



ECONOMIC CONTRIBUTIONS

OF CONTRA COSTA COUNTY AGRICULTURE



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I am pleased to share the information captured by the **Economic Contributions of Contra Costa County Agriculture** report, which takes an important step beyond the traditional Crop Reports we have published over the past several decades. 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 healthy local economy.

Section 2279 of the California Food and Agriculture Code requires all county agricultural commissioners to report the "value" of agriculture. This typically occurs each year via the annual Crop Report. Thanks to twenty-first century economic tools, we can now fulfill this mandate better than ever.

My staff and I hope you enjoy this report. Please do not hesitate to contact us with any feedback or questions.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Chad Godoy".

Chad Godoy

Contra Costa County Agriculture

...contributes a total of \$225.0 million to the local economy, including:

- ◆ \$154.2 million in direct economic output;
- ◆ companies and their employees.

...provides 2,277 jobs in Contra Costa County economy, including:

- ◆ 1,735 direct employees;
- ◆ 542 additional jobs made possible by expenditures by agriculture companies and their employees.

...has exceptional diversity that provides critical economic stability within agriculture and to the broader county economy (Diversity Index of 2.67).



Introduction

Residents and visitors alike know and value the rural character of Contra Costa County. Farmers' markets overflow with fresh produce and community spirit. Sweet corn, tomatoes, grapes, and dozens of other crops grow in fertile soils and a moderate climate. Clearly, agriculture plays a key 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 contribute to the local economy? How many jobs does agriculture support? In other words, just how important is agriculture as a driver of the 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 Contra Costa County economy. The report also examines agricultural diversity and its role in supporting economic resiliency, including a first-ever quantitative measure. On the whole,

the findings offer important information for policy makers, the public, and anyone who values a vibrant 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 effect 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 6 explains this further.

It's 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 is a basic industry in Contra Costa County, so 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. Local sources include annual Crop Reports and industry experts. National data sources come via 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 and for each of more than 500 industry sectors. Except where otherwise noted, all figures are from the year 2013, the most recent IMPLAN® dataset available, inflation-adjusted to 2015. Please contact the authors for additional details on the methods used.

