cattle Ranching," which is included in **Figure 2** under "Livestock," supported 78 *direct* jobs plus an additional 37 *indirect effects* jobs and 26 more from *induced effects*. The 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 2023 direct production value in **Figure 2** ($89,936,510, rounded to $89.9 million) slightly exceeds the $85,311,000 reported in the 2023 Marin County Crop and Livestock Report. Among other minor differences, the $4.6 million "Misc. Other Products" category in **Figure 2** includes data from companies that reported forest-related activities.

Figure 2. Economic Effects of Marin County Farm Production

Dollar values are in $ millions. Figures are for 2023 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	
Livestock	$41.7	$11.3	$7.8	$60.8
Livestock Products	$23.6	$6.5	$4.1	$34.2
Field Crops	$9.7	$2.4	$1.9	$14.0
Aquaculture	$6.1	$0.0	$1.1	$7.2
Fruit, Vegetable & Nursery Crops	$4.3	$0.6	$2.7	$7.7
Misc. Other Products	$4.6	$0.1	$1.0	$5.6
TOTAL ECONOMIC OUTPUT	$89.9	$20.9	$18.6	$129.5
	Employment Effects (# of Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	586	118	89	793



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 key role in the Marin 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., Marin 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 $919,000 direct dollar value of wine grapes in its "Fruit, Vegetable & Nursery Crops" row. We only calculated the value created by converting wine grapes into wine.

Nor did we include the county's $23,557,000 in milk production (organic and conventional), since the "Livestock 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 Marin County's $62.2 million in bread and bakery products because most raw ingredients such as flour and yeast came from outside the county. Nor did we include the county's manufacturing of flavoring syrups ($71.6 million), coffee and tea ($64.4 million), and spices and extracts ($35.1 million).

We also did not count the county's beer brewing sector, worth $6.3 million in 2023. Brewers depend on outside grains, especially hops grown in the Pacific Northwest or Germany. Recent attempts to grow hops in Marin County have had limited success.

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

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
Cheese & Other Dairy Products	$60.0	$10.3	$2.5	$72.8
Wineries	$30.1	$5.8	$3.7	$39.6
Miscellaneous Other Food Manufacturing	$5.3	$1.2	$0.3	$6.9
Light Processing of Fruit, Vegetable & Nursery Products	$3.9	$0.7	$0.5	$5.0
Meat & Other Livestock Products	$2.0	$1.1	$0.3	$3.4
TOTAL ECONOMIC OUTPUT	$101.3	$19.1	$7.3	$127.7
	Employment Effects (# of Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	164	89	35	288

The largest sector by far, **"Cheese & Other Dairy Products"** in **Figure 3**, reflects production by Marin County's many dairy farms. 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, yogurt, and kefir. Several operations produce ice cream through a combination of mixing, pasteurizing, homogenizing, aging, freezing, and hardening.

Artisan cheeses are especially prominent. Marin County's many cheese types range from brie, camembert and blue, to gouda, Toma and quinta, and many more. A dairy near Petaluma, for example, draws from traditional French cheesemaking techniques and has operated continuously since 1865, making it the country's oldest cheese company. Another dairy specializes in goat and sheep cheeses. A few operations produce and sell soaps and skincare products.

"Wineries" in **Figure 3** reflects the value added to the county's wine grape crop. Eleven vineyards leverage Marin County's unique microclimates and terroirs to produce a wide range of wines on over 150 planted acres.

Popular varietals include Pinot noir, chardonnay, merlot, and cabernet sauvignon. Many wineries add extra value by hosting tastings, weddings, private tours, and other events. A meadery in Point Reyes Station makes wine from local honey.

