



# **Hawai'i County Food Self-Sufficiency Baseline 2012**

*Prepared for*  
Hawai'i County Department of  
Research and Development

*Prepared by*  
University of Hawai'i at Hilo  
Geography and Environmental Studies Department

Jeffrey Melrose MURP  
Donna Delparte PhD.





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# Executive Summary

The Hawai'i County Food Self-Sufficiency Baseline study was commissioned by the County of Hawaii Research and Development Division to help inform the public and policy makers about the current status of food production on the island of Hawaii. It is intended to provide a context for shaping individual and collective initiatives to help increase the island's capability to be more food self-reliant. The report follows a recommendation in the Hawai'i County Agricultural Plan to set a baseline from which to measure change in the island's local food system. It was prepared by the University of Hawai'i at Hilo's Geography and Environmental Studies Department in partnership with the Hilo-based land use consulting firm of Island Planning.

Food self-sufficiency on Hawai'i Island has been in decline for over 230 years. Prior to 1778, Hawai'i was 100% food self-sufficient with no more than a dozen major food crops feeding a population arguably similar in size to the current resident population. The plantation era that followed was relatively food self-reliant and saw the expansion of the island's food palette to accommodate growing ethnic diversity. The introduction of transportation innovations such as refrigerated shipping containers after WWII helped to open Hawai'i's marketplace to fresh, mass-produced foods from around the world. Today, Hawai'i County's food marketplace is dominated by a global food system and by consumer demands for crops that are not, and will likely not be, produced locally.

## **Key findings of the Baseline Study include:**

### ***Local Consumption***

- There are over 210,000 people consuming over 630,000 meals every day on Hawai'i Island. Based on estimates of national per capita food consumption, this amounts to roughly 410 million pounds of food annually.
- The State abandoned its historical efforts to monitor local farm production and imports in 2008, and complex food distribution channels make it increasingly difficult to access precise information to monitor local food self-sufficiency over time.
- Within the context of available data, this baseline report suggests that Hawai'i Island currently produces roughly 95% of the fresh milk, over 17% of the fresh beef, over 51% of the seafood, more than 34% of the vegetables, more than 32% of the fruit and none of the grain consumed on the island. (See Food Scorecard, p 26. and following pages for details)
- There is also an informal food system that is even more difficult to measure but which has a significant impact on local food consumption patterns. Food sales at farmers markets, trade and sharing among neighbors, recreational fish catch, subsistence hunting, home gardening and animal husbandry are important, yet unmeasured, parts of the island's rural economy and lifestyle.
- A significant portion of Hawai'i Island's food consumption is done away from home in restaurants, fast food outlets, schools, hospitals, and other institutions that control a large portion of the island's food procurement budget. Expanding the amount of local food being purchased by these food purveyors would help to expand the marketplace for local food producers and encourage new production.

### ***Local Food Production***

- There are over 42,700 acres in crop production on the island, half of which (21,000 acres) are in macadamia nuts, over 6,000 acres are in coffee and another 1,700 acres are planted in flowers and foliage crops. These crops are important to the agricultural economy of Hawai'i though they play very minor roles in the island's food supply.
- Vegetable crops, taro, tropical fruits, banana, papaya, aquaculture and specialty food crops account for 10,400 acres of active agricultural land use. Local consumption of these locally produced crops varies as a significant portion of each crop type is exported to other parts of Hawai'i and continental U.S. and global markets. Hawai'i Island also produces a range of specialty products aimed at boutique markets which help to insure farm viability but do not necessarily contribute significantly to local food supplies.
- Roughly 94% of all existing crop lands on Hawai'i Island are located in 11 areas around the island and are referred to in this report as "Core Crop Lands." These are the areas where the momentum of existing farming activity is most active and therefore most likely to support new agricultural production.
- The patterns of post-plantation land ownership, supporting natural resources, available labor, weather conditions and other factors vary from region to region around the island. Understanding the specific needs and capabilities of each farming area on the island is important to understanding how to urge new food production in each region. The keys to new food

## ***2 - Baseline Study for Food Self-Sufficiency in Hawai'i County***

production are in the details of each producing region and not in a generic discussion of agriculture in abstract terms. The report contains detailed maps of existing agricultural region and a discussion of the factors that drive farm activity in each.

- The existing settlement and diversified land ownership patterns on Hawai'i Island present significant opportunities for small scale food production for both commercial and home use. There are 135,000 agricultural lots between 0.5 and 20 acres in size which encompass over 200,000 acres with varying degrees of food production capacity available to a diverse set of local landowners.
- Surface water irrigation systems in four areas around the island present varying levels of opportunity for the expansion of new farm activity. These systems all require some form of external subsidy to operate in a sustained fashion. The Department of Water Supply is the largest and most expensive purveyor of agricultural water through its extensive distribution system that serves farms island-wide. Much of the island's agricultural production relies exclusively on rainfall.
- Ocean and forest resources are important parts of the local food system with unique stewardship challenges to insure that they remain long-term contributors to the island's ecology and food supply.
- Honey bees play an important role in pollinating certain food and export crops on the island. Bees are also one of many examples where Hawai'i's susceptibility to invasive species can have a devastating impact on the island's ability to produce its own food supply.

### ***The Context for Change***

Building a more self-sufficient food system on Hawai'i Island is not as simple as just adding new farms and additional acreage to the existing agricultural footprint. Successful food production is a function of commerce and markets. It also requires that producers are able to make a reasonable and sustainable return for their efforts. Some of the key issues currently shaping the terrain of increased food self-reliance are discussed in Chapter 8 and include:

- Energy Costs
- Food Safety Requirements
- Agricultural Labor
- Access to Capital
- The Price of Local Foods
- Consumer Preferences
- County Real Property Tax Programs
- Land Use Regulation
- Food Data Collection
- Genetically Modified Organisms
- Organic and Natural Farming Methods

### ***Ways to Make a Difference***

Hawaii County real property tax policies provide important incentives for landowners to pursue agricultural uses. Over 11,000 parcels are enrolled in one of two programs that reduce the assessed value of lands that claim agricultural use. The programs reduce County tax revenues by \$34 million dollars annually, though lack regular oversight to insure that agricultural uses persist once assessment adjustments are granted. Revisiting the policies and procedures for these programs could produce new incentives for increased food production and local distribution.

Food self-sufficiency will not be achieved by government actions alone. It requires the actions of many people in many different roles. Chapter 9 provides a list of over 100 actions that could be taken by different types of stakeholders to promote increased food self sufficiency on Hawai'i Island. These actions are broken into 16 separate action groups from parents and children to government agencies, landowners, farmers, ranchers and fishermen. Some steps are simple and involve actions that could be taken by individual consumers or groups of neighbors; others are more complicated and require collective effort and sustained political will to build a stronger, durable base for local food production.

### ***Moving Forward***

Hawaii Island is a rich and diverse landscape that is well suited to diversified food production. The economy of its rural communities has deep roots in agriculture and the existing small-lot settlement pattern creates a productive setting for individual action and innovation. The island has visionary leadership in the farmer, rancher, consumer, retailer, educator, land owner, government and other sectors that are capable of moving the island towards food self sufficiency to the degree that it is economically practical. 2012 is a good time to act. Rising energy prices, the cost of transportation, declining public health, the emerging slow food movement, school gardens and other national mega trends all help to drive the collective concern for locally sustainable food supplies.

The movement towards increased food self-sufficiency has already begun. "Buy Local" campaigns have been a constant theme across Hawai'i's promotional landscape for decades and are now part of the daily vocabulary of most island residents. This Baseline Study is a mark on the wall to measure what is measurable about Hawai'i Island's state of food self reliance in 2012. To be useful, the baseline needs to be revisited every 5 to 10 years to track areas of progress and to measure where specific efforts have been successful or not. It is also intended to stimulate conversation about how the people of Hawai'i Island set priorities and adjust their lifestyles to support local food producers and the contributions that such support stimulates in the local economy.

Finally, Hawaii County is not isolated in this issue. Food self-sufficiency is a concern for all counties and for the State of Hawaii as a whole. Real progress will require a collaborative effort and some strategic decisions to invest both public and private funds where they will make the most difference. A small cluster of islands in the middle of the Pacific Ocean does not have the luxury to operate in isolation from one another. Leadership at the State level and strategic cooperation across the island chain is a fundamental requirement for a sustained movement towards increased food self-sufficiency in the great State of Hawai'i.



# Acknowledgements

The process of compiling the Hawai'i County Food Self-Sufficiency Baseline has required the support and insight of many people, a few of whom require particular recognition.

Dayday Hopkins, Agricultural Specialist with the County's Department of Research and Development, was part of the impetus for this report. She and members of the Mayor's Agricultural Advisory Commission, both individually and as a group, provided useful input and inquiry throughout the process of this study.

Nick Turner, a graduate of University of Hawai'i at Hilo (UHH), Geography and Environmental Studies program, played a lead role in digitizing agricultural uses Island wide and producing graphics for this report. His expertise and patient demeanor were a welcome addition to this project. Susan Yugawa and her staff at the UHH Graphics Department provided cover art and graphic support that added greatly to the final product. UHH student interns, Mahina Patteson and Alex White both conducted projects that supported this effort. Text editing and useful critique was provided by Julie Hugo, Rick Richardson and Peter Adler.

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The authors are particularly grateful for the contributions of the nearly 150 individuals who were interviewed or played a role in this report, graciously providing their time and insights (Appendix A).

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*"We should start from the perspective that eating is an agricultural act"*

- Poet and Philosopher Wendell Berry

# 1 Introduction

This report was prepared for the County of Hawai'i Department of Research and Development and has two goals:

1. to provide a context for examining the issue of food self-sufficiency on Hawai'i Island and
2. to compile available data into a 2012 baseline with which to monitor Hawai'i Island's progress towards the goal of increased food self-sufficiency.

The impetus for this report emerges from recommendations in Hawai'i County's 2010 Agriculture Development Plan, approved by Council in 2011, to commission a baseline study for increased food self-sufficiency. Although this report is not a road map to food self-sufficiency, it provides a benchmark to show us where Hawai'i County is in early 2012 and what resources we have to apply to the task of producing more food locally.

The measure of success for this document is the degree to which the stakeholders and advocates of local food self-sufficiency on Hawai'i Island use it to help reshape the ongoing discussion, focusing on the places, people, resources, policies, and purchasing practices that can make the most impact on the amount of local food we produce and consume on the Island.

## 1.1 Scope of Work

The scope of work for the project focused in three areas:

### **1. Agricultural Mapping**

- Digital maps of existing agricultural activities and key resources were created in a Geographic Information System (GIS) based on satellite imagery, County of Hawai'i tax information and site visits. To summarize regional farm and ranch activities, a map was generated for each district to reflect the unique characteristics of agricultural production that vary depending upon location. These maps help to focus the discussion of food production by providing a benchmark of where farming is already occurring and where it varies by location, as well as identifying opportunities to increase local production.

### **2. Summarize Current Food Production and Consumption Data**

- This report uses available data to present several ways to measure our current food production and consumption on Hawai'i Island. There are significant data limitations associated with measuring both the local production and consumption rates that handicap this discussion. Data is simply not available to clearly define the local resident diet or measure the import of all food types. Farm production data is equally hampered by limited record keeping and recent changes in the State's commitment to track local food production. Within the context of these constraints, the report provides several approaches to help understand the food self-sufficiency challenge by focusing the discussion to areas where it might be most productive.

### 3. Geodatabase Development

- A digital geodatabase for agricultural lands and related resources has been developed for the County and the general public. Much of this data is already in the public domain and frequently used by planners and researchers to shape land use and other policies. A new body of information has been recently compiled to display the existing agricultural activity on Hawai'i Island. These data are referenced and displayed in this report and will be useful for monitoring the growth of new agricultural activity in addition to analyzing the circumstances that support current production.

Principal Investigators for this project were Jeffrey Melrose of Island Planning, a Hilo based land- use consulting business and Dr. Donna Delparte of the University of Hawai'i at Hilo's (UHH) Geography and Environmental Studies Department. Extensive GIS mapping and analysis was completed by Nick Turner, UHH Research Assistant, using satellite imagery, County Real Property land use data, Natural Resource Conservation Service (NRCS) data and a wide range of interviews and site visits with farmers and kama'aina in each farming region. Outreach and conversations took place with nearly 200 individuals and agencies over an eight month period from May 2011 to February 2012.

Several important distinctions are needed to set the stage of this report:

## 1.2 Self-sufficiency verses Sustainability

This report's focus is food self-sufficiency; the ability of Hawai'i Island residents to depend upon the resources of the Island to support their food needs, including agriculture, aquaculture, fishing, hunting and other activities that produce nutrients. The State of Hawai'i's level of dependency on sources of food from elsewhere, driven largely by market forces and consumer demand, has increased dramatically over the last century. The State's integration into the global economy has left Hawai'i's residents vulnerable to disruptions in food supply and susceptible to the geo-politics of oil and other scarce resources.

Sustainability is a much bigger question than self-sufficiency, although these terms are often used interchangeably. Sustainability is an economic, social, and ecological concept that is tied to the ability of systems to endure over the long term. It is a societal challenge to develop new, "green" technologies, to seek out alternative energy sources, to improve land use and transportation patterns, to adjust individual lifestyles and to pursue ethical consumerism. These are important challenges that are woven into the food self-sufficiency discussion at many levels. Self-sufficiency is linked to sustainability by the cost of energy, the availability of fertilizers and feeds, the health of ecosystems and other global factors that are beyond the scope of this study.

## 1.3 Food verses Non Food Agriculture

Agriculture in Hawai'i consists of edible and non-edible food production for local consumption and those products that are exported elsewhere. Export is an important part of Hawai'i's agricultural production history and is a major driver of the economic engine that supports rural economies around the state. Sugar, macadamia, coffee, flowers and foliage are all produced on Hawai'i's agricultural land but only a portion of each remains in the state to feed or, otherwise support, our lifestyle. These export crops are the largest user of agricultural land on Hawai'i Island and account for over 50% of the intensive agricultural land use on the Island.

This study maps crop lands to inform a baseline of agricultural land use, however; it will focus mostly on the food elements of our local production and less on the 1,700 acres of non-edible flower and foliage production or the 21,000 acres of the largely export oriented macadamia industry. These are both important parts of our agricultural industry but play a relatively minor role in propelling food self-sufficiency.

This report is intended as an aid to inform ongoing food self-sufficiency discussions. It is a work in progress and provides several tools by which to identify our current status and to monitor our progress towards producing more of our own food on Hawai'i Island.



## 2 Food Self-sufficiency on Hawai'i Island

### 2.1 History of Food Self-sufficiency in Hawai'i

Prior to the first human settlement of the Hawaiian Islands, there was little in the way of edible food growing on the islands. Fresh water, seafood and nesting seabirds were abundant but there was little in the way of edible food growing on the islands. The first Hawaiian voyagers brought a small suite of canoe crops to insure their survival when they arrived, including breadfruit, taro, sugar cane, gourds, coconut, wauke



*Breadfruit or 'ulu was an important food staple for early Hawaiians*

and a few other plants that could survive the open ocean journey. Pigs, chickens and dogs also came in early voyages. Successive voyages brought additional food, wood, oil and fiber plants. Early Hawaiians fed themselves by farming, animal husbandry and the gathering of wild plants, birds and seafood. By the time of western contact, Hawaiian society had amassed an intimate

knowledge of how to plant and manage the natural and agricultural bounty of these remote Islands. There were no outside food resources available and residents of the Hawaiian Islands were 100% food self sufficient.

Estimates of Hawaiian population at the time of western contact vary widely. the first census was not conducted until 1832, over 50 years after contact. Pre-contact population estimates for Hawaii Island range from 80,000 to 400,000 with most estimates in the 100,000 to 150,000 range<sup>1</sup>. By comparison the 2010 US Census for Hawai'i Island documents 185,000 residents.

A depiction of the estimated agricultural foot print for Hawai'i Island prior to western contact is provided in Figure 1. Wetland farming in the rain fed gulches of Kohala, Hāmākua, and Hilo produced a

sustained supply of kalo and other products that were eaten locally and traded islandwide. Large dry land agricultural complexes in Kona and North Kohala expanded, receded and expanded again as demand for food varied over the years. In every settlement area there were gardens to provide food for its residents in seasonal cycles. The ahupua'a system that divided lands into units running from the forested mountains to the waters off shore was a basic building block of food self-sufficiency. 'Ohana played an essential role in food productivity with the inter-dependency of the family unit being a basic building block for the communal effort it took to insure that there was a dependable food supply for all.

The shoreline and surrounding ocean provided a rich supply of protein, salt and other nutrients that was harvested in accordance with the natural ebb and flow of marine life. These practices were guided by observed traditions and protocols that helped to insure a sustainable food supply. Food, tools, fibers and stone were gathered from nature and the techniques of their use were refined and passed from generation to generation. Stone and fiber were the extent of the "technology" available to produce both food and shelter. Feeding the Island's population required hard work and everyone had a role and a responsibility in the process. There were times of shortage and times of plenty, there was trade and barter and there were strict practices and religious beliefs that wove the many acts of food self-sufficiency into an accomplished art.

The traditional Hawaiian food palette was substantially less complicated than what we enjoy today. Hawai'i ate what it could provide and imported nothing. Simple staples such as kalo, 'ulu, u'ala and plantains provided basic starches. Fish and

meat from chickens and pigs provided proteins. There were few fruits or nuts, no grains, no wide array of spices and few options to allow for storage without spoilage. Providing food for over 100,000 Island residents was a relentless task. It was made somewhat easier by a rich, varied landscape but ultimately hard work, shared knowledge, and daily persistence was required by everyone to sustain early life in the islands.

#### ***Native Hawaiian Food Palette Prior to Western Contact***

Taro, Sweet Potato, Yams, Banana,  
Coconut, Arrow Root, Fish, Shellfish.  
Seaweed, Pig, Chicken, Breadfruit, Sugar  
Cane, Sea Salt

<sup>1</sup> Robert Schmitt, "New Estimates of Pre-Censal Population in Hawai'i", The Journal of Polynesian Society, 1971, Vol. 80, No. 2, pp. 241-242



Figure 1. Pre-Contact Estimated Food Production Areas





*Backyard gardening was an important supplement to the diet of local families in the plantation era*

*(Photo courtesy of Wayne Subica)*

### **Food Self-sufficiency in Decline**

Hawaiian food self-sufficiency remained largely uninterrupted for decades after western contact. Western goods like cloth, tools, building materials and leather goods entered the Hawaiian market place but most people still depended on locally produced foods to subsist. In the early 1800's local surplus was often sold or traded to passing sailing ships to feed their crews. During the mid-1800's significant shipments of Hawaiian sweet potato and other foods helped to feed workers during the Gold Rush on the West Coast. Other introduced plants, like oranges, were planted to be sold to sailing vessels to protect crew members from scurvy and other forms of malnutrition.

In these early years, the shift from a self-sufficient/barter economy to a cash economy began to unravel the collective commitment to local food production which was the foundation of the pre-contact self-sufficient food system.

During the 1800's, new plants and animals were introduced, expanding the local food palette. Imported canned, salted and dried goods supplemented local food production and the selection of available goods grew dramatically. Mom and Pop stores opened up around the Island offering options to local food production and creating small market places to sell locally produced foods to those who were no longer focused on producing food for themselves.

In the late 1800's and early 1900's, plantation communities flourished around the Islands. Immigrant labor from Asia and Western Europe brought with them their own collection of plants and spices to the Island diet. Some of this was imported and some of it, like rice, was extensively cultivated in the same areas that once produced taro and other native foods. Back yard gardening was a common practice and workers assumed the responsibility to produce as much of their own food as possible. Gardening was not a luxury; it was an essential part of feeding families and providing the varieties of fresh produce that Hawai'i's ethnically diverse communities wanted.

Throughout rural Hawai'i, most plantation and ranching communities had their own dairies that produced and delivered milk products to local door steps. Local Hilo historian Wayne Subica documents 132 private and commercial dairies on Hawai'i Island between 1894 and 1964<sup>2</sup>. In 1930 alone, there were over 130 dairies in the Territory, most of which were in windward O'ahu, to provide milk, and butter to the growing city of Honolulu<sup>3</sup>. Piggeries were common in many communities and chickens were raised as part of daily life. Canned goods that could withstand the long journey from other parts of the world became increasingly common in local stores, but much of the available fresh food was still produced and distributed locally.

Electricity on Hawai'i Island was first produced from the flow of irrigation ditch water at the Hilo Boarding School in 1890, much of which was used to produce ice. Household refrigerators were not commercially available until the 1930's, so for decades, ice was the principal method to keep meat and other foods fresh in Hawai'i's tropical climate. In 1894, with demand for ice and electrical power growing rapidly, the Boarding



***Hawai'i Island is deeply embedded in the global food system. Fresh produce from around the world is available locally every day of the year.***

School's system was turned over to Hilo Electric Light Co. who produced half ton slabs of ice and delivered it in blocks to nearby residents and businesses. Hilo's fishing fleet, based at the Wailoa River, grew rapidly in the early 1900's in direct proportion to the growth of the local ice industry and expanding population Island wide.<sup>4</sup>

In the late 1940's, spurred by WWII innovation, the shipping industry adapted refrigeration technology to shipping containers and began delivering fresh food items to the Islands. As the capacity for fresh imports increased, so did the demand for crops that Hawai'i could not grow. Refrigerated shipping

<sup>2</sup> Wayne Subica, personal communication

<sup>3</sup> David Livingstone Crawford, Hawai'i's Crop Paradise, 1937

<sup>4</sup> Subica, Mom and Pops Before Wal-Mart and K-Mart, Volume 1, 2010

opened up the Hawai'i market to a wide range of foreign products that could be delivered to Hawai'i docks at a price that was cheaper than what could be produced locally.

In a period of about 60 years, from 1900-1960, Hawai'i became fully integrated into the web of world food production and supply. Local food production declined substantially as families relied less on their own gardens and neighborhoods for food and more on large retail grocers to put food on their tables. Hawai'i's food preferences shifted from the simple array of foods that could be locally grown to a global array of both fresh and processed foods that can be stored easily and sourced from farmers around the world, regardless of season.

In 2012, Hawai'i Island is deeply embedded in a global food system that relies heavily on cheap energy and access to a relatively inexpensive global food system built on economies of scale. Large agribusiness networks produce and consolidate the food production process, enabling massive amounts of fresh and processed food to be produced at prices well below what most communities around the country could match. Fresh vegetables from the Central Valley of California, fresh fruits from around the world in seasonal abundance, beef from feedlots in the western US and New Zealand, fish from China and the Philippines and processed foods from major corporate producers around the globe have come to define the global food system. Large retailers like Foodland, Safeway and Costco have helped to shape our consumer expectations that all foods are available all the time, seemingly fresh and displayed in ample piles of abundance.

Global shipping and delivery systems have eliminated the need for long term food storage warehouses. Technological advances in "just in time" delivery enables shelves to be stocked from newly arrived containers parked at the back of the store. Today, it is estimated that there is between 7 and 21 days of food stored on Hawai'i Island at any time. This estimate comes from Hawai'i County Civil Defense and is predicated on the assumption that there would be some orderly dispersal of available foods if the supply chain were interrupted. If hoarding by individuals occurred during such a crisis, even what little food storage there is would disappear more quickly.

From a short list of locally grown and collected foods in 1778, Hawai'i residents now choose daily from thousands of different foods that are grown, packaged, processed and shipped from places and by people we rarely consider when we shop. We are detached from the food we eat and have come to expect nothing less than to eat what we want, when we want.

It would be futile to believe that Hawai'i could entirely unring the bell of global food dependency. Returning to a state of 100% food self-sufficiency is not a practical goal in this modern era. Hawai'i Island could however set some goals that reflect times in its plantation era past where communities were significantly more food self reliant, where demand was shaped by the types of food the Island produces and neighbors help to feed each other.

## 2.2 Measuring Hawai'i Island Food Self-sufficiency: 2012

### 2.2.1 Limitations in Available Data

Measuring Hawai'i County's food dependency in 2012 is a significant challenge. It is difficult to determine, with any certainty, what is produced locally versus what is imported to the State, let alone provide a break-down by County. Data sources are limited. For decades, the Department of Agriculture (DOA) and the National Agricultural Statistical Service (NASS) have collected data on local fruit and vegetable production and maintained a record of imports versus local production of agricultural goods. That data collection effort was discontinued in 2009 due to budget short-ages with the layoff of 25 State employees in the Agricultural Statistic Division of DOA. It has been several years since even minimal amounts of agricultural data were collected in Hawai'i. Gone too is the collection of farm gate pricing data that helped farmers price their production against a Statewide or Island averages. A

copy of the tables summarizing vegetable and fruit production and imports published in 2008 and 2009 is included in Appendix B to illustrate the difference between what was collected in 2008 compared to the lack of data available in years following the 2009 State layoffs.

A National Census of Agriculture is conducted by NASS every five years. This provides a rich data base of farm activity in a wide variety of categories. Data is gathered from a 25 page survey that is sent to ranchers, farmers, bee keepers and other agricultural producers across the nation. Filling out the census is voluntary and compliance varies from place to place. In Hawai'i, most of the data collected in the NASS survey reflects statewide production numbers and rarely disaggregates to the County level. This report will reference NASS data from the 2007 Census. Readers should understand that NASS is a diligent effort by the USDA to collect agricultural data but it is only as good as the people who complete the census survey. The last NASS census was published in 2009 from data col-



***Farmers' Markets are a growing trend in local food distribution. Most transactions are conducted in cash and are hard to measure***



lected in 2007. The next census will be conducted in 2012 and will be published in 2014.

On the consumption side of the discussion, there is a diverse set of food distributors, grocery stores, restaurants, and institutions that operate in between the farmer/rancher and the end consumer. These are business relationships that operate in a competitive environment that makes it difficult to access detailed documentation of just how much food gets delivered and consumed in Hawai'i County. There is no central source, nor a set of data sources that clearly define what foods gets distributed locally and what we import from elsewhere. This study will explore strategies for measuring our consumption, but there is no definitive set of data to define how much of what crop or food type is eaten annually on Hawai'i Island.

There are large portions of the food supply chains that are not measured. Farmers Markets are a growing trend in Hawai'i County. There are currently over 25 regular farmers markets in operation on the Island and more emerging all the time. Ideally, farmers markets are a way for farmers to sell their produce directly to consumers. Many vendors also purchase fruits and vegetables from distributors and resell them at the market. Sales are largely transacted in cash and there is no definitive source of data available to measure the amount of local produce purchased in this manner.

Also missing from Hawai'i's food data collection is a way to measure the amount of food that is produced in home gardens for local consumption. Recreational fishing goes largely unrecorded, as do portions of the local meat supply from cattle, pigs, sheep, and goats that are slaughtered privately. Small ranchers, pig farmers, and goat herders harvest hundreds of animals annually for personal use, family gatherings, and parties, none of which appears in public data sources. The best this baseline study can do is to acknowledge these informal sources of local food exchange and make some informed estimates as to their volume.

## 2.3 Measuring Food Demand

Given the state of data on food production and consumption on Hawai'i Island, there is no reasonable way to accurately measure just how much food is consumed here annually. There are, however, useful ways to estimate overall food demand in the County and to characterize local food demand based on the different types of food in the average diet.

Measuring food demand in Hawai'i County starts with population. Based on the 2010 census the County's resident population was 185,079. Hawai'i's economy is largely based on hospitality so the food demand of visitors is part of the Island's basic consumption pattern. Based on Hawai'i Visitor and Convention Bureau (HVCB) data in 2010, there were roughly 1.3 million visitors on the Island with an average length of stay of 7.1 days<sup>5</sup>. This is equivalent to 9.23 million total visitor days annually.

Divide that by 365 days and there is an average of 25,287 visitors on the Island every day. The combined resident and visitor population is referred to as the de facto population and amounts to 210,366 mouths to feed on the Island every day. Assuming

**Table 1. The Food Challenge**

<i>The Food Challenge</i>	
<i>Resident Population 2010</i>	<i>185,079</i>
<i>Average Daily Visitor Count</i>	<i>25,287</i>
<i>Total De facto Population</i>	<i>210,366</i>
<i>X 3 Meals per Day</i>	<b><i>631,098 Meal per Day</i></b>

three meals per day, Hawai'i Island needs the capacity to serve an average of over 630,000 meals per day (Table 1).

Translating population counts into the actual amount of food consumed is more complicated. There is no research that depicts the amount and types of food that Hawai'i Island residents consume annually. There are, however, several national food consumption models based on mainland eating habits which can be used to get a broad understanding of food demand. Hawai'i's eating habits are likely to vary from mainland norms in areas like fish and rice consumption for instance, but research on the differences between mainland and local eating habits has not been published.

Allowing for a variation between local and national consumption patterns, Table 2 displays the average consumption, in pounds per year, of selected food groups. These numbers are derived from a USDA report published in 2008 and utilizing estimated per capita numbers from 2000<sup>6</sup>. Each per capita food group number is then multiplied by the number of Hawai'i Island resident and the de facto population to include visitors on the island on any given day. This data suggest that Hawai'i Island requires over 410 million pounds of food annually to feed its combined resident and visitor population. It is also useful to note the relative percentages of total food that each food group involves. Food groups with the largest volume by weight are dairy, vegetables and fruit.

USDA's Economic Research Service indicates that the aggregate food supply in 2000 provided 3800 calories per person per day. Of that number, roughly 1,100 calories were lost to spoilage, plate waste, cooking and other losses.<sup>7</sup> Add to this the amount of spoilage that happens on farms, ranches and fishing boats and it is clear that gross food demand is significantly higher than just what appears in stores or gets loaded in cars at the market.

Another way to visualize these numbers was developed by a firm named Visualeconomics whose website features creative ways to visualize important social issues. Their graphic "What Are We

<sup>6</sup> Average per capita consumption derived from charts in USDA Fact Book, Chapter 2; Profiling Food Consumption in America, 2008. Numbers based on 2000 estimates

<sup>7</sup> USDA Agricultural Fact Book 2001-2002, Ch. 2, Profiling Food Consumption in America



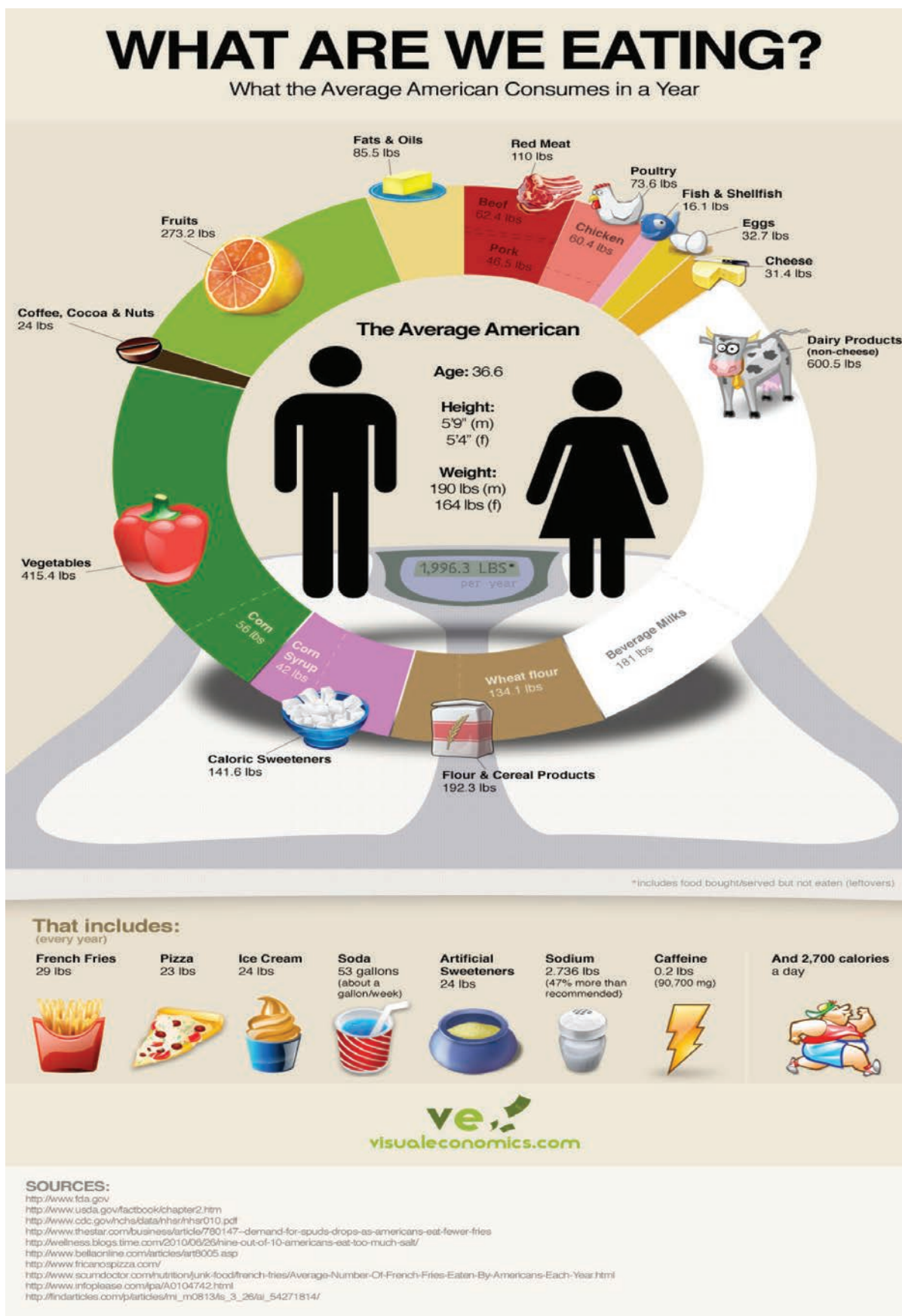


Figure 2. Summary of American Eating Habits

Summary of Average 36 year old American Eating Habits from Visualeconomics <http://visualeconomics.creditloan.com/?s=Average+food+consumption>

Eating” is provided in Figure 2. The numbers used for each food group may vary slightly from the USDA numbers used in Table 2, but the differences are relatively slight. In order to monitor progress towards improved food self-sufficiency, there needs to be some consensus developed statewide about what consumption numbers are relevant and which need to be adapted to reflect eating patterns that are unique to Hawai'i.

### ***Eating at Home Verses Eating Out***

According to the 2010 Census, the average American household spends 13.7% of their household income on food<sup>8</sup>. A 2008 report prepared for the Cooperative Extension Service suggests that in 2005, Honolulu consumers spent 52.3% of their household food budget on food eaten at home and 47.7% of that budget purchasing food away from home.<sup>9</sup>

This suggests that most Hawai'i residents control only a portion of their personal food buying decisions. Many of these decisions are delegated to restaurants and other food establishments. The practice of eating out frequently will vary from one Hawai'i Island community to the next, but clearly, much of the food we consume we do not purchase or prepare ourselves. For the 25,000 daily visitors, that number is substantially higher.

**Table 2. Estimate of Hawai'i Island Food Demand**

Food Type	Average lbs/year	Hawai'i County residents lbs/year	De facto Population lbs/year	% of Total diet
Grains	199.9	36,997,292	42,052,163	10.2%
Sweeteners	152.4	28,206,040	32,059,778	7.8%
Fruits	279.4	51,711,073	58,776,260	14.3%
Vegetables	428.7	79,343,367	90,183,904	21.9%
Added Fats and Oils	74.5	13,788,386	15,672,267	3.8%
Dairy	593	109,751,847	124,747,038	30.4%
Meat, fish, eggs, & nuts				
red meat	113.5	21,006,467	23,876,541	5.8%
poultry	66.5	12,307,754	13,989,339	3.4%
fish	15.5	2,868,725	3,260,673	0.8%
eggs	21.2	3,923,675	4,459,759	1.1%
nuts	8.8	1,628,695	1,851,221	0.5%
<b>TOTAL</b>	<b>1953.4</b>	<b>361,533,319</b>	<b>410,928,944</b>	<b>100%</b>

Restaurants, fast food outlets, and prepared foods at grocery stores account for a significant amount of Hawai'i Island residents' decision making about what food to eat and where it comes from. Institutions such as schools, hospitals, care homes, prisons etc. also make food decisions for significant portion of Island residents. Some restaurants have tried hard to brand themselves as serving fresh, locally grown meats and produce. Others get their food directly from mainland distribution networks with little or no attention to local sources. Public schools, in particular, get substantial portions of their food from national food surplus distribution networks, passing on significant cost savings for school lunches. are explored.

Many fine dining restaurants on Hawai'i Island have taken the opportunity to promote the use of local produce. Chefs around the Island now provide steady markets for some of Hawai'i Island's highest quality fruits, vegetables, meats and condiments. These chefs understand the value of serving fresh, local food and connecting their clientele to the special characteristics of Hawai'i's food supply. This trend is often referred to as “Farm to Plate” and is a national phenomenon, particularly in the world of fine dining.

