

The 2010 County of Hawai‘i Agriculture Development Plan

April 9, 2010

He ali‘i ka ‘āina, he kauwa ke kanaka.
The land is the chief, man is the servant.
‘Ōlelo No‘eau, 531

Prepared for:
The Research and Development Department
County of Hawai‘i
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DISCLAIMER: The 2010 County of Hawai‘i Agriculture Development Plan is presented to the County of Hawai‘i for review and possible action—until adopted by the County Government and Council, it remains a draft plan, subject to approval.

The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands. The legislature shall provide standards and criteria to accomplish the foregoing.

Article 11, Section 3
The Constitution of the State of Hawai‘i

Executive Summary

Hawai‘i is the most isolated inhabited landmass on the planet, located approximately 2,500 miles from North America and Asia. This geographical isolation, coupled with the state’s current reliance on imported goods, means that Hawai‘i’s food supply and its agricultural export industry are particularly vulnerable to natural disasters and other events beyond the control of local markets and local government. The contamination of imported food and the introduction of invasive species via imports create significant risks to the state’s food supply.

Although the Hawai‘i State Constitution calls for the conservation and protection of agricultural land—as well as for the promotion of diversified agriculture and an increase in agricultural self-sufficiency—these principles have not yet been fully realized. From 1995–2005, the Hawai‘i Department of Agriculture conducted a study that revealed that food consumption in the state had outpaced local food production in most categories. The results of the study, as reported by its authors PingSun Leung and Mathew Loke, concluded that Hawai‘i had become *less* food self-sufficient. Also, a white paper issued by the same agency reported that this trend of increased reliance on imported food must be reversed in order to provide a greater degree of food safety for the state.

With its extensive arable lands and rich farming/ranching traditions, Hawai‘i County is uniquely positioned to correct this imbalance. Its support of agriculture is a vital factor to preserving the industry as one of the island’s primary economic drivers. Understanding this, in the spring of 2008, the Hawai‘i County Department of Research and Development sought proposals for the preparation of an updated Agriculture Development Plan to replace its 1992 plan.

The 1992 Hawai‘i County Agriculture Development Plan reflects the dominant role of sugar production as an economic driver for the island economy. With the demise of the sugar plantations—which caused dramatic changes in Hawai‘i’s agriculture industry—the County Department of Research and Development recognized the necessity for a new examination of island agriculture.

The Kohala Center, a nonprofit independent research and education institute based in Waimea, answered the call to prepare a 2010 Agriculture Development Plan for the County of Hawai‘i. The Kohala Center has endeavored to revise the 1992 plan to address market and societal changes and to provide a template for County government officials to participate in this important economic sector. For this effort, The Kohala Center enlisted the help of local agricultural expertise and has relied on information provided by members of the local agricultural community. Agricon Hawaii LLC, an agribusiness consulting firm that provides business and technical services to Hawai‘i, the Pacific Basin, and other tropical environments, was a key collaborator and link to local growers and commodity groups. The firm contributed in-depth understanding of market and transportation impacts and the inner-workings of island export agriculture.

Devising this plan followed a process designed to glean maximum input from both the community at large and from that segment of the community engaged in agriculture production or related fields. A total of thirteen public listening sessions and four industry feedback sessions

were conducted in order to solicit public input regarding the plan. Additionally, an *ad hoc* committee (appendix A) was formed to provide plan development oversight and met several times to review and discuss the ongoing process. Among the contributions of the *ad hoc* committee is the vision statement that *A thriving and sustainable agriculture industry is a vital contributor to Hawai‘i County’s economy, rural lifestyle, and character, by producing food, fiber, energy, and ornamentals for local consumption and export.*

The County of Hawai‘i Agriculture Development Plan consists of four parts. Section I provides background information that includes definitions, physical resources available for agriculture production, a brief history of Hawai‘i Island agriculture, and an overview of market trends in the recent past. Section II presents a discussion of the role of County government in the agriculture industry and a list of specific policies and recommended actions for the County of Hawai‘i to respond to the major opportunities and challenges identified in the industry and public listening process. Section III introduces 12 key agricultural system elements with recommended action items resulting from industry and public listening sessions. Section IV includes detailed crop-specific discussions of current industry trends and potential for future development. This section was compiled by Agricon Hawaii LLC in collaboration with industry experts. It was not addressed in the public listening sessions of September 2009 and, as such, was not subject to substantive review or revision by The Kohala Center.

The purpose of this plan is to serve as a guide for County actions intended to revitalize agriculture as a basis for economic development, serving as a guide for the creation of policies, allocation of resources, and advocacy for the growth of agriculture on Hawai‘i Island. Recommended goals that reflect the expressed wishes of the agricultural industry and community members who provided comment for this plan include:

- Expand Hawai‘i Island food production so that 30% of its residents’ demand for food can be supplied by local producers by 2020.
- Remove impediments that currently exist between local agricultural producers and export markets.
- Protect local agriculture from the introduction of invasive species and pathogens.
- Promote and support educational programs that provide the opportunity for agricultural industry participants of all sorts to productively, profitably, and sustainably expand Hawai‘i’s agricultural systems.

The actions needed to achieve the goals for agriculture on Hawai‘i Island are numerous. The Plan includes the following recommendations for immediate County government attention:

- (1) Increase or reallocate existing resources for the County Research and Development (R&D) Agriculture Program so that the County can be an active and more effective leader in implementing or facilitating the actions deemed important by the stakeholders consulted during the planning process and which are embodied in this report. The following functions were identified in public listening sessions as critical to the growth of the agriculture industry on the island: (a) marshalling resources for key infrastructure projects that would broadly benefit the agricultural sector; (b) serving as a liaison and ombudsman for local agricultural ventures and interests and government agencies at the County, State, and U.S. federal levels; and (c) providing extension and inspection services.

- (2) Complete the designation of important agricultural lands (IAL) by approaching the legislature in 2010 for funding and, if necessary, allocating the additional financial assistance to complete the formal IAL designation process.
- (3) Develop a comprehensive and actively managed agricultural Web site for Hawai'i Island agricultural information, providing a reference and repository for data and links about agricultural production, marketing, events, research, and resources.
- (4) Work with U.S. federal and State regulatory agencies, industry stakeholders, and commodity groups to create and implement a comprehensive and effective strategy to (a) eliminate the introduction and spread of invasive species into and throughout Hawai'i Island, and (b) to safely eradicate those species that are interfering with agricultural production.
- (5) Work with U.S. federal and State agencies to improve agriculture inspection systems and storage facilities at Hawai'i Island airports and harbors in order to ensure safe and efficient movement of locally produced agricultural products.
- (6) Undertake or commission a Baseline Study for Increased Food Self Sufficiency to be used by the County government to address existing regulations and recommend, in detail, economic initiatives needed to increase food self-sufficiency.
- (7) Facilitate and advocate for formal and informal agricultural education to (a) assure that Hawai'i residents understand the value of local agricultural production and can support demand for fresh, high quality local food, and (b) train knowledgeable producers to profitably and sustainably meet this demand.

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I. BACKGROUND

E kanu mea 'ai o nānā keiki i ka ha'i.

Plant food lest your children look with longing at someone else's.

'Ōlelo No'eau, 317

The Vision:

The guiding vision for agriculture on Hawai'i Island articulated by the *ad hoc* agricultural plan committee from comments made during the thirteen public listening sessions is:

A thriving and sustainable agriculture industry is a vital contributor to Hawai'i County's economy, rural lifestyle, and character by producing food, fiber, energy, and ornamentals for local consumption and export.

Definitions in this Plan:

Agriculture is a wildly diverse industry around the world and is no less diverse and variable on Hawai'i Island. This diversity has led, at times, to fragmentation of the key groups of producers, processors or consumers who collectively comprise the agriculture industry. To clarify that an island-wide plan intends to embrace agriculture in all its possible forms, the following are terms and definitions used in this plan:

Agriculture: The art or science of cultivating the ground to produce food, fiber, energy or other tangible good for the benefit of mankind. From: Webster's New International Unabridged Dictionary, Second Edition (1961). Note that this report also includes water-based agriculture (aquaculture) for the purposes of this plan.

Agriculture Enterprise: A human endeavor that specifically produces food, fiber, energy or other tangible good from the land or water resources. For this report, this definition includes all plant and animal products that can be grown, cultivated, raised or harvested from the land or water. Other common terms for this enterprise include farm, ranch, plantation, orchard, greenhouse, dairy, feedlot, fish pond, nursery, etc. This plan does not attempt to define a minimum or maximum level of production to be included in this definition. Since 1975, the USDA has defined a "farm" for statistical purposes as "any place from which \$1,000 or more of agriculture products were sold or normally would have been sold during the year..." On Hawai'i Island, many "farms" meeting the definition of USDA are considered gardens by their owners or neighbors—this plan includes ALL production, regardless of size or kind, in its definition of agriculture enterprise.

Agriculture Producer: Any occupation that has decision-making authority for the production of agriculture products is included in this plan under this term. This includes but is not limited to: farmer, rancher, dairymen, horticulturalist, orchardist, floriculturalist, aquaculturist, apiarist, forest managers and nurserymen, to list just a few of the many terms embraced by the phrase agriculture producer.

Agriculture Processor: Any industry that engages in cleaning, sorting, preparing, packaging, and distributing or that, in any other way, participates in modifying primary agriculture production to a consumable state is included here under this term. This includes minor processing, such as washing and sorting as well as slaughter, packaging, cooking and preparing, and extends to

packing plants, distribution centers, saw mills, chippers and other industries designed to modify primary production. With this definition, the term “processor” is specifically linked to the enterprise, not the owner/operator.

Physical Resources

The archipelago of Hawai‘i is the most remote land on earth—more isolated from any continental landmass than any other island chain. This isolation has figured prominently in its ecology, settlement, and the development of the people and economy of this place. Three key components for agriculture production include land, climate, and water. Each component is discussed briefly in the following sections.

Land and Soils

Hawai‘i Island consists of four volcanic mountains extending from the Pacific Basin to heights approaching 14,000 feet above sea level. Three of the four volcanic peaks are considered to be active, with eruptions within the past two centuries; one has been continuously erupting for the past 25 years. This volcanic origin creates the geologically young nature of the island. The island, approximately 2,500 miles from the nearest part of the continental United States contains approximately 4,028 square miles of land and is growing constantly in response to new volcanic activity. For comparison purposes, it approximates the size of Connecticut in land area.

Falling below the Tropic of Capricorn, Hawai‘i Island’s native vegetation and soils are similar to other tropical regions of the earth. The volcanic origin results in shallow to non-existent soils in some areas (notably the Kona Coffee Belt), contrasted with areas of volcanic cinder or ash deposits resulting in deep and well-textured mineral soils in Kohala and the Hāmākua regions, among others. As is true for most tropical soils, the soils of Hawai‘i Island tend to be underdeveloped and highly oxidized with minimal organic material. The combination of soil chemistry and temperature/moisture regimes ideal for microbial activity result in the rapid oxidation of any organic soil nutrients, with the result that most organic materials on a given site will be contained in living tissue. This is in sharp contrast to the highly productive soils of the great plains of the Continental United States and Canada, where colder temperatures and variable moisture result in a soil matrix with most organic matter on a specific site contained in the deep loam soils and available for plant growth during the growing season.

Large scale continuous cropping and burning of sugar cane over the past century has not increased the carbon reservoirs or nutrient availability in those soils, nor has conversion to Eucalyptus groves. Tropical soils are normally considered to be low in nutrients, quickly depleted under continuous cropping, and highly susceptible to rapid erosion from tropical rainfall events if plant cover is removed. Hawai‘i’s soils share these characteristics and limitations with tropical regions around the world.

Climate

Steep and varied mountainous terrain deflects the trade winds in unique patterns that result in 11 of the 13 recognized terrestrial ecosystem types on the earth being present. These variable climates with varying elevation and exposure create virtually unlimited potential for crops or livestock. Unfortunately, they also provide perfect conditions for the establishment of invasive species and pathogens as described later.

The prevailing trade winds and the surrounding Pacific Ocean, as well as the location on the northern boundary of the tropical zone, provide the island with moderate weather and temperature regimes. High daytime temperatures seldom reach 90°F. and low night temperatures rarely fall below 60° F. for most of the island. The exceptions at extreme upper elevations include winter snows and recurring frost. The earliest Hawaiians recognized two seasons—the wet season of cooler temperatures roughly embracing fall and winter, and the dry season of warmer temperatures roughly synonymous with spring and summer, except for the Kona districts which experience a dry winter and wet summer. Diurnal temperature fluctuation is generally less than 20° F. in the warm season and less than 30°F. in the cool season. Desiccating winds that are problematic for agriculture producers in other locations are neither common nor long lasting on the island, due to the surrounding ocean.

Rainfall varies by site, from annual averages exceeding 200 inches on mid-elevations of the windward side to less than 4 inches on the leeward coastal plain. Precipitation patterns are well understood, however, and site-specific rainfall seasonality and totals are not greatly variable through time or season. The impact of global warming may, however, increasingly affect these established historical patterns.

The unique combination of ocean surface temperatures between 75° and 82° year-round, trade winds out of the northeast bringing cooling air masses from the Gulf of Alaska, and great distance from any continental landmass thermal loading combine to provide a stable and moderate climate regime that may be unique on Earth. It is this climate that results in the unique potential (and needs) of Hawai‘i Island agriculture.

Water

Water, in the form of rain, snowmelt, soil moisture, surface flow or irrigation is a critical need for agricultural production. On Hawai‘i Island, rainfall is the primary source of water. Fast draining, poorly developed soils and substrates with minimal clay content retain little moisture and support virtually no surface springs. Rapid percolation precludes surface run off in all but the most severe rainfall events, so streams, springs, lakes and other common surface water sources are largely absent. Very few sites for surface storage earthen reservoirs can be found and this common and economical means of storing water in other locations is not possible without expensive construction of water retaining barriers. Although irrigation is important in some regions (discussed more fully later), diversion of surface flow for irrigation use is complicated by a lack of streams or earthen catchments. The same “leakage” limitations affect transport efficiency of the many miles of irrigation supply ditches currently in use on the island.

The rainfall that quickly percolates through the island landmass fortunately accumulates in a freshwater lens that floats above the saltwater permeated rocks at or below sea level. This subterranean lens provides the water source that the County of Hawai‘i Department of Water Supply pumps into storage tanks and pipeline distribution systems. The cost of water on Hawai‘i Island is therefore driven by the pumping costs of raising the water, as well as the cost of distribution, but the resource remains abundant. Energy costs limit large-scale use of deep-well water for agriculture uses like irrigation, and even livestock water supplied from County wells is cost-prohibitive.

A Brief History of Hawai‘i Island Agriculture

Historians suggest that Polynesian voyagers first settled in the Hawaiian Archipelago on the island now called Hawai‘i about two millennia ago. These early settlers brought with them at least twenty individual crops and three domestic animals to support their agricultural lifestyle. Half of the plant crops were food items (taro, ti, sweet potato, breadfruit, banana, sugarcane, *kukui* nut, coconut, and Polynesia arrowroot), and the other half was comprised of both medicinal plants (gingers, *noni*, *‘ōlena*, *‘awa*) and structural plants (bamboo, gourds, and fibers). Their success was spectacular. Roughly 1,800 years later, when the English fleet sailing under Captain James Cook arrived in Kealahou Bay, the civilization on this island supported an oligarchy with discrete and well-defined ruling classes: a priesthood, a scholar class, a warrior class, and numerous specialist trades, e.g., canoe builders, stone workers, chanters, artisans, weavers, and land managers (*konoiki*). And all of these people were fed by agriculture producers with crops from well-designed and maintained irrigation and field systems and world famous sustainable large-scale aquaculture.

Why is this relevant as background to the 2010 County of Hawai‘i Agriculture Development Plan? Because it is important to know that this remote and isolated island historically supported as many people as it does now, with no trade routes or imports of any kind. Without labor-saving technologies, fossil-fuel based soil amendments, motorized distribution systems, or new crop varieties; without refrigeration or food preservation technologies like canning or drying; without crops that lent themselves to extended storage, like the small grains of the Mediterranean region; and with a balanced agriculture that included food production as well as structural, fiber, medicinal and cosmetic crops. It is most important to note that these early Hawaiians did not develop the proto-typical subsistence lifestyle of tropical Africa or the Amazon River Basin. Instead, they evolved a highly productive stratified society where some of the people were agriculture producers so that other members of society had sufficient time and resources to pursue other interests.

After Captain Cook sailed into Kealahou Bay, and trade routes began to open with improved shipbuilding, the Hawaiians launched an agriculture export economy, exporting sandalwood and similar forest products to China and building an entire industry around replenishing food and water for the sea-trade. This export economy was sufficient to create a treasury; support the military unification of the islands by Kamehameha I, including the outright purchase of two European warships; and provide at least three generations of nobility with both high mobility and higher education—beyond even what Europe, Canton, or Nippon offered their ruling classes of the time.

Recent Market Trends

In keeping with the definition of agriculture production chosen for this plan, and as a critical foundation for the recommendations that follow, it is valuable to look at market trends for Hawai‘i Island agriculture. The more recent history of the island remains one of a vibrant agriculture industry supporting both local and export markets in all elements of the agricultural sector including food, fiber, medicine, structural components, horticulture, and other uses. Labor from Asia, Europe, and North America were imported to meet the demands for Hawai‘i Island agriculture production. As these new immigrants came to the island, new crops and new agriculture production patterns came with them. The shift of diet away from *poi* and *lauau* to

bread, rice, and milk also required a shift in diversified agriculture production and processing. The plantations and output of the sugar industry commonly overshadow these historical agricultural achievements, but it is important to recognize that the island community produced all of its own food prior to the days of scheduled shipping routes to the U.S. Mainland or Asia and prior to the invention and commercialization of refrigerated containers for moving fresh produce. But what conclusions can be drawn about diversified agriculture and market share once shipping became established?

An interesting compilation of historical statistics published by the University of Hawai‘i includes the annual reports of the Hawaii Crop and Livestock Reporting Service for the period immediately after the Second World War and extending into the mid-1970s. These reports state that in 1946, when shipping was well established, 61.4% of the red meat, 24.4% of the poultry, 55.2% of fresh market vegetables, 39.3% of the eggs, and 100% of the milk marketed in Hawai‘i was produced in Hawai‘i. Twenty-eight years later, in 1974 (the last year for which data is available from this source), locally produced red meat still supplied 35% of the local market, and 18.4% of poultry, 42.2% of vegetables, 91.4% of eggs, and 100% of the milk consumed was locally produced in Hawai‘i. And, note that throughout this period, sugar and pineapple were the dominant crops of the archipelago.

More recent data is available through the County of Hawai‘i Data Book prepared by the County of Hawai‘i Department of Research and Development. The overall production trends are interesting, and are reported in nominal dollar values as reflected in the following tables. In 1978, the total value of all Hawai‘i State Agriculture production was up to \$419 million and the portion produced on Hawai‘i Island was \$148 million or 35.4% of the state total. Thirty years later, in 2007, well after the end of the pineapple and sugar plantation era, total statewide agriculture production was up 22.6% to \$513.6 million, and Hawai‘i Island production had increased 36.8% to \$202.5 million—39.4% of the state production. What these data summaries reflect is simply that the demise of the sugar and pineapple markets have been compensated for by the agriculture producers and the industry remains strong and continues to expand in output and market share. Tables 15.1 and 15.5 from the County of Hawai‘i Data Book are included below to support this assessment.

