CROP REPORT PLUS *Series*

Economic Contributions of Tehama County Agriculture

The Honorable Board of Supervisors of Tehama County

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Commissioner's Letter

I am pleased to share the **Economic Contributions of Tehama County Agriculture**. This report takes an important step beyond the Annual Crop Report our department publishes each year. Instead of stopping at crop production values and acreage, it quantifies agriculture's total economic contribution through food production, local food processing, employment, and economic multiplier effects. In short, the report documents agriculture's broader role in sustaining a thriving local economy.

Section 2279 of the California Food and Agriculture Code requires all county agricultural commissioners to report the annual "value" of agriculture. This typically occurs via our Annual Crop Report. Using twenty-first century economic tools, we can now fulfill this mandate better than ever. We can also explore additional topics that clarify agriculture's role in sustaining a healthy local economy.

For 2017, agriculture contributed a total of $679.1 million to the county economy. This far exceeds the $381.7 million figure from our 2017 Annual Crop Report. Agriculture also supported 4,190 direct employees, or nearly one out of every six jobs in the county (16.5%). Adding multiplier effects brought total employment to 4,410 jobs. With an economic diversification index of 0.58, agriculture also provided a stabilizing force to the county economy.

Agriculture has a long tradition in Tehama 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,

Doni Rulofson

Doni Rulofson
Interim Agricultural Commissioner/
Sealer of Weights & Measures

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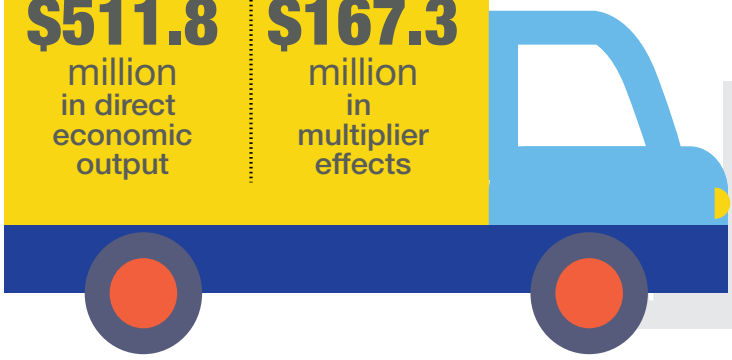
FOR 2017

$679.1 million
Tehama County Agriculture's total contribution to the local economy

$1.860
MILLION PER DAY

$511.8 million in direct economic output

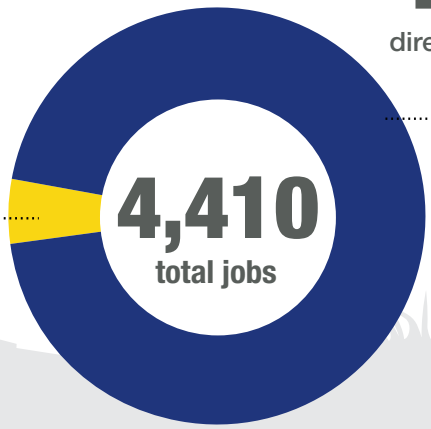
$167.3 million in multiplier effects

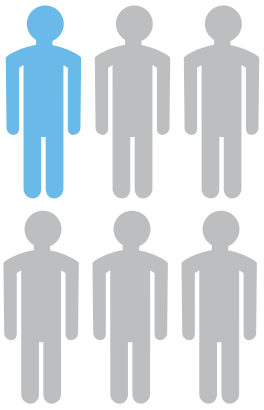


Employment Effects
of the Agricultural Industry

4,190
direct employees

220
additional jobs attributable to multiplier effects: expenditures by agricultural companies and their employees





ONE in SIX
jobs in Tehama County directly attributable to the agricultural industry

Introduction

Residents and visitors alike know and value the contributions agriculture makes to Tehama County. Groves of walnuts, almonds, and olives stretch for miles. Livestock dot the hillsides and valleys. Bee hives buzz with activity and seasonal farmers' markets nurture local food and community pride.

