CROP REPORT PLUS *Series*

Economic Contributions of Glenn County Agriculture

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Commissioner's Letter

I am pleased to share the **Economic Contributions of Glenn County Agriculture.** This report takes an important step beyond the Annual Crop & Livestock Report our department publishes each year. Instead of stopping at crop production values and acreage, it quantifies agriculture's total economic contributions 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 yearly Annual Crop & Livestock 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 $1.352 billion to the county economy. This far exceeds the $834.6 million figure from our 2017 Annual Crop & Livestock Report. Agriculture also supported 4,182 direct employees, or nearly one out of every three jobs in the county (30.2%). Adding multiplier effects brought total employment to 5,245 jobs. With an economic diversification index of 0.55, agriculture also provided a stabilizing force to the county economy.

Agriculture has a long tradition in Glenn 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,

Marcie Skelton
Agricultural Commissioner/Sealer of Weights & Measures

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Economic Contributions

of the Agricultural Industry

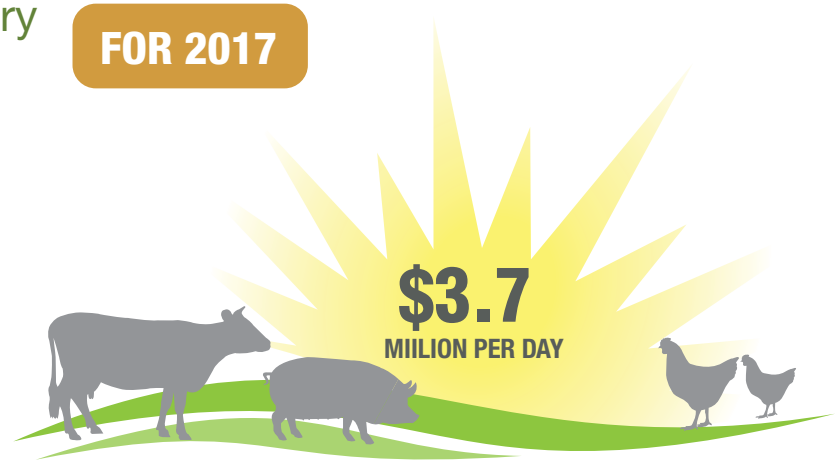
FOR 2017

$1.352 billion

Glenn County Agriculture's total contribution to the local economy

$1.014 billion in direct economic output

$337.7 million in multiplier effects



$3.7 MIILION PER DAY

Employment Effects

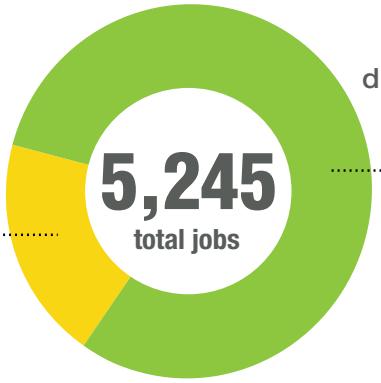
of the Agricultural Industry

ONE in THREE (30.2%)

jobs in Glenn County was attributable to the agricultural industry

1,000+

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



4,182 direct employees

One Dollar *out of* every $2.20

Agriculture accounted for 1 dollar out of every $2.20 of the county's direct economic output

Introduction

Residents and visitors alike know and value the contributions agriculture makes to Glenn County. Almonds, walnuts, rice, and dozens of other crops grow in deep, fertile soils and help feed the world. Cattle and calves dot the hillsides and valleys, bee hives buzz with activity, and breathtaking views of sunflower fields highlight the landscape's patchwork effect.

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 Glenn 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 Glenn 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.

