CROP REPORT PLUS *Series*

Economic Contributions of Yuba County Agriculture

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of Yuba County

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Commissioner's Letter

I am pleased to share the **Economic Contributions of Yuba County Agriculture**. This report takes an important step beyond the Yuba County Crop Report that we publish every year. Instead of stopping at crop production values and acreage, it quantifies agriculture's total economic contributions through production, local processing, employment, and economic multiplier effects.

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

This new study shows that in 2018, agriculture contributed a total of $391.8 million to the county economy. This far exceeded the $241.1 million figure from our 2018 Yuba County Crop Report. Agriculture supported 2,791 direct employees, roughly one of every eleven jobs in the county. Adding multiplier effects brought total agriculturally-related employment to 2,961 jobs. This report also examines economic diversification within agriculture, which has important implications for countywide economic resiliency.

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

Respectfully submitted,

Stephen M. Scheer
Agricultural Commissioner

Table of Contents

Agricultural Commissioner's Letter ..... **Inside Cover**

Yuba County Agriculture by the Numbers **2**

Introduction **3**

Our Approach **3**

Direct Effects of Yuba County Farm Production **4**

Figure 1. Distribution of Yuba County Farm Production

Multiplier Effects of Yuba County Farm Production **5**

Figure 2. Economic Effects of Farm Production

Locally Sourced, Value-added Food Processing **7**

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

Total Economic Contributions of Yuba County Agriculture **9**

Figure 4. Overall Economic Effects of Yuba County Agriculture

How Resilient is Agriculture to Economic Shocks? **10**

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

Figure 6. Ten-year Trend in Yuba County Agriculture's Economic Diversification

Toward the Future **13**

Additional Questions **13**

Acknowledgments **13**

Yuba County Agriculture
By the Numbers

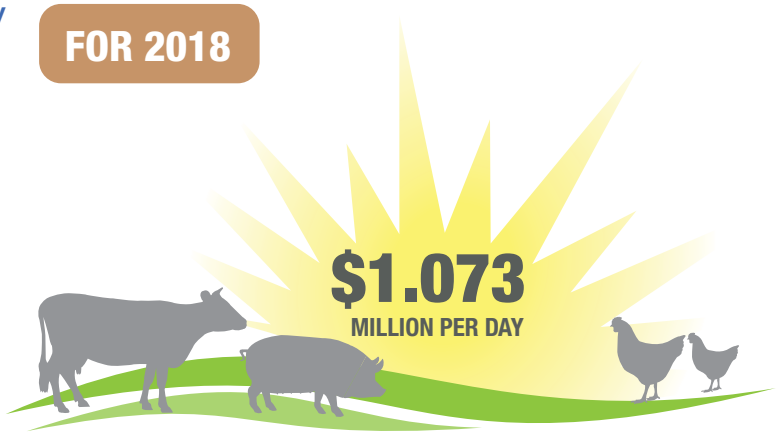
Economic Contributions
of the Agricultural Industry

FOR 2018

$391.8 million
Yuba County Agriculture's total contribution to the local economy

$303.2 million in direct economic output

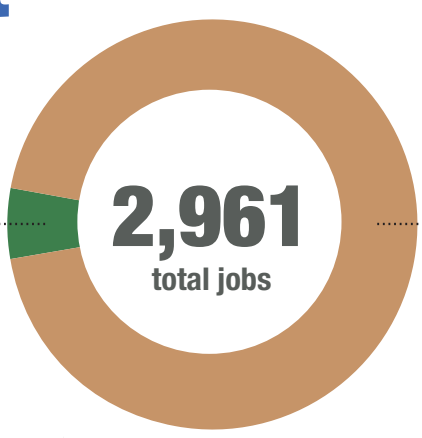
$88.6 million in multiplier effects



$1.073
MILLION PER DAY

Employment Effects
of the Agricultural Industry

170
additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees



2,791
direct employees

ONE in eleven
jobs in Yuba County directly attributable to the agricultural industry

Introduction

Residents and visitors alike know and value the contributions agriculture makes to Yuba County. Rice fields stretch for miles. Cattle and calves dot the hillsides and valleys. Walnuts, timber, and many other crops grow in fertile soils while farmers' markets nurture local food and community pride. It is not difficult to see that agriculture plays a vital role in sustaining a healthy economy in Yuba County.