Clearly, agriculture plays a vital role in sustaining a healthy local 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 Tehama 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 Tehama County economy. The report also examines agricultural diversification and its role in supporting economic resilience, including a first-ever quantitative measure. Overall, the findings offer important information for policy makers, the public, and anyone who values a thriving local economy.

Our Approach

When it comes to economic analysis, it's important to examine the fullest possible range of economic contributions. This report does that by focusing not just on *direct* economic effects such as farm production and employment, but also on *multiplier effects*. *Multiplier effects* are ripples through the economy. These ripples include inter-industry business-to-business supplier purchases as well as consumption spending by employees. The **Multiplier Effects** section on page 4 explains this further.

It is appropriate to calculate *multiplier effects* when analyzing what economists call a *basic industry*. 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 Tehama County. Therefore, this report includes *multiplier effects* when describing agriculture's total economic contribution.

Our analysis only examines agriculture's economic contributions. To understand agriculture's full economic impact, one would also need to assess agricultural-related costs to society, for example 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 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). IMPLAN uses econometric modeling to convert data from more than a dozen federal government sources into local values for every U.S. county and zip code, across 536 industry sectors. Except where otherwise noted, all figures are from the year 2017, the most recent IMPLAN dataset available. Where appropriate, we adjusted IMPLAN sector names and values to reflect Tehama County conditions. Please contact the authors for additional details on the methods used.

Direct Effects of Tehama 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

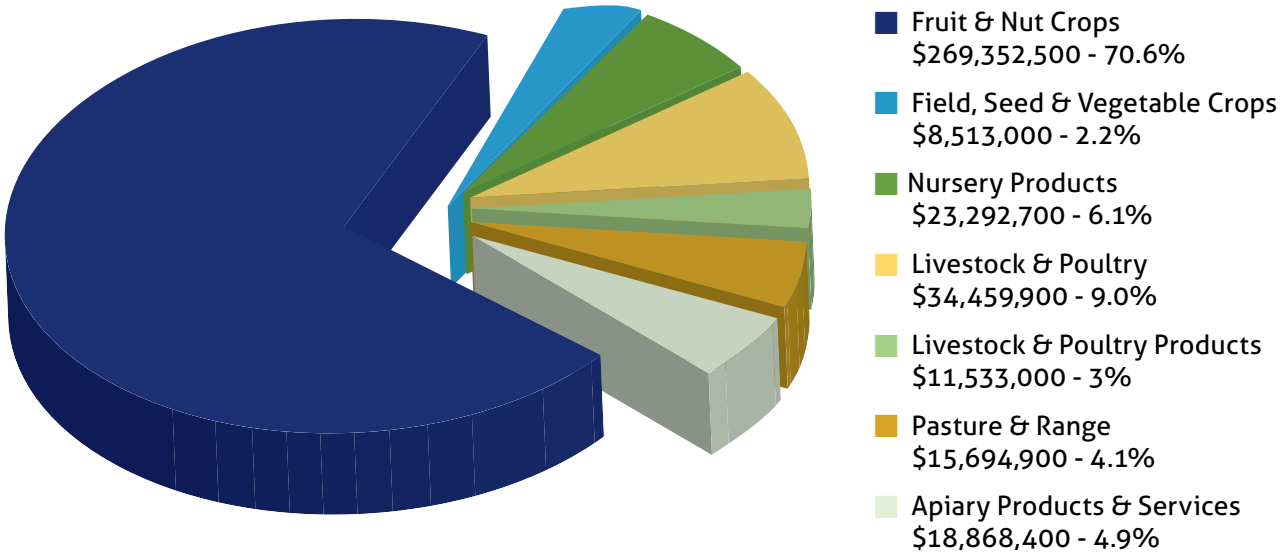
Figure 1 shows the various categories that made up Tehama County's farm production value. At $269.3 million, Fruit & Nut Crops was the single largest production category by dollar value, comprising 70.6% of the county total. Walnuts dominated this category with $120.1 million, followed by almonds ($53.3 million), table olives ($39.3 million), and prunes ($29.7 million).

