County of Hawai‘i Agriculture Development Plan

October 12, 2009

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

Agricon Hawaii LLC.
Prepared for
The Kohala Center

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DISCLAIMER: The County of Hawai‘i Agriculture Development Plan is in the final stage of development, and the present draft is intended for the purpose of soliciting additional public comments. Please do not quote or reference information in this plan without first contacting Guy Kaulukukui at The Kohala Center, 887-6411, or at agplan@kohalacenter.org.

EXECUTIVE SUMMARY

Hawai‘i is the most isolated inhabited land mass on the planet, at approximately 2,500 miles removed from North America and Asia. This distance and isolation, coupled with the state’s reliance on imported goods, places Hawai‘i and its entire population at risk—especially in terms of food security. Eighty-five percent of the food consumed in Hawai‘i is imported, rendering its food supply particularly vulnerable to natural disasters and other events beyond the control of local markets and local government. Any major political or physical disruption, such as a shipping strike, would create shortages on store shelves within a matter of days; retail outlets in Hawai‘i would be at risk of *completely* running out of food in approximately two weeks. Additionally, contamination of imported food and the introduction of invasive species via imports creates significant risks to the state’s food supply.

While the Hawai‘i State Constitution calls for the conservation and protection of agricultural lands, as well as for the promotion of diversified agriculture and an increase in agricultural self-sufficiency—these principles have not yet been fully realized. A recent study conducted by the State of Hawai‘i Department of Agriculture reports that over the ten-year period 1995–2005, food consumption in Hawai‘i outpaced local food production in most categories, leading the authors to conclude that the state was actually becoming *less* food self-sufficient. A white paper issued by the same agency also reports that the increasing trend of reliance on imported food must be reversed in order to provide for a larger degree of food safety. Hawai‘i County, given its rich tradition of farming and its arable lands, is in a unique position to correct this imbalance.

Hawai‘i County support for agriculture is a vital factor in establishing the industry as one of the island’s primary economic drivers. The strategies and actions proposed in the County of Hawai‘i Agriculture Development Plan are focused on expanding local agriculture and maintaining the rural character and lifestyle of the island.

Recommended priority actions include increasing resources for the County Agriculture Development Team, so that County government is better able to assist with (1) formal identification of Important Agricultural Lands, (2) development of a comprehensive agriculture resources information repository, (3) implementation of a strategy to eliminate the introduction and spread of invasive species, (4) development of a food self-

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sufficiency baseline study, (5) advocacy for formal and informal agricultural education, and (6) improvement in agriculture handling and inspection programs at airports and harbors.

This list represents immediate County actions that lead to a long range goal of producing 50% of the food consumed on Hawai‘i Island by 2030.

INTRODUCTION

Hawai‘i’s year-round growing seasons present ideal conditions for the expansion of agricultural activities and the achievement of food self-reliance. Prior to Western contact in 1778, Hawai‘i provided for 100% of its food supply and sustained a population upwards of 700,000 to perhaps a million people. With improved agricultural technologies and a concerted effort to replace food imports with local production, Hawai‘i should be able to achieve a high degree of food self-reliance and provide its current population of 1.2 million people with a safe, secure, and fresh supply of locally produced food.

In nominal terms, agriculture in Hawai‘i currently contributes between 1% and 3% annually to the State Gross Domestic Product (GDP), and in terms of value, is ranked 18 among the 19 revenue generating industries contributing to GDP in Hawai‘i.

Although the primary focus of the Agriculture Development Plan is to expand food production, it’s worth noting that the largest contribution to the overall value of Hawai‘i agricultural production, other than sugar and pineapple, are ornamental flowers (ornamentals) and nursery products, which accounts for 27% of total agriculture output. The role of floriculture in stabilizing the agriculture industry since the glory days of sugar and pineapple has been critical. In fact, the industry’s ability to maintain its contribution to State GDP during recent economic downturns has largely been due to the export market for Hawai‘i plants and nursery items. The present plan anticipates that this important sector of the industry will continue to grow at current levels given market demand for its products.

Hawai‘i County is the largest of the state’s four counties. Its 2005 General Plan included the goals of preserving the agricultural character of the island, and enhancing opportunities for the expansion of Hawai‘i’s agricultural industry, which at the time accounted for 9.5% of the county’s employment. Its 820,000-acres of farms constitute 63% of all the farmland in Hawai‘i.

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The county is home to the largest cattle ranching operations in the state as well as two of the three remaining dairy farms in Hawai‘i. It also includes the state’s only significant commercial aquaculture operations. Further, almost 40% of all farm workers in the state are employed by Hawai‘i County farms.

The agricultural resources of Hawai‘i County—farming ranching, forestry, and bio-fuel crops—have the potential to support a major expansion of food production for the island, thereby contributing to the increase in food self-reliance of the state. However, production follows demand in a free market economy, making the increase in consumer preference for locally produced food a significant challenge in the expansion of food production in the county. A 2008 study conducted by the 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.