What is not so apparent, however, is the true size of that role. How much money does agriculture pump into the local economy? How many jobs does agriculture support? In other words, just how important is agriculture as a driver of Yuba 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 Yuba County economy. The report also examines agricultural diversification and its role in supporting economic resilience, including a quantitative measure. Overall, the findings offer important information for policy makers, the public, and anyone who values a thriving local economy.

Our Approach

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

Direct economic effects include farm production, local processing, and their related employment. *Indirect* effects consist of inter-industry, business-to-business supplier purchases. *Induced* effects reflect consumption spending by employees. The **Multiplier Effects** section on page 5 explains this further.

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

Our calculations draw from local and national data sources. The local sources include industry experts and the annual Yuba County Crop Report produced by the Department of Agriculture. 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 536 industry sectors. Because IMPLAN draws from multiple sources, including the recent USDA Census of Agriculture, its employment and economic output numbers often differ from those reported by individual state and federal agencies.

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

Direct Effects of Yuba County Farm Production

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

PRODUCTION

Figure 1 shows the various categories that made up Yuba County farm production value. At $121.9 million, Fruit & Nut Crops was the single largest production category by dollar value, comprising 50.6% of the county total. Walnuts led this category with $42.3 million in production value. Prunes / Dried Plums were second ($32.4 million), followed by peaches ($19.9 million) and kiwi ($13.9 million).

At 35.7%, Field & Vegetable Crops represented the second largest category ($86.1 million) and consisted mostly of rice at $62.9 million. Livestock ranked third ($20.3 million, 8.4%), followed by Timber ($12.2 million, 5.1%).

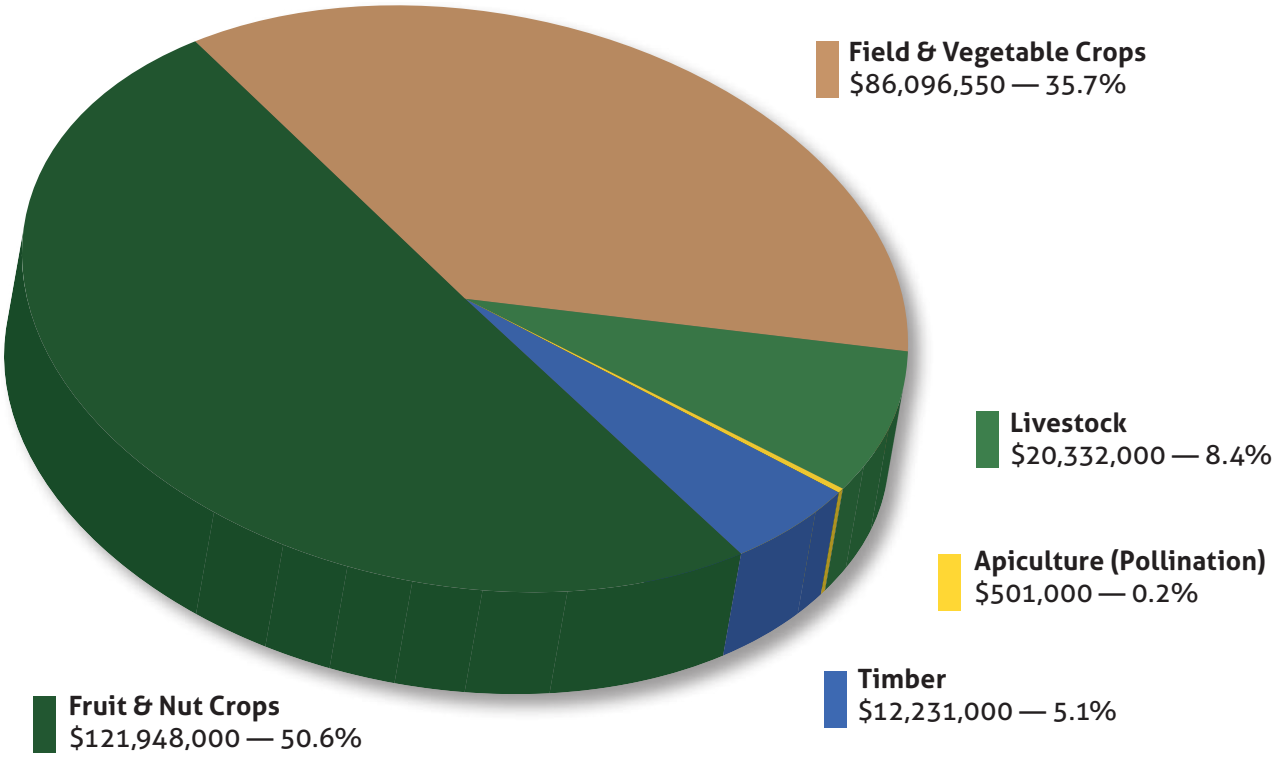
The combined, total dollar value for all products rose $42.9 million over the previous decade, from $198.2 million in 2009 to $241.1 million in 2018. Inflation totaled 15.5% during this period, averaging under 2% per year. Thus, agricultural production grew 6.2% even after adjusting for inflation. Total values do not reflect net profit or loss experienced by individual growers or by the industry as a whole. Interested readers are encouraged to consult the 2018 Yuba County Crop Report for additional details on specific products and their value.