**Table 15.1-- MARKET VALUE OF AGRICULTURAL PRODUCTS SOLD:
1978, 1982, 1987, 1992, 1997, 2002 AND 2007**

Subject and period	State total	Hawai'i County
Total sales (\$1,000):		
1978	419,251	148,399
1982	558,608	206,427
1987	609,741	219,756
1992	552,054	187,593
1997	496,935	168,111
2002	533,423	187,736
2007	513,626	202,572
Sales per farm (dollars):		
1978	97,274	65,490
1982	121,569	81,302
1987	125,203	78,205
1992	103,458	59,421
1997	90,798	50,651
2002	98,819	58,375
2007	68,292	43,564

Source: U.S. Bureau of the Census, 1982 Census of Agriculture, Geographic Area Series, Hawaii, State and County Data, AC82-A-11 (September 1984), chapter 2, table 3; 1987 Census of Agriculture, Geographic Area Series, Hawaii, State and County Data, AC87-A-11 (August 1989), chapter 2, table 2; 1992 Census of Agriculture, Geographic Area Series, Hawaii, State and County Data, AC92-A-11 (October 1994), chapter 2, table 1; 1997 Census of Agriculture, Geographic Area Series, Hawaii, State and County Data, AC97-A-11 (March 1999), chapter 2, table 1; U.S. Dept. of Agriculture, National Agricultural Statistics Service, 2002 Census of Agriculture, Vol.1, Part 11, Hawaii (June 2004), p185; and 2007 Census of Agriculture, Vol.1, Part 11, Hawai'i (February 2009), p.233 (Updated September 2009).

**Table 15.5-- VALUE OF CROP, LIVESTOCK, AND AQUACULTURE SALES,
HAWAII COUNTY:
1982 TO 2007**

(In thousands of dollars)

Year	Total crops, livestock, & aquaculture 2/	Crops			Live-stock	Aqua-culture
		All crops	Sugar (unprocessed cane)	Other crops		
1982	176,021	152,244	86,900	65,344	23,777	-
1983	191,814	167,941	100,000	67,941	23,873	-
1984	185,216	161,983	94,000	67,983	23,233	-
1985	171,645	149,523	69,800	79,723	22,122	-
1986	187,958	165,976	74,100	91,876	21,982	-
1987	180,306	153,891	64,400	89,491	26,415	-
1988	194,679	165,619	60,000	105,619	29,060	-
1989 1/	207,445	174,741	56,900	113,841	32,704	-
1990 1/	198,310	168,893	55,000	113,893	29,417	-
1991 1/	179,716	149,009	43,600	105,409	30,707	-
1992 1/	168,406	140,235	38,200	102,035	28,171	-
1993 1/	166,309	140,610	39,000	101,610	25,699	-
1994 1/	161,475	140,770	35,800	104,970	20,705	6,865
1995 1/	146,427	128,564	12,200	115,818	17,863	11,403
1996 1/	142,160	125,428	1,700	124,215	16,732	13,197
1997 1/	163,195	130,737	-	130,737	19,078	13,380
1998 1/	155,905	121,676	-	121,676	20,846	13,383
1999 1/	157,847	121,939	-	121,939	22,531	13,377
2000 1/	170,249	128,161	-	128,161	26,079	16,009
2001 1/	176,456	134,380	-	134,380	25,878	16,198
2002 1/	172,980	128,261	-	128,261	27,648	17,329
2003 1/	179,231	132,331	-	132,331	27,241	19,639
2004 1/	195,599	143,972	-	143,972	30,416	21,211
2005 1/	215,204	164,772	-	164,772	30,253	20,179
2006 1/	200,632	152,302	-	152,302	30,860	17,470
2007	193,356	140,618	-	140,618	32,583	20,155

1/ Revised.

2/ Total includes aquaculture beginning 1994.

Source: Hawaii Agricultural Statistics Service, *Statistics of Hawaii Agriculture* (annual); and Website:

<http://www.nass.usda.gov/hi/stats>

The County of Hawai‘i Agriculture Development Plan prepared in 1992 is also a wealth of information on the needs and production of Hawai‘i Island at that time. The goals, suggested policies, and summary of concerns in that plan are virtually identical to ones that can be written today, based on the outcome of the similar public listening sessions, with one exception—that being, the dominant role that the sugar industry played in island agriculture at that time.

It was repeated throughout the public and industry sessions that agriculture on Hawai‘i Island has taken a major setback when the last of the sugar plantations closed as a result of changing federal policies, beginning with the 1985 Farm Bill and with international trade agreements like GATT and NAFTA. However, the market and production data presented above do not support that conclusion. For example, as the nominal value of sugar production declined from 1984 to 1996, the nominal value (taken at the farm gate) of other crops increased. Although there has been some shifting in the market of individual commodities—for example, local dairy and red meat production has dropped while flowers, foliage and fruit, and aquaculture have expanded to take up the shortfall—the overall industry continues to expand and provide vital contributions to the economy of this island. Unfortunately, as is the case with agricultural products in general, inflation has increased at a faster rate than the expansion of the agriculture industry, stripping it of any real increase in value. In 1996, the value of agriculture crops (other than sugar) produced on Hawai‘i Island was \$124,215,000. The nominal value of the same category of crops in 2007 was \$140,618,000, indicating a 12% nominal increase in value. However, based on the Consumer Price Index, inflation increased by about 25% over the same period.

The Missing Links

The 2007 Rocky Mountain Institute Report titled: *Island of Hawaii Whole System Project Phase I Report* discusses food security risk mitigation and agribusiness market development for Hawai‘i Island. Two recurring themes are repeated throughout that report: one is that Hawai‘i Island currently imports 85% of the food consumed here, and the second is that the agriculture industry here lacks the infrastructure of other regions. In a cursory comparison of Hawaiian Island agriculture with U.S. Mainland agriculture, one critical element is lacking: adequate and appropriate processing and distribution systems.

In the agriculture practiced on the U.S. Mainland, the better agriculture producers focus on their crop selection, cropping patterns, and on-farm costs—knowing that they will have a ready market for their production after harvest. Some savvy producers that pay attention to market trends institute on-farm storage so that they deliver their production to market at the most advantageous time to obtain the best price. This simple system requires two entities to work—a willing seller with production to sell and a willing buyer with sufficient cash or credit to pay for the agriculture products. Unfortunately, on Hawai‘i Island, it is not so simple. Identifying the willing buyer can be problematic and agriculture producers cannot be satisfied with growing a strong and abundant crop—they must also focus intently on what to do with that crop when it is harvest time. The most significant loss to the Hawai‘i Island agriculture community was not the loss of big sugar, it was the loss of smaller scale operations such as dairies and egg farms, along with the loss of smaller scale processors to purchase, wash, sort, label, can, butcher, and distribute the production of the agriculture community.

There is a reason for this loss. As agriculture in the United States has contracted into fewer owners of larger enterprises under the international market forces that displaced the sugar plantations, agribusiness has been affected by the same forces and perceived economies of scale. Linked to the United States by federal and state policy as well federally-funded agriculture research and education through ARS and Cooperative Extension, the Hawaiian Islands have relied on North American technology and trends to inform both agricultural production and processing industries. Although the scale, commodities produced, markets, storage and distribution networks in Hawai‘i have little in common with North America, it is the North American model that informs much of the local agriculture decision-making and establishes the technologies and business-development for the agricultural sector.

Farm ownership patterns in the United States, coupled with a surface transportation system that can move field production to processing plants within 24 hours of harvest over most of the country, has focused technological advances in food and related processing on extremely high volume and high unit-efficiency operations. Smaller scale operators have either been bought out or out-competed by agribusiness giants. As a result, there are few counterparts in North America for agriculture processors physically limited to a small geographical area and isolated market.

For example, there is no industry in the United States, based on a root crop with 12+ months maturity period from planting to harvest, grown from sprouted shoots rather than seeds; therefore, no technological advances in production, harvesting or processing of this crop type have drawn national interest. The foundational community-sized dairies with 80-milk cows and associated milkmen and creamery businesses have disappeared in North America and have been replaced with thousand-head automated milk factories as the direct result of improvements in refrigerated shipping and sanitized robotic milking. Consequently, research activities and technological improvements are no longer focused on the community size dairy that may make sense in an island context. Multi-million dollar automated feeding systems based on cheap electricity and grain-based pelletized rations have much less utility here, so new, island-specific systems must be developed or borrowed from other parts of the world.

Another illustration is the reality of the cattle industry. We can produce fine beef, but the mainland advances in industrial feed and slaughter automation are based on a different age and size of finished steer than can be economically produced here. So, again, emerging technologies based on the North American agriculture model have no application, and the formerly vibrant Hawai‘i red-meat industry must look to other production models for its renewal.

In addition to these production differences, distribution networks are also an issue. In contemporary Hawai‘i, the close link between agricultural production and consumption has been affected by the revolution in real-time communications and shipping to make it appear advantageous to order produce from California for delivery to the grocery store receiving dock, rather than take steps to acquire fresh produce from local agriculture producers. The agriculture community in Hawai‘i must begin to seek alternate models for developing this required distribution segment of the agriculture economy if food security and long-term economic and ecological sustainability are to be realized.

There are clear reasons to overcome the barriers noted above. A 2008 study conducted by the State Department of Agriculture and University of Hawai‘i College of Tropical Agriculture and Human Resources concluded that replacing just 10% of the consumption of imported foods with locally produced foods would result in \$94 million in sales at the farm gate, generating an estimated economy-wide impact of \$188 million, \$47 million in earnings, \$6 million in state tax revenues, and more than 2,300 jobs. Hawai‘i County, by virtue of its large share of local food production, has the potential to capture between 40% and 50% of increased sales, earnings, and jobs, which would contribute to overall economic growth for the island.

II. COUNTY GOVERNMENT AND AGRICULTURE

He ali 'i ka 'āina, he kauwa ke kanaka.

The land is the chief, man is the servant.

'Ōlelo No'eau, 531

Since earliest recorded history, the Island of Hawai'i has been a recognized political entity. Prior to unification, the island had a king. After Kamehameha I unified the Hawaiian Islands, the Island of Hawai'i was home to the Hawaiian royalty but was ruled by a governor. More than a century later, when the royalty was deposed, the territorial government established the Island of Hawai'i as the "County of Hawai'i" governed by a council and mayor modeled loosely after county governments in the United States. When the Hawaiian Archipelago became the 50th state of the United States in 1959, the existing Island of Hawai'i government structure became the County of Hawai'i government we have today. A critically important foundation for this Agriculture Development Plan is that at no time during the period of recorded history has this island been without independent and local governance.

The responsibility of the County government of the Island of Hawai'i has no real counterpart in any other U.S. jurisdiction. Isolation remains one major factor that contributes to this statement. Hawai'i County shares no land boundary, and therefore no land-based commerce, with any other jurisdiction. The island, approximately the size of the State of Connecticut, is in the top 2.5% of all U.S. counties in landmass, and in the top 10% of all U.S. counties in population according to the most recent U.S. Census. It is not part of the electric distribution grid, does not link to the interstate highway system, and has no cross deputization with adjoining jurisdictions. Remarkably, there are no incorporated cities or towns in Hawai'i County, and none are provided for in the Hawai'i State Constitution. There is no town council, no town police or fire departments, no town roads department, no local commissions, and no local school boards. In short, the Hawai'i County government takes on all the myriad responsibilities that would be distributed among numerous local jurisdictions anywhere else in the United States. Consequently, county-level workloads increase and time to research or debate issues becomes constrained. These government organizational realities and constraints are factored into the following recommendations.

County of Hawai'i government plans have been written and voted into law to guide future development (Appendix B). These include the County of Hawai'i General Plan and Community Development Plans (CDPs), completed or in progress. Although the Hāmākua CDP has not been completed, the district developed the Hāmākua Agricultural Plan in 2006. All of these documents consider agriculture and increased food production to be a major and necessary part of the economies of both the state and Hawai'i Island and are specific in their goals and priorities for Hawai'i Island's agriculture. The policies and recommendations in these plans relevant to agriculture that can be accomplished by the County, either through direct implementation or advocacy, are incorporated into the 2010 County of Hawai'i Agriculture Development Plan.

This Agricultural Development Plan was commissioned by the County Department of Research and Development, whose mission is to provide proactive leadership, enhancing the quality of life and sustainability of Hawai'i Island communities through programs related to agriculture,

energy, tourism, economic development, community development, and film. County R&D's Agriculture Program currently provides a multi-faceted, though limited, support to the Hawai'i Island agricultural industry. (See Appendix C for recent projects funded.)

Because the public has clearly expressed the view that agriculture is a vital and desired aspect of Hawai'i Island's economy and rural lifestyle, this planning document recommends the establishment of a County Department of Agriculture to begin implementing plan recommendations and to seek additional opportunities to improve the island's economy through the agriculture sector. This recommendation is in concert with the opportunities available to county governments in the United States to provide federal or state agriculture services through intergovernmental agreements.

Recommended Priority Actions

It is recommended that the County of Hawai'i Implement the 2010 County of Hawai'i Agriculture Development Plan by taking the following direct actions:

1. The Hawai'i County Council should adopt the County Agriculture Development Plan by resolution. Appendix D contains some suggested language for a Council and County policy statement.

2. Hawai'i Island Agricultural Policy Committee: To assure that there is a vehicle for ongoing community involvement in agricultural plan implementation, we propose establishment of a Hawai'i Island Agriculture Policy Committee (APC), a volunteer group of agricultural stakeholders convened by the existing County Department of Research and Development to guide and monitor the implementation of plan recommendations and serve as a conduit for continued community and industry input. The APC will play a vital role in prioritizing actions, moving initiatives forward, and adjusting strategies as opportunities and challenges arise. The initial members of the APC should include industry volunteers from the Plan's Ad Hoc Committee; its subcommittees should recruit representatives from specific industry sectors such as food, ornamentals, timber, and biofuels. If the Mayor's Office or County Council establishes a similar citizen's panel prior to adopting this plan by resolution, a separate APC is not deemed necessary.

3. The County of Hawai'i Research and Development Department should increase or reallocate existing resources in order to undertake the following functions deemed essential for the growth of the agriculture industry on Hawai'i Island.
 - a. Intergovernmental Affairs: Staff would serve as the liaison between and among the other County Departments, the State of Hawai'i Department of Agriculture and the Department of Land and Natural Resources, and the numerous offices of the USDA at the state and national level. Additionally, this office could serve an ombudsman role on behalf of individual agriculture producers who can benefit from third-party assistance in dealing with these other entities. The important work here will be to identify, link, coordinate, and collaborate with all appropriate governmental departments that currently provide, or should provide, services to Hawai'i Island agriculture producers. This office is critical in accomplishing the Memorandums of

Understanding that can provide funding as described below. (County, State, and U.S. government departments and agencies that support agriculture are described in Appendix E.)

b. Agriculture Inspection Services: A critical need discussed repeatedly in various public and industry sessions was an overreaching need to improve the agriculture inspections operations taking place on Hawai‘i Island. These inspections are conducted by various agencies—usually, but not exclusively, USDA—on both incoming shipments (USDA-APHIS) and outgoing shipments (FSIS, among others). A new critical need is a formal inspection process for those agriculture producers who are trying to be in compliance with Food Safety Certifications so they can market directly from the farm. And finally, a critical barrier to slaughter and butchering is the need for a USDA FSIS Veterinarian to inspect live animal and carcass at the time of slaughter. This mixture of various inspection services can be consolidated in a single office with largely cross-trained inspectors serving multiple roles as the need arises and to avoid burnout. The USDA State Vet can deputize the Meat Inspectors, and the County can enter into Memorandums of Agreement (MOU) with the USDA Agencies currently conducting the inspections. In other states it is common for the state or county Department of Agriculture to hire the inspectors, using the USDA budgeted dollars under an MOU to accomplish the task normally performed by the USDA employees. Local control of this function provides the flexibility for inspectors to inspect on-farm, reducing or eliminating spoilage losses caused by shipping or inspection delays in non-climate controls staging areas at ports and airports. Additionally, county services in this area should include the immediate establishment of temporary staging area shelters to protect products awaiting inspection from environmental hazard, an especially acute problem at Kawaihae Harbor, according to public comment. It is possible that using USDA funding through an MOU process, augmented with minor user fees that are offset by reductions in spoilage and shipping loss, could create a full county inspection program that includes the current food safety inspection and certification with little or no county funds invested beyond current budget levels. This inspection service would also ensure that the county resources are protected, locally, from unwanted and invasive agriculture pests or pathogens.

c. Agriculture Marketing Services: Many counties and all states have an office or department tasked with maintaining agriculture statistics, cooperating with the U.S. Agriculture Census and Economic Research Service, providing critical market data, as well as general marketing support and promotion. Note that the Hawai‘i State Department of Agriculture reports that it no longer has the resources to record crop and market data at the county level and will only compile statewide summaries from U.S. Agriculture Census data. The county level office would conduct directly, or contract for, the investigations into the realities of the market.

In preparing this report we were apprised of a situation that illustrates the importance of having accurate market data: There is a continued belief that the local cost of food production exceeds the market’s ability to pay. Yet, we were supplied with reliable information from the avocado industry that locally grown avocados sell for significantly less money, wholesale, than the imported California Haas avocado, and also sell for less retail, but chain grocery stores receive less mark-up from local avocados than from California imports. A county marketing information service could research these issues, publish the results, and thereby provide data to assist the wholesalers, retailers, producers, potential investors, and consumers with better knowledge of the local conditions.

d. Agriculture Extension Services: The USDA Cooperative State Research Extension and Education Service is the renamed Cooperative Extension Service that provides Agriculture Extension Agents to all the counties in the United States. These positions are primarily funded by USDA, with administrative contributions of the state land-grant university (UH) who is the actual employer, and the agents are housed in county facilities usually provided by the county government as their contribution. In this way, USDA is able to confirm that the program is actually a cooperative effort engaging the states and counties as well as the federal government. County extension agents have a wide range of duties and provide the critical informational access point for many on-farm USDA services; link with NRCS and FSA, Risk Management (crop insurance), Rural Development Animal Plant Health Inspection Service (APHIS)—to name a few USDA agencies—and, of course, perform the education and outreach services of the agriculture experiment station and university. They are invaluable, and Hawai‘i County should have at least one extension agent assigned by UH to work directly with the County Department of Agriculture. Because most counties in the United States are only about 100,000 acres in size, using that size criteria, Hawai‘i Island should, by comparison, have a minimum of 45 extension agents. While this is obviously unrealistic, it is worth mentioning in order to illustrate how currently underserved the agriculture community is in Hawai‘i County compared with their competitors on the Mainland or other counties in this state.

The critical role for the county extension service, whether staffed with a UH-sponsored extension agent or a separate county employee, would be the education and dissemination of important advances in tropical agriculture and opportunities for collaboration, cooperative development, and cross-training across all segments of the agriculture community on Hawai‘i Island, including both the University and USDA research entities, agribusiness, and agriculture producers of all types and sizes.

Importantly, the county extension agents are to be supervised by a county committee in the same way that the Farm Service Agency has county and state committees to oversee their work and approve all applications, and NRCS uses the Conservation District (formerly the Soil Conservation District) with an elected board of local agriculture producers to oversee their programs—in most jurisdictions, the conservation district and the county boundaries are one and the same.