“Direct Effects” of Contra Costa County Farm Production

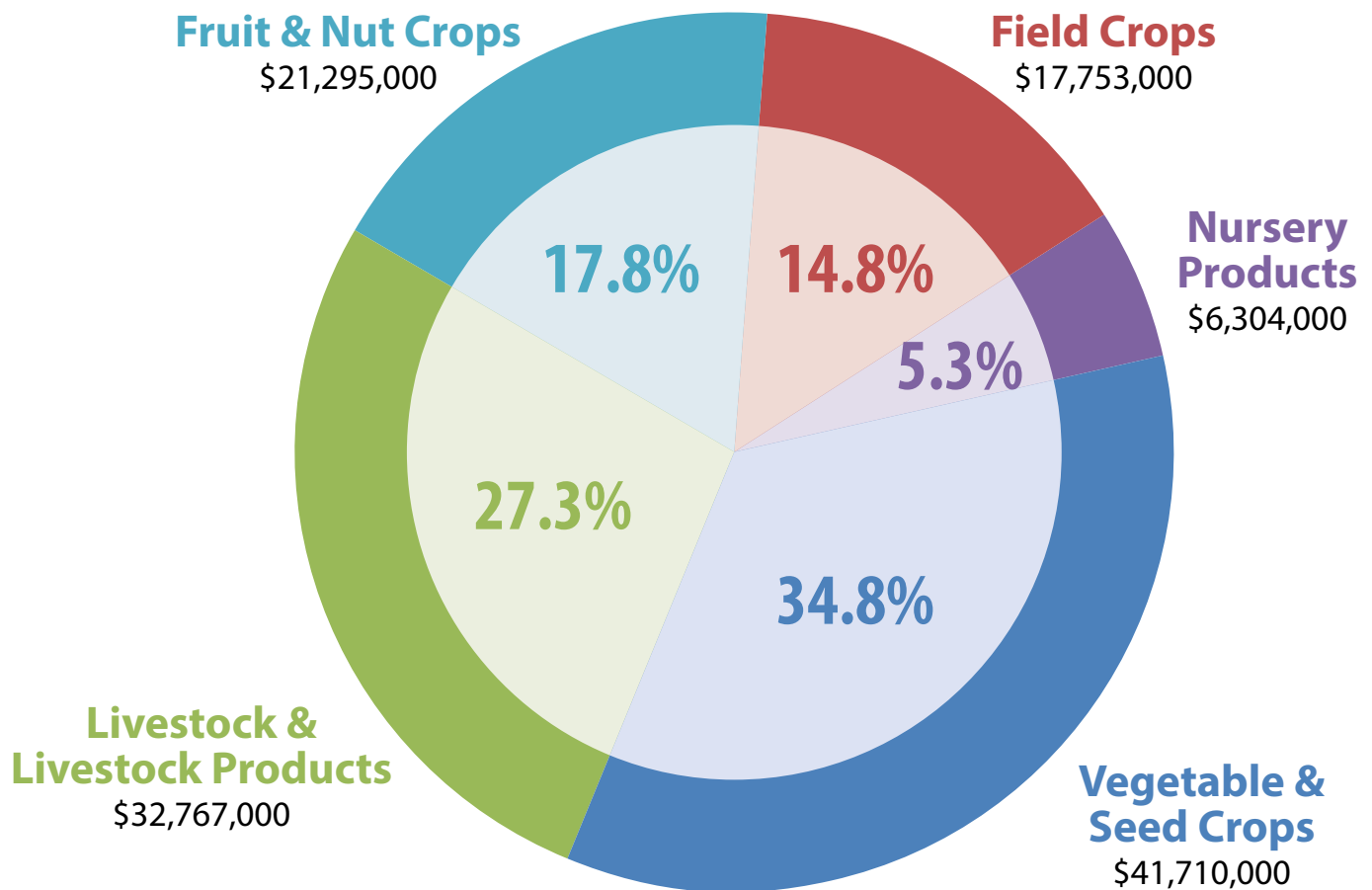
This section focuses on the simplest measures of economic output: production and employment. It describes total farm production and how production has changed over recent years, as well as the number of agricultural jobs.

Figure 1 shows the various categories that make up Contra Costa County farm production value. Vegetable & Seed Crops are the single largest production category by dollar value, comprising 36% of the county total. Sweet corn (\$18.1 million) and tomatoes (\$15.9 million) dominate this

category. Livestock & Livestock Products represent the second largest category (27%), consisting mostly of Cattle & Calves (\$30.5 million). Together, these two categories account for \$74.5 million (62%) of the county’s direct farm production values. Total farm production value for 2014 was \$119.8 million. This gross value does not reflect net profit or loss experienced by individual growers or by the industry as a whole. Interested readers are encouraged to consult the annual Crop Report for additional details.

