



## The Contribution of Agriculture to Hawai'i's Economy: 2013

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### I. Overview

Many people are still asking about the size and importance of agriculture in Hawai'i. Supporters and detractors alike may take comfort from the fact that estimates of agriculture's contribution to Hawai'i's economy may diverge, contingent on the definition of "agriculture" and the methodology applied in the estimation process. This follow-up article to three prior CTAHR publications, EI-2 (2000), EI-3 (2002), and EI-13 (2008), provides an update to the metrics established previously. Agriculture as defined here adopts the latest industry classification based on the 2012 North American Industry Classification System (NAICS). It includes crop and animal production (farms); forestry, fishing, and support activities; and food product manufacturing<sup>1</sup> (Table 1).

As was established in the earlier publications, the most inclusive measure of an industry's contribution to the economy is "value-added," or the industry's gross domestic product (GDP). A real GDP measure is included in this update to account for the price effects of inflation. GDP is a more robust measure as compared to market receipts (sales), or farm-gate value of production, which is traditionally used in agricul-

ture. While farm-gate value is easier to measure and is more readily available from state statistics, it does have its shortcomings, and these are more evident now since the gathering and reporting of production estimates has been greatly reduced in the past few years. Foremost, it is biased upwards by "double counting." To illustrate this case, consider local papaya growers who must buy seeds from certified suppliers. Existing seed sales by the seed suppliers and eventual fruit sales by the papaya growers are recorded independently as farm-gate values. The value contribution of the seeds is therefore expressed in both products (seeds and papayas) and thus counted twice.

Employment (full- and part-time) provides another benchmark measure of an industry's contribution to the economy. This measurement is complemented by the labor income measure or earnings received by participants involved in production of an industry. The final measure is industry cash receipts (sales) that is customary utilized in assessing economic activities. Despite its "double-counting" character flaw, cash receipts measure the extent of business transactions, and constitute the levy baseline for consumption (use) and general excise taxes.

We start this article by updating, summarizing, and comparing the four measures described above – value added (GDP), employment, labor earnings, and cash receipts (sales) to assess the contribution of agriculture to Hawai'i's economy for three equally spaced years, 1997, 2005, and 2013.

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<sup>1</sup>This classification is similar to that used in publication EI-13 but differs significantly from the earlier publication EI-3 due to the changeover from the previous Standard Industrial Classification (SIC) system to NAICS.

**Table 1. Sectors representing Hawai'i's agriculture**

Sector	2012 North American Industry Classification System (NAICS)
<b><i>Crop and animal production (farms)</i></b>	<b>111 and 112</b>
Seed	111150
Vegetables and melons	1112
Fruits and tree nuts	1113
Floriculture and nursery products	11142
Other crops	Other 111
Cattle and calves	1121
Dairy products	11212
Other livestock and products	Other 112
<b><i>Forestry, fishing, and support activities</i></b>	<b>113, 114, 115</b>
Fisheries and forestry	
Forestry and logging	113
Commercial fishing	114
Support activities for agriculture and forestry	115
<b><i>Food product manufacturing</i></b>	<b>311 and 312</b>
Food manufacturing	311
Beverage (and tobacco) manufacturing	312