Increasing or reallocating Research and Development Department resources can be critical to making the plan a reality. As an alternative, it may be informative to compare the remainder of this document with the plan written in 1992, and contemplate how failure to act at this time may influence a County of Hawai‘i Agriculture Development Plan in the year 2028.

Community Input and Priority Action Items

Agriculture, as envisioned for Hawai‘i County, is a community activity and requires community input. Public listening sessions conducted at various times during the plan development process elicited the needs and preferences of participating community members and provided important information on how overall demand for locally produced foods can be increased. The drive, innovation, and creative force required to implement the plan requires a collaborative effort between the County, the agriculture industry, and community leaders.

The actions needed to achieve the goals for agriculture on Hawai‘i Island are numerous. On the County’s part, we make the following recommendations for immediate attention:

(1) Increase or reallocate resources for the County Research and Development Department so that the County can be an active and effective leader in implementing or facilitating the actions deemed important by the stakeholders consulted during the planning process and embodied in this report.

(2) Complete the designation of important agricultural lands (IAL). The County is required by State law to identify and map the IAL on Hawai‘i Island and is mandated to consult with all those having a stake in the process. Although preliminary mapping of IAL is shown in the County of Hawai‘i General Plan, the process to formalize the maps for State Land Use Commission approval has not been started. The leader for these actions is the County Planning Department. We recommend that Hawai‘i County approach the legislature in 2010 for funding and, if necessary, allocate the additional financial assistance to complete the formal IAL designation process.

(3) Develop a comprehensive and actively managed agricultural Web site for Hawai‘i Island agricultural information. This site would be used by the County to post its ongoing projects and reports, as well as be a reference site and repository for information and links about agricultural production, marketing, events, research, and resources.

(4) Work with U.S. federal and State regulatory agencies, industry stakeholders, and commodity groups to create and implement a comprehensive and effective strategy to (a) eliminate the introduction and spread of invasive species into and throughout Hawai‘i Island, and (b) to safely eradicate those species that are interfering with agricultural production. This is a recommendation coming directly out of the planning team meetings with industry representatives who understand that the recent and ongoing flow of new species and diseases into and around Hawai‘i is creating a crisis for specific agricultural sectors and could dramatically limit future agricultural production in general.

(5) Undertake or commission a Baseline Study for Increased Food Self Sufficiency: Prepare a baseline study to determine the current inventory of resources on Hawai‘i Island as they relate to increased food production including land, water, labor, energy, materials, and supplies. The data will be analyzed and presented to County, State and U.S. federal agencies and elected officials to address existing regulations and recommend, in detail, economic initiatives needed to increase food self-sufficiency.

(6) Facilitate and advocate for formal and informal agricultural education to (a) assure that Hawai‘i residents understand the value of local agricultural production and can support demand for fresh, high quality local food, and (b) train knowledgeable producers to profitably and sustainably meet this demand.

(7) Work with U.S. federal and State agencies to improve agriculture inspection systems and storage facilities at Hawai‘i Island airports and harbors in order to ensure safe and efficient movement of locally produced agricultural products.

III. PLAN ELEMENTS AND IMPLEMENTATION

Uwē ka lani, ola ka honua.
When the sky weeps, the earth lives.
‘Ōlelo No‘eau, 2888

The County of Hawai‘i Agriculture Development Plan includes twelve plan elements, outlining the current situation for each element and the changes necessary to achieve the plan’s goals. Successful implementation of the plan requires a significant expansion of the county resources currently dedicated to supporting the agriculture industry on the island. Acknowledging that executing all of the plan action items will involve public-private partnerships and alliances; this document also suggests entities that could collaborate with the County to facilitate full plan implementation.

Although the key elements are presented in twelve discrete sections, they are interdependent and operate together as a system focused on increasing agricultural production on Hawai‘i Island. Each individual element is a necessary, but insufficient, condition for the growth of a vibrant agriculture sector in the county. For example, land, labor, water, energy, infrastructure, and transportation are necessary for the production of farm products. These products will only be created if the farm generates sufficient income for economic sustainability. Economic sustainability depends in part on research in technological advances, efficiencies gained through communication within the industry, education of the farmer and the consumer, and the effective processing and marketing of locally grown farm products. With each of these elements in place, greater food self-sufficiency can be attained and a local food system will be strengthened. On the other hand, this value chain will be threatened if invasive species are not controlled and eradicated.

Although it’s true that certain plan elements must be in place before others (e.g., land, water, labor, and energy, which are paramount), a critical link in the agricultural value chain is the creation and expansion of local processing and distribution channels, as noted in a previous section. However, the plan is written with the understanding that the island’s productive potential can only be realized when all the elements are adequately resourced and working as an efficient and integrated system.

In this section of the plan each element is presented and followed by a broad objective and a list of proposed action items intended to achieve the objective. The recommended actions in the plan can be modified over the next several years as industry and community needs change or as determined by the County and its Agriculture Policy Committee. A complete list of proposed action items, lead organizations, partners, and timelines is provided in Appendix F.

County of Hawai‘i Agriculture Development Plan elements include:

- A. Communication
- B. Economic Sustainability
- C. Food Self-Reliance and Food Security
- D. Marketing and Promotion
- E. Education
- F. Land
- G. Water
- H. Energy
- I. Transportation
- J. Infrastructure
- K. Research
- L. Invasive Species Protection

A. Communication

Current Situation. In order to achieve the plan’s vision of a thriving and sustainable agriculture industry, communication between the stakeholders and the community is essential. There are more than 70 agricultural commodity groups, cooperatives, and other industry organizations represented on Hawai‘i Island (Appendix G). Information about these groups and their activities is not currently available from a centralized source, resulting in inefficiencies and missed opportunities for collaboration. The floriculture industry recognized this problem and recently formed the Hawai‘i Floriculture and Nursery Association (HFNA) to provide statewide coordination for this sector of the agriculture industry. Other commodity groups are similarly organized, but there is still a great deal of room for improved communication and information sharing.

There is an abundance of agricultural and gardening information specific to Hawai‘i that is available on the Internet, in the island’s newspapers, through the UHM-CTAHR-Cooperative Extension Service (CES), County R&D, and various other sources. Yet, the plan’s listening sessions revealed a general lack of knowledge by the public and many in the agriculture industry, as to the existence and extent of this information.

Objective: Improve communication to increase efficiency and strengthen partnerships between the County, the agriculture industry, and the Hawai‘i Island community. Lead partner: County R&D and then an expanded County Agricultural Department.

The plan identifies the development of the Hawai‘i Island Agriculture Web site as one of its priority actions. The Web site will collect and disseminate agriculture-related information significant to the industry and the public, as well as promote the County R&D Agriculture Program. This Web site can serve as an information clearinghouse and repository, with links to available resources that will enhance the flow of information and encourage the development of partnerships and efficient use of resources. Though not every farmer or gardener has ready access to the Internet, this online resource will allow intermediaries to locate and disseminate the cataloged material in other mediums, e.g., printed hard copy, public presentations, and educational sessions, etc.

Proposed Action items:

- (1) Hawai‘i Island Agriculture Web site: Revise, update, expand and keep current the R&D Agriculture Program Web site as an information repository.
- (2) Agriculture Organization List: Update and keep current a master commodity and agricultural organization list with current contact information and links and post it on the Hawai‘i Island Agriculture Web site.
- (3) Media Partnerships: Enhance the dissemination of information about R&D's Ag Program.

B. Economic Sustainability

Current Situation. Economic sustainability refers to the ability of any agricultural business to profitably maintain operations over the long-term.

The plan’s goal of increasing agricultural production on Hawai‘i Island will be severely compromised unless systems are in place that allow farmers to reduce their production costs and to create efficient processing and distribution channels so that competitively-priced products are readily available to consumers at the local level and for export.

Hawai‘i Island farmers rely on O‘ahu and U.S. Mainland sources for almost all of their supplies, and the additional cost of shipping erodes profitability and contributes to relatively high retail prices. An increase in the availability of farm inputs, (such as fertilizer and feed) on Hawai‘i Island could dramatically lower the production costs of many farmers and ranchers.

The substitution of locally generated fertilizer and feed for imports is an essential part of the development of an economically viable local food system. Priority should be placed on ways of supporting composting operations, rendering facilities and research into viable locally grown feed options. These inputs are often the outputs of other island-based systems, for instance, green waste to compost, by-products of beef processing to bone and blood meal, potential by-products of biofuel production for feed. Some of these conversion processes will entail relatively large investments in infrastructure and/or research.

Additionally, farmers have competed with the tourism and construction industries for labor, creating a shortage of labor for farming and increasing the hourly wage the farmer must pay its employees. The Federal H2A program for non-immigrant foreign workers has been moderately successful in helping to solve the labor shortage. Providing incentives for hiring local workers should be explored through participation in the Hawai‘i Enterprise Zone (EZ) program, a partnership between State and County government and private enterprises meant to stimulate business activity and create and preserve jobs with tax and other incentives. Hawai‘i Island has established Enterprise Zones in parts of Hilo, Hāmākua, North Kohala, North and South Kona and Ka‘u.

Most Hawai‘i Island farms are small, and their size is often a barrier to utilizing cultivation and harvesting technologies that tend to reduce the costs of production. Mechanization on lands where it would be appropriate can be made available to groups of small farmers who could cost share on the equipment and take advantage of a technology previously beyond their financial means. An example of this is Agribusiness Development Corporation’s (ADC) work with the

island cattle industry to investigate the economic feasibility of the mobile slaughterhouse concept that has proven successful on Lopes Island, Washington, and is in use on the island of Maui. There are also Mainland models for farm equipment cooperatives that could be replicated on Hawai‘i Island.

In addition to cost-reduction measures, Hawai‘i Island farmers may be able to increase their revenue through sales to programs and government agencies such as the military, social services, and schools. State procurement laws were recently changed via Act 175, which provides a 15% price advantage to local farmers over Mainland imports. Technically, a local farmer’s price for a particular farm commodity can be up to 14% higher than the imported alternative and still be awarded a government contract in a competitive bidding process. The County should “lead by example” in its own food procurement processes and assist food producers in gaining access to additional government markets. However, it will be difficult to take advantage of this government buying capacity without adequate processing and distribution systems available to food producers.

Farmers can also take advantage of agricultural tourism as a method of increasing their revenue. Several agricultural tourism operations currently exist on the island, providing visitors with opportunities ranging from horseback rides to visiting the operations of a cacao farm.

Agricultural tourism is a permissible use on agricultural land (HRS Chapter 205 section 4.5 (13), and Bill 148 regulates agricultural tourism in Hawai‘i County. The County Planning Department is developing a brochure to include an application as well as instructions for operators.

Objective: Increase the profitability of Hawai‘i Island’s agricultural businesses through cost reduction strategies and greater market share for local products.

Proposed Action items:

- (1) Sales to county, state, and federal agencies - Lead by example: Convene a working group to meet with Hawai‘i County and Hawai‘i Department of Education food purchasing agent(s) to facilitate the sale of Hawai‘i Island grown agricultural products for the school lunch programs.
- (2)(a) Labor: Revise the method used to calculate the federal H2A prevailing wage rate.
- (2)(b) Labor: Post links on Hawai‘i Island Agriculture Web site of farm intern programs, volunteer programs, and contract labor providers.
- (3)(a) Production of Fertilizer and Feed: Realize the potential of County green waste conversion to compost for farming and gardening.
- (3)(b) Production of Fertilizer and Feed: Investigate the potential for using excess non-firm electricity to manufacture nitrogen for fertilizer.
- (4) Harvesting and Processing Techniques: Financially support research projects to develop small scale technology systems for cultivation, harvesting, and processing.
- (5)(a) Real Property Tax Incentives: Convene a working group to develop additional real property tax incentives for commercial agriculture operations and community gardens including adherence to HRS 205-46 IAL, make recommendations to the County of Hawai‘i Department of Finance Real Property Tax Division (Property Tax Division) and advocate for their acceptance.
- (5)(b) Real Property Tax Incentives: Post a link on the Hawai‘i Island Agriculture Web site to the agriculture dedication program of the Property Tax Division.
- (6) Financial Resources: Post links on the Hawai‘i Island Agriculture Web site to sources of financial assistance for farmers and ranchers including grants and loans for projects, promotions,

start-up capital, and operations, as well as a list of sources that can assist with the application and business planning process involved.

(7)(a) Agricultural Tourism: Establish a Special Use permitting process for small scale agriculture operations.

(7)(b) Agricultural Tourism: Seek variances for older structures that had no permit requirement when they were erected so that they can be permitted for Special Use.

C. Food Self-Reliance and Food Security

Current Situation. Producing more of the food we eat on Hawai‘i Island is a desired goal of many in the community. At the State level, Governor Linda Lingle has designated “Food Self-Sufficiency” as one of her key initiatives for 2009. The Governor said, “We need to take action now to increase food self-sufficiency for Hawai‘i and preserve and strengthen the agricultural industries for future generations.”

This increased food self-sufficiency would provide new opportunities for the agriculture industry with positive impacts for the economy as a whole, as suggested by the 2008 CTAHR study on the effects of food import substitution.

Food security is an especially salient issue in an island setting. The availability of most of the food supplied by retail stores depends on an uninterrupted shipping service. It is widely accepted that these retail outlets have only enough food to last approximately two weeks. In the case of emergencies—natural disasters, labor strikes or interruptions to shipping deliveries—no clear plan exists for food sourcing and distribution. Currently, the State and County Hazard Mitigation Plans do not have specific actions for food producers and distributors to follow. Note that these Mitigation Plans will be reviewed and updated in 2010.

Additional benefits of greater food self-reliance include (1) increased access to fresher—and possibly healthier—food, (2) the economic multiplier effect of circulating wealth within the island community rather than shipping dollars off-shore, and (3) a potential reduction in invasive species.

The market share of locally grown food varies widely among many products. Locally grown fruits, for example, enjoyed a 36% market share in 2007; vegetables were close behind with a 34% share of the local market (Appendix H). There is an opportunity for farmers to produce a greater variety of the fruits and vegetables currently being imported; for example, watermelons (once a major import) have captured 77% of the local market for fruit. Given the current prices of feed and limited processing capacity, the commercial production of protein is especially challenging. Dairy, however, seems to be turning an economic corner with improved pricing and production processes, and the continued existence and expansion of the beef industry on Hawai‘i Island seems possible with additional infrastructure investment. In short, this plan calls for the systematic examination of any and all products that could be generated on Hawai‘i Island to determine whether, with what resources, and at what scale they could be added to the food supply and/or to agricultural inputs.

Local food systems provide farmers with a greater degree of control over the price of their products and consumers with more say over the selection and variety of food they find in stores.

By contrast, industrial food systems compromise the market power of farmers and consumers, and provide middlemen distributors with an inordinate amount of control over food variety and price. Industrial food systems inflate the retail price of food products while squeezing the profits of farmers. Any program that brings farmers closer to consumers, such as farmers' markets, CSA's, and promotions like the Buy Local, It Matters campaign, will tend to move Hawai'i Island closer toward a more robust local food system.

There are many levels at which this local system can be built. The most basic is the front yard and home garden, with a second level being the school or community garden. These settings can not only add to the food supply in substantial ways (*'ulu*, mango, avocado, and banana trees, *u'ala* as ground cover, row crops grown by students, etc.) but also provide important sites for family and community-based agricultural education. A concerted effort to reestablish home gardening and informal community exchange is one element in assuring local food security and should be encouraged by County actions and regulations.

The majority of Hawai'i farms are small family operations scattered among a limited number of medium to large-scale commercial operations. Closer connections and greater local market control can be formed between farmers and consumers through an expansion of subscription-based Community Supported Agriculture (CSA) programs, farmers' markets, local processing and branding initiatives (exemplified by Mountain Apple Brand), and locally-based food distributors.

Objective: Increase the local production of food consumed on Hawai'i Island by growing and marketing commercial crops to substitute those being imported and by encouraging island residents to grow some of their own produce. Facilitate the use of federal subsidies, such as food stamps, in CSA's and at Farmers' Markets.

Proposed Action items:

- (1) Baseline Study for Increased Food Self-Sufficiency: Explore funding sources (e.g., WSARE OR USDA Rural Development) and partners to prepare a baseline study to determine the current inventory and future need of resources as they relate to increased food production including land, water, labor, energy, materials and supplies. The data will be analyzed and presented to County, State, and U.S. federal agencies and elected officials to address existing laws, rules and economic incentives needed to increase food self-sufficiency.
- (2) Emergency Food Sourcing and Distribution: Review, analyze, and revise, as needed, existing plans for sourcing and distributing food on Hawai'i Island in an emergency situation.
- (3) Import Situation: Encourage and support new and existing farmers to produce crops to replace those currently being imported by disseminating information on the Hawai'i Island Agriculture Web site with links to statistical data and cultivation information for crops that can be grown for import substitution.
- (4)(a) Home and Community Food Production: Encourage consumers to produce some of their own food with educational programs for home gardeners and dissemination of information on the Hawai'i Island Agriculture Web site.
- (4)(b) Home and Community Food Production: Advocate for the development of community gardens and include a list of these gardens on the Hawai'i Island Agriculture Web site.

(4)(c) Home and Community Food Production: Review regulatory impediments to home food production.

D. Marketing and Promotion

Current Situation. Marketing and promotion programs for Hawai‘i’s crops and value-added products are critical for the growth of both local and export sales. The cost to develop and sustain a successful marketing program is beyond the means of many small farmers. Some larger private corporations (e.g., macadamia nut companies), farms, and ranches (e.g., Hāmākua Springs and Kahua Ranch) have their own branded promotion strategies. Small farms and commodity groups can benefit from the same type of program by jointly promoting their products at trade shows and in the general market, and by participating with retail distributors in a model exemplified by the Mountain Apple product line.

The County R&D and the HDOA have supported both brand and generic commodity marketing efforts over the years in partnership with commodity groups, cooperatives, and individual branded products. This has been accomplished primarily through the following:

- (a) Trade shows: national and international for export crops, e.g., coffee, macadamia, tropical fruits, and flowers; and local opportunities for chefs and buyers to sample products, e.g., the exhibition before the Taste of the Range public event.
- (b) Production of collateral and educational material, e.g., recipes, posters, point-of-sale material and informational brochures.

There are a number of existing marketing and promotion programs administered by various governmental agencies as noted below. Island farmers can utilize these and other programs rather than incur the cost to develop new promotion strategies.