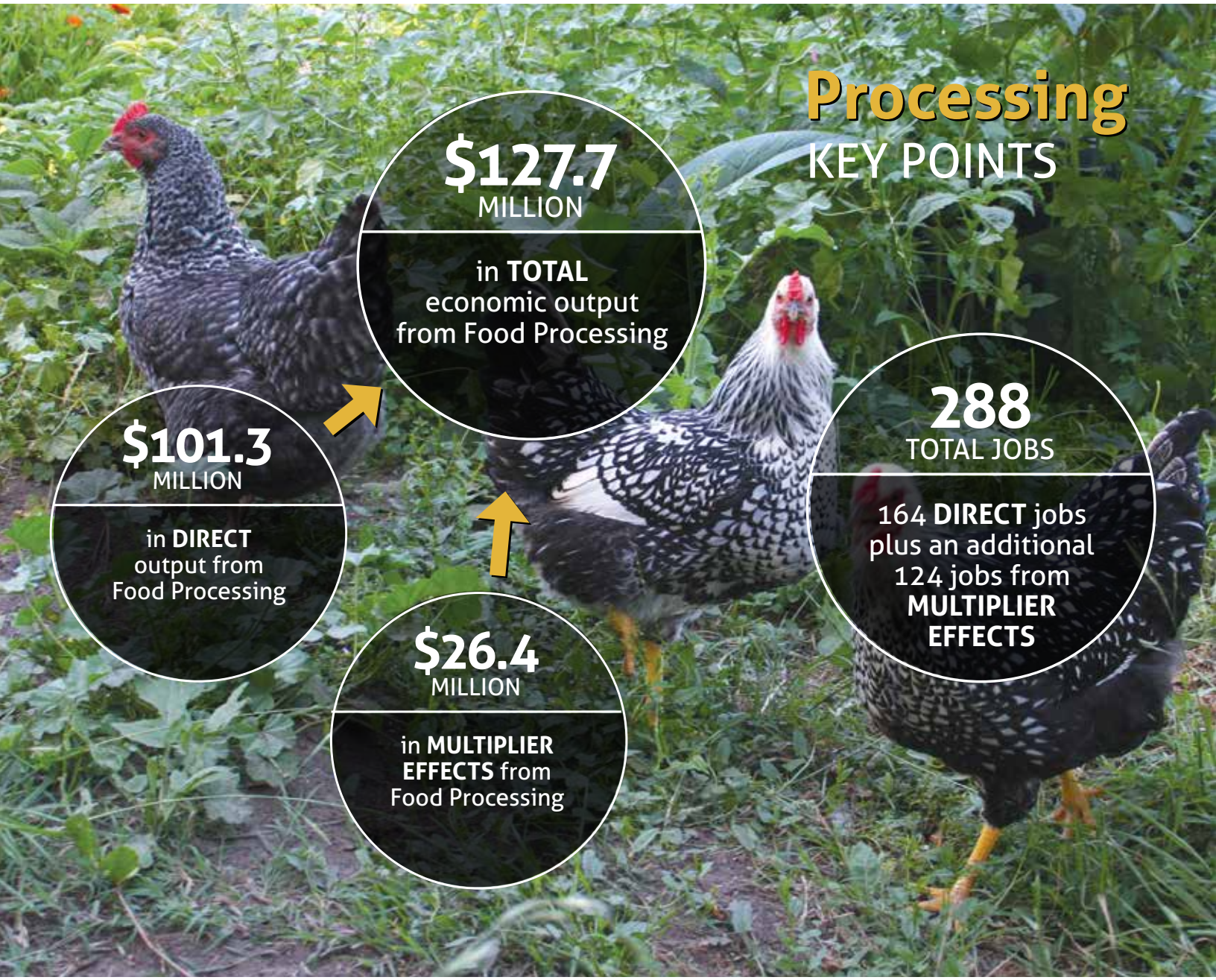
The catchall category **"Miscellaneous Other Food Manufacturing"** in **Figure 3** encompasses a wide range of boutique-scale processing. For example, some producers process strawberries and other fruits into jams, jellies and other jarred products with extended shelf life and easy storage, often sold at farm stands and farmers' markets. A farm near Tomales presses over a dozen varieties of organic apples into bottled ciders. A large (500-plus acres) farm mills fruit from over 18,000 olive trees into award-winning bottled olive oils, as well as olive-based beauty products such as soap, balms, and lotions. A handful of apiary operations offer occasional beeswax and pollination services in addition producing and selling jars of small-batch local honey from domesticated and wild hives. An organic farm with locations in Lagunitas and Nicasio uses its on-site distillery to process aromatic plants and edible flowers into essential oils and other bottled products. Farmers' markets and online stores offer direct outlets for many of these niche products.