EMPLOYMENT

How many people work in agricultural production? In 2018, IMPLAN data indicate that agricultural production directly employed 2,182 people in Yuba 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 pages 7-8. Nor did it include Yuba County's many public sector jobs in agriculture, across a wide range of local, state, and federal agencies.

Figure 1. Distribution of Yuba County Farm Production

Source: 2018 Yuba County Crop Report.



Multiplier Effects of Yuba County Farm Production

This section quantifies the economic ripples that farm production creates in the local economy. These ripples take two forms: *indirect effects* and *induced effects*. The first consists of business-to-business supplier purchases. For example, when a grower buys fertilizer, pesticides, seed, insurance, banking services, farm equipment, and other inputs, the grower 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 that occur within Yuba County. Quantifying expenditures outside the county would be an expensive, complex effort that lies well beyond our scope here.

Every sector has its own, unique multipliers that reflect where companies and employees spent their money. Each sector also has its own unique multipliers for employment, resulting in the combined employment numbers shown in **Figure 2**.

For example, "Beef Cattle Ranching" in Yuba County has an *indirect effects* multiplier of 0.3576 and an *induced effects* multiplier of 0.1327. This means that for 2018, each dollar's worth of direct output from cattle and calves generated an extra 35 cents in supplier purchases, plus 13 more cents in consumption spending by employees of agricultural companies and their suppliers. Multipliers change every year, for each sector and county in the entire nation, based on where companies and employees spend their money.

Note that category names and production values in **Figure 2** differ from the county's 2018 Crop Report. They follow a standard classification system used nationwide called the North American Industrial Classification System (NAICS), as modified by IMPLAN. Each NAICS / IMPLAN category has an explicit definition.

Also, because NAICS and IMPLAN uses a different methodology than the county's annual agriculture survey, the $247.8 million direct production value in **Figure 2** differs slightly from the $241.1 million total reported in the 2018 Crop Report.

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.