Source: U.S. Census Bureau, U.S. Department of Commerce, 2012 NAICS Definition

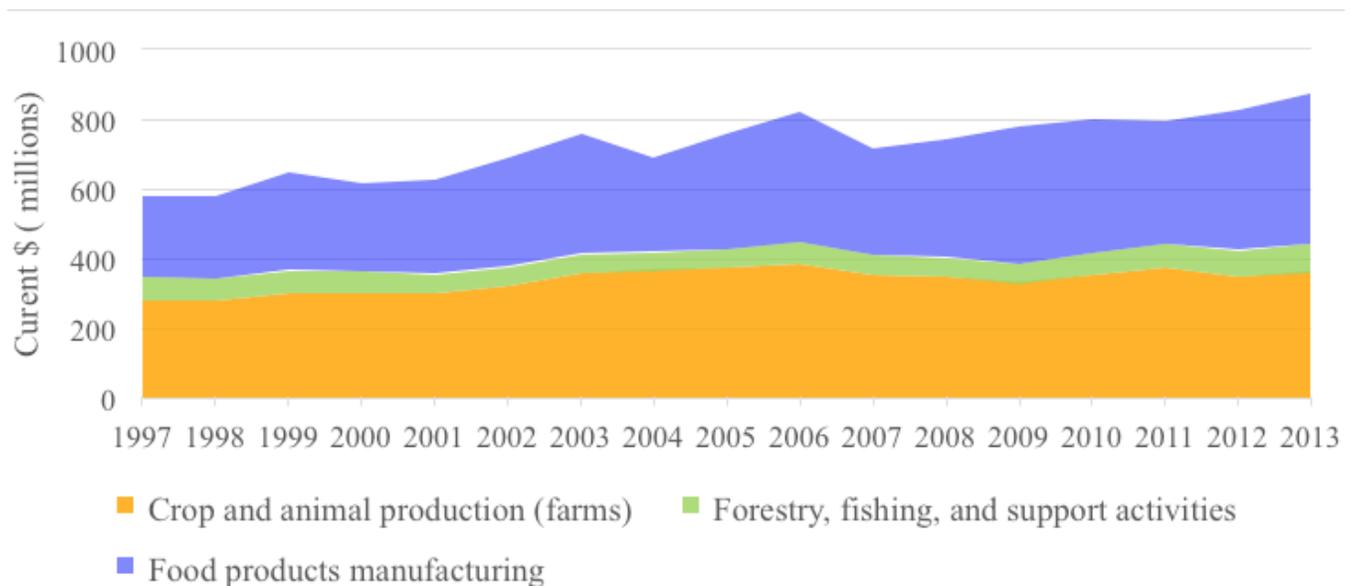
## II. Agriculture's contribution to gross domestic product (GDP)

The value-added<sup>2</sup> measure in an industry is generally recognized as the most precise indicator of that industry's contribution to overall economic activity as measured by GDP because it measures the value of final output less the value of intermediate inputs. Across the 50 states, the U.S. Bureau of Economic Analysis (BEA) provides annual estimates of the contributions of various industry sectors to GDP. Its dataset provides about 90 industry codes that are fully NAICS compliant. In reference to agriculture, BEA furnishes the GDP of three industries – crop and animal production (farms); forestry, fishing, and support activities; and food product manufacturing.

<sup>2</sup>A pertinent description of "value-added" and its avoidance of double-counting is provided in publication EI-13.

### *Nominal GDP*

Nominal (current-dollar) GDP measures the market value of all final goods and services produced by industry sectors within an economy in a given time period, usually a year. Figure 1 shows the annual trend of the value-added (nominal GDP) of Hawai'i agriculture, spanning 16 years between 1997 and 2013. There is a steady increase from \$579 million to \$872 million over the defined time period (Table 2). This translates into an annual growth of 2.6%. In comparison, Hawai'i economy, as reflected by total nominal GDP, increased by a faster annual rate of 4.3%. Reflecting the faster acceleration in growth of the state's overall economy, agriculture's contribution as a share of nominal GDP declined from 1.5% in 1997 to 1.2% in 2013.

**Figure 1. Hawai'i's Agriculture GDP, 1997-2013****Real GDP**

Most economists do not view nominal GDP as the best measure of economic well-being. The reason is that nominal GDP at its core foundation has two component sets, prices and quantities. Hence, nominal GDP can increase because prices rise, quantities rise, or both prices and quantities rise. If all prices doubled without any increase in quantities, nominal GDP would double. In this case, no output performance is realized in the economy, only price inflation. A better approach to economic well-being is to measure the economy's output of goods and services without the influence of changing prices. Real GDP achieves this objective as it measures the value of goods and services using a constant set of prices.

The BEA currently provides an inflation-adjusted data series expressed in chain-weighted measures of real GDP. With these new measures, the base year changes continuously over time. Various year-to-year growth rates are then put together to form a "chain" that can be used to compare the output of goods and services between any two dates. Table 3 shows the trend of the contribution of agriculture to Hawai'i's real GDP between 1997 and 2013. Hawai'i's overall economy as measured by total real GDP increased at an annual rate of 2.3% from 1997 to 2005 but then decelerated to 0.9%

from 2005 to 2013. In contrast, agriculture's real GDP grew at a faster 3.0% per annum from 1997 to 2005 and then flip-flopped, decreasing at an annual rate of 2.0% thereafter. The decline was fueled by an annual 6.2% decrease in farm production while food product manufacturing increased marginally. For the entire period spanning 1997 to 2013, agriculture grew at an average rate of 0.5% annually while the total economy grew much faster at 1.6% per annum. Agriculture's share of contribution to total Hawai'i real GDP fell from 1.2% in 1997 to 1.0% in 2013.