Figure 1: Distribution of Contra Costa County Agriculture by Production Value

Source: 2014 Contra Costa County Crop Report



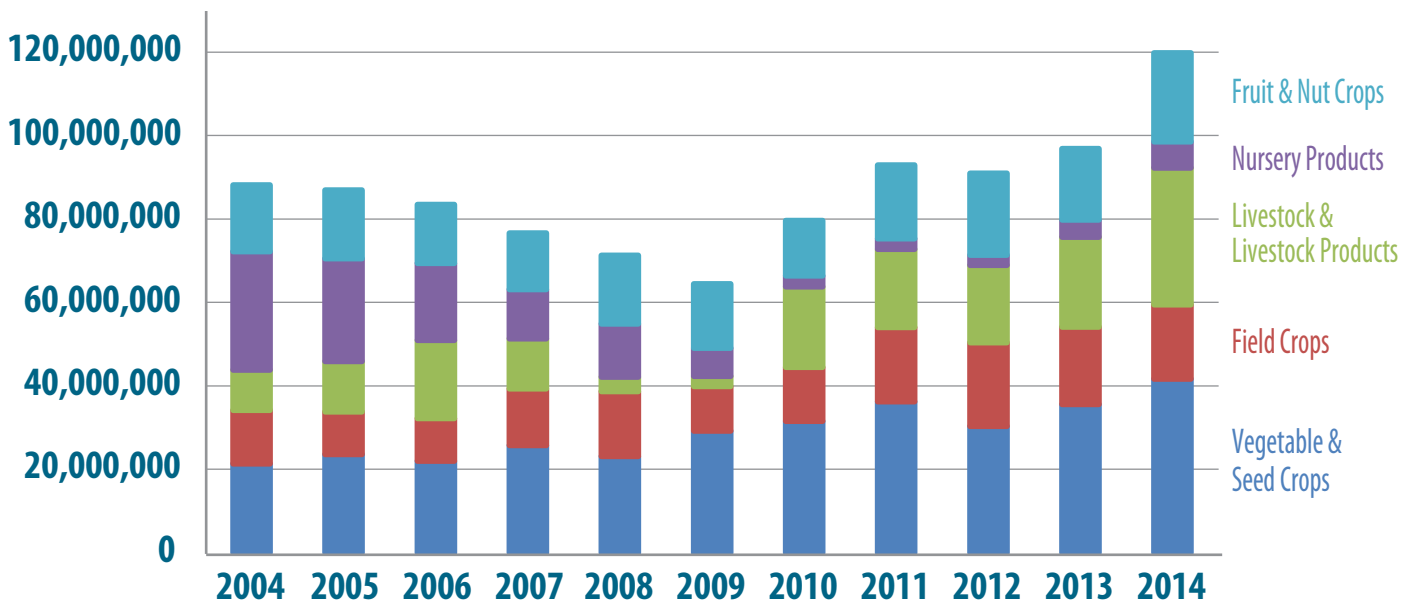
“Direct Effects” of Contra Costa County Farm Production (continued)

How has farm production changed over time? **Figure 2** shows eleven-year production trends for five major categories. The total growth in agricultural production from 2004 to 2014 was 36.0%, from \$88.1 million to \$119.8 million. Such growth is especially impressive given that a major economic recession occurred during this time. Based on the Consumer Price Index, inflation totaled 25.5% over this period, which **Figure 2** does not reflect. Thus, the “real” (inflation adjusted) production increase

was 10.5%, or less than a third of the original figure. Growers made more revenue than ever in 2014, but they also paid 25.5% more for seeds, transplants, fuel, and everything else compared to a eleven years prior. After inflation, four categories rose during this period: Livestock & Livestock Products (+211.8%), Vegetable & Seed Crops (+69.8%), Field Crops (+13.3%), and Fruit & Nut Crops (+8.4%). Nursery Products dropped -103.3%.

Figure 2: Trends in Gross Production Values

Source: Contra Costa County Crop Reports



Employment. How many people work in agricultural production? For 2013, agricultural production directly employed 1,660 people in Contra Costa County. The figure encompasses a wide range of production-related jobs, including not only growing and harvesting, but also sales, marketing and many other roles. It does not include food processing jobs, which we discuss below. Nor does it include employment attributable to other natural resource-based activities, for example 22 jobs in commercial forestry.



“Multiplier Effects” of Contra Costa 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 farm equipment, fertilizer, seed, insurance, banking services, and other inputs, the grower creates *indirect effects*. The second ripple type, *induced effects*, consist of “consumption spending” by agricultural business owners and employees. They pay for housing, healthcare, leisure activities, and other things for their households. All of this spending creates ripples in the economy.

Figure 3 shows agriculture’s direct, indirect, and induced economic effects within the county for major production categories. The numbers use

IMPLAN multipliers for each sector, which are rooted in U.S. Bureau of Economic Analysis production data and other sources. Note that category names and production data in **Figure 3** differ from the County’s annual Crop Reports. 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**” refers to soil preparation, planting, cultivating, harvesting, labor contracting, post-harvest crop activities and various other farm management services. The numbers describe these activities as well as “U-pick” and other types of local, direct economic output that the county’s annual Crop Report is not designed to capture.