"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. For example, some producers peel, wash or cut vegetables and fruits to serve fresh at farmers markets and festivals. A farm near Lagunitas specializes in growing herbs that are dried, jarred and sold as herbal formulas and blends.

Growers add value to the county's nursery stock 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. One niche farm specializes in mature olive trees sold for decorative landscaping, which requires careful bundling of root balls for transport by helicopter.

Producers add similar value to floriculture products. After harvest, they trim, cool, arrange, and package flowers, then add labels. A farm near Point Reyes Station even hosts farm visits during which customers create their own holiday wreaths and floral arrangements. Many of these products are sold either on the farm or at the county's many farm stands and farmers' markets.

"Meat & Other Animal Products" captures the portion of the county's cattle, sheep, poultry and miscellaneous other animals that are processed within Marin County. Nearly all of the county's $14.8 million in cattle go to



nearby Petaluma (Sonoma County) for processing at the San Francisco Bay Area's last USDA-inspected slaughter facility, as do many pigs, goats and sheep. Several operations sell packaged lamb, meat and other products directly online and via local retail outlets. A few sheep ranches convert wool into value-added products that are sold online and at various retail outlets. A sheep ranch in Marshall, for example, produces and sells hand-woven yarns, roving, fleeces and blankets.

Although aquaculture products such as oysters, mussels, and clams are typically sold fresh rather than processed, producers add value through various means. A prominent oyster farm along Tomales Bay, for example, shucks and packages oysters for online sales and hosts tastings and tours.

Overall, Marin County's agricultural industry has an exceptionally high level of locally-sourced, value added food processing. Among twenty-two California counties analyzed to date, the total direct value of local food processing typically ranges from 25% to 60% of the direct value of the county's farm production. But in Marin County, the $101.3 million in direct processing (**Figure 3**) is an unprecedented 113% of the county's $89.9 in direct farm production (**Figure 2**).

Total Economic Contributions of Marin 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 Marin County agriculture.

As **Figure 4** shows, the total 2023 economic contribution of Marin County agriculture was $257.2 million. This consisted of $191.3 million in combined direct output from production and processing, plus $65.9 million in multiplier effects.

For perspective, agriculture pumped over *seven hundred thousand dollars per day* into the county economy during 2023 ($704,643 to be exact). This translates to $29,360 per hour.

Total agricultural employment covered in the scope of this study was 1,081. Of these, 750 jobs were directly in agricultural production and processing, with the remaining 331 from multiplier effects.

Figure 4. Overall Economic Effects of Marin County Agriculture

Columns and rows may not compute exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects ($ Millions)	$89.9	$20.9	$18.6	$129.5
Employment Effects (# Jobs)	586	118	89	793
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects ($ Millions)	$101.3	$19.1	$7.3	$127.7
Employment Effects (# of Jobs)	164	89	35	288
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects ($ Millions)	$191.3	$40.0	$25.9	$257.2
Employment Effects (# of Jobs)	750	207	124	1,081

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 Marin 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, Marin 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 rising costs for fuel, equipment, water 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.

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 Marin County, where solid diversification helped agricultural production grow 4.0% when the pandemic began in 2020, then decline just 5.1% during the pandemic's peak in 2021.

HOW DIVERSIFIED IS MARIN COUNTY AGRICULTURE?