OVERVIEW OF AGRICULTURE IN HAWAI‘I

Historical Perspective

Polynesian voyagers arrived in Hawai‘i approximately 2,000 years ago, and found these islands to be hospitable to settlement. Subsequent waves of Polynesian settlers arrived with plants and animals that eventually provided the foundation for an abundant food supply. Archaeologists have determined that transmigration between Hawai‘i and other Pacific islands continued for centuries before ending around 1400 AD, indicating that Hawai‘i was entirely food self-reliant from then until western contact in 1778, when its population was estimated to be 700,000 to perhaps a million people.

Food self-reliance in Hawai‘i was sustained by a subsistence lifestyle that eventually yielded to a plantation-based economy in which a large portion of the population and an equally large proportion of arable lands were employed in the production of sugar cane rather than food production. Plantation-style agriculture dominated the landscape in Hawai‘i County beginning

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with the explosive growth of sugar cane production around 1900 and ending with the close of the industry in 1995.

The Plantation Years

In the late 1800s, sugar became an important export crop produced throughout the islands. New rural camps were built to house farm labor and to support the businesses and community services that in turn supported the growing and processing of sugar cane for export to the United States. Sugar production continued for approximately 150 years and dominated agriculture, using large tracts of the best cropland. The expanse of the industry was such that at its zenith the Hāmākua district alone boasted 13 sugar plantations.

However, sugar cane production became increasingly less profitable during the 1970s and 1980s as a result of competition from foreign sugar imports, and all Hawai'i Island plantations shut down by 1995. Previously cultivated land lay fallow, businesses that depended on the sugar plantations were no longer profitable, and plantation camps used to house workers were under extraordinary stresses to remain viable. The sugar plantations worked with County, State and U.S. federal governments, labor unions, and private entities—including Kamehameha Schools, the largest private landowner on the island—to mitigate the effects of the collapse of the sugar industry. Though this transition entailed major economic and social restructuring, the change also provided the potential for a shift back to more diversified agricultural production.

Post-Plantation Era Farming

As large parcels of the best agricultural land on the island became available for crops other than sugar and for livestock grazing, farmers and ranchers began to purchase and lease the land for diversified agriculture: from timber and papaya plantations to small farms producing such products as goat cheeses, tropical fruits, vegetables, and cacao.

Presently, there is a great opportunity for the continued expansion of agriculture on Hawai'i Island, as a substantial number of acres of former sugar land remain unused. Although rainwater collection and water delivery infrastructure is currently deficient, rainfall is sufficient in many areas on the island to support extensive macadamia orchards, timber plantings, livestock grazing, and crops tolerant of occasional dry seasons. With improved agricultural water systems, an even greater variety of crops could be produced.

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The rural camps that are a legacy of plantation days are still used for housing and community services. Though the majority of Hawai‘i Island’s population no longer live in these camp settings, preserving this rural lifestyle is of primary importance to the island residents who attended the public listening sessions that were held to obtain input for this plan. Establishing a more self-sufficient local food system is also a high priority to those who provided comment, and this document incorporates their suggestions for expanded home, school, and community garden production to augment a vibrant and profitable commercial agriculture sector.

Current Challenges and Opportunities

Two primary issues facing Hawai‘i Island agriculture and its rural communities are the impact of an increasingly global economy and the rise in the cost of energy associated with the dependence on fossil fuels. Lack of food self-reliance for the entire State of Hawai‘i is a major concern that simultaneously creates both a threat and an opportunity. Only 10-15% of the state’s food supply is produced locally.[1] Any major political or physical disruption would put retail outlets in Hawai‘i at risk of running out of food in approximately two weeks. Additionally, potential contamination of the imported food supply and the importation of invasive species creates a danger to the state’s population. Opportunity lies in expanding local food production to decrease these risks. However, crop production that can be sustained without damaging the environment and that can generate a reasonable profit for producers is a challenge that must be addressed if Hawai‘i Island agricultural expansion is to be successful.

Educating the Market to Promote Greater Food Self-Reliance

Providing educational opportunities for farmers, marketers, and consumers is a key component of expanding the diversification and development of a sustainable agricultural industry on Hawai‘i Island. Farmers need assistance in applying new technologies to improve the quality of crops and the efficiency of farms. Additionally, farmers require assistance in the marketing and promotion of their products. Likewise, distributors, processors, supermarket managers, and chefs will be more effective in selling local agricultural products if they are better informed about the quality and benefits of these food items. Consumer education will play a critical role in the expansion of local food production. As consumers become aware of the quality and availability of locally produced food at competitive prices, their consumption should shift from imports to locally grown produce.

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Also of extreme importance is the education of our youth so that they are exposed to the industry as a rewarding and economically viable career and can obtain the skills and resources to pursue such a career. The farm workforce, including the field farm worker, the family farmer, and the commercial entrepreneur, must be recognized as respected contributors to the Hawai‘i Island community.

Energy Production and Farming

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. Recently formed bio-fuel 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 bio-fuel industry might present include infrastructure improvements, enhanced energy security, an increase in agricultural support services, and funding for research to modify bio-fuel 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 islands resources.

Export Crops

Although transportation costs make exporting crops expensive, continuing to pursue export crop opportunities, while expanding the demand for locally grown products, will increase the potential for existing farmers to increase their incomes and for new farmers to emerge. The model of agriculture established by the sugar industry, which was based upon exports, continues to exist today at a diminished but much more diversified level. Macadamia, coffee, tropical fruit, ornamentals, and livestock are examples of agricultural industries on Hawai‘i Island that currently depend upon exports to achieve economic success, and these exports represent a significant percentage of agricultural income generated on the island.