Figure 3: Economic Effects of Farm Production

FARM PRODUCTION SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
	OUTPUT EFFECT (\$ MILLIONS)			
Support activities for agriculture	\$27.6	\$1.7	\$10.2	\$39.6
Vegetable and melon farming	\$22.3	\$2.4	\$6.8	\$31.6
Fruit farming	\$18.3	\$2.7	\$6.9	\$27.8
Animal production	\$20.5	\$3.7	\$3.5	\$27.7
Tree nut farming	\$9.0	\$1.1	\$3.2	\$13.3
Greenhouse, nursery, & floriculture production	\$8.9	\$1.0	\$3.0	\$12.9
All other crop farming	\$7.2	\$2.0	\$2.5	\$11.8
Grain farming	\$5.8	\$3.5	\$0.9	\$10.1
TOTAL ECONOMIC OUTPUT:	\$119.7	\$18.1	\$37.0	\$174.8
EMPLOYMENT EFFECT (# JOBS)				
TOTAL EMPLOYMENT:	1,660	182	263	2,105

Dollar values are in \$ millions. Figures are for 2013 and come from IMPLAN®, Crop Reports, and U.S. Bureau of Economic Analysis.

Agricultural production created \$174.8 million in total economic output within Contra Costa County, of which \$55.1 million were multiplier effects. Indirect and induced spending supported an additional 446 jobs within the county, bringing agriculture-related production’s total employment to 2,105.

Locally Sourced, Value-Added Food Processing

Farm production tells only part of the story. Contra Costa County agriculture also includes food processing that contributes to 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. A full assessment would require significant additional research that includes collecting detailed financial information from individual producers.

To avoid overstating the numbers, we only included 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. Using these precise measures, nearly all food processing within the county were excluded. For example, considerable manufacturing of bread, sugar, tortillas, dairy products, and other foods occurs in Contra Costa County. Most of the raw products, however, come from outside the county.

Raw product moves in the opposite direction, too. For example, a significant portion of the county's \$15.9 million tomato crop goes to canneries each year, all of them located outside the county. A similar phenomenon occurs with much of the beans, corn, and other vegetables. Even the \$30.5 million in cattle & calf production goes to external processors, either directly (e.g. Harris Ranch) or via the local auction.

Consultations with local experts highlighted anecdotal examples of small-scale, valued-added

processing. For instance, a few growers process stone fruit, pears and apples into jams, jellies, pies, and pastries. This provides a value-added option for fruit that hasn't met fresh market standards. In recent years, local food processors have invested significantly in on-farm processing infrastructure such as freezers, refrigerators, kitchens, and packing areas for labeling and storage.

Growers pack nearly all of the county's \$18.2 million sweet corn crop into forty-eight count boxes for direct sale to retail outlets. A small amount of corn is also lightly processed. In regards to the county's \$246,000 olive crop, a portion of Contra Costa olives is pressed and bottled in Contra Costa County, and the remainder is processed in nearby facilities in adjacent counties.

"Wineries" offer a significant exception. **Figure 4** shows the economic effects of locally sourced, value-added food processing by wineries. Note that the numbers avoid double-counting by including only the dollar values and employment that wineries add to wine grapes by producing wine. The **Farm Production** section above already captured the value of wine grape production. Wineries produce significant multiplier effects despite the fact that most wine grapes leave the county for processing in Alameda, Napa, Sonoma, and other nearby counties. As with all food processing, documenting precise multiplier effects within the county would require significant further study.

Figure 4: Economic Effects of Locally Sourced, Value-added Food Processing

FOOD PROCESSING SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
Economic Output by Wineries (\$ Millions)	\$34.5	\$7.3	\$8.3	\$50.2
Employment Effect of Wineries (# Jobs)	75	37	59	171

Sources: IMPLAN® and U.S. Bureau of Economic Analysis data, with input by local industry experts.