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

- **Grain Farming:** Corn (grain), Corn (silage), Oats, Rice, Wheat;
- **Fruit Farming:** Kiwi, Peach, Prune / Dried Plum, Miscellaneous Fruits;
- **Tree Nut Farming:** Almond, Walnut;
- **Forestry & Forest Products:** Timber;
- **Beef Cattle Ranching:** Cattle & Calves;
- **Dairy Cattle & Milk Production:** Milk;
- **All Other Crop Farming:** Hay (Alfalfa), Hay (Other), Pasture (Irrigated), Pasture (Dryland);
- **Vegetable and Melon Farming:** Corn (Sweet), Corn (Ornamental), Pumpkins, Safflower, Squash, Miscellaneous Vegetables and Seed;
- **Support Activities for Agriculture:** Pollination, Soil Preparation, Planting, Cultivating, Harvesting;
- **Greenhouse, Nursery, & Floriculture Production:** Nursery Stock;
- **Other Animals & Animal Products:** Lambs, Sheep, Wool.

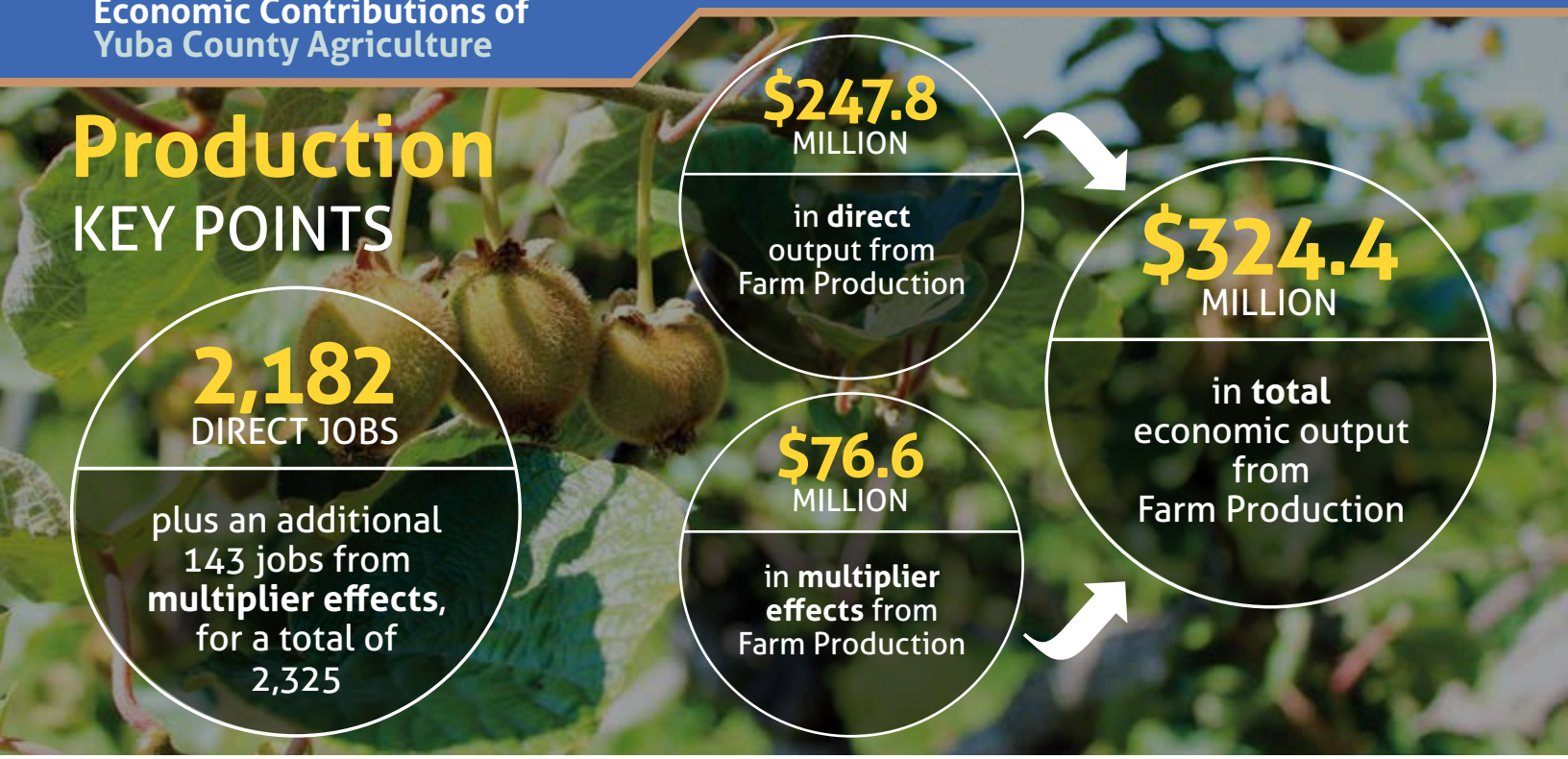


Figure 2. Economic Effects of Yuba County Farm Production

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

FARM PRODUCTION SECTOR	Output Effects ($ Millions) Direct	Indirect	Induced	TOTAL
Grain Farming	$72.4	$9.1	$14.8	$96.3
Fruit Farming	$71.7	$11.8	$7.8	$91.3
Tree Nut Farming	$50.9	$7.8	$7.7	$66.5
Forestry & Forest Products	$12.5	$1.8	$2.2	$16.5
Beef Cattle Ranching	$9.5	$3.4	$1.3	$14.2
Dairy Cattle & Milk Production	$9.6	$2.2	$0.6	$12.4
All Other Crop Farming	$8.7	$1.9	$0.9	$11.5
Vegetable & Melon Farming	$5.1	$1.1	$0.4	$6.7
Support Activities for Agriculture	$3.1	$0.1	$0.6	$3.8
Greenhouse, Nursery, & Floriculture Production	$3.0	$0.4	$0.2	$3.6
Other Animals & Animal Products	$1.3	$0.1	$0.3	$1.7
TOTAL ECONOMIC OUTPUT	$247.8	$39.7	$36.9	$324.4
	Employment Effects (# Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	2,182	82	61	2,325

Locally Sourced, Value-added Food Processing

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

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