Another benefit of these agricultural export crops is their popularity with visitors. Visits to the farms where crops are grown and processed have become popular and can generate both on-island sales and increased long-term demand. This visitor interest has encouraged agricultural tourism, which provides additional income to farmers and ranchers.

PLAN DEVELOPMENT

Representatives of the agriculture industry, related stakeholders, and the general public participated in the

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development of the present plan. An Ad hoc Committee (Appendix G), comprised primarily of members of Hawai‘i Island's agricultural community, representing a wide range of knowledge and experience, was formed to review, filter, focus and prioritize the data collected by the planning team at various informational meetings.

In order to ensure that a broad range of information was obtained from the agriculture community, stakeholder meetings were held with individuals and small groups of people who had specific agricultural interests. Additionally, the University of Hawai‘i at Mānoa (UHM) College of Tropical Agriculture and Human Resources (CTAHR) and University of Hawai‘i at Hilo (UHH) College of Agriculture Forestry and Natural Resource Management (CAFNRM) contributed pertinent data and information (Appendix H).

In addition to the previously noted meetings, the general public was invited to six public listening sessions (Appendix H) held in September 2008 at various locations on Hawai‘i Island at which wide-ranging suggestions were gathered and compiled. Comments were also solicited from individuals who were able to contact planning team members directly via a phone number or an e-mail address posted at The Kohala Center Web site.

The material gathered from research, industry stakeholders, workshops, and public listening sessions have been compiled and grouped into thirteen plan elements. Each element is described in terms of the current situation of agriculture on Hawai‘i Island and in concert with the plan’s vision and goals. A measurable objective is stated for each element and actions are identified to achieve each objective. The actions are presented in an easy-to-read chart; for each action, the role of County R&D and its public and private sector partners are determined, and the lead entity among them is identified.

The Purpose, Vision, and Goals of the Plan

The County of Hawai‘i Agriculture Development Plan will guide the revitalization of agriculture as a basis for economic development that maintains the rural lifestyle and unique character of Hawai‘i Island. The plan will be used by Hawai‘i County to develop policies, allocate resources, and advocate for the sustainable growth of agriculture on the island, guided by the vision of ***a thriving and sustainable agriculture industry as a vital contributor to Hawai‘i County’s rural lifestyle, character, and economy by producing food, fiber, energy, and ornamentals for local consumption and export***.

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Short-term goals include:

1. Expand the production of locally grown food so that 30% of the island's demand for food can be supplied by local producers by 2020.
2. Remove existing impediments between local agriculture producers and export markets.
3. Protect local agriculture from the introduction of invasive species.
4. Support and advocate for education that will develop farmers, ranchers, and foresters who can productively, profitably, and sustainably develop Hawai'i's agricultural systems.

A primary long-term goal is to expand the production of locally, sustainably grown food so that 50% of the island's demand for food can be supplied by local producers by 2030.

GOVERNMENT'S ROLE IN AGRICULTURE

This Agricultural Development Plan was commissioned by the County Department of Research and Development, whose mission is "to provide pro-active 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."[2] County R&D's Agriculture Program provides a multi-faceted, though limited, support to the Hawai'i Island agricultural industry. (See Appendix E for recent projects funded.)

Government's role in agriculture has been to encourage and support the industry with public resources and regulations. Although there is overlap and cooperation among these agencies, they are constricted by their specific mandates. (County, State, and U.S. government departments and agencies that support agriculture are described in Appendix D.**)**
This Plan's focus is on Hawai'i County's role in direct action and advocacy that impacts agriculture on the island. Departments within the County structure that can assist or impact agricultural systems include Planning, Public Works, Finance, Water Supply, and Research & Development (R&D).

County of Hawai'i government plans have been written and voted into law to guide future development (Appendix F). These include the County of Hawai'i General Plan and Community Development Plans (CDPs), completed or in progress. All of these plans consider agriculture to be a major and necessary part of the economies of both the state and Hawai'i Island. The Community Development Plans are specific in their goals and priorities for

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Hawai‘i Island’s agriculture. Although the Hāmākua CDP has not been completed, the district developed the Hāmākua Agricultural Plan in 2006. All relevant policies and recommendations in these plans that can be accomplished by the County, either through direct implementation or advocacy, are incorporated into the County of Hawai‘i Agriculture Development Plan.

Expanding the local production of food in Hawai‘i County will require a significant effort from the County government in partnership with various stakeholders from the private sector. If agriculture is to become a major economic driver on Hawai‘i Island and provide for greater food self-sufficiency, the County must support the plan’s initiatives with increased funding and additional staff. Currently, there is one position at the Hawai‘i County Department of Research and Development dedicated to agriculture. County R&D should investigate grant opportunities available from the Food, Conservation and Energy Act of 2008 (2008 Farm Bill) and American Recovery and Reinvestment Act (Economic Stimulus Package) for supplemental program funding. County R&D should also consider the option of using a portion of the annual Agriculture Program funds for additional staff rather than project funding, as well as appealing to the Mayor and County Council for expanded staffing resources from the yearly County budget. County allocations would then better reflect public concern about the island’s economy and food supply and better align with the new Community Development Plans.