At 9.0%, Livestock & Poultry represented the second largest category ($34.5 million), consisting mostly of cattle. Nursery Products were next at $23.3 million (6.1%).

The combined, total dollar value for all products rose $222.6 million over the previous decade, from $159.1 million in 2008 to $381.7 million in 2017. Inflation totaled 19.5% during this period, averaging just under 2% per year. Thus, agricultural production grew an impressive 120.4% 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 Department of Agriculture's 2017 Annual Crop Report for additional details on specific products and their value.

Figure 1. Distribution of Tehama County Farm Production

Source: 2017 Annual Crop Report, Tehama County Department of Agriculture



EMPLOYMENT

How many people work in agricultural production? For 2017, agricultural production directly employed 3,522 people in Tehama County. The figure encompasses a wide range of production-related jobs, including not just growing and harvesting, but also sales, marketing and many other roles. It does not include food processing jobs, which we discuss below.

Multiplier Effects of Tehama 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 Shasta County, Butte County, and many other locations outside Tehama County, this study only reflects those expenditures that occur within the 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 U.S. Bureau of Economic Analysis data and other sources.

Figure 2. Economic Effects of Tehama County Farm Production

Dollar values are in $ millions. Figures are for 2017 and come from IMPLAN and U.S. Bureau of Economic Analysis. Not all columns and rows add exactly due to rounding.

FARM PRODUCTION	Output Effects ($ Millions)			TOTAL
	Direct	Indirect	Induced	
Tree Nut Farming	$182.2	$43.1	$30.5	$255.8
Fruit Farming	$79.3	$19.0	$13.0	$111.3
Animals & Animal Products	$57.5	$7.0	$7.1	$71.5
Support Activities for Agriculture & Forestry	$31.9	$0.3	$9.7	$41.8
Greenhouse, Nursery & Floriculture Production	$20.2	$2.7	$3.7	$26.6
Forestry & Forest Products	$7.8	$0.5	$2.0	$10.3
Grain Farming	$3.5	$1.2	$0.4	$5.1
Miscellaneous Other Crop Farming	$2.4	$0.5	$0.4	$3.4
TOTAL ECONOMIC OUTPUT	$384.9	$74.3	$66.7	$525.9
	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	3,522	138	61	3,721