- (a) Buy Local, It Matters. The Buy Local, It Matters campaign aims to encourage residents to support Hawai‘i farmers by making conscious decisions to purchase locally grown produce. This campaign is a joint project involving UHM-CTAHR, the Hawai‘i Farm Bureau Federation, and the HDOA. The County R&D Agriculture Program joined this promotion as a funding partner in 2008. As a community service, the Hawai‘i Medical Service Association (HMSA) also sponsors the printing of the Buy Local, It Matters Seasonality Chart, which contains information on when different types of local produce is in season. The KITV Morning News crew also features a Hawai‘i farmer and chef preparing dishes using Hawai‘i produce each month. Three Hawai‘i Island farmers were featured in 2008, and one was featured in the first quarter of 2009.
- (b) Seal of Quality.⁵ The HDOA Seal of Quality Program was established to protect the integrity and value of Hawai‘i branded farm and value-added products. Products with this seal are genuine Hawai‘i-grown or Hawai‘i-made premium products, a guarantee enforced by the State of Hawai‘i. In the case of value-added goods, the primary agricultural product must be entirely produced in Hawai‘i.
- (c) Country of Origin Labeling 6 (COOL). As of September 30, 2008, the USDA’s mandatory COOL program became effective for retailers. The law is designed to distinguish U.S. goods from imports and is seen by many as a way to expand on “buy

local” promotions. The law covers muscle cuts and ground beef, veal, lamb, chicken, goat, and pork, as well as perishable agricultural commodities such as fresh and frozen fruits and vegetables, macadamia nuts, pecans, ginseng, and peanuts. USDA had previously implemented the COOL program for fish and shellfish commodities in October 2004. This program allows retailers to label the goods, packages, shelves or bins with tags. The labeling could say “Product of the U.S.A.” or “Hawai‘i Grown.” These origin labels can appear on stickers, placards, stamps, bands, twist-ties, and pin tags.

In addition to government-assisted promotions, locally grown food is also marketed in the community through farmers’ markets and CSA’s, where the interaction between consumers and farmers successfully promotes local produce. There is room for expansion of these direct marketing and sales channels, and some of this expansion could be supported through one-time USDA grants to improve access to fresh local food for lower-income residents, e.g., by increasing capacity for CSA’s and Farmers’ Markets to process EBT payments.

Special events featuring island farmers and chefs are another way to promote locally grown food, and the introduction of new or exotic crops can create a demand for local food where it did not previously exist.

This plan recommends that the County assist farmers in taking advantage of all of the marketing opportunities noted above and work with retail food outlets to encourage the optimal labeling, placement, and promotion of local food items.

Objective: Increase awareness and sales of Hawai‘i Island’s crops and value-added products for local consumption and export with effective marketing strategies.

Proposed Action items:

(1)(a) Farmer/Livestock Producer and Grocer Relations: Coordinate and facilitating meetings between farmers and grocers in East and West Hawai‘i to identify ways to improve retail labeling and increase promotion of local agriculture products.

(1)(b) Farmer/Livestock Producer and Grocer Relations: Support Farmer/Retailer workshops modeled after the Farmer/Chef workshops to share information and to enhance the farmers’ and vendors’ understanding of each others’ challenges and constraints. Training and information can be presented on Buy Local, It Matters; Seal of Quality; product branding; and other promotional tools.

(2) Farmers’ Markets: Encourage development and growth of farmers’ markets by posting a link to HDOA’s list of Hawai‘i Island farmers on the Hawai‘i Island Agriculture Web site.

(3) Promotion Programs: Continue to support agriculture industry promotional programs, food and trade show participation.

(4) Buy Local, It Matters Campaign: Continue funding and participation in the HDOA’s Buy Local, It Matters campaign and encourage Hawai‘i Island farmer and commodity group participation. A line item shall be established within the County R&D agriculture program budget in an amount not less than \$26,000 for Buy Local, It Matters annually.

(5) Seal of Quality: Encourage producers to participate in the HDOA Seal of Quality program and post links to the program on the Hawai‘i Island Agriculture Web site.

E. Education

Current Situation. Agricultural education is a key component in the development of future farmers, increased community food self-reliance, knowledgeable consumers, and responsive policy makers. Currently, interest in farming as a career choice is low, as are enrollments in formal agricultural education programs. Home production of food, once a way of life in our rural communities, has significantly decreased over the last generation. Most consumers do not understand how their food choices help to develop an agricultural economy or that eating fresh, locally grown foods provide increased nutritional value and improve overall health. Agricultural education is in need of revitalization.

Agricultural education begins with our children. Good nutrition and a healthy connection with nature is an essential building block for student success. School Gardens K-8 can be the beginning of a reconnection to food, farming, family, and community. Our high schools and post secondary schools can provide curricula that inspire young people to reconnect with the land, using ecologically sound methods of farming suitable for tropical agricultural production, distribution, and sales of products. However, elementary and secondary school programs, pervasive until the 1970s, have been neglected or dismantled; they need to be revived and integrated into the core curriculum of our public schools.

There are limited opportunities emerging at the post secondary and continuing adult educational level for students who seek a career in agriculture, for those already in agriculture to expand their knowledge, and for the community to regain the knowledge of tropical home production. We recommend that UH Hilo, Hawai'i Community College (Hilo and West Hawai'i) become revitalized and expanded centers for sustainable tropical agricultural education for the young farmers of tomorrow in the Pacific Rim. Current educational initiatives include the following:

- School Gardens are beginning to sprout throughout Hawai'i island. The Kohala Center's Hawai'i Island School Garden Network is assisting schools at the K-12 level with garden development, curriculum development, professional education, grant opportunities, nutritional education, and agricultural resources. Currently, 50 of 75 schools are part of this network, though most of these programs lack sufficient funding for a garden teacher. There is also one Hawai'i Youth Agricultural Project in which high school and college students intern at a North Kohala farm. An expanded public/private funding partnership will be needed to adequately support this school and community garden initiative, along with additional support for youth after-school programs such as Future Farmers of America (FFA) and 4H Clubs.
- HCC Hawai'i Community College offers a two-year Associate Degree in Agriculture. HCC also has a program that prepares students to manage native and planted forests and includes an intern program. They also have the Mahi'ai Associate in Applied Sciences Degree (A.A.S.). This program encompasses an interdisciplinary local and global knowledge base that allows students to consider a wide variety of potential careers. The West Hawai'i Campus has no agriculture programs at this time.

- UH Hilo-CAFNRM (College of Agriculture, Forestry, and Natural Resource Management) offers a Bachelor of Science degree with seven areas of specialization focusing on crops, livestock, forestry, and aquaculture production and management.
- University of Hawai‘i at Mānoa on O‘ahu offers eleven undergraduate programs in agriculture as well as graduate programs. UHM also has a new Sustainable and Organic Agriculture Program.
- Kaua‘i Community College is now offering the Food Industry Career Pathways Program. The goal of this program is to increase the supply of locally grown food by training people in the skills of home gardening, community gardening, and small commercial gardening. Their newest “Seed to Table” Training Program began in September 2009 and includes hands-on experience and classroom instruction in the living art of farming in Kaua‘i’s semi-tropical environment. We recommend that this type of farmer training program be replicated on Hawai‘i Island.
- Leeward Community College on O‘ahu has incorporated the Ma‘o Farm Youth Leadership Training College Internship Program leading to an AA Arts degree for 17-24 year olds. Students spend 20 hours a week operating a commercial farm while attending LCC. This is a model also recommended for replication through an HCC/private sector partnership.
- Maui Community College has both AA Applied Science degrees and Certificate Programs in many areas of agriculture, including sustainable tropical horticulture.
- The Agricultural Leadership Foundation of Hawai‘i (ALFH) provides a statewide multi-disciplinary Leadership Training Programs for those working in agriculture and rural businesses and organizations.
- County of Hawai‘i Research and Development Agriculture Program has sponsored regional educational opportunities for both farmers and home producers. Programs include a series, “Practical Agriculture for Hāmākua” coordinated by the Hilo-Hāmākua Community Development Corporation, and Hawai‘i Island Homegrown Food Self-Reliance Workshops.
- The Kona Outdoor Circle’s “Tropical Gardening Program” provides agricultural education to new and experienced gardeners in the Kona area. The program focuses on managing lands in sustainable ways that help fulfill the mission of KOC to create “clean, green, and beautiful” landscapes.
- The Puna Small Farm Initiative will give volunteers educational opportunities on existing farms and help support the future of Puna’s small family farms.
- Seed Exchanges - Educational venues for farmers and gardeners to learn about seed saving on a local grassroots level are provided by The Eastside Seed Exchange every fall and by the Hawai‘i Island Seed Exchange every year in Kona.

- The University of Hawai‘i at Mānoa – College of Tropical Agriculture and Human Resources (CTAHR), County Extension Services offices in Hilo (Komohana Agricultural Station), Waimea (Mealani Agricultural Station), and the Kona Agricultural Station provides educational and consulting services to commercial farmers and ranchers. Home producers are served through the Master Gardener Program. Currently, resources for these programs are shrinking and some areas of the island are underserved.
- Island agricultural commodity groups hold annual educational conferences providing producers with new research on technology, production, and market news.

Consumer Education: Improved consumer education regarding the widespread benefits of consuming locally grown food is a critical factor in the effort to increase food self-sufficiency and build a viable local food system. Research has shown that consumers are very price-sensitive with regard to food purchases. This presents a challenge for local farmers because locally grown food is often sold at a higher price than the imported alternative in our retail stores. Increasing consumers’ understanding of the importance of agriculture to the local community and building relationships with local farmers can mitigate this pricing effect to some degree. The Hawai‘i Department of Agriculture’s “Buy Local, It Matters” campaign is an example of efforts to encourage residents to support Hawai‘i’s farmers by making conscious decisions to purchase locally grown foods. Other promotions have been conducted by County R&D and the nonprofit group Kanu Hawaii.

Increasing consumer knowledge about basic nutrition and how to prepare fresh agricultural products may also increase the desirability of local products. Start Living Healthy⁷ is a promotion campaign sponsored by the Hawai‘i Department of Health (HDOH) and funded through the Tobacco Settlement. This multimedia educational campaign, with partnerships in both the private and public sectors, is designed to provide the people of Hawai‘i with easy to understand information on healthy living, including information on healthy food choices. Additionally, health care insurers have programs, publications, and classes to promote healthy eating. Also, there are some programs that encourage people to rediscover diets based on Pacific Island traditions. These programs stress the importance of fresh fruits and vegetables, which promotes consumption of local products.

Informing Policy Makers: County elected and appointed officials, as well as civil servants, are often uninformed about the agricultural industry and discount its importance in relation to other industries. This is reflected in the attention given to other economic sectors, which receive a disproportionate share of public resources in comparison with agriculture. If there were a sufficient number of Hawai‘i County agricultural staff members, at least one of those staff members could act as a liaison to other government entities and officials to educate them in the importance of investing in agricultural systems to address the basic needs of the citizens they serve.

Objective: To increase the availability and quality of agricultural education on Hawai‘i island.

Proposed Action items:

(1) Kindergarten through High School: Encourage educational and agricultural entities to work with the Hawai‘i Island school system to promote careers in agriculture.

- (2) Industry Education: Continue support for community education programs and commodity conferences.
- (3) Consumer Education: Continue and expand the Hawai‘i Department of Health’s programs and private programs that educate consumers in basic nutrition, the value in purchasing and preparing locally grown crops.
- (4) Education for County Personnel: Develop an educational program for County elected and appointed officials, as well as civil servants, that focuses on the importance of agriculture and its potential benefits for Hawai‘i County and the state, so that these individuals can assist the industry in becoming a predominant economic driver.

F. Land

Current Situation. Providing suitable agricultural land at a reasonable cost to farmers is a key factor to the sustainability and expansion of the agricultural industry in Hawai‘i County. Market prices for all land on Hawai‘i Island are driven largely by sales of residential and resort properties. This condition hinders the ability of farmers to purchase affordable land for farming. In order to counter the movement of using agricultural lands for residential and commercial development, the State passed the Important Agricultural Lands (IAL) legislation (HRS 205-47). The intention of the IAL is to protect select agriculture lands by keeping them in long-term agricultural use.

The counties are required to identify and map the IAL within 60 months after the legislature approves funding and the funds are released by the Governor. In this process, the County is mandated by the law to consult with landowners, the HDOA, agricultural interest groups, including representatives of the Hawai‘i Farm Bureau Federation, USDA Natural Resource Conservation Service (NRCS), County Planning Department, and other groups that have a stake in the outcome of this process. Although preliminary mapping of IAL lands is shown in the County of Hawai‘i General Plan, the formal process to complete the maps has not been started.

The 2008 State Legislature passed Act 233, providing landowners with economic incentives to place their lands in the IAL status. Additionally, the law requires the counties to develop their own set of economic incentives to encourage the use and development of agriculture on IAL. Landowners on Maui and Kaua‘i petitioned the State Land Use Commission to give certain lands IAL status; their petitions were approved.

HDOA Agricultural Parks are another means of obtaining land suitable for farming. The parks are located in Pahoia, Panaewa, Keahole and Hāmākua (Appendix M). These parks provide land at reasonable lease rates for farming. In addition, HDOA has separate parcels of agricultural land available to lease for farming throughout the county. In the past, Hawai‘i Department of Land and Natural Resources (HDLNR) controlled most of the agricultural leases for crop and range land, but these leases are slowly being transferred to the control of the HDOA, where the personnel have more expertise in managing agricultural properties and policies are generally more favorable to farm and ranch businesses.

State and County funding programs exist for the purchase and preservation of agricultural land threatened by reclassification and rezoning for other uses (Appendix N). The State statute HRS 173, known as the Legacy Land Conservation Program, provides a degree of protection for

parcels that are unique and productive agricultural lands. The County of Hawai‘i allocates 2% of the annual property tax (not allocated in 2009 and 2010 because of severe budget constraints) for the purchase of legacy lands.

Besides large tracts of fallow land, an underutilized resource is agricultural lands owned in relatively small parcels (5 to 200 acres). Enforcing County level tax assessments which give a break to land that is truly being used for agriculture might increase the amount of land available for farmers, as landowners will have greater incentive to make the land productive. Having an array of legal agreement models could encourage a larger number of landowners to make land available for agriculture with lower transaction costs to the lessee and lessor.

Even when reasonably priced land is available, County zoning laws related to housing on agricultural land can be an impediment to farming. The lack of simple regulations to permit farm worker housing construction is a serious problem for farmers who require housing to attract farm labor for their operation. Clustering of farm labor housing or the use of barrack-type facilities are needed if agriculture is to expand. The ADC is investigating a demonstration agriculture worker housing project at its Kekaha property on Kaua‘i that could be a model for Hawai‘i Island. Similarly, there should be legal ways for young family farmers to move on to land with minimal residential infrastructure, allowing for residential infrastructure improvements to be built as agricultural activities grows and becomes profitable.

Objective: Secure affordable land with long-term tenure for farming and ranching, and simplify permitting for farm dwellings and farm worker housing.

Proposed Action items:

- (1)(a) Designation of Important Agricultural Lands (IAL): Secure funding to implement the identification of mapping of IAL.
- (1)(b) Designation of Important Agricultural Lands (IAL): Identify and map IAL according to the process defined in the IAL statute HRS 205-47.
- (1)(c) Designation of Important Agricultural Lands (IAL): Disseminate information on the incentives for the designation of IAL to the landowners, farmers, ranchers, and the public.
- (2) Agricultural Leases: Coordinate with agricultural industry organizations to secure affordable, long-term agricultural leases.
- (3) Agricultural Park Listings: Post links to HDOA and HDLNR Agricultural Park information.
- (4) Agricultural Worker Housing: Form a Working Group to review all U.S. federal, State, and County laws and regulations that affect agriculture worker housing on Hawai‘i Island and formulate recommendations that will facilitate the development of agriculture worker housing. These recommendations shall be forwarded to the County Planning Department, County Council, and County Planning Commissions for review and action.
- (5) Grubbing and Grading Ordinances: Revise the County's grubbing and grading ordinances as they pertain to agriculture, especially with regard to oversight and inspection permits or farm dwellings and farm worker housing.
- (6) Land Buffers: Support efforts by the industry to require that buffers between existing agricultural lands and proposed rural or urban development be the responsibility of the land developer.

G. Water

Current Situation. Water is an essential component of a successful Hawai'i Island agriculture industry. Stored water (reservoirs) must be provided to crops and livestock where rainfall is insufficient and during periods of drought. Currently, there is insufficient stored water available for agriculture due to a lack of water systems infrastructure. As a result, many farmers depend on rainwater catchment systems or trucked water.

The County Department of Water Supply's (DWS) policy is to provide potable water to much of the island's population. Commercial agricultural operations can use water from DWS systems and may apply for preferential rates. These rates are not available for mills, packing, or treatment facilities. In the case of water shortages or service problems, domestic water customers have priority use. DWS does not have an agricultural water plan.

There are four (4) major agricultural water systems (non-potable water) on the island:

- (a) Kohala Ditch System. This system, owned and operated by Surety Kohala Corporation, was severely damaged by the earthquake of October 2006. The Kohala Ditch Project Steering Committee, a community-based stakeholder group of ditch users, led a two-year fundraising effort and secured approximately \$5 million in federal, state and private funds to repair the ditch and restore irrigation to North Kohala farms. Under the oversight of State Civil Defense, the North Kohala Community Resource Center served as fiscal agent for the repair effort. Remaining state funds may be expended until June 30, 2010. Additional federal funds are expected in the 2010 federal budget. A USDA/CREES grant is assisting ditch stakeholders organizing the newly incorporated nonprofit Kohala Ditch Foundation to operate the ditch to serve agricultural irrigation, and as an educational and cultural benefit for the North Kohala Community.
- (b) Lower Hāmākua Irrigation System. This system is operated by the HDOA and services areas from Kukuihaele to Pa'auilo. The system was also damaged by the earthquake of October 2006. HDOA has made repairs and improvements to this system so water is available to farmers.
- (c) Upper Hāmākua Irrigation System. This system is also operated by HDOA, and services farmers in Waimea and Lalamilo. The system is functional, although repairs and improvements are necessary to increase the delivery of water to the farmers.
- (d) Pahala Ditch System. The water source for this system is owned by the HDLNR. The system was not maintained following the closure of the sugar company in Pahala, but volunteers have repaired portions of the system and farmers have limited access to the water.

The State Commission on Water Resource Management (CWRM) has an Agricultural Water Use and Development Plan (AWUDP) that was written by the HDOA in 2003 with revisions in 2004 and 2008. The AWUDP addresses the major issues concerning the two HDOA systems, but does not address the other two systems on the island.

The Ka‘u to South Kona Water Master Plan was completed in September 2004. The plan addresses the future water requirements for the area from Ho‘okena to Na‘alehu. Much of this area has no public water system and DWS considers it outside its service area.

The South Kona Watershed Irrigation Project is a partnership among the County R&D, U.S. Environmental Protection Agency (EPA), USDA NRCS, the HDOA, and the Kona County Farm Bureau. The Project was initiated to develop an agricultural irrigation system to service the communities of Honomalino and Kapua. The project is currently in the Environmental Impact Statement (EIS) development phase.

This plan recommends that a comprehensive analysis of existing and potential island water resources be undertaken with a systemic approach that examines both potable and agricultural water, their relationship to energy use and production, and the potential effects of climate change on drought and flood cycles to plan for appropriate and adequate water capture and storage. This analytic work might be accomplished through a public-private partnership with foundation and government funding. The results of this analysis would be used to advocate for and inform future water system development.

Objective: Provide adequate and affordable agricultural water for farmers, livestock producers, and food processors.

Proposed Action items:

(1)(a) Department of Water Supply (DWS): Include agricultural water in County water system expansion plans.

(1)(b) Department of Water Supply (DWS): Monitor DWS to insure the continuation of preferential agricultural water rates.

(2) Agricultural Water Systems: Continue to support and serve as an information resource for new and existing agricultural water development on Hawai‘i Island.

H. Energy

Current Situation. The agriculture industry depends on energy derived from imported fossil fuels for transport as well as for electricity and fuel to run farm machinery and processing, packing, and refrigeration equipment. When the price of oil peaked in the summer of 2008, energy costs on Hawai‘i Island hit record highs and substantially increased the cost of production and transportation.