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

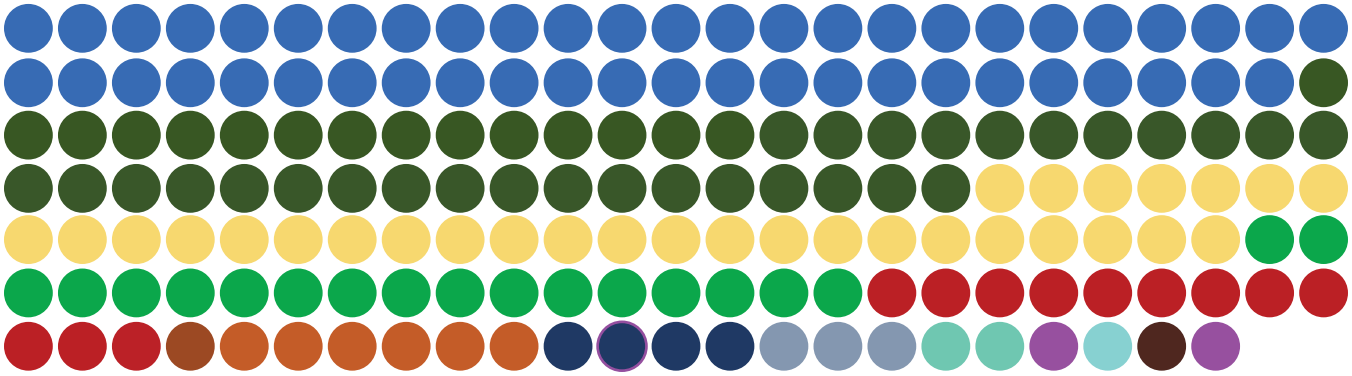
To answer this question, we calculated the Shannon-Weaver Index for Marin County agriculture. Created in 1949 for military code breaking, the Shannon-Weaver index is widely used by economists and others interested in quantifying diversification. Different versions of the basic Shannon-Weaver formula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

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 over the past decade; 2) remove wool, the single outlier product that had an average production value less than 0.25% of the county total; 3) enter the data into the Shannon-Weaver formula; and 4) convert to scale from 0.0 to 1.0. For additional details, please contact the authors.

Over the past decade, Marin County has consistently produced and reported thirteen 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 40.1% of the county total (organic milk in 2016). **Figure 5** depicts their most recent relative contributions.

Figure 5. Relative Distribution of Marin County Agricultural Commodities

Each circle below represents approximately $500,000 in gross sales, and each color represents a unique agricultural commodity. Combined, the circles and colors visually portray major agricultural commodities' relative contributions to Marin County's total 2023 farm gate value. Commodities less than $500,000 million 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: 2023 County of Marin Crop and Livestock Report)



For 2023, the Shannon-Weaver Index for Marin County's agricultural industry was **0.43**.

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. No single county could accomplish this.

At first glance, Marin County's index of **0.43** seems near the middle of the 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 0.43 index is high compared to typical U.S. counties, many of which focus on a just one or two crops such as corn, soybeans or wheat. Compared to more than twenty California counties analyzed thus far, the 0.43 index is below average. Overall, Marin County's number suggests decent protection from economic shocks.