Based on our strict criteria, we excluded IMPLAN food and beverage sectors that other studies often include.[1] For example, Yuba County produced over $55.7 million in pastries, chocolates, bread, ice, soft drinks and other food products. This production supported more than a hundred jobs. Adding these sectors to local agriculture's tally could overstate the value of local agriculture, including its employment and multipliers.

Figure 3 shows the economic effects of locally sourced, value-added food processing. Like the previous section, sector names generally follow IMPLAN and the North American Industrial Classification System (NAICS).

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

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

FOOD PROCESSING	Output Effects ($ Millions) Direct	Indirect	Induced	TOTAL
Dried Food Products Manufacturing	$37.2	$0.8	$7.8	$45.7
Miscellaneous Processing & Packing	$11.9	$1.3	$0.3	$13.5
Wineries	$4.6	$1.0	$0.2	$5.8
Meat & Other Animal Products	$1.7	$0.6	$0.1	$2.4
TOTAL ECONOMIC OUTPUT	$55.4	$3.7	$8.3	$67.4
	Employment Effects (# Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	609	20	6	636

At $37.2 million in direct output, "Dried Food Products Manufacturing" was the largest food processing category. It reflects several facilities that dry and package fruits, nuts, and grains. Significant portions of the county's $42.3 million walnut crop go to these facilities, as does part of the $62.9 million rice crop that is dried locally before being milled elsewhere. Likewise, an estimated 90% of the county's $32.4 million dried plum crop goes to local facilities for drying, after which a smaller amount is further processed for bagging and shipping.

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

As its name suggests, "Miscellaneous Processing & Packing" in **Figure 3** is a catch-all category combining multiple niche activities. Among other things, this includes adding value to kiwis and other fresh products by cleaning, sorting, packing and labelling. It also reflects local jams, jellies, and other fruit products that are sold online, at farmers' markets, and other outlets.