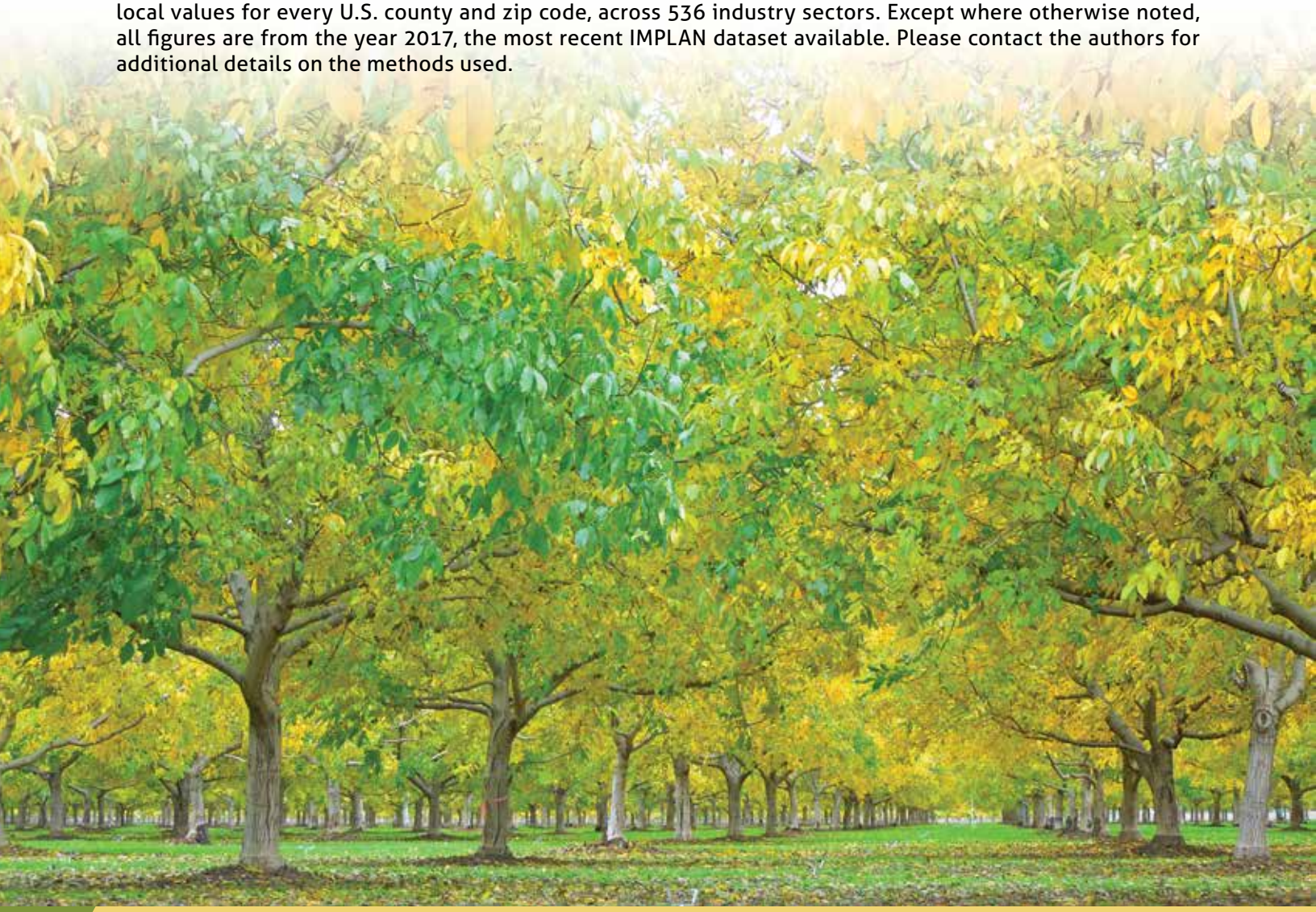
Our Approach

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. M ultiplier 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 6 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 Glenn County. Therefore, this report includes *multiplier effects* when describing agriculture's total economic contributions.

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 & Livestock Report produced by the Glenn County 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. Please contact the authors for additional details on the methods used.