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

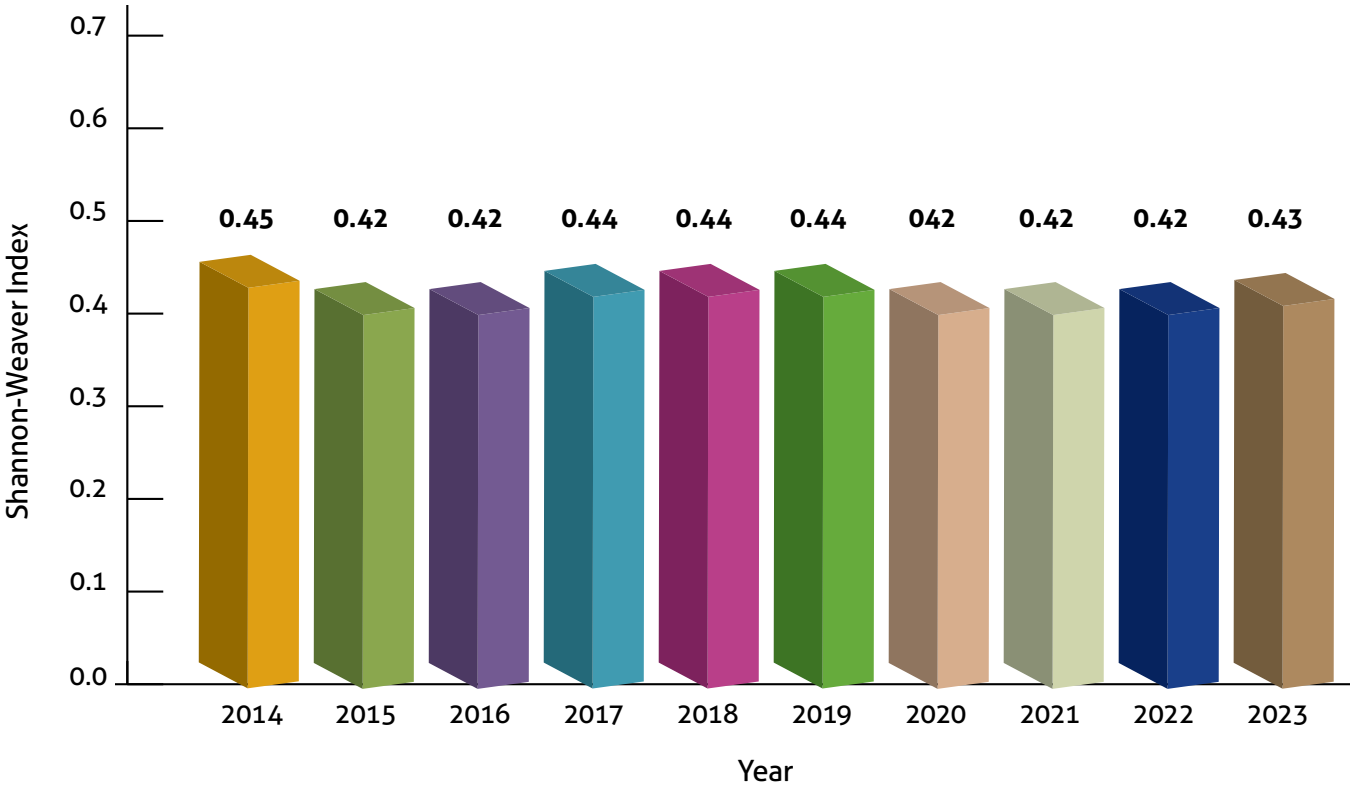
Has agriculture become more diversified in Marin County, or less? **Figure 6** shows the Shannon-Weaver Index for the past decade.

The main thing to note is consistent, substantial economic diversification across the years. The index has held steady over time, always within the narrow 0.42 to 0.45 range. This suggests solid ongoing economic resiliency within agriculture. It also contrasts with the downward trend occurring in many California counties that have become dependent on one or two major products such as almonds or wine grapes.

Related, while overall diversification has held steady over time, it has likely increased within specific product categories. Poultry, for example, has diversified into greater emphasis on pasture-raised birds and eggs, as well as organic production, both of which have contributed to higher prices. Also, looking back forty years instead of just twenty, the index was 0.33 in 1994. This indicates a sizable jump in the level of economic diversification over the longer term.

Figure 6. Ten-Year Trend in Marin 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 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 Marin County products declined in value when the Covid-19 pandemic hit. Prominent examples included aquaculture (-45.8%) and wine grapes (-31.5%). But increases in sheep (+22.4%), nursery products (+16.6%), fruits & vegetables (+11.5%), organic milk (+11.4%) and five other products offset the losses. The county's overall production value rose $3,911,000 (4.0%) for the year.

Bottom Line

The discussion here supports three key points:

- Economic diversification helps buffer against economic shocks such as wildfires, droughts, and even pandemics.
- Marin County agriculture has a decent level of economic diversification across crops, which likely benefited the industry during the recent Covid-19 pandemic.
- Agriculture's level of economic diversification has held steady over time.

All of this bodes well for the future. In an era of rapid change and rising risks, the agricultural community can take pride and comfort in not having "all of its eggs in one basket."

Ecosystem Services from Agricultural Lands

Marin 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 Marin 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 Marin 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, Muir Woods National Monument, Point Reyes National Seashore, and Mount Tamalpais State 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 Marin 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, and the Marin Resource Conservation 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 Protection" 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, 2025, February 6).

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.

Food Production

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

Fuel Production

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

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.

Water Cycling

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

Pest Control

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

Pollination Services

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

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.

Fiber Production

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

Recreation and Cultural

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

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.

Atmospheric Gas & Climate Regulation

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

Water Quality

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

Wildfire Protection*

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

**This new category, Wildfire Protection, 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, Hedonistic Pricing, Replacement Cost Method and Contingent Valuation.