In a specific example, an orchard near Marysville specializes in peaches but also sells local honey, olive oil, olives, and nuts at its farm stand. Two farms near Oregon House and Bangor specialize in olive oils. Last, the category reflects a portion of the county's corn and oat crops that growers convert into silage for livestock feed.

"Wineries" in **Figure 3** reflects and handful of family-run operations, mostly near Oregon House. What Yuba County lacks in quantity of wineries, it makes up for with history and quality. The county name likely stems from the Spanish word "Uva," which means grapes. Winemaking flourished during the Gold Rush, faded during Prohibition, then came back to life in the 1970s. Like wineries elsewhere in California, local wineries add value to grapes not just through crushing, fermentation, and bottling, but also by hosting visitors for tastings and other events.

"Meat & Other Animal Products in **Figure 3** reflects the small portion of cattle and other animals that are processed locally. An estimated 95% of Yuba County's animals leave the county for processing. The remainder goes to niche operations. Examples include a custom butchery in Marysville and a Browns Valley facility that specializes in jerky products. A larger, USDA-inspected meat processing facility in West Linda produces cuts of beef, pork, chicken, and lamb, as well as marinated, smoked, and cured meats.

Processing
KEY POINTS

609
DIRECT JOBS

plus an additional 26 jobs from **multiplier effects**, for a total of 636 (rounded)

$67.4
MILLION

in **total** economic output from Food Processing

$55.4
MILLION

in **direct** output from Food Processing

$12.0
MILLION

in **multiplier effects** from Food Processing

Total Economic Contributions of Yuba 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 Yuba County agriculture.

As **Figure 4** shows, Yuba County agriculture's 2018 economic contributions totaled $391.8 million. This consisted of $303.2 million in combined, direct output from production and processing, plus $88.6 million in multiplier effects.

For perspective, agriculture pumped just over *one million dollars per day* into the county economy during 2018 ($1,073,260 to be exact), or $44,719 per hour. The $280.9 million in direct output represented 6.1% of the county's total economic output of $4.988 billion, roughly one out of every sixteen dollars.

Total agricultural employment covered in the scope of this study was 2,961. This included 2,791 jobs directly in agriculture and 170 more attributable to multiplier effects. The 2,791 direct agricultural jobs represented 8.8% of Yuba County's total employment of 31,548. Thus, agriculture accounted for nearly one out of every eleven jobs.

Figure 4. Overall Economic Effects of Yuba County Agriculture

Not all columns and exactly add due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects ($ Millions)	$247.8	$39.7	$36.9	$324.4
Employment Effects (# Jobs)	2,182	82	61	2,325
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects ($ Millions)	$55.4	$3.7	$8.3	$67.4
Employment Effects (# Jobs)	609	20	6	636
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects ($ Millions)	$303.2	$43.4	$45.2	$391.8
Employment Effects (# Jobs)	2,791	103	67	2,961

How Resilient is Agriculture to Economic Shocks?