Significant transformation of electrical production and transmission is needed for long-term energy sustainability, in combination with energy conservation and improvements in operating efficiencies. The high oil prices of 2008 brought these issues to the forefront; the current political climate makes it more affordable for individuals, businesses, and the community to make changes that are necessary for becoming more energy self-reliant, e.g., through the use of renewable resources and by energy efficient practices.

The 2008 Farm Bill provides grants and loans for farmers, ranchers, and rural small businesses to purchase renewable energy systems and to make energy efficiency improvements.⁹ Additionally, tax incentives initiated by the U.S. federal and State governments present an opportunity for

farmers and agricultural businesses to transition to alternative energy sources. Hawai'i Electric Light Company (HELCO) offers incentives for energy saving measures. A complete list of current incentive programs can be found online at the Database of State Incentives for Renewables and Efficiency (DSIRE) Web site.

Farmers can also enter into a net metering agreement with HELCO to produce electricity using photovoltaic cells (solar panels). This allows the meter holder to offset a portion of electricity use by producing electricity that enters HELCO's grid through a two-way meter. The amount of electricity that HELCO can receive via net metering is presently capped at 2% of the utilities peak demand. However, the Public Utilities Commission (PUC) can increase the cap. The PUC has also proposed a feed-in tariff that could allow small private ventures, including agricultural entities, to become net energy producers to HELCO, though the details are not yet available.

Private investors and businesses are beginning to enter into power purchase agreements (PPA's) that offer an opportunity for agricultural operations to lower energy costs without incurring the cost of investment in photovoltaic systems. Under the condition of these agreements, an alternative energy system, e.g., solar, is installed and operated by a private investor who pays for upfront costs and collects the benefits from U.S. federal and State tax incentives. Farmers, ranchers, and other owners of agriculture land can potentially lease land to energy producers wanting to invest in solar or wind energy farms.

Act 122, a State law enacted in June 2009, allows for the formation of agricultural parks that allow for transmission of electrical energy across Tax Map Keys. The development of such agricultural park energy systems may also be an opportunity to cut farming and processing costs.

Growing crops for biofuels and using crop by-products to run machinery and equipment offers an opportunity for new agriculture enterprises. Although producing biofuels for export will be difficult due to global competition, production for local use has potential. Excess or waste heat can be deployed for direct use in agricultural production such as aquaculture ponds or applications for value-added processing of crops and off-peak production of fertilizers and other inputs.

Besides employing alternative sources of energy, farmers can conserve energy and lower their production and transportation costs. Energy audits can reveal methods to reduce or maximize an operation's use of electricity. Typical measures include using compact fluorescent light bulbs (CFL's), upgrading to newer more efficient machinery, e.g., refrigeration and air conditioning units, or retrofitting existing equipment. Additionally, efficiencies in transportation can be realized with the transition to energy efficient vehicles including diesel or hybrids, and other new technologies as they become available. Coordinating and combining processing and delivery with other farmers also offer savings in electricity and transportation costs.

Recent developments related to local bio-energy production have the potential to cause land-use conflicts but may ultimately open the door to new agricultural crops and a greater degree of energy self-reliance. Recently formed biofuel companies are looking for very large tracts of land to grow raw material such as timber for wood chips, or oil palm, algae, and jatropha for liquid fuel. The opportunities that a biofuel industry might present include infrastructure improvements,

enhanced energy security, an increase in agricultural support services, and funding for research to develop biofuel crop production techniques for Hawai‘i’s requirements. The challenge will be to find the right food-fuel balance that safely and sustainably uses and replenishes island resources. For a further discussion of biofuel issues on Hawai‘i Island, (see Appendix I, *Biofuels in Hawai‘i: A Case Study of Hāmākua.*)

Objective: Reduce the costs of energy and fuel for agricultural producers.

Proposed Action items:

- (1) Incentives for Installation of Alternative Energy: Post links on the Hawai‘i Island Agriculture Web site to U.S. federal, State and local programs that offer incentives and assistance for the agriculture industry to transition to alternative energy systems; keep the links updated as opportunities emerge.
- (2) Private Agricultural Parks: Educate and encourage Hawai‘i Island Farmers and ranchers to participate in the activities outlined by the 2009 Act 122 which allows for private agricultural parks energy production and transfer.
- (3)(a) Biofuel Energy Production: Support research to develop small scale, efficient, on-farm systems for biofuel production and processing.
- (3)(b) Biofuel Energy Production: Develop large-scale biofuel projects that will supply renewable transportation fuels and power for Hawai‘i Island in ways that are community-supported, sustainable, ecologically sound, and complementary to food production.
- (4) Conservation: Post links on the Hawai‘i Island Agriculture Web site to resources for energy audits and energy efficiency topics; keep links updated as new technologies or programs become available.

I. Transportation

Current Situation. All agricultural export products are dependent on air or sea transportation. This is also the situation for all offshore farm inputs. The USDA recognized the importance of adequate transportation for agricultural products in a November 2003 report submitted to the U.S. Congress titled “Report on Geographically Disadvantaged Farmers and Ranchers.”¹⁰ The report stated that “Hawai‘i shippers of agricultural products do not have adequate transportation infrastructure and equipment necessary to be competitive.”

Hawai‘i Island has two major airports: Hilo in East Hawai‘i and Keahole, Kona in West Hawai‘i. Both are used for agricultural transport. Air shipment of perishable produce is generally dependent upon unit load device (LD) container space on passenger aircraft, as there are few dedicated cargo aircraft. Express services, such as FedEx and UPS, have backhaul (Hawai‘i to the U.S. Mainland) space but this is usually contracted to larger grower/shippers. The coffee and floral industry have negotiated less expensive rates for air shipment and the Hawai‘i Farm Bureau Federation is working with Aloha Air Cargo to offer a discounted rate to its members statewide.

The 2005 Hawai‘i County General Plan addressed the deficiencies noted in the USDA report when it set the goal of providing transportation terminals and related facilities for the safe, efficient, and comfortable movement of people and goods. Specifically, the plan sought to “encourage the programmed improvement of existing terminals, including adequate provisions

for control of pollution and appropriate and adequate covered storage facilities for agricultural products.” Additionally, the plan intended to “encourage the construction of an Agricultural Processing and Packing Center at the Old Hilo Airport, the planning of which shall be coordinated with future development plans for Hilo Harbor,” and “encourage the construction of a centralized air cargo distribution complex at the Hilo International Airport.”¹¹

Hawai‘i Island's two deep draft harbors (Hilo and Kawaihae) also lack the space and facilities to adequately handle perishables prior to shipping. In particular, there is no warehouse at Kawaihae to protect cargo from the high temperatures prevalent there. The situation at Kawaihae was further exacerbated when the October 2006 earthquake damaged Kawaihae Harbor’s Pier 1, which has been out of service ever since. Although Kawaihae Harbor facilities are scheduled for repairs, and the funds have been allocated, the work has not begun. The State is in the process of developing The Hawai‘i Island Commercial Harbors 2035 Master Plan and is expected to complete the plan in January 2010.

Ground transportation on Hawai‘i Island also provides significant challenges to the movement of local agriculture products. The Hawai‘i Belt Highway circles the entire island and is the primary route for all vehicular traffic. Congestion on this highway can be severe in particular locations and at given times during the day. The Saddle Road crosses the island between Mauna Kea and Mauna Loa from Hilo to South Kohala. Although recent improvements on this road make it safer and more user-friendly, freight is generally not moved along this route, adding to the congestion on the Belt Highway. If agricultural transport cannot take place during periods of lowest traffic congestion, at least some consolidation of loads through cooperative agreements among farm entities might minimize the time and costs involved in roadway transport for each collaborator.

Objective: Improve transportation systems and infrastructure for the movement of agricultural products within and off Hawai‘i Island.

Proposed Action items:

(1)(a) Agricultural Shipping: Convene a Working Group with harbor and airline management and agricultural shippers to determine the most effective method to improve handling at the point of shipment of perishable products and livestock.

(1)(b) Agricultural Shippers: Monitor that the improvements agreed on in the meetings are implemented.

(2)(a) Marshaling Yards: Inventory existing facilities for produce consolidation (HDOA Marshaling Yards) and determine needs for renovation of existing facilities and development of new ones.

(2)(b) Marshaling Yards: Publish facility list on the Hawai‘i Island Agriculture Web site.

J. Infrastructure

Current Situation. Packing and processing facilities assist agricultural producers in adding value to or preparing their farm products and livestock for the market. Facilities within individual operations exist for packing or processing of crops such as flowers, fruit, and vegetable crops. In other cases, cooperatives may operate a facility such as the Kamuela Vacuum Cooling Plant. Some commercial operations purchase farm gate crops and custom process or pack for farmers.

Examples of these facilities include Kona coffee mills, macadamia nut processors, and Hawai‘i Pride, an irradiation treatment facility for tropical fruit.

As the agriculture industry expands, there is a need for HACCP (Hazard Analysis and Critical Control Point) certified facilities. A safe food certification pilot program for farmers throughout the state will be managed by the HDOA and was funded in Act 09 of the 2009 legislature. In addition, HDOA has training programs to assist the farmer in complying with Farm Food Safety and Good Agricultural Practices (GAP). Note that the cost of complying with HDOA regulations is very high and is dependent on abundant quantities of potable water at low cost. It will be important for an entity or entities with Hawai‘i County to acquire the resources to establish processing facilities adequate to the new regulations and able to operate sustainably from an economic perspective.

Slaughterhouses in East Hawai‘i for beef, pork, and sheep include Kulana Foods in Hilo and Hawai‘i Island Beef in Pa‘auilo. Presently, there are no operations that process poultry or farm-raised fish for independent producers on the island. Permitting and regulations add to the cost of developing new operations such as these, and the volume of animals or fish may not sustain the economies of scale needed to profitably operate the facility. Similarly, there are no rendering plants on the island to recycle the waste from live animal and wild-caught fish processing facilities. Waste is currently taken to the landfill or buried on site. This adds to the volume of waste in the island’s landfills and may not be allowed in the future. It also disposes of potentially useful rendering by-products.

The lack of adequate slaughterhouse and rendering facilities severely limits ranchers ability to process beef for local consumption. There is increased demand for grass-fed beef and a heightened interest on the part of the Hawai‘i Island cattle industry to cooperate in ways that would produce high quality local beef and generate adequate returns to expanded local processing operations. These facilities are essential to both the availability of locally produced protein and the provision of important local agricultural inputs for vegetable and fruit crops.

Discussions regarding the production of timber for lumber products are ongoing, but to date only small independent timber mills exist, producing wood for crafters, cabinet, and furniture makers. On a somewhat larger scale, Hawai‘i Island Hardwoods focuses on higher-value solid lumber products from a mixture of species, and plans to build a new state of the art facility. In addition, Tradewinds Inc., plans to mill hardwoods for the laminated veneer lumber market for export and to establish a biomass power plant as part of its operation in O‘okala. Expanded wood processing infrastructure should provide additional opportunities for the timber industry to supply a local market that imports nearly all of its building materials.

Farm infrastructure can also benefit from developing commercial kitchens that allow for the creation of value-added products. There are cumbersome Hawai‘i Department of Health (HDOH) rules for small scale, on-farm operations for food manufacturing. Therefore, community kitchens and incubator kitchens for shared use are important for adding value to local crops. Community kitchens are shared by small businesses that find it impractical to set up their own facility, and incubator kitchens are used by start-up food manufacturers until they are able to establish independent operations. The incubators are generally small and offer support services

in addition to space and equipment to help the business get established. The kitchens are HDOH certified facilities providing small-scale, multi-use manufacturing of food products and are usually rented by the hour. In East Hawai‘i there are a number of kitchens that may be rented for value-added processing, however, this is not the case in other parts of the island. A recent study by the Kona Producers Cooperative determined the cost and risks were too high to develop a new community kitchen in West Hawai‘i. Start-up and small-scale food manufacturers may be able to use existing HDOH certified kitchens during off-peak hours at churches, schools, restaurants or other facilities.

There is an opportunity to assist these potential food manufacturers by taking inventory of existing kitchens to determine those that are willing to rent their facility and publish this list on the Hawai‘i Island Agriculture Web site. If more sophisticated food processing facilities are warranted to handle increases in local food supply, there is possible private and USDA support for their establishment.

Objective: Develop additional packing and processing facilities for ranching and agricultural crops, timber, and value-added products.

Proposed Action items:

- (1) Slaughter Houses: Develop and implement a plan to develop slaughter house and farm-raised fish processing facilities on Hawai‘i Island.
- (2) Rendering Plant: Develop and implement a plan to build a rendering plant for Hawai‘i Island.
- (3)(a) Community Kitchens: Inventory existing certified community and incubator kitchens available for use by food manufacturers.
- (3)(b) Community Kitchens: Post and keep updated a list of certified community and incubator kitchens available for use by food manufacturers on the Hawai‘i Island Agriculture Web site.
- (4) Input Production and Distribution Systems : Obtain funding and permitting to facilitate the development of input production and distribution systems.

K. Research

Current Situation. To expand production and diversity and to continually improve the quality of its agricultural output, Hawai‘i needs to invest in research. This may necessitate a shift from the research resources that were designed during the era of “big sugar” to an emphasis on developing cutting edge practices that support sustainable farming, ranching, forestry, and floriculture.

There is a lack of consensus about the specific research needed for many of the different crops grown on Hawai‘i Island by the agricultural community. Sources of funding for research are often in short supply, especially if there is no concerted effort to secure funding by the agricultural commodity groups in partnership with researchers. Some of the commodity groups, such as the Hawai‘i Tropical Fruit Growers, have prioritized their research requirements and have been successful in securing funding from the State, County R&D, and the U.S. federal government through the Western Sustainable Agriculture Research & Education (SARE) program. The revitalization of the UHM-CTAHR Industry Analysis process has succeeded in prioritizing research for those commodities that have used it. Some groups, such as the Hawai‘i cattlemen’s organizations, have collaborated on strategic plans that require research to accomplish their goals.

Aquaculture research is in its infancy and has the potential to be a major economic driver on Hawai‘i Island. There are presently two entities that are capable of expanding research, the Natural Energy Laboratory of Hawai‘i Authority (NELHA) in Keahole, Kona, and the Pacific Aquaculture and Coastal Resource Center (Center) in Hilo. The Center is a joint effort by the UHH, County of Hawai‘i, the State and the Keaukaha Hawaiian Homelands Community Association. In addition to research, the Center is a training facility for local aquaculture farmers and university students. In addition, the State Aquaculture Development Program (ADP) provides support services for the aquaculture industry. Attracting funding for aquaculture research is presently a limiting factor to expanding the industry.

Other research entities include the Pacific Basin Agriculture Research Center (PBARC), Hawai‘i Agriculture Research Center (HARC) on O‘ahu, the UHM-CTAHR, and UHH-CAFNRM. There is a lack of knowledge within the farming community about the research presently being done at UHM-CTAHR, UHH-CAFNRM, PBARC, and HARC which could be remedied with better industry-research center communications systems.

Research on genetically engineered agricultural crops is being conducted on five islands in the state of Hawai‘i by corporations and university and government institutions. Although aspects of this type of research are controversial at the present time, it has made a contribution to the island’s agricultural industry through the development of the ring-spot resistant, genetically engineered papaya. In 2009, the Hawai‘i County Council banned the growing of and research on genetically engineered taro and coffee varieties. The Hāmākua Agricultural Development Plan calls for Hāmākua to be a GMO- Free Zone. Public discussion of future plantings or outdoor research of genetically engineered agricultural crops on Hawai‘i Island is ongoing. Citizens who participated in the public listening sessions for this Agricultural Development Plan suggested that the Precautionary Principle be adopted by the County as a lens to view future genetically engineered crops or research in the field. We recommend that County officials continue a serious and informed dialog with citizens and agricultural producers about such principles to formulate effective County Policy.

Because of its varied climates and the bounded nature of the island, Hawai‘i has the potential to attract research that focuses on integrated system approaches to agricultural development at the individual farm, commodity, district, and island-wide level. The Hawai‘i County Department of Research and Development recognizes this opportunity and should be a catalyst for public-private partnerships that bring researchers and research programs to Hawai‘i Island to study and develop sustainable agricultural systems and assist in determining how to maximize the use of island resources for the long-term well-being of the land and its inhabitants. Hawai‘i Island and its various educational institutions could also take the lead in research that focuses on sustainable development of the Pacific Basin region, attracting researchers and students as part of an economic sector based on agricultural and natural resource knowledge generation.

Objective: Facilitate practical, applied research that will assist local farmers in crop and livestock production using sustainable techniques and establish the Island of Hawai‘i as an internationally-recognized center for tropical agricultural research. Effectively disseminate the research results and recommendations to the agricultural community.

Proposed Action items:

- (1) Funding: Continue to assist with funding of industry supported research.
- (2) Improve Communication: Disseminate research results to the public and agriculture community by publishing final reports of Agriculture Program funded projects. Post links to these reports and other Hawai'i agriculture research sites on the Hawai'i Island Agriculture Web site.
- (3) Research Conference: Initiate a major applied research conference on Hawai'i Island encompassing tropical agriculture and aquaculture.

L. Invasive Species Protection

Current Situation. Invasive species are an increasing threat to the local agricultural industry. The current safeguards are inadequate due mainly to the lack of adequate staffing for the government agencies responsible for the regulation and inspection of cargo.

HDOA staff in the Plant Industry Division inspects incoming cargo from the U.S. Mainland and some foreign shipments, and the U.S. Department of Homeland Security inspects much of the cargo from international ports and airports. The HDOA Plant Industry Division uses a commodity-specific risk level assessment system that is updated on a regular basis. This new system was instituted as part of the bio-security program required since 2005. Where the risk is very high, such as pests found in organic leafy vegetables and some flowers imported from Southeast Asia, 100% of incoming products are inspected. The majority of the outgoing agricultural products are inspected and regulated by USDA Animal and Plant Health Inspection Service (APHIS) with some participation by the HDOA Plant Industry Division.

State legislators are aware of the extremely detrimental effect invasive species are having on the Hawai'i agricultural industry, and recently passed a law (Act 236) to implement the bio-security program. This law permits the HDOA to collect a fee on incoming cargo (\$0.50 per 1,000 pounds of cargo) to fund the program.

Another facet of the invasive species problem is inter-island and intra-island transfer of pests. This is proving to be an increasing concern on Hawai'i Island. The discovery of the honeybee varroa mite (*Varroa destructor*) on O'ahu, followed by its appearance in East Hawai'i and its inevitable spread throughout the island is a good example of the difficulty of inter-island and intra-island control.

The Big Island Invasive Species Committee (BIISC) is a frontline group of private citizens, community organizations, businesses, landowners, and government agencies that works with the existing agencies and organizations to prevent the entry of new pests and to control those already on the island. In cases where timely action is needed and the other entities are not addressing the pest problem, BIISC responds quickly to increase the local capacity to attack the problem. In addition to BIISC there are two State groups dedicated to control of invasive species, the Coordinating Group on Alien Pest Species (CGAPS), and the Hawai'i Invasive Species Council (HISCS). The CGAPS is comprised of management level staff from every major agency and organization involved with invasive species and the HISCS is a policy and coordination group

that works with State, U.S. federal, and international agencies to control and eliminate harmful invasive species.