This raises an important question: ***what is the annual dollar value of ecosystem services provided by Marin 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 three 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 those three studies. It shows average dollar value per acre for ecosystem services provided by three specific land use types that are common in agricultural settings, adjusted for compounding inflation through 2023.

Of the three counties listed in **Figure 8**, Sonoma County is most relevant to this analysis. Despite differences, Marin and Sonoma share a lengthy border and both have agricultural sectors where dairy farms and grasslands feature prominently.

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	$5,163	$11,002	$4,428	$9,457	$3,009	$13,361
Pasture	$655	$14,065	$1,360	$13,403	$643	$10,382
Cultivated	$163	$3,386	$163	$3,386	$163	$3,386

Figure 9 lists acreages for Marin County agricultural land use types based on the county's 2023 Crop and Livestock Report, then multiplies those acreages by the 2023 inflation-adjusted Sonoma County values from

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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 2023 inflation-adjusted averages calculated from Table 7 (pp. 27-30) in R. Schmidt *et al.*, 2015, Nature's Value in Marin County. Earth Economics, Tacoma, WA & the Resource Conservation District of Marin County, Capitola, CA.

3 2023 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 2023 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 8. As the final column shows, this puts the 2023 estimated total value of ecosystem services provided by Marin County agricultural lands at $464.8 million to $2.081 billion per year.

Figure 9. Estimated Value of Ecosystem Services Provided by Marin County Agricultural Lands in 2023

Agricultural Land Cover Type	# of Acres	Value per Acre ($)		Total Value ($)	
		Low	High	Low	High
Grassland	154,000	$3,009	$13,361	$463,404,620	$2,057,651,123
Field Crops	2,115	$643	$10,382	$1,359,435	$21,957,422
Fruit, Vegetable & Nursery (Cultivated)	383	$163	$3,386	$62,430	$1,295,154
TOTALS	156,498			$464,826,485	$2,080,903,699

Please see text for details and important caveats. "Value per Acre" derived from a detailed Sonoma County study. Acreages were provided by the Marin County Department of Agriculture, Weights and Measures.

We would like to highlight two key points from **Figure 9**. First, the total value, $464.8 million to $2.081 billion per year, may be higher than some readers expected. It might come as a surprise that for 2023, Marin County's agricultural industry likely produced far more economic value in ecosystem services as it did in direct production of commodities ($85.3 million), and perhaps more than *five to twenty-four times* that amount.

Second, grasslands delivered nearly all of the value. The county's 2023 Crop and Livestock Report lists 154,000 acres of pasture, which we categorized as grasslands for the purposes of this study. The report indicates that those 154,000 acres accounted for $8.8 million in direct economic output, or 10.3% of the county's total agricultural production value. However, because grasslands produce so many invisible benefits for people, their total 2023 economic contribution through ecosystem services alone was likely $463.4 million to $2.058 billion. This represents 98.9% to 99.7% of the total value of all ecosystem services provided by Marin County's agricultural lands.

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. For additional discussions of methods and limitations, please consult the studies cited above.

Getting robust numbers would require a full, county-specific study. *The results of such a study would almost certainly yield higher dollar values than the conservative estimates contained in this report.* The following five factors would likely increase the total value per acre:

- Significant investments made to capture and store soil carbon on Marin County agricultural lands compared to other counties. For an overview, please see the eight-page feature article "Stewardship in Practice: Climate-Smart Agriculture in Marin and Sonoma County" in the 2023 County of Marin Crop and Livestock Report;
- The presence of rivers, streams, wetlands, forests and other natural features on Marin County farms and ranches. Forest patches, for example, likely provide an additional $3,690 to $8,863 per acre on more than 14,000 acres;
- Steadily rising per capita personal income in Marin County, which could increase residents' willingness to pay for ecosystem services;

- Increased scarcity of western monarch butterflies and other imperiled species, making their presence on Marin County agricultural properties even more valuable; and
- Ongoing expansion of the 'agritourism' sector fueled by visitors who value products and services such as local wines, artisanal cheeses, scenery and recreation.