Local food processing by wineries produced an estimated \$34.5 million in direct output. Multiplier effects bring the total value to \$50.2 million. The sector directly employed 75 workers. These workers and their employers spent enough money in the local economy to support an additional 96 jobs, bringing Contra Costa County's total food processing employment effect to 171.

Total Economic Contribution of Contra Costa 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 effect of Contra Costa County agriculture.

As **Figure 5** shows, the total economic contribution of Contra Costa County agriculture was \$225.0 million. This consisted of \$154.2 million in direct output from production and processing, plus \$70.8 million in multiplier effects. Total employment was 2,277. This included 1,735 jobs directly in agriculture and another 542 attributable to multiplier effects.



Figure 5. Overall Economic Effect of Contra Costa County Agriculture

TYPE OF EFFECT	DIRECT	INDIRECT	INDUCED	TOTAL
FARM PRODUCTION SECTOR				
Output Effect (\$ Millions)	\$119.7	\$18.1	\$37.0	\$174.8
Employment Effect (# Jobs)	1,660	182	263	2,105
LOCALLY SOURCED, VALUE-ADDED FOOD PROCESSING SECTOR				
Output Effect (\$ Millions)	\$34.5	\$7.3	\$8.3	\$50.2
Employment Effect (# Jobs)	75	37	59	171
TOTAL VALUE OF AGRICULTURAL SECTOR				
Output Effect (\$ Millions)	\$154.2	\$25.5	\$45.3	\$225.0
Employment Effect (# Jobs)	1,735	220	322	2,277



The Value of Agricultural Diversity

Economists disagree on many things but there's one thing they all can agree on: a diverse economy is a resilient economy. Any region that depends on a large number of economic sectors reduces risk of catastrophic shocks. This important economic principle applies to agricultural diversity, too. For example, a county with just one or two main crops faces higher vulnerability to shocks in the form of price drops, disease outbreaks, new regulations, emerging competitors, spikes in the cost of key inputs, and other unpleasant surprises. Meanwhile, a county with a diverse agricultural industry can withstand shocks to certain crops without the entire agricultural economy unraveling. Bottom line: having "all your eggs in a single basket" is never a good idea, especially when it comes to something as economically important as agriculture.



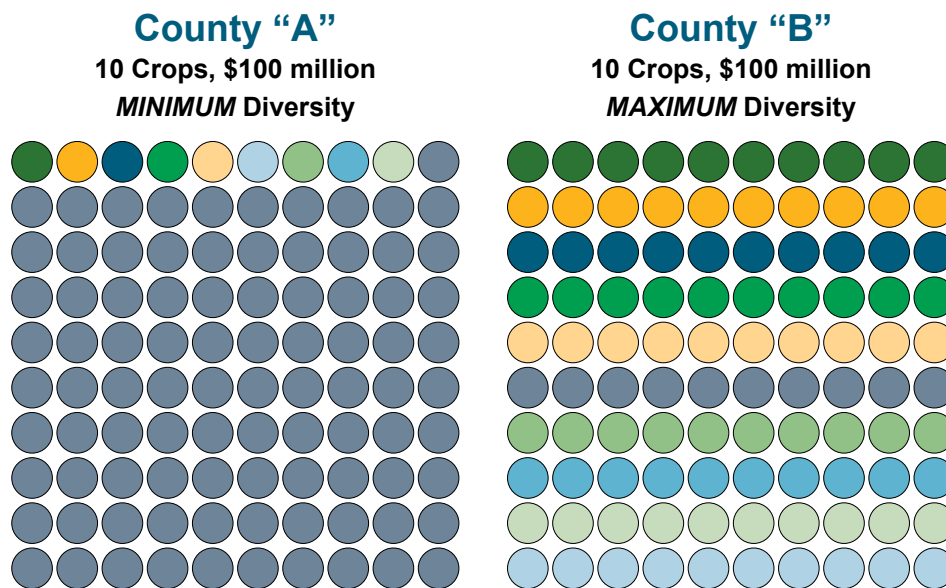
fields. They see farmstands and farmers' markets overflowing with different kinds of food. But no one has attempted to quantify that diversity or its economic value. Part of the reason is that measuring diversity is a complex job. It requires more than just counting the different things for sale at the farmers' market or listed in the annual Crop Report.