While Hawai'i's measures may not reflect the more robust national trend, they do mirror conditions in some regional economies, such as the Southwest and New England. According to the same BEA dataset, agriculture's real GDP declined at an annual average rate of 1.6% in the Southwest and by 1.0% in New England states between 2005 and 2013. The real GDP annual growth for the regions' economies was 2.8% and 0.7% respectively. At the state level, agriculture's real GDP in Texas decreased at an annual average of 1.8% while its total real GDP grew much faster at an annual rate of 3.5% between 2005 and 2013. Agriculture's share of contribution to total Texas real GDP fell from 2.0% in 1997 to 1.3% in 2013. Texas and Hawai'i appear to share the same trends.

**Table 2. Agriculture's contribution to Hawai'i's gross domestic product (GDP): 1997, 2005, and 2013**

	1997	2005	2013
<b>GDP (millions of current \$)</b>			
Crop and animal production (farms)	282	375	362
Forestry, fishing, and support activities	66	52	81
Food product manufacturing	231	328	429
Total agriculture	579	755	872
Total Hawai'i GDP	37,915	58,123	74,156
<b>Percent of total agriculture</b>			
Crop and animal production (farms)	48.7%	49.7%	41.5%
Forestry, fishing, and support activities	11.4%	6.9%	9.3%
Food product manufacturing	39.9%	43.4%	49.2%
<b>Percent of total Hawai'i GDP</b>			
Total agriculture	1.5%	1.3%	1.2%
<b>Average annual growth rate (%)</b>			
	<b>1997–2005</b>	<b>2005–2013</b>	<b>1997–2013</b>
Crop and animal production (farms)	3.6%	-0.4%	1.6%
Forestry, fishing, and support activities	-2.9%	5.7%	1.3%
Food product manufacturing	4.5%	3.4%	3.9%
Total agriculture	3.4%	1.8%	2.6%
Total Hawai'i GDP	5.5%	3.1%	4.3%

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

### III. Agriculture's contribution to employment

Table 4 shows that employment (measured as the number of full- and part-time jobs) for the agricultural economy: farm production; forestry, fishing, and support activities; and food product manufacturing have exhibited a “see-saw” trend. Total employment in Hawai'i increased at an annual rate of 1.1% from 740,028 jobs in 1997 to 877,229 jobs in 2013. However, total employment in agriculture decreased at an annual rate of 0.7% from 25,809 jobs in 1997 to 23,093 jobs in 2013. The decrease can be attributed primarily to decreases in the forestry, fishing, and support activities sector, and to a lesser extent the food product manufacturing sector. If there is any sign

of improvements, employment in the period 2005 to 2013 shows increasing trends (+0.7%) as compared to declining trends in the earlier period, 1997 to 2005 (-2.1%).

In 1997, agriculture contributed 3.5% of total employment in the state, but it declined to 2.6% in 2005 and remained constant at 2.6% in 2013. This measure is encouraging, taking into account the closure of three plantation operations during this time period, Del Monte Fresh Produce on O'ahu (2006), Maui Pineapple Co. on Maui (2009), and Gay & Robinson Inc. on Kaua'i (2009). Although its share of employment has declined somewhat, agriculture remains a major and continual contributor to Hawai'i's employment.

**Table 3. Agriculture's contribution to Hawai'i's real gross domestic product (GDP): 1997, 2005, and 2013**

	1997	2005	2013
<b>GDP (millions of chained 2009 \$)</b>			
Crop and animal production (farms)	228	365	219
Forestry, fishing, and support activities	65	57	70
Food product manufacturing	348	387	402
Total agriculture	641	809	691
Total Hawai'i GDP	53,493	64,348	69,163
<b>Percent of total agriculture</b>			
Crop and animal production (farms)	35.6%	45.1%	31.7%
Forestry, fishing, and support activities	10.1%	7.0%	10.1%
Food product manufacturing	54.3%	47.8%	58.2%
<b>Percent of total Hawai'i GDP</b>			
Total agriculture	1.2%	1.3%	1.0%
<b>Average annual growth rate (%)</b>			
	<b>1997–2005</b>	<b>2005–2013</b>	<b>1997–2013</b>
Crop and animal production (farms)	6.1%	-6.2%	-0.3%
Forestry, fishing, and support activities	-1.6%	2.6%	0.5%
Food product manufacturing	1.3%	0.5%	0.9%
Total agriculture	3.0%	-2.0%	0.5%
Total Hawai'i GDP	2.3%	0.9%	1.6%