FINAL THOUGHTS ON THE VALUE OF WORKING LANDS

This section has explored the non-market economic benefits that Marin County's farms and ranches provide to society. The county's agricultural lands clean our water, control floods and erosion, recharge aquifers, provide fire breaks, supply habitat for fish, wildlife and pollinators, control pests, sequester carbon, remove pollutants from the air, create space for outdoor recreation, attracts tourists, and offer us 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 Marin County's agricultural lands, while challenging, reminds us that protecting them is a smart investment—one that pays dividends today and into the future.

Toward the Future

This report has documented the fuller contributions that Marin County agriculture makes to the local economy. Key points for 2023 are:

- Including farm production, local food processing and their multiplier effects, agriculture contributed $257.2 million to the county economy – more than seven hundred thousand dollars per day.
- Agriculture also played a vital role in county employment, supporting 750 jobs directly in agricultural production and processing, plus another 331 jobs from multiplier effects, for a total employment of 1,081.
- With a Shannon-Weaver Index of 0.43, Marin County agriculture has a stable and noteworthy level of economic diversification across products, providing important economic resilience to the industry and to the larger county economy.
- Marin County agricultural lands delivered an estimated $464.8 million to $2.081 billion to society in the form of scenic beauty, wildlife habitat, wildfire protection and more than a dozen other non-market services.

That's the good news. The not-so-good news is that Marin County's agricultural operations face mounting economic pressures. For example, many farmers are 'land rich' but financially poor. Also, a large percentage depend on off-farm income in order to survive. While this report was being researched and written, yet another dairy went out of business. Twelve dairies and ranches will soon exit Point Reyes National Seashore as part of a legal settlement. The fact of the matter is that despite the significant economic contributions they make to the local economy, Marin County's agricultural producers are locked in a constant struggle to survive.

Agriculture is an important pillar of the Marin 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 below). In the meantime, the findings herein provide the most complete view to date of Marin County agriculture's vital economic role.

Additional Questions

- ADDING VALUE LOCALLY. Marin County agriculture already exhibits exceptional vertical integration compared to other counties, especially for dairy, 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?
- ORGANIC PRODUCTION. Marin County has significant organic production but many information gaps remain. For example, how many acres of certified organic farmland currently exist? What is the total contribution to the county economy attributable to organic production of milk and other products?
- KEY PARTNERS' IMPACT. The Marin Resource Conservation District, Point Blue and many other organizations play key roles in supporting local agriculture. The Marin Agricultural Land Trust (MALT, see https://malt.org/), in particular, has invested $112 million in land protection through agricultural conservation easements covering nearly 59,000 acres, plus nearly $3 million in stewardship projects. Including multiplier effects, what is the total economic contribution attributable to working lands supported by MALT and other partners?
- TRENDS AND PROJECTIONS. This report has provided a snapshot for a single-year. What are the long-term economic trends in Marin County agriculture related to the number of farms and acres, farm revenues and expenses, and other key features? If current trends continue, then what will agriculture look like in the coming years?
- ECOSYSTEM SERVICES. This report has provided an initial estimated dollar value of open space, scenic beauty, wildlife habitat and other non-market benefits that Marin County's working lands provide to society. Future work could refine and update the estimate. For example, what is the annual economic value of ecosystem services provided by natural features that occur on agricultural lands, such as creeks and streams, wetlands, and forests?
- FOREST PRODUCTS. As noted earlier, Marin County businesses reported $4.6 million in forest-related activities for 2023. This raises questions about the current and potential future role of selective tree removal for thinning, post-fire salvage, wildfire safety, firewood sales and other forest-based activities, as well as opportunities to add value through local milling.

Acknowledgments

This report was produced by Agricultural Impact Associates LLC under contract to the Marin County Department of Agriculture, Weights and Measures. Lead researchers were Dr. Jeff Langholz (jeff@ag-impact.com) and Dr. Fernando DePaolis (fernando@ag-impact.com). Joe Deviney supervised the project on behalf of the county. We thank the many agency staff and members of the agricultural industry who helped develop this report, especially David Lewis, Albert Straus, Raissa De la Rosa, Lily Verdone, Sonia Hammons, and Zach Mendes for their significant detailed feedback.

Marin County Department of Agriculture, Weights and Measures

https://www.marincounty.gov/departments/AWM

July 2025

Agricultural Impact Associates