Direct Effects of Glenn 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

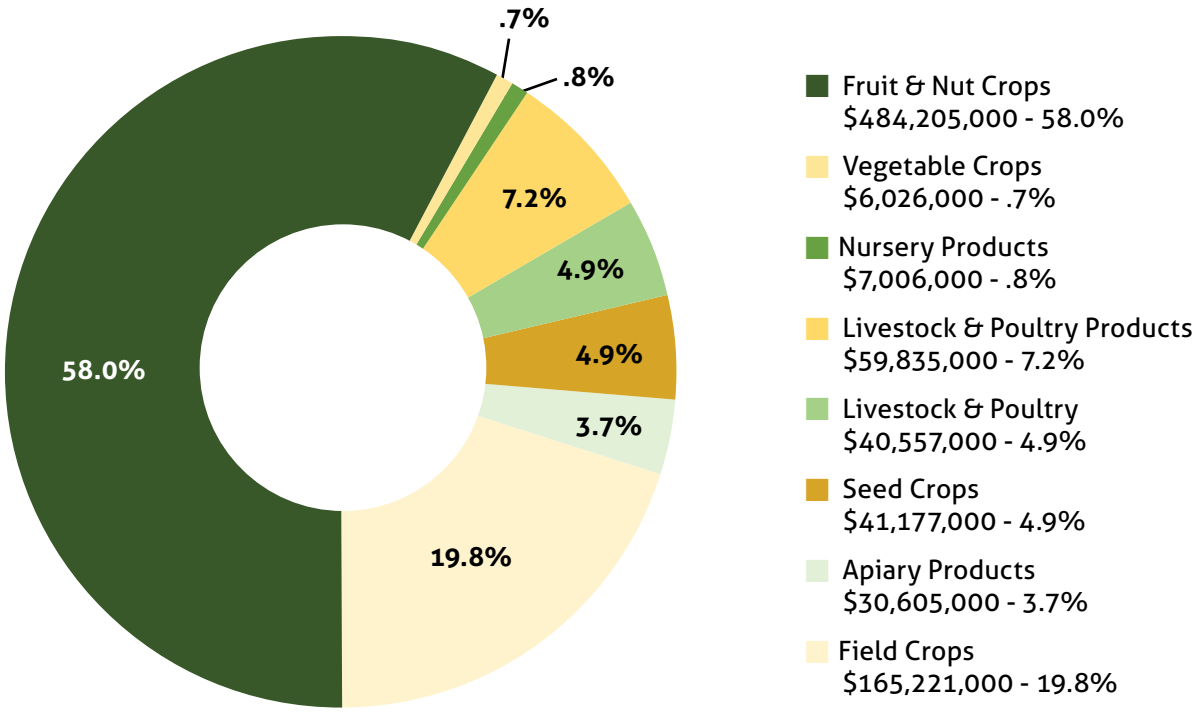
Figure 1 uses data from the 2017 Glenn County Annual Crop & Livestock Report and shows the various categories that make up Glenn County's farm production value. At $484.2 million, Fruit & Nut Crops was the single largest production category by dollar value in 2017, comprising 58.0% of the county total. Two commodities dominated this category: almonds at $217.1 million and walnuts at $184.7 million.

Field Crops, at $165.2 million, represented the second largest category (19.8% of total production), led by rice at $125.5 million. Together, the two super categories of Fruit & Nut Crops and Field Crops accounted for 77.8% of the county's direct farm production value.

The combined, total dollar value for all products rose $276.1 million over the previous decade, from $558.5 million in 2008 to $834.6 million in 2017. Inflation totaled 19.5% during this period, averaging just under 2% per year. Thus, agricultural production grew an impressive 30.0% 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 Glenn County Department of Agriculture's 2017 Annual Crop & Livestock Report for additional details on specific products and their value.

Figure 1. Distribution of Glenn County Farm Production

Source: 2017 Annual Crop & Livestock Report, Glenn County Department of Agriculture



EMPLOYMENT

How many people work in agricultural production? For 2017, agricultural production directly employed 3,843 people in Glenn 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 is discussed on pages 8 and 9.

Multiplier Effects of Glenn 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 consist 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 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.