COMMUNITY INPUT AND PRIORITY ACTIONS

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.

This plan proposes the establishment of a Hawai‘i Island Agriculture Policy Committee (APC), a volunteer group of agricultural stakeholders, convened by the County Research & Development Department to guide and monitor the implementation of plan recommendations and serve as a conduit for continuing community input. The APC will play a vital role in prioritizing

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actions, moving the initiatives forward, and adjusting the strategies as opportunities arise. The initial members of the APC should include industry volunteers from the Plan's Ad Hoc Committee; its sub-committees should recruit representatives from specific industry sectors such as food, timber, ornamentals, and energy.

Priority Actions

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 resources for the County Agriculture Development Team to a minimum of an administrator, administrative assistant, and at least two specialists 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. One of these specialists would focus on marshalling resources for key infrastructure projects that would broadly benefit the agricultural sector. Another specialist would serve as a liaison and omnibudsman for local agricultural ventures and interests and government agencies at the County, State, and U.S. federal levels. In the best case scenario, the agricultural administrator would be a cabinet-level position, to encourage an integrated County approach to agricultural policy and resource allocation that included water systems, land-use regulations and planning, waste management, transport, and energy systems.

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.

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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 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 farmers 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.

PLAN ELEMENTS AND IMPLEMENTATION

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-

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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 not sufficient, 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 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, energy are paramount, the plan does not attempt to order them into a critical path at this time. Instead, it presents them as necessary conditions for the potential of a vibrant and expanding agriculture sector in Hawai‘i County, 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 chart of action items intended to achieve the objective. From over sixty action items, seven priority actions have been identified as those that should be addressed immediately, with the additional recommendation that County agricultural staffing resources be expanded to support the achievement of plan objectives. 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. Plan elements include:

A. Communication
B. Economic Sustainability

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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 L). 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 communication improvement and information sharing.

There is an abundance of agricultural and gardening information specific to Hawai'i 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, agriculture industry, and the Hawai'i Island community.

The plan identifies the development of the Hawai'i Island Agricultural Web site as one of its priority actions. The Web site will collect and disseminate agriculture-related information of significance 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,

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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 on-line 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.

B. Economic Sustainability

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

Profitability of Hawai‘i Island's agriculture industry currently depends heavily on exporting products to the U.S. Mainland and other countries. A relatively small share of the island’s agriculture resources is employed in the production of food, largely due to the disparity in price between locally grown products and imported alternatives that generally sell at a lower price. The plan’s goal of increasing food production on Hawai‘i Island will be severely compromised unless systems are in place allowing farmers to reduce their production costs and to create efficient distribution channels so that competitively-priced products are readily available to consumers.

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 bio-fuel production for feed. Some of these conversion processes will entail relatively large investments in infrastructure and/or research. The County should assist the private sector in obtaining the necessary funding and permitting to facilitate the development of input production and distribution systems.

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Additionally, farmers compete 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. Volunteers found through networks like World Wide Opportunities for Organic Farms (WWOOF), and student interns from programs at UHH-CAFNRM and Hawai‘i Community College (HCC) can also be a resource for agricultural labor. Agricultural education that prepares and supports family farmers and farm managers is also necessary to increase production capacity on the island. (See Section E for discussion and recommendations.)

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 that was 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.
In addition to cost-reduction measures, Hawai‘i Island farmers may be able to increase their revenue through sales to government agencies and programs 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.

Farmers may also be able increase their revenue by participating 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.

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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 and instructions for operators.

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

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 supply in Hawai'i Island retail stores depends on an uninterrupted shipping service that can be threatened by natural disasters or events such as labor strikes. Although it is widely accepted that retail outlets in the state have only enough food to last approximately two weeks if delivery were interrupted, there is no clear plan for food sourcing and distribution in the case of an emergency. The State and County Hazard Mitigation Plans do not have specific actions for food producers and distributors to follow. These Mitigation Plans will be reviewed and updated in 2010.

Additional benefits of greater food self-reliance include increased access to fresher and possibly healthier food, the economic multiplier effect of circulating wealth within the island community rather than shipping dollars off-shore, and a

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potential reduction in invasive species that currently occurs as a result of food importation.

The market share of locally grown food varies widely among the many products. Locally grown fruits, for example, enjoyed a 36% market share in 2007 and vegetables were close behind with a 34% share of the local market (Appendix K).[3] 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 the fruit.[3] With 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 dairy industry on Hawai‘i Island is 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, like the one currently in place on Hawai‘i Island, 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 fresh - Buy local 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 re-establish home gardening and informal community exchange is one element in assuring local food security and should be encouraged by County actions and regulations.

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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.

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 into the general market and 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; 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.

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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 Fresh - Buy Local.[4] The Buy Fresh - Buy Local 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 Fresh - Buy Local 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 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 that is 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

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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.

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.

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.