One of the best strategies to control invasive species is to increase Hawai'i's agricultural production and, in particular, production on Hawai'i Island. This would decrease importation of agricultural products that are a main source of invasive pests.

In the short- and medium-term, a much higher rate of inspection is needed to prevent new pests from being introduced into the islands and greater effort needs to be put in educating residents about preventing and limiting the spread of invasive species on the island, as well as techniques for eradication when available. There are many agencies with partial responsibility for addressing the problem of invasive species. The County should be a coordinating entity that assures these organizations and entities are working together most efficiently. The County should also advocate for adequate resources for invasive species inspection, eradication, education, and research.

Objective: Eliminate the introduction of new invasive species to Hawai'i Island and eradicate those that are already present.

Proposed Action items:

- (1)(a) Invasive Species: Convene and facilitate meetings between the stakeholders when a new invasive species is identified on Hawai'i Island and develop strategies to manage the pests.
- (1)(b) Invasive Species: Develop a page on the Hawai'i Island Agriculture Web site on Invasive Species that include links to pertinent organizations and government agencies.
- (1)(c) Invasive Species: Support ongoing efforts of HDOA and Congressional Delegates regarding initiatives to improve invasive species inspection and entry prevention.

IV. HAWAI‘I ISLAND’S AGRICULTURE INDUSTRY

I ola no ke kino I ka mā‘ona o ka ‘ōū.
The body enjoys health when the stomach is well filled.
‘Ōlelo No‘eau, 1246

Trends

Presently, there is a wide diversity of agriculture crops grown on Hawai‘i Island that are marketed locally and internationally. Since the mid-1800s, the main export crops from Hawai‘i Island were sugar, beef and hides, remount horses, macadamia, papaya, coffee, flowers, cool climate vegetables, and koa lumber. Except for sugar and remount horses, all of these crops are still important island exports. In the mid- to late-twentieth century, many other crops, including milk, bananas, foliage, ginger root, tropical fruits (lychee, longan, and rambutan), live cattle (usually weaned calves), and peach palm hearts were exported mainly to O‘ahu, Japan, and the U.S. Mainland. These crops, as well as several others, are still exported from Hawai‘i Island.

The trend that has developed over the last ten to fifteen years is that more crops are being produced for local on-island consumption and for the state as a whole—especially for O‘ahu with its population of 1.2 million and for the state’s annual visitor population of 6–7 million per year. Those involved in the local agricultural industry are not only striving to produce a variety of crops to replace imported foods, they are using sustainable farming methods that result in improved soil and water resources as well as quality products for consumers. For example, UHM-CTAHR currently works with farmers to (1) grow improved pasture forages that are easier for herbivore animals to digest, and (2) utilize new strains of fattening forages, e.g., ekoa (*Leucaena glauca*), to replace imported feed.

According to the USDA 2007 Census of Agriculture (Appendix J), the major commercial crops on Hawai‘i Island are export crops that represent almost 80% of total market value. The 2007 annual sales figures for the three major crop categories are:

- | | |
|----------------------|--------------|
| • Orchard Crops | \$68,150,000 |
| • Flower & Nursery | \$60,865,000 |
| • Livestock (Cattle) | \$30,476,000 |

The total market value of crop and livestock production combined for 2007 was \$202,572,000.

Hawai‘i Island represents slightly greater than 60% of both the total farms and the total acreage farmed in the state; however, the overall market value of sales represents approximately 40% of the state. This is due to a disproportionate ratio of extensive livestock acreage on Hawai‘i Island. O‘ahu has the highest market value per acre farmed.

Some interesting statistical trends in recent years are: For the time period USDA Census 2002–2007, the number of farms on Hawai‘i Island increased by 45% while the amount of land for farming decreased by 17%. The market value of production increased for the same period by 8%, in contrast to the state trend of decreasing market value. Hawai‘i Island and the state as a whole reflected the national trend of an increase in the number of farms that averaged fewer acres per farm.

Major challenges and opportunities exist, in the short- and long-term, for farmers and ranchers on Hawai‘i Island. The County R&D can make substantial contributions by helping to address the challenges and by taking advantage of the opportunities through its partnerships with the local agricultural community.

Crop and Livestock Industries

The expansion of commercial agriculture on Hawai‘i Island is dependent upon its profitability for participants. In addition to the problems outlined in the critical areas, there are crop specific challenges as well as opportunities that affect each individual industry. The industries’ ability to successfully meet industry-specific challenges and opportunities will, to a large extent, determine the economic impact of agriculture in the county. As the County of Hawai‘i implements its Agricultural Development Plan over the next few years, in partnership with agricultural industries on the island, the impact of the combined effort will be a strong and positive impetus to position the agriculture industry as a major economic force on Hawai‘i Island.

(The source for all statistics noted for each crop is the most recent NASS information in cooperation with the HDOA.)

Ornamentals and Nursery

Hawai‘i Island’s ornamentals and nursery industry represents a segment of export agriculture on the island that began with the introduction of the anthurium to Hawai‘i in the late 1800s. The industry is currently one of the largest segments of agriculture on Hawai‘i Island.

The industry is made up of four primary groups: orchids, cut flowers, foliage, and potted plants. A number of other ornamentals and nursery products are included in other categories (lei flowers, landscape plants, sod, and unspecified sales) by the NASS.

The ornamentals and nursery industry on Hawai‘i Island is comprised of more than 430 farms. Most of these farms are located on the eastern side of the island where a favorable climate, e.g., warmer year-round temperatures, consistent and heavier rainfall, and light to moderate winds, present the best growing conditions.

This industry’s revenue is derived primarily from exports to retailers on the U.S. Mainland. Since retail sales of most floriculture and nursery products fall into the discretionary income category, it can be expected that sales will decline over the next several years due to current economic conditions. Nursery products that support local development projects, such as sod and field stock, will also see a drop in sales due to the slowdown in construction and residential development on Hawai‘i Island. In 2008, the ornamentals and nursery industry grossed \$42.8 million on Hawai‘i Island.

Challenges:

- Increases in competition from Mainland and foreign flower producers are negatively impacting the industry.
- Shipping (air cargo) costs will increase the cost of products in export markets as fuel prices continue to rise over time.

- A lack of computerized programs (for assessing the costs of potted plants) hinders efficiency.
- Agrichemicals and packing materials that are imported increase finished product costs relative to increasing fuel costs.
- Since most of the products are discretionary purchases, sales can be expected to decline due to the current worldwide financial situation.
- Local sales will decline with the reduction of both the tourist and the construction industries.
- Declining export sales may jeopardize the continuation of non-stop Hilo to Mainland FedEx flights due to decreases in outgoing products.
- Consumers are looking for new and unique varieties of flowers and foliage.

Opportunities:

- There are local market opportunities, such as direct advertising to Hawai‘i residents or an increased in the presence of floral and nursery products at supermarkets, restaurants, and hotels.
- Improved computerization for calculating costs and comparisons with out-of-state competition will assist the industry in competitive pricing and cost control.
- Training in risk management will improve the industry’s ability to overcome problems.
- Targeting new export areas, such as large international resorts, will increase sales.
- Negotiating back-haul rates with various airlines and air cargo companies can lower shipping costs.
- The development of new and unique varieties for the market will improve competitiveness.

Livestock

The 2007 Hawai‘i State Legislature passed House Concurrent Resolution #170, Senate Draft 1, “Requesting The Department of Agriculture To Establish A Task Force To Develop Long-Term Solutions To Effectively Protect The Livestock Industry In Hawai‘i.” In addition, The Livestock Feed Reimbursement Program (LFRP) passed by the Legislature in 2007, created a livestock revitalization program that gives grants for a short term to qualified producers to reimburse a percentage of their feed expenses. These recent State laws represent the start of the State’s process in giving more substantive assistance to the livestock industry. Implementation of the

County of Hawai‘i’s Agriculture Development Plan will further support the livestock industry in its achievement of economic stability.

Livestock - Cattle. Cattle ranching has been a major commercial activity on Hawai‘i Island since 1830, when the prohibition on cattle disturbance was lifted; the *kapu* was mandated by King Kamehameha I following the arrival of eight cows and four bulls in 1793 and 1794. The first cattle industry products were hides and salt beef for merchant marine ships sailing to and from Hawai‘i.

Today, most of the cattle ranches on the island are cow and calf operations. Calves are either sold to a broker for shipment to the U.S. Mainland; or they are “grown out” by ranchers on Canadian or U.S. Mainland pastures, and “finished” at a Mainland feedlot before being sold “on the hoof” or “on the hook.” In recent years, there has been a successful effort to sell Hawai‘i Island grown grass-fed and grain-fed cattle within the state. Locally grown and processed beef is gaining in market share because shipping costs have increased and consumers are concerned about the nutrition, quality, and freshness of the foods they buy.

Hawai‘i Island produces 60% of the cattle in the state. Cattle are raised on the island in all districts and micro climates.

Challenges:

- A constraint to expansion of beef processing is the lack of sufficient or large enough slaughterhouses that meet stringent U.S. federal and State health requirements.
- Competition for grazing land among other agricultural users, especially planned bio-energy crops, has the potential to be a limiting factor.
- Grazing leases are often not long-term.
- Occurrences of Bovine Spongiform Encephalopathy (BSE) in Canada and the U.S. Mainland can severely impact the market.
- There is a lack of diverse marketing and promotional activities for the cattle industry.
- Transportation is costly and often inefficient, especially for the live shipment of cattle.
- The cost of shipped grain is too expensive for Hawai‘i grain-fed beef to be competitive in the local market.
- The local grass-fed beef is often inconsistent in quality and quantity.

Opportunities:

- There is an opportunity to provide more beef for consumers statewide; this means increases in beef production. Increased production, in turn, creates incentives to invest in better and expanded processing facilities.

- Promotion of locally produced beef, including value-added products, provides an opportunity for market expansion and increased revenue.
- Improvements in the availability of good land—at a reasonable cost and with access to water—for pasture will provide the resources for improved pasture and cattle carrying capacity and for grass-fattening cattle for the local market.
- The production of local feed utilizing forages and by-products, instead of the use of imported grains, would provide a wider range of options for marketing higher quality beef.
- Increased funding for research will hasten the development of better pasture for grass fattening cattle and the types of cattle suited to a grass fattening regime.
- The education of policy makers and legislators will enhance perceptions about the industry and engender a favorable political climate.
- Agricultural tourism expansion is a potential source of additional revenue as cattle ranching in Hawai‘i is perceived by many as glamorous and has historical and cultural value.

Livestock - Sheep. Sheep ranching has been an agricultural activity on Hawai‘i Island since the 1800s. During the early 1900s and to the 1950s, Parker Ranch in Waimea raised and sold lamb and mutton locally, as well as on O‘ahu. Wool was also an important product shipped and sold on the U.S. Mainland. After Parker Ranch stopped raising sheep at its Humuula Station, sheep ranching decreased. In the late 1980s and early 1990s, hair sheep were imported and bred on the island to provide range and orchard management of grass and weeds. This was followed by resurgence in growing sheep for meat. A North Kohala ranch is one of the largest producers of sheep; its lamb products are used at many fine restaurants statewide. No statistics are available for island sheep, due to privacy issues, as there is only one main producer.

Challenges:

- Processing facilities are limited.
- There is a lack of sheep numbers which presents problems in securing marketing funding and developing markets.
- Wool prices are low and shipping costs are high; also, there is no wool market in Hawai‘i.
- Expensive fencing is required to protect the sheep from predators, especially dogs.
- Health problems, such as worms in the wool, are frequent in sheep.

Opportunities:

- There is an expanding market for quality, locally raised lamb and mutton products.

- The ease of pasturing smaller animals on small farms increases interest in purchasing sheep for this type of operation.
- Organically raised sheep is an untapped market.

Livestock – Swine. Swine production has been a part of Hawai‘i’s agriculture since the arrival of the first Hawaiians, who brought pigs in their sailing canoes. Pork was an important part of the Hawaiian diet, and pigs were grown domestically for their meat. The domesticated pigs eventually escaped into surrounding forests, and have since become a source of food for modern-day hunters and their families.

In the past, pig farms existed in all island districts, and pork was consumed locally as well as sent to O‘ahu. In the late 1960s and 1970s, pork production on the island declined. As feed costs increased and competition from U.S. Mainland pork producers accelerated, Hawai‘i Island pig farmers were not able to produce price competitive pork. In addition, strict environmental regulations on waste management added another level of expense for swine operations. Presently, swine farms are small, family-owned operations that sell products to local clientele. There are approximately 70 of these on Hawai‘i Island.

Challenges:

- Waste management is one of the most difficult obstacles to profitable swine production.
- Grain feed costs imported to Hawai‘i are high.
- Importation of live hogs is a major constraint for local producers.
- Disease in hogs can be difficult to manage.
- There is a need for improved genetics.
- There is little or no marketing program for local pork products.
- There are no slaughter facilities in West Hawai‘i for swine, which means trucking to Hilo.

Opportunities:

- The development of new waste management technology provides an opportunity for swine production on Hawai‘i Island to be cost competitive with Mainland imports.
- There is a large market for pork products and for weaned pigs produced from swine with improved genetics.
- Pork has strong, stable pricing in the marketplace.
- Improved farm practices, such as artificial insemination, can make island pork production more cost effective.

- Research to improve the quality of waste food for feed can improve the cost of production.

Livestock - Goats. Llamas, Other Exotic Animals. Goats arrived on Hawai‘i Island in the 1800s, escaped into the wild and proliferated on the island; they became a source of meat for hunters and their families. Domestic goats are raised for milk and meat. Goat cheese has become a popular item at gourmet and hotel restaurants. In addition, goats are used successfully for weed and grass control throughout the island. Cull goats from these herds are sold “on the hoof” to people from various ethnic groups who enjoy goat meat in their diets.

Llamas and other exotic animals, such as miniature horses, have been imported to Hawai‘i Island and are bred here. These animals are a hobby industry; this industry provides interesting field trips and displays at local fairs for school children and families.

Challenges:

- Importation and quarantine regulations can be a constraint when bringing in exotic species to Hawai‘i Island.
- There is a lack of health programs and veterinarian expertise for treating these animals.
- Waste management for confined pens is difficult.
- There is a very limited market for some of these animals and their products.
- Theft is a problem, especially for the smaller species.
- Meat products are generally confined to ethnic markets.

Opportunities:

- Individual farmers have developed excellent goat milk products, such as cheese, that have a stable and increasing market, especially in gourmet restaurants.
- Increasing marketing will help expansion of the industry.
- There are agro-tourism opportunities for these farms.
- More support and interest from the agriculture industry will assist these farmers and advance the possibilities for expansion.
- Better public education about these animals could encourage more hobbyists and those interested in recreational and educational opportunities for school-age children to raise these animals.
- Processing facilities will assist goat farmers in marketing meat.

- Improving the genetics of some species, such as goats, will improve production and quality.

Livestock - Dairy Cattle. The dairy industry on Hawai‘i Island has been one of the most important agricultural businesses to supply basic food (e.g., milk for school lunches) for Hawai‘i Island and O‘ahu. Dairies appeared on Hawai‘i Island in the 1800s. Each district on the island had its own dairy, which provided for residents within the district and also exported milk products to people outside of the district. Most cattle ranches had dairies, and most of the dairy cows were grazed on pasture. A small amount of locally grown grain, usually corn, was fed to supplement the pasture. Gradually, island dairies adopted the Mainland model of milk parlors and dry-lot feeding combined with cow grazing to achieve cost efficiencies and to compete with Mainland milk that was being shipped to supermarkets on O‘ahu.

Because of the continually increasing costs of imported grain, dairies are no longer profitable. Only two dairies remain in the state and both are located on Hawai‘i Island. All the rest of the milk consumed in the state is shipped from the U.S. Mainland. The two remaining dairies, one of which is located in Kohala and the other in Hāmākua, are struggling financially to remain in business. These two dairies produce less than 20% of the state’s fluid milk requirements. Their dry milking cow herds total 1,500 head. The average farm price for milk is \$35.40 per 100 weight (June 2009).

Challenges:

- Imported Mainland produced milk is sold at a cost lower than local dairies can produce.
- Costs for imported grain are too high.
- The state milk quota is a constraint.
- Waste management is a problem.
- Heat stress in some areas can decrease milk production and cause health problems in cow herds.
- Urban encroachment can be a problem.
- Transportation of milk to other islands is costly and schedules for delivery are not flexible.

Opportunities:

- Expansion of the dairy industry on the island—for the purpose of supplying a much greater proportion of the state’s milk supply—is possible.
- Pasture improvement research and extension could lessen the requirement for Mainland feed imports.

- More forage production products, such as silage, could decrease the amount of grain needed and extend the utilization of pasture during dry periods.
- The demand for locally produced milk products is high—the supply, at present, is insufficient to meet demand.
- Public policy is supportive of more local milk production because of security issues.
- Dairy herd expansion could generate a dairy heifer and young stock grazing business.

Livestock – Fowl. Fowl have been on the island since the early Hawaiians brought chickens on their sailing canoes. The various ethnic groups that later came to Hawai‘i brought chickens, ducks, and turkeys. These types of fowl were home-raised for food. Commercial production was minimal until large poultry farms were established for meat and eggs in the 1950s. Hawai‘i was self-sufficient in these products until the last couple of decades. However, with the high costs of imported grain and the advent of cost-effective mega poultry farms on the Mainland (such as Tyson’s and Foster Farms), Hawai‘i farms were no longer price competitive.

There are presently no Hawai‘i Island poultry farms producing meat or eggs on any large scale, and the island’s supermarkets are dependent on Mainland imports for most of their poultry products. However, there are several small poultry farms with 100 to 300 chickens, mostly layers. These farms are starting to supply local stores and farmers’ markets. There are no accurate statistics available for poultry.

Challenges:

- Locally grown poultry products, raised on grain in confined poultry houses, cannot compete with low cost Mainland poultry products.
- Food safety regulations are becoming more stringent.
- Regulations for importing poultry replacement hens are stringent.
- Waste management is a problem.
- There is no poultry slaughter facility on Hawai‘i Island.
- There are no veterinarian services specializing in poultry.
- Urban encroachment is a problem because of odor.
- More backyard producers are raising fowl, diminishing the demand for the commercial product.

Opportunities:

- Pastured poultry is perceived as a higher quality product and may command a higher price for a limited clientele.

- Better market promotion will educate the consumer about local poultry products.
- Some ethnic groups prefer fresh poultry products.
- Eggs produced by poultry raised on pasture are often preferred by the consumer who will pay a higher price.
- Locally produced poultry products are fresher.
- Ducks and geese are in demand for sustainable weeding practices.
- Compost and manure waste products provide an excellent source of locally produced crop nutrients.

Aquaculture

Aquaculture in Hawai‘i dates back to the early Hawaiians who developed a very sophisticated system of salt water and brackish water ponds with gates that opened to the ocean for water circulation. In these ponds, Hawaiians raised mullet (*Mugil cephalus* Linnaeus), moi (*Polydactylus sexfilis* Valenciennes), and many other species of fish for food.

Commercial aquaculture on Hawai‘i Island is centered at NELHA on 322-acres at Keahole Point in Kona. Individual companies are producing algae, shrimp, lobster, abalone, and other products in tanks using deep sea water.