## **2.4 What Local Food Do We Produce?**

Hawai'i Island produces a wide array of fresh foods and a relatively small number of value-added, processed foods made from local produce. Year-round growing conditions produce a rich set of fruits and vegetables, a small selection of starches, virtually no grains, processed dairy products, and an assortment of meats and fish. Virtually all of these locally produced foods have various growing seasons, so not all of what is produced is available in the market place all of time. There are also thousands of regularly-eaten food products that are un-



***Restaurants menus define a significant portion of Hawaiian Island food purchase decisions***

<sup>8</sup> Hawai'i County Data Book 2010, Table 12-12

<sup>9</sup> Economic Impacts of Increasing Hawai'i's Food Self-sufficiency, PingSun Leong and Matthew Loke, UHM cooperative Extension Service Economic Issues EI-16



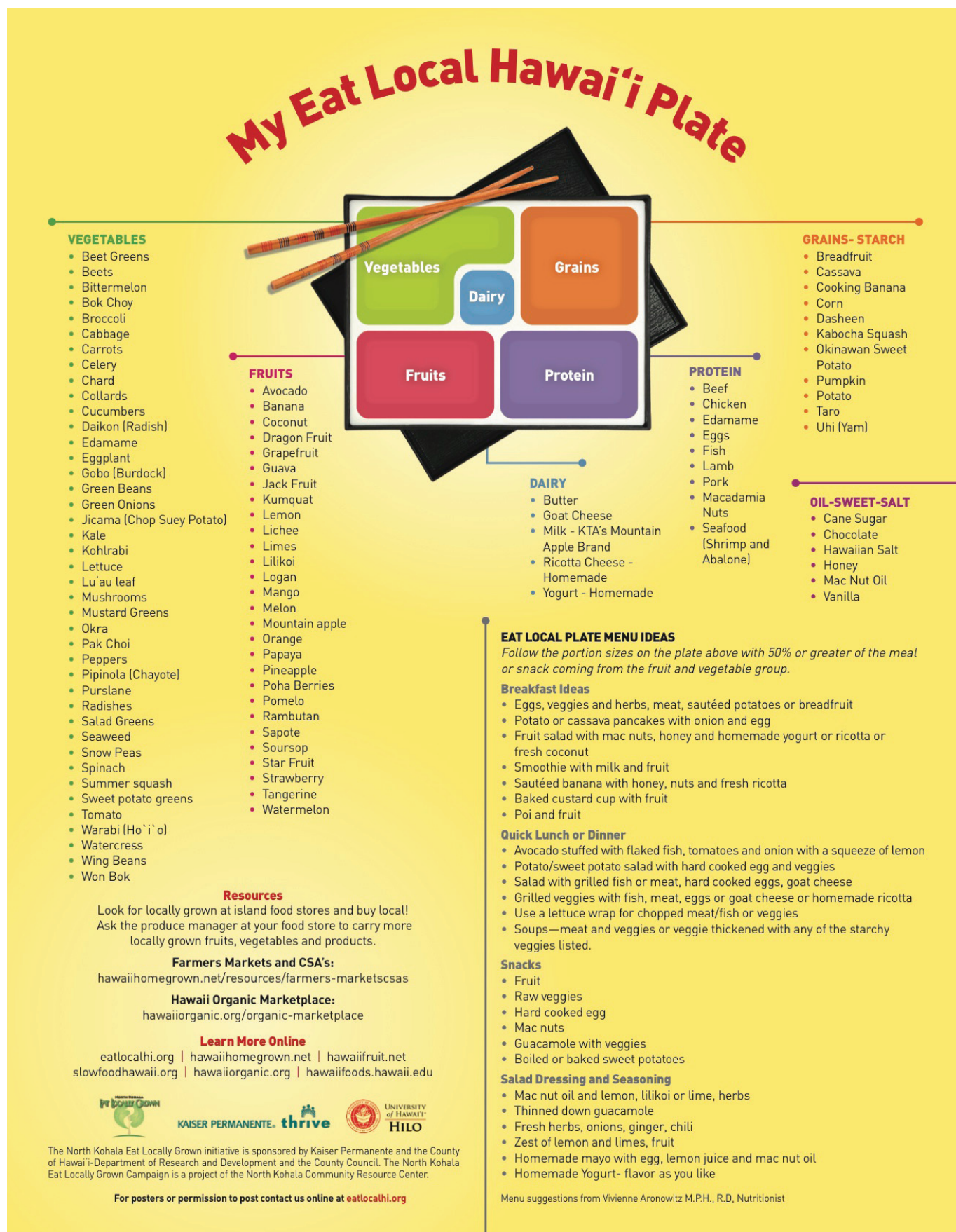


Figure 3. My Eat Local Hawai'i Plate

likely to be produced in Hawai'i. Cereals, pasta, rice, cheese, temperate climate fruits, and some popular vegetables are all outside the reach of Hawai'i's agricultural production capacity in a practical, economic sense.

Figure 3 provides a graphic poster developed by Andrea Dean of Sustainable Initiatives LLC, in partnership with this food baseline study. It depicts a listing of what foods Hawai'i Island produces in the context of an adapted USDA My Plate graphic. The My Plate Graphic was released in 2011 to replace the national food pyramid model and emphasizes the balanced diet promoted by the US Department of Agriculture<sup>10</sup>.

## 2.5 Hawai'i Island Food Self-Sufficiency Scorecard

Figure 4 displays the current state of Hawai'i Island's food self-sufficiency dilemma in terms of common food groups and the percentage of total consumption that is produced locally on Hawai'i Island. The specific percentage number in the graph displays the amount of local production that can be documented based on formal sources of data. The gradient portion of each column displays an estimate of the informal sources of food that contribute to the overall food supply. Many of the food types produced on the island are also exported to other islands or out of the State. Export opportunities are part of what drives the economics of local agriculture and links Hawai'i Island food producers to the demands of the State and global marketplace. Data sources for this graph come from a range of sources that are discussed in the sections that follow.

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<sup>10</sup> USDA Choose My Plate.gov

# Hawai'i Island FOOD SELF-SUFFICIENCY SCORECARD: 2012

Percentage of locally produced food consumed by food group

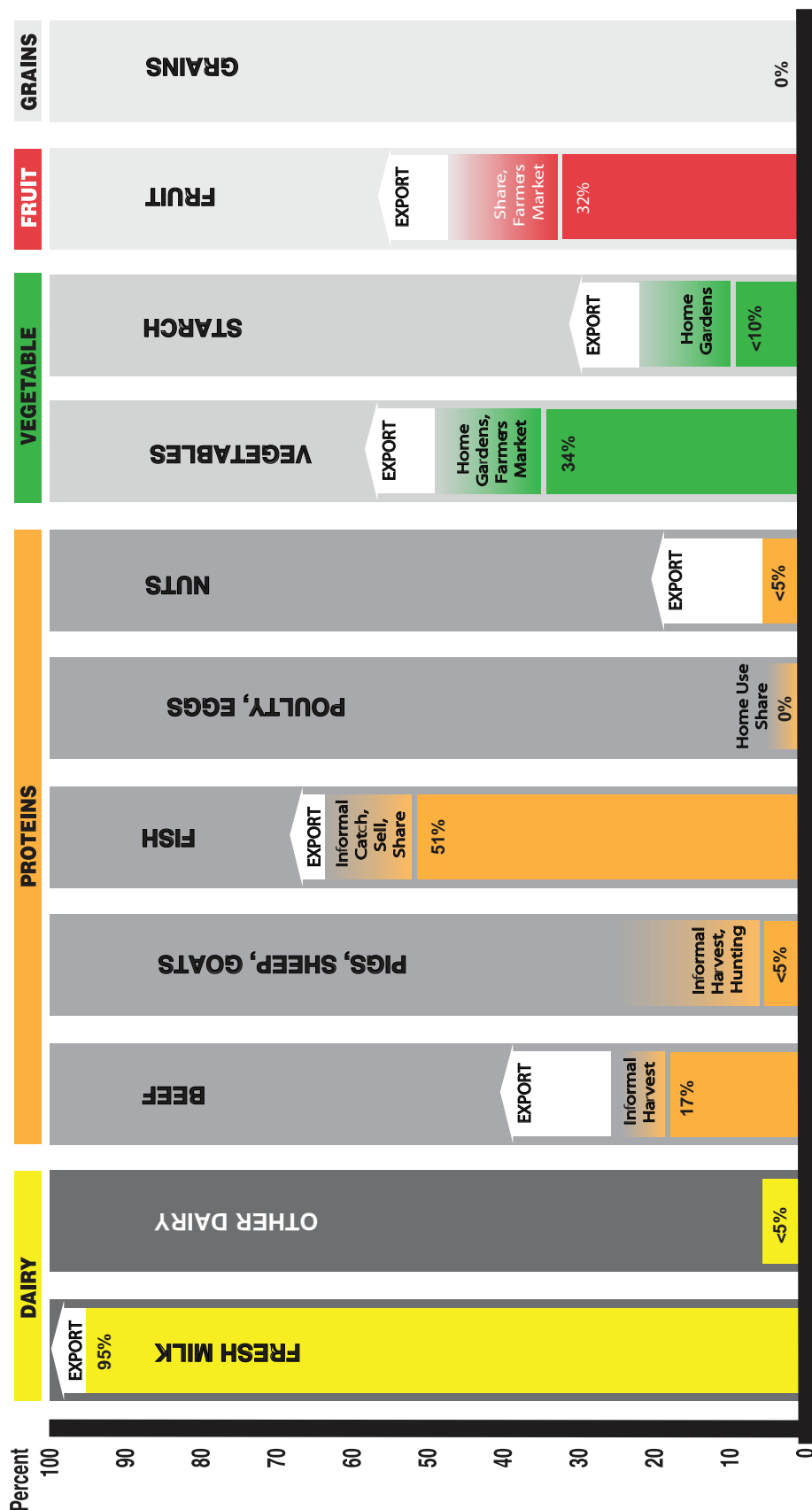


Figure 4.

Baseline Study for Food Self Sufficiency in Hawaii County



UNIVERSITY  
of HAWAII  
HILO

Figure 4. Hawai'i Island Food Self-sufficiency Scorecard

### 2.5.1 Fresh Milk

In 2012, the only two remaining dairies in the State, both located on Hawai'i Island, produced an average of 7,600 gal/day or about 14% of the State's total fresh milk demand<sup>11</sup>. Hawai'i Island in the 2010 census was 14% of the State's population. Hawai'i Island dairy production is equal to, or exceeds, the total amount of fresh milk consumed on the Island, and has been that way for several years.

Milk from both Big Island Dairy in 'O'okala and Clover Leaf Dairy in North Kohala is sold to Meadow Gold and processed exclusively in their facility in Hilo. The milk is packaged in various sized milk containers under a variety of labels, including KTA's Mountain Apple, Safeway's Lucerne, Foodland's Best Yet, and Costco's Kirkland, among others. A portion of Hawai'i Island's milk supply is also packaged as Hawai'i Fresh and shipped to other islands for branded local milk sales through Foodland, Whole Foods and other retailers on O'ahu, Maui and Kaua'i. During periods of the year when milk production is high, milk is also shipped off Island in bulk containers to be mixed with imported milk at the Meadow Gold facility on O'ahu.

As long as local milk production is adequate to cover the current Hawai'i Island demand of fresh milk, virtually all brands of fresh milk sold on Hawai'i Island come from Hawai'i Island sources. To confirm that the milk consumers' drink is locally produced, look for the Meadow Gold processors code on the top of the container with numbers beginning in 1506.

No organic milk or soy milk products are produced locally and there are some smaller milk brands that appear on local shelves imported from elsewhere. Roughly 95% of all fresh milk consumed on the Island comes from local dairies. This included milk provided to students at DOE lunch programs. Market conditions keep locally produced milk on local grocery shelves in 2012. A disruption in supply from either dairy would require imports to meet existing demand.

The USDA estimates that the average American consumes 593 pounds of Dairy products per person per year. (Table 2). Fresh milk constitutes about 34% of the Dairy food category by weight<sup>12</sup>. Milk consumption in America has declined by 38% since the 1950's and cheese consumption has increased nearly four times. The USDA estimates that part of this shift is the increased frequency of Americans to eat away from home and the replacement of milk with soft drinks.<sup>13</sup>

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*Roughly 95% of all fresh milk consumed on the Island comes from local dairies.*

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### 2.5.2 Other Dairy Products

Butter fats from Hawai'i Island dairies are processed locally at Meadow Gold to produce much of the half and half and whipping cream available on the Island. Surplus butter fat is shipped to Honolulu for similar processing. There are several goat cheese dairies on the Island producing small volumes of cheese that is sold at markets and to restaurants. Goat cheese is a boutique product with a very narrow slice of the overall dairy product market.

Given that there is no significant cheese, butter or yogurt production on Hawai'i Island, only a small proportion of the supply of other dairy products consumed on the Island comes from local sources. Half and half and whipping cream are the extent of other dairy products on local shelves from local sources. This amounts to something less than 5% of the total Other Dairy category. The remainder is imported from the global marketplace.

#### *New Directions in Dairy*

In 2012, there are approximately 3,360 acres in dairy use on Hawai'i Island, including pasture, silage production, and milk barns. Island Dairy in 'O'okala has just changed hands and the Clover Leaf Dairy in North Kohala is for sale. Both of these existing operations require new capital investment to keep them operational. A new dairy is proposed for State lands near Pa'auilo with an emphasis on local cheese production and is in search of start-up capital. There are also several new dairies under consideration, some on Hawai'i Island, Kaua'i, and O'ahu. Establishing a series of stable milk producers across the state is an important step in securing the state's self-sufficiency in this important food group.



*Cows pasturing outside of the Dairy in 'O'okala*

Dairy operations have many challenges to overcome including the disposal of waste material and the production of local feeds to replace imported grains. Cows do best in a cool environment between 500-1000' elevation with adequate rainfall

11 Personal conversation with Grant Tomita, DOA Milk Control Specialist.

12 USDA Agricultural Fact Book 2001-2002 Ch. 2, Table 2-2, milks weighs 8.6 pounds per gallon, divided by total dairy products

13 Ibid, Ch 2



to produce pasture grass in the areas immediately around the dairy. Dairies also require farmable acreage to support the growth of corn or other silage to supplement imported feed costs. Due to the concentration of large animals, dairies are best sited away from population centers.

### 2.5.3 Local Beef

The total state of Hawai'i's cow herd inventory in 2009 was 81,200<sup>14</sup>. In that year, 57,000 calves were marketed, the majority of which were sent to the mainland for finishing. 43,500 head or 76% of all Hawai'i calves market in that year came from Hawai'i Island. In 2009, 6,485 head were slaughtered at federally inspected facilities on Hawai'i Island<sup>15</sup>.

The average American consumer demand for beef is estimated at 60.8 lbs. per person annually<sup>16</sup>. Based on Hawai'i Island's de facto population of 210,000 and an average retail beef equivalent of 450 lbs. per head, Hawai'i Island's current annual beef demand is 28,373 head<sup>17</sup>. In 2009, Hawai'i Island ranchers sold or slaughtered 49,985 head<sup>18</sup>, or nearly twice the number of cattle than the Island needs to meet annual beef demand. Counting just the number of head that were commercially slaughtered on the island (6,485 head), Hawai'i Island ranchers and processors actually produced 23% of the meat needed to meet local consumption. Since an estimated 40% of the production from Hawai'i Beef Producers<sup>19</sup> was shipped to Honolulu in the form of bulk hamburger and cuts of grass fed beef, **the total of amount of local beef eaten on Hawai'i**

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***Hawai'i Island's  
current annual  
beef demand is  
28,373 head***

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#### ***Trends in the Cattle Industry***

Hawai'i's cattle industry is principally an export industry that ships its calves to the mainland for finishing and sale. The shift from local sales to mainland exports began in the late 1980's and is a result of shifting economics, transportation costs and the high price of grain. The expense of shipping

young cattle to the mainland is less than what it takes to bring the grain to Hawai'i for local finishing. In 2012, cattle prices are higher than it has been in many years, so there is strong market pressure to sell cattle at a young age while the market demand is high.

Processing meat at a federally certified slaughterhouse is required for all meat sold commercially. Hawai'i Beef Producers in Pa'auilo and Kūlana Foods in Waiākea are the only two remaining certified slaughterhouses on Hawai'i Island. Both of these operations face significant constraints in their ability to expand operations, including their capacity to treat waste water and to process offal from the slaughter. The Pa'auilo plant is currently preparing to move forward with installation of a rendering plant and other improvements that will help to expand their capacity, but there are other hurdles as well.

The Hawai'i cattle industry, as a whole, is looking to expand the amount of local grass fed beef that is raised locally and available in the Hawai'i market place. The grass fed initiative is being pursued on a small scale today by several ranches and retailers, most notably Kuahiwi Ranch in Ka'ū and KTA's Mountain Apple Brand. The challenge to producers of grass fed beef is to consistently provide high quality 1,000 plus pound animal to local slaughter operations from pastures that have a regular supply of grass to finish animals on a year-round basis. The availability of quality pastures is dependent on rainfall and on the investment by ranchers to improve pasture quality, productivity, and forage management systems.

There are approximately 640,000 acres in pasture on the Island, much of it in low rainfall areas, below 30 inches annually. Pasture lands with higher rainfall are important for stabilizing a local grass fed beef industry. There is discussion of using surplus water in the Hāmākua Ditch to irrigate pastures in the Honoka'a to Pa'auilo area, makai of the ditch. This will require



***Market calves at the University's beef cattle research station in Waimea (photo courtesy of G.F. Fukumoto)***

**Island is roughly 17% of the Island total beef consumption.** In addition to the commercial cattle ranches and slaughter op-

14 NASS. 2011. Statistics of Hawaiian Agriculture 2009. Hawai'i Dept. of Agriculture and USDA NASS

15 Hawai'i Department of Agriculture, Animal Industry Division, 2012.

16 USDA ERS Data 2009 from Glen Fukumoto, CTAHR

17 60.8 lbs X 210,000 de facto population/450 lbs/head = 28,373 head total beef demand

18 43,500 marketed plus 6,485 locally slaughtered

19 Personal communication, Jill Mattos, Hawaii Beef Producers

investment in irrigation systems and some accommodation by the State to further subsidize water prices from the Hāmākua ditch specifically for pasture irrigation purposes. Lands makai of the Hāmākua ditch represent some of the best quality former cane lands to be converted to pasture and could play an important role in the development of a larger grass fed beef supply for local consumption.

The Hawaii Cattle Producers Cooperative has also been experimenting with the market for local veal using 600-800 pound animals that would otherwise be exported to the mainland. Developing a viable local market for veal would help to keep more local beef on-island.

There is opportunity within the local beef industry to increase the amount of protein that can be both produced and consumed on Hawai'i Island. This is one of the areas where Hawai'i County can expect some positive traction in increasing food self-sufficiency. There are many moving parts to this puzzle, but key portions of the industry, including ranchers, landowners, processors, agencies, and consumers are beginning to make new progress towards increasing local beef production in a manner that makes economic sense to both the producers and the consumer. It is not likely that Hawai'i will stop its practice of exporting calves to the mainland within the foreseeable future, but there are signs that major producers are looking closely at the benefits of increased local beef production. Consumers play an essential part in this equation. The growth of a grass fed beef industry is dependent on consumers' sustained support by purchasing local meat on a regular basis. An enthusiastic local market for grass fed beef will provide the opportunity for ranchers to keep more of their animals at home for local consumption.

## 2.5.4 Pigs, Sheep and Goats

### **Pig Production**

The number of commercial piggeries statewide has fallen off dramatically in the last 20 years, due to the cost of feed and the regulations associated with managing confined animals. There are currently 65 piggeries on Hawai'i Island with two to 30 sows a piece<sup>20</sup>. Many of these animals are sold at weaning to small back yard operations. Most of the hog production in the state takes place on O'ahu closer to the center of market demand. O'ahu, and more specifically Waikiki, is also where most of the waste food supply is created which accounts for a major portion of the feed needed to bring pigs to market. Hawai'i County accounted for just 5% of the total state hog production in 2008<sup>21</sup>.

The vast majority of the pork eaten in Hawai'i comes from the mainland, much of it in frozen form. Live pigs are also imported via ship from the west coast and most are harvested

at the slaughterhouse on O'ahu. Kūlana Foods in Waiākea does slaughter pigs as a service to small producers. Most of that meat is for private use and rarely appears in retail stores as fresh meat.

New innovations in piggery management offer some hope that Hawai'i could become a larger supplier of its own pork supply. A piggery in Mountain View, partially funded by the County of Hawai'i's Department of Research and Development, employs the approach of Master Cho, a Korean agriculturalist, to piggery design and operation with encouraging results. Waste material is dealt with by the design of the facility through the introduction of indigenous micro-organisms (IMO) to break down waste naturally. CTAHR promotes several piggery designs to address the cost efficient disposal and re-use of pig waste and wash down fluids. New investment is needed to grow Hawai'i's pig industry both on Hawai'i Island and elsewhere. Slaughter capacity is also an issue and will require improvements and expansion of kill floors and chill space to support additional capacity. Expanding the feed supply from agricultural waste products like sweet potato, macadamia and papaya and the expanded use of table waste would help to support this effort.

### **Sheep Production**

Sheep are produced by several commercial ranches around the Island. There are also a number of small producers who grow sheep for meat and for wool production. Kahua Ranch in North Kohala is the largest sheep producer. They have their sheep slaughtered locally, sell direct from the ranch and provide fresh lamb to island restaurants. Smaller sheep producers report difficulty getting their animals to harvest at



**Sheep are raised for meat and wool production**

a price they can afford. There has been discussion by some of the small producers about seeking funds to support a federally certified mobile slaughterhouse that could travel to ranches. No such facility is currently available. Another alternative would be to fund improvements to

existing slaughterhouses to accommodate a larger volume of sheep. Herd sizes are likely to remain small until this bottleneck is addressed.

Sheep have the advantage of a shorter cycle from conception to harvest than cattle. For some ranchers this may allow them to recover the investment they hold in each animal more quickly. To be successful, harvest infrastructure issues need to be addressed and there needs to be a rise in consumer demand for local meat products to support ranch diversification.

20 Mike Dupont, CTAHR personal communications

21 State Agricultural Statistics, 2008, pp77

### Goat Production

Goats are grown on several ranches on Hawai'i Island and are used both as a source of income and to assist in clearing invasive shrubs from pasture lands. Managed correctly, goats can be a significant asset to ranchers for the improvement of pastures overgrown with guava and other shrubs. Goat meat is also popular with some ethnic groups but it is not currently a commercially available product on Hawai'i Island. Nevertheless, there is a market for direct sales that can be expanded.

### Feral Pig, Sheep and Goats

Recreational and subsistence hunters kill nearly 10,000 feral pigs, sheep and goats annually on Hawai'i Island. Most of this harvest is unrecorded. A more expanded discussion of this local food supply can be found in Section 6 of this report. The meat contribution of pig, sheep and goat hunting is represented in Figure 4 as an estimate of the amount of meat that is gathered informally by local hunters that is in excess of 400,000 pounds per year or the meat equivalent of over 900 head of cattle annually.

## 2.5.5 Fish and Seafood

In March 2012, the College of Tropical Agriculture and Human Resources released a report on seafood consumption and supply in Hawaii<sup>22</sup>. Using the best available data on commercial, recreational and aqua cultural seafood sources, the authors suggest the following:

- Total seafood consumption in the state of Hawai'i is 50.4 million edible pounds annually
- Seafood is 11.4% of the per capita Hawaii food budget (compared to 6% nationally)
- 32% of the seafood budget is spent at home, 68% is spend eating out
- The average Hawaii resident consumed 37 pounds of seafood per person annually, 8 pounds (or 39%) of which comes from non-commercial (aka recreational) sources
- 63% of all commercial seafood sales is imported, 57% from foreign countries
- Including both commercial and non-commercial catch, 51% of state's seafood consumption is sourced locally
- 7.4% of Hawai'i commercial catch is exported (6.2% to US, 1.2% foreign)
- Tuna (yellowfin, bigeye and others) is the most frequently consumed seafood in Hawaii (12.76 pounds per capita per year); Salmon is the second at 4.23 pounds.

These figures represent the best and most current information

available on seafood supply and consumption in the State of Hawai'i. They are based on available data, and subject to ongoing critique and improvement. How accurately they reflect the particular circumstances on Hawaii Island could be debated. For example, how much of the commercial catch is actually reported and how accurate the estimates are for non-commercial and recreational harvest could be the basis for ongoing debate. Additionally, figures on the amount of seafood eaten at home or purchased outside the home are collected from a Honolulu consumer study and may not necessarily apply to neighbor island circumstances. For the purpose of this report, the scorecard in Figure 4. Hawai'i Island Food Self-sufficiency Scorecard uses the 51% figure and adds an uncertain volume of locally caught fish to represent the unknown volume of local seafood collection that happens on the island which is not reflected in the CTAHR study.

At a statewide level, aqua culture produces 623,000 pounds of seafood annually or just 3% of the state's total commercial seafood production<sup>23</sup>. The rest of the commercial catch comes for the shorelines and oceans surrounding the state which are part of a commonly held resource that will require active management to ensure its long term sustainability. Further discussion of ocean resource management is in Section 5 of this report.

## 2.5.6 Eggs and Poultry

Eggs and poultry account of 13.5 million pounds of Hawai'i Island food consumption<sup>24</sup>. Currently there is no commercial egg or poultry production on the Island. The last commercial egg producer, located on the Kawaihae road, shut its doors in the mid 2000's. Feed costs, waste disposal and competition from mainland imports have rendered the local poultry business uneconomical on Hawai'i Island. There are several small commercial operations on O'ahu, most notably Ka Lei Eggs, but competition in the marketplace is stiff. The last chicken slaughter facility on Nimitz highway in Honolulu has been shut down for several years.

There are a small number of informal chicken and egg producers on Hawai'i Island who sell eggs at farmers markets and directly to their neighbors. There are also several individuals who raise chickens on pre-paid contracts with neighbors to deliver fresh poultry. This represents a very small fraction of total egg and poultry demand on the Island which operates outside of regulations associated with the commercial marketplace.

There is a small scale production trend developing with innovative natural farming techniques. This approach uses small flocks in simple enclosures with special bedding under the coups. Bedding is treated with microorganisms, to dispose of waste without

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*Tuna is the  
most frequently  
consumed seafood  
in Hawai'i*

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22 An Overview of Seafood Consumption and Supply Sources: Hawai'i Verses U.S., Matthew Loke et al, Economic Issues EI-22, March 2012

23 Personal communication, Matthew Loke, CTAHR/DOA

24 See Table 2



odors or flies. These types of chicken operations are small but could be expanded in a decentralized format to provide a new source of fresh eggs and poultry for the informal market place. The cost of grain to feed chickens remains the largest barrier to increasing production in a commercial context.

## 2.5.7 Nuts

Hawai'i Island produces nearly nine million pounds of macadamia nut kernels annually<sup>25</sup>. This amount is roughly five times the annual total nut consumption of Hawai'i Island's de facto population (Table 1). Currently, 75% of Hawai'i's crop is exported and 25% is packaged for retail sales to local residents and visitors<sup>26</sup>. The bulk of local sales are to visitors who take the nuts home with them as gifts. The actual numbers for locally consumed macadamia nuts is not available.

The pattern of nut consumption in Hawai'i is probably not that dissimilar to national trends, where peanuts, almonds, pistachios, pecans and walnuts account for 88% of all nut consumption<sup>27</sup>. USDA's Economic Research Service estimates that the average American consumes less than 0.2 pounds of macadamia annually<sup>28</sup>. That number is certainly higher in Hawai'i, but the relative role of macadamia nuts in Hawai'i Island's current nut consumption patterns are still relatively small, perhaps in the range of four to five percent of total nut consumption.

The presence of 21,000 acres of macadamia nuts on Hawai'i Island is a partial assurance that local nutritional demand for nuts can be met entirely by local supply. If food supplies to the Island were disrupted for an extended duration, the existing nut orchards would be a nutritional resource that could be drawn upon. Currently, however, the realities of the market place, the cost of collection and processing, and consumer preference for other types of nuts delegates the macadamia nut to a relatively small player in the current Island food supply.

## 2.5.8 Vegetables

The Vegetable Food Group is made up of several categories of produce with differing nutritional characteristics, including Dark Green Vegetables, Beans and Peas, Starchy Vegetables, Red and Orange Vegetables and a general class called Other Vegetables<sup>29</sup>. Because of a lack of detailed data on individual crops, for the purpose of this discussion, these crops are clustered into two categories: general Vegetables and Starch vegetables. Taken as a general food group, vegetables account

for over 90 million pounds of local food consumption on Hawai'i Island (Table 1).

Vegetables are the primary product in the farm category called "truck crops". There are 3,600 acres in truck crops on Hawai'i Island in 2012, located primarily in Waimea and in South Hilo.

Vegetable production appears on small farms island wide, both in green house and open field settings.

State Agricultural Statistics in 2008 suggested that

Hawai'i, as a state, produced roughly 34% of the fresh vegetables consumed<sup>30</sup>. These statistics summarize the volume of 34 different varieties of Hawai'i produced and imported vegetables. The percentage of Hawai'i production for each type of vegetable ranged from Chinese cabbage (87 % local production) and head cabbage (80% local production) to celery (7% local production) and lettuce (11% local production)<sup>31</sup>. Refer to Appendix B for more details. 2008 was the last year of DOA data collection. Since then, there has been some progress in import replacement for some targeted crops but there is no clear information to determine just how much difference that has made to the overall percentage of local production. As a result, the 34% figure is used as basis for this analysis.

Different types of vegetables are grown in different regions of Hawai'i Island with varying degrees of commercial success. For example, farmers in Waimea and Pu'ukapu, South Kohala produce a mix of leafy and root vegetables on roughly 445 acres of flat, irrigated land. Although total production numbers are not available for the Waimea farmers for 2010, there were approximately five million pounds of produce processed at the vacuum cooling plant/refrigeration facility that is operated cooperatively amongst local Waimea farmers<sup>32</sup>. This is a portion of the total production in the area, as there are also private cooling facilities and some products, such as head cabbage, which go from field to market without cooling. Farmers who were interviewed estimated that about 50% of Waimea's total production was shipped to Honolulu and the rest stayed on the Island.

Other commercial vegetable growing areas, like South Hilo, produce tomatoes, cucumbers, beans and a range of other vegetables that are sold locally and shipped to O'ahu markets. Several of the farms in Ka'u grow almost exclusively for direct local sale to regular buyers in addition to farmers markets. Puna has a growing number of small farms and green houses producing organic, or near organic vegetables that now compete with each other in the local market place.

An increasing number of small to medium sized producers are opting to farm organically, both for the market price advantage and to fulfill other goals they have for the quality of the food they provide to the marketplace.



25 Interview with David Rietow, President Hawai'i Macadamia Nut Growers Association

26 Personal communications, Richard Snitzler and Mark Crawford

27 USDA-ERS data summarized by the Peanut Institute 2009

28 <http://www.ers.usda.gov/amberwaves/june08/findings/almonds.htm>

29 USDA Choice MyPlate.gov (<http://www.choosemyplate.gov/food-groups/vegetables.html>)

30 Hawai'i State Agricultural Statistics, 2008

31 Hawai'i State Agricultural Statistics, 2008

32 Data provided by vacuum cooling plant accountants

### Expanding Vegetable Production

Distributors, retailers, restaurateurs and consumers all indicate that they are looking for new sources of competitively priced local vegetables. From the standard lettuce and cabbage to boutique heritage tomatoes and artichokes, the market for local produce appears strong but it is not always easy for smaller farmers to access this supply network. Distributors and retailers need consistency in both supply and quality which is difficult for small independent operations. Food Safety Certification is increasing being required by large retailers and institutional buyers. This requires farmers to invest new money in packing, sanitation and crop tracking capabilities; additional investments are thus demanded which may be beyond the means of smaller farms.

There are several collaborative programs on the Island that model ways to expand the role of small farm producers in the larger vegetable market place. Adaptations is a distributor of organic produce that operates out of Honaunau. They consolidate produce from as many as 100 small producers and distribute it to stores and other outlets around the Island. Adaptations work with producers to direct production towards marketable items and provide a delivery service that many small producers cannot afford to do themselves. Hāmākua Springs, in Pepe'ēkeo, also serves as a consolidator of vegetables from smaller farms and uses its existing statewide market penetration to move produce into larger market places. Hāmākua Producers is their secondary label used for distributing non-food certified produce alongside their certified tomatoes and cucumbers. Larger food distributors, like Armstrong Produce, Cal-Kona and Hilo Produce also play important in consolidating local production and channeling it to major markets.

Farmer Cooperatives are not a major factor in vegetable production in Hawai'i and this may be a direction that some farmer networks could develop further. This applies to both marketing and the purchasing of bulk supplies and the sharing of equipment. Kamehameha Schools has begun to assert its interest in supporting farmers on their property through more farmer friendly land leasing and exploring farm-to-plate initiatives with their school operations statewide. They are also exploring the potential of constructing a facility to consolidate packing and processing that could meet food safety requirements for small farmers in the South Hilo area.

Community Supported Agriculture (CSA) is an approach to production for members who are regularly delivered fresh produce based on current availability of local produce. CSAs are signifi-

cant food providers on the mainland where this market is concentrated in urban areas. There are four to five CSAs on Hawai'i Island with relatively small memberships. This is an approach that can work in certain circumstances.

Vegetables are one of the food groups that residents have the ability to grow for themselves in their back yards. There are parts of the Island where home-based gardening is a significant contributor to family and neighborhood diets. The Hawai'i Home Grown Food Network ([www.Hawaiihomegrown.net](http://www.Hawaiihomegrown.net)) serves an expanding community of small gardeners and food producers Islandwide. This effort, and others like it, are creating a broader network for small scale food producers and are also supporting collective efforts to advocate for local foods and to spread the skills, knowledge and attitudes necessary for family and community food self-sufficiency.

One of the most profound trends in new vegetable production is taking place on school campuses across the Island. Over 60 public, private and charter schools in 2011 had teaching gardens on their campuses with over 5,000 students participating in garden programs<sup>33</sup>. Hands-on student exposure to farming and the joy of eating what they have grown has an immeasurable impact on the future of these students as both consumers and potential farmers.



***Sweet Potato production on the South Hilo coast is largely an export product to West Coast markets.***

### 2.5.9 Starch

Local sources of starch come from several vegetable sources including sweet potato, taro, green peas, field peas, lima beans, breadfruit, corn, green banana and cassava<sup>34</sup>. Sweet potato, taro and corn are the crops that most frequently appear in the local market place. Pumpkins are another local source of starches. Cassava is a basic starch for many Pacific Island cultures, but it is not grown commercially in

Hawai'i due to the lack of a significant market. Cooking bananas also provide starches, but this is not a widely used source in most Island diets. The predominant source of starches in the local diet comes from russet potatoes which are not produced locally.

In 2008, DOA agricultural statistics indicate that Hawaii imported 22.29 million pounds of potatoes and produced none. In that same year Hawaii produced 8.1 million pounds of sweet potato and imported and additional 1.6 million pounds (83% locally produced). Taro accounted for 232,000 pounds of import compared to 100,000 pounds produced locally (30%

33 Kohala Center Report to PREL, Characteristics of School Gardens of Hawai'i Island

34 Choose MyPlate, USDA, <http://www.choosemyplate.gov/food-groups/vegetables.html>

locally produced). 79% of the sweet corn in the state was locally produced with a total consumption of 2.8 million pounds.

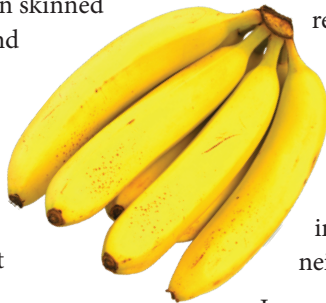
Sweet potatoes are grown on many farms around Hawai'i Island. Several varieties of sweet potato are marketed in farmers markets and grocery stores with the purple Okinawan variety being, by far, the most prominent. The biggest production of sweet potato is in South Hilo where as many as 500-600 acres of the purple Okinawa sweet potato are planted annually. Actually production has varied based on market conditions but sweet potato growers have been a big part of the farm landscape in the region for the last decade. Sweet potatoes are treated at the local irradiator facility in Kea'au and then shipped to markets on the West Coast. In 2010, the irradiator processed 11.8 million pounds of sweet potato, virtually all of which was sent on to the West Coast<sup>35</sup>. An additional 1.8 million pounds was marketed locally<sup>36</sup>.

There are about 50 acres of wetland taro in Valley and approximately another 100 acres of dry land taro in production on the Island at any time. The bulk of the wet land taro is made into poi and much of it is sold directly by the farmers to individual consumers or to local retail outlets. A substantial portion of Hawai'i Island's poi consumption comes from sources on other Islands, particularly Kaua'i.

There is one small farmer in the volcano area that has begun to produce a small volume of red, thin skinned potatoes that appear in farmer markets and several retail outlets.

Without a strong set of reliable data, it would be reasonable to estimate that Hawai'i Island produces between 5-10% of its total starchy vegetable demand. This does not include the volume of sweet potatoes exported to mainland markets.

Hawai'i has the capacity to produce a substantially higher percentage of starchy vegetables than is consumed locally. Strong export markets and limited local demand draws local sweet potato production elsewhere. One way to increase the current level of self-sufficiency in starch is to build demand for local starchy vegetables like sweet potato, taro and breadfruit. There is a significant market for taro yet only a limited number of farmers are growing it. Breadfruit is a highly underutilized source of local starch for which there is little market and no significant commercial production. Efforts to grow these crops for local production need to be accompanied with an educational effort to provide consumers with new recipes and preparation instructions to help shift consumption patterns.



## 2.5.10 Fruit

Hawai'i produces a range of tropical fruits for local consumption and export. Papaya, rambutan, longan, guava, banana and avocado are grown in the largest volume. There is also a range of citrus and other specialty fruit crops that add to the local fruit supply. Based on a summary DOA and NASS statistics from 2007 and 2008, Hawai'i Island produces somewhere in the vicinity of 50 million pounds of fruit<sup>37</sup>; the largest contributors being papaya, banana, avocado and a suite of tropical specialty crops. (Data for all fruit crops is not broken out by County.) Based on the projected de facto population demand for fruit in Table 1, the Hawai'i Island demand for fruit is roughly 58.7 million pounds. If, for some reason, food supplies were interrupted, Hawai'i Island would have a significant supply of locally produced fruits that approximates local demand.

Fruit supplies are seasonal and are abundant at times and non-existent at others. Figure 5 provides a simple look at some of the fruits and vegetables produced in Hawaii and the seasons in which they are most likely to be available.

Hawai'i Agricultural Statistics for 2008 suggest that of the 18 fruit groups they kept statistics on, Hawai'i, as a state, produces 32% of its total fruit consumption. For lack of better numbers, this is a reasonable place to start in measuring Hawai'i Island's current fruit self-sufficiency. Given that many Hawai'i Island residents live in places where fruit is grown wild or in back yards, it can be estimated that the percentage of local fruit consumption is higher than the 32% State statistic. Just how much so is very difficult to determine. For the purpose of the scorecard in Figure 4 we use the statewide number and added an indicator of additional informal supply to reflect production in backyards and neighborhoods around the Island.

Issues like consumer preference, seasonality, cost and short shelf life are what keep Hawai'i from being more self-sufficient in the fruit food group. Hawai'i does not grow temperate fruit like apples, grapes and pears and we are unlikely to do so at any scale in the future. Consumer demand drives the import of these and other fruits which consumers expect to be in the fruit section of the grocery store every time they shop. Hawai'i also imports some tropical fruits, like mango, to meet local demand and to balance seasonal availability.

Roughly half of the state's bananas are imported from the global supply network at prices that are competitive with local growers. The same is true with avocados, which Hawai'i Island grows particularly well in the Kona area. Hawai'i's lemons and limes amount to less than 5% of current consumption and the same is true for tangerines<sup>38</sup>. Expanding production in these types of import replacement crops presents market opportunities for Island growers.