Measuring diversity includes the number of different crops grown as well as the assessing their economic *abundance or evenness*.

For example, imagine two California counties where the annual farm production value is \$100 million each. Both counties grow ten different kinds of crops. In County "A," a single crop contributes 91% of the revenue and the nine other crops make up 1% each (see **Figure 6** below). In County "B" the ten crop types all contribute equally, at 10% each. *Both counties have the same number of crops and total revenues, but County "B" has much higher economic diversity.* Thus, we could expect County "B" to be much more resilient to economic shocks than County "A".

Unfortunately, robust measures of Contra Costa County agricultural diversity do not exist, let alone the total economic value of such diversity. People see assorted crops growing in well-tended

Figure 6. Agricultural Economic Diversity is More Than Just the Number of Crops



The Value of Agricultural Diversity (continued)

Because economic diversity is so important, economists have developed sophisticated tools for measuring it. The most popular one is a summary statistic called the Shannon-Weaver Index. The index stems from the Shannon-Weaver entropy function, which was created in 1949 and is widely used in both ecology and economics. Economists and ecologists alike use the formula to calculate the Shannon-Weaver Index, which we share here and can explain further to interested readers:

$$SW_t^k = - \sum_{n=1}^k p_n * \ln (p_n)$$

The lowest possible index score is 0.00. Zero represents an extreme case where all economic output occurs in only one sector. In ecology, this would be a rain forest with only one species. In agriculture, it would be a county with just one commercial crop. The other extreme – an open system where potential diversity is unlimited – would have a much higher score. In other words, the higher the score, the greater the diversity.

To measure agricultural diversity in Contra Costa County, we started by creating a list of specific crops mentioned in Crop Reports. We only used crops for which production values were provided

for the past decade, even though the total number of commercial crops grown is certainly much larger. For example, we tracked beans from their 2014 total (\$4.6 million) all the way back to 2004 (\$1.3 million). Careful lumping and splitting resulted in 33 different crop categories consistently reported over the past decade. Next, we applied the list of crops and production values to the formula above. This resulted in a 2014 Shannon-Weaver Diversity Index score of **2.67**.

By itself, the index score says little. Where it comes in handy is making external and internal comparisons. Internally, the agricultural community can track the score over time to ensure that overall agricultural economic diversity remains high. Maintaining high economic diversity in agriculture will minimize the risk of significant economic shocks. It's an insurance policy against economic earthquakes.

Speaking of earthquakes, note that the equation above includes a logarithmic function ("ln"), similar to the Richter Scale for measuring 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 to Shannon-Weaver Diversity Index scores: a tiny numeric difference represents a big change.



The Value of Agricultural Diversity (continued)