Other commercial ventures are centered in Kohala and East Hawai‘i. Some examples are:

- Tropical Ponds Hawai‘i, LLC, produces a variety of freshwater aquarium fish for both the local market and for export.
- Friendly Aquaponics grows tilapia and uses the fertile water to grow hydroponic vegetables.
- Honomu Aquatics produces juvenile tilapia and catfish for the local market.
- Kohala Crawfish Farm grows crawfish and juvenile freshwater prawns.

Below is a summary of the general categories of commercial aquaculture products that are currently grown on Hawai‘i Island:

- Marine shrimp. Due to its isolation, Hawai‘i can maintain a stock of disease free shrimp that is propagated and sold as seed stock to commercial operations in other parts of the world.
- Freshwater fish. Carp, catfish, and tilapia.

- Saltwater fish. Moi, mullet, *kahala* (amberjack), Japanese flounder.
- Seaweed or sea vegetables, such as ogo.
- Ornamental fish and plants, such as the seahorse.
- Oysters and clams.
- Coldwater warehousing of lobsters and crabs from the Atlantic Coast.

Hawai‘i County continues to lead the state in sales of aquaculture products with \$20.2 million annually which represents 80% of the state's annual sales.

Challenges:

- Providing an adequate and reliable supply to buyers can be difficult to accomplish.
- The certification of crop quality is inadequate.
- There is inadequate support by State and U.S. federal quarantine services.
- There is only one UHM-CTAHR aquaculture extension agent for Hawai‘i Island and 50% of his time is required on funded research.
- Transportation is inadequate and costly.
- There is a lack of highly skilled technicians required by the aquaculture industry.
- Costs of aquaculture processing facilities and operations are high.
- The cost of imported feed is high.
- When State resources of land or water are used, an Environmental Assessment (EA) or EIS is required.
- Importation of new stock requires an EA.
- Plant quarantine approvals can take years for new species.
- There is no process to certify fish hatcheries.
- There is no lab to certify waters for shellfish culture.
- Government departments (HDLNR & HDOH) are not supportive of the aquaculture industry.

- Financing resources for aquaculture development is inadequate.
- University of Hawai‘i aquaculture programs struggle to secure funding.

Opportunities:

- Production of fresh aquaculture food products can be expanded.
- Marketing promotion of locally grown aquaculture products will educate the consumer as well as public policy persons about the quality and nutritional advantages of these products.
- A full spectrum of aquaculture crops is available on a year-round basis. This gives the aquaculture farmer the opportunity for a stable cash flow during the year.
- There is the potential for ultra-high quality products.
- Aquaculture products have many uses so the market is varied and large.

Forestry

Forestry has been a part of the Hawai‘i Island economy and culture since the first Hawaiians arrived on the island. Trees were cut down and shaped for canoes and wood was used to make implements, weapons, bowls for food, etc. Forest products were used for rope, decorative items, medicinal products, and many other items that were useful in daily life. With the arrival of merchant mariners, missionaries, and the myriad peoples who settled in Hawai‘i during the 1800s and 1900s, wood products from native forests became an important commercial crop, starting with the sandalwood export trade in 1790.

Koa (*Acacia koa*) wood is the premier native wood and has been harvested for centuries. It is now being planted as a plantation forestry crop along with other species such as varieties of eucalyptus and other exotic tropical hardwoods like teak (*Tectona*) and mahoganies. A 12,500-acre eucalyptus plantation planted in the 1990s in Hāmākua; 3,700-acres in Ka‘u; and 4,500-acres in Waimea (a total of 20,700-acres for the three plantations) are ready for harvest. In addition, the Waiakea Timber Management Area near Hilo has 11,700-acres available for harvest. Logging of both koa and ‘ōhi‘a continues today in native forests. However, the supply of koa is limited as livestock grazing replaced many of the native forests in the past two centuries and regrowth after logging was very limited because of the conversion of the land to pasture. This situation is changing in the twenty-first century as many of these pasture areas are being restored to native and plantation forests by landowners, the State, and environmental groups. Sawmills that sell both rough-cut and finished lumber have existed in Hawai‘i for the last 200 years. However, these businesses are usually two- or three-man operations that mainly produce high value koa lumber. Two mills are being built in Hāmākua, one for veneer production and the other for lumber. A third lumber mill is currently operational. The veneer mill will use the waste from veneer processing to produce electricity for HELCO. Bio-energy companies are negotiating for land to plant trees and for access to stands of timber to harvest for energy production. There are presently more than 20,000 acres in standing, harvestable timber on Hawai‘i Island that could be cut and milled during the next few years.

Challenges:

- There is a need to develop economic harvesting and processing technology for Hawai'i Island industrial forestry that includes both large and small operations.
- A major constraint is the perception held by members of the rural communities that industrial forestry will have a negative impact on the community.
- Applied research is needed to obtain better information on growth and yield.
- Economic and operational information is needed to allow operations and family farms to be economically sustainable.
- There is insufficient training available for industrial forestry jobs.
- Landowners are limited in their silviculture and forest management skills.
- There is a lack of readily available financing or capital for industrial forestry development.
- There is a lack of suitable industrial sites for processing mills.
- The markets for timber by-products are limited.
- Market development needs to be improved.
- Labor costs that include benefits are very high for timber operations.
- There is a lack of clear and consistent guidelines for landowners who want to use safe harbor agreements to protect themselves and endangered species on their land.
- There is no mechanism for payments for ecosystem services, e.g., carbon sequestration and watershed protection.

Opportunities:

- Industrial tree species have good growth rates that provide a competitive edge for trees grown on Hawai'i Island.
- There is a large knowledge base about the silviculture of industrial trees species on Hawai'i Island that accumulated over a long period of time and which facilitates the growing of these species.
- Existing road systems developed by sugar plantations and ranching decrease the cost of this type of infrastructure for a timber operation.

- There is the potential to produce higher value timber products, such as veneer and saw timber.
- The expansion of the craft and furniture trade can be encouraged.
- Biomass for energy production has the potential to be an important economic crop from waste generated by the manufacture of veneer and saw timber as well as for whole-tree harvests.
- Locally grown timber products provide import substitution for building materials and energy.
- There is the potential for skilled job creation on Hawai‘i Island in forest plantation establishment, consulting, harvesting, and manufacturing.
- There is the possibility of payments for ecosystem services, e.g., carbon sequestration and watershed protection.

Vegetable Crops

When the first Hawaiians settled in Hawai‘i around 1000 AD, according to archaeological records, they brought taro, sweet potato, and yam. These nutritious food crops were the staples of the Hawaiian diet and are important crops that today are grown for both home and commercial use. As the population of Hawai‘i Island diversified, each new ethnic group brought favorite food crops and vegetable variety expanded.

Today, the list of commercially grown vegetables is long, and the quantities produced by our local farmers are expanding. Cruciferous vegetables like cabbages, have been produced commercially by farmers in the Waimea region of South Kohala since the early 1900s; these have also been shipped to O‘ahu markets. Taro, a staple of the pre-contact Hawaiian diet, and its products (*poi*, taro chips, taro rolls, and bread), have become more prevalent in the marketplace and popular with consumers. Presently, demand for taro and taro products exceed supply. The promotion of Hawaiian Regional Cuisine by a group of innovative chefs in the 1980s, and their efforts to educate farmers about the produce they needed, prompted farmers to expand production of lettuces, tomatoes, bell peppers, and many other nutritious vegetables. As the quality and variety of farm produce improved, the demand increased, and today farmers’ markets and local supermarkets carry a wide array of vegetables grown on Hawai‘i Island. The farm gate value of vegetable production on Hawai‘i Island in 2006 was \$15.4 million.

Challenges:

- Fertilizers, chemicals, fuel, boxes, and other packaging materials must be imported and are expensive for farmers.
- Energy costs associated with refrigeration have increased dramatically in recent years.

- Because of the smaller size of the vegetable farms on Hawai‘i Island, local farms have difficulty competing with mega farms on the U.S. Mainland and in foreign countries in terms of production costs.
- Farmers are pressured by competing uses of land, especially if their farms are located near urban or rural towns.
- New pests and diseases are being introduced continually.
- Facilities, such as marshalling yards and refrigeration boxes, are limited and aging where they do exist.

Opportunities:

- Varying climate zones give Hawai‘i Island farmers more choices in the type of vegetable crops they can grow.
- Hawai‘i Island vegetables are known for their high quality, an attribute that can be promoted to expand the market.
- Locally grown vegetables are fresher than imported vegetables—this aspect can be promoted to expand the market.
- Hawai‘i Island growers can expand exports to O‘ahu markets.
- Increasing sales at farmers’ markets has potential.
- Working closely with Hawai‘i Island grocery stores to display and label local vegetables and to hold food demonstrations will educate consumers about these vegetables.
- More education about the nutrition and quality of Hawai‘i Island vegetables will assist in promoting local vegetables to the consumer.
- Investigation of the feasibility of exporting Hawai‘i Island vegetables to Alaska will educate farmers about export potential.

Orchard Crops

Since the early 1800s, orchard crops were grown but relegated to home use and small commercial plantings for local markets. In the early 1900s, banana flour was an export crop from Hawai‘i. Many orchard crops were brought to Hawai‘i by botanists as single specimens and improved cultivars developed from these. In the mid 1930s, Ralph H. Moltzau and J.H. Beaumont started working on improved varieties of macadamia. Later, researchers at UHM-CTAHR and other dedicated farmers developed improved cultivars of mango, papaya, avocado, lychee, longan, and other orchard crops. As CTAHR released these cultivars, which produced fruits and nuts of better quality and higher yields, commercial industries based on these orchard trees became feasible.

Orchards represent a long-term commitment to agriculture on Hawai‘i Island. The high cost of developing new orchards is not returned for several years as some crops take twelve or more years to reach full production. Once planted, orchards tend to stay in production unless pests, disease, or market conditions make them no longer feasible for farming. The continual introduction of invasive species to Hawai‘i is a serious threat to the industry. Orchards can be less than an acre (as in the case of some coffee and guava farms) or large (such as the 3,500-acre macadamia operation, MacFarms of Hawai‘i). Orchards are found in all districts of Hawai‘i Island; fruit and nut trees are widely planted in home gardens for family consumption. There is a tremendous potential for import replacement for tropical fruits based on NASS market data.

Due to the presence of fruit flies and other insect pests, most orchard-grown fruits cannot be shipped to the U.S. Mainland without quarantine treatments. The USDA rules regulating the shipment of Hawai‘i fruit to the U.S. Mainland market were developed in 1908 and have not been reevaluated since then. Foreign fruit producers, who received more recent clearance for shipment to the U.S. Mainland market have fewer regulations than Hawai‘i producers. The treatments required by the USDA regulations and the competitive disadvantage for Hawai‘i fruit, add to the cost of production. As a result, many tropical fruits grown in Hawai‘i are only economically viable if they are high value, niche market crops.

Other orchard crops such as coffee, macadamia, and guava are processed into value-added products before being exported or sold to the consumer. Infrastructure for this processing is an important component for these crops. There is, at present, a lack of effective support for the development of additional value-added products and for the infrastructure for manufacturing these products, especially in West Hawai‘i.

Quality is the key component for success of Hawai‘i’s fruits. Pre- and post-harvest handling and packaging are an important aspect of quality control for fresh sales.

Orchard Crops – Avocados. The avocado was one of the earliest fruit trees brought to the Hawaiian Islands. It was likely introduced by Don Francisco de Paulo Marin, an expatriate Spaniard who served under King Kamehameha I in the early nineteenth century. By 1855, avocado trees were quite common on O‘ahu and were distributed to the other islands. Hawai‘i’s earliest association of avocado growers was formed in the late 1920s by two major growers—Baldwin on Maui, and the Hawaiian Avocado Company on O‘ahu. At that time, acreage was about 750-acres with an estimated production of 1,200,000 pounds. The Hawai‘i Avocado Association was formed in the early 1980s in response to the increased planting of the Sharwil variety on coffee lands in Kona which resulted from the long-term decline in the Kona coffee industry. Sharwil is a variety introduced from Australia that was improved by UHM-CTAHR’s selection work and accepted by commercial growers and home gardeners for its flavor, small seed, and ability to keep well in cold storage.

Avocado production and value of sales spiked in the mid to late 1980s as industry leaders worked with regulators to develop and implement protocol for the export of the Sharwil variety to the U.S. Mainland without a quarantine treatment. In February 1992, the shipping to the U.S. Mainland was suspended, resulting in a decline in production and value. Hawai‘i production of avocados is approximately 1,000,000 pounds per year. However, as much as 40% of the

production is lost due to waste. Costco is a major buyer of Hawai'i grown avocados but is not able to purchase as much as it would like to purchase due to the lack in supply.

A cold treatment is available to export avocado to the U.S. Mainland but this is not in use by anyone at present. Note that the treatment was used with varying success in the 1990s. Avocados can be shipped to Alaska and Canada and some growers have established markets in both places. Avocado production for the state (estimated at 1.0 million pounds for the 2008/09 season at an average price of 73.0 cents per pound) is predominantly based in the Kona district with up to 90% of production occurring on small farms of less than 2 acres. Avocado imports into the state are 2 million pounds annually. There is a significant opportunity and renewed interest in expanding the market share for Hawai'i grown avocados as farmers take advantage of direct sales to restaurants and retailers as well as farmers' markets.

Challenges:

- Transportation and transportation facilities at the harbors are major problems, especially inter-island.
- Food safety requirements are an added cost.
- There is a lack of an efficient APHIS approved treatment for U.S. Mainland export that maintains the quality of the fruit.
- There is minimal marketing promotion of avocados.
- Local avocados are often poorly displayed and marked in the marketplace.
- There is little or no differentiation between Hawai'i grown avocados and imported fruit in the marketplace.
- There is a lack of standardization in cultivars being grown and in the grading system.
- There is a large percentage of waste due to poor harvesting and poor marketing techniques.
- The supply of Hawai'i avocados is inconsistent.
- Poor quality and unnamed mixed varieties are sold and marketed, which downgrades the avocado for consumers.
- Backyard avocado growers give and sell their product erratically, which impacts the commercial grower.
- There is a lack of coordination in varieties grown by farmers and what buyers prefer.

Opportunities:

- There is room in the marketplace to increase avocado production to meet year-round consumer demand since there is no sufficient supply of quality locally produced avocados.
- Promotion of the freshness, quality, and health benefits of local avocados will expand the market.
- There is a need to address the 30-year-old demographics under which supermarket produce departments still function that downgrades local produce.
- An inspection fee charged on imported produce could be used for market development to increase import substitution.
- Improved communication with the transportation segment and elected officials concerning recurring shipping problems could minimize costs and damage to fruit.
- Cooperation with the markets to organize better labeling and displays and the removal of poor quality fruit could expand consumer interest.
- Increasing the Canadian and Alaskan markets will enable the industry to expand.

Orchard Crops – Bananas. The first Hawaiian settlers brought bananas to Hawai‘i. All of the major commercial varieties of bananas are now grown here.

Plants were introduced to the state during the nineteenth and twentieth centuries for research and commercial planting by both the private sector and UHM-CTAHR. Although regulatory and management practices are in place, Banana Bunchy Top Disease remains a threat to island growers.

Today, most of the state’s production of bananas is on Hawai‘i Island in the Puna and Hāmākua Districts. Hawai‘i produced 17.4 million pounds in 2008 for an average price of 46.0 cents per pound for fresh bananas. Hawai‘i grown bananas account for 56% of all bananas sold in the state.

Challenges:

- Disease, especially bunchy top virus, limits production.
- It is difficult to import new cultivars because of plant quarantine regulations.
- The COOL laws are adhered to casually or not at all.
- There is a lack of market promotion of exotic cultivars.
- There is a lack of consumer education about the many banana cultivars available in the marketplace.

Opportunities:

- Develop protocols for tissue cultured material to facilitate importation of new cultivars.
- Farmer education in several languages, based on the producer's first language, on disease management, and planting resistant cultivars will help to control disease.
- Marketing promotions will educate consumers about the quality, nutrition, and taste of locally grown bananas.
- Cooperative marketing will strengthen the impact of producers.
- Marketing and promotion of exotic cultivars will expand the Hawai'i market.

Orchard Crops - Guava. Don Francisco de Paula Marin is credited with the introduction of guava to Hawai'i, but it is likely that guava was brought prior to his arrival in 1791. Commercial production of guava was first done by Robert Rycroft and his son Walter at Pohoiki in Puna from about 1900–1910. Guava jam and jelly were made in an old coffee mill. Since the 1940s, various companies have been in operation on Hawai'i Island, producing guava products first with wild fruit and later with varieties developed by UHM-CTAHR. With the help of the food-processing lab at CTAHR, research was conducted that assisted in the growth of the guava industry in Hawai'i.

125-acres of guava are grown on the east Hawai'i farms that are mostly small, one- to two-acres in size. Guava is harvested and processed into puree and used for nectars, drinks, jams, and jellies.

The price per pound paid to Hawai'i Island guava farmers increased in 2007 when statewide production decreased due to the shutdown of orchard operations on Kaua'i and increased demand on the U.S. Mainland. The Hawai'i Guava Growers Cooperative negotiated a raise in its selling price in 2008 for its farmers. 3.5 million pounds of utilized guava were produced in 2008 at an average farm price of 15.8 cents per pound.

Challenges:

- The price paid to farmers is the main constraint to a viable guava industry.
- Insect pests are a production problem.
- Guava is a commodity crop, sold as puree.
- If the industry expands, better processing facilities will be required.
- Food safety and DOH requirements for the processed puree are stringent.

Opportunities:

- The opening of the Japanese market for puree and the recent price increase to farmers allows the guava industry to expand.

- Abandoned guava fields that exist in East Hawai‘i can be rejuvenated.
- Promoting the market for high quality guava puree will further expand sales.
- Puree processed in compliance with HACCP regulations has the potential for a substantial market among the hotel restaurants.
- Puree sold in metric measurements is better accepted by the market.
- Value-added products can be manufactured as the guava industry recovers.
- In-state marketing of puree and value-added products will assist in developing the the industry.

Orchard Crops - Macadamia Nuts. Macadamia is indigenous to Australia where it grows in native forests. The macadamia nut was first introduced to Hawai‘i in 1881 by William Purvis, the manager of the Pacific Sugar Mill in Kukuihaele, Hāmākua. One of the original trees planted by Purvis is said to still be growing in the yard of a private residence.

The development, growth, and success of the macadamia industry occurred due to the efforts of the USDA Federal Experiment Station and UHM-CTAHR researchers. Orchards were planted around the island in the 1920s. The industry expanded to a peak of 22,600-acres in 1990–1991. Most of the state’s 570 farms and 17,000-acres currently planted in macadamia are on Hawai‘i Island (2008-2009 season.)

Macadamia is grown in all districts. Farmers sell their crops to processors who dry, crack, and roast the nuts. Nuts are sold in bulk to end users who add additional value by retailing roasted mac nut products, candies, cookies and other baked goods. Some small farmers process their nuts on-farm and retail their product at farmers’ markets and over the Internet.

Hawai‘i’s 2008–09 macadamia nut harvest was estimated at 50 million pounds net, wet-in-shell at an average 67.0 cents per pound, and total farm value of the crop grossed \$33.5 million. Low farm gate prices continue to be a problem and cause nuts to not be harvested. The 2009–2010 season indications are that a small increase in nut price will occur and that processors will expand nut purchases.