35 Personal communications, Eric Weinert, Hawai'i Pride

36 Personal communication, Stephen Wheat, Alembic International Ltd., distributor

37 Tropical Specialty Fruit 1.09 M pounds; Avocado 1.0 M pounds; Banana 17.4 M pounds; Papaya 30.5 M pounds

38 See Table 1 in this study



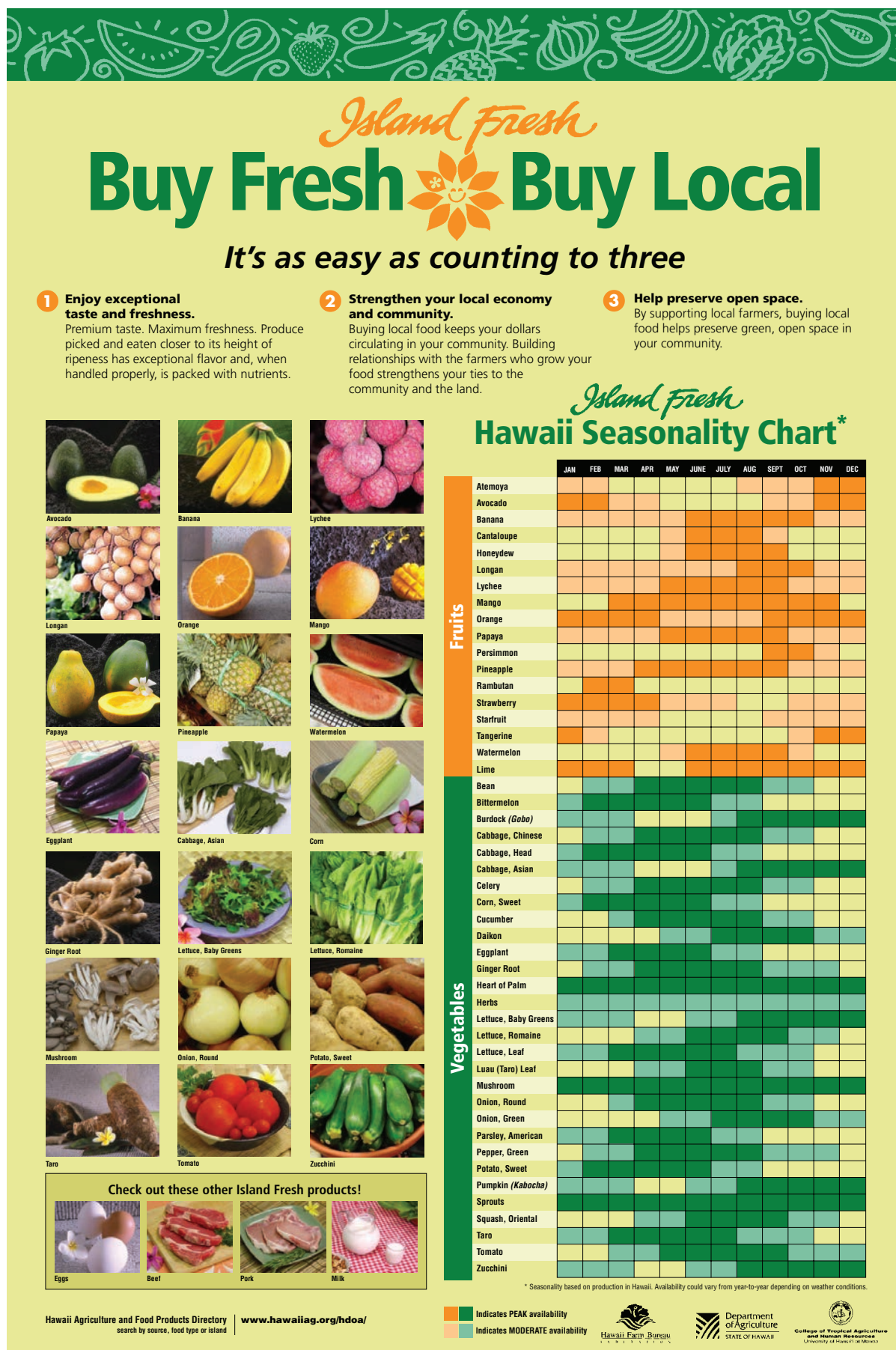


Figure 5. Hawai'i Seasonality Chart

## 2.5.11 Grains

Grains constitute approximately 10% of the total food demand, as displayed in Table 2. 100% of the roughly 42 million pounds of grain residents consume annually on Hawai'i Island is imported<sup>39</sup>. Hawai'i's climate and growing conditions does not support the commercial cultivation of most kinds of grain, including wheat, rice and oatmeal.

Grains come in whole and processed form and include rice, flours, pasta, bread, crackers, cereals etc. Rice is one of the most popular grains in the Hawai'i food palette, and although Hawai'i has grown rice in the past, it is unlikely any commercial rice operation will compete successfully with rice imported from other places. Most grain production requires vast acreage and an economy of scale that far exceeds Hawai'i's ability to match with the global market place. Grain is an area of food dependency that will be difficult to remedy, beyond adjusting the amount of that is locally consumed.

Hawai'i also imports millions of tons of grain for the purpose of feeding livestock and pets. The high cost of these imported feed grains has driven cattlemen to ship their cattle to the mainland for fattening and slaughter. It has also resulted in a near-collapse of the local poultry industry and a substantial reduction in the number of dairies within the state. Horse owners experience the impacts of rising feed costs as do sheep, goat, and exotic bird owners. The same is true of dog and cat owners whose feed contains grain as an important ingredient. Animal feeds are another area where Hawai'i is significantly dependant on imports and global market pricing.

There are several current local initiatives to mitigate

the impact of this dependence on imported grain for animal feed. The aquaculture industry is exploring ways to process agricultural waste for fish feed. Both dairies on Hawai'i Island are using surrounding lands to grow corn, sorghum, or cut grass to supplement grain imports. There have also been federally-sponsored programs to reimburse ranchers for a portion of the cost of shipping feed to the state. These are small, but important efforts to move the State in the direction of food self-sufficiency. However, more work needs to be done to identify ways to produce the kinds of feed Hawai'i needs to support its own livestock production.

Hawai'i plays an increasingly important role in the production of grains, particularly corn, worldwide. For decades, Hawai'i's year-round growing conditions have attracted major seed companies to invest their research and development dollars in the use of some of Hawai'i's most productive lands. Major seed companies, like Monsanto, Dow Agrosience, Syngenta and Pioneer, now lease or own some of Hawai'i's most productive agricultural land on Maui, Molokai, Kaua'i and the central plain of O'ahu. Hawai'i's ability to support three to four crop rotations per year makes the state an ideal location to test crop varieties and conduct research in biogenetics. 96% of the Hawai'i based research is in corn with soybean, sunflower and other crops contributing the rest. The industry claims that just about any new corn hybrid in the United States would have spent some time in Hawai'i during the research and development phase<sup>40</sup>. This type of agricultural activity is of concern for people alarmed by the growing global trend in genetically modified organisms (GMO) and their uncertain impacts on the food system as a whole. None of this research currently takes place on Hawai'i Island, but its products do return to Hawai'i in the form of new species of corn-based feed and other grains.



39 See Table 1 in this study

40 Pacific Business News, November 4, 2007, Charlotte Woolard



## 3 Summary of Hawai'i Island Agriculture

### 3.1 Agriculture Land Use

A large component of this study involved the comprehensive mapping of where crops are currently grown on Hawai'i Island. The purpose was to help define the areas, circumstances and resources that drive the agricultural production that is taking place in 2012. An important step towards increasing food self-sufficiency is to understand what areas are currently farmed and to discern what contributes to making that production viable. Regional distinctions are critical because what drives farming in Kona, is not necessarily what propels it in South Hilo or in Ka'u. Each agricultural region has its distinct historical farming patterns, natural resources, infrastructure and people that impel farm activity in each area. Strategies to enhance food production need to be cognizant of what occurs today and why, so that effective actions are taken to increase local food production in the future.

Mapping the state of current agriculture on Hawai'i Island used the Geographic Information System (GIS) resources at the University of Hawai'i at Hilo's Spatial Data Analysis Labs, in conjunction with the Geography and Environmental Studies Department. The workflow process involved painstakingly digitizing crop outlines based on the most current commercial satellite imagery available. Additional data layers provided by the Natural Resource Conservation Service (NRCS) and the Hawai'i County Real Property Tax Office contributed to identification of areas of crop production. Satellite imagery from DigitalGlobe (QuickBird 2, 2006 and WorldView2, 2009) was provided through USDA-NRCS/USGS. Cross-checking was supplemented by reviewing pictometry data from Bing maps as well as referencing imagery from Google Earth. Remote sensing analysis with ENVI software aided in differentiating crop types and highlighting those areas with crop production. Most of the croplands mapped were greater than three acres; the exceptions included intensively farmed areas such as Waipi'o Valley. The result is a 2012 crop layer for the entire Island of Hawai'i. Other derived mapping products include an update of the State's ditch layer that was modified to reflect currently viable irrigation and ditch systems. The digital data created in this process has been submitted to the County of Hawai'i Research and Development group.

Additional verification of the digitized croplands data involved plotting regional crop outlines on large paper maps with a satellite image backdrop and working directly with people familiar with farming activities in each region of the Island to cross-check the crop category identified on the map. This was an iterative process that took the better part of five months to complete. Specific crop types were not identified. Crops were classified using the categories outlined in Appendix C. As the most recent satellite imagery was from late 2009, the digitized crop outlines primarily capture information from

this time period. Although every effort was made to ground-truth or cross-check the digitized crop category with known information, not all crop lands could be readily identified or site visited. Uncertainty in the digitizing process and lack of current satellite imagery as a reference for outlining crop categories means that the final numbers in Table 3 represent the best possible estimate. As well, it is important to note that the values are dynamic as crops move to other fields and agriculture practices change over time. The current iteration of the digitized crop categories serves as a benchmark and will require constant updating.

Hawai'i Island contains roughly 2,580,000 acres, of which 1,185,000 acres are designated as Agricultural by the State Land Use system. Of those Agricultural acres just 4% is in active crop production, 2% is in commercial forestry and 40% is in pasture use. The remaining 54% of State designated Agricultural land is un-used. Figure 6 displays the broadest look at this data.

### 3.2 Crop Data

Crop data was classified into 11 categories and do not include commercial forestry or pasture. A breakdown of the types of crops in each mapped category is provided in Table 4 below. Figure 7 summarizes the acres in each crop type, provides an Island-wide look at the location of active crop lands in 2012 as well as annual rainfall and location of the four major irrigation ditch systems that serve lands in North Kohala, Waimea, Hāmākua and Pahala.

Numbers contained in Figure 7 and in Table 3 above were determined by using real property tax data, NRCS crop layer information, and visual inspection of satellite imagery. Bing Map's oblique pictography, where coverage was available, was used to confirm a crop type or determine crop boundaries. Satellite imagery coverage varied from region to region, with some as new as late 2009 and others dating back to 2006. Interviews of individuals and small groups familiar with agricultural land use in each region were used to supplement the data collection process and to update observations on recent changes.

There are over 42,700 acres in crop production on the island, half of which (21,000 acres) are in macadamia nuts, over 6,000 acres are in coffee and another 1,700 acres are planted in flowers and foliage crops. These crops are important to the agricultural economy of Hawai'i though they play very minor roles in the island's food supply. Vegetable crops, taro, tropical fruits, banana, papaya, aquaculture and specialty food crops account for 10,400 acres of active agricultural land use. Local consumption of these locally produced crops varies as a significant portion of each crop type is exported to other parts of Hawai'i and continental

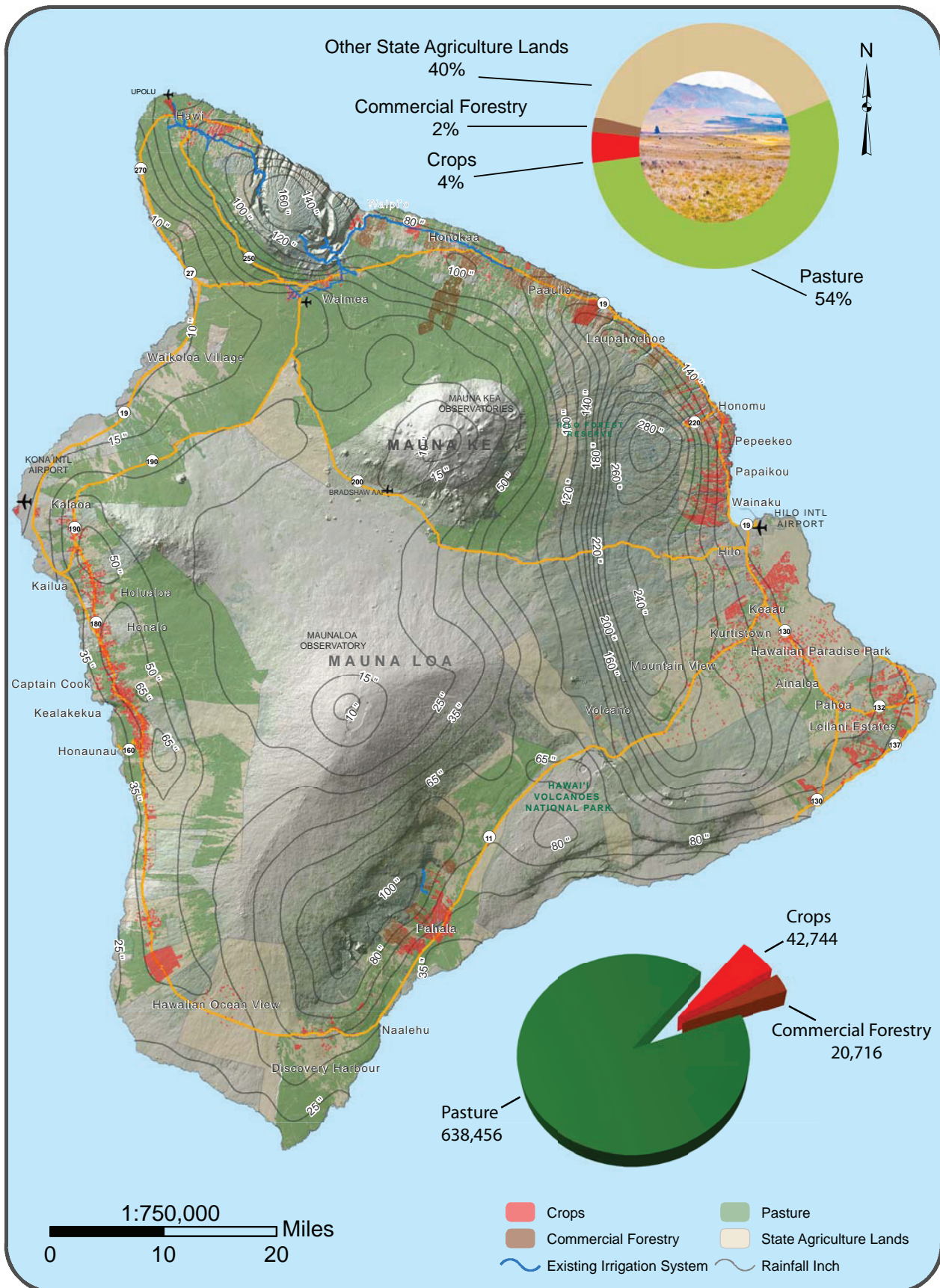


Figure 6. Hawai'i Island Agriculture Land Use Summary



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U.S. and global markets. Hawai'i Island also produces a range of specialty products aimed at boutique markets which help to insure farm viability but do not necessarily contribute significantly to local food supplies.

The numbers used in these summaries may vary from more commonly used estimates of acreage for individual crops. For example, a papaya crop takes about 4 years from the time it is planted to the time it is too tall to pick. In between plantings, the land is fallowed for 2-5 years to address soil born bacteria that compromises subsequent plantings. Mapping the papaya crop has to accommodate that crop mobility. The industry estimates that there are generally about 2,000 acres in the fields at any point in time. Numbers from our study suggest that 2,709 appeared to be in production from satellite coverage but this may include recently abandoned fields or cleared areas that were not yet planted when the imagery was taken. There are also about 6,800 acres of land that appear to be in papaya rotation and may be replanted at some point in the future. This study will use the

2,709 acre figure for active production and the 6,800 figure to indicate the total papaya footprint in the Puna region. In many cases, these excess acres remain under lease to a packing operation or papaya grower who anticipates replanting in the future.

**Table 3. Summary of Crop Acres on Hawai'i Island 2012**

Crops	Acres
Aquaculture	<b>165</b>
Banana	<b>436</b>
Coffee	<b>6,128</b>
Dairy	<b>3,362</b>
Flowers & Foliage	<b>1,700</b>
Macadamia Nuts	<b>21,111</b>
Papaya	<b>2,709</b>
Specialty Crops	<b>292</b>
Taro	<b>51</b>
Tropical Fruits	<b>3,168</b>
Truck Crops	<b>3,597</b>
<b>Total</b>	<b>42,744</b>

With respect to the coffee industry, 6,128 planted acres is higher than the 4,000 acres figure that is more frequently quoted. The difference can be attributed to a closer examination of the small plantings, some of whom may not be currently harvested for one reason or another. There is also an increased proportion of the coffee crop that has been inter-planted with macadamia and other crops making it difficult to determine acreage for each<sup>41</sup>.

It is also difficult to get a detailed footprint for truck crops on the Hilo coast. There are over 500 acres of sweet potato planted on the coast annually, but it is nomadic, moving every year to avoid nematodes and other pests. Although the current acreages planted in this crop may be accurate their locations will move annually.

**Table 4. Crop Categories**

Crop Class	Crop Types
Flowers and Foliage	Potted Plants, Ornamental, Dracena, Orchids, Antherium, Nursery plants, Cut Flowers, Landscape plants, lei flowers
Tropical Fruits	Lichee, Rambutan, Longon, Mangosteen, Mango, Dragon Fruit, Avocado, Oranges, other
Papaya	Active production and fallow/cleared
Taro	Wet and Dry Land
Banana	
Macadamia Nuts	
Coffee	All varieties and locations
Speciality Crops	Mushrooms, Vanilla, Cacao, Tea, Noni, Awa, Heart of Palm
Aquaculture	Fishponds, Talapia, NELHA
Truck Crops	Commercially grown Vegetables, Melons, Squash, leaf and root crops etc.
Dairy	Includes processing area, surrounding pasture and cultivated corn/grass feed

<sup>41</sup> In the Kona Region crops were mapped using a category of mix coffee and macadamia with over 2,266 acres in that category. For the purposes of simplifying the crop list, this number was adjusted to add 60% of it to the coffee count and 40% to the macadamia nut count, based on estimates of KS land managers and others familiar with the practice of mixed crop plantings in Kona.



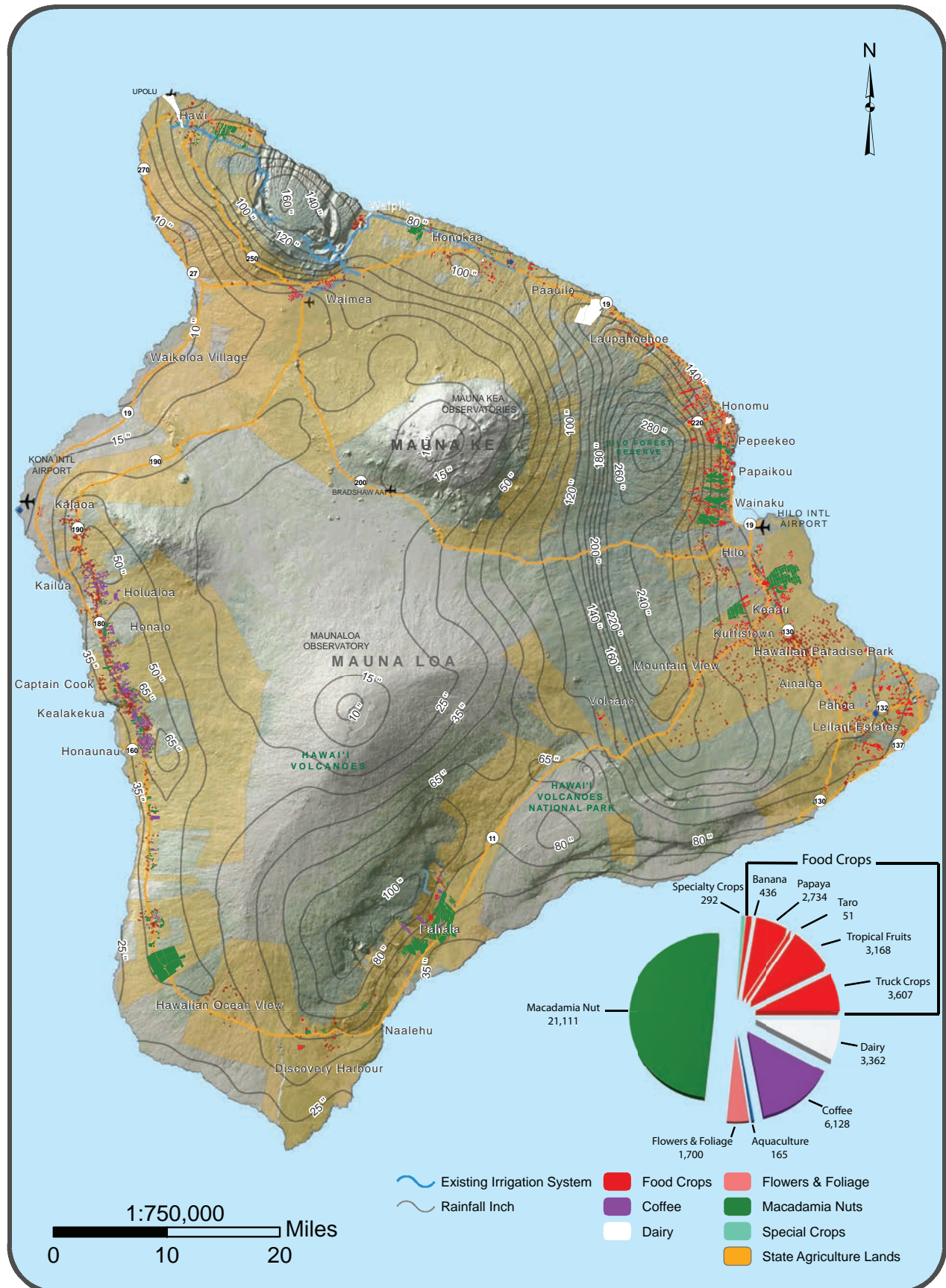


Figure 7. Hawai'i Island Crop Summary



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### 3.3 Pasture Land

Pasture for meat production is the largest use of agricultural land on Hawai'i Island. There are two approaches to measuring pasture area in this report. The first uses a grasslands data layer that was created by NRCS using remote sensing techniques and satellite imagery to extract all grass covered areas on the Island of Hawaii. This grasslands data was then adjusted to remove areas that are not in active ranch use, such as lands in the Hawai'i Volcanoes National Park, Pohukuloa Training Area as well as other lands withdrawn from ranching for reforestation and other purposes. This approach indicated that there were 638,466 acres in active grass lands as shown in Figures 8 and 9.

A second approach at summarizing pasture lands utilized County real property tax records to depict properties that have an agricultural assessment rate that specifies pasture use. Since tax savings associated with this program are substantial, it is reasonable to assume that most pasture land managers would have entered their lands in this program. Tax records indicate that 533,127 acres were charged a reduced tax rate in

a pasture category under the current real property tax system. This approach is displayed in Figure 16 and is included in a future section on County Real Property Tax Programs. Mapping by this method produces a distorted view of what lands are in pasture since entire TMK's are highlighted and not just the portions which were agreed to by the tax office and the landowner.

Both approaches have their limitations, although it is reasonable to assume that between 30 to 35% of the Islands' agricultural land area is in active pasture use. Figure 9 provides further analysis for the pasture lands by shading pasture acres by the amount of rainfall. The most useful lands for commercial beef production are found at rainfall gradients between 40 and 120 inches per year. Lands with lower rainfalls are productive only seasonally, lands with too much rain produce less optimal pasture quality. Only a small amount of pasture lands below the Hāmākua Ditch have access to irrigation that might supplement their productivity.

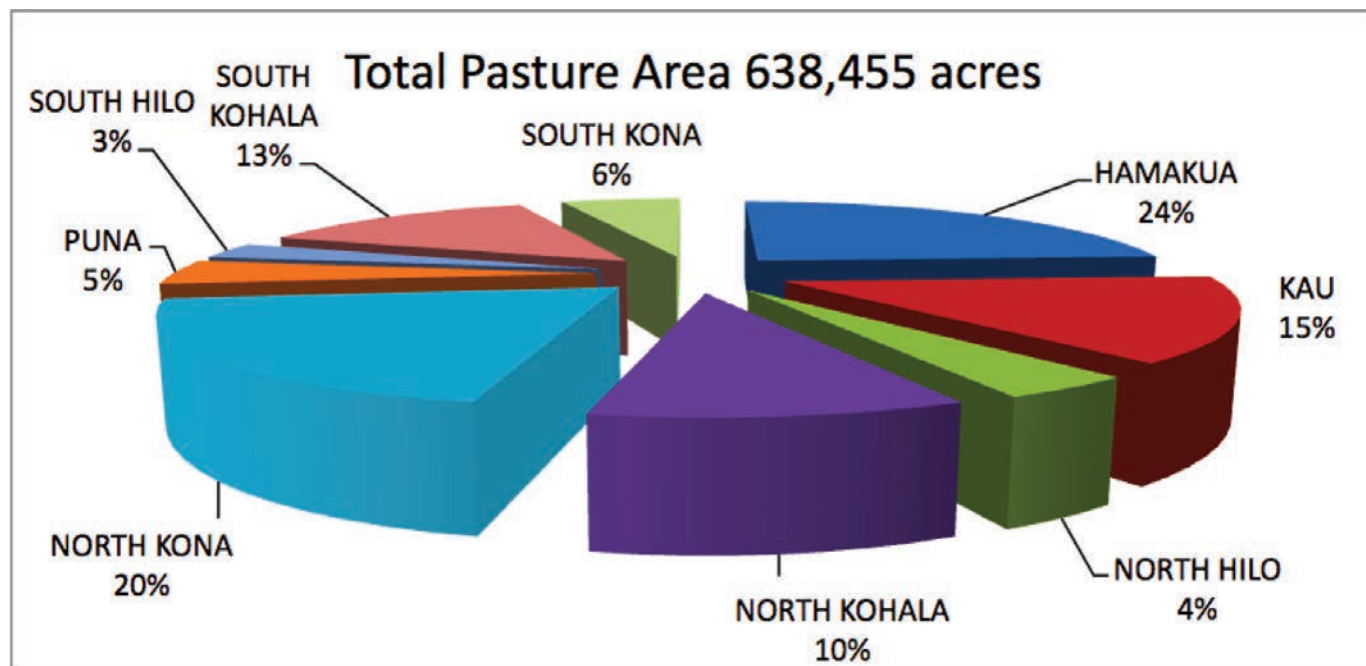


Figure 8. Percentage of pasture lands by judicial district

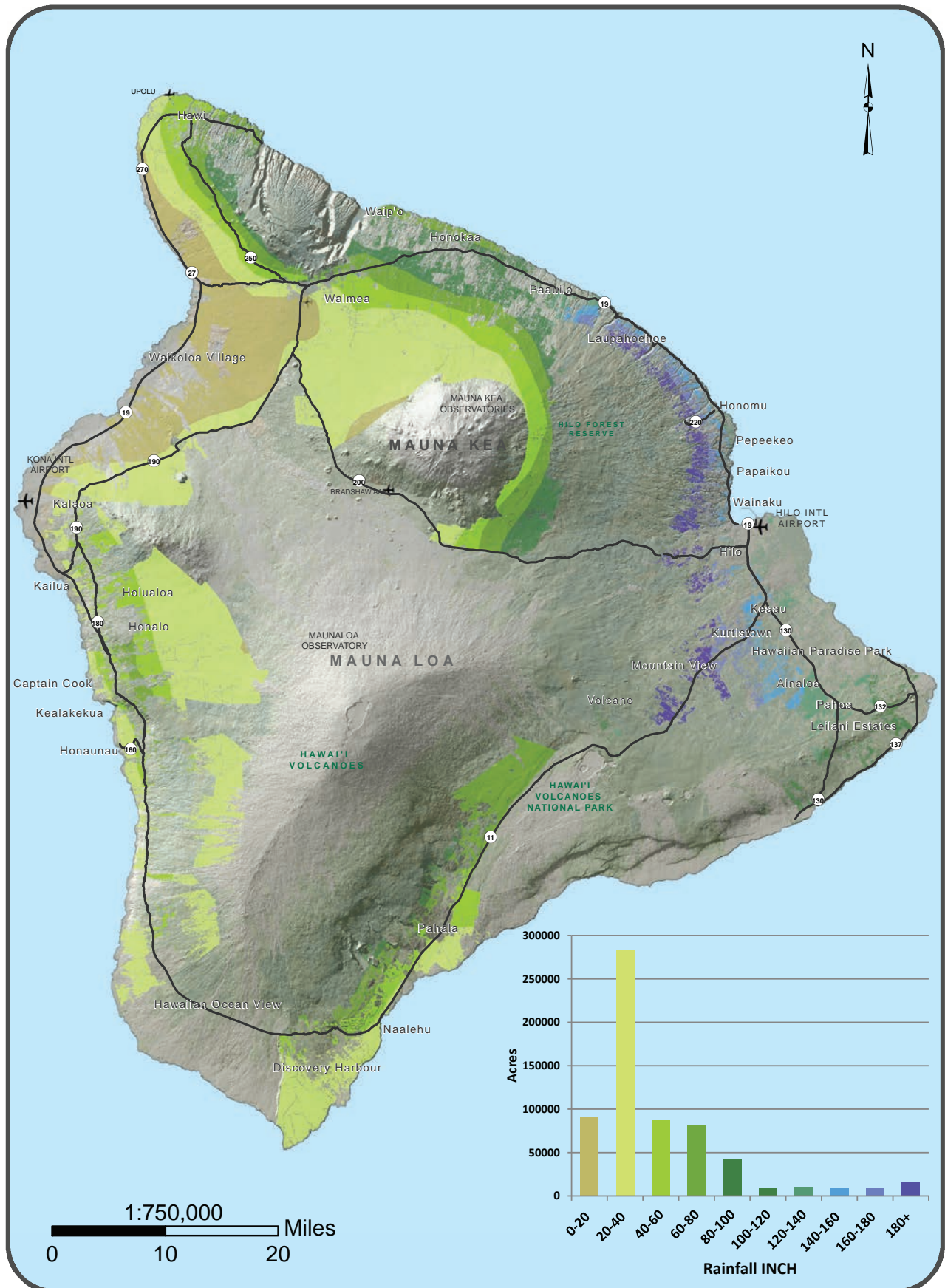


Figure 9. Pasture Lands Summary



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### 3.4 Hawai'i Island Irrigation Systems

Hawai'i Island has four major agricultural water systems that provide surface water for the irrigation to commercial agricultural producers. Two of these systems are run by the Department of Agriculture's, Agricultural Resources Management Division (Lower Hāmākua Ditch and Waimea Irrigation System), and two operate in a private, or semi-private fashion (Kohala Ditch and Ka'ū Springs). The County Department of Water Supply (DWS) also provides potable water for commercial agricultural use through its Agricultural Use Rate program. Additionally, there are several surface water systems that provide stock water to private ranches in the Kohala / Waimea area and several private well systems that irrigate macadamia nut orchards in Pahala and South Kona from ground water sources. There are a growing number of small private wells that serve a number of agricultural and residential uses around the island and a significant number of farms that use rain catchment to supplement crop demand. There are also a range of small springs, seeps, and stream intakes that supplement rainfall on individual farms, particularly along the windward coast.

The key factor in agricultural water is the cost of energy. Gravity fed water from mountain streams, springs and catchment are significantly less expensive to operate than the water from wells or other sources that need to pay energy costs for pumping and distribution.

Figure 10 shows the locations of the major irrigation systems and the locations of DWS agricultural water users around the Island.

#### 3.4.1 Waimea Irrigation System

The State DOA operates the Waimea Irrigation System, serving the Pu'ukapu and Lālāmilo areas in South Kohala. The system provides water to privately owned lands in Lālāmilo and Pu'ukapu as well as Hawaiian Home lands in the Pu'ukapu area. There are 692 acres enrolled in the service area and in FY 2009 the system provided 296 million gallons to truck crop, green houses, and nursery operations. 89% of the water was used in the Lālāmilo Farm Lots area. Annual water revenues collected from farmers in 2009 was roughly \$152,000<sup>42</sup>. The cost of water is \$0.50/1000 gallons plus a monthly service fee of \$5.50/acre served

The Source for this water supply system comes from stream intakes in the upper area of Kohala Mountain with open storage in a reservoir near Lakeland and at the end of Wight Road. The system is run by State employees and supported annually

by taxpayers for both operations and capital improvements.

#### 3.4.2 Honoka'a-Pa'auilo Irrigation System

The use rights to the Hāmākua Ditch system was acquired by the State from Kamehameha Schools in leasehold several years after Hāmākua Sugar Co. closed in the mid 1990's. It serves both farmers and ranchers makai of the ditch from Kukuihaele to Pa'auilo. Records from 2009 indicate that the system could potentially serve 777 acres of farm land and 5687 acres of pasture land, although only a small portion of the farm land is in active cultivation at this time. In FY 2009 the system sold 24.2 MGD and received \$10,300 in water sales<sup>43</sup>. The cost of water is \$0.50/1000 gallons plus a monthly service fee of \$4.81/acre for farm use and \$0.29 for ranchers served.

The sources of this system are four intakes at the back of Waipi'o Valley with several small reservoirs along the ditch alignment. Flow in the ditch is capped at 17 MGD but due to limited demand, daily withdraws are substantially lower than that in 2012. This system is operated by State employees and subsidized annually by taxpayers for both operations and capital improvements.

#### 3.4.3 Kohala Ditch

The Kohala Ditch is currently operated by Surety Kohala Corporation and is in the process of being transferred to a newly created non-profit corporation called the Kohala Ditch Foundation. The system has been sustained by private funds since the shutdown of Kohala Sugar in 1974. Its primary source is one 10MGD intake in Honokane Valley that is controlled by Kamehameha Schools. The Ditch currently serves approximately 60 users; the largest is Clover Leaf Dairy which uses the water for stock purposes and to irrigate pastures for green chop to reduce

grain imports. There is also a small hydro-power plant that produces electricity from excess ditch flow to contribute to the utility grid. The largest revenue from ditch operations comes from tour activities conducting kayak float tours.

Earth quake damage in 2007 resulted in the collapse of a major flume in a remote portion of Honokane Valley and

the collapse of significant portions of the trail system that leads to the main intake. The flume has been rebuilt and additional improvements have been made to keep the ditch flowing using Federal and State funds. Access to the main intake is limited, making regular maintenance difficult. Basic agricultural water is charged at \$0.25/1000 gallons. Total revenue from the system is not available but revenues do not currently cover the full cost of operations. No public funds are spent to operate the system.



Waimea Irrigation System irrigating leaf crops in Lālāmilo

42 DOA Annual Report 2009

43 DOA Annual Report, 2009



### 3.4.4 Ka'ū Springs

The Ka'ū district has 38 perched water sources that have been developed at the 1700' to 2500' elevation in the lower reaches of the Ka'ū Forest. These springs have been enhanced with development tunnels that extend several hundred yards back into the mountain to improve the flow from each spring. The sugar plantation used this water for fluming cane to the mill, and later for wash and factory purposes. Several of these springs (Ha'ao and Mountain House) provide domestic water to the Na'alehu/Wai'ōhinu area. Most of the spring sources are on State land and are the responsibility of the Department of Land and Natural Resources. They are currently leased to the



*Small spring contribution to the Keaiwa-Noguchi System near Pāhala.*

State's Agricultural Development Corporation (ADC) to be subleased to local water cooperatives and the Department of Water Supply.

Makakupu spring, located above Wood Valley, provides stock water to Kapāpala Ranch, which operates under a State lease. A portion of Noguchi tunnel provides agricultural water to Wood Valley farmers, and Alili Springs, once used to provide domestic water to Pahala town, now supplies irrigation water to a local vegetable farmer above Pahala. Above Wood Valley a cluster of 10 springs are connected together by new transmission pipeline improvements paid for by recent public and private investments. This system, referred to as the Keaiwa-Noguchi system, transmits water from Noguchi tunnel above Wood Valley to Keaiwa Reservoir above Wood Valley Road and is used to provide stock, farm, and processing water to new agricultural improvements in that area. This improved system is managed by the Olson Trust and has the capacity to deliver 2 to 3MGD. It is currently charging \$0.50/1000 gallons, pending a more detailed assessment of final water delivery expenses. No public funds are currently used to operate the system.

Improvements to several additional spring sources are planned to provide crop and stock water, pending completion of agree-

ments with the ADC and formalization of cooperative agreements among users. Taken together, the Ka'ū springs offer important new opportunities to bring inexpensive gravity fed water to agricultural activity in the region. Cooperation and joint expenditures by users are keys to unlocking the potential these small, spring-fed systems to support future food production in the Ka'ū region.

### 3.4.5 Dept. of Water Supply (DWS)

The County DWS provides potable drinking water to residents throughout much of Hawai'i Island. They have multiple separate systems from various water sources that provide an average of 24 MGD to 41 700 customers island-wide. The bulk of municipal water is pumped from deep wells around the island and incurs significant energy cost to distribute the water to customers. DWS has a policy to allow agricultural use of water from their system at reduced rates when surplus water is available. To be eligible for this service, customers are required to be commercial agricultural operations, stock raisers, or dairy operations, and to carry a current general excise tax license. Customers must install a backflow preventer at their meter and are required to apply annually for this special rate.

Water rates for consumers with agricultural rates vary by the size of the installed meter and are similar to the rates paid by domestic consumers for initial consumption volumes. Water rates then drop to \$1.00/1000 for larger volumes. All water users on the DWS system also pay a small standard monthly standby fee and an energy adjustment fee that spreads the rising cost of water pumping across the entire system. In March 2012, the energy adjustment fee was \$2.35/1000 gallons, making the total cost of agricultural water from the DWS system well over \$3.35/1000 gallons.

DWS provides agricultural water to 820 customers (2% of the total) who consume roughly 2.8 MGD or 12% of the total DWS consumption. The largest single user of agricultural water is the Hawaii Natural Energy Lab at Keāhole Point in Kona, which consumes over 600K gallons per day in support of algae and other aqua cultural ventures.