There are 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

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knowledge of tropical home production. We recommend that UH Hilo, Hawai‘i Community College (Hilo and West Hawai‘i) become revitalized 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 all around 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 enough 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

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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 - The Eastside Seed Exchange every fall and the Hawai'i Island Seed Exchange each year in Kona provide educational venues for farmers and gardeners to learn about seed saving on a local grassroots level.

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- 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. (See Appendix for a complete list of commodity groups.)

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 Fresh - Buy Local" Program 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 Hawai‘i.

Increasing consumer knowledge about basic nutrition and how to prepare fresh agricultural products may also increase the desirability of local products. Start Living Healthy[7] 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 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.

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Informing Policy Makers: County elected and appointed officials and civil servants are often uninformed about the agricultural industry and discount its importance relative to other industries. This is reflected in their attention to other economic sectors, which receive a disproportionate share of public resources compared to 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 as to 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.

F. Land

Current Situation. Providing suitable agricultural land at a reasonable cost for farming is a key issue in Hawai'i County for the sustainability of an expanding agricultural industry. Market prices for all land on Hawai'i Island are largely driven by sales of residential and resort property. This condition hinders the ability of farmers to purchase affordable land for farming. In order to counter the movement of agricultural lands into residential and commercial developments, the State passed the Important Agricultural Lands (IAL) legislation (HRS 205-47) that is intended to protect selected 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 and these petitions have been approved.

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HDOA Agricultural Parks are another means of obtaining land suitable for farming. The parks are located in Pahoa, 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.

There are State and County funding programs for the purchase and preservation of agricultural land that is being threatened by reclassification and rezoning to other uses (Appendix N). The State statute HRS 173, called 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 the 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 land owners will have a 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.

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

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 in periods of droughts. 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 is owned and operated by Surety Kohala Corporation. The system was severely damaged by the earthquake of October 2006. Efforts are in progress to return the system to full capacity and this effort is being directed by North Kohala Community Resource Center, a nonprofit organization that has been responsible for securing approximately $5 million towards this effort.

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 and 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.

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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 though 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 and livestock producers.

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

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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 and the current political climate makes it more affordable for individuals, businesses, and the community to make the changes necessary to becoming more energy self-reliant through use of renewable sources and energy efficient practices.

The 2008 Farm Bill provides grants and loans for farmers, ranchers, and rural small businesses to purchase renewable energy systems and 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, and Hawai‘i Electric Light Company (HELCO) offers incentives for energy saving measures. A complete list of current incentive programs is 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) in Hawai‘i offering 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 the upfront costs and collects the benefits from U.S. federal and State tax incentive. Farmers, ranchers, and other owners of agriculture land can potentially lease land to energy producers wanting to invest in solar or wind energy farms.

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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 bio-fuels and using crop by-products to run machinery and equipment offers an opportunity for new agriculture enterprises. Although producing bio-fuels 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 offers savings in electricity and transportation costs.

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

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 which are used for agricultural transport. Air shipment of perishable produce is generally

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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 of 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

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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.

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).

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.

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The lack of adequate slaughterhouse and rendering facilitates 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 on-going, 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.

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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 Agricultural 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.

K. Research

Current Situation. To continually improve the quality and expand production and diversity of its agricultural output, Hawai'i needs to invest in research. This may necessitate a shift in research resources that were designed in 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 not a 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

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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.

Biotechnology research is being conducted in various venues throughout the state, including Hawai‘i Island. Although aspects of this type of research are controversial at the present time, it has already made a contribution to the island agricultural industry through the development of a ring spot virus resistant variety of papaya. In 2009, the Hawai‘i County Council banned genetically modified organisms (GMO) research on coffee and taro on Hawai‘i Island, as well as the planting of GMO coffee and taro, and the Hāmākua Agricultural Development Plan calls for Hamākua to be a GMO-free zone. The discussion as to what GMO research is appropriate on Hawai‘i Island is ongoing.

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 the farmers in crop and livestock production using sustainable techniques. Effectively disseminate the research results and recommendations to the agricultural community.

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L. Invasive Species

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

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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.

HAWAI‘I ISLAND AGRICULTURE INDUSTRY

A. Trends

Presently on Hawai‘i Island there is a wide diversity of crops being grown, then marketed locally and internationally. Historically, the main export crops from this island—beginning in the mid 1800s—were from agricultural industries such as sugar, beef and hides, remount horses, macadamia, papaya, coffee, flowers, cool climate vegetables for O‘ahu, and koa lumber. Except for sugar and remount horses, all of these crops continue to be 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 added to the list of exports transported mainly to O‘ahu, Japan, and the U.S. Mainland. These crops, as well as several others, are still being exported from Hawai‘i Island.

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A recent trend that developed over the last ten to fifteen years is the movement to produce more crops for consumption on Hawai‘i Island and within the state as a whole—especially with O‘ahu’s population of 1.2 million and the state’s annual visitor population of six to seven million per year. The Hawai‘i Island agricultural industry is striving not only to produce a variety of crops (vegetables, fruit, dairy, and livestock products) to replace imported foods, but to farm using sustainable methods that provide quality products for the consumer while also improving the soil and water resources required for production. As an example, UHM-CTAHR is working with farmers to grow improved pasture forage that is easier for herbivore animals to digest, and to utilize new strains of fattening forages like ekoa (Leucaena glauca) to replace feed imports.