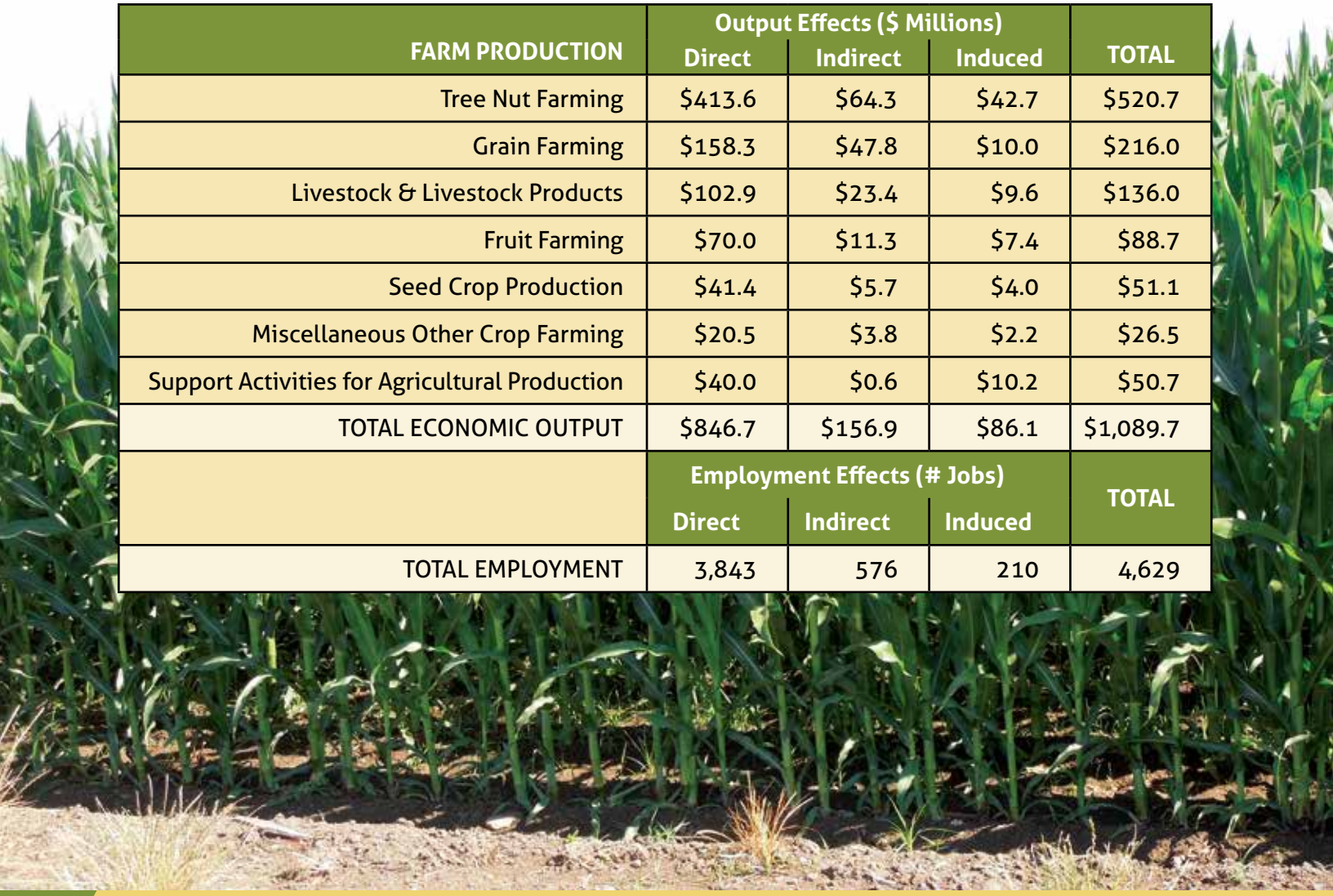
Although agricultural companies and their employees certainly spend money in many locations outside Glenn County, this study only reflects those expenditures that occur within the county. Quantifying expenditures outside the county would be an expensive, complex effort that lies well beyond our scope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

The numbers in **Figure 2** use IMPLAN multipliers for each sector, which are rooted in U.S. Bureau of Economic Analysis data and other sources. Note that category names and production values differ from the county's Annual Crop & Livestock Report. This report follows a standard classification system used nationwide, called the North American Industrial Classification System (NAICS). Each NAICS category has an explicit definition.

Figure 2. Economic Effects of Glenn 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	$413.6	$64.3	$42.7	$520.7
Grain Farming	$158.3	$47.8	$10.0	$216.0
Livestock & Livestock Products	$102.9	$23.4	$9.6	$136.0
Fruit Farming	$70.0	$11.3	$7.4	$88.7
Seed Crop Production	$41.4	$5.7	$4.0	$51.1
Miscellaneous Other Crop Farming	$20.5	$3.8	$2.2	$26.5
Support Activities for Agricultural Production	$40.0	$0.6	$10.2	$50.7
TOTAL ECONOMIC OUTPUT	$846.7	$156.9	$86.1	$1,089.7
	Employment Effects (# Jobs)			TOTAL
	Direct	Indirect	Induced	
TOTAL EMPLOYMENT	3,843	576	210	4,629



For example, NAICS and IMPLAN spread seed production across multiple sectors. These sectors include 'Grain farming' (rice and bean seeds), 'Oilseed farming' (sunflower seeds), and 'Vegetable and melon farming' (e.g., vine seeds). For clarity, we consolidated them into a new **Seed Crop Production** category. Additionally, **Support Activities for Agricultural Production** includes not just the county's $18.1 million in pollination, but also aerial crop dusting, soil preparation, planting, cultivating, harvesting, labor contracting, and other farm management services. Additional lumping and splitting resulted in a tailored category list that bridges NAICS and IMPLAN with Glenn County commodities:

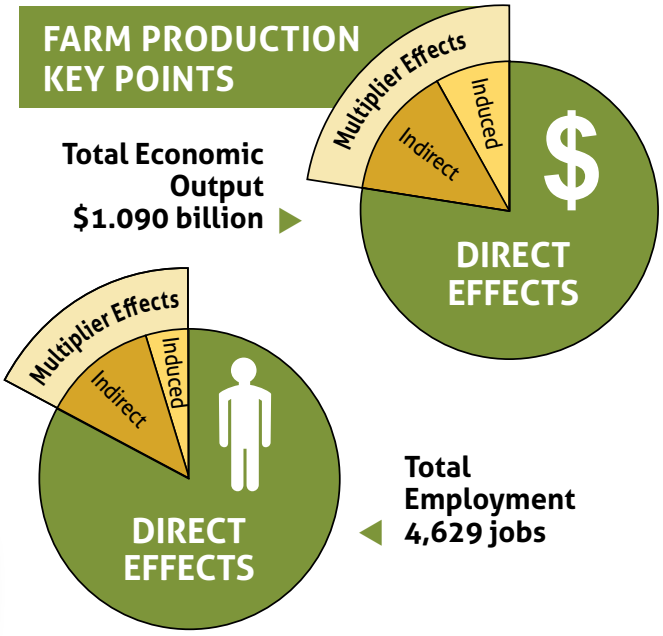
The resulting categories list, as seen below, bridges NAICS and IMPLAN with Glenn County commodities:

- **Tree Nut Farming:** Almond, Almond Hull, Pistachio, Walnut, Pecan;
- **Grain Farming:** Corn (all), Oats, Rice, Wheat (all), Barley, Sorghum;
- **Livestock & Livestock Products:** Beef Cattle, Dairy Cattle, Sheep, Hogs, Goats, Chickens, Game Birds, Milk, Wool, Eggs;
- **Fruit Farming:** Citrus, Grape, Olive (all), Prune, Blueberry, Cherry, Kiwi, Pear, Peach;
- **Seed Crop Production:** Beans, Rice, Sunflowers, Vine (Melon, Pumpkin, Squash, Watermelon, Cucumber), Carrot, Cabbage, Chard, Gourd, Onions, Kale, Mustard, Radish;
- **Miscellaneous Other Crop Farming:** Alfalfa, Beans, Cotton, Hay (all), Nursery Products, Packaged Bees, Queen Bees, Vegetables (not for seed), Safflower, Honey, Beeswax, Pasture & Rangeland;
- **Support Activities for Agricultural Production:** Pollination Services, Aerial Crop Dusting, Soil Preparation, Planting, Cultivating, Harvesting, Farm Labor Contracting, Farm Management Services.

Figure 2 shows agriculture's *direct*, *indirect*, and *induced* economic effects within the county, across major production categories. For example, **Tree Nut Farming** in Glenn County has an *indirect effects* multiplier of 0.1555 and an *induced effects* multiplier of 0.1033. This means that for 2017, each dollar's worth of direct output generated an extra 15 cents in supplier purchases, plus 10 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 figures shown in **Figure 2**.

Also, because IMPLAN uses a different methodology from the county's annual agriculture survey, the $846.7 million direct production value in **Figure 2** differs slightly from the $834.6 million reported in the 2017 Annual Crop & Livestock Report.



Locally Sourced, Value-Added Food Processing

Farm production tells only part of the story. Glenn 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 Glenn County were it not for the abundant supply of nuts, fruit, and other raw agricultural products.