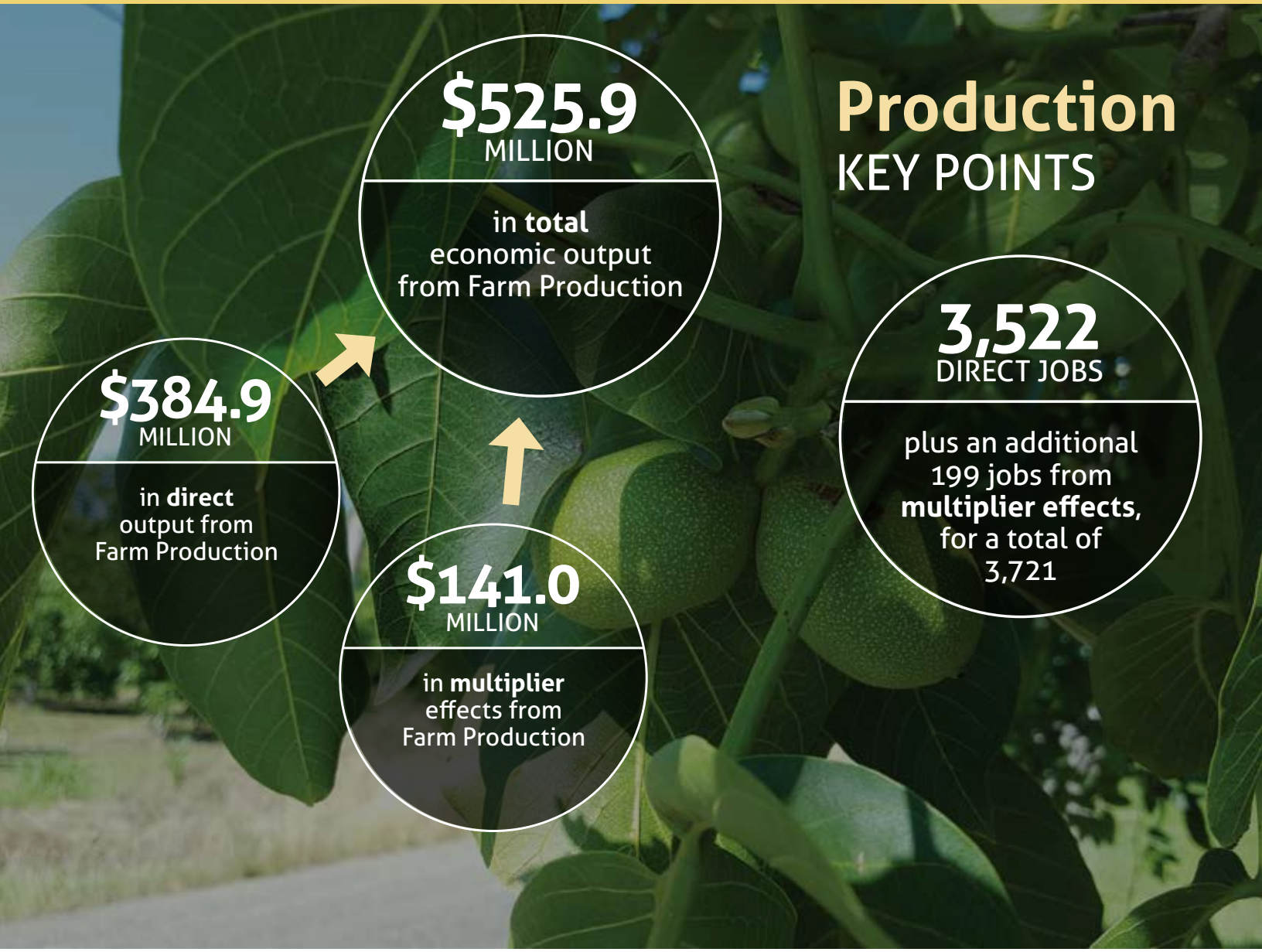
For example, "Tree Nut Farming" in Tehama County has an *indirect* effects multiplier of 0.2365 and an *induced* effects multiplier of 0.1674. This means that for 2017, each dollar's worth of direct output generated an extra 23 cents in supplier purchases, plus 16 more cents in consumption spending by agricultural company owners and employees.

Every sector has its own, unique multipliers reflecting 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**.

Note that category names and production values in **Figure 2** differ from the county's 2017 Annual Crop Report. They follow a standard classification system used nationwide called the North American Industrial Classification System (NAICS). Each NAICS category has an explicit definition. For example, "Support Activities for Agricultural Production" includes not just the county's $4.4 million in pollination, but also soil preparation, planting, cultivating, harvesting, labor contracting, and other farm management services.

We combined several small sectors into "Miscellaneous Other Crop Farming." Examples include Vegetable Crops and Seed Crops. The county's $14.5 million in honey bees, queen bees, and other apiary products appears in "Animals & Animal Products."

Also, because IMPLAN uses a different methodology from the county's annual agriculture survey, the $384.9 million direct production value in **Figure 2** differs slightly from the $381.7 million total in the 2017 Annual Crop Report.



Locally Sourced, Value-Added Food Processing

Farm production tells only part of the story. Tehama County is home to several food processors that play a key role in the local economy. This section captures 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 Tehama County were it not for the abundant supply of fruit, nuts, and other raw agricultural products.

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 by local industry experts.
Not all columns and rows add exactly due to rounding.