According to the USDA 2007 Census of Agriculture (Appendix J), the major commercial crops on Hawai‘i Island continue to be export crops and 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 followed the national trend: an increased number of farms that averaged fewer acres per farm.

Major challenges as well as opportunities exist for the farmer and rancher growing agricultural crops on Hawai‘i Island for both the short- and long-term. The County R&D can make a

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substantial contribution to assisting in the addressing of these challenges, and to taking advantage of these opportunities through its partnerships with the agricultural community on the island.

B. Crop and Livestock Industries

The expansion of commercial agriculture on Hawai‘i Island is dependent on its profitability for participants. In addition to the problems outlined in the critical areas there are crop specific challenges and opportunities that affect the individual industries. The agricultural industries’ success in meeting the challenges and taking advantage of the 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 the agricultural industries on the island—the impact of the combined effort will be a strong positive impetus to increase agriculture’s position 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.

C. 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. Today, the industry is 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 are located on the eastern side of the island where a favorable climate—warmer year-round temperatures, consistent and heavier rainfall, and light to moderate winds—present the best growing conditions.

The 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

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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. The ornamentals and nursery industry grossed $42.8 million in 2008 on Hawai‘i Island.

Challenges:

- Increasing Mainland and foreign competition in flower production is negatively impacting the industry.

- Shipping (air cargo) costs will increase the cost of the product in the export markets as fuel continues to rise over time.

- Lack of computerized programs to assess costs of potted plants hinders efficiency.

- Agrichemicals and packing materials that are imported will increase finished product cost in relation to increasing fuel costs.

- Since most of the products are discretionary purchases, sales can be expected to decline with the current worldwide financial situation.

- Local sales will decline with the drop in both the tourist trade and the construction industry.

- Declining export sales may jeopardize the continuation of non-stop Hilo to Mainland FedEx flights due to decrease in outgoing product.

- Consumers are looking for new and unique varieties of flowers and foliage.

Opportunities:

- There are opportunities in the local markets, such as direct advertising to Hawai‘i residents or increasing the presence of floral and nursery products in 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.

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- 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 achieving economic stability.

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

Today, most Hawai'i Island cattle ranches are cow and calf operations. Calves are either sold to a broker who ships them to the U.S. Mainland, or kept by ranch owners and grown out on Canadian or U.S. Mainland pasture, finished in a Mainland feedlot, then sold on the hoof or on the hook. In recent years, there has been a successful effort to sell Hawai'i Island raised grass fed cattle, as well as some grain fed cattle, within the state. Because of increasing shipping costs and more consumers becoming concerned about the nutrition, quality, and freshness of foods they buy for their families, locally grown and processed beef is gaining in market share.

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

Challenges:

- A constraint to the expansion of processing beef in Hawai‘i is the lack of sufficient or large enough slaughterhouses that can 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.

- Bovine Spongioform Encephalopathy (BSE) in Canada and the U.S. Mainland when it appears, severely impacts the market.

- There is a lack of diverse marketing and promotion activities for cattle.

- Transportation is costly and often inefficient, especially for the live shipment of cattle.

- The cost of grain shipped to Hawai‘i 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, thus increasing beef production. Increased production, in turn, creates the incentive to investment 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 for pasture at a reasonable cost and access to water will provide the resources for improved pasture and cattle carrying capacity, as well as the resource for grass fattening cattle for the local market.

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- Production of local feed utilizing forages and by-products instead 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 type 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 also been an agricultural activity on Hawai‘i Island since the 1800s. During the early 1900s and until the 1950s, Parker Ranch in Kamuela raised and sold lamb and mutton locally, as well as on O‘ahu. Wool was also an important product shipped to 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 a resurgence in growing sheep for meat. A North Kohala ranch is one of the largest producers, and its lamb products are now found in 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.

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- Health problems, such as worms in the wool, can be 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 is increasing the 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. These domesticated pigs eventually began escaping into surrounding forests, and later became a source of food for modern-day hunters and their families—which continues today.

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

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- There is little or no marketing program for local pork products.

- There are no slaughter facilities in West Hawai‘i for swine, which requires 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 that have 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 cost of production.

Livestock - Goats. Llamas, Other Exotic Animals. Goats arrived on Hawai‘i Island in the 1800s, escaped into the wild and roamed throughout the island, becoming a source of meat for the hunter and his family. Domestic goats are being raised for milk and meat. Goat cheese is becoming a popular item for gourmet restaurants and hotel dining rooms. In addition, goats are being 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 prefer goat meat in their diet.

Llamas and other exotic animals, such as miniature horses, have been imported to Hawai‘i Island and are being bred here. These animals are currently a hobby industry, providing interesting field trips for school children and local fair displays.

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.

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- 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 genetics of some of 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 supplying basic food (including milk for school lunches) to both the Hawai‘i Island and O‘ahu populations. Dairies appeared on Hawai‘i Island in the 1800s; each district on the island had its own dairy, which provided for locals within the district. These dairies also exported milk products outside of the district. Most of the cattle ranches also 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 grazing of cows, in order to achieve cost efficiencies and to compete with Mainland milk, which was starting to be shipped to O‘ahu supermarkets.