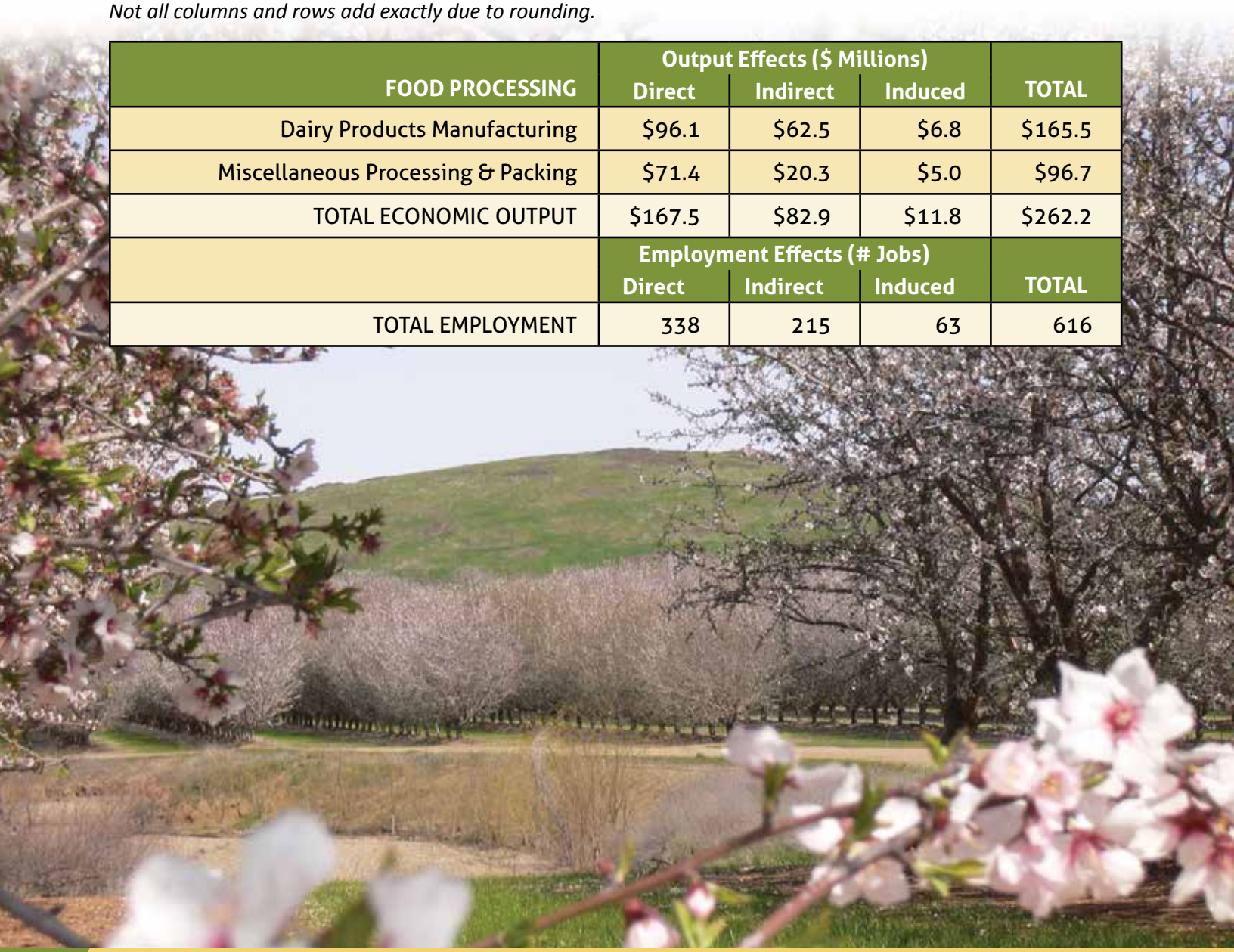
Figure 3 shows the economic effects of locally sourced, value-added food processing.

Dairy Products Manufacturing is by far the largest sector. An estimated 50% of the local milk production is processed within the county. Multiple facilities process milk into butter, yogurt, and cheese, then package it for retail sales. This is primarily cow's milk, although the figure does include output from a goat dairy.

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.

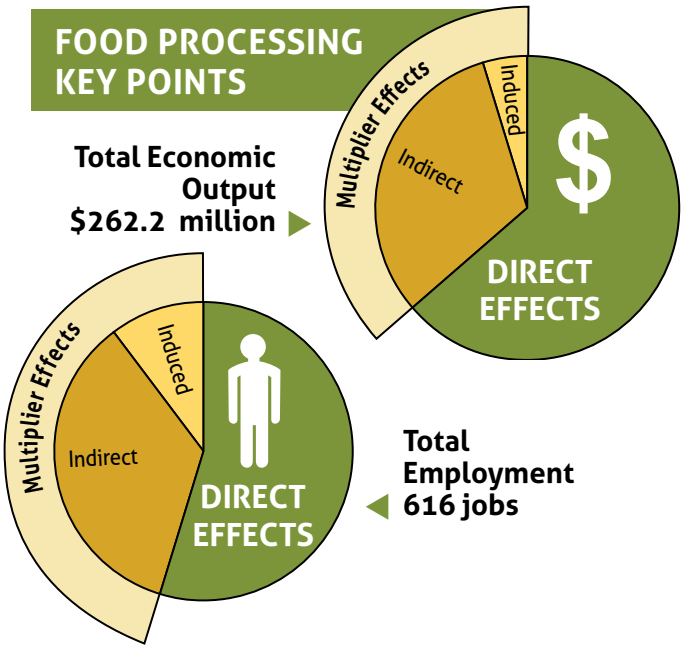
FOOD PROCESSING	Output Effects ($ Millions) Direct	Indirect	Induced	TOTAL
Dairy Products Manufacturing	$96.1	$62.5	$6.8	$165.5
Miscellaneous Processing & Packing	$71.4	$20.3	$5.0	$96.7
TOTAL ECONOMIC OUTPUT	$167.5	$82.9	$11.8	$262.2
	Employment Effects (# Jobs) Direct	Indirect	Induced	TOTAL
TOTAL EMPLOYMENT	338	215	63	616