For some commercial farmers, access to domestic quality water provides an important resource for irrigating and spraying food crops because catchment or ditch water does not generally meet food safety certification standards. Many regular domestic customers use domestic water to periodically irrigate home gardens and orchards, which are planted for home consumption rather than commercial purposes. DWS plays an important role in delivering water to agricultural properties around the Island in a decentralized fashion from multiple sources. Figure 10 provides a summary of the irrigations systems discussed above and identifies the location of DWS agricultural customers based on the size of the water meter installed on the property.

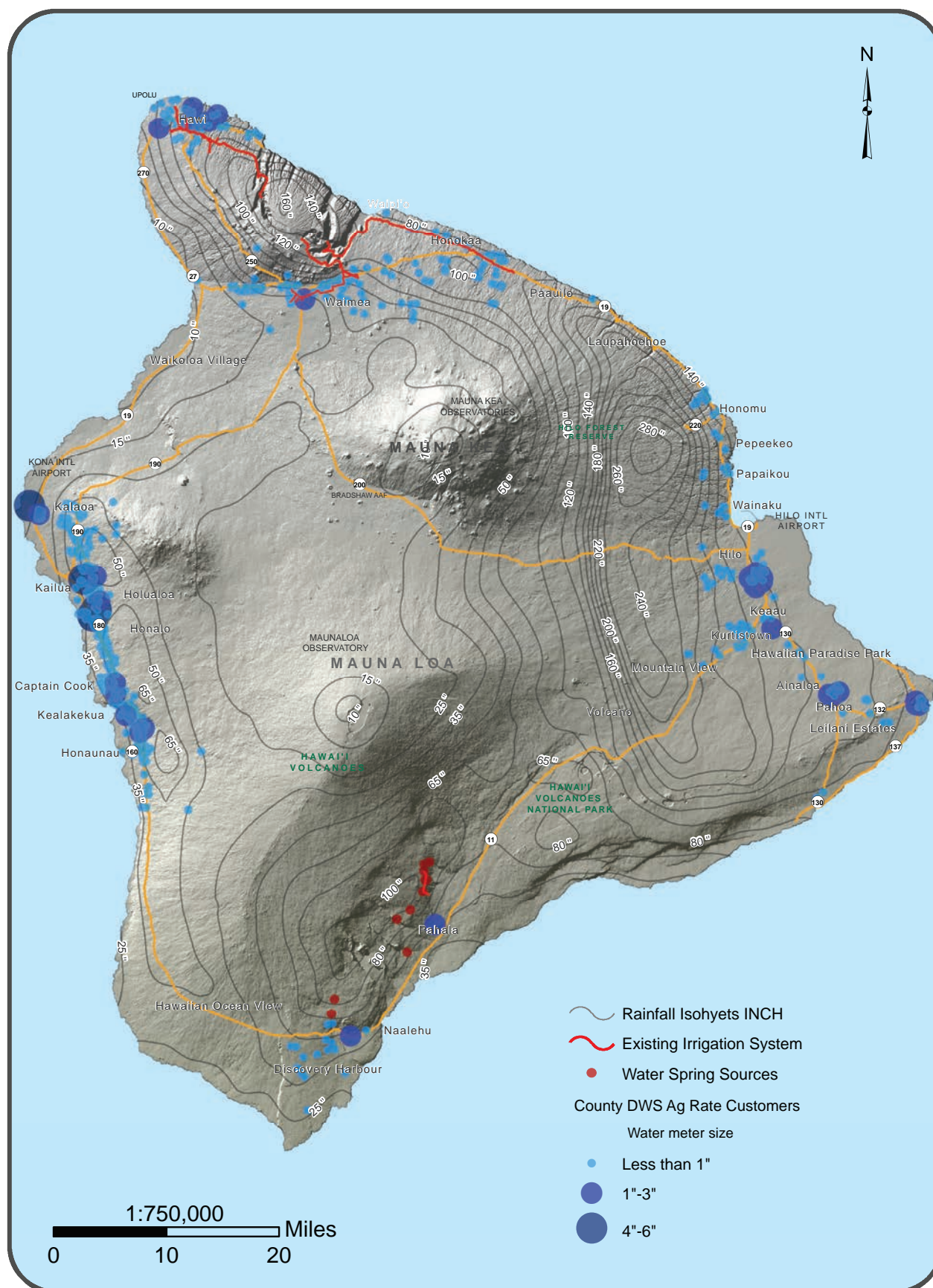


Figure 10. Agriculture Water Sources



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## 3.5 Agricultural Land Use Statistics

The State and County employ several land use regulatory and classification tools to define the quality and allowable uses of agricultural land. This section provides a summary of some of those classification systems as they relate to the actual farming that takes place on Hawai'i Island.

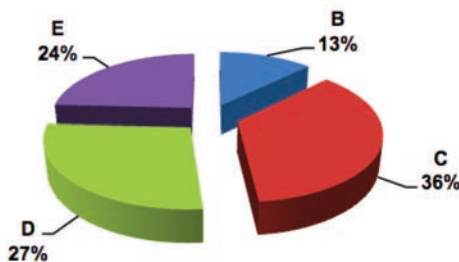
### 3.5.1 State Land Use Agriculture

Hawai'i Island's total land area is roughly 2,580,000 acres, of which 1,185,000 acres (48%) are in the State Land Use Agricultural district. Of that total agricultural land, 42,744 acres (4%) are in active crops, 20,700 acres (2%) are in commercial forestry, and 638,000 acres (54%) are in pasture use. The remaining 40% of the State Agricultural district on Hawai'i Island is not utilized.

### 3.5.2 LSB Soil Classification

The Land Study Bureau (LSB) classified Hawai'i's soils into five categories from A to E depending on their relative fertility and

**% of Current Crops by LSB Soil Class**



**Figure 11. Crops by LSB Soils Class**

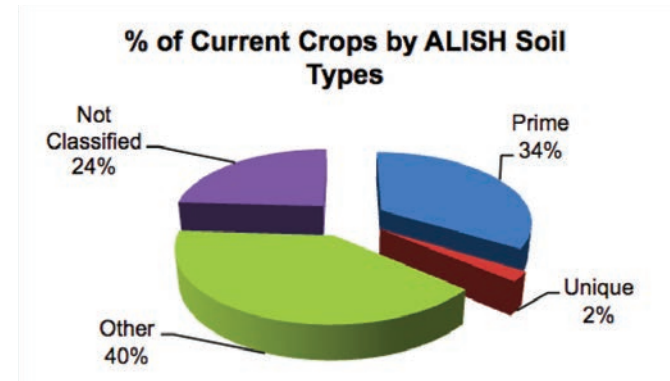
general growing conditions. Since soils are relatively young on Hawai'i Island there are no A class soils on the Island. B soils represent what the LSB would call the best of our agricultural lands. Based on the current foot print of crops, 13% of existing crops are on B class soils. 36% are on C class soils and 51% are on soils classed as D or E. Figure 11 summarizes the area in current crop production in each of the four soils classes on Hawai'i Island.

There are 46,430 acres of land in the B soil class, while just 5,363 acres (12%) are in active crop production in 2012. This would suggest that the agronomic quality of Hawai'i Island soils alone is not necessarily the best predictor of where farming is likely to take place. Other factors like location, land ownership, irrigation accessibility, wind etc. play key roles in decisions about farm location.

### 3.5.3 Agricultural Lands of Importance to the State of Hawai'i (ALISH)

The State also uses the ALISH soil classification system to distinguish the quality of agricultural soils. ALISH has three classifications; Prime, Unique and Other that covers 552,267 acres, or about 47%, of the State Land Use Agricultural land on Hawai'i Island. Prime land accounts for 114,501 acres and follows the general footprint of the former sugar industry in

North Kohala, Hāmākua, South Hilo, Puna and Ka'ū. Unique lands amount to only 1,686 acres located in areas where a small portion of the coffee crop grows in North and South Kona and the taro lands on the floor of Waipio Valley. Other lands amount to the bulk of the ALISH classification system with 436,000 acres scattered in pasture and crop areas around the island.



**Figure 12. Crops by ALISH Soil Types**

Overlaying the existing crop map on the ALISH classifications indicates that 34% of the currently cultivated lands are in the Prime category, just 2% are in the Unique category and 40% are classified as Other. 24% of the existing crop base is on land that is not even classified as Agricultural Lands of Importance to the State of Hawai'i (Figure 12).

## 3.6 Hawai'i County General Plan: Important Agricultural Lands

The County's General Plan contains a map to guide the allocation of land uses in the County. One of the categories inserted in the 2005 GP Update is referred to as Important Agricultural Lands. This category of use is defined in the plan as follows:

**Important Agricultural Land:** Important agricultural lands are those with better potential for sustained high agricultural yields because of soil type, climate, topography, or other factors. Important agricultural lands were determined by including the following lands:

- Lands identified as "Intensive Agriculture" on the 1989 General Plan Land Use Pattern Allocation Guide maps.
- Lands identified in the Agricultural Lands of Importance to the State of Hawaii (ALISH) classification system as "Prime" or "Unique".
- Lands classified by the Land Study Bureau's Soil Survey Report as Class B "Good" soils. (There is no Class A land on the island of Hawaii)
- Lands classified as at least "fair" for two or more crops, on an irrigated basis, by the USDA Natural Resource Conservation Service's study of suitability for various crops.

- In North and South Kona, the “coffee belt,” a continuous band defined by elevation, according to input from area farmers.
- State agricultural parks<sup>44</sup>.

**The Important Agricultural Land category in the General Plan encompasses a total of 381,657 acres of which just 35,080 acres or 9% are in active crop use in 2012.**

### 3.6.1 Existing Parcel Size and Truck Crop Production

Properties with truck crops are where most of the fresh vegetables are grown on Hawai'i Island. The size of the parcels where these crops are grown give us an indication about the land use circumstances in which vegetable farming is currently taking place. Figure 13 displays the percentage of land in truck crops based on the size of parcel they are grown on. 16% of all truck crop production takes place on parcels of 3 acres or less. 68% takes place on lots 20 acres or less. These numbers emphasize the importance of small agricultural properties to the production of food crops. Smaller agricultural lots are not always the enemy of future agricultural production since 48% of all truck farming that is currently occurring on Hawaii Island happens on parcels less than 10 acres in size. Preserving large agricultural parcels may be less of an issue in food production than are the incentives and circumstances in which farmers can get access to reasonably sized properties for farm purposes.

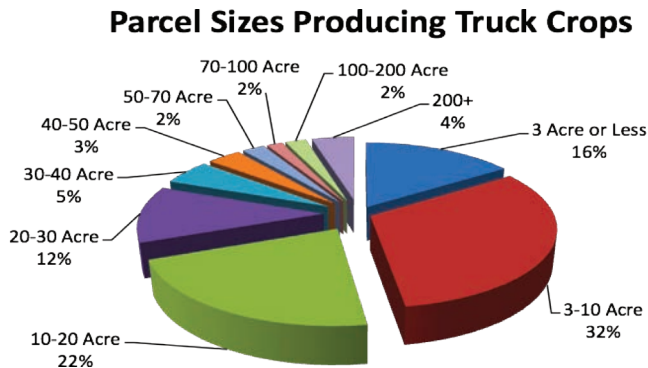


Figure 13. Parcel Sizes Producing Truck Crops

### 3.7 Core Crop Lands

Existing soil classification systems, like ALISH and LSB, and land use regulatory districts, like State Land Use Agriculture and County General Plan IAL, represent traditional methods to help focus attention, and regulatory protection, on the lands that should be the most important to the future of agriculture in Hawai'i. Once adopted, these classification systems become static and may lose their utility for helping current decision makers to discern which lands are actually most important for

the vitality of the agricultural industry. ALISH, for example, was adopted in the 1980's when sugar was still a dominant land use in the State. As a result, all the former cane lands were generally classed as Prime, in part, because they were currently in production. With the departure of sugar, new agriculture has evolved differently but the ALISH classification remains a commonly used tool to describe agricultural productivity. Further, there is a substantial over statement of what lands are “Important” for agricultural use for fear the lands that were not classified as agriculturally valuable, might become the target of new land use development activities.

The presence of existing irrigation systems is often used as a key factor in determining the relative value of agricultural land. In the Waimea area, this relationship between intensive agriculture and the availability of a State operated irrigation system is fairly clear, particularly in the Lalamilo area. In North Kohala and in Hāmākua, the existence of functioning, former plantation era ditch systems is less a determinant of where farming actually happens. In both of these cases, there is very little active, irrigated crop production taking place.

A comparison of the existing land use and soil classification systems with a map of current farm activities suggests that these tools are not necessarily efficient predictors of where farming occurs on Hawai'i Island. The General Plan Important Agricultural Land category designates 91% more land than is in current crop production and only 4% of the State Agricultural District is in an active agricultural crop. Only 12% of the B classed soils are in active crop production, and 64% of existing crop activity occurs on lands that ALISH refers to as Other or Unclassified. Using soil quality and the availability of irrigation water to predict the success of sustained agriculture can produce a distorted view of which lands are really the most Important for current and future agricultural production.

Another way to identify where the most important agricultural lands are would be to use the existing crop map to identify where crops are already being grown. On the crop lands map in Figure 7, agriculture occurs in clusters, around the confluence of certain resources, ownership patterns or weather conditions. Each cluster is a little different from the other with

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*Core Crop Lands are the lands from which additional food self sufficiency is most likely to emerge because it is where the conditions that support sustained agriculture already exist.*

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<sup>44</sup> Hawaii County General Plan: 2005 Update page 14-8

a unique set of forces that drive farm investment. Based on the footprint of existing agriculture as shown in Figure 7 clusters are easy to pick out. For example, in North Kohala the core agricultural area would run below the Kohala Ditch and out to the dairy at 'Upolu, and perhaps encompass some of the homestead lands at Ka'auhuhu where small landowners could farm on County water. In Kona, the Coffee Belt has been general defined by County Council action, Community Development Plan and by existing farm use. In Ka'u, the lands from Wood Valley to Punalu'u, including the existing macadamia nut orchards, where the land is reasonably sloped and water is available, would make a logical unit of agricultural potential. There are eleven such clusters on Hawai'i Island within which 93% of all the existing farming on the island takes place. These areas are depicted in Figure 14, and could be referred to as Core Crop Lands.

An advantage of the Core Crop Lands approach is that it focuses collective attention on the ground where farming is

taking place, and on the existing conditions that make farming feasible. From that vantage point, it is easier to see what kind of support or intervention is needed to expand existing farm activity, or begin some anew. These are the lands from which additional food self sufficiency is most likely to emerge because it is where the conditions that support sustained agriculture already exist.

Core Crop Lands should not be viewed in a regulatory fashion. This is not a new regulatory designation, nor is it an exclusion of the agricultural value of lands outside of the circles. Rather Core Crop Lands should be seen as a way to identify strategic lands within which efforts to stimulate new food production is likely to be most successful. Understanding the unique challenges that each area faces will help to inform the kinds of investment and public policy supports needed to drive new farm activity. Like efforts to stimulate a campfire, these are the places where the judicious addition of new fuels or strategic blowing on the ambers, is most likely to produce new flame.



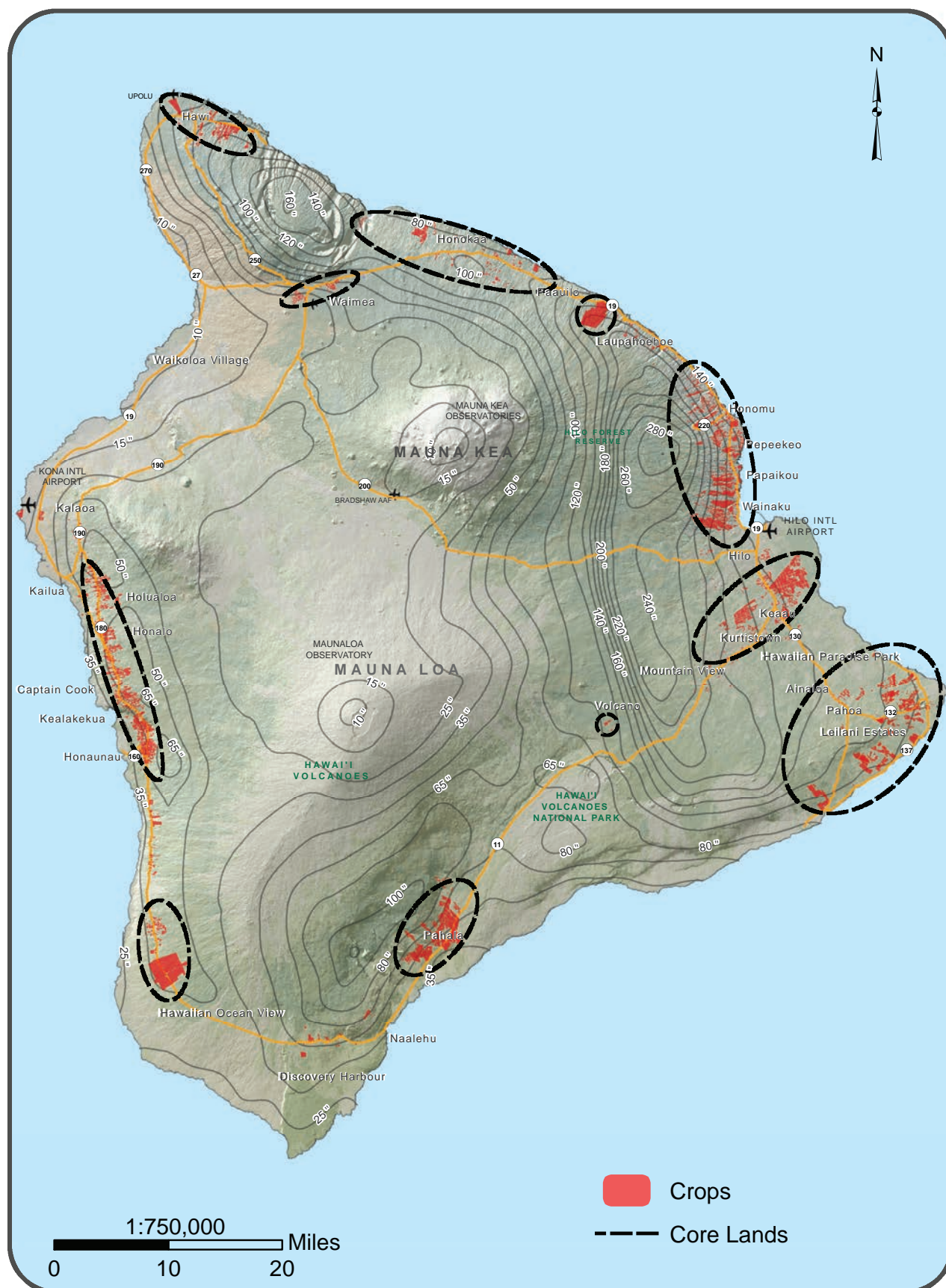


Figure 14. Core Crop Lands



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### 3.8 Small Farm Opportunities

Hawai'i Island's existing settlement pattern is another important factor shaping the future of local food production. More than any other island, Hawai'i has a large number of small agricultural parcels scattered around the island. These parcels create a setting for both small scale farming and for back yard gardening.

These existing lots are the product of historical subdivision processes that started with Land Commission and the awarding of lands at the Mahele in 1848. Throughout the monarchy years other lands were cut into parcels and sold to island resident. Territorial homesteading programs followed at the turn of the 20th century provide individuals the ability to acquire public lands by proving their ability to set up productive homesteads in areas like Āhualoa, Laupāhoehoe, Hakalau, Ka'auhuhu and others. Further subdivision in the Kona Coffee Belt was done in the early 1900's, largely to adapt the struggling coffee industry to a more sustainable model of small

independent farmers managing small orchards using family labor. This era was followed in the 1960's by large speculative agricultural subdivisions in Puna and Ka'ū that predated the adoption of modern planning regulations. Today, the existing agricultural settlement pattern on Hawai'i Island creates opportunities for individuals to acquire and utilize agricultural land in small to medium sized units. Not all of these lands are currently utilized, but they hold significant potential for more active use in future food production.

Figure 15 depicts the location and general size of agricultural parcels from 0.5 acres to 20 acres in size. This rural settlement pattern accounts for over 135,000 parcels, and more than 200,000 acres of agricultural land. The existing settlement pattern on Hawai'i Island is a potential asset for increasing food production. Small agricultural parcels provide opportunities for small landowners to explore more intensified agricultural use and, in the event of a future food crisis; each of these landowners has a resource to turn to for supplementing their own food supply and producing food for others.

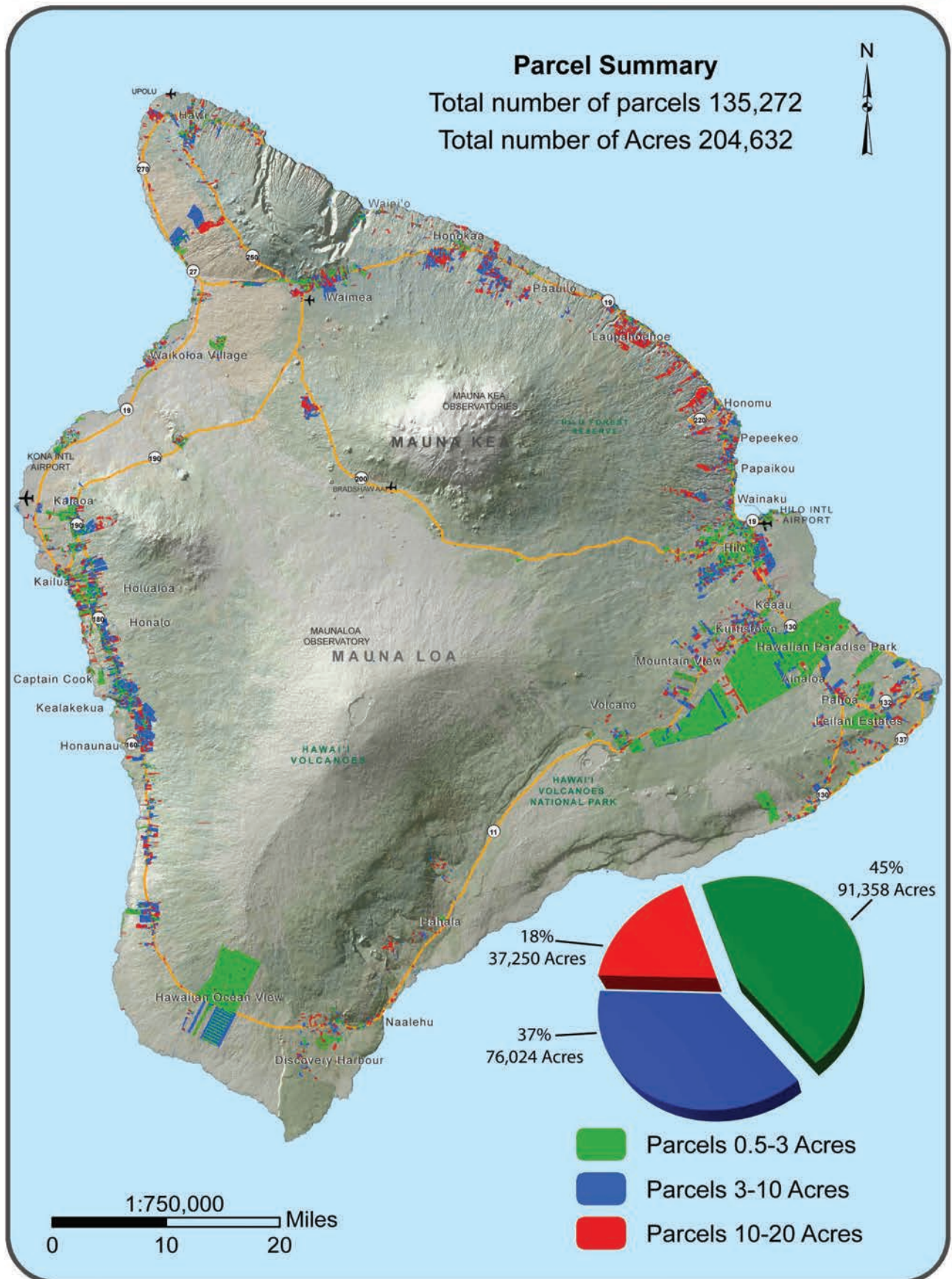


Figure 15. Small Farm Opportunities: Parcels under 20 acres



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### 3.9 Other Existing Agricultural Statistics

This section provides a summary of existing statistics that shed some light on the nature of agricultural activities on Hawai'i Island.

#### National Agricultural Statistics Service (NASS) 2007 Census of Agriculture

The 2007 Census of Agriculture is produced by the National Agricultural Statistics Service (NASS), a branch of the US Department of Agriculture (USDA). The census was conducted in 2007 and issued in 2009. The next census will be conducted in 2012 and released in 2014. The census is conducted by a mail-out survey to farmers and ranchers across the United States; participation is voluntary. Results are used to inform policy makers for allocating resources to support agriculture nationally.

#### Statistics of Hawai'i Agriculture 2009, State Department of Agriculture

The 2009 report on agricultural statistics from DOA is the latest available data on Hawai'i agriculture. Due to budget cuts in 2008, the majority of staff assigned to collect crop and other data for this report were laid off. As a result, 2009 data is less robust than it has been in the past. Nevertheless, there is some useful agricultural data in the report, which come from other administrative requirements, in addition to reporting from farmers, ranchers, processors and others.

The following are some highlights extracted from available data sources on agriculture in Hawai'i. Unless otherwise footnoted, the source for these highlights is NASS 2007 Agricultural Census for Hawai'i: State and County Data report Volume 1, Geographical Area Series, Part 1.

#### ***Farm and Ranch Measures***

- There are 4,650 farms and ranches on Hawai'i Island, which is 62% of the total number in the state of Hawai'i.
- There are 683,819 acres in farm and ranch on the Island, accounting for 61% of all such land in the state.
- 62% of all farm and ranches on the Island are less than 10 acres and 90% are less than 50 acres.
- There are 58,635 acres of irrigated land in the State of Hawai'i, 14% of this is on Hawai'i Island. Maui has 48% of the total, O'ahu has 14% and Kaua'i has 24%.

#### ***Farm Revenues***

- 42% of all farms and ranches on Hawai'i Island report less than \$2,500 in annual sales. 6% report more than \$100,000 annually.
- The average farm and ranch sales on Hawai'i Island is \$43,564 with an average net of \$5,362.
- The State's average farm and ranch gross revenue is \$68,292 with an average net reported income of \$410,089.
- Vegetables, melons, and sweet potatoes yielded \$8.4 million on Hawai'i Island which was 14% of the state's total of \$61.2 million
- Nursery, greenhouse, and floriculture produced \$60.8 million or 51% of the state's total of \$119.6 million
- Fruits, nuts, and berries produced \$60.8 million or 44% of the state's total of \$119.5 million

#### ***Cattle and Pork***

- The cattle and calves inventory in the state in 2007 was 151,479; 71% of those (108,093) are on Hawai'i Island.
- 50% of all ranches on Hawai'i Island sell fewer than 10 head annually. 4% of the ranches account for 68% of the sales.
- In 2007, Hawai'i Island had just 8% of the State's inventory of hogs and pigs.

#### ***Farm Labor***

- 51% of the State's hired farm labor (5,894 employees) is on Hawai'i Island. 23% of the farms hire just one worker and 69% hire fewer than 4 workers.
- In 2009, the total farm workforce was 10,600 statewide, 33% of these were in self-employed farm operations and 10% were unpaid family workers<sup>45</sup>

#### ***Crop Production***

- In 2007, there were 535 acres of taro grown in the State, 71 acres, or 13%, were grown on Hawai'i Island
- 78% of the orchard land in the State is on Hawai'i Island.
- 81% of the State's papaya acreage is on Hawai'i Island, as well as 66% of its lemons and 65% of its limes
- 98% of all the macadamia nut acreage is on Hawai'i Island.
- 69% of the State avocado acreage is on Hawai'i Island and 54% of its banana orchards

<sup>45</sup> Statistics of Hawai'i Agriculture 2009, State Department of Agriculture



## 3.10 Agriculture and Hawai'i County Real Property Taxes

In 2010, the County of Hawai'i's real property tax (RPT) system provided agricultural property value adjustments for 11,741 parcels (1.16 million acres) that claimed to be in active agricultural use. These exemptions reduced the property values on those lands from \$4.5 billion to \$442 million, with a resulting tax savings to those agricultural property owners of \$34 million annually. Provisions for these exemptions are contained in the Hawai'i County Code Chapter 19, Sections 19-57 and 19-60.

There are two types of County land use tax incentives for agricultural land. The Agricultural Use Rate program revises the market value of a property to reflect the value of the crop that is being grown on it. Assessed values for land in agricultural use vary, based on the value of the products that are being produced. Pasture lands carry the lowest assessed value, while more intensive uses like truck crops and orchards pay more since they usually produce more revenue per acre. A breakdown of assessed values by agricultural use is found in Table 5. Land owners apply for the program and provide a map of their agricultural use to the County Tax Office. Assessors confirm that the agricultural use has been, or is being, installed before the new assessment rate is approved. There are no formal ongoing inspections or requirements to prove that the use remains active, nor is there a commitment by the landowner to have to retain the proposed use for any particular period in time.

**Table 5. Hawai'i County real property tax assessed values for agricultural uses.**

Type of Agricultural Use	Sample of Applicable Crops	Assessed Value per acre
Intensive Agriculture	Truck crops, vegetables, ginger, taro, herbs, foliage, nurseries, apiaries, confined animals, piggery, dairy, poultry	4,000
Orchard & Multi-Year Crops	Macadamia, banana, papaya, coffee, tropical fruit	\$3,000
Biomass & Agronomics	Forage crops, sugar cane, fast rotation forestry (7 years or less)	\$1,000
Extensive Agriculture & Forestry	Pasture, slow rotation forestry, dedicated native forest	\$420

The second program is an Agricultural Dedication program that is similar to the Agricultural Use Rate program, but requires the landowner to remain in the selected crop for a minimum of 10 years. Dedicated agricultural land is charged annual taxes based on half of the assessed values for agricultural use outlined in Table 5. The dedication program contains penalty provisions in the event that the agricultural use is terminated before the end of the dedication period. The agricultural use rate program has no such penalty provisions.

Real property tax break programs for agricultural land use are used throughout the United States as well as other countries. They are intended to apply real property tax policy to encourage intensive agricultural production and to mitigate the impacts of rising real estate values on the economics of commercial farms and ranches. Public benefits from these programs are expected to come in the form of more active agricultural use, sustained employment, and other business revenues. In Hawai'i County, real property tax incentives for agricultural use are the largest form of annual government subsidy that the agricultural industry receives. There is, however, little in the way of active enforcement to ensure ongoing productive agricultural use and no requirement for the landowner, in either program, to submit proof of agricultural activities in the form of taxes paid on farm revenues or receipts to verify that produce from the lands were used in some publically beneficial fashion.

Figure 16 depicts the location of lands in Hawai'i County that are currently in either the Agricultural Dedication or Agricultural Use programs. The map shows the entire Tax Map Key on which an approved use occurs and tends to overstate the area that is actually in agricultural production. The pie chart in Figure 16 illustrates the actual number of acres that are subject to beneficial agricultural valuations as they have been agreed to by the County and the landowner.

Further review of RPT data suggests that most landowners prefer not to commit their property for agricultural dedication for a period of 10-20 years. Instead, they generally prefer to

pay slightly more in taxes for the Agricultural Use Rate and avoid the commitment and related penalties associated with dedication. 63% of all pasture acres are in the agricultural use program while only 37% are dedicated. Only 16% of the land in truck crop is dedicated while 84% is in the agricultural use program.

County real property tax data was used in the agricultural mapping process presented in Section 4 of this report. It was particularly helpful in locating

small agricultural producers on properties of 3.0 acres or less. A map of these small properties and a summary of the area and uses claimed to be agriculture under this program are provided in Figure 17. With the use of current satellite imagery, it was clear that some of the claimed uses appeared to be ongoing, while others did not.



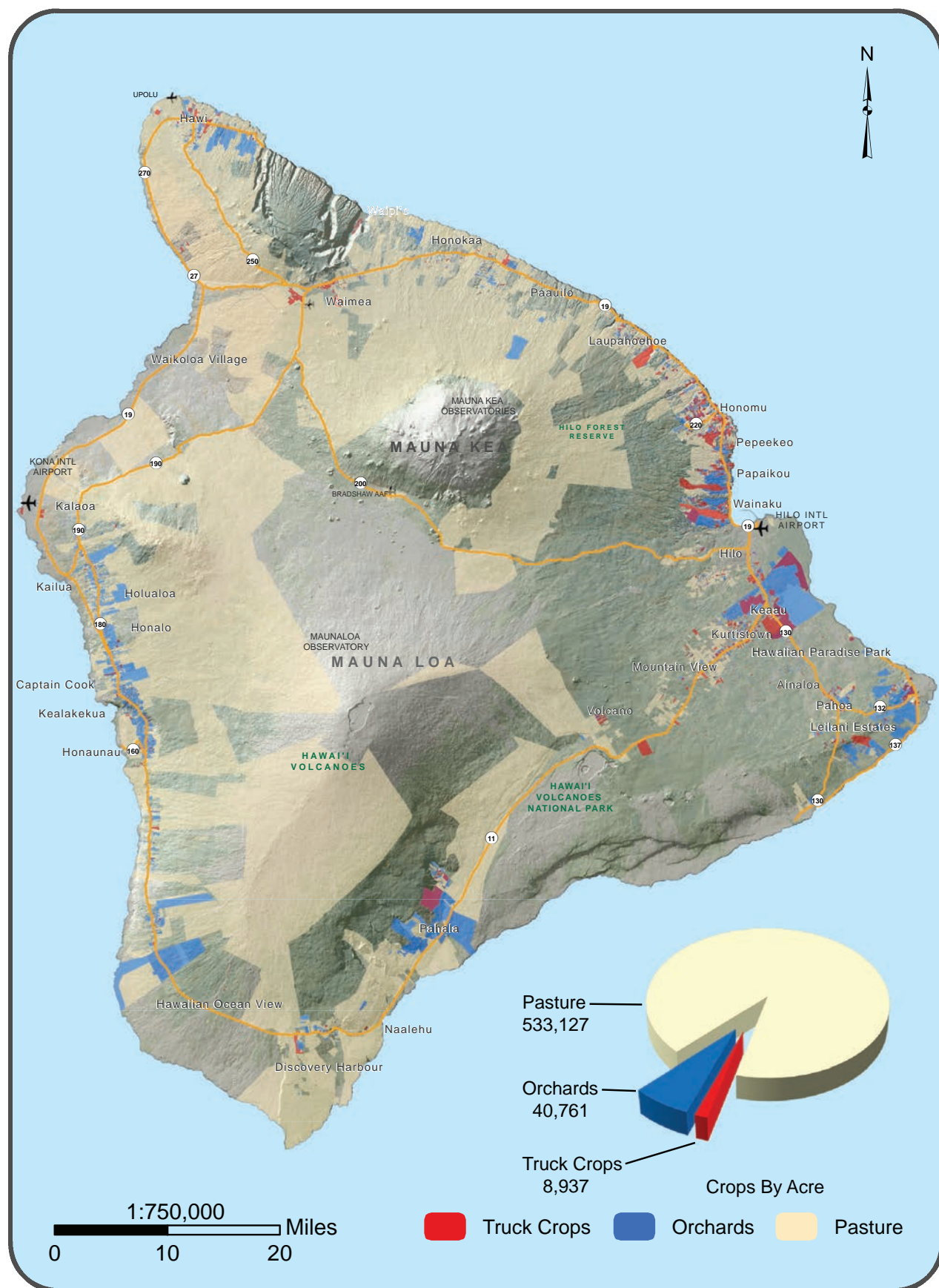


Figure 16. Lands with Agricultural Use and Dedications Programs in 2011



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### 3.10.1 Tax Policy and Food Self-Sufficiency

The current County agricultural real property tax program was established decades ago when much of Hawai'i agriculture was in large sugar operations that were relatively easy to monitor. Since plantation operations had been around for decades with stable land use patterns, the tax program was developed without a requirement to report annual proof of ongoing farm or ranch activities. As a result there is little accountability on the part of the landowner to insure that agricultural use remains active and productive. The Real Property Tax Office is not funded to provide comprehensive inspection and enforcement of the program, nor is the office staffed with agricultural expertise. As a result, it is fairly simple to receive agricultural benefits with little or no public benefits accrued from the claimed agricultural use.

For many agriculture land owners, both the agricultural use rate and dedication programs are a practical way to reduce their real property tax liability. The lowest rate is paid by landowners who fence their land, provide stock water and keep animals in a pasture setting. Owners who purchased their property for \$20-\$30 000 per acre are paying real property taxes on the same land based on an agricultural use rate assessed

value for pasture of \$420/acre. There is also no tax incentive that would suggest that a landowner actually farm, or find a truck farmer to farm their property, when a less intensive use garners the lowest possible tax rate. The County tax revenue implications of this agricultural land devaluation are significant, particularly if there is no measurable benefit to the public from some portions of the claimed agricultural use.

The current agricultural land tax system is an important tool for viable farms and ranches to mitigate tax expenses. Given the run-up in real estate values in the last 30 years, many commercial farmers and large ranchers could not afford to pay property taxes on the current market value of their land. The County's program buffers the impact of land speculation on agriculture and is critical to retaining active agricultural operations Island-wide. It has, however, become a tool for any agricultural land owner to seek tax relief based on minimal agricultural use with limited agency oversight. A comprehensive review of the current agricultural land tax program could help to update the focus of this important policy and create procedures to increase accountability for receiving the incentives and to encourage certain types of agriculture that could help to increase local food self-sufficiency.