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

#### IV. Agriculture's contribution to labor income

The trends of labor income for Hawai'i's agricultural economy: farm production; forestry, fishing, and support activities; and food product manufacturing follow closely the corresponding employment trends. Table 5 shows that the share of agriculture labor income to total labor income declined from 2.0% in 1997 to 1.6% in 2005, and remained steady at 1.6% in 2013. More interestingly, agriculture labor income increased at a slightly faster rate of 3.3% annually in the period 2005 to 2013, as compared to 3.1% for total labor income in Hawai'i. Overall, the share of labor income for agriculture remains lower than its employment share, reflecting the correspondingly lower income of agricultural jobs in the state.

#### V. Sales of agriculture products

As shown in Table 6, farm production sales value increased modestly at an annual growth rate of 1.8% for the period 1997–2013. Production values of fruits and nuts and dairy products declined during the same period at an annual rate of 3.4% and 6.5%, respectively. These declines in production value are largely offset by the remarkable growth of seed crops, which increased at an annual rate of 14.8% during the 1997–2013 period. Sales value of cattle and calves recorded an annual growth rate of 8.2% during the same period. The sales value of fishery and forestry products doubled from \$61 million in 1997 to \$122 million in 2013, representing more rapid growth of 4.4% per annum during the same period. Within the food product-manufacturing sector, food processing

**Table 4. Agriculture's contribution to Hawai'i's employment (measured as the number of full- and part-time jobs), 1997, 2005, and 2013**

	1997	2005	2013
<b>Employment (number of total jobs)</b>			
Crop and animal production (farms)	11,848	11,395	11,869
Forestry, fishing, and support activities	6,030	3,619	4,193
Food product manufacturing	7,931	6,807	7,031
Total agriculture employment	25,809	21,821	23,093
Total Hawai'i employment	740,028	826,725	877,229
<b>Percent of total agriculture employment</b>			
Crop and animal production (farms)	45.9%	52.2%	51.4%
Forestry, fishing, and support activities	23.4%	16.6%	18.2%
Food product manufacturing	30.7%	31.2%	30.4%
<b>Percent of total Hawai'i employment</b>			
Total agriculture employment	3.5%	2.6%	2.6%
<b>Average annual growth rate (%)</b>			
	<b>1997–2005</b>	<b>2005–2013</b>	<b>1997–2013</b>
Crop and animal production (farms)	-0.5%	0.5%	0.0%
Forestry, fishing, and support activities	-6.2%	1.9%	-2.2%
Food product manufacturing	-1.9%	0.4%	-0.7%
Total agriculture employment	-2.1%	0.7%	-0.7%
Total Hawai'i employment	1.4%	0.7%	1.1%

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

increased slightly at an annual rate of 1.2%, but beverage manufacturing jumped to an annual growth rate of 3.9% during the 1997–2013 period. Overall, food product manufacturing registered a health gain of 1.7% annually.

Total agriculture sales (including farm production, forestry, fishing and support activities, and food product manufacturing) increased from \$1,653 million in 1997 to \$1,901 million in 2005 and increased further to \$2,196 million in 2013. The share of agriculture sales as compared to the total Hawai'i sales slipped from 2.8% in 1997 to 2.1% in 2005. The same measure is not available for 2013 since the 2012 Economic Census no longer reports estimates of total sales for individual states.