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

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

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

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

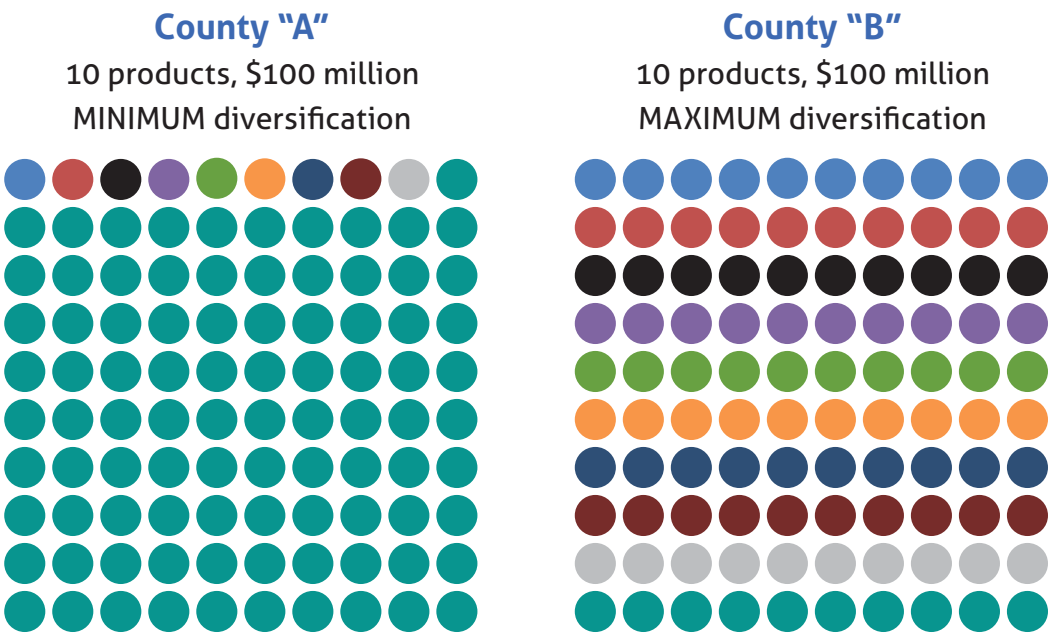
To answer this question, we calculated the Shannon-Weaver Index for Yuba County agriculture. Created in 1949 for military code breaking, the Shannon-Weaver index is widely used by economists, ecologists, and others interested in quantifying diversity. Different versions of the basic Shannon-Weaver formula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

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

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

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

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



SHANNON-WEAVER INDEX

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

For 2018, the Shannon-Weaver Index for Yuba County's agricultural industry was **0.48**.

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

Over the past decade, Yuba County has consistently produced fourteen major commodities. The relative contribution of individual commodities has varied from 0.25% of the county's total farm gate value (the minimum threshold for this analysis) to 39.5% of the county total (rice in 2009).

At first glance, Yuba County's resulting index of 0.48 seems near the middle of 0.00 to 1.00 range. But the Shannon-Weaver formula includes a logarithmic function, which complicates interpretation. The logarithm makes the scale exponential, like the Richter Scale that measures earthquakes. Many Californians understand that a 7.4 earthquake releases twice the energy of a 7.2 earthquake even though the numbers are not far apart. The same principle applies here.

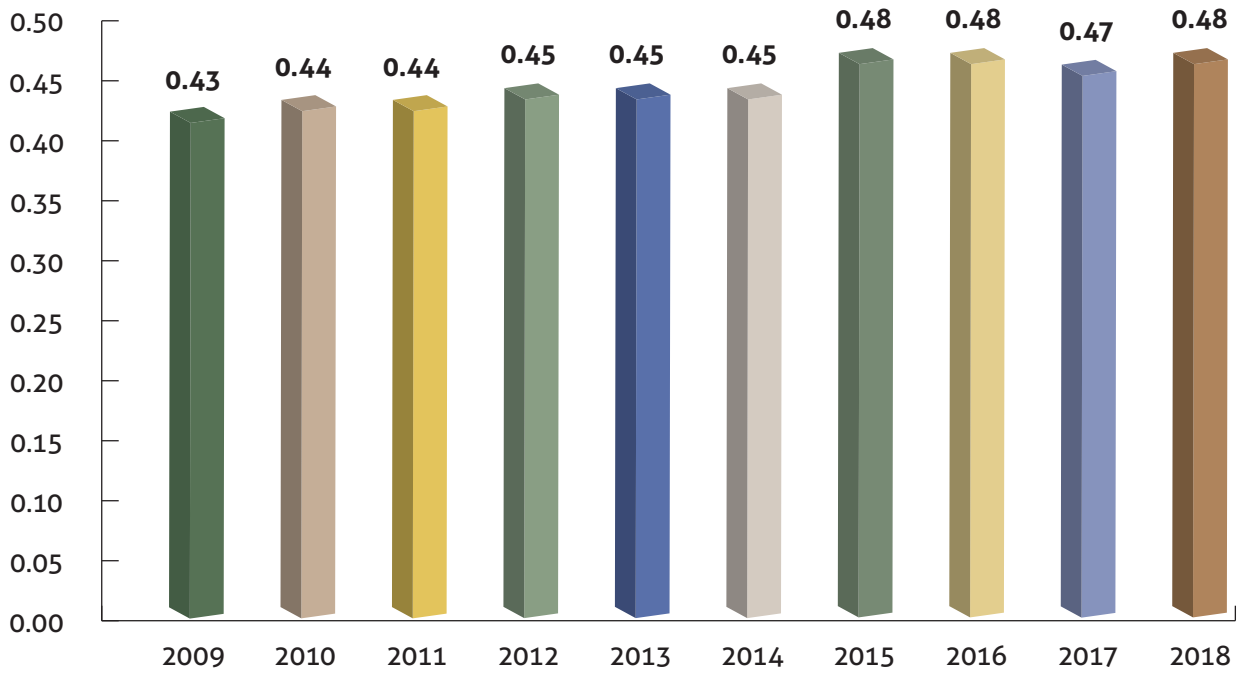
The 0.48 index suggests moderate protection from economic shocks. Validating that protection would require stress testing, i.e., modeling specific shocks to see how they affect the industry.