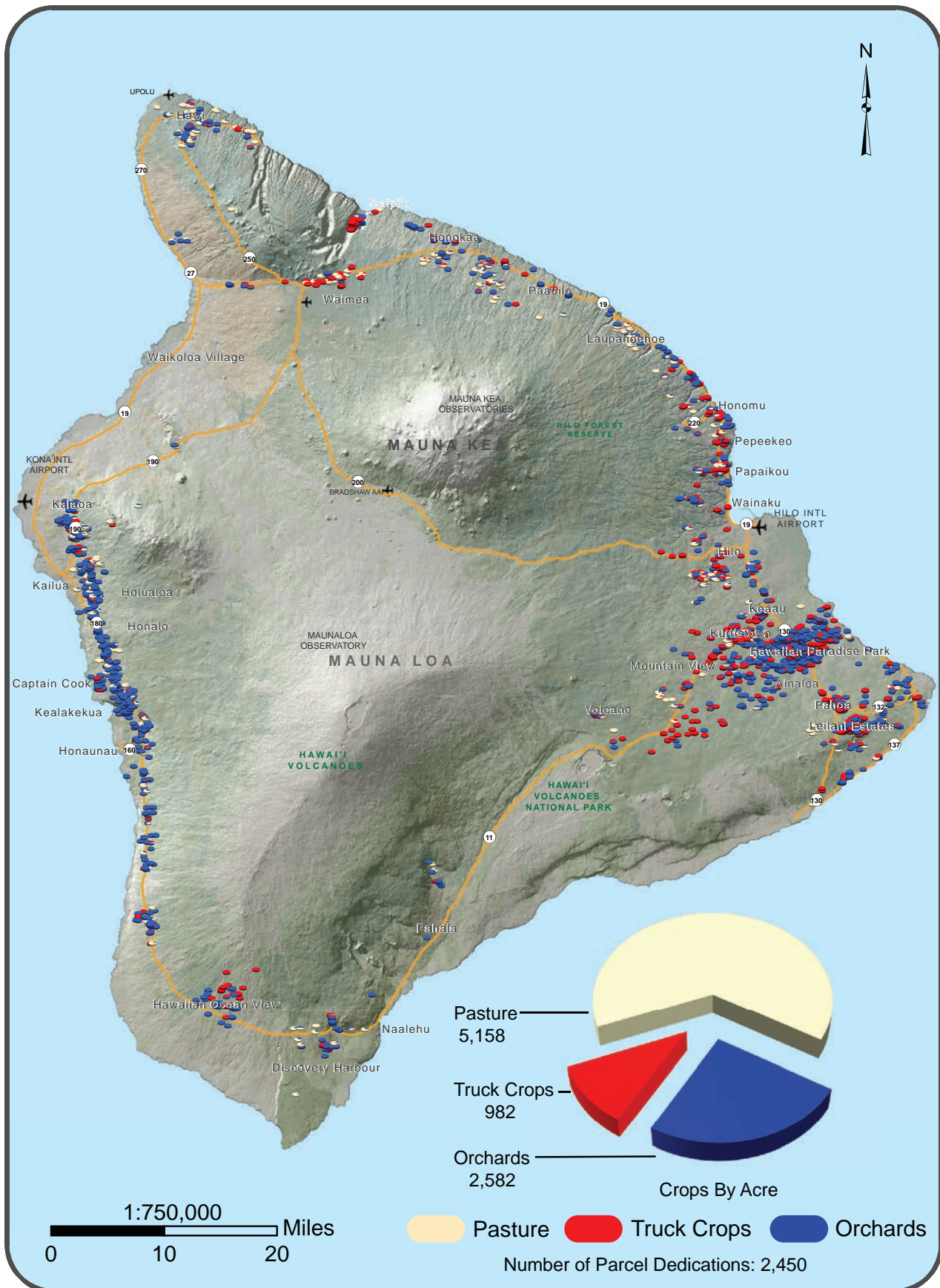


Figure 17. County Real Property Tax Agriculture Use and Dedicated Land



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## 4 Regional Agricultural Summaries

### 4.1 North Kohala

#### Background

North Kohala was once one of the most active agricultural areas on Hawai'i Island. For centuries, wetland taro was produced in the windward valley and an extensive dryland field system stretched for miles along the mid-level slopes of Kohala's leeward coast. By the 1860's, sugar began to replace subsistence farming as the primary agricultural activity. By the early 1900's nearly 20,000 acres of sugar production were fed by a surface irrigation system that served six sugar mills and irrigated the most leeward plantation fields. Sugar production ended in 1974, and new agricultural activity has emerged in sporadically over the last 40 years.

The **foliage industry**, led by Kohala Nursery, was the first successful post-plantation agricultural venture to develop from a host of unsuccessful efforts that were envisioned by the State's Kohala Task Force in the mid to late 1970's. For a time, Kohala Nursery was the biggest foliage plant exporter in the State. Rising competition and economic cycles, both locally and nationally, have seen the foliage industry grow and then recede in Hawai'i. Kohala Nursery and several other smaller foliage operations in Kohala are now much smaller businesses than in the 1980's and 1990's. There are currently about 100 acres of land in North Kohala dedicated to foliage production, most of it in Honomaka'u and Kapa'au. Products include palms, potted plants, and landscape trees and shrubs.

**Macadamia orchards** were part of plantation diversification experiments beginning in the 1960's. It was not until the early 1980's that commercial planting began in earnest. Today, there are over 1,300 acres in macadamia nuts in North Kohala. The orchards are largely un-irrigated once the trees are established. The success of macadamia nut growers and processors has fluctuated with market conditions over the years. In 2012, Kohala's growers are able to sell virtually all of the nuts they produce at a higher price than they have seen in some time. Nuts are sold to several processors on the Island and are generally exported for bulk use or packaged for retail sales across the country.

Kohala is home to **Clover Leaf Dairy**, which moved into a State-owned feedlot near 'Upolu Point in 1985. The Dairy operates on 880 acres and has 600 milking cows. The dairy uses Kohala Ditch water to irrigate pasture lands to produce green chop which is used as feed to reduce the grain imports required by concentrated dairy operations. Clover Leaf is one of only two



*Irrigated grass lands being harvested to provide green chop for dairy cattle at clover Leaf Dairy in 'Upolu Point*

commercial dairy operations in the State of Hawai'i. As a result, it is an important strategic asset in Hawai'i Island's overall food self-sufficiency. Milk from Clover Leaf Dairy is sold to Meadow Gold Dairies and processed at its facility in Hilo. It appears on consumer shelves under several different brand names.

There is a small amount of **vegetable farming** in North Kohala, although there is significant interest within the Kohala com-

munity to strive for community food self-sufficiency. A Food Forum held in North Kohala in 2009 identified a relatively short list of five to six commercial farmers in the region, most of whom were organic vegetable growers who marketed their crops to local residents, restaurants, and to retail outlets around the Island. There was a longer list of farmers who did not see themselves in commercial terms, but rather farmed to help feed themselves and their neigh-

bors in a more informal fashion. In addition to these commercial and private farm operations, there are several community-based efforts to educate Kohala young people in the business of farming and to promote family farming for local self-sufficiency. Statistics gathered at the 2009 Food Forum estimated that North Kohala produced just 1% of the food that was consumed in the region and 8% of the food consumed in local restaurants.

There are about 90 acres of tropical fruit orchard in the North Kohala district, most of which is sold locally or shipped to distributors on other Islands.

**Cattle pastures** are the largest single agricultural lands in the district. Large ranches, such as Ponoholo, Kahua, Kukuipahu and, Parker, use most of Kohala's pasture lands. There are also a number of smaller independent cattle producers in the district. The bulk of cattle production is exported as wean-offs and shipped to the west coast. A portion of the beef and pork that is raised by small producers in North Hawai'i is slaughtered and chilled at a private facility in North Kohala for home use or distributed informally within the community.

*Table 6. North Kohala Crop Land Acres*

North Kohala	2143 (crop acres)
Dairy	841
Flowers & Foliage	92
Macadamia Nuts	1100
Special Crops	6
Tropical Fruits	89
Truck Crops	16



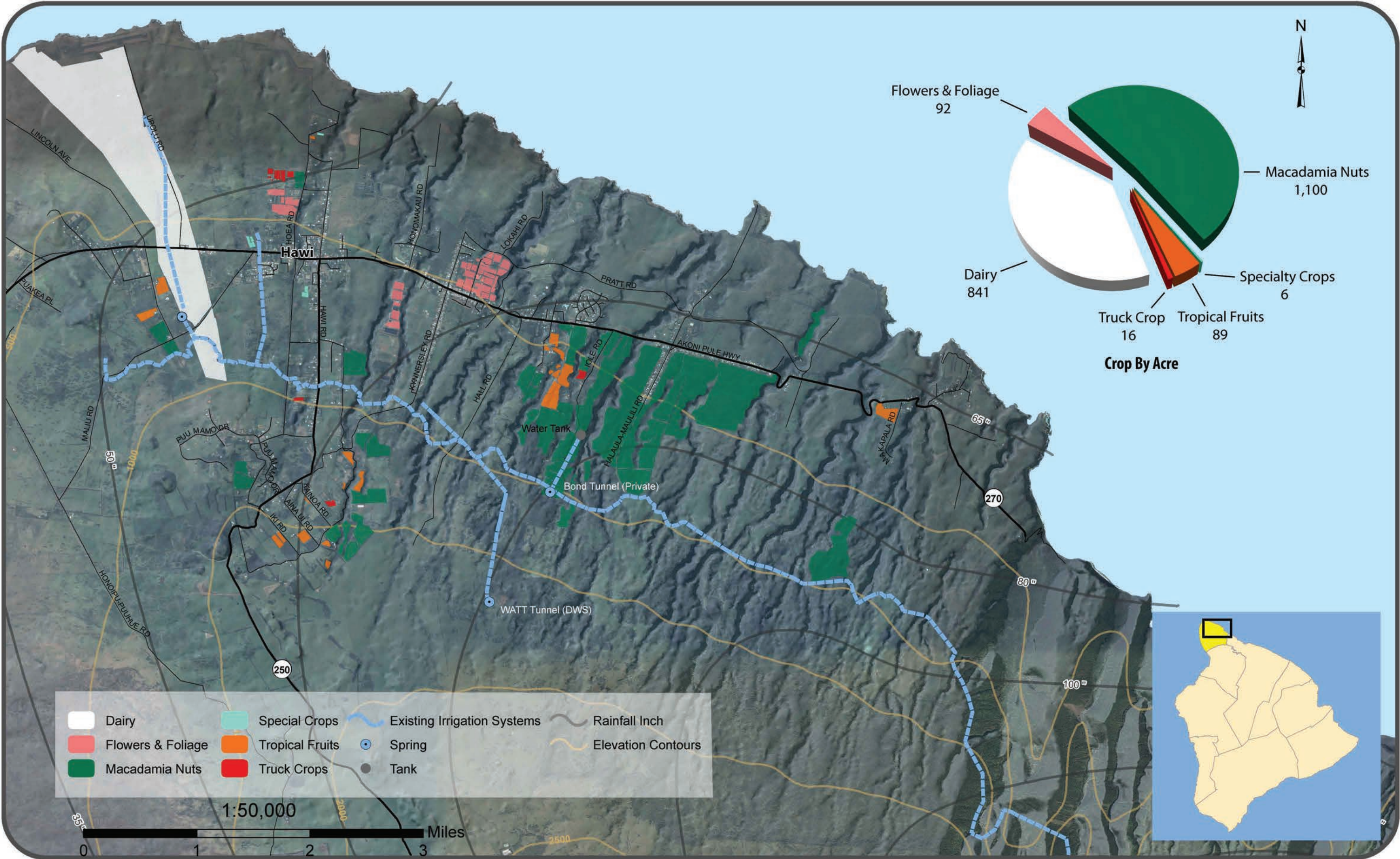


Figure 18. North Kohala Crop Land Summary

# North Kohala Crop Land Summary



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## Irrigation Water

North Kohala has agricultural land with both windward and leeward weather exposure. The remote valleys of the Kohala

Mountain have been the main source of irrigation for the district. The use of irrigation water is particularly important on leeward lands west of Kapa'au. Water is transmitted through the Kohala Ditch which extends 22 miles from remote stream intakes to the wind-swept lands near 'Upolu Point. The Kohala Ditch was built in 1906 and is now



***Commercial tours of the Kohala Ditch help to support the continued flow of irrigation water to the region***

owned and operated by the district's largest landowner, Surety Kohala Ltd. The ditch's principal stream intake is on lands owned by Kamehameha Schools in the remote east branch of Honokane Valley.

The Kohala Ditch is an anomaly in the world of Hawai'i plantation irrigation systems. It has survived for nearly 40 years after the sugar industry shut down without being acquired or subsidized by the State or other government funds. The ditch remains in private ownership and the process is underway to lease it to a non-profit foundation to operate it in the future. As originally designed, the system had the capacity to convey 30 to 40 MGD at high flow. It now has a renovated intake in Honokane that limits flow to 10.0 MGD and even this amount exceeds the region's current agricultural demand. The first government monies invested in the Kohala Ditch came as a result of emergency repairs after a large earthquake in 2007 damaged key flumes, destroyed access trails, and silted up the major intake. The last of the federal money was spent in 2011 to install pipelines in portions of the ditch that were subject to major water losses due to seepage. Currently the ditch is fully operational, but there are ongoing issues associated with trail access to the intakes and the condition of flumes and distribution lines that challenge future operations.

The Kohala Ditch is at a major crossroads and its viability as an agricultural resource to the North Kohala district is uncertain. Current demand for agricultural water by commercial agricultural endeavors in the region is low. Aside from the dairy at 'Upolu Pt, there are few commercial farmers using ditch water. The largest income producer for the ditch has been kayak float tours that use the ditch to transport visitors through the district on private flume adventures. There is also a small hydro-power plant near the end of the ditch, which has produced intermittent electrical power to the public utility company for several decades. The Kohala Nursery and an aquaculture operation were both steady users of ditch water prior to the earthquake.

In addition to the Kohala Ditch, there are several perched water springs that provide reasonably dependable agricultural water. The privately-owned Bond Tunnel in I'ole and the County Water Department-controlled Watt Tunnel are two important resources for agriculture in the region. Together, they produce approximately 1.0 MGD. Both of these springs are currently used to support small truck and orchard operations and provide interim water to the Kohala Nursery when ditch service was interrupted.



### 4.1.1 North Kohala Contribution to Food Self-Sufficiency

The following are some of the drivers in North Kohala's contribution of Food Self-Sufficiency

- There is over 65,100 acres of pasture lands in North Kohala, a portion of which have windward weather exposure making them some of the most productive grasslands on the Island. More high quality pasture lands could be added by addressing invasive species like guava and christmas berry in several windward areas.
- Some of Hawai'i's most recognized pasture managers run cattle in North Kohala.
- An existing dairy operation produces a significant portion of Hawai'i Island's fresh milk supply. Were it to receive new investment capital and sustained ditch water, the dairy could be a major player in Island food self-sufficiency over the long term.
- The Kohala Ditch system that could provide new farm opportunities for landowners and farmers willing to commit to the work and investment it takes to sustain such a system without government subsidies. Currently without State subsidies or significant agricultural water users in the region, the Kohala Ditch's future depends heavily on non-agricultural revenues from tour activities and hydropower generation which are insufficient to secure its future.



*Students participating in a Eat Local program in North Kohala (photo courtesy of Andrea Dean)*

- There is an active group of North Kohala residents who seem committed to being a model of community food self-sufficiency and who work hard to promote production and buying of local produce. This includes several youth programs aimed at training new farmers and connecting Kohala families to their potential as food producers.
- Strong community advocacy for shoreline protection is showing results through public open space acquisition and new coastal trail access to the shoreline areas for fishing and gathering of food. Similar efforts to preserve community access to mauka hunting opportunities also help to sustain the community's access to portions of its local food supply.

## 4.2 South Kohala

### Background

Farm lands in South Kohala are concentrated around Waimea and are some of the most productive food producing areas on Hawai'i Island. Taken together, the farms lots in Lālāmilo and Pu'ukapu account for about 445 acres of active truck crop production. Crops include Chinese and head cabbage, tomatoes, corn, pumpkins, celery, beets, strawberries, a wide variety of let-tuces, and other leaf crops. This produce ends up on store shelves and in restaurants throughout Hawai'i Island. Roughly 50% of the crop is exported to O'ahu and other neighbor Islands.

There are approximately 25 farmers currently in production in this region. The bulk of the Waimea produce is grown on lands that are held in fee simple. The Lālāmilo Farm Lots were initially State-owned lands that were sold off to farmers in the 1980's. Most parcels remain in active agriculture, yet several have migrated to other business operations, including a veterinary facility, horse boarding and training facility, and an ice cream manufacturer.

In the Pu'ukapu area, lands are either owned in fee simple or leased to Hawaiian homesteaders from the Department of Hawaiian Home Lands. Very few of the Hawaiian Homes parcels are in active agriculture, most are in pasture use. One bright light on DHHL lands is the green house tomato and vegetable producer WOW Farms who is continuing to expand their family operation.

There has been a slow decline of active farming in the Waimea area, driven in part by the lack of next generation farmers and the difficulty in producing commercial food crops in an environment of increasing costs and relatively inflexible market prices.

Parker Ranch is the largest land owner and agricultural business in the district. The ranch is run by the Parker Ranch Foundation Trust, which is dedicated to the support of several educational and medical beneficiaries in the region and to the betterment of the community as a whole. Parker Ranch runs its cattle operation primarily as an export, cow/calf business and retains little of its beef production in the state. Discussions are ongoing within Parker Ranch on ways that the company might increase its role in the local grass fed beef industry and ways to use selected lands for more intensive agricultural purposes.



*Organic lettuce grown in Lālāmilo by Chris Robb Farms and distributed statewide*

### Waimea Irrigation System

The Waimea Irrigation System is 15 miles long and is designed to deliver 400+ MG per year. The current service area for this system is approximately 700 acres, based on monthly service area payments in 2009, but not all of that land is in active production. Annual water use in 2009 was less than 300 million gallons. The source of the system is surface water collected in the upper elevations of the Kohala Mountains. Water

is collected from surface streams, sent by ditch and pipeline to several tanks and reservoirs in eastern Waimea, then piped through Pu'ukapu to the leeward side of Waimea in Lālāmilo. Water is sold to farmers a \$0.50/1000 gallons, plus a monthly service charge of \$5.50/acre per month. Water prices are set by the Board of Agriculture with fixed step ups and are

applied similarly to all State owned irrigation systems.

The State-run irrigation system requires a significant annual subsidy from the State General Fund to cover the actual cost of operations. All capital expenses associated with dams, intakes, reservoirs and pipe repairs or replacement are funded through legislative appropriations and are not covered by operating revenues. Like all other State-operated irrigation systems, there is a public subsidy applied to the collection and delivery of Waimea irrigation waters that is not factored into the actual price of locally grown produce.

Prolonged periods of drought, as the region has experienced in recent years, does have an impact on available water supply.

When reservoir levels drop, farmer's use of the system can be restricted. The Kohala Mountains provide surface water for several important surface water collection systems that support domestic, agricultural and pasture uses in the region. Watershed management efforts conducted by the Kohala Watershed

Partnership are important to help insure that these high level gravity fed water sources are sustainable on the long term.

**Table 7. South Kohala Crop Land Acres**

SOUTH KOHALA	468 (crop acres)
Flowers & Foliage	7
Special Crops	5
Truck Crops	457

## Crop Production Estimates

There is no published data source to determine the exact amount of food grown in the Waimea area. The most useful data set comes from the operations of the vacuum cooling plant which processes about 70% of the vegetables produced in the region. Conversations with several farmers in the area suggest that roughly 50% of the area's production is exported to Honolulu via the cooling plant and Young Brothers. The remaining volume is sold to Hawai'i Island retailers, restaurants, and institutions for local consumption. Cooling Plant Co-Op records indicate that roughly five million pounds of vegetables were cooled at the plant in 2010. This is down from 2007, when cooling demand topped seven million pounds.

## Production Challenges

Farmers in Lālāmilo and Pu'ukapu share many of the same constraints that other food farmers face. The price for fuel, fertilizer, and labor all continue to increase. The cost of packing boxes and shipping costs also continue to rise, eating away at basic profitability. Shipping costs, in particular, are a persistent market challenge to Waimea farmers as the cost of exporting are ultimately born by the farmer who has to compete on a price-per-pound basis with producers on O'ahu and elsewhere.

Food safety certification is a growing issue for many commercial farmers. There is increasing pressure from major retailers and institutional buyers to insure that the produce they sell or process has been food safety certified. Conforming to food safety certification standards does, however, provide opportunities for access to larger retail markets statewide and many of the Waimea farmers have stepped up to that opportunity.

Other constraints that may impact the production of food in Waimea include:

- Increase in land values that may prompt the sell-off and shut down of farm operations
- Climate trends that impact surface water supplies
- Competitive production of similar crops in the central plain of O'ahu
- The age of equipment at the vacuum cooling plant will require new investment in coming years
- Energy costs associated with operating vacuum cooling equipment continue to rise
- Persistent windy condition that limit field crop selection

## 4.2.1 South Kohala Contribution to Food Self-Sufficiency

The following are some of the drivers in South Kohala's contributions toward Food Self-Sufficiency

- Affordable irrigation water provided by the State-operated Waimea Irrigation System
- Flat, deep, arable soil in a cool weather environment that is conducive to leaf crop production
- A State-owned and cooperatively operated vacuum cooling plant to prepare crops for shipment
- A body of long term commercial farmers, many of which have been in operation for decades
- Parker Ranch Foundation Trust, the district's largest landowner, has a long standing commitment to local beef production and is committed to a leadership role in helping to shape the region's future
- Convenient access to Kawaihae Harbor and Keāhole Airport to support product export
- A watershed with existing stream diversions and a delivery system to provide gravity-fed water



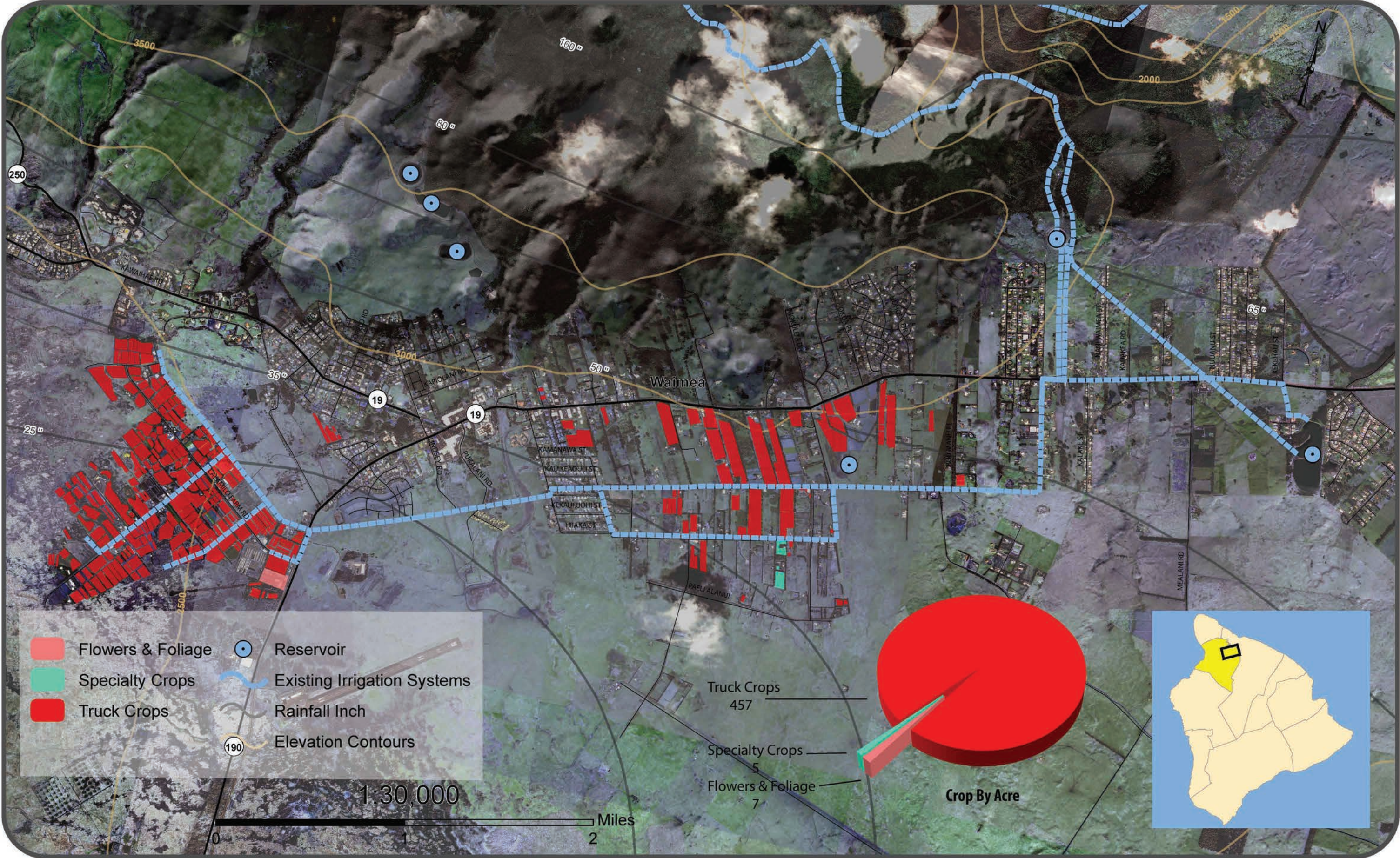


Figure 19. South Kohala Crop Land Summary

South Kohala Crop Land Summary





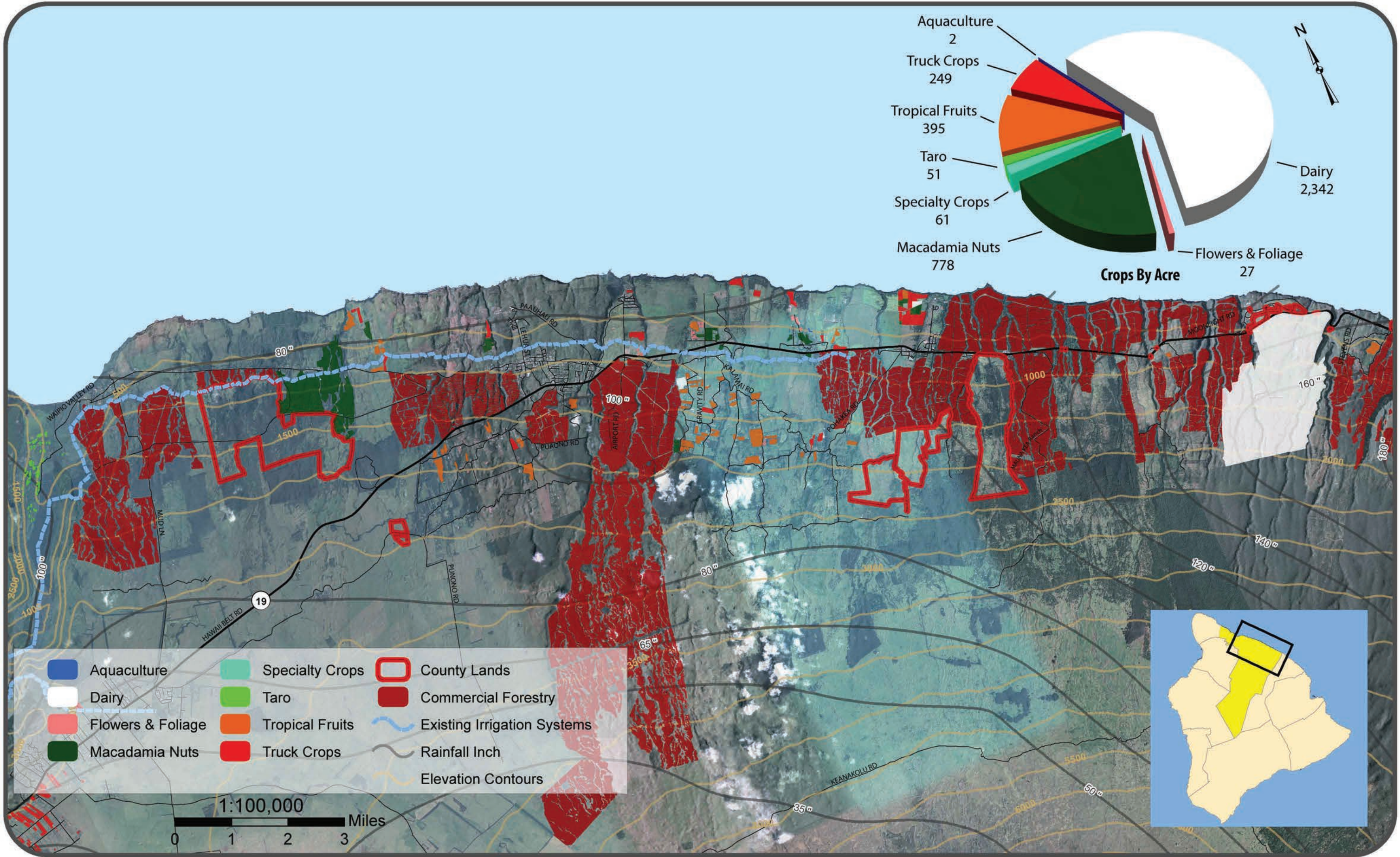


Figure 20. Hāmākua Crop Land Summary

# Hāmākua Crop Land Summary



## 4.3 Hāmākua

### Background

The Hāmākua District extends from 'O'okala to Waipi'o Valley. The area supported a significant pre-contact population centered on the deep, watered valleys of Waipi'o and Waimanu where taro was grown in abundance. In addition to traditional lo'i agriculture, Hawaiians grew other staples in gardens and scattered patches in areas surrounding settlements that stretched along the coastline on the upper plateau.

Hāmākua shares a long plantation history with much of Hawai'i Island's windward coast. Sugar was the predominant crop produced by multiple plantations from the 1870's to 1994. Hāmākua also has a long ranching tradition which flourished on lands above the cane fields in pastures on the upper slope of Mauna Kea. Cattle operations remain a major land user in the district today. Some of the earliest commercial plantings of macadamia nuts were in the Kapulena area in the 1960-70's with additional orchards planted in the 1990's.

**Table 8. Hāmākua Crop Land Acres**

Hāmākua	3905 (crop acres)
Aquaculture	2
Dairy	2342
Flowers & Foliage	27
Macadamia Nuts	778
Special Crops	61
Taro	51
Tropical Fruits	395
Truck Crops	249

The bankruptcy of Hāmākua Sugar Co. in 1992 was a point of major transformation within the district. The bulk of the HSC land—nearly 30,000 acres—was purchased in foreclosure by Kamehameha Schools and then leased primarily for pasture and forestry use. State lands in the district were leased to ranchers and to a cooperative of small farmers who have struggled to establish viable small farm operations along the coast where irrigation water was available. The State Department of Agriculture assumed operating responsibility for the Hāmākua Ditch, which had brought 30 to 40 MGD of surface water from multiple intakes at the back of Waipi'o Valley to serve approximately 5,500 acres of former cane land from Waipi'o to Pa'auilo. The remaining 20,000+ acres of the sugar land in the Hāmākua District were unirrigated, relying on seasonal rainfalls of 60 to 120 inches annually.

### Current Agricultural Activity

In 2012, the largest intensive agricultural crop in the Hāmākua region is eucalyptus forestry. There are over 17,300 acres in commercial forestry production in Hāmākua, most on lands leased from Kamehameha Schools and Parker Ranch by mainland-based forestry companies. The forests were initially planted to produce wood fiber to be shipped off-island for paper production on a 7 to 8 year rotation. Due to a combination of market conditions, changing leasehold ownership and export infrastructural issues, the eucalyptus plantings have yet to be harvested nearly 20 years after they were planted. The most likely market for the wood now appears to be biomass to fuel electrical energy generation. There may also be a market for selected larger logs which could be sold for higher economic uses including veneer and dimensional timber. The Hāmākua forest plantings are a key asset in the development of a forest industry on Hawai'i Island but it is still uncertain whether that opportunity will be realized.

**Macadamia nut orchards** take up 778 acres in Hāmākua and are managed by small landowners or lessees in 5 to 20 acre orchards. These orchards are generally un-irrigated and production varies based on regional rainfall and the degree to which market values provide sufficient incentives to small farmers to maintain and harvest their orchards. The market in 2012 has been strong and many of Hāmākua's small producers are actively managing their orchards.

**Waipi'o Valley** continues to be the center of Hawai'i Island's wetland taro production (Figure 21). There are several hundred acres of former taro lo'i in the valley of which only about 51 acres are in current production. Most of the taro land in the Valley is leased from Bishop Museum who owns the largest share of the valley floor. There are approximately 12 farmers in the valley actively producing taro and 3 to 5 main growers who produce most of the Valley's production. Several of these growers process their own taro into poi which is sold directly



**Waipio Valley is the center of Hawai'i Island's wetland taro production**



to local consumers along the highway, at farmers markets, or at local retail outlets.

The market for taro far outpaces supply, both on Hawai'i Island and statewide. In Waipi'o, the issues impacting production include damage from the invasive apple snail, a lack of consistent labor, and periodic flooding. For the farmers who grow taro, the motivations for continuing to farm go far beyond simple market value of the crop. Taro is an iconic Hawaiian staple that is tied to the roots of the culture and the genealogy of its people. Several of the farms in the Valley are used frequently for educational purposes to immerse students and visitors in the power and mo'olelo of early Hawai'i and of Waipi'o Valley, in particular.

**Cattle ranching** is the largest user of agricultural lands in the Hāmākua district. Approximately 24% of the island's pasture lands are in Hāmākua, running from the coastal cliffs to over 6,000 feet in elevation. Roughly 4,500 acres below the Hāmākua Ditch are in pasture use and is some of the best pasture lands on the Island. The availability of stock and irrigation water from the ditch offers additional opportunities to improve pasture carrying capacity in this area. The state-owned and privately operated Hawai'i Beef Producers (HBP) slaughter house in Pa'auilo is one of only two certified slaughter houses on the Island. The HBP slaughter facilities, and lands surrounding it, are a key part of the infrastructure needed to increase the supply of local grass-fed beef to markets statewide.

In 2011, Big Island Beef Producers processed 4,200 head of cattle from local ranchers<sup>46</sup> and have plans to increase that number substantially. Key to this expansion is the construction of rendering facilities to process cattle waste. The State has agreed to fund this effort through the County of Hawai'i Office of Research and Development. Other keys to expanding the market for local grass-fed beef in Hāmākua is the potential to use ditch water to irrigate pasture lands in the vicinity of the Pa'auilo slaughter house to produce higher quality pastures on which to graze cattle prior to harvest.

One of last two dairy operations in the State is located at the southern end of the Hāmākua District. Big Island Dairy leases about 2,000 acres from the State of Hawai'i and runs nearly 1,000 head of dairy cows. All of this milk is sold to Meadow Gold for packaging and processing. Big Island Dairy has embarked on an aggressive effort to grow forage crops on both lands in 'O'okala and in Onomea, South Hilo. Forage production has helped to reduce feed costs for the dairy operation and added

roughly 100 acres of intensive farming to the Hilo to Hāmākua coastline.

**Truck farming** in Hāmākua accounts for roughly 250 acres of land use in Hāmākua. The Hāmākua Farmers Cooperative was set up in the mid-1990's to enable former plantation workers to gain access to State lands below the Hāmākua Ditch. Over the years, Co-op members experienced a range of difficulties establishing new farm operations. Major repairs to the ditch and damage from earthquakes interrupted water flows for long periods of time, ending the efforts of many farmers. The ditch is now back in operation and the Co-op (with its 60 members) is working to settle old issues with the State of Hawai'i and is moving forward with plans to expand farm production on several State-leased farm areas. There are also a number of small, independent farms in the district that produce vegetables and fruit for the local market, including an emerging Community Supported Agriculture (CSA) farm in the Kalōpā area.

There are several small hydroponic farms in Hāmākua using water from the ditch to produce leaf crops and fish, primarily perch. Production is currently small, with potential for additional growth. There are also several foliage and flower operation and scattered plantings of tropical fruit orchards. Agricultural landowners in the homestead areas of Pa'auilo, Kalōpā and Āhualoa operate a range of small agricultural operations including a goat dairy, several apiaries, in addition to tea and coffee plantings that all contribute to the overall agricultural production of the region.

## County Lands in Hāmākua

In the early 1990's, the County of Hawai'i acquired 4,400 acres in Hāmākua in payment of roll-back tax liabilities from Hāmākua Sugar Company. Initially, these lands were to be sold to cover the outstanding tax. Public, political, and market issues

conspired to keep these lands in County hands and they remained idle for nearly 20 years. The County has now embarked on a farm and ranch lease program to put these lands into more productive use. All of the County lands are in areas where there is no agricultural water sources available. The ability of these County lands to contribute to food or general agricultural production is yet to be determined.

In any event, allowing the County's lands to be used, as opposed to standing idle, may result in more active land management and some measure of new farm and ranch activity on these public properties.