Miscellaneous Processing & Packing combines multiple activities, including ones from the broad IMPLAN sector mentioned earlier, **Support Activities for Agricultural Production**. Among other things, it reflects the county's significant nut hulling, shelling, and packaging of almonds and walnuts for export to over 50 countries.

The sector also captures grain cleaning, and drying, as well as fruit and nut sorting, grading, cleaning, and packing. Among fruits, the county's entire $5.8 million tomato crop leaves the county for processing. Much of the prune crop goes to three local drying facilities, including one owned by a national brand, before being shipped elsewhere.

Other products in this catch-all category include: 1) drying, cleaning, packaging of sunflower seeds, and vine seeds such as melon, pumpkin, squash, watermelon, and cucumber; 2) processing of olive oil and table olives; 3) meat that is processed at local butcher shops; 4) light processing of local corn, wheat, hay, and other crops into livestock feed; and 5) production from a small winery. In the future, this sector will no doubt incorporate production by a new facility west of Willows that converts rice straw into medium density fiberboard panels.



Total Economic Contributions of Glenn 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 Glenn County agriculture.

As **Figure 4** shows, the total 2017 economic contributions of Glenn County agriculture were $1.352 billion. This consisted of $1.014 billion in combined, direct output from production and processing, plus $337.7 million in multiplier effects.

For perspective, agriculture pumped $3.7 million dollars per day into the county economy during 2017 ($3,703,896 to be exact), or $154,329 per hour. The $1.014 billion in direct output represented 44.5% of the county's total economic output of $2.281 billion. Thus, agriculture accounted for about one dollar out of every $2.20 of the county's direct economic output.

Total employment was 5,245. This included 4,182 jobs directly in agriculture and another 1,064 attributable to multiplier effects. For perspective, the 4,182 direct agricultural jobs represented 30.2% of Glenn County's total employment of 13,862, or about one out of every three jobs.

Figure 4. Overall Economic Effects of Glenn County Agriculture

Not all columns and rows add exactly due to rounding.

Type of Effect	Direct	Indirect	Induced	TOTAL
FARM PRODUCTION				
Output Effects ($ Millions)	$846.7	$156.9	$86.1	$1,089.7
Employment Effects (# Jobs)	3,843	576	210	4,629
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING				
Output Effects ($ Millions)	$167.5	$82.9	$11.8	$262.2
Employment Effects (# Jobs)	338	215	63	616
TOTAL VALUE OF AGRICULTURAL INDUSTRY				
Output Effects ($ Millions)	$1,014.2	$239.8	$97.9	$1,351.9
Employment Effects (# Jobs)	4,182	791	272	5,245

How Resilient is Agriculture to Economic Shocks?

Like growers and ranchers everywhere, Glenn 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, 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's a complex topic, though, with many factors in play and much research yet to be done.