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Because of the continually increasing cost of imported grain, the dairies are no longer profitable and only two dairies remain in the state; 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 dairies, one in Kohala and one in Hāmākua, are struggling financially to remain in business. These two remaining 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 dairymen 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 the cow herd.
- 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 Hawai‘i Island to supply a much greater proportion of the state 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 is at present insufficient to meet demand.

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- 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. Chickens, domestic ducks, and turkeys have been part of home-raised food products since the arrival of various ethnic groups to Hawai‘i who brought these animals with them. 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 increasing cost of grain and the advent of huge, cost efficient 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.

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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 Hawaiians who developed a very sophisticated system of salt water and brackish water ponds with gates 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.

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- Kohala Crawfish Farm grows crawfish and juvenile freshwater prawns.

A summary of the general categories of commercial aquaculture products currently grown on Hawai‘i Island is as follows:

- 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.

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- 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.

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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, to name just a few. Forest products were used for rope, decorative items, medicinal products, and many other items of use 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 many 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 to be harvested. 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 another for lumber. A third lumber mill is currently operational. The veneer mill will use the waste from the veneer processing to produce electricity for HELCO. Bio-energy companies are presently in negotiations 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.

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- 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 including 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.

- A mechanism for payments for ecosystem services, e.g., carbon sequestration and watershed protection, is lacking.

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, accumulated over a long period of time, that facilitates the growing of these species.

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- 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 the O'ahu market. 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

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the produce needed for its clientele, 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 constantly being introduced.
- Facilities, such as marshalling yards and refrigeration boxes, are limited and aging where they do exist.

Opportunities:

- Varying climate zones give the Hawai'i Island farmer more choices in the type of vegetable crop 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 freshness can be promoted to expand the market.
- Hawai'i Island growers can expand their exporting to the O'ahu market.
- Increasing sales at farmers' markets has potential.

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- Working more closely with Hawai‘i Island grocery stores in displaying and labeling local vegetables as well as having food demonstrations will educate the consumer 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

Although orchard crops have been grown in Hawai‘i since the early 1800s and bananas were brought by the Hawaiians, they were relegated to home use and small commercial plantings for local markets until the 1900s. 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; 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 dedicated farmers developed improved cultivars of mango, papaya, avocado, lychee, longan, and other orchard crops. As CTAHR released these cultivars that produced fruits and nuts with 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 before reaching full production. Once planted, orchards tend to stay in production unless pests, disease, or market conditions no longer make it feasible to farm them. The continuing proliferation of invasive species into 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 (Appendix K).

Due to the presence of fruit flies and other insect pests, most orchard-grown fruits cannot be shipped to the U.S. Mainland

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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 resulting 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

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is approximately 1,000,000 pounds per year. However, as much as 40% of the production is lost due to waste. Costco has become 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 of supply.

A cold treatment is available to export avocado to the U.S. Mainland, but no one is using it at this time. The treatment was used with varying success in the 1990s. Avocados can be shipped to Alaska and Canada and some growers have established markets there.

Avocado production (estimated at 1.0 million pounds for the 2008/09 season, at an average price of 73.0 cents per pound) for the state is predominantly based in the Kona district (up to 90% of production) on small farms (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.

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- The supply of Hawai‘i avocados is inconsistent.

- Poor quality, unnamed mixed varieties are sold and marketed, which downgrades the avocado to the consumer.

- Backyard avocado growers give and sell their product erratically which impacts the commercial grower.

- There is a lack of coordination between the varieties grown by farmers and what buyers prefer.

Opportunities:

- There is a lack of sufficient supply of quality locally produced avocados to meet the consumer demand year-round, so there is room in the marketplace for an increase in production.

- 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 the 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 the costs and fruit damage.

- Cooperation with the markets to organize better labeling and displays and removal of poor quality fruit could expand consumer interest.

- Increasing the Canadian and Alaska 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

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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 promotion to educate consumers about the quality, nutrition, and taste of locally grown bananas.
- Cooperative marketing will strengthen the producers' impact.
- 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 more than likely that it was brought here prior to his arrival in 1791. The first commercial production of guava was at Pohoiki in Puna by Robert Rycroft and his son, Walter, from about 1900 to 1910. Guava jam and jelly were made in an old coffee mill. Since the 1940s, various companies have operated on Hawai'i Island,

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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 side of Hawai‘i Island on 45 farms, and it is grown mostly on small, one- to two-acre, farms. 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 due to the decrease in production statewide because of the closing of orchard operations on Kaua‘i and increase in 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:

- 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.

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- 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 the development of 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 beginning in the 1920s. The industry expanded to a peak of 22,600-acres in 1990-91. Most of the state’s 570 farms and 17,000-acres currently planted in macadamia are on Hawai‘i Island. (2008-2009 Season.)

Macadamia are grown in all districts. Farmers sell their crop to processors who dry, crack, and roast the nuts. Nuts are sold in bulk to end users that add additional value by retailing roasted mac nut products, candies, cookies, and use them in 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 causing nuts not to be harvested. The 2009-2010 season indications are that a small increase in nut price will occur and the processors will be expanding nut purchases.