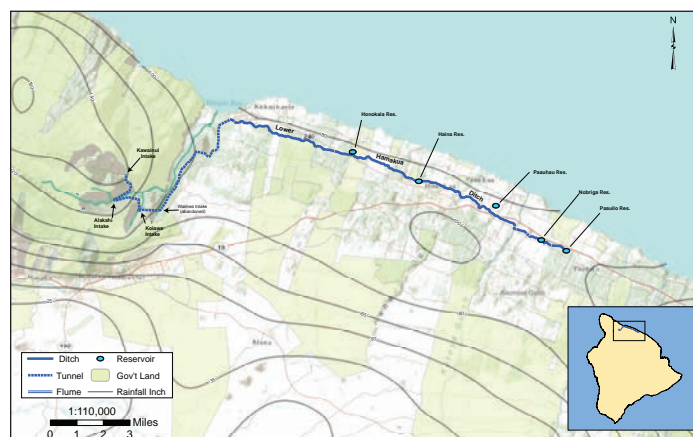


Figure 20: The Lower Hāmākua Ditch

46 Personal communication, Jill Mattos, Hawai'i Beef Producers



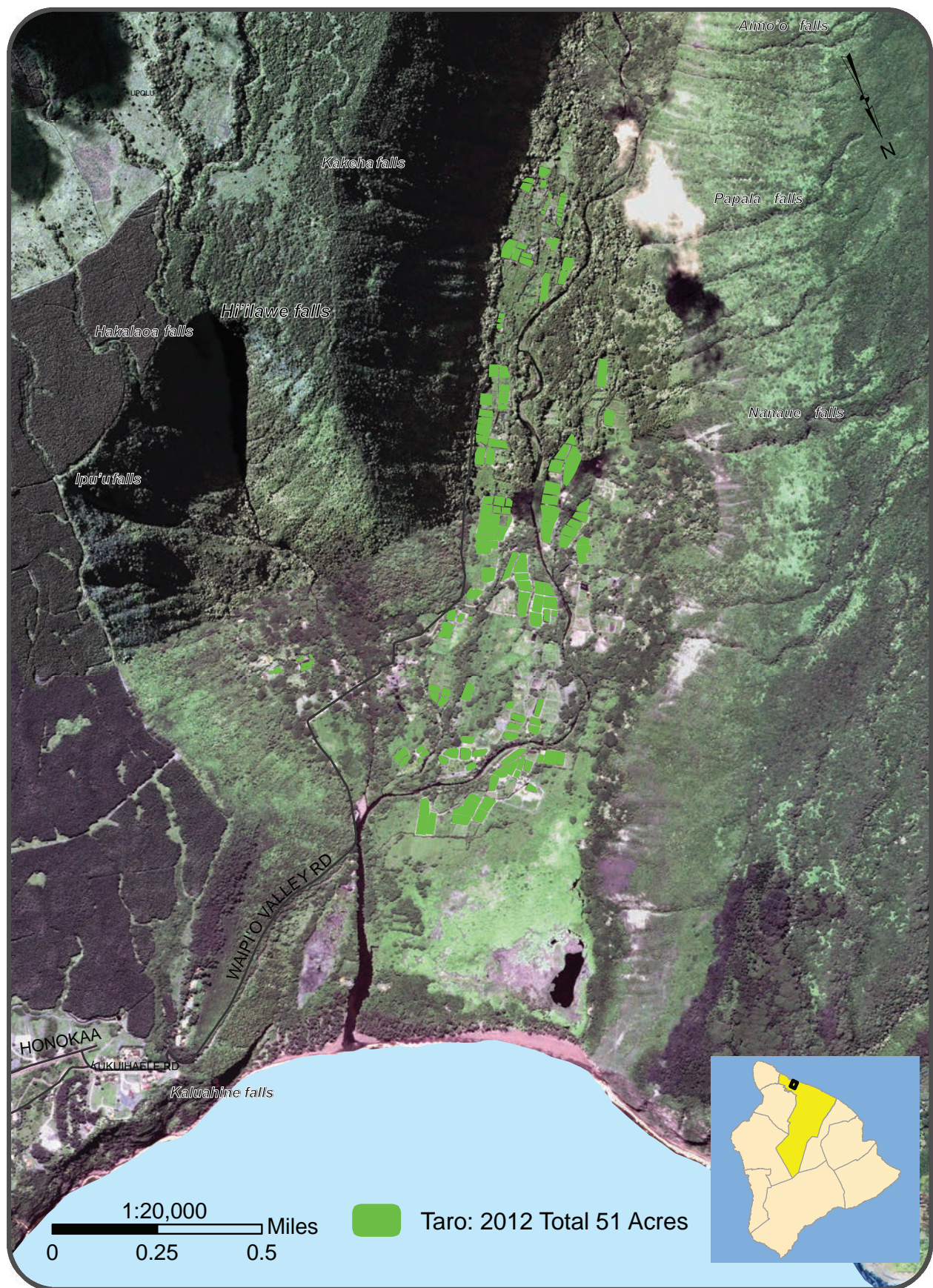


Figure 21. Waipio Taro Lands in Production 2010



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## Irrigation Water

The Hāmākua District is served by the largest surface irrigation system on the Island of Hawai'i. The Hāmākua ditch was opened in 1910 and runs from four main intakes at the back of Waipi'o Valley through 23.5 miles of tunnel, ditch and pipeline, ending just north of Pa'auilo town. The system was designed to serve several plantations which used the water primarily to drive mill operations, including washing, flume transportation, steam production, and domestic consumption. In later years, water was utilized for irrigation purposes for about 5,000 acres in the lowest elevations, the driest lands along the northern Hāmākua Coast.

After the plantation shut down, agreements were reached to set an initial cap on water taken from Waipi'o Valley to 17 MGD, leaving significant portions of the flow to remain in the stream to support other economic and biological uses. In 2010, ditch operations withdrew roughly 10 MGD from the

valley with consumption for farming and ranch purposes running below 1.0 MGD<sup>47</sup>. The ditch is highly subsidized by State taxpayers and will remain so until there is significant growth in farm operations in the region, thereby driving more active water demand. Another likely source of water demand for Hāmākua ditch water is the irrigation of pasture lands to provide dependable forage for grass-fed cattle operations centered around the Pa'auilo slaughter house.

The easement underlying the Hāmākua Ditch does not completely cover the full extent of the infrastructure. The State is in the process of securing the legal tenure needed to manage the ditch over the long term. Users of ditch water include both formal, metered consumers, and others who have long-standing, unofficial use of the water. Insuring that all users of the ditch pay for the cost of its operation is an important part of guaranteeing the long term viability of the system.

### 4.3.1 Hāmākua's Contribution to Food Self-sufficiency

The following are some key elements that drive the Hāmākua district's contribution to food self-sufficiency:

- Waipi'o Valley continues to be the best place on the Island to produce quality wetland taro. Land is currently fallow and could be put into production to increase the volume of taro and poi available to Island residents.
- The State's commitment to operate the Lower Hāmākua Ditch, despite substantial annual subsidies and capital improvement expenses, represents an opportunity for new and existing farmers to prove the viability of the region for sustained food production.
- Small farmer training programs are underway to build the capacity within the Hāmākua community to take better advantage of the land and water resources the district has to offer
- Kamehameha Schools, the district's largest landowner, is taking a more active role in encouraging new pasture management approaches in support of grass-fed beef, and in promoting the use of its land for increased food production.
- The potential of Hawai'i Beef Producers to stabilize and build a sustainable slaughter capacity at its Pa'auilo plant is an important step in building a grass-fed beef industry statewide.
- The availability of Hāmākua ditch water to irrigate high productivity pastures in the area could give the Hāmākua district a particularly important role to play in the future of the local grass-fed beef industry.
- The availability of County lands in Hāmākua for agricultural leasing may offer some new opportunities for new farm and ranch operations.
- The Mauna Kea and Kohala Watersheds are important contributors to the rainfall patterns and water collection systems that support both irrigated and un-irrigated agriculture in the region
- Small agricultural lots in the upper homesteads like Kalōpā, Pa'auilo, and Āhualoa offer the potential for new, small-scale farming innovation and local food production.
- The eventual harvest of eucalyptus forests in the district may help to disconnect energy production from oil imports and provide a more robust agricultural land use climate within the region.

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<sup>47</sup> Personal communication, Steven Dias, Hamakua ditch supervisor



## 4.4 North and South Hilo

### Background

The districts of North and South Hilo extend from the urban center of Hilo to 'O'okala. It is one of the most agriculturally productive regions in the County and contains key infrastructure that supports agricultural production island-wide. The lands along the coast receive 100 to 180 inches of rain annually and have supported un-irrigated sugar cultivation for over a century. The land experiences less wind, has less slope and receives slightly more southern sun exposure than Hāmākua. As a result, it is a patchwork of roughly 8,800 acres of diversified agriculture that produces a significant amount of Hawai'i Island's food supply.

Hilo's harbor and international airport are points of entry and export for agricultural materials and produce. The University of Hawai'i at Hilo and Hawai'i Community College are educational resources for young farmers and business people who may drive the future of the agricultural industry. The University of Hawai'i College of Tropical Agriculture and Human Resources (CTAHR) is based in South Hilo with extension service centers around the Island. Federal programs like the US Department of Agriculture (USDA), the US Forest Service, the Natural Resource Conservation Service (NRCS) and others, all have personnel and facilities in the South Hilo area.

The agricultural history of the Hilo coast tracks most sugar producing regions in the State. Native subsistence farming was replaced by modern plantation agriculture beginning in the 1860's. Small, independent mills initially emerged and eventually consolidated into larger operations. Towns, roads, railway, and water systems were created to serve plantation communities and their footprints are still visible in current settlement patterns. One of the unique elements of Hilo's sugar history

is the predominance of small independent cane growers that cultivated their own sugar cane on private and government lands and then sold their crop to both private and cooperative mills for processing. In the 1950's, there were over 600 small, independent cane growers producing cane for Hilo Coast Processing in Pepe'ekeo. For this reason, the tradition of small farming along the Hilo coast has deep roots. Though few of today's active farmers are descendants of the independent growers, the settlement pattern that underlies the region continues to support a wide variety of small-scale farming.



*Lychee fruit*

### Crop Production

In 2012, North and South Hilo have 8,800 acres in crop production plus 12,000 acres in eucalyptus forestry and another 44,000 acres in pasture (much of which is above the forest along the Mānā road). In general, there are three main types of food producing agriculture on the Hilo shoreline: fruit and nut orchards, diversified farming on small parcels, and nomadic production that moves from place to place annually.

The largest single crop in the region is macadamia nuts (4,300 acres) which were largely planted by C. Brewer in the early 1980's as part of their Mauna Loa Macadamia operation. These fields have since been subdivided and sold in 10 to 40 acre lots; many farms now have attractive homes embedded in the orchards. The macadamia market has been variable in recent years and many of the small producers on the coast have had difficulty finding a market for their nuts. In 2010, the market began to improve and in 2012, there is a robust market for nuts which has invigorated orchard management island-wide.

Beginning in the early 1990's, tropical fruit orchards were developed on the coast on former cane lands that were largely purchased from C. Brewer as it sold its holdings from 1990 to 2004. These orchards now contain roughly 1,300 acres of tropical fruits such as rambutan, lychee, longan, and star fruit. The bulk of the commercial tropical fruit crop is sent off-Island and sold as a boutique product around the world. Rambutan and longan require treatment at the irradiation plant in Puna prior to Mainland export. Lychee production is primarily sold within the state. Some portion of all these tropical fruits end up in the stores and farmers markets on Hawai'i Island and on the doorsteps



*2009 image from DigitalGlobe WorldView-2 satellite imagery of agricultural land use in the Honomu to Hakalau area of South Hilo (USDA-NRCS/USGS)*



***Truck farming in Pepe'ekeo, South Hilo***

of neighbors and friends during harvest season.

Truck crops cover over 2,200 acres on the Hilo coast, making it one of the most productive local food regions on the Island. Farmers produce a range of vegetables, berries, sweet potato,

taro and other crops in open field and green house settings. A prominent farm on the coast is Hāmākua Springs, which owns 500 acres near Pepe'ekeo and is one of the state's largest producers of tomatoes, banana and a range of green house vegetables. Hāmākua Springs also leases portions of its land to other small farmers and provides some marketing services for these and other growers along the coast.

Most small farming is done on lands leased from private land-owners. Kamehameha Schools (KS) is one of the largest lessors of farm land in the region to over 20 farmers. KS farmers have one to five year leases with some certainty that, if they operate responsibly, they will be able to hold on to their farms and operate longer term. KS is also exploring ways to include produce from its farmers into school lunch programs at their Keaau campus.



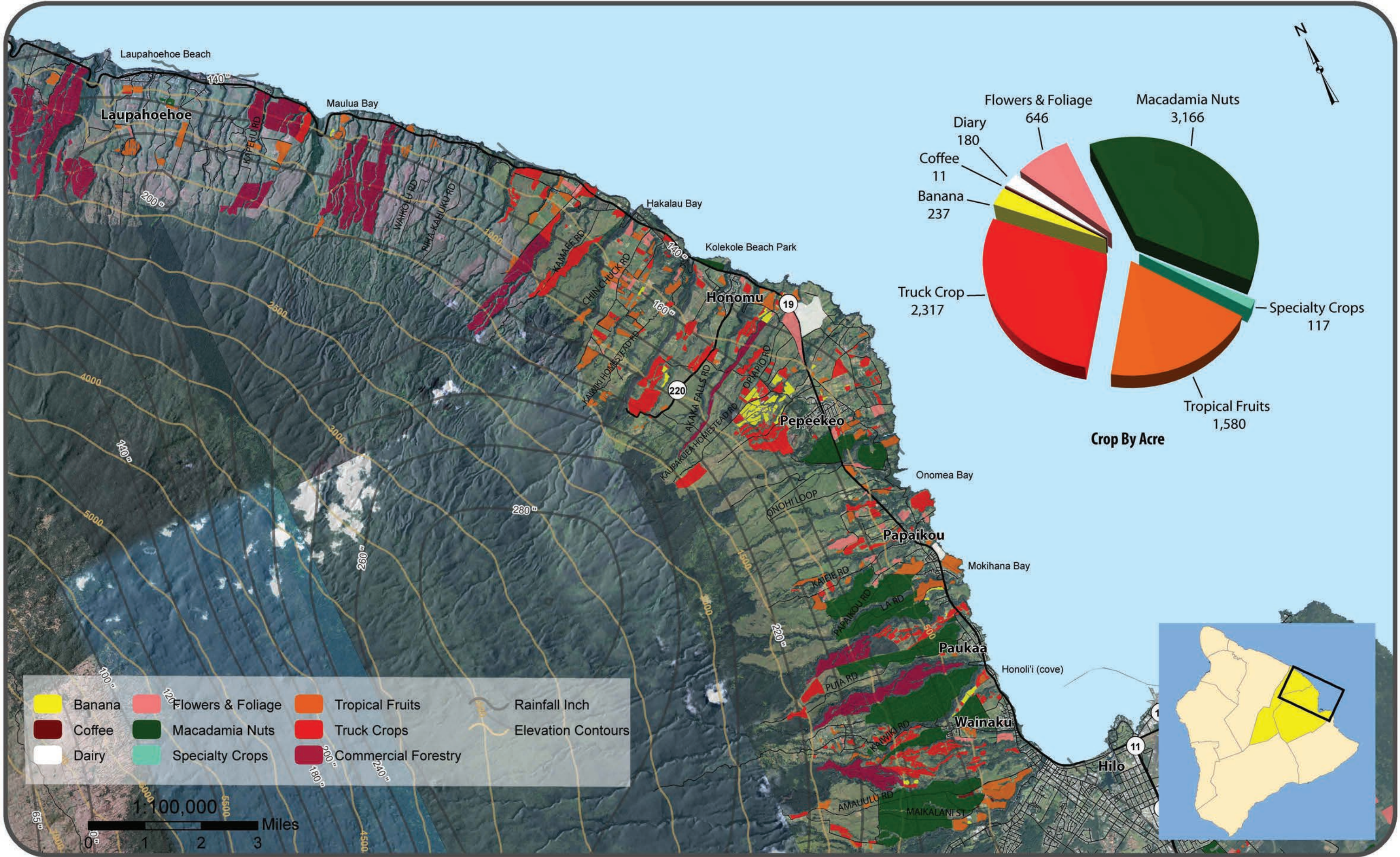


Figure 23. Hilo, North and South Crop Land Summary

# Hilo, North and South Crop Land Summary





Many Hilo farmers do not have a similar sense of leasehold security, because many landowners are not certain about the future of their holdings. As a result, lease terms are shorter and farmers are not able to set up a truly diversified farm operation. This has a negative impact on the sustainability of food production on the coast.

One of the largest food crops on the Hilo coast is Okinawan sweet potatoes with over 500 acres planted at any given time. This crop is grown by Chinese and other Asian farmers who sell to large distributors. The crop is treated at the irradiator plant in Kea'au to kill a weevil that infests the corms and then shipped to markets on the West Coast. In 2010, 11.8 million pounds of sweet potato were irradiated prior to export. Sweet potato production is nomadic. Farmers do not return to the same

**Table 9. North Hilo Crop Land Acres**

NORTH HILO	820 (Total acres)
Banana	3
Flowers & Foliage	30
Macadamia Nuts	20
Special Crops	22
Tropical Fruits	335
Truck Crops	410

ground year after year. Instead, they seek "virgin soil" that is free from nematodes that feed on unharvested corms left in the ground from prior harvests. As a result, hundreds of new acres are needed annually to support this export crop. Sweet potato farmers are like root ginger growers—also nomadic consumers of farm land in the 1980's and early 1990's. The agricultural practice of short term, nomadic plantings is not a good land stewardship practice and does not contribute significant food production to local supplies. Production far exceeds local consumption of the purple Okinawan variety, and there is no effort to produce other potato varieties.

Flower and foliage industries have a small presence on the Hilo coast. There are several nursery operations that export foliage and several hundred acres of foliage cane stock in open-field plantings. Specialty crops, such as hearts of palm, are grown on several farms and sold to high-end restaurant markets across the County. There is a mushroom producer in Laupahoehoe who



**Sweet potato crop in upper Kaieie, South Hilo**

produces an array of fresh mushrooms for local consumption and export. Small plantings of cacao and coffee are emerging as well. In recent years, portions of the flat, low elevation land in Onomea have produced large plantings of both food and feed corn. Currently, these fields produce feed corn for Big Island Dairy in 'O'okala.

Kamehameha Schools planted portions of their Hilo holdings in commercial eucalyptus forestry during the mid-1990's. This added to some earlier plantings by C. Brewer from the 1970's and 1980's when they were exploring forestry options for some of their cane lands under a grant from the US Department of Energy. Altogether, there are over 12,600 acres in eucalyptus forestry on the Hilo coast. The future of these plantings is not certain; though it is likely the trees will be harvested primarily for their value as fuel to drive electrical production. Larger trees may have a future as dimensional timber or veneer, the economic viability of that market is yet unknown.

**Table 10. South Hilo Crop Land Acres**

SOUTH HILO	7434 (Total Acres)
Banana	234
Coffee	11
Dairy	180
Flowers & Foliage	616
Macadamia Nuts	3146
Special Crops	95
Tropical Fruits	1245
Truck Crops	1907

#### 4.4.1 North and South Hilo's contribution to Food Self-sufficiency

- The Hilo coast has deep arable soils, minimal adverse wind conditions, gentle slopes, and ample rainfall to support the growth of many types of food crops.
- There is a mix of small, medium, and large agricultural properties on the coast that enable access to land by multiple landowners and lessees.
- The region is close to Hilo's harbor and airport, facilitating export and access to agricultural materials and supplies.
- Over 50,000 residents in the Hilo area provide an accessible market for food products both through commercial distribution networks and less formal farmers' markets.
- Former plantation and immigrant families who are familiar with agricultural operations make up a significant portion of the district's population and can contribute to its agricultural future.
- Many new residents have invested in orchard and diversified operations, creating a mix of farmers and landowners with a shared interest in agricultural production
- Land owners, like Kamehameha Schools and large farm operations like Hāmākua Springs, support smaller farmers in land availability and product marketing.



## ***70 - Baseline Study for Food Self-Sufficiency in Hawai'i County***

- Springs and stream water sources along the coast provide supplemental irrigation and small-scale energy production to support agricultural operations.
- The communities along the Coast have long agricultural traditions and seek to retain their agricultural identities and support farm activities.
- For the last 30 years, there has been very little pressure for urban land use changes along the Coast.
- South Hilo contains a high concentration of agricultural support services including the University of Hawai'i and Hawai'i Community College that provide agricultural training programs; the UH Extension Service providing outreach to farmers; the new USDA Research Center to support front edge research and problem solving; Kūlana Foods for animal slaughter and a number of agricultural distribution companies.

## 4.5 Puna

### Background

The Puna district contains most of the State's papaya industry, much of its macadamia and tropical fruit production, and a large portion of its foliage and flower production. It is a district with little soil and no regional irrigation system. Puna's agricultural success depends on ample rainfall, relatively inexpensive land costs and a diversified agricultural workforce that can live affordably on water catchment and non-standard subdivisions. There is also a growing portion of Puna residents who are committed to living off the lands they inhabit and practicing sustainable, organic practices to feed themselves and their neighbors.

One of the first commercial crops in the region was coffee, grown in the Kurtistown and Mountain View area beginning in the late 1800's. Coffee was soon replaced by sugar cane. Approximately 18,000 acres in the district, from Glenwood to 'Opihikao, were devoted to sugar production from the 1880's until 1984, when Puna Sugar Company closed. The macadamia

**Table 11. Puna Crop Land Acres**

PUNA	8880
Aquaculture	3
Banana	200
Coffee	27
Energy	321
Flowers & Foliage	775
Macadamia Nuts	3783
Papaya	2709
Special Crops	4
Tropical Fruits	762
Truck Crops	298

nut industry was established in the 1970's and has been relatively self sustaining since then. Puna has a long tradition of tropical flower production. This began as small family operations with anthuriums under backyard and forest canopies of hapu'u fern. Today, there are hundreds of acres of shade cloth greenhouses producing anthuriums, orchids,

and other tropical flowers.

The foliage industry flourished in Puna from 1980 to 2000, and has declined in recent years. Potted house plants have been cultivated and shipped to local and mainland markets



**The Puna District contains most of the State's papaya industry.**

from large green house operations around the region. Landscape plants, palm trees, and other foliage crops nevertheless remain a significant part of Puna's agricultural palette.

In the 1990's, several growers began planting tropical fruits like rambutan, lychee, star fruit, and longan. This region is also home to the largest grafted tree nursery in the State, providing quality trees to commercial and backyard farmers. Kea'au was also the State's largest banana producer and several smaller growers are continuing that tradition. Other specialty crops like noni, tea, coffee, and cacao emerge and re-emerge on small parcels throughout the district.



## Current Crop Summaries

Macadamia nut orchards cover about 3,780 acres in Puna. Mauna Loa Macadamia provides a major processing facility for its own nuts and periodically purchases nuts from local and imported sources. Its processing plant takes macadamia nuts from the shell to packaged candies and sold in gift shops to visitors and locals residents. Smaller macadamia plantings are scattered in the region on individual parcels with produc-



**Macadamia nut orchard**

tion sold to one of several nut processors on the Island. The papaya industry is based in the Kea'au area with three papaya processing facilities that treat fruit for export markets around the Pacific Rim. Production in 2011 was 11 million pounds. Approximately 65% was exported; the remaining 35% was sold locally. Fruit flies in Hawai'i necessitate treatment of all fruit prior to export to the U.S. mainland: papaya is treated with hot water vapor to kill fruit fly larvae. Another treatment alternative is irradiation, generated from electricity. The Hawai'i Pride treatment facility in Kea'au processes a portion of the papaya crop as well as much of the tropical fruit and sweet potato crop for mainland export.

Papayas are grown primarily by independent farmers, most of whom work with specific processors. There are also farmers who independently grow and sell papaya. It is a three to four year crop that is rotated through an inventory of farmable acres so that each field can rest for several years between plantings. As a result, the crop has a footprint that is substantially larger than the amount of fruit that is planted or harvested at any given time. Of the 6,800 acres identified in Figure 24 and Figure 25 as papaya lands in the Puna district, about 2,700 are planted in papaya at any one time with the balance lying fallow for several years at a time.

Approximately two-thirds of the Island's papaya production is grown in lower Puna, from Kalapana to Wa'awa'a. The primary landowners in this area, who lease to papaya farmers, include the Lyman Estate, Kamehameha Schools, and the State of Hawai'i. The remaining third of the Island's production is located in the Kea'au area, largely on lands owned by W.H. Shipman Estate. This split of production areas helps to stabilize production by spreading the crop over several different weather patterns.

Papaya producers have confronted an array of agricultural and market issues over the years. An infestation of the ring spot virus threatened to decimate the industry in the 1990's. A genetic modification to the Solo papaya DNA led to the virus-resistant Rainbow variety, which has become a major commercial brand. This genetic modification helped to save

the industry, but also cost it access to important markets, such as Japan, who have substantial market restrictions on genetically-modified crops. In 2012, Japan announced that it will begin accepting genetically-modified papaya. It will take several years for the industry to rebuild this market. Local and national resistance to GMO agriculture is an ongoing issue for the papaya industry, as is the rising cost of fertilizer and other crop inputs.

The flower and foliage industries have an important role to play in the Puna region. There are 775 acres of foliage and flower production in the Puna area. This includes both greenhouse and open field agriculture. Orchids, anthuriums, and potted plants are most often grown intensively under shade cloth or in greenhouses while tropical flowers, foliage cane stock, palms and other landscape species are grown in open fields. The State operates two agricultural parks which are primarily used for this kind of agriculture, one near Pahoa and the other, just outside of Puna in Pana'e'wa. Kapoho and



**Flowers and foliage crops can be successful on small parcels of land less than an acre in size**

Kurtistown also host concentrations of foliage and flower operations on private lands. This form of agriculture can be done on small parcels of less than an acre in size, making it well adapted to Puna's extensive agricultural subdivisions. Puna has a mix of both large and small-scale opera-

tions, and there are networks of producers that work collaboratively to move product from farm to market. The proximity of the harbor and airport facilities in Hilo is essential to the ability of this sector of agriculture to sustain a presence in the global export market.

Tropical fruit is a relatively new piece of Puna's agricultural system. Rambutan, longon, lychee, and star fruit are just a few of the many species that are grown on about 750 acres across the region. Any fruit that is exported to the U.S. mainland is treated for fruit flies at the Kea'au irradiator plant. In 2010, this facility treated 316,000 pounds of rambutan, 247,000 pounds of longan and 7,600 pounds of lychee<sup>48</sup>. Exports to Canada do not require this treatment, so these additional exports are not reflected in these figures. Rambutan is remains a seasonal crop while new cultural practices for longan can result in year-round production. The lychee crop is seasonal and is consumed almost exclusively within the State.

Plant It Hawai'i Nursery in Kurtistown has been a leader in providing grafted fruit trees for the statewide market, producing between 60,000 to 90,000 trees annually<sup>49</sup>. A growing

<sup>48</sup> Personal communications, Eric Weiner, CalAvo

<sup>49</sup> Personal communications, Susan Hamilton, Plant It Hawaii



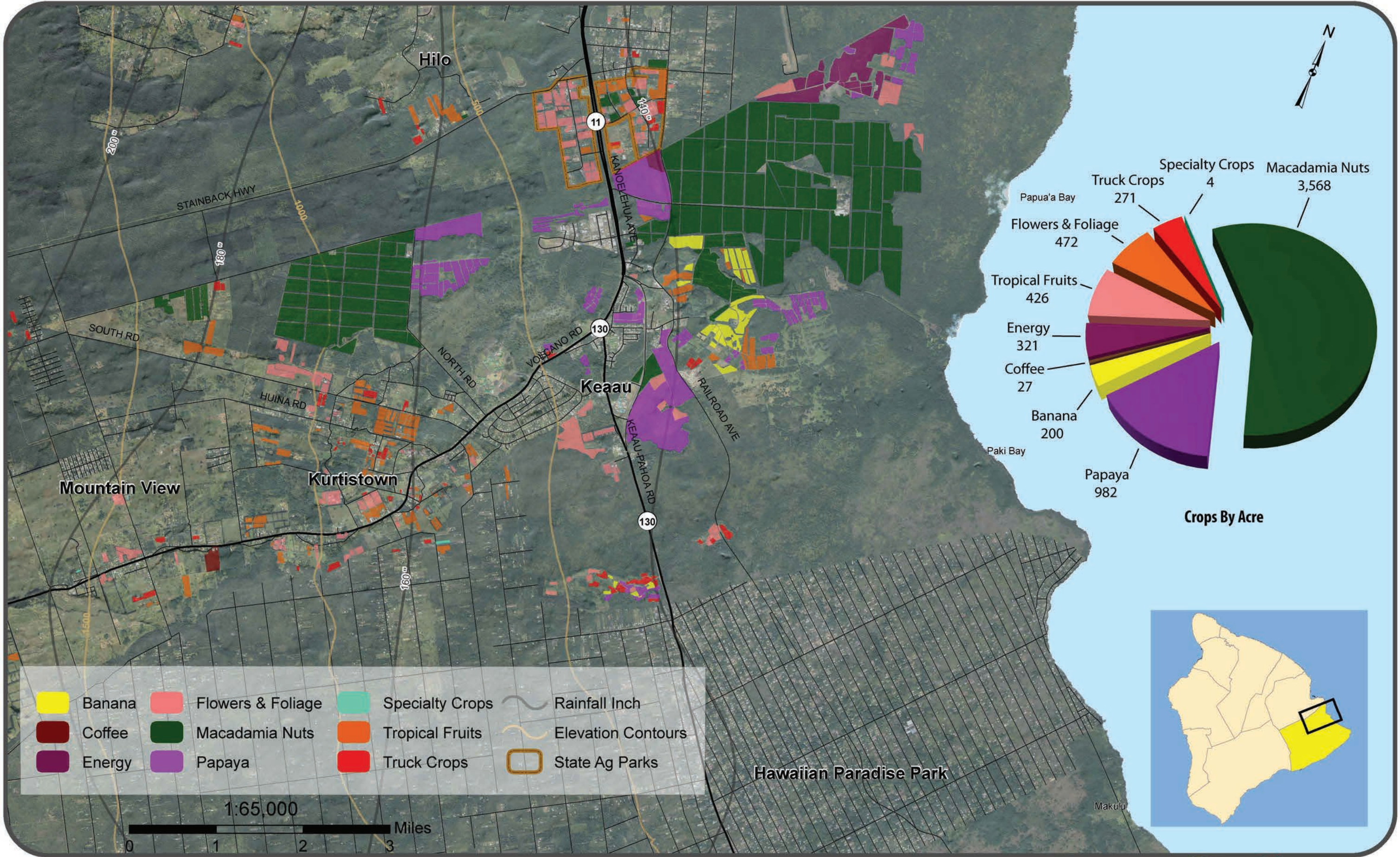


Figure 24. Upper Puna Crop Land Summary

Upper Puna Crop Land Summary



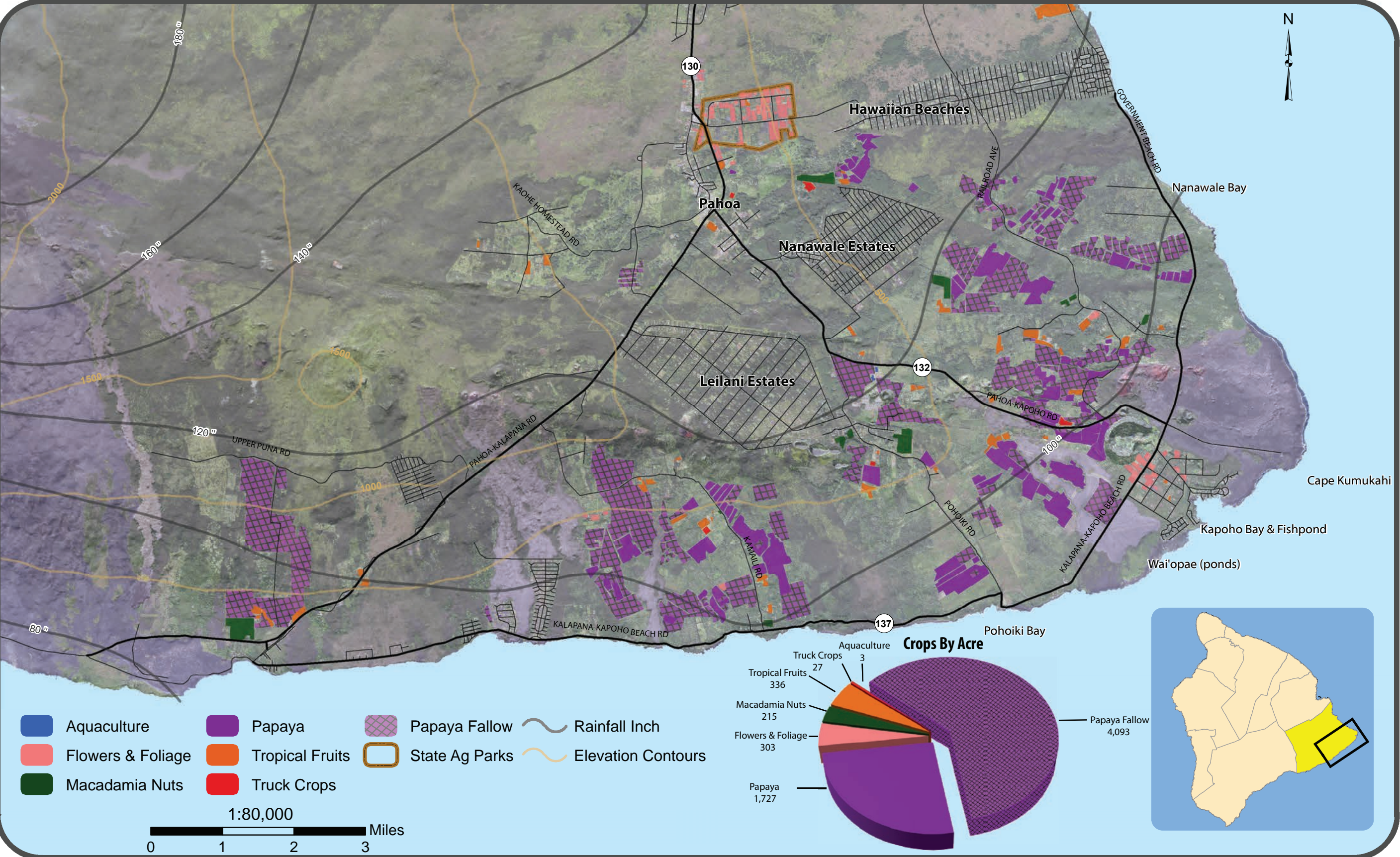


Figure 25. Lower Puna Crop Land Summary

# Lower Puna Crop Land Summary



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***A growing portion of the tropical fruit tree market is in the retailing of fruit trees to individual landowners***

portion of the tropical fruit tree market is in the retailing of fruit trees to individual landowners who plant small stands of fruit trees for home and neighborhood use. This decentralized form of farming rarely shows up on any tally of food production and is a growing segment of the Island's local food supply. nd is a growing segment of the Island's local food supply.

Puna supports 200 acres of banana production, a small amount of coffee, and about 300 acres of truck crops. Small farmers on W.H. Shipman lands, in the Volcano area, and scattered elsewhere throughout the district, produce dry land taro, potatoes, pineapples, tomatoes, strawberries, and an assortment of vegetables that are primarily sold to the local market through retailers and farmers markets. There is also a growing amount of small backyard gardening and subsistence agriculture done in the vast agricultural subdivisions where residents have ample land to contribute to their own food self-sufficiency.

A private venture is growing jatropha on 300 acres near Kea'au. The jatropha bean is high in oil content and can be processed into a biofuel. If yields are sufficient and harvesting practices can be perfected, this new crop could be expanded to aid in the State's drive towards energy self-sufficiency. There are also several aqua cultural ventures in the district, including one that produces oyster fry for export to commercial producers around the country.

Farms in Upper Puna, from Mountain View to Volcano are scattered broadly. There is a cluster of small farms at the back of Wright Road in Volcano Village that has a long history of truck farm and flower production. The number of active farms in the area has fallen in recent years but there are several small farms producing red potatoes and other truck crops that are not grown elsewhere on the island. Proximity to the Kilauea Volcano and its volcanic emissions has had a negative impact on some crops in recent years but there is significant potential in this upper elevation micro-climate to produce food varieties that don't grow well elsewhere.

Like all agricultural areas in the State, Puna is susceptible to invasive species and new diseases that can seriously undercut agricultural production. The Red Fire Ant has negatively impacted the fruit and tropical flower industries while fruit flies and viruses such as the Ring Spot virus, cause damage to the papaya crop. An array of other diseases challenges growers to stay just steps ahead of major crop loss.

### **Puna's Small Agricultural Lots**

Underlying most of Puna's agriculture is a land settlement pattern that was shaped by the subdivision of both public and private lands into some 40,000 parcels from ½ to 50 acres in size. Although this rather unplanned parcelization presents challenges for modern land use and infrastructure development in the region, it also offers a rich opportunity for small landowners to participate in farm activities and to flourish or fail without seriously impacting the vitality of the diversified production of the region as a whole.

Figure 26 shows a portion of the Puna district and the parcels three acres and below which currently receive a beneficial agricultural use assessment value from the County of Hawai'i Real Property Tax Division. The large, sub-standard subdivisions, including Hawaiian Paradise Park, Hawaiian Acres, Fern Forest and others, are of sufficient size to support small agricultural endeavors both for subsistence and small scale commercial farm activity. There is no way to be certain that all of the properties highlighted in this figure are currently making a meaningful contribution of the Island's food self-sufficiency, although the potential for small-lot, decentralized agricultural productivity is apparent.

### 4.5.1 Puna's contributions to food self-sufficiency

- Production of the majority of the papaya consumed in the state, occurs in Puna
- Tropical fruit production generates a variety of new products in the local market place
- Small truck farms produce a range of vegetable and starch crops for local consumption
- Production of flowers and landscape materials help to support Hawai'i's global tropical image and are used in landscaping of resort properties island wide.
- Papaya and Tropical Fruit treatment facilities in the Ke'eau area support the continuation of fruit production in the region.
- Extensive agricultural subdivisions in Puna provide small landowners with an opportunity to grow their own food and to explore agricultural production at a scale that a family can support.
- Land and housing prices are more affordable in Puna than anywhere else in the State. This is a competitive advantage for farming and helps to secure a work force than can live more affordably than they can in other areas.
- Subsistence farming is a way of life for some Puna residents. There are networks for small farmers working to manifest sustainable, decentralized and often organic approaches to local food production.
- W.H. Shipman Estate is a large landowner with a long term view for much of their agricultural land. Shipman's commitment to the future of Hawai'i Island agriculture helps to insure that some of the most farmable land in the Puna district will remain in active production in the future.
- Industrially zoned lands in the Shipman Industrial Park offers opportunities of value added processing and provides a home for many support services that farmers in the region require.
- Geothermal energy developed in the Puna region has the potential of slowing the rise in Island energy prices and could spawn new agricultural processing industries that use excess heat from the energy production process. Fertilizer and liquid fuels production for local use are two possible spin-off industries.
- Plentiful rainfall and good drainage in the region supports a range of food production without having to absorb the added cost of irrigation.



## 4.6 Ka'ū

### Background

Agriculture in the district of Ka'ū is concentrated in the area around Pahala and Wood Valley, with a scattering of outlying orchards and small farms throughout the region. Ka'ū is best known for its macadamia nut orchards and for its emerging coffee crop. Residents also make active use of the region's vast, undeveloped coastline for fishing and gathering. Hunting in the forests of Ka'ū also provides an important portion of the community's food supply.

Pahala is the location of the last sugar mill that operated in Ka'ū until 1993 and is the site of major macadamia nut orchard plantings from the early 1980's. Most of the extensive macadamia nut planting is managed by Mauna Loa Partnership (MLP). There are two private irrigation wells on MLP lands that provide intermittent irrigation to the trees to insure production during periods of drought. There is a total of 5,000 acres of macadamia nuts in the Ka'ū region.

Following the closure of Ka'ū Agribusiness, former sugar workers and their families pioneered an emerging coffee industry based in the Pahala area. Workers were offered short term leases to undivided lands in 1992 on which most planted coffee. This group of 40 farmers has held on to their coffee dreams for nearly 20 years, much of that time with little or no certainty of their land tenure. Today, there are approximately 55 coffee farmers in the region and Ka'ū Coffee has achieved high standings in recent international cupping contests and is a growing contributor to Hawai'i's boutique coffee marketplace. Expansion of Ka'ū coffee production is likely and will depend in part on existing farmers' ability to secure improved leasehold tenure for their farms. There is also potential for a larger, even mechanically harvested, coffee crop in the Pahala area with the right combination of lands, people, and investment capital.