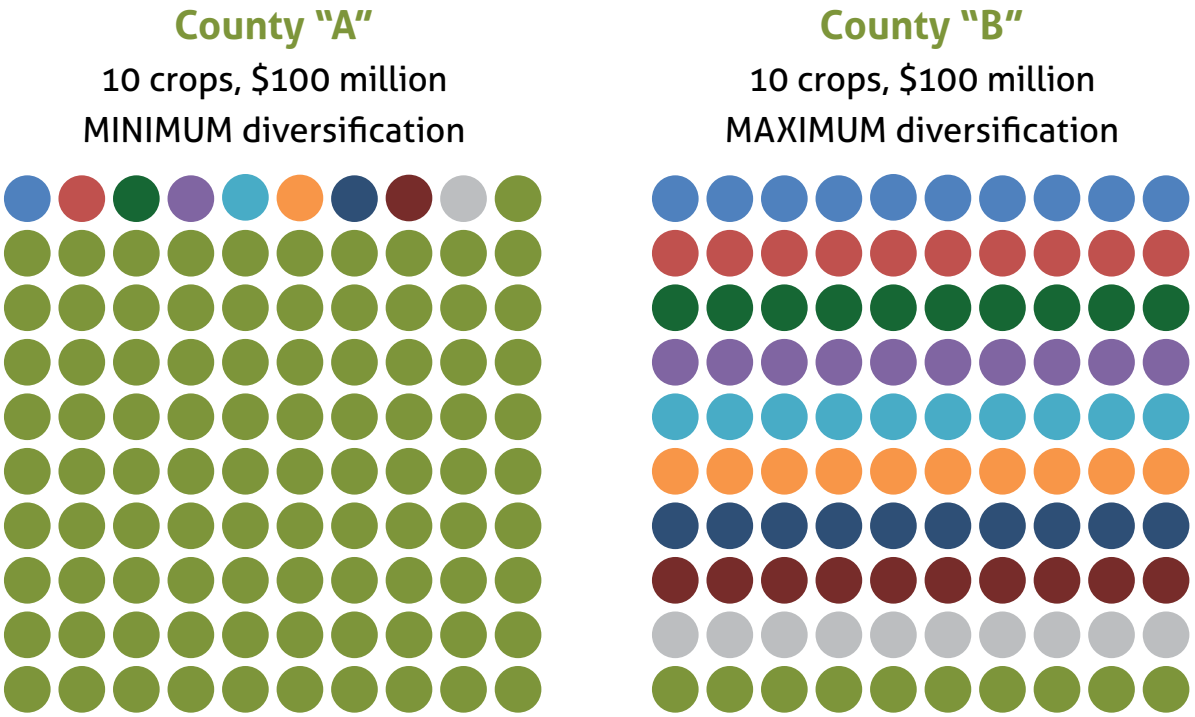
This raises the question: How economically diversified is Glenn County agriculture? Does the county have low agricultural diversity, likely increasing its risk to economic shocks? Or is agriculture highly diversified, implying a stronger economic buffer?

To answer this question, we calculated the Shannon-Weaver Index for Glenn 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



SHANNON-WEAVER INDEX CONTINUED

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 beans, oats, hogs, and sheep; 3) enter the data into the Shannon-Weaver formula; and 4) convert to a 1.0 scale. For specifics, please contact the authors.

The 2017 Shannon-Weaver Index for Glenn County's agricultural industry was 0.55. This implies a medium level of protection from economic shocks. 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 Glenn County agricultural production was not only diverse but was also well distributed across types.

Toward the Future

This report has documented the role that Glenn County agriculture plays as a local economic driver. Including local food processing and multiplier effects, agriculture contributed $1.352 billion to the county economy. Agriculture also played an important role in county employment, directly or indirectly supporting 5,245 jobs. Finally, agriculture's solid diversification has provided critical economic stability to the county. The economic value of this stability is certainly high, albeit hard to quantify.

Agriculture is an important pillar of the Glenn 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 page 13). In the meantime, the findings herein provide the clearest picture yet of Glenn County agriculture's important economic role.

Additional Questions

Processing

The overwhelming majority of Glenn County's raw agricultural products leaves the county for processing. What new policies, programs, and other initiatives could expand locally sourced, value-added food processing within Glenn County?

Farm Equipment Suppliers

Glenn County's multiple farm equipment suppliers generate revenue from well beyond the county. What economic ripples does such spending create within the county?

Ecosystem Services

What is the annual dollar value of wildlife habitat, scenic beauty, carbon sequestration, pollination, and more than twenty other ecosystem services that Glenn County's agricultural lands provide to society?

Economic Diversification

How is agriculture trending over time not just in terms of product diversification but also in 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, or changes in the price of key inputs? Modern economic tools make it possible to analyze various scenarios.

Industrial Hemp

The California Industrial Hemp Farming Act went into effect on January 1, 2017, legalizing commercial production. What economic opportunities and risks does this present for Glenn County growers?

Acknowledgments

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Glenn County Department of Agriculture

www.countyofglenn.net

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Agricultural Impact Associates