FOOD PROCESSING	Output Effects ($ Millions) Direct	Indirect	Induced	TOTAL
Canned Fruits Manufacturing	$59.0	$7.5	$3.3	$69.8
Nuts & Other Dried Products	$31.2	$1.0	$8.2	$40.4
Oils Refining & Blending	$17.0	$2.0	$0.3	$19.4
All Other Food Manufacturing	$14.5	$2.0	$1.0	$17.5
Wineries	$5.1	$0.7	$0.4	$6.2
TOTAL ECONOMIC OUTPUT	$126.8	$13.1	$13.2	$153.2
	Employment Effects (# Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	668	13	8	689

The largest category, "Canned Fruits Manufacturing," encompasses fresh, canned, and bottled products made from the county's abundant fruits. This includes, for example, the portion of the county's $39.3 million table olive crop that is processed locally into canned products.

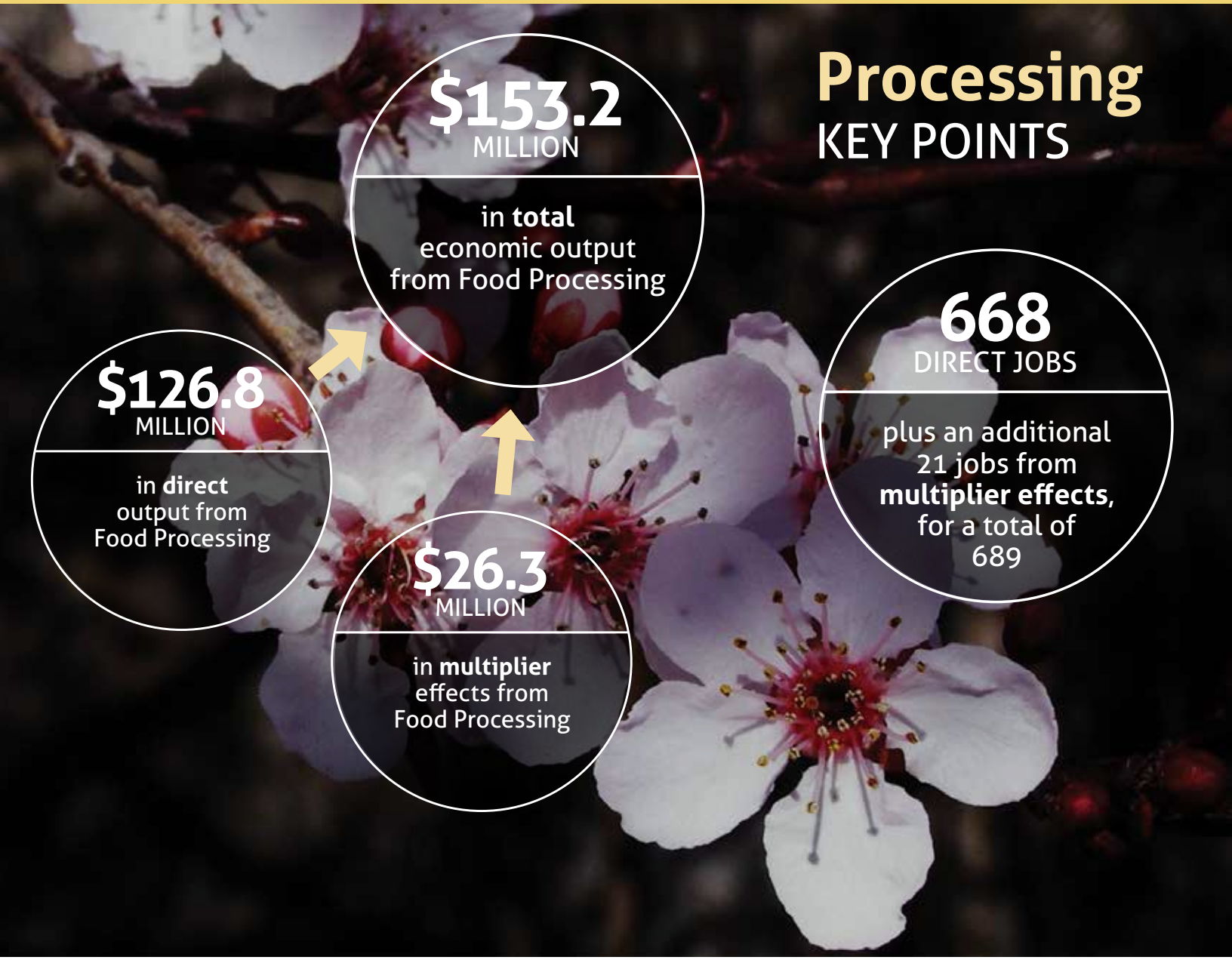
"Oils Refining & Blending" in **Figure 3** reflects portions of the county's $10.4 million olive crop destined for local oil production, rather than table olives. As with olive canning, much of the oil production occurs near Corning, a nationally-renown center for olive products. A few operations even offer tours and tastings.