Once the global leader in macadamia production and technology, Hawai‘i has fallen behind Australia. Macadamia was once synonymous with Hawai‘i, but has become a global commodity with other countries growing and selling the nuts for a lower price than those grown in Hawai‘i. Although macadamia has the

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potential to regain its niche as a high value product in the world market, the lack of aggressive marketing, innovative leadership and a unified industry is hampering 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 the farmer. 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

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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.

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- Competition from papayas grown in the Philippines, Thailand, and Taiwan and exported to Japan is cutting into Hawai‘i Island papaya industry’s market.

- Competition from Mexico on the Mainland West Coast and Brazil on the Mainland East Coast is cutting into the Hawai‘i Island papaya market there.

- New insect and disease pests are continuing to negatively impact costs and production.

- Farm gate price of papayas has not increased while 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 will assist farmers in producing organic fruit which will open a new market.

- Marketing of papaya and papaya products as a medicinal will expand the market.

- Research on growing papayas in other areas on Hawai‘i Island that are drier, such as in Ka‘u, could decrease the farming costs associated with the 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 of these fruits grew rapidly in Puna, Hilo, Hāmākua, and to a lesser

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extent, in Kona during the mid to late 1980s. The trees began producing with enough volume to market in the early 1990s.

Selling the fruit has been a challenge as most consumers are not familiar with them. The initial marketing effort focused on the ethnic Asian markets in Hawai‘i, on the U.S. Mainland, and in Canada. Markets were expanded to the gourmet food industry with targeted promotional campaigns. Today, when in season, these fruits can be found in farmers’ markets around the island, in grocery stores, and on restaurant menus. Irradiation is an approved treatment used in the export of these fruits to the Mainland U.S. markets.

A total of 970-acres of specialty fruit were harvested from 1,470 planted acres with more than half of the 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 that year.

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 that can now be irradiated and has fewer regulations for shipment than Hawai‘i fruit impacts the U.S. Mainland and O‘ahu markets.

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Opportunities:

- Marketing programs need to be increased locally and in the U.S. Mainland and the nutritional qualities of these fruits 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 moved trees to Captain Cook, Kona, in 1828, starting 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 1960’s Kona coffee was being 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 selling green bean and roasted products. Now farmers can sell cherry or they have the option to add value to their crop by processing and

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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 the coffee tree 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.

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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 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.

<u>Bio-fuels</u>

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

A bio-fuel 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, bio-fuels 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 bio-fuels is focused on timber crops, algae, oil palm,

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jatropha, and waste vegetable oil. The primary market for bio-fuels is HELCO and the production of electricity.

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 the importation of 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 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 bio-fuels is in the replacement of fossil fuel in the firm power sources.

Companies that are in the process of establishing potential sources for bio-fuels on Hawai‘i Island are:

- Hāmākua Biomass Energy LLC is proposing a 30-megawatt plant in Pa‘auilo that will utilize approximately 14,000-acres of eucalyptus currently growing on Kamehameha Schools’ land.

- Hā 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.

Bio-fuel from algae, palm oil, and oil from jatropha are all possible sources of bio-fuel 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

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growing jatropha is in progress at HARC on O‘ahu, and a palm oil demonstration project is planned at the University of Hawai‘i at Hilo.

Challenges:

- There is competition for the large acreages of agricultural land needed for bio-fuel resource growth.

- There is a limited amount of economic data available on the profitability of growing, harvesting, and processing bio-fuels on Hawai‘i Island.

- The capital requirement to plant the bio-fuels, 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 bio-fuel production on Hawai‘i Island.

- Although there is a wide knowledge base about growing, harvesting, and processing bio-fuel 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 bio-fuel industry.

Opportunities:

- Local production of fuel for agriculture will provide a more secure and possibly lower cost fuel source.

- Bio-fuel production will provide new jobs for Hawai‘i Island families.

- Successful, cost effective bio-fuel production could be exported to provide fuel to O‘ahu and the other islands.

- Bio-fuel will provide a more sustainable fuel source.

- Bio-fuel production will keep more money circulating on Hawai‘i Island, rather than being exported for outside fuel.

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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 have now been found in bee traps around the airport in Hilo. The HDOA is monitoring the situation and destroying hives in the area. The mites have a huge negative potential impact on the industry and 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.

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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 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 verify its percentage of Hawai‘i Island cacao.
- Marketing of Hawai‘i Island cacao and chocolate products has been done by only one grower/processor.
- Local chocolate products are very expensive.

Opportunities:

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- 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 the Hawai‘i Island. First introduced in 1887 for large scale production, and then in the 1980s again 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 for 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.

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- 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 contribute to developing a consistently high-quality, year-round supply of fruits for local markets. The project began by working with chefs, fruit buyers, and growers to select 12 desirable fruits to meet these goals. The fruits were planted at a demonstration orchard in Kona; farmers have since been encouraged to cultivate these 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.

Because these crops are being produced in such small quantities and are in a research and development stage, 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 by people gathering the berries. Recent studies done 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 use as an ornamental landscaping plant because of its attractive red crown of young leaves. Additional research on the economics of growing the plants for both berry production and the landscape is needed. 'Ohelo berry is still in the research phase; industry challenges and opportunities have not yet been developed.

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