## VI. Summary

This article updates the contribution of agriculture to Hawai'i's economy as measured in terms of GDP, employment, labor income, and sales. Overall, the chosen metrics show a slightly declining trend as the state's diversifying economy outpaces the growth of agriculture in recent years. In 2013, agriculture contributed to 1.2% of nominal GDP, 1.0% of real GDP (inflation adjusted), 2.6% of employment, and 1.6% of labor income. These results does not necessary reflect a weakness in the agriculture industry. On the contrary, the information in Figure 1, Table 2, and Table 3 show the continuing progress made in Hawai'i's agricultural

**Table 5. Agriculture's contribution to Hawai'i's labor income, 1997, 2005, and 2013**

	1997	2005	2013
<b>Labor income (millions of current \$)</b>			
Crop and animal production (farms)	169	197	280
Forestry, fishing, and support activities	34	33	52
Food product manufacturing	228	271	320
Total agriculture labor income	431	501	652
Total Hawai'i labor income	21,077	32,104	40,974
<b>Percent of total agriculture labor income</b>			
Crop and animal production (farms)	39.2%	39.3%	42.9%
Forestry, fishing, and support activities	7.9%	6.6%	8.0%
Food product manufacturing	52.9%	54.1%	49.1%
<b>Percent of total Hawai'i labor income</b>			
Total agriculture labor income	2.0%	1.6%	1.6%
<b>Average annual growth rate (%)</b>			
	<b>1997–2005</b>	<b>2005–2013</b>	<b>1997–2013</b>
Crop and animal production (farms)	1.9%	4.5%	3.2%
Forestry, fishing, and support activities	-0.4%	5.8%	2.7%
Food product manufacturing	2.2%	2.1%	2.1%
Total agriculture labor income	1.9%	3.3%	2.6%
Total Hawai'i labor income	5.4%	3.1%	4.2%

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

economy over time. It is also evident that the food product manufacturing sector is expanding as a proportion of total agriculture in recent years, as measured in real GDP; rising from 47.8% in 2005 to 58.2% in 2013 (Table 3).

In addressing the often-quoted “industry contribution to total economy,” there is no rule of thumb for optimum contribution ratio for agriculture; considering the eclectic nature of resource inputs (land, water, labor) and distinct economies in each of the 50 states. In general, more advanced economies have a lower ratio while developing, agrarian economies have a higher ratio. By comparing the contribution of agriculture to real GDP in 2013, we find the US national measure was more than double that of Hawaii at 2.4%. Among states

in the union, plain states recorded some of the highest ratios - Nebraska, 9.9%; Iowa, 9.7%; and South Dakota, 9.5%. At the lower ratio spectrum were states like New York, 0.94%; New Jersey, 0.83%; Rhode Island, 0.68%; and Nevada, 0.62%. Generally, less economically diversified, more agro-based states have a higher ratio, while more economically diversified, services-focused states have a lower ratio.

Agricultural employment and labor income exhibited measured resiliency in recent years (2005–2013) in maintaining a steady proportion to the total economy; despite watershed losses relating to the closure of three iconic plantations. A rapid expansion in seed crops production, complemented by resurgence gains in cattle and

**Table 6. Sales of agriculture and related sectors, 1997, 2005, and 2013**

	1997	2005	2013
<b>Sales (million \$)<sup>1</sup></b>			
<b><i>Crops and animal production (farms)</i></b>			
Seeds	20	63	184
Vegetables and melons <sup>2</sup>	34	54	43
Fruits and nuts	193	107	110
Floriculture and nursery products <sup>2</sup>	67	101	72
Other crops	106	185	170
Cattle and calves	14	23	51
Dairy products	29	18	10
Other livestock and products	41	33	18
Subtotal crops and animal production	505	584	659
<b><i>Forestry, fishing, and support activities</i></b>			
Fisheries and forestry	61	71	122 (e)
Support activities for agriculture and forestry	31	75	43 (e)
Subtotal forestry, fishing, and support activities	93	146	165
<b><i>Food product manufacturing</i></b>			
Food processing	902	880 (e)	1,089 (e)
Beverage manufacturing	152	291 (e)	283 (e)
Subtotal food product manufacturing	1,054	1,171	1,372
<b>Total agriculture</b>	<b>1,653</b>	<b>1,901</b>	<b>2,196</b>
<b>Total sales</b>	<b>58,868 (a)</b>	<b>88,968 (e)</b>	<b>NA (b)</b>