In the late 1990's Kamehameha Schools (KS) dedicated most of their former cane lands in the Pahala area to the production of roughly 3,000 acres of commercial eucalyptus forestry. The market for this type of forest product is still uncertain and the tree stands have been adversely impacted by drought and vog from Kilauea Volcano. KS manages the bulk of its Ka'ū holdings in a number of small pasture operations and is exploring other types of forestry on these lands. The Edmond Olson Trust, one of the largest buyers of former C. Brewer land in the region, has provided important new investments in agricultural operations in Ka'ū. They have planted roughly 500 acres of new macadamia orchards and constructed nut husking facilities and a coffee processing operation along



*Transmission line leading from perched springs in the Ka'ū forest to Keaiwa Reservoir above Pahala (Photo by Ron Terry)*

Wood Valley Road. These facilities will provide new options for Ka'ū farmers. The Olson Trust has joined with the State and County to put new investment in the collection and delivery of perched water from spring sources above the former cane line in the Ka'ū Forest Reserve. The Trust has also spearheaded the refurbishing of Noguchi Tunnel and roughly a dozen other small spring sources, along with transmission and reservoir improvements on what is called the Keaiwa-Noguchi water system. As this new investment comes online, the availability of surface water for truck farm irrigation, processing, and hydro-energy production will contribute to new agricultural momentum within the region.

There are a small, but growing number of truck farmers in the Pāhala area that produce vegetables for the local market. The Hester Farm above Pāhala draws water from Alili Springs to serve about 30 acres of diversified food production. Other farmers on Olson land are serviced by the Noguchi springs and other sources located above Wood Valley. The availability of low cost, gravity-fed water will enable these farmers to utilize Ka'ū's fertile soils and favorable growing conditions, without being as susceptible to the droughts that the region is known for.

The cattle industry plays an important role in the use of Ka'ū's agricultural lands. Larger ranches, such as Kapāpala and Kuahiwi in addition to a variety of smaller operations, produce both beef and goats for local consumption. Kuahiwi Ranch has worked hard to develop local grass-fed beef, which has achieved some statewide market acceptance. Ka'ū ranches also ship calves to the mainland for fattening and slaughter.

Recent proposals to produce biofuels from cultivated grass species grown in the Pāhala area may have an impact on Ka'ū's agricultural future. If successful, the biofuels operation would

*Table 12. Ka'ū Crop Land Acres*

KA'Ū	6100 (Total acres)
Coffee	582
Flowers & Foliage	17
Macadamia Nuts	5032
Special Crops	43
Tropical Fruits	243
Truck Crops	182

use as many as 10,000 acres in the region to grow one or more species of grass to be converted to liquid fuel. Such a use may offer new employment and economic opportunities for the people of Ka'ū. It may also compete with some of the cattle operations and emerging agricultural activity. The future of this option is uncertain at this time.

## Irrigation Water

Historically, Ka'ū sugar operations were unirrigated. There are, however, several dozen springs that were developed just above the mauka cane line at approximately the 2000' elevation that were historically used for fluming cane and providing wash water for mill operations. Kapāpala Ranch uses Makakupu Spring for stock water, which it pumps more than 12 miles north of Wood Valley to remote pastures near the National Park boundary. The County Department of Water Supply (DWS) uses two springs (Ha'ao and Mountain House) to provide domestic water to Nā'ālehu nu. Alili Springs, located above Pāhala, was a source of domestic water for Pāhala residents until 2007, when it was replaced by a deep well. Alili Springs is now used to support truck crop operations above Pāhala.

The future of these water sources is now in the hands of the State's Agricultural Development Corporation (ADC), which holds the State license to use the spring sources. The ADC intends to sub-lease the use of these sources to individual farmer cooperatives, which will be given the responsibility for upkeep and operation.

There is estimated to be three to five MGD in spring flow above Pāhala town. Reconditioning old springs and improving delivery and storage systems will insure a significant, yet modest, amount of low-cost water to support sustained food production in the Pāhala area. This will require new investment to clean out the springs and replace water transmission lines to make them serviceable. High level storage at Keaīwa Reservoir is another key water asset that can extend the value of high level spring water to support new farming activities.

## Volcanic Impacts

Ka'ū has borne the brunt of several years of vog from Kilauea Volcano. High sulfur and other chemicals in the volcanic smoke have a tendency to hang in the air against Mauna Loa and build up in high concentrations in Ka'ū. This has health impacts on people and has a negative impact on several types of farming. Several flower growers have lost, or nearly lost, their production

capacity, portions of the eucalyptus plantings have died, and ranchers are experiencing health issues in their livestock plus rapid deterioration of their metal fencing. These are problematic issues which have no simple solutions. Government assistance for drought and natural hazard mitigation are part of the near term solution, while continued persistence at the farm and ranch level, is essential.

### 4.6.1 Ka'ū's Contribution to Food Self-sufficiency

- Upper elevation ranch lands nearest to the Ka'ū forest reserve provide sustained pasture for local beef production. Lower lands provide productive seasonal pastures when there is sufficient rainfall.
- Perched water springs at upper elevations provide an important source of gravity-fed water for both ongoing and new agricultural endeavors. Recent public and private investments in these water sources, as well as their transmission and storage infrastructures, is key to promoting additional food and export crop growth in the region.
- Assistance from the Agricultural Development Corporation (ADC) in securing organized use of agricultural water sources is an important first step toward cooperatively-managed systems led by local users.
- The Ka'ū Forest Reserve provides over 80,000 acres of native forest watershed for the region and helps to insure rain and spring water over the long term.
- Unlike Kona or other post sugar cane regions, Ka'ū's real estate market for larger parcels of agricultural properties has yet to result in high end lot sales. Several landowners are poised to make agricultural land are reduced because of vog and other market conditions, which has slowed the almost inevitable break up of large parcels into smaller agricultural lots.
- Ka'ū has a local work force with a plantation tradition and few non-agricultural job opportunities exist in the region. This is a potential asset for any new agricultural venture.
- The major landowners in the region, including KS, Olson and the State, are long term players with no immediate exit strategy. This lends important stability to new agricultural ventures.
- Export crops like macadamia and coffee are proven crops in the region, both have opportunities for expansion.
- There is small group of new vegetable farmers in the region taking advantage of fertile soil and gravity-fed water to produce food for the local market place.



*Intake pipe inside Noguchi tunnel above Wood Valley*



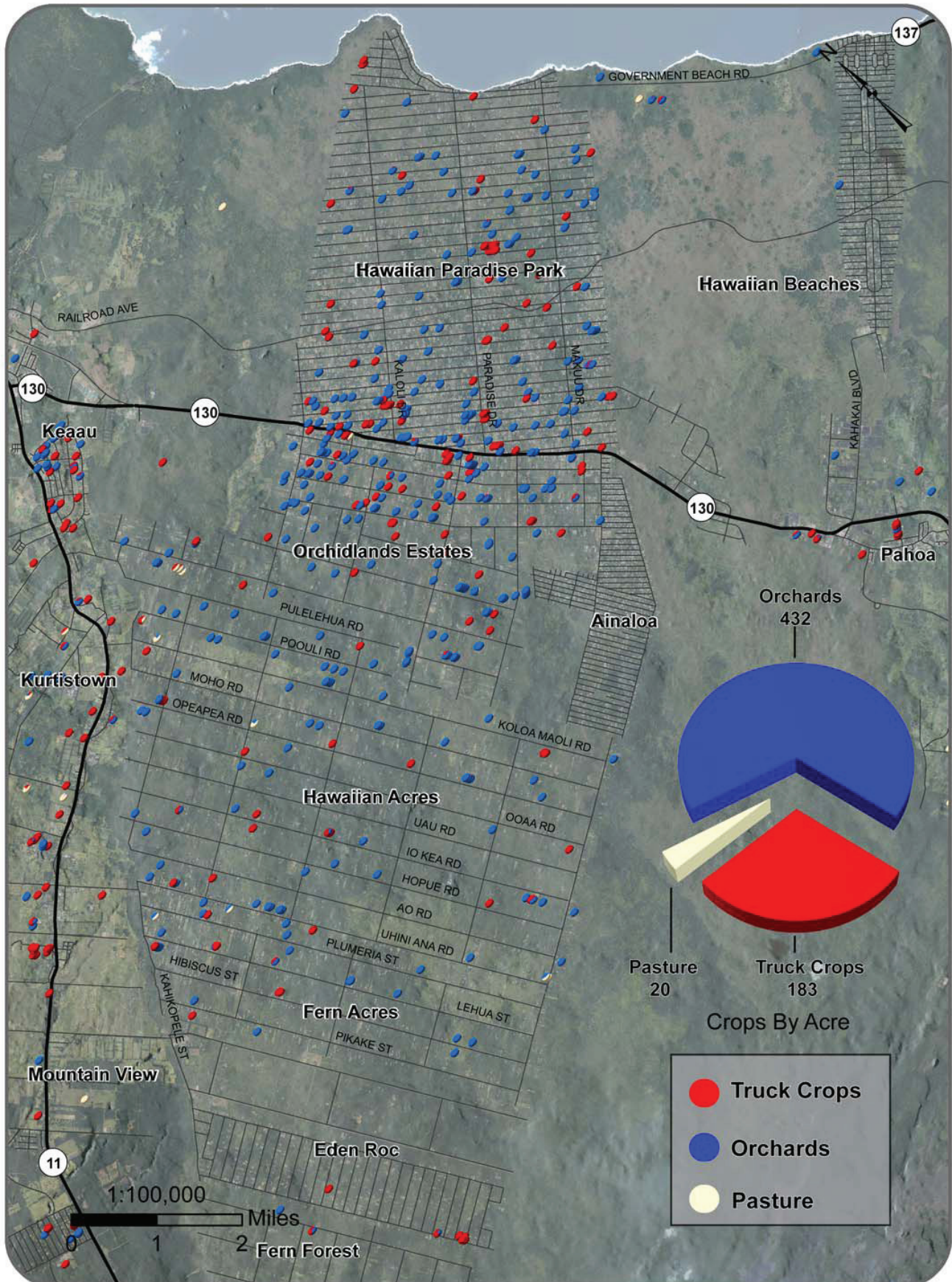


Figure 26. Puna Small Agriculture Use, 3 acres or less







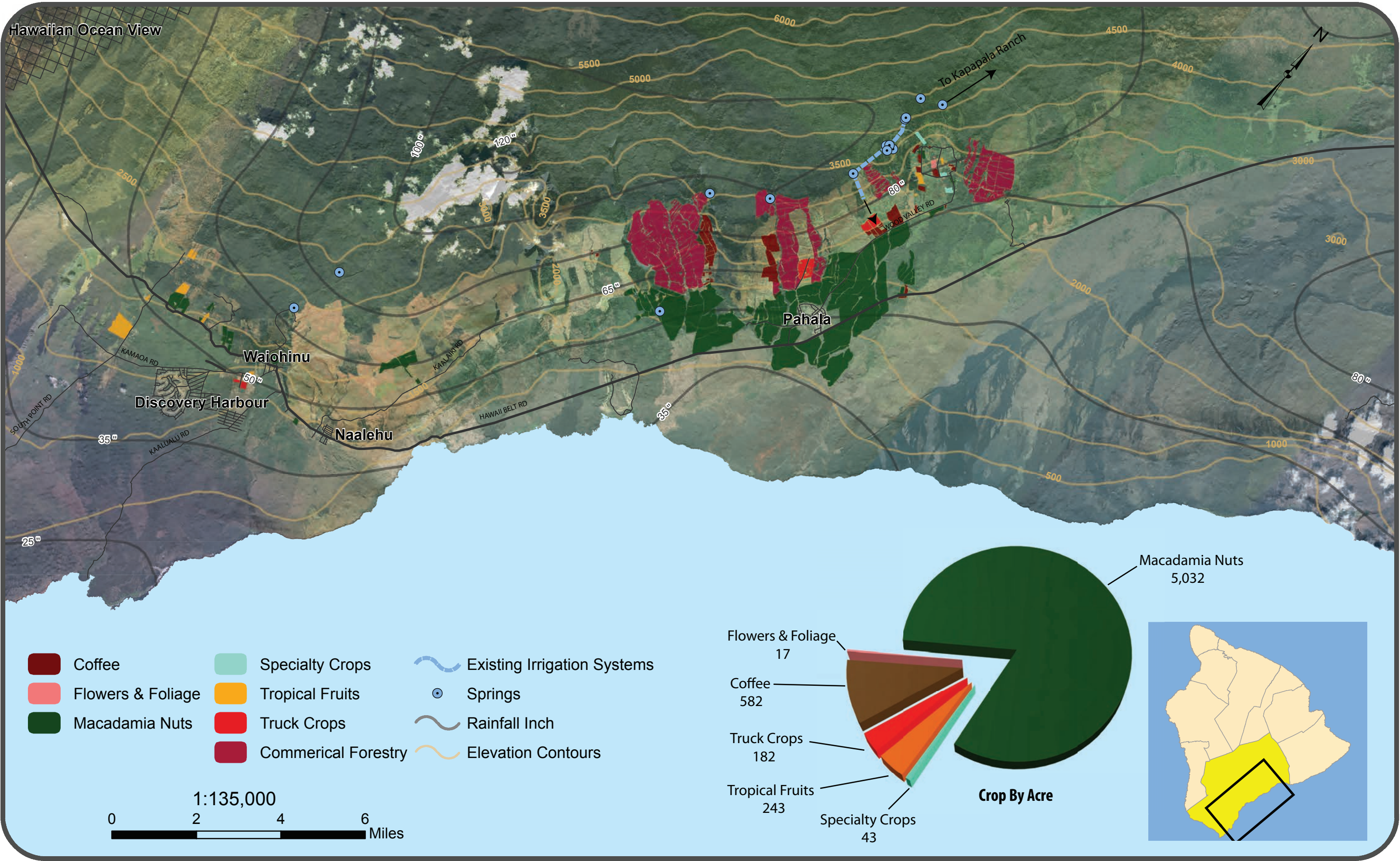


Figure 27. Ka'u Kona Crop Land Summary

# Kau Crop Land Summary









## 4.7 North and South Kona

### Background

Kona's agricultural production is concentrated in a long slender portion of the leeward slope of Hualālai and Mauna Loa, between 700' and 2,500' in elevation. The lands are steep and rocky with rainfall patterns between 40" and 70" annually. This agricultural zone supports an array of orchard crops. Coffee and macadamia nuts make up the bulk of the orchard crop mix with tropical fruits, avocado, and mango, providing produce for both local consumption and export.

For centuries prior to western contact, the Kona district supported a significant native population. An extensive agricultural field system was established to produce sweet potato, dryland taro and other essential crops. Large breadfruit plantings dotted the landscape and historic field system improvements are still visible today in undisturbed areas in both North and South Kona. Sailors aboard Captain Cook's ship in 1779 described an agrarian landscape that stretched for miles in all direction.

Western influence brought new crops to the Kona region. Cattle were an early introduction and eventually reshaped much of the Kona landscape. Oranges were planted to feed sailors fighting scurvy. In 1899, sugar growers tried to produce sugar from the steep rocky fields, which lasted until 1927. Tobacco was grown commercially in Kona from 1908 to 1929 before it succumbed to a fire that destroyed processing and storage sheds. Coffee was introduced to Kona in 1828 and began a long history of boom and bust plantation-style production. When large-scale coffee operations failed in the 1920's and 30's, they were replaced by small farms on leasehold lots that allowed individual farmers to produce coffee using family labor. This decentralization of farm production helped to stabilize the coffee industry and laid the foundation for the small farm lot settlement pattern that defines land use in the region.

Macadamia nuts were planted in small parcels in the late 1950's. In 1962, the world's largest macadamia orchard was planted on the lands of Kapua in South Kona. The MacFarms orchard consists of 3,900 acres between 1,200' and 2,500' elevation. Smaller macadamia orchards have been planted in the upland farms in both North and South Kona, often intermixed with coffee and other orchard crops.

Orchard crops such as avocado, mangos and other tropical fruit began appearing in commercial plantings in the 1980's. There are several orchards dedicated to just one or more of these crops, but it is common to see these fruit tree species mixed with coffee, macadamia and other crops.



*Kona Coffee is the defining crop for much of the Kona District (Photo courtesy of Greenwell Farms)*

### Current Agricultural Production

**Kona Coffee** is the defining crop for much of the Kona district. It has a global identity and the distinction of being one of the world's most expensive coffee varieties. Most of Kona's coffee is grown on five to ten acre parcels in what is referred to as the Kona Coffee Belt. This growing region extends from Kaloko to Ho'okena between the 700 and 2,500 foot elevations. Many of the producing farms contain one or more farm residences, allowing the farmer to live on the property they farm. Over 600 of these farms are on leasehold property from Kamehameha Schools.

Coffee can be sold as cherry at the time of harvest or it can be processed and then roasted for estate sales on individual farms with direct market options over the Internet. The bulk of Kona's coffee production is sold to one of three or four large processors who fill commercial orders to coffee purveyors around the world.

Mapping conducted as part of this study suggests that there are roughly 4,100 acres in coffee production in North and South Kona combined. It is difficult to get a precise number since, in many cases, coffee is planted with other tree crops—mostly macadamia—so it is difficult to get a firm number of planted acreage. There are also many small backyard coffee plantings that were too small to map.

Over the last 10 years there has been a significant amount of new coffee planted in the Kona area, much of it in fields of 20 or more acres. New investment capital has flowed into the Kona coffee industry from both large corporate sources and from individuals who have bought property and invested money in their own surroundings. Federal income tax credits have enabled some of this new investment by sheltering income that is invested in agricultural endeavors. Much of the new coffee plantings are in conjunction with large residences to create a coffee estate lifestyle.

Labor is an ongoing challenge for coffee growers. Harvest season requires hundreds of pickers and processors to annu-

ally produce over four million pounds of parchment coffee. Immigrant labor has been a mainstay of the industry for more than a decade with as many as 1,000 workers, many from Mexico, Central America and Micronesia. Providing housing for migrant workers and meeting federal immigration requirements are two major challenges for the industry.

The Kona coffee industry faces some serious challenges in 2012. Although cherry prices are at an all-time high (\$1.50/lb.), the supply is impacted by the coffee borer beetle (*Hypothenemus hampei*) which burrows into the bean and renders it useless. Extensive on-farm practices to combat the beetle are vital and there is an equally important need to protect the quality of the export product to preserve the brand identity and value. The industry has weathered many ups and downs over the years so it will likely overcome the current challenges. Coffee is a decentralized industry with many small producers and several large players in both production and processing. Collaboration within the industry ebbs and flows and is essential for the long term stability of the industry.

**Macadamia nuts** are planted throughout the Kona Coffee Belt in orchards of two to twenty acres in size. Many macadamia orchards are inter-planted with coffee and other orchard trees. Kona farms are thus increasingly diversified, with several types of crops. This strategy provides multiple sources of farm income. There is a rich mix of food produced on many of the farms in Kona though it is difficult to measure because of the small scale of their operations and the integration of multiple agricultural products on the same farm.

MacFarms is the largest macadamia producer in the region with

**Table 13. South Kona Crop Land Acres**

SOUTH KONA	9122 (Total Acres)
Coffee	1759
Flowers & Foliage	46
Macadamia Nuts	5598
Macadamia Nuts/Coffee	1658
Special Crops	12
Tropical Fruits	26
Truck Crops	23

approximately 4,000 acres in production in South Kona. In 2012, macadamia farmers have several options for where to sell their nuts as market demand is high. In some years, the market is such that farmers

have left the nuts on the ground rather than spending money to collect them.

**Tropical fruits** are planted in small orchards in Kona and are mixed into many farms. Avocados, mangos, rambutan, longan, dragon fruit, and other species grow well in the region with both local and export markets.

**Flower and foliage** operations are concentrated in the State Agricultural Park near Keāhole Airport. There are several plumeria flower orchards in the district and a number of landscape



**Labor costs are an ongoing challenge for coffee growers**  
(Photo courtesy of Greenwell Farms)

nurseries that service the resort and residential markets on the Kona-Kohala coast. Tropical landscaping with flowers, fruits, and colored foliage is a hallmark of the Kona region and is part of what defines the unique Kona experience.

**Vegetable crops** have a relatively small footprint in the Kona region due, in part, to the rocky nature of the soil and general topography of the region. There are, however, a significant number of small farms that produce a range of vegetables and several commercial green house operations that produce tomatoes and cucumbers.

The **bee industry** in Hawai'i is based in South Kona with several of the largest apiaries in the State are located just above Kealahou Bay. Kona is also the largest producer of queen bees in the Pacific, with several companies producing hundreds of thousands of queens annually to restock the apiaries of bee keepers around the world. Bees play an important role in pollinating Kona's coffee and macadamia orchards and are also important to other tropical fruit and vegetable growers.

**Table 14. North Kona Crop Land Acres**

NORTH KONA	4167
Aquaculture	159
Coffee	2389
Flowers & Foliage	90
Macadamia Nuts	749
Macadamia Nuts/Coffee	608
Special Crops	43
Tropical Fruits	73
Truck Crops	56

**Cattle ranching** has been a defining part of Kona's upcountry landscape for well over a century. In 2012, there are only a few commercial cattle operations remaining. Several large mauka ranches were sold or split-up among family members in the 1990's, and are now managed with less active intent to produce cattle. Several portions of large ranch areas in both North and South Kona have become integrated into native forest protection programs by the Nature Conservancy, the State, and the U.S. Fish and Wildlife Service. Ranching is still a part of Kona's identity and lifestyle, but beef production is a significantly lower priority than it was during much of the 20<sup>th</sup> century.



## South Kona Crop Land Summary



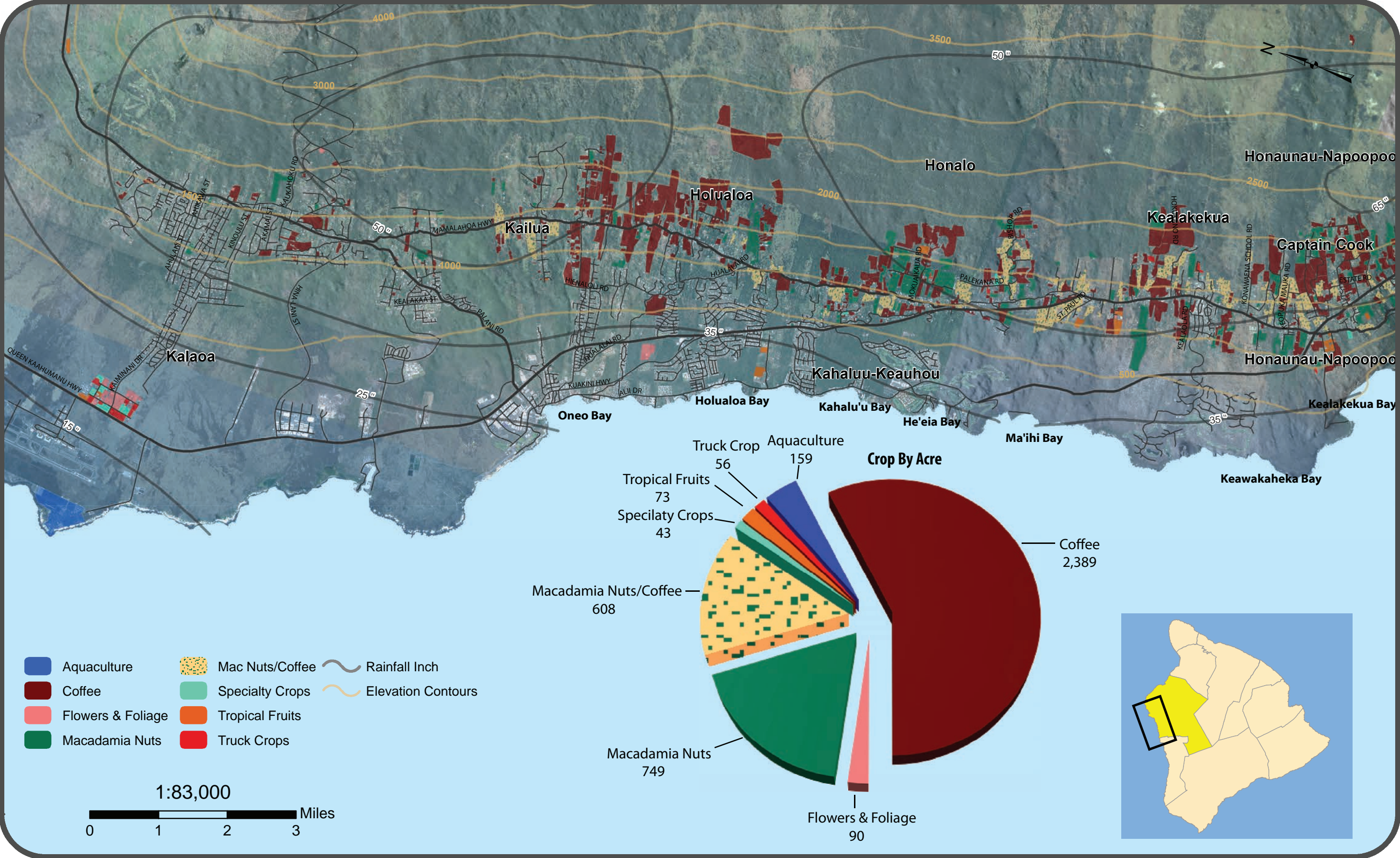


Figure 29. North Kona Crop Land Summary

# North Kona Crop Land Summary



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### **4.7.1 Kona's contribution to food self-sufficiency**

- Kona's agricultural strength is in orchard agriculture and is currently dominated by export crops like coffee and macadamia nuts. Relatively small percentages of these two crops are consumed locally, compared to the volumes that are exported.
- Tropical fruit, avocado, breadfruit, and other tree crops grown in Kona provide a significant food source for residents and visitors. Portions of these crops are also exported to Honolulu and elsewhere.
- The small farm settlement pattern in mauka Kona is a rich setting for diversified food production. Many small farms provide a wide range of food crops for family and neighborhood consumption, with an increasing surplus sold at farmers' markets, local retailers, and specialty restaurant markets.
- The tourism industry in Kona helps to drive local agricultural product sales and to create opportunities for farmers to conduct agricultural tour activities on their farms (Agro tourism). Tourism revenues and direct sales are an important part of Kona's rural economy.
- There are several commercial vegetable producers in the region and distribution companies such as the organic-oriented Adaptations, which collects, markets, and distributes food to commercial outlets Islandwide.
- Kona's ocean resources are rich and actively fished and gathered. Kona harbors register the largest amount of commercial fish catches annually and recreation fishing is a significant source of food for Island families and local eateries.
- Several cattle producers in the Kona area are exploring grass-fed operations that will provide more local meat
- The bee industry in Kona produces honey for export and local consumption as well as queen bees for hives around the world. It also has a systemic impact on pollination of most crops in the region. This is particularly critical due to the decline of wild hives that followed the recent introduction of the Varroa mite and hive beetle.
- Aquaculture operations at the Natural Energy Laboratory at Keāhole Pt. provide a small amount of local fish, algae, and shellfish for local consumption. Research at these facilities will help to expand seafood production for local use and export.
- Kamehameha Schools plays a large role in the management of farm lands with over 600 small farm leases in the Kona area. Their current commitment to long term agricultural land use helps to insure that large areas of the Kona region will remain as productive farms.
- Chefs at many Kona resorts and restaurants make a strong commitment to the use of local produce as Farm to Plate cuisine. This provides a steady market for local produce and expands the variety of products that the Kona region can provide on a sustained basis. It also educates Hawai'i's visitors about the value of Hawai'i's agricultural sector and the unique products it produces.
- Local grocery retailers like KTA and Choicemart make a significant effort to promote local foods and to work with producers to maintain a steady supply to the marketplace. Costco is also a major vendor for larger farm operations, particularly for local fruits and vegetables..

## 5 Seafood Resources

### Background

Coastal and open ocean waters surrounding Hawai'i Island provide a rich array of sea foods that are an essential part of the Island diet. Stewardship of these ocean resources is essential to insure that the food supplies of local waters are available for Island residents for generations to come. Commercial, recreational and subsistence fishing are part of daily life for many on Hawai'i Island and there are important balances to be struck between the ability to harvest food and the need to insure that the resources, and the habitats they come from, remain productive and sustainable.

With 1.3 million State residents and another 7 million annual visitors, Hawai'i's oceans are a critical part of our island economy: 51% of the fish eaten locally comes from Hawaii waters<sup>50</sup> and many families depend on the ocean for their livelihood and/or to put food on the family table. The current condition of Hawai'i's fisheries is an issue of some debate. Clearly, portions of the State experience adverse impacts from land use activities that cause runoff into rivers and coastal waters. Invasive species have compromised the vitality of some coastal areas, and commercial and recreational harvests of some species have depleted fish populations. Managing Hawai'i's fisheries for sustained use and enjoyment by residents and visitors is a challenge that will require sustained effort and collaboration.

Hawai'i Island is fortunate to be behind the curve of declining fish stocks for some species compared to O'ahu and Maui, where fishing pressure and development impacts are more prevalent. Large areas of Hawai'i Island's coastline are inaccessible by vehicle or have been cut-off by gates and new land ownership patterns. Portions of the shoreline are also protected by steep cliffs that make coastal fishing difficult. Lack of accessibility both protects fish stocks and limits the ability of local fishermen to fish along much of the eastern shoreline. Other portions of the shoreline are under significant pressure. Commercial aquarium fish collection has had a significant impact on portions of the Kona coast and is an ongoing management concern. Kona's reputation as a fishing mecca attracts global attention to the area's ocean resources and drives pressure that would not be there from local use. Shoreline fishing with poles, spears, and nets is a popular local pastime. 'Opihi and other seafood favorites are collected in volume to serve at luaus, special gatherings and celebrations on a regular basis. Hawai'i Island's ocean resources face a variety of challenges and remain a sustainable part of the Island's food-basket for future generations.



*Managing Hawai'i's fisheries for sustained use is a challenge that will require persistent effort and collaboration*

### Seafood Demand

Hawai'i residents consume 37 pounds of seafood per capita per year, as compared to a U.S. average of just 16 pounds<sup>51</sup>. Studies indicate that Hawaii catches 51% of its own fish supply, including both commercial and non-commercial sources. The remaining 49% of local consumption is imported, primarily from foreign sources. Most of the imported seafood comes into the state frozen; some of it processed into fish sticks and other fast food products, some in bags of shrimp and lobsters, and some are whole fish from international fleets plying waters around the Pacific Rim. Imports come from wild and farmed sources and from fisheries with their own sustainability issues.

Yellow fin, bigeye, and tuna species are the most in-demand seafood products in Hawai'i. The second most-consumed species is salmon, followed by mollusks, crustaceans, and aquatic invertebrates. Mahimahi, shrimp and billfish follow in that order<sup>52</sup>. The Hawaiian seafood marketplace has a range of ethnic and socio-economic preferences. Raw seafood, including opihi, poke, and sashimi are local favorites year-round, with seasonal surges in demand. Pelagic species like ahi, mahimahi, ono, and marlin are favorites in local eateries and high-end restaurants. Bottom fish, such as onaga and 'opakapaka are always available and demand has seasonal spikes. Reef fish, like uhu, menpachi, ulua, enenue and others, are caught and shared by residents who skin dive and pole fish for meat and the enjoyment associated with sport fishing. There is no method to accurately measure how much seafood is harvested annually from Hawaiian waters, yet it is clear that the islands depend on the ocean and many of its species to meet a variety of local food demands. Some of the higher-end catch is shipped to Japan and the Mainland which offer strong price incentives to export seafood.

Aquaculture is another source of seafood from fresh water, fish-

50 An Overview of Seafood consumption and Supply Sources: Hawai'i verses U.S., CTAHR, Matthew Loke et al, March 2012, See section 2.5.5 of this study

51 Ibid

52 Ibid



pond, and open-ocean farming. On a statewide basis, 623 000 pounds of seafood come from aquacultural sources, which amounts to just 3% of the state's total consumption<sup>53</sup>. Fresh water species, particularly tilapia, are grown as part of hydroponic operations that also produce vegetables and rely on fish waste for fertilizer. Experiments in open-ocean cage aquaculture have produced some successes off of the Kona coast and there are proposals to expand this form of fish farming in both near-shore and open-water areas. Although traditional fishponds on several Islands have been repaired and restocked, they account for little in the way of a stable food supply at this juncture. Some commercial seaweed production is taking place on Molokai, and Hawai'i Island, thereby filling niche seafood markets.

Hawai'i Island's fishing fleet is an amalgamation of serious commercial fishermen; commercial charter operations; part time, subsistence; and recreational fishermen. Catch is sold to local distributors, retail outlets, and restaurants. It is also sold directly to consumers on the roadside, in farmers markets, and is also shared with families and friends.

### 5.1.1 Measuring Ocean Resources

There are a variety of data sources to track the amount of seafood that Hawai'i consumes from its own waters. The State Department of Aquatic Resources (DAR) collects data provided by licensed commercial fishermen. This data tracks where fish were landed, what species they are, and by what method they are caught. This data set does provide some sense of what commercial fishing activity takes place, though it is hard to generalize based on the way fishing boats travel between Islands to off-load their catch. It also does not account for commercial fishermen, who harvest and sell informally without reporting details of this portion of their total catch.

The National Oceanic and Atmospheric Administration (NOAA) conducts annual surveys of recreational fishermen throughout the nation. In Hawai'i, NOAA utilizes a series of phone interviews with Hawai'i residents and a team of surveyors periodically visit boat ramps and other fishing areas to collect data on catch, method, and ancillary concerns. These surveys are used to better understand recreational fishing practices and to inform estimates about the volume of recreational catch. Hawai'i is the only state that does not require recreational fishermen to have fishing licenses, so there is some degree of uncertainty when measuring the number of people who fish in these waters and to track catch data. Efforts to improve non-commercial catch data are ongoing.

There is a significant amount of scientific research carried out on several major fisheries to understand the species life cycles and habitat interaction, and to aid in setting limits on sustainable harvest. In pelagic waters within the Exclusive Economic Zone of the United States (200 miles off shore), organizations, like the Western Pacific Regional Fisheries Management

Council, (WPRFMC) and Western Pacific Fisheries Council (WESTPAC), perform continuing studies as well as monitoring to set limits on open ocean species and to protect non-target species from undue impacts from commercial fishing.

Locally, research is conducted on Hawai'i's bottom fish fishery and is used to set limits for the harvest of popular species including ehu, gindai, hapu'upu'u, lehi, kalekale, onaga, and 'opaka-paka. Bottom fishing is a significant commercial and recreational fishing resource that is under increasing pressure and regulatory oversight. Several locations on Hawai'i Island are designated bottom fish fisheries management areas and are managed by quotas with periodic closures enforced by the State DAR.

Closer to shore, the monitoring of reef fish populations and the management of fishing and collection practices is conducted regularly along the West Hawai'i coast to track the impact of commercial aquarium fish collection. Additionally, the University of Hawai'i and other institutions undertake various studies and train students to assume leadership roles in future stewardship efforts. Many resort areas are required to monitor their offshore waters annually and submit results to the County. On Hawai'i Island, coastal fisheries management is focused largely on West Hawai'i where land development and the pressure from commercial fishing and aquarium collection is the most pronounced. East Hawai'i management initiatives focus on places like Hilo Bay, Kapoho's Wai'opae tide pools, and stretches off the Keaukaha shoreline.

### 5.1.2 Managing Hawai'i Island's Fisheries

Sustaining fisheries around Hawai'i Island requires the consistent and collaborative efforts of a wide variety of stakeholders. Effective resource management is most successful when there is a shared understanding of the need to protect ocean systems and habitats, and to do so in a cooperative fashion. From a food perspective, a key goal should be to strive for sustainable use of the resources and to commit to the application of



*Much of Hawai'i Island's favorite seafood is imported from other places*

53 Personal communication, Matthew Loke, DOA/CTAHR ag economist

accurate information to monitor and guide adaptive resource management. The success of management efforts hinge on broad community understanding that management is essential for sustained harvest and on the need for fishermen to teach their children how to fish responsibly.

The West Hawai'i Fisheries Council (WHFC) is an example of a collaborative initiative to manage fisheries resources. WHFC was set up by legislative act in 1990 to provide a forum for cooperative fisheries management between 'Upolu Point and South Point. It has maintained that discussion monthly for over a decade with no formal legislative authority and very little State financial support, with the commitment of active individuals to maintain a forum for management discussion. WHFC has helped to shepherd major management efforts associated with the aquarium collection in West Hawai'i and has set up and assisted with monitoring Fish Replenishment Areas (FRA). Over the last decade, it has managed an ongoing dialogue about fisheries issues and dealt with ocean resource issues in an open public forum. WHFC has proven to be a model organization for other regions who want to focus a collective effort on doing what is right for the ocean environment and its many different users. Together with fishery regulations, enforcement, and responsible compliance, management initiatives such as WHFC are building blocks for sustainable Island fisheries.

Figure 31 displays the state of current ocean resource management on Hawai'i Island. It depicts various types of management areas and preserves already in place to protect species as diverse as humpback whales, bottom fish, and reef species. Each of these areas has their own enforcement challenges and efforts are made to educate the public about the need to act responsibly to ensure that these fisheries are used responsibly. The map also locates public boat ramps and fish aggregating

buoys that are part of the public infrastructure that enables ocean use and promotes the collection of fish for Island consumption. The combined goals of use and protection are at the heart of long term sustainability in Hawai'i's fisheries resources.

Figure 30 also highlights several community-based resource initiatives that reflect emerging, place-based coastal management efforts. Milolii's Subsistence Fisheries designation, near-shore management efforts at Ka'upulehu and Kiholo, and work by Kalapana residents along the National Park shoreline are examples of community-based efforts that are on the leading edge of a growing trend toward locally-influenced stewardship for coastal areas on Hawai'i Island. These initiatives involve the people who are most intimately connected to and dependent upon these resources.

### 5.1.3 Building an Ethic for Ocean Use

One of the greatest threats to long-term fishery resources is the loss of a collective memory about what healthy ocean resources looks like. As each generation adapts new techniques and technologies to harvest a decreasing fish supply, the baseline shifts and individuals forget what a healthy system looks like. One of the great benefits of the Northwest Pacific Islands (NWPI) is that it protects an extensive ocean system that is still pristine. Its teeming sea life, with schools of apex predators like sharks and ulua, is an example of the characteristics of a vibrant ecosystem and offers a basis to assess the health of near-shore waters. Hawai'i is not likely to ever revert to the pristine state of the NWPI, nor can it be content to let a declining ocean resource become the accepted norm.