Hawai‘i was the global leader in macadamia production and technology but has fallen behind Australia. Macadamia was once synonymous with Hawai‘i but has become a global commodity; other countries are growing and selling the nuts at a lower price than those grown in Hawai‘i. Although macadamia has the potential to regain its niche as a high value product in the world market, the lack of industry unity, aggressive marketing, and innovative leadership hampers the macadamia industry on Hawai‘i Island.

Challenges:

- Low nut-in-shell price paid to the farmer discourages new plantings and the continuation of existing farms.

The major processors (Mauna Loa Macadamia Nut Co. and Mac Farms of Hawai‘i) are not locally owned, and thus do not promote Hawai‘i product as a priority.

- The current high cost of fertilizer and other agrichemicals increases the cost of production for farmers. This, coupled with the low nut-in-shell price, reduces profitability for most farmers.
- High volume sales in low margin markets (Costco, Sam’s Club, Trader Joes) reduces the margin to the processor and thus continues to support the low nut-in-shell price paid to the farmer.

Opportunities:

- Efficient farms that can remain profitable will be able to take advantage of the higher demand caused by less Hawaiian macadamia kernel in the local market.
- Increase the ratio of high margin retail sales to low margin high volume sales.
- Create a high quality brand identity and enter the up-scale brand market where there is currently a void.
- There is a need to partner with Hawai‘i chefs and UHM-CTAHR Department of Human Nutrition, Food and Animal Science (HNFAS) to develop more value-added products.
- Consolidate the crop of small farmers by region to increase leverage over the processor and reduce the cost of transportation.
- Encourage farmers and processors to work together in support and funding of generic promotion of the Hawai‘i Grown Macadamia Nut and of research projects aimed at improving the cultivation technology and the efficiency of the value-added process.

Orchard Crops – Papaya. Dr. Garritt P. Wilder, a botanist at the Bishop Museum, is credited with introducing the Solo papaya to Hawai‘i from Barbados and Jamaica in 1911. Solo became the dominant type in commercial production. As the industry grew, marketing became one of the most important issues of the papaya industry. In May 1971, the papaya industry united to form a Federal Marketing Order, an entity of the USDA. The Papaya Administrative Committee mandated an assessment on all papaya grown and sold in Hawai‘i. The funds collected were used for research and marketing of papaya. This successful program was instrumental in the development and growth of the industry until 2002, when growers voted to inactivate the marketing order.

In the 1990s, due to economic losses in papaya production because of the papaya ringspot virus (PRSV), the development of the transgenic papaya was the focus of activity for the industry. Two new PRSV resistant varieties, Rainbow and SunUp were introduced in 1998. In 2007, Rainbow represented 67% of all papaya produced in the state.

In 2007, there were 120 farms on Hawai‘i Island accounting for 89% of the state’s total papaya acreage with most of the production in the Puna district. 12.1 million pounds of fresh papaya were produced in the first six months of 2009 at an estimated 44.0 cents per pound in May.

Papaya is sold as a fresh fruit locally and can be sent to the U.S. Mainland after treatment by either irradiation—high temperature forced air or vapor heat treatments. Papaya is also exported to Japan, Europe, and other countries. Papaya exports are the backbone of all fruit marketed out of state. The volume of papaya shipped from Hawai‘i Island made it feasible for the 1995 initiation of the state’s first irradiation facility in Puna. Declining demand due to economic conditions in Hawai‘i and around the globe is destabilizing the market and prices paid to farmers. As a result, production on Hawai‘i Island has decreased.

Challenges:

- At present there is no acceptance by Japan of GMO (genetically modified organisms) papayas.
- Competition from the Philippines, Thailand, and Taiwan, where papayas are grown and exported to Japan, is cutting into the market of the Hawai‘i Island papaya industry.
- Competition from Mexico for the west coast of the U.S. Mainland, and competition from Brazil on for the east coast of the U.S. Mainland are also cutting into the Hawai‘i Island papaya market.
- New insects, pests and diseases continue to negatively impact costs and production.
- The farm gate price of papayas has not increased but costs have increased.

Opportunities:

- Improved marketing of local papayas to the local consumer promoting quality, nutrition, and flavor could increase local consumption.
- More education for farmers on disease, pest control, and nutrition could result in a more efficient operation with better quality fruit.
- Research on organic fruit production could assist farmers in producing organic fruit which could result in a new market.
- Marketing papaya and its products as a medicinal will expand the market.
- Research on growing papayas in dry areas on Hawai‘i Island, such as in Ka‘u, could decrease farming costs associated with high rainfall areas where the greatest papaya production is presently grown.

Orchard Crops - Tropical Specialty Fruit and Minor Fruit Crops. Crops that fall into this group include citrus, abiu, atemoya, caimito, cherimoya, durian, langsat, longan, loquat, lychee, mango,

mangosteen, persimmon, rambutan, sapodilla, soursop, star fruit, white sapote, breadfruit, canistel, jaboticaba, jackfruit, poha, rollina, cacao, peach palm, and others.

This relatively new industry has seen steady growth since the 1990s when statistics were first recorded. The fruits with the highest value of sales grown predominantly on Hawai‘i Island are longan, lychee, and rambutan. Commercial plantings in the mid to late 1980s grew rapidly in Puna, Hilo, Hāmākua, and to a lesser extent, in Kona. These trees produced enough volume for market in the early 1990s.

Most consumers are not familiar with these kinds of fruit so selling them has been a challenge. Initial marketing efforts focused on ethnic Asian markets in Hawai‘i, the U.S. Mainland, and Canada. Markets were expanded to include the gourmet food industry with the use of targeted promotional campaigns. When in season, these fruits are available in farmers’ markets, grocery stores, and restaurants. Irradiation is an approved treatment for exports to U.S. Mainland markets.

A total of 970-acres of specialty fruit were harvested from 1,470 planted acres—with more than half of that acreage in Hawai‘i County. An estimated 2.3 million pounds of fresh fruit were produced in 2007 with the total value of sales estimated at 4.5 million dollars.

Challenges:

- Lack of marketing and consumer knowledge about these crops discourages purchase.
- Brokers and wholesalers lack knowledge about the quality and availability of these crops.
- There is a limited effort to develop and expand the market.
- There is insufficient technology on post harvest practices, shipping techniques, and packaging.
- There is little economic information to assist new farmers in developing business plans.
- Labor for harvesting and packing is expensive.
- Knowledge about controlling disease and insect pests is limited.
- There are few or no value-added products to utilize the various off grade fruit.
- Competition from Asian fruit, which can be irradiated for export and which have fewer shipping regulations than the fruit produced in Hawai‘i, impacts markets on O‘ahu and the U.S. Mainland.

Opportunities:

- Marketing programs need to be increased locally and on the U.S. Mainland; also, the nutritional qualities of these fruits need to be promoted.

- Development of post harvest technology is needed to improve the quality of the shipped fruit.
- Dissemination of information on existing post harvest technology and packaging is needed.
- Identification of varieties will assist the marketing of the fruit.
- Research on disease and pest control and management strategies on the farm will increase production and improve the field quality of the fruit.
- Research on improved varieties will give the industry a more competitive place in the market.
- Grower education on cultivation techniques and management will improve production and quality and assist in farm efficiency.
- Development of value-added products will broaden the market for these fruits and utilize off grade fruit.

Orchard Crops – Coffee. Don Francisco de Paulo Marin is credited with introducing coffee to O‘ahu in 1813. Reverend Samuel Ruggles brought trees to Captain Cook, Kona, in 1828, and started the Kona coffee industry. Historically, small family farms in Kona grew coffee and sold their crops as parchment to cooperatives or processors. This coffee was sold as green bean on the world commodity market, making it difficult for farmers to be profitable. The coffee industry went through many boom and bust cycles during the early 1900s. By the 1960s Kona coffee was sold as a premium coffee, bringing in a higher price for farmers.

In the 1980s, new independent farmers began processing, roasting, packaging, and selling their own “estate” coffee in order to increase profits. Additionally, new processors bought cherry coffee from the farmers processing it and sold green bean and roasted products. Now, farmers can sell cherry or they can add value to their crop by processing and selling their coffee in the various stages of production (parchment, green bean, or roasted).

There are 790 farms on Hawai‘i Island, covering 3,800 acres, with the major production area in the Kona districts. A growing number of farms are also producing coffee in Ka‘u, Puna, and Hāmākua. In 2007, 3,000 harvested acres produced 3.9 million pounds with a farm gate value of \$23,350,000.

Challenges:

- The availability of labor, especially for harvesting.
- The cost of labor impacts cultivation and harvesting expenses.
- Because coffee requires consistent moisture throughout the year, the high cost of irrigation water adds another cost to cultivation expenses.

- The continual introduction of harmful insects and diseases negatively impacts the health of coffee trees and control adds more costs.
- The influx of inexperienced growers with little or no education in agriculture affects the overall crop quality and yields negatively.
- There is minimal centralized marketing of 100% Kona coffee.
- All of the Hawai‘i Island coffees lack sufficient marketing funds and effort.
- The U.S. economic recession is decreasing the price and quantity of expensive gourmet coffees consumed, which in turn depresses the price for Hawai‘i Island cherry.
- There is a lack of processing facilities in some coffee growing areas of Hawai‘i Island.
- There is a lack of protection for the district names of Hawai‘i Island coffees.
- There is a lack of protection from abuse of the uniqueness of Hawaiian products.

Opportunities:

- Innovative methods of cooperating on use of labor crews will assist with the labor problem.
- Improvements in the availability of agricultural water, including the planned agricultural water well in South Kona and repair of the water tunnels in Ka‘u, will improve yields and expand production.
- More stringent control of green coffee imports will protect the local coffee crop from pests and provide a competitive advantage to the local growers.
- Development of higher quality standards and new origin characteristics will open the market for higher value retail products such as espresso.
- Marketing to take advantage of the trend for consumers to buy local food products can increase consumer purchases.
- Cooperation on marketing the array of Hawai‘i Island coffees provides the growers and processors with a new marketing tool.
- “Lifestyle” growers have time, often advanced educational and professional backgrounds, and the financial resources to promote Hawai‘i Island coffee.
- Changing the law to increase the percentage of Hawai‘i’s coffee in blends will improve the quality of these products.

Biofuels

With present concerns regarding Hawai‘i Island's dependence on imported fossil fuels and the continuing increase in the cost of fossil fuels, biofuels produced from local resources are an alternative that is being investigated.

A biofuel is defined as a solid, liquid, or gas fuel derived from recently dead biological material, as distinguished from fossil fuel that is derived from long-dead biological material.

Theoretically, biofuels can be produced from any biological carbon source although the most common sources are photosynthetic plants. On Hawai‘i Island, investigation into the use of biofuels is focused on timber crops, algae, oil palm, jatropha, and waste vegetable oil. The primary initial market for biofuels is HELCO and the production of electricity. Use of biofuels for transportation is also a possibility, given the resource-intensity of biofuel production and the continued need for diesel fuel for large vehicle and heavy equipment operation.

HELCO currently produces electricity primarily from its own fossil fuel generating facilities although approximately 30% of the electricity produced on Hawai‘i Island comes from renewable energy. The renewable energy sources are geothermal, wind, hydroelectric, and solar. Although HELCO's business model relies heavily on imported fossil fuel, there is a recent agreement between the State of Hawai‘i and the Hawaiian Electric Companies (which includes HELCO) to move away from fossil fuels and move towards renewable energy.

In the movement toward renewable energy sources, HELCO must balance its firm power sources, generally engine driven generators or steam turbine driven generators that use fossil fuel, with non-firm renewal sources, such as wind, solar, and hydroelectric. The main market for biofuels is in the replacement of fossil fuel in the firm power sources.

Companies that are in the process of establishing potential sources for biofuels on Hawai‘i Island are listed below:

- Hu Honua Bioenergy LLC is proposing a 24-megawatt biomass power plant at the former Hilo Coast Processing Company mill site in Pepe‘ekeo that will burn biomass.
- Tradewinds has a 20-year contract with HELCO to provide electricity from biomass.
- SunFuels Hawai‘i LLC, a company based in Waimea, is exploring the opportunity to establish a biomass to liquid (BTL) plant to produce SunDiesel™ fuel on Hawai‘i Island. Biomass for feedstock will be provided by tree and other non-food crops through long-term supply contracts.

Biofuel from algae, palm oil, and oil from jatropha are all possible sources of biofuel for HELCO. Cellana LLC, a joint venture between HR BioPetroleum and Royal Dutch Shell, has a pilot algae project at the Natural Energy Lab. Research on growing jatropha is in progress at HARC on O‘ahu, and a palm oil demonstration project is planned at the UH Hilo.

Challenges:

- There is competition for the large acreages of agricultural land needed for biofuel resource growth.
- There is a limited amount of economic data available on the profitability of growing, harvesting, and processing biofuels on Hawai‘i Island.
- The capital requirement to plant the biofuels, other than the existing eucalyptus plantations, and to build the processing infrastructure may be difficult to acquire because of a lack of any track record for biofuel production on Hawai‘i Island.
- Although there is a wide knowledge base about growing, harvesting, and processing biofuel crops for power generation or thermal conversion technologies, there has been little or no application on Hawai‘i Island.
- There is a limited amount of skilled labor and management personnel for a biofuel industry.

Opportunities:

- Local production of fuel for agriculture could provide a more secure and possibly lower cost fuel source.
- Biofuel production might provide new jobs for Hawai‘i Island families.
- Successful, cost effective biofuel production could be exported to provide fuel to O‘ahu and the other islands.
- Biofuel might provide a more sustainable fuel source.
- Biofuel production will keep more money circulating on Hawai‘i Island, rather than being exported for outside fuel.

Other, Emerging, and Potential New Commercial Crops for Hawai‘i

Other Crops - Bees and Honey. Hawai‘i was one of the few places free of the varroa mite that infests bees and can have devastating effects on hive health and production. Varroa mites were found first on O‘ahu and then later in bee traps around the Hilo airport. The HDOA is monitoring the situation and destroying hives in the area. The mites have a huge negative potential impact on the industry and on the pollination of crops.

Hawai‘i’s state honey production for 2008 is estimated at 900,000 pounds from 10,000 honey producing hives. Farm value of honey totaled \$1.3 million and the beeswax value totaled \$31,000. Although no statistics are available, Hawai‘i Island also has an important export queen bee industry.

Challenges:

- The continuing invasion by new insects and diseases, especially the recent introduction of the varroa mite, is the most challenging problem.
- There is competition from Mainland and foreign honey products in Mainland and local grocery outlets.
- There is a lack of funding for research.
- There is a lack of funding for marketing.

Opportunities:

- Funding for government entities to do 100% inspection of the transportation industry arrivals will slow down the arrival of new insects and diseases.
- Hawai‘i honey, especially organic, needs more marketing to promote its excellent quality and superior taste.
- Marketing programs in local grocery outlets that identify Hawai‘i Island honey will encourage consumers to purchase more of the product.
- Funding to develop better hive management programs for protection against invasive pests and diseases will improve the chances for hives to remain free of new insects and diseases.

Other Crops – Cacao. Cacao was planted in Hilo and East Hawai‘i originally in the 1890s, yet a commercial industry was never established. In the late 1980s and into the 1990s, interest in cacao grew as potential projects—including the infrastructure to process chocolate—were planned.

Although the large scale projects never materialized, a small industry has developed. The Original Hawaiian Chocolate Factory in Kona grows cacao, buys it from other farmers, and processes it to make various chocolate products. Small scale processing equipment is also available, and some individual farmers are making and selling their own chocolate. Hawai‘i grown chocolate is marketed as a high value, high quality, niche product.

Challenges:

- Insects, especially the rose beetle, are a problem.
- Processing facilities are very limited.
- Processing equipment for small farms or groups of farms is difficult to source and is usually too large and too expensive.
- There is a lack of economic data on growing and processing cacao on Hawai‘i Island.
- Cultivation and harvesting information specific to Hawai‘i is limited.

- There is a lack of information on over-story crops for field cultivation.
- Protocols to identify origin of beans and trees are not available.
- No regulations are in place to identify the origin of the finished product and to verify Hawai‘i Island cacao percentage.
- Marketing of Hawai‘i Island cacao and chocolate products has been done by only one grower/processor.
- Local chocolate products are very expensive.

Opportunities:

- Hawai‘i Island chocolate is well received and used by chefs.
- More efficient cultivation, harvesting, and processing techniques will assist in making the chocolate more cost competitive.
- Funding for research on cacao cultivation, harvesting, and processing will accelerate the growth of the industry.
- Marketing is needed to broaden the consumer base.

Other Crops – Tea. With the help of the various research institutes in Hawai‘i and enthusiastic growers, tea (*Camellia sinensis*) is a new crop with commercial potential on Hawai‘i Island. First introduced in 1887 for large scale production, and then again in the 1980s for large scale production, Hawai‘i tea could not compete with tea producing countries in Asia that had lower labor costs. However, the tea farmers of today are focusing on quality gourmet teas. The Hawai‘i Tea Society supports educational programs and promotion of tea and value-added products grown on Hawai‘i Island. Small farms focused on high quality tea have been established in Volcano and on the Hāmākua Coast.

Challenges:

- There is no central processing facility.
- A lack of planting material is slowing the development of the industry.
- There is little information on growing and processing tea on Hawai‘i Island in the different climate conditions.
- There is insufficient production to warrant a major marketing program at this time.

Opportunities:

- The production of Hawai‘i Island gourmet teas will increase the diversification of the island’s agricultural base.

- A marketing program that promoted different teas and their quality from different parts of Hawai‘i Island will establish local tea as a gourmet product.
- Continuing to work with local chefs to serve the tea in the best restaurants will help to establish the teas as unique in their quality and flavor.
- Promoting the story of the teas will enhance their place in the market.
- More funding for research on cultivation and processing will expand the industry.

Twelve Fruits with Potential Value-Added and Culinary Uses

The goals of the 12 Trees Project are to increase profitable agricultural diversification and to contribute to the development of a consistently high-quality, year-round supply of fruits for local markets. To meet these goals, the project began with chefs, fruit buyers, and growers who selected 12 desirable fruits. The fruit trees were planted at a demonstration orchard in Kona and farmers have since been encouraged to cultivate these kinds of fruit trees. A publication by UHM-CTAHR includes information on these fruits, cultivation techniques, recipes, yield and cost data. The twelve fruits are: cherimoya, fig, grumichama, kumquat, loquat, Mysore raspberry, poha, pomegranate, Rangpur lime, Surinam cherry, tree tomato and tropical apricot.

These crops are produced in such small quantities and are currently in a research and development phase so it is premature to discuss industry challenges and opportunities at this time.

‘Ohelo Berry

The ‘ohelo berry is a native Hawaiian shrub that produces small red berries favored by local residents for making jams and jelly. They grow in the wild, and the environment can be negatively impacted from people gathering berries. Recent studies conducted by USDA-PBARC Tropical Plant Genetic Resources Management Unit researchers developed propagation and cultivation techniques for ‘ohelo. The plant has potential, not only for its fruit but for its use as an ornamental landscaping plant due to its attractive red crown of young leaves. Additional research on the economics of growing the plants for both berry production and for landscaping is needed. ‘Ohelo berry is still in the research phase; industry challenges and opportunities have not yet been developed.

Disclaimer: All references to businesses, products, and other identities are used in this report as examples only and do not constitute an endorsement of the business, product, or identity mentioned.

V. APPENDICES