"Nuts and Other Dried Products" reflects portions of the county's $120.2 million walnut crop and $53.3 million almond crop that are processed within the county rather than shipped elsewhere. For example, an operation near Vina hulls, dries, packages, and ships a wide range of walnut products, including trail mixes, roasted, flavored, and natural nuts. A nationally prominent company with six facilities in California operates one of them in Red Bluff. A producer in Los Molinos sells online and retail, hosts weddings, and even sells a Tehama Sampler Gift Box that contains a microcosm of the county's agricultural production: walnuts, plums, apricots, pecans, pistachios, and almonds. This category also includes portions of the county's prune crop that stays local for dehydration, especially at a Red Bluff facility owned by a prominent national brand.

"All Other Food Manufacturing" in **Figure 3** combines multiple activities, many of them occupying narrow niches. For example, the overwhelming majority of the county's $34.5 million in livestock departs the county for processing, but a tiny amount goes to local butchers for slaughtering, processing, and packaging. An aquaculture operation near Paynes Creek supplies trout to restaurants and grocery stores across a wide swath of California. A grower near Corning cleans, sorts, and packages figs for direct shipment to restaurants, grocery chains, and others. A facility in Dairyville makes and sells jams and other products, including local walnuts and almonds covered with chocolate. Many other examples exist, all of them adding value to locally produced raw products.

What Tehama County's "Wineries" sector lacks in size, it makes up for with quality, tradition, and variety. A combination of distinct soils, hot days, and cool nights help transform the county's $1.1 million grape crop into quality products.

For example, a fifth-generation winemaker and community of Trappist-Cistercian monks near Vina handcraft award-winning wines. Wineries in the federally-recognized Manton Valley American Viticultural Area (AVA) boast a unique combination of elevation, terrain, and volcanic soils. Many wineries host tastings, weddings, and other events.



Total Economic Contributions of Tehama 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 Tehama County agriculture.

As **Figure 4** shows, the total 2017 economic contribution of Tehama County agriculture was $679.1 million. This consisted of $511.8 million in combined, direct output from production and processing, plus $167.3 million in multiplier effects.

For perspective, agriculture pumped over $1.8 million dollars per day into the county economy during 2017 ($1,860,474 to be exact), or $77,520 per hour. The $511.8 million in direct output represented 14.6% of the county's total economic output of $3.500 billion. Thus, agriculture accounted for one dollar out of every $6.80 of the county's direct economic output.

Total employment was 4,410. Of these, 4,190 were jobs were directly in agriculture, with the remainder from multiplier effects. The 4,190 direct agricultural jobs represented 16.5% of Tehama County's total employment of 25,384, or about one out of every six jobs.

Figure 4. Overall Economic Effects of Tehama County Agriculture

Not all columns and rows add exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects ($ Millions)	$384.9	$74.3	$66.7	$525.9
Employment Effects (# Jobs)	3,522	138	61	3,721
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects ($ Millions)	$126.8	$13.1	$13.2	$153.2
Employment Effects (# Jobs)	668	13	8	689
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects ($ Millions)	$511.8	$87.4	$79.9	$679.1
Employment Effects (# Jobs)	4,190	151	70	4,410

How Resilient is Agriculture to Economic Shocks?