Table 6, cont'd. Sales of agriculture and related sectors, 1997, 2005, and 2013

	1997	2005	2013
<b>Percent of total agriculture sales</b>			
<b><i>Crops and animal production (farms)</i></b>			
Seeds	1.2%	3.3%	8.4%
Vegetables and melons <sup>2</sup>	2.1%	2.9%	2.0%
Fruits and nuts	11.7%	5.6%	5.0%
Floriculture and nursery products <sup>2</sup>	4.0%	5.3%	3.3%
Other crops	6.4%	9.8%	7.7%
Cattle and calves	0.9%	1.2%	2.3%
Dairy products	1.8%	1.0%	0.5%
Other livestock and products	2.5%	1.7%	0.8%
Subtotal crops and animal production	30.6%	30.7%	30.0%
<b><i>Forestry, fishing, and support activities</i></b>			
Fisheries and forestry	3.7%	3.7%	5.6%
Support activities for agriculture and forestry	1.9%	3.9%	2.0%
Subtotal forestry, fishing, and support activities	5.6%	7.7%	7.5%
<b><i>Food product manufacturing</i></b>			
Food processing	54.6%	46.3%	49.6%
Beverage manufacturing	9.2%	15.3%	12.9%
Subtotal food product manufacturing	63.8%	61.6%	62.5%
<b>Percent of total sales</b>	<b>2.8%</b>	<b>2.1%</b>	<b>NA</b>

Table 6, cont'd. Sales of agriculture and related sectors, 1997, 2005, and 2013

	1997–2005	2005–2013	1997–2013
<b>Average annual growth rate (%)</b>			
<b><i>Crops and animal production (farms)</i></b>			
Seeds	15.2%	14.4%	14.8%
Vegetables and melons <sup>2</sup>	6.0%	-2.7%	1.5%
Fruits and nuts	-7.1%	0.4%	-3.4%
Floriculture and nursery products <sup>2</sup>	5.3%	-4.1%	0.5%
Other crops	7.2%	-1.1%	3.0%
Cattle and calves	5.8%	10.7%	8.2%
Dairy products	-5.7%	-7.2%	-6.5%
Other livestock and products	-2.6%	-7.1%	-4.9%
Subtotal crops and animal production	1.8%	1.5%	1.7%
<b><i>Forestry, fishing, and support activities</i></b>			
Fisheries and forestry	1.9%	7.0%	4.4%
Support activities for agriculture and forestry	11.7%	-6.7%	2.1%
Subtotal forestry, fishing, and support activities	5.8%	1.5%	3.6%
<b><i>Food product manufacturing</i></b>			
Food processing	-0.3%	2.7%	1.2%
Beverage manufacturing	8.4%	-0.4%	3.9%
Subtotal food product manufacturing	1.3%	2.0%	1.7%
<b>Total agriculture</b>	<b>1.8%</b>	<b>1.8%</b>	<b>1.8%</b>
<b>Total sales</b>	<b>5.3%</b>	<b>NA</b>	<b>NA</b>

<sup>1</sup>Totals and subtotals subject to rounding errors.

<sup>2</sup>Receipts are from respective annual USDA/NASS Hawaii reports.

(a) Total output from the 1997 Hawaii Input-Output Study.

(b) Estimate not available since figure is no longer reported in the 2012 Economic Census.

(e) denotes authors' estimates.

Source: Economic Research Service and National Agricultural Statistics Service, U.S. Department of Agriculture, CTAHR Economic Issues, EI-13, and the 2007 Hawaii Input-Output Study.

calves, fisheries and forestry, and beverage manufacturing operations helped to offset the losses arising from the plantation closures. Finally, sales of total agriculture in Hawai'i exceeded the \$2 billion mark for the first time in 2013. This figure, excluding distribution margins, is a historic milestone and may represent the new benchmark for which to evaluate Hawai'i's overall agriculture performance in the near future.

## References

- Leung, P.S., K.R. Sharma, and S.T. Nakamoto (2000). Agriculture's Contribution to Hawaii's Economy. *CTAHR Economic Issues, EI-2*. Available at: <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-2.pdf>
- Leung, P.S. and M.K. Loke (2002). Agriculture's Contribution to Hawaii's Economy-An Update. *CTAHR Economic Issues, EI-3*. Available at: <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-3.pdf>
- Leung, P.S. and M.K. Loke (2008). The Contribution of Agriculture to Hawai'i's Economy: 2005. *CTAHR Economic Issues, EI-13*. Available at: <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-13.pdf>

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