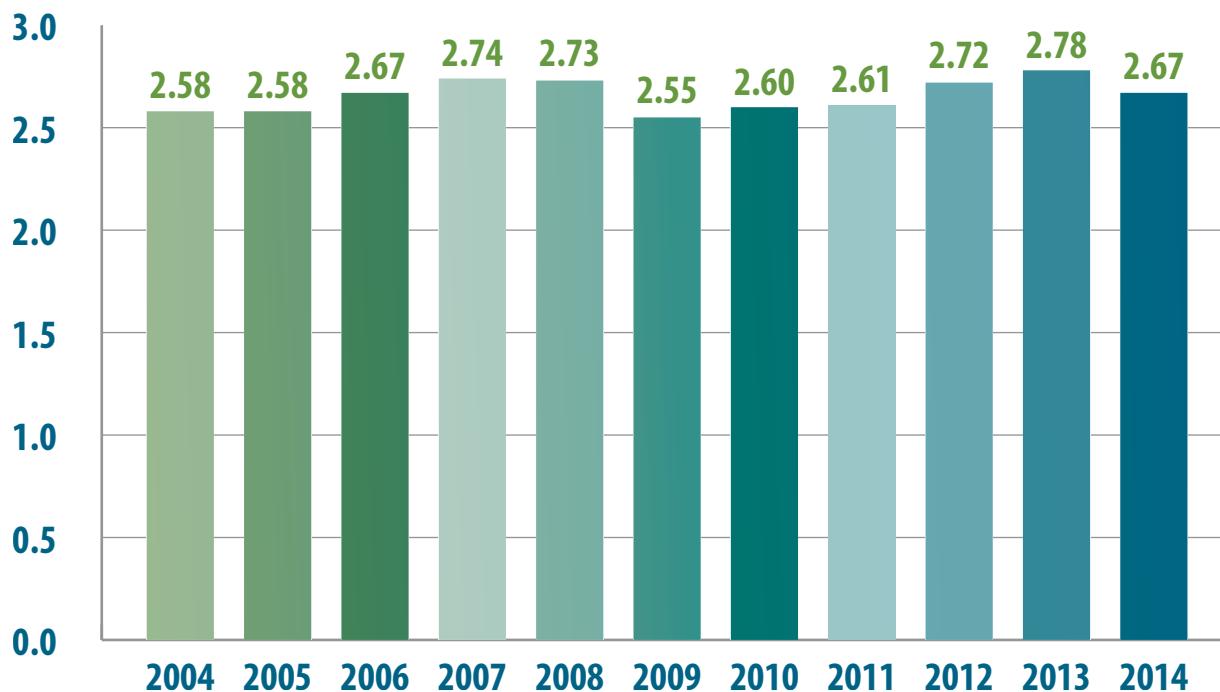
Figure 7 shows how the Shannon-Weaver Diversity Index score has fluctuated over time. The overall eleven-year change has been positive, suggesting increased economic diversity within agriculture. Note that the diversity index hit a low point in 2009 at 2.55 before rebounding to new highs. This does not mean that fewer crop types were being grown in the county in 2009. It means that a small number of crops represented larger pieces of the economic pie that year, for example sweet corn and tomatoes.

Externally, the score can allow useful comparisons to other industries within the county such as real estate, manufacturing, and tourism. It also facilitates comparisons between Contra Costa County agriculture and other counties in California. Examples include the coastal counties of Santa Cruz (2.01), Santa Barbara (2.49), and San Luis Obispo (2.92). Because Contra Costa is an innovator when it comes to measuring agricultural economic

diversity, the number of external comparisons remains limited at this time. Potential comparisons will no doubt grow over time as more counties follow Contra Costa's example. In the meantime, Contra Costa residents can take pride in having one of the most economically diverse agricultural industries anywhere, with numbers to prove it.



Figure 7. How Economically Diverse is Contra Costa County Agriculture?



The **Shannon-Weaver Diversity Index** score combines the number of different crops grown and their relative economic value.

Toward the Future

This report has documented the role that Contra Costa County agriculture plays as a local economic driver. Agriculture contributes \$225.0 million to the county economy. This far exceeds the direct production values reported in Crop Reports, such as the \$119.8 million figure reported for 2014. Agriculture also plays an important role in county employment, directly or indirectly supporting 2,277 jobs. Finally, agriculture's impressive diversity provides 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 Contra Costa 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 (**Box 1**). In the meantime, the findings herein provide the clearest picture yet of Contra Costa County agriculture's important economic role.