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

What's the best way to lower these risks? Opinions vary, but most emphasize product diversification. From the old adage, "don't keep all your eggs in one basket" to the advice 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 Tehama 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?

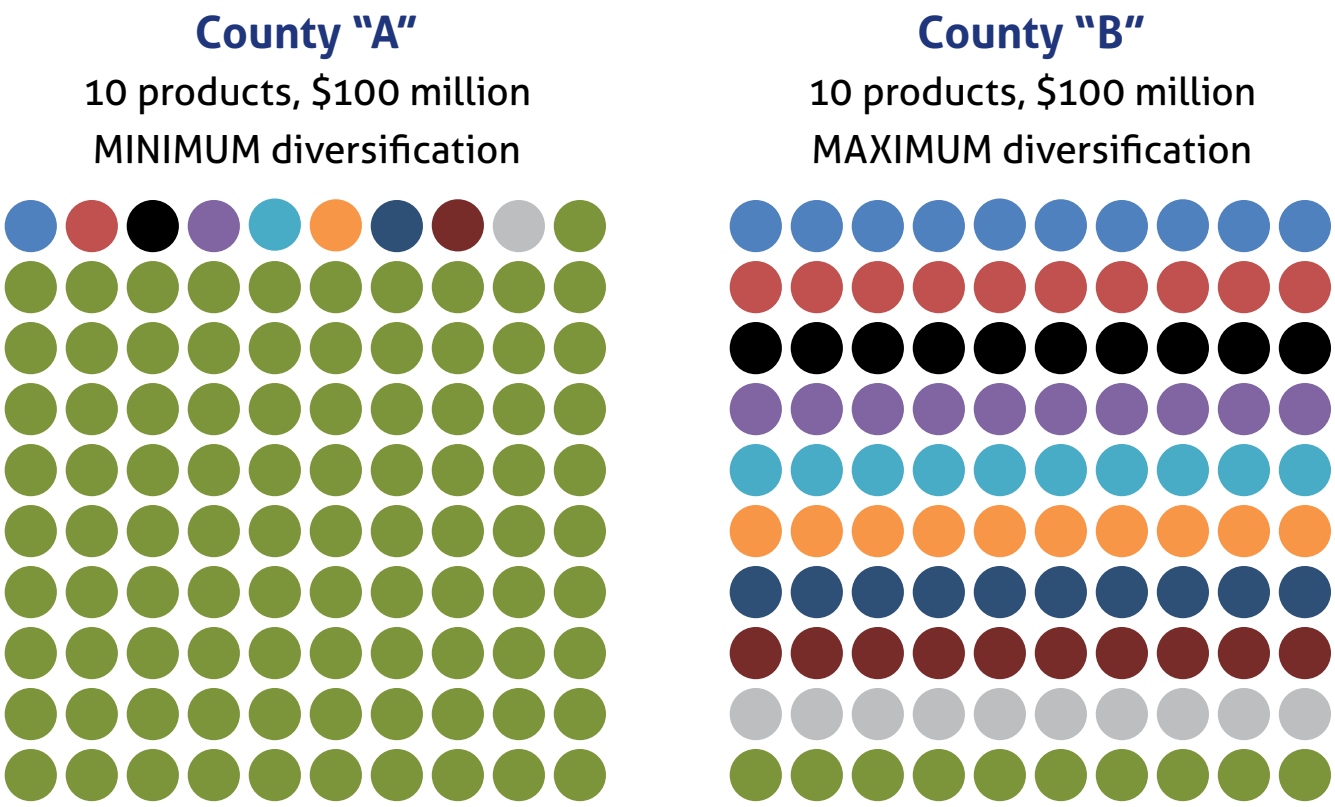
To answer this question, we calculated the Shannon-Weaver Index for Tehama County agriculture. Created in 1949 for military codebreaking, the Shannon-Weaver index is now widely used by economists, ecologists, and others interested in quantifying diversity. Different versions of the basic Shannon-Weaver 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 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 that have production values less than 0.25% of the county total, such as corn, hay, silage, and goats; 3) enter the data into the Shannon-Weaver formula; and 4) convert to a 1.0 scale. For additional details, please contact the authors.