How has the Shannon-Weaver Index changed over time? Has agriculture become more diversified, or less so? **Figure 6** shows the Shannon-Weaver Index for the past decade. The main thing to note is consistency across years. Agriculture's economic resiliency has held steady for ten years and has even risen a bit. This contrasts with the downward trend in many California counties that have become dependent on one or two major products.

Again, the logarithmic scale means that what might look like small shift in **Figure 6** is actually a big one. Going from 0.45 to 0.48, for example, represents exponential change.

Figure 6 . Ten-year Trend in Yuba County Agriculture's Economic Diversification

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



Changes over time underscore the importance of a strong, diversified production base. For example, 2015 brought a 37% one-year decline in the county's most valuable commodity, walnuts. The second-ranked commodity, rice, dropped 29%. Such a sudden, major drop in its two largest commodities might have damaged a less diversified agricultural economy. But gains in kiwi, cattle, peaches, and other commodities buffered the decline, limiting it to just 16% overall. Yuba County also set a new high mark for its Shannon-Weaver Index, at 0.48 (**Figure 6**).

Toward the Future

This report has documented the role that Yuba County agriculture plays as a local economic driver. Including local food processing and multiplier effects, agriculture contributed $391.8 million to the county economy, just over one million dollars per day. Agriculture also played an important role in county employment, directly or indirectly supporting 2,961 jobs. Finally, agriculture's diversification is rising over time, providing critical economic resilience to the industry and to the larger county economy. The economic value of this resilience is certainly high, albeit hard to quantify.

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

Additional Questions

- ADDING VALUE LOCALLY. As this report has shown, processing of Yuba County's raw agricultural products occurs mostly outside the county. What new policies, programs, and other initiatives could expand locally sourced, value-added food processing within Yuba County?
- ECOSYSTEM SERVICES. What is the annual dollar value of wildlife habitat, scenic beauty, carbon sequestration, and more than twenty other ecosystem services that Yuba County's agricultural lands provide to society?
- DIVERSIFICATION. How is economic diversification trending not just in terms of production across commodities, but also in terms of farm sizes, geographical markets, and organic/conventional?
- ECONOMIC SHOCKS. How would potential shocks affect agriculture's economic results, for example significant new regulations, pests, labor policies, water issues, or changes in the price of key inputs?
- CANNABIS AND HEMP. Commercial cannabis and industrial hemp production continue to gain momentum in California. What economic opportunities and risks do they pose for Yuba County agriculture?

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Yuba County Department of Agriculture

www.yuba.org/departments/agricultural_commissioner_and_sealer_of_weights_and_measures/index.php

(April 2020)

Agricultural Impact Associates