Box 1: Additional Questions to Answer

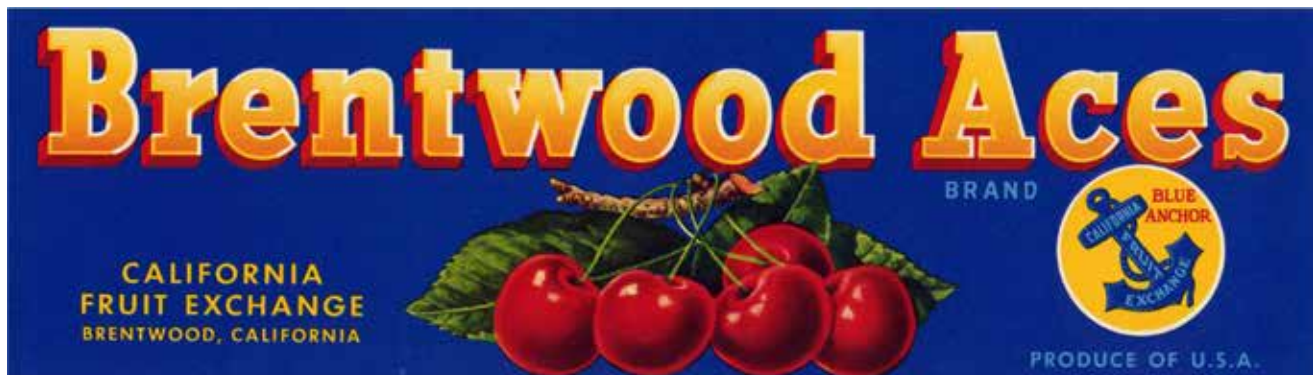
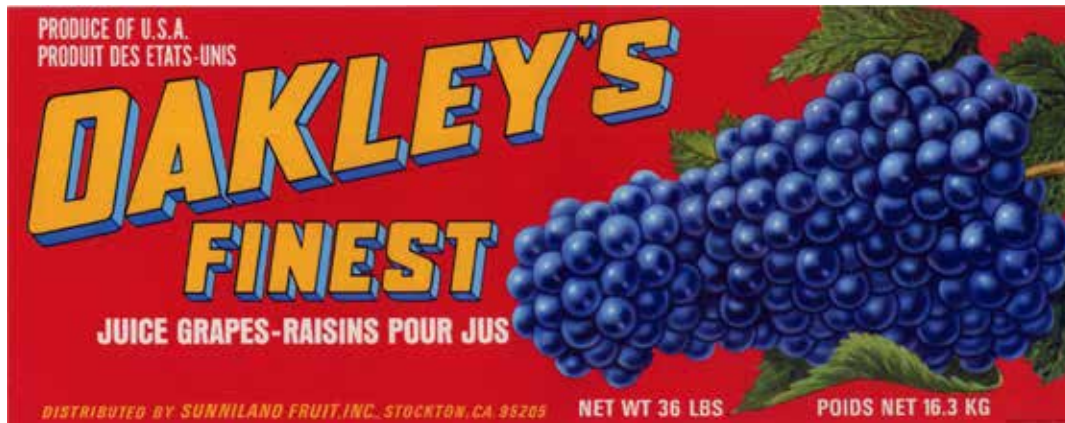
- ◆ What is the annual dollar value of wildlife habitat, open space, scenic beauty, carbon sequestration, pollination, and other ecosystem services that the county's agricultural lands provide to society? Economists now possess robust tools for quantifying the dollar value of these services and have recently done so in three California counties.

- ◆ Contra Costa County is a recognized leader in the burgeoning "urban agriculture" movement. What is the economic value of more than 40 community gardens, 30 Certified Farmers' Markets, and 60 school gardens?
- ◆ Agricultural diversity includes other elements beyond those covered in this report. For example, what trends exist with respect to diversity of production type (organic or conventional) and farm size (small, medium, large)? Organic production continues to grow in Contra Costa County, hitting new highs in 2014 of 17 farms and 1,449 acres. What implications might this growing diversity have for future economic stability and growth?
- ◆ Contra Costa County could create significant economic value through locally sourced, value-added food processing. Which new policies, programs, and other initiatives, if implemented, could create the biggest breakthroughs in this potential growth area?
- ◆ How would "shocks" affect agriculture's economic results, for example significant new regulations, labor policies, farm land annexations, water challenges, or changes in the price of key inputs?
- ◆ To what extent does Contra Costa County agriculture contribute to economic prosperity and food security of the Greater Bay Area as part of its "foodshed"?



Acknowledgments

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Past labels used to market produce grown in Contra Costa County.



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