The 2017 Shannon-Weaver Index for Tehama County's agricultural industry was **0.58**. This suggests a medium level of protection from economic shocks, and above average protection compared to other counties. Validating that protection would require stress testing, i.e. modeling specific shocks to see how they affect the industry. For now, suffice it to say that Tehama County agricultural production was not only diverse but was also well distributed across types.

Toward the Future

This report has documented the role that Tehama County agriculture plays as a local economic driver. Including local food processing and multiplier effects, agriculture contributed $679.1 million to the county economy. Agriculture also played an important role in county employment, directly or indirectly supporting 4,410 jobs. Finally, agriculture's solid diversification has provided critical economic stability not just to the agricultural industry, but to the larger county economy. The economic value of this stability is certainly high, albeit hard to quantify.

Agriculture is an important pillar of the Tehama 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. The process of developing this report has raised several additional questions that lie beyond the scope of this report but may warrant future research **(see below)**. In the meantime, the findings herein provide the clearest picture yet of Tehama County agriculture's important economic role.

Additional Questions

- PROCESSING. Most of Tehama County's raw agricultural products leave the county for processing. What new policies, programs, and other initiatives could expand locally sourced, value-added food processing within Tehama County?
- ECOSYSTEM SERVICES. What is the annual dollar value of wildlife habitat, scenic beauty, carbon sequestration, and more than twenty other ecosystem services that Tehama County's agricultural lands provide to society?
- ECONOMIC DIVERSIFICATION. How is agriculture trending over time not just in terms of product diversification but also other measures such as farm size, farm ownership, and geographical markets?
- ECONOMIC SHOCKS. How would potential shocks affect agriculture's economic results, for example significant new regulations, labor policies, water issues, weather events, or changes in the price of key inputs? Modern economic tools make it possible to analyze various scenarios.
- CANNABIS AND HEMP. Commercial cannabis and industrial hemp production continue to gain momentum in California. What economic opportunities and tradeoffs do they pose for Tehama County agriculture?

Acknowledgments

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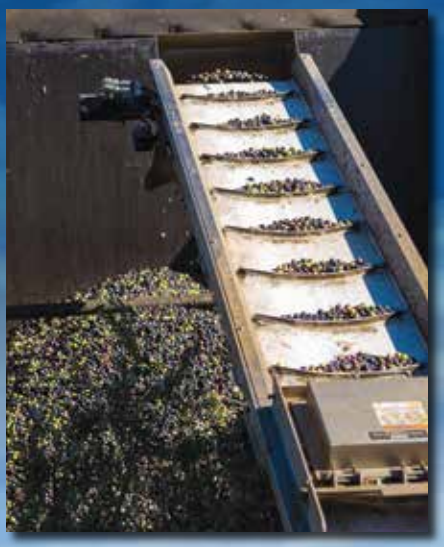

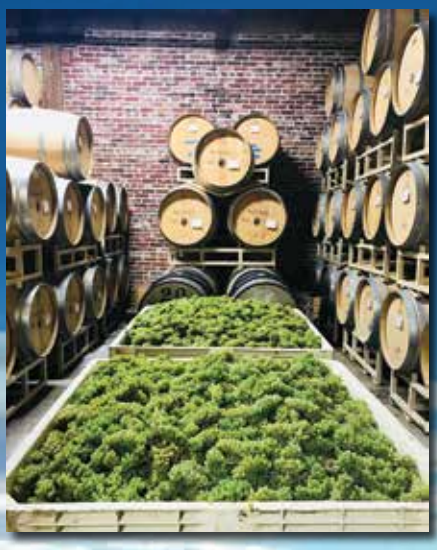

Tehama County Department of Agriculture

https://www.co.tehama.ca.us/dep-agriculture

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Agricultural Impact Associates