There are many organizations in the state committed to ocean resource protection and are working to insure viability for

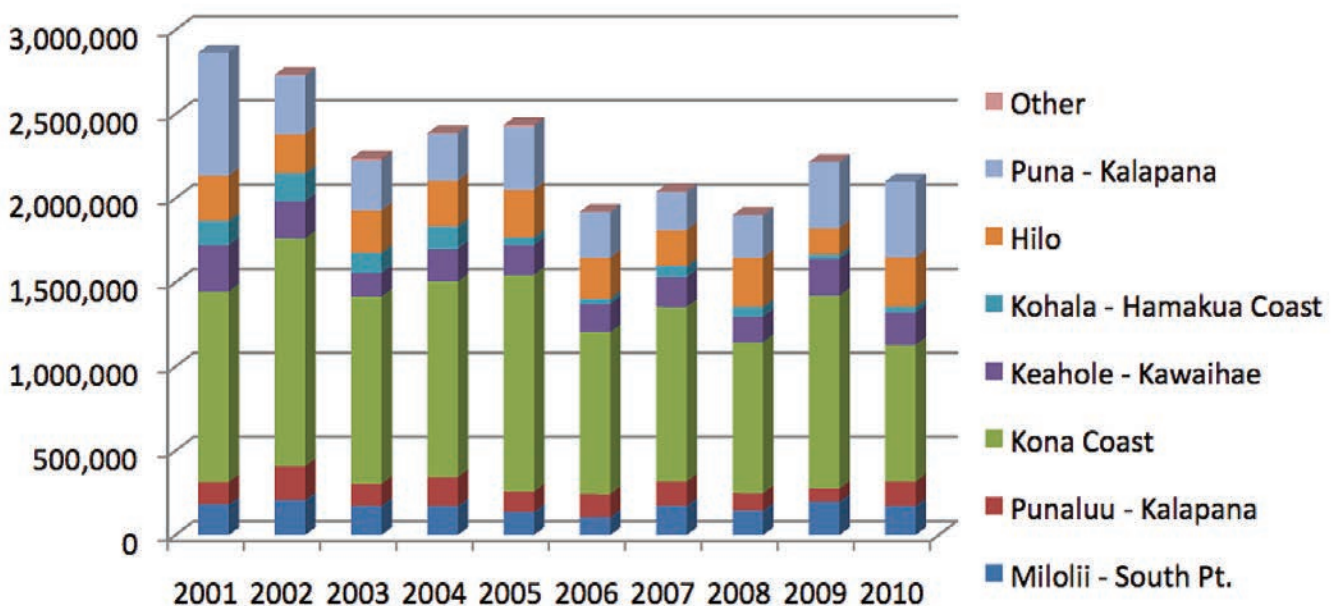


Figure 30: Division of Aquatic Resources commercial fish catch data Hawai'i Island 2001-2010 (pounds)





*Fishing responsibly for future generations. (Photo courtesy of Orion Enecencio)*

future use. There is also a wide array of State and Federal regulations and rules in place to set fishing limits, control fishing methods, minimize land use impacts, mitigate runoff and to stem the flow of invasive species. Money for enforcement and monitoring is never adequate and there are global climate issues that are likely to complicate ocean resource management issues. There is also a new wave of young students graduating from

college marine science programs locally and around the country, schooled in marine science and new methodologies that can record and monitor the condition of the ocean's resources. Many of these students have a unique Hawaiian perspective and are working to integrate cultural methods and sensitivities into the science and practice of resource management. This new generation of resource managers potential bodes well for the future.

The scale of the oceans is daunting and the demand for fish and the impacts of modern life on fisheries is increasing at an alarming rate, both in Hawai'i and around the world. If Hawai'i Island expects to be able to rely on its surrounding ocean for part of its basic food self-sufficiency capabilities, it must make a concerted management effort. This is a multifaceted challenge and requires the participation of many people.

For this most important role, Lawai'a Magazine and the Pacific Island Fisheries Group (PIFG) offers some very good recommendations under the umbrella of a simple creed, "**Fish Today for Fish Tomorrow.**"<sup>54</sup> The emphasis is on taking personal responsibility for how each of us engages the ocean so that future generations will learn to know and love the ocean and learn to live with the bounty it can supply. Said simply, the PIFG suggests the Fisherman's "Pledge for the Future" which includes:

- Learning and following fishing laws and regulations
- Taking only what is needed and practicing "catch and release" of fish that are unwanted or prohibited
- Practice safe fishing principles and safety at sea
- Engaging in the rule making process
- Being respectful of other resource users
- Being knowledgeable and respectful of all natural resources
- Property disposing of trash
- Setting a good example for others to follow, walking the talk. Good fishing, conservation practices and fellowship are infectious.

<sup>54</sup> Lawai'a Magazine, December 2011, published by Pacific Island Fisheries Group

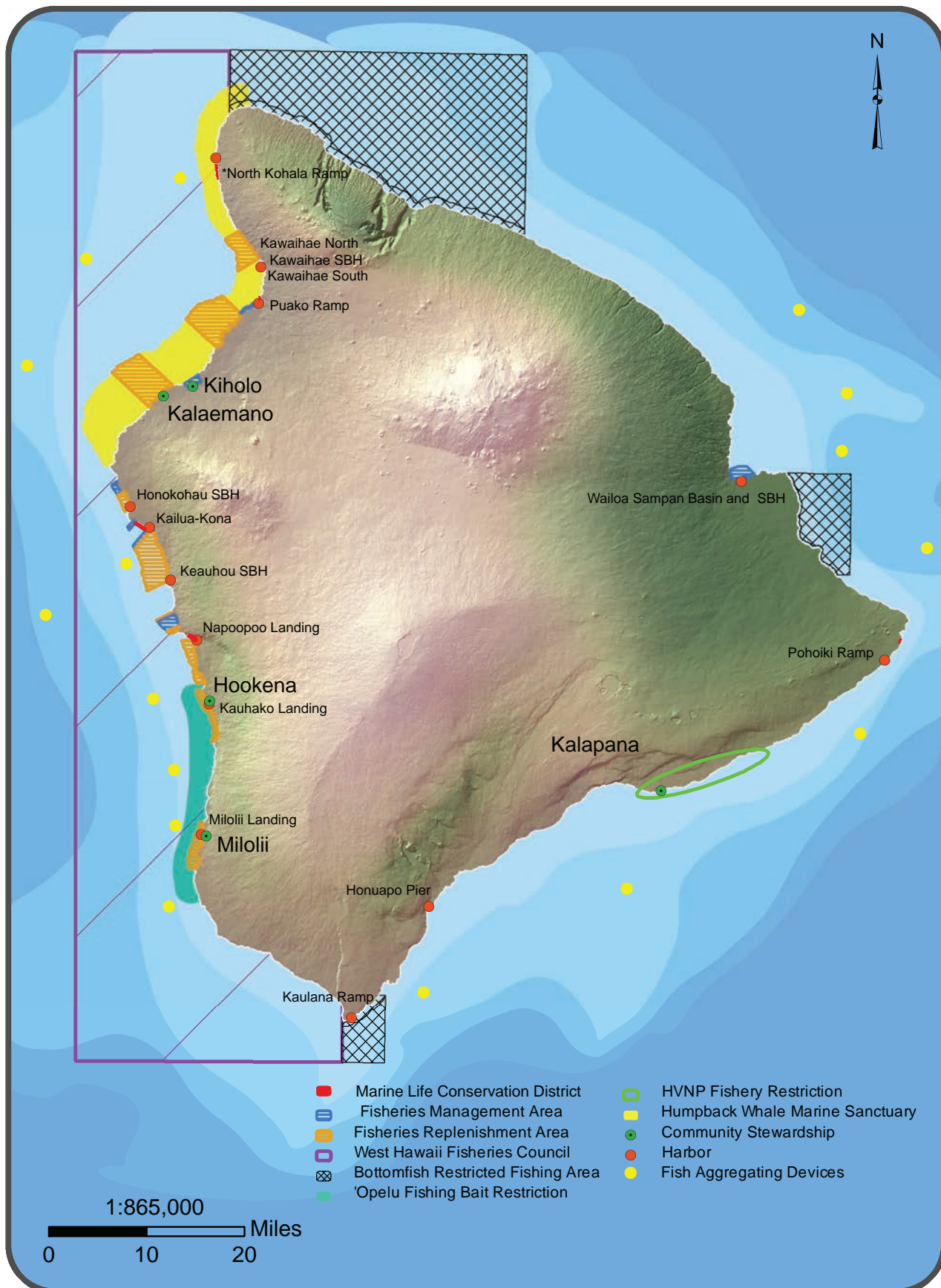


Figure 31. Hawai'i Island Marine Management Areas



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## 6 Recreational and Subsistence Hunting

For many local residents of Hawai'i Island, hunting is an outdoor recreational activity that also plays an important role in putting food on the family table. It is difficult to measure the exact contribution of hunting to the Island's food supply but it would be inappropriate not to mention the contribution of hunters in the context of a food self-sufficiency baseline study. Feral pigs, sheep, and goats comprise the largest portion of the wild meat supply on the Island. This, along with a number of game birds species (including pheasants, turkeys, chuckar, and quail), supplements the annual meat consumption of Island residents.

Public hunting takes place on State lands that have been designated as Game Public Hunting Areas as displayed in Figure 33<sup>55</sup>.

Hunters must have State hunting licenses and, technically, are required to report their results at unstaffed hunter check-in stations. A summary of reported hunting results from all State hunting areas, provided by the Division of Forestry and Wildlife (DOFAW), is summarized in Figure 32.

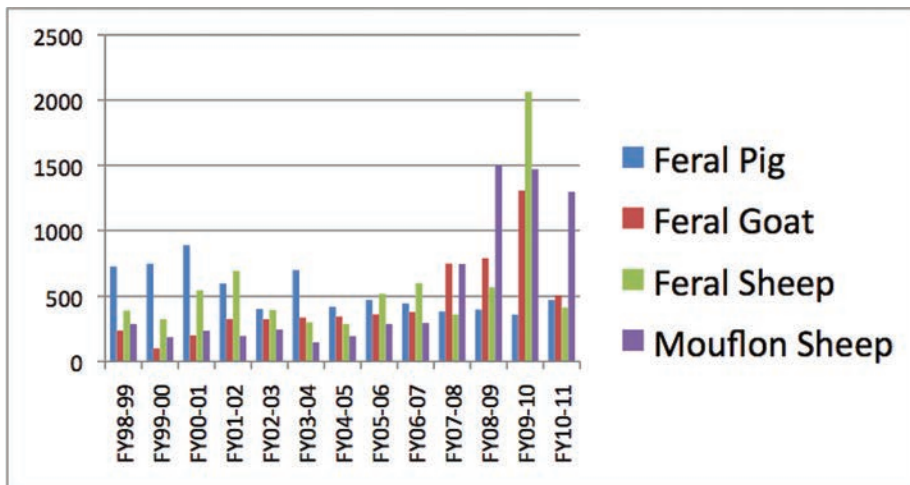


Figure 32: Mammals taken from State lands on Hawai'i Island FY 1999 to FY 2011 (Source DOFAW)

Harvest from public lands varies from year to year based on many variables; the amount and timing of rainfall; grazing conditions; hunter efforts, etc. The increased harvest of mouflon sheep from fiscal year 2009 to fiscal year 2011 appears to reflect management mandates to remove mouflon from the slopes of Mauna Kea to protect the habitat of endangered birds. The number of mouflon harvested on Mauna Kea will likely decrease significantly in coming years, as eradication efforts proceed.

<sup>55</sup> Data from DLNR DOFAW

***Taken together, the recorded feral mammal catch from public lands and a conservative estimate of 5000 additional pigs caught outside of the State hunting areas amount to 413,000 pounds of meat in the Island food basket from hunting activities alone, the approximate meat equivalent of 910 head of cattle annually.***

Hunting also takes place on private properties and ranges from high end gun clubs with international clientele, to local residents hunting in orchards, farms, and pastures to reduce the damage from feral animals on truck crops and macadamia orchards, in particular. Feral pig populations have increased substantially in some communities and forested areas. Contracted hunting and trapping, along with outlaw hunting and unmonitored trapping of pigs occurs islandwide. There is no easy way to track all of the hunting that takes place on Hawai'i Island. It is clear, however, that unrecorded pig hunting, in particular, occurs islandwide and that it far exceeds the roughly 400 pigs that are reported annually from public hunting lands, perhaps by a factor of 10 to 20 times.

Feral sheep and goats may weigh between 50 and 100 pounds with a net dressed weight of approximately 30 pounds of meat. Wild pigs are often larger, weighing between 50-200 pounds apiece. When dressed out, feral pigs produce closer to 50-60 pounds of meat. In fiscal year 2009-2010, there were 4,839 sheep and goats reportedly harvested from public hunting areas. Assuming a conservative average of 30 lbs. of meat per animal, this would equate to 145,170 pounds of meat. Add 357 feral pigs at 50 pounds each (17,850 pounds) for an estimated total of 163,000 pounds of meat taken from public hunting lands in a one year period.

Pig hunters and land owners interviewed during this study suggest that the number of pigs harvested from private lands and farms around the Island far exceeds what is recorded from designated public hunting land. Estimates range from 4,000 to 8,000 additional pigs killed annually on Hawai'i Island. Based on a 2004 mail survey to hunters conducted with 1,298 hunters statewide, DOFAW's state hunting coordinator estimates that as many as 10,000 pigs were harvested and not recorded statewide for that year<sup>56</sup>. For the purposes of this study, we estimate that 5,000 additional mature pigs (100+ pounds each)

<sup>56</sup> Ed Johnson, DLNR Hunting Coordinator, pers. comm., Feb 26, 2012

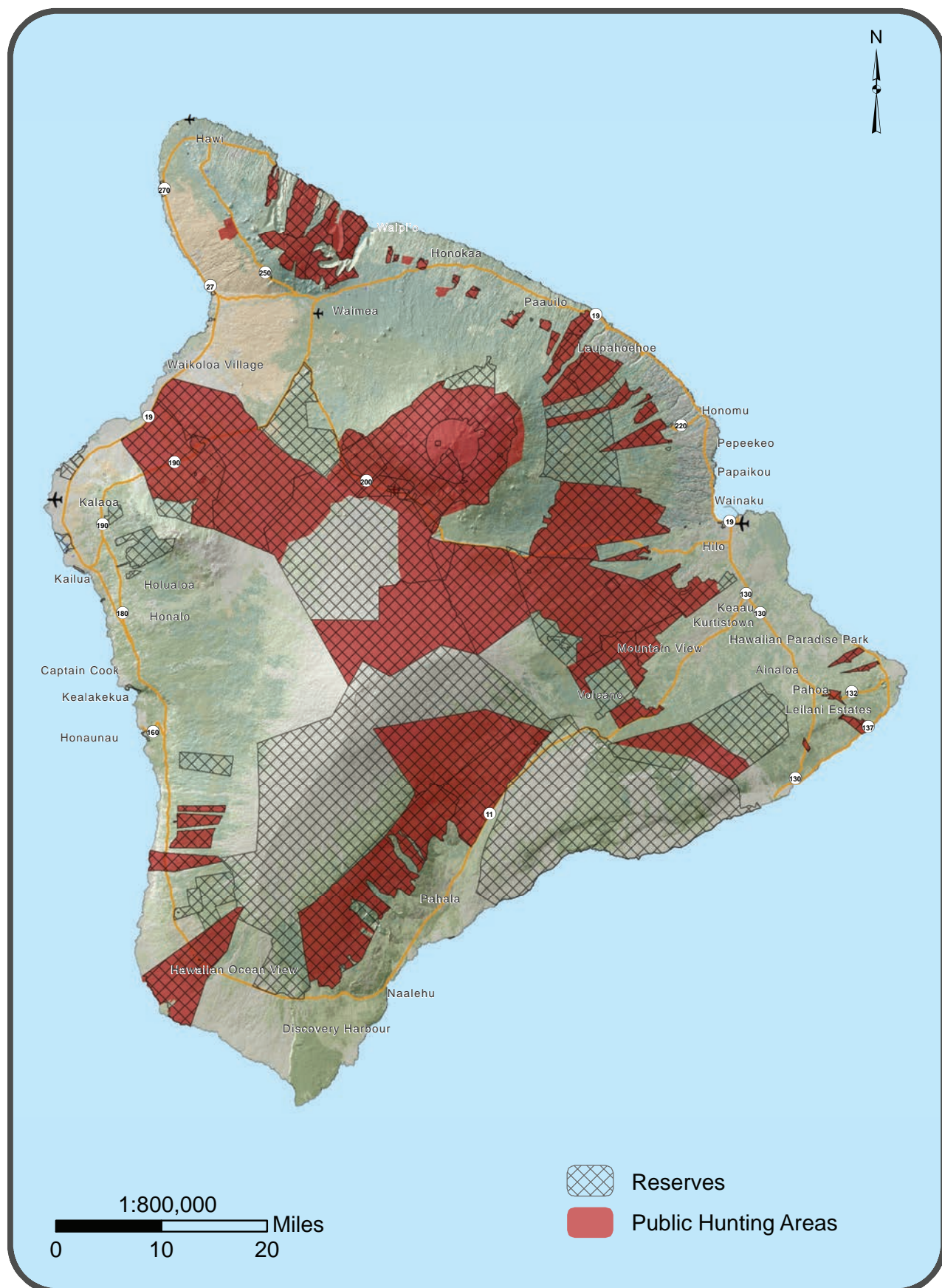


Figure 33. Hawai'i Island Public Hunting Areas



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were taken and not recorded through the DLNR hunter station system. Using a conservative value of 50 pounds of meat per pig, this would produce 250,000 pounds of meat. Add this number to the public lands estimate above and hunting could account for a total 413,000 pounds of wild meat annually in local freezers and on dinner plates. Divide this number by 450 pounds, which is an estimated yield of a full-sized steer at slaughter, and this wild meat harvest is the equivalent to the amount of meat produced by harvesting 910 head of cattle per year. Most of this meat is dispersed to family freezers around the Island while some is smoked or made into sausage for home use. There is also a small commercial demand for wild pig meat. It appears on some resort restaurants and in KTA stores as smoked wild boar. Wild pig meat that is sold commercially must be captured in the wild and killed in a certified slaughterhouse, the same as any other inspected meat product.

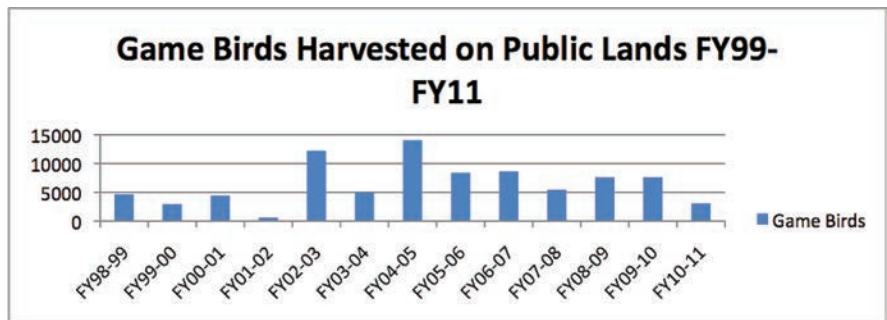
Under certain conditions, feral ungulates of all kinds are known to have a negative impact on native species and the quality of the Island's watersheds. Conflicts between resource managers and hunters have flared repeatedly over the past several decades as more land, particularly in native forest areas, is fenced to exclude feral animals. Maintaining areas for public hunting is the responsibility of the Division of Forestry and Wildlife. This is a *kuleana* that DOFAW managers must balance with their responsibility to steward Hawai'i's watersheds and to protect native plant and bird species.

Game birds also produce a substantial amount of meat for local families. The number of birds shot each year varies significantly based on the amount and timing of rainfall, habitat conditions in portions of the Island where hunting is permitted, and a number of other factors. Due to poor habitat conditions in recent years, primarily due to lack of rainfall, game bird harvest has been restricted. The number of birds shot has declined and is reflected in the summary numbers provided in Figure 34.

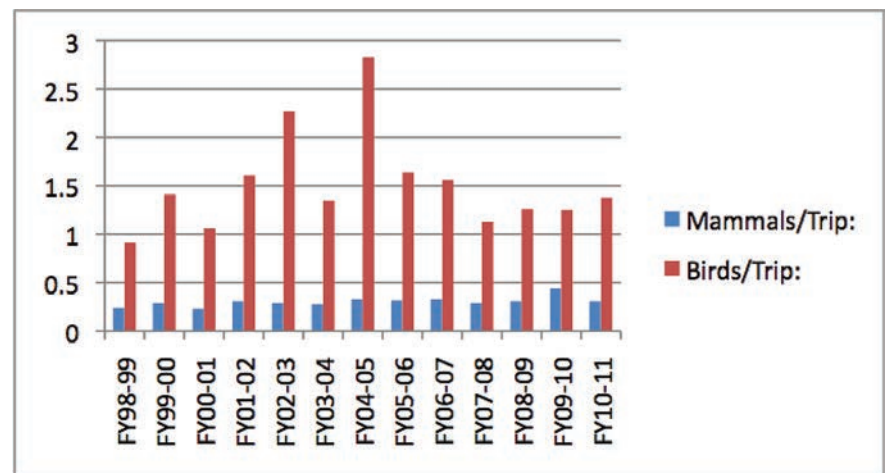
Hunting may not be the most efficient method to secure food from a simple cost-versus-benefit point of view. Figure 35 displays DOFAW data related to the average harvest of game animals per trip. Although the value of the hunted meat may not be competitive with the cost of meat in the marketplace, there are other important values



*Hunting is a part of life in rural Hawai'i (Photo courtesy of Orion Enecencio)*



**Figure 34: Game Birds Harvested from Public Lands (Source DOFAW)**



**Figure 35: Animals harvested per hunting trip on Hawai'i Island, (Source DOFAW)**

associated with hunting activities. Camaraderie, recreation, environmental awareness, voluntary management of feral species and sportsmanship are just some of the broader community benefits associated with hunting.

## 7 Hawai'i Island Honey Bees

Honey bees are important to Hawai'i Island's food self-sufficiency in several ways:

- Bees are pollinators of agricultural crops and contribute to the production of several important Hawai'i Island crops including macadamia nuts, coffee, tropical fruit and certain types of truck crops, such as melons and squash. The farm gate value of honey bee-pollinated produce in Hawai'i exceeds \$218 million per year.<sup>57</sup>
- Beekeeping provides commercial and backyard honey production for both local and export sales. Hawaiian honey is some of the most sought after and valued honey on the global market, estimated at more than \$1 million per year.

Queen bees are bred in and sold commercially from South Kona to support pollination and agriculture in Canada and the mainland United States. Hawai'i is one of the largest producers of queen bees in the world and its unique year round temperate climate can produce queens at times when they are most needed to repopulate commercial hives elsewhere in the world.

### Historical Background

Honey production in Hawai'i dates back to 1857 when the first bee hives were successfully shipped to O'ahu from the west coast of the U.S. The first commercial venture began in 1895, with the first export of honey and beeswax occurring in 1897. Within several decades, Hawai'i's mild climate and year-round flowering plants proved to be a good place to produce honey commercially. Early production was primarily an export crop and much of it was shipped to Germany and the U.S. mainland. The next large growth of the beekeeping industry was spurred on by ranching interests, including Parker and Hind Ranches. The large kiawe forests on the leeward coast required pollination to produce kiawe beans as high nutrient feed for cattle.<sup>58</sup>

In 1907, the first association of beekeepers was organized to advance the interests of the emerging industry. One of its first acts was to work with the Territory to end the import of new bees to Hawai'i as a protection from bacterial diseases which were devastating beekeepers in other regions. American Foul

Brood attacks developing bee broods and requires destruction of infected hives to prevent further spreading of the disease. It was accidentally introduced to Hawai'i in 1930<sup>59</sup>. The impacts of the disease, coupled with the collapse of honey prices during the Great Depression, resulted in the end of the industry by about 1935, followed by a slow rebuilding period.

Honey production on Hawai'i Island eventually grew to include ohia lehua, macadamia nut, Christmas berry, and other plant species. In 1970, the largest honey operation in the Islands was located in Pu'uana'hulu in North Kona. In 1973, this operation was bought by a major national honey producer, Powers Apiaries Inc., and moved to Kealahou in South Kona. The area around Kealahou Bay remains the center of economic beekeeping operations on the Island and is one of the largest in the Pacific Basin.

Products from the hive take several forms. There are several large producers that export honey in large volume containers to markets in the U.S. and elsewhere. Others market smaller value-added products for both local consumption and export as specialty Hawaiian products. Honey producers also sell beeswax, a by-product of honey harvests. Yet one of the most valuable products of Hawaiian beekeeping is the production of queen bees. Queens are bred and reared for shipment to honey produc-

ers internationally, to increase hive numbers and maximize productivity in the early spring as crops requiring pollination come into bloom around the world.

### Native Bee Species

There are 62 known species of native bees in Hawai'i and they occupy niches from sea level to over 10,000 feet in elevation primarily pollinating native plants. Hawai'i's native bees do not gather in hives, nor do they produce honey that could be used for human consumption. The quantity of native bees is small in comparison to the number of managed bees and several of the native species are candidates for the Federal Endangered Species List. Certain species of native bees suffer from loss of habitat as native plants decline. Some scientists have suggested that competition from introduced honey bees may have an impact on the viability of native species. More research is needed to confirm this claim. In any event, native bees are not as likely to pollinate the plants used as food crops, which are also introduced species. Native bee species do not appear to be impacted by the current suite of pests that are impacting the commercial honey bees.



*Kiawe forests are desired for gourmet honey production*

<sup>57</sup> Number provided by DOA bee staff

<sup>58</sup> A History of Honey Bees in the Hawaiian Islands, posted on Hawai'i Beekeepers Website: <http://www.HawaiiBeekeepers.org/history.php>

<sup>59</sup> Ibid



## **Current Status**

In March of 2007, the varroa mite, one of the most damaging pests to honey bees worldwide, was first detected on O'ahu. By August of 2008, it was discovered on Hawai'i Island. It is now widespread on both Islands and has contributed to the collapse of many hives. Following the introduction of the varroa mite, the Small Hive Beetle was also discovered in Hawai'i. Together, these two new pests, a gut parasite, and several viruses that are vectored by the mite, have produced a crisis in the bee industry that is certain to reshape the practices and viability of both the commercial and backyard beekeepers statewide. Managed and feral hive counts have fallen dramatically in recent years and the amount of time and expense to manage healthy hives, and to keep them alive, has increased substantially. Growers, who paid no mind to pollinators, now notice a silence of their blooms; where there were many bees, there are now few or none.

The NASS 2007 Census on Agriculture indicated that there were 161 beekeeping operations on Hawai'i Island with 13,240 hives producing 764,963 pounds of honey. The value of commercial honey sales at the national average of \$1.50 per pound is approximately \$1,147,000, although most Hawaiian beekeepers sell their honey at a premium, as a value-added prod-

uct, usually for \$5 to \$40 pound. Beeswax and queen sales are in addition to these honey sales, and may at least double that value. Statistics on non-honey revenues are not available due to proprietary protections for the small number of producers.

Figure 36 provides a simple graphic to display the vegetation types on Hawai'i Island that contribute to viable honey bee habitat. Portions of the industry utilize agricultural crops such as macadamia and coffee farms to collect their honey; other portions situate bee hives to take advantage of both native and non-native vegetation during their flowering cycles. The red line on the map indicates, generally, where hives might be placed on public and private lands to collect honey. The average range of a bee from the hive is approximately 2.5 miles.

Actions that would help to strengthen the role bees play in food self-sufficiency:

- Continue to fund State initiatives aimed at supporting the bee industry and addressing the impacts of introduced species that threaten bee populations.
- Increase vigilance to prevent further introduction of species that threaten bee populations.
- Educating farmers to avoid the application of chemicals on crops when the bees are most active.



Figure 36. Honey Bee Resources



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## 8 Issues that Impact Increased Food Production

The following is a list of some of the key issues that have an impact on food self-sufficiency in Hawai'i County. Each has its own unique impact and most of them are interrelated in some fashion. Each deserves ongoing attention and, where appropriate, new policy directions to address their implications on local food productivity.

### 8.1 Energy Costs

Global energy prices and has a systemic impact on the food industry. The costs of fertilizers, feed, equipment, transportation, packaging and chemicals all increase as the cost of energy rises. If current trends continue many local business models will collapse under the weight of energy costs.

The price of electrical and liquid fuel energy on Hawai'i Island has eroded both the capacity of farmers to produce food and for consumers to purchase it. This trend will continue until there is significant progress in the production of energy from local, non-fossil fuel sources. Geothermal development, in particular, offers the opportunity to eventually decouple the price of base-load energy from the rising cost of fossil fuel. County, State, and private support is needed to move geothermal development forward as quickly as possible and to insure that the benefits of lower priced energy accrue to local residents.

Alternative energy from other sources, including farm waste, hydro, wind and solar energy are other ways to mitigate the rising cost of energy. Investment tax credits, low-interest loans, and other incentives are useful to propel alternative energy investments in farm, ranch, and processing ventures, which will help to promote food self-sufficiency. Reducing the price of energy embedded in food production will reduce the cost of local food, making it more competitive with the cost of importing food.

### 8.2 County Real Property Taxes

Hawai'i County Agricultural Use Rate Assessments and Agricultural Dedication Programs are intended to help mitigate the cost of rising real estate values on the property taxes of farm and ranch operators. These programs are the largest single financial benefit offered to the farm and ranch communities by county tax payers and amount to over \$34 million dollars in adjusted tax collection annually. These tax policies are critical for the support of bonafide agricultural operations that could not operate if taxes were assessed based on current market assessed values.

The current agricultural Use Rate and Dedication programs was initially designed to serve a type of large scale plantation

agriculture that we no longer have on the island. The transition from large landowners to smaller lot, diversified ownership presents new challenges to insure that decentralized agricultural uses are still occurring and accomplish some larger public purpose. As currently implemented, these programs have no mechanisms requiring landowners to submit periodic evidence that productive agricultural activity is still occurring. The current system also assign the lowest assessment rates to landowners who do the least amount of regular farm work on their property by installing exterior fencing and stock water for pasture use. Landowners who work to produce commercial food products for the local market are taxed at a higher rate. It might be appropriate to update these programs so that they incentivize landowners to seek qualified farmers and ranchers to increase local food production on their property. Another option would be to consider ways that landowners could report farm revenue annually by providing evidence of General Excise taxes paid from agricultural activities or to provide receipts of food donations to the Hawai'i Island Food Basket or other safety net programs.

Real property tax policies are clearly the biggest tool in the County's tool box with which to encourage new food production and to support the ongoing contribution of real farmers and ranchers islandwide. There is also a complex web of issues and politics that surround these programs that will need to be navigated responsibly so the system can be applied islandwide and help to shape a new era of rural land use.

### 8.3 Food Safety

Federal legislation and market trends conspire to lift the bar for insuring food safety on farms and food processors. This is in reaction to several recent public health incidents resulting in the spread of pathogens in the nation's food supply. Locally, occurrences of Rat Lung disease resulting from snail and slug contacts with leaf crops, has made some consumers afraid to buy their vegetables from small local producers. Food safety is a real issue, both nationally and locally. Large retailers are adopting policies that require food safety certification from their suppliers and have had to invest heavily in their own food handling protocols.

Some of the food safety certification requirements have significant cost implications for farmers. Capital investment in packing facilities and strict record keeping are two major areas of concern. The State of Hawai'i is considering formal food safety regulations and there is heightened concern expressed by many small farmers that the rules will force them out of business.

Food Safety is an issue with far reaching implications for local food self-sufficiency. All farmers need to commit to providing

clean, pathogen-free food for the public marketplace. Retailers, distributors and government agencies need to work with farmers to establish reasonable standards of cleanliness and accountability. Consumers also need to take responsibility for handling, washing, and preparing foods regardless of where they come from.

New food safety regulations and the need for food producers to adhere to best management practices is a fair expectation for consumers. Since so much of Hawai'i Island's food production is done by small farmers, it will be important to have their voice at the table as regulations are crafted and best management practices are defined.

## 8.4 Access to Capital

Investment capital is an essential ingredient in the expansion and development of new food production initiatives. Commercial banks and other lending institutions see farming, ranching, aqua-culture and other food producing activities as inherently risky and seek very limited portions of their investment portfolio in these sectors of the economy. This leaves smaller commercial scale farmers with few options for new capital to support business growth, address new food safety requirements or maintain existing infrastructure. Government loans and other assistance programs fill part of the void left by the absence of other commercial financing options. A renewed commitment by local financial institutions to invest in local food production and to mentor farmers as important community assets would go a long way to building the financial support that increased local food production will require.

## 8.5 Agricultural Labor

The average age of farmers in Hawai'i continues to increase and there are few young people entering the field. This is a serious problem for food production in the future. Tax payers make significant annual investments in University agricultural programs and in farm outreach, yet farmer shortages persist. There is a disconnect between the need for new farmers and the ability, or willingness, of young farmers to enter the industry. This has been an issue for many years. There are several innovative efforts underway to seek and retain new local farmers. There is also a need to help grow farms into enterprises with improved mastery of their markets and the ability to produce strategically in a competitive environment.

From an historical perspective, virtually all of Hawai'i's agricultural success since the late 1800's has been driven by immigrant labor. This reliance on immigrant labor is still true today. Most of the papaya production, macadamia field work, coffee picking, or truck farm labor is done by first or second generation immigrants. Hawai'i needs to keep its doors open to immigrants who want to farm and to provide outreach pro-

grams in multiple languages to help them apply best management practices and thus grow their businesses.

Agriculture is a labor intensive business. Hawai'i's agriculture needs a steady supply of both farm labor and entrepreneurial leadership in order to thrive. Efforts to insure both are essential elements needed to propel local food self-sufficiency.

## 8.6 Organic and Natural Farming

Organic farming and ranching requires a commitment to avoid imported chemical inputs and to harness the power of natural systems to sustain soil fertility and control insects and other pests. There are currently 56 certified organic farms on Hawai'i Island utilizing 846 acres, plus several organic pasture operations with another 1,200 acres<sup>60</sup>. The Korean Natural Farming method is another non-chemical approach to harnessing the productive power of indigenous micro-organisms (IMO) in soil to promote plant growth and soil health. There may be as many as 100 practitioners of this approach on the Island.

These farming approaches are a growing part of Hawaiian agriculture. They seek to enhance soil fertility without the importation of expensive chemical fertilizers, and to fend off plant diseases by managing a more holistic mix of factors that promote farm health. Organic and natural farmers practice a high level of land and soil stewardship that can insure long term farm productivity. The future of organic and natural farming initiatives on Hawai'i Island will hinge, in part, on the support consumers provide by purchasing organic products and by the availability of informed farm extension services and supporting research to aid in organic farming successes.

## 8.7 Price of Local Foods

Much of Hawai'i Island's agricultural production is sold as boutique products to markets that have the means to pay premium prices. Local coffees, macadamia nuts, chocolate, vanilla, and exotic fruits are produced for high-end or export markets. These are niche products to be sold to people who can afford their boutique pricing. Other local products, like beef and most vegetables, compete in a more competitively-priced commodity market and must either absorb higher input costs or charge more for their product in the local marketplace.

A December 2011 study of Honolulu consumers commissioned by the Ulupono Initiative, found that "consumers across O'ahu strongly believe local food is important, they don't think there's enough available; and they are willing to pay more for local food." They also found that "price is important but not the only thing. Freshness as well as trust in local busi-

60 Hawai'i Organic Farmers Association (HOFA) website based on a summary of listed certified organic producers



nesses are also important.”<sup>61</sup> This is good news for local food producers; it suggests that there is reasonably strong consumer support for locally produced foods, even at a small price premium.

In a University of Hawai'i at Hilo student study conducted in East Hawai'i in 2011, it was found that price differences between local and imported foods varied depending on the product. In some cases, local produce like pumpkin, tomato, and avocado were less expensive than mainland imports. Other local products such as lettuce, carrots, and oranges were often more expensive. With a relatively small sample size, it was estimated that for 20 commonly purchased food items, the average price differential for local produce was approximately 17% higher than imports.<sup>62</sup> Prices rise and fall from day-to-day, so this number will vary. There were also clear indications that shopping in farmers markets in East Hawai'i produced the best price advantage for local produce. Taking advantage of opportunities to buy direct from local farmers is one way to reduce the cost of local produce.

Pricing for local food products will continue to be an issue for farmers and consumers. Fortunately, there are values at work in the local marketplace that place a premium on freshness, shelf life and the benefits of supporting local businesses. Still, farmers need to aim at market price parity and not assume that this local advantage will persist as the price of all goods and services continues to rise.

## 8.8 Consumer Preferences

Consumers are the biggest driver in the local food self-sufficiency movement. Their preferences help dictate what retailers provide. Yet most consumers have little understanding about seasonality, for example. Consumer demand for fruits and vegetables during off-season periods helps to secure the role of imports and heightens competition for certain products year-round. The tendency to pick perfect looking produce and avoid blemishes encourages waste and benefits large market sources and uniform genetics. Preferences for branded and processed foods also compete with fresh and local alternatives; just as mainland-fattened, marbled beef competes with leaner, healthier local grass fed options.

The cartoon philosopher Pogo said, “We have met the enemy...and he is us.” Consumer preferences drive the marketplace and the powerful forces of large corporate agriculture and international food processors have invested heavily in marketing to shape buying habits. If Hawai'i is to become more food self-sufficient, consumers will need to use their

food dollars wisely and ask their grocers to bring more local products to their shelves. A stronger market for local food will help to reshape the retail marketplace and create opportunities for farmers and ranchers to play a bigger role in feeding Hawai'i's residents.

## 8.9 Genetically Modified Organisms (GMO)

There is significant debate about the value and safety of the genetic modification of crops in the global food system. The capacity to induce unique qualities, rigor, or disease resistance into the genetic structure of food products has prompted new food production techniques worldwide and fostered debate about the long term safety and the unintended consequences of manipulating natural genetic codes. There are significant passions embedded in the argument from both sides of the discussion and pressure for, among other things, labeling requirements to inform consumers about the presence of GMO materials. GMO technology has had important impacts on the local papaya industry and has also prompted significant resistance when proposed for taro and coffee. This is an issue that requires ongoing research and that will be debated for decades. Hawai'i Island is not likely to be able to wall itself off from this global issue. With proper disclosure, local consumers do have an influence on the kinds of food they chose to consume, or avoid.

## 8.10 Food Data Collection

Due to budget cuts, the State abandoned much of its agricultural data collection in 2008. This decreased capacity to monitor progress towards increased food self-sufficiency. The State needs to strategically rebuild its agricultural data collection capacity and to organize the data in a way that will assist local residents to monitor progress towards food self-sufficiency in a format that helps to focus the collective conversation on areas of production that Hawai'i can actually hope to make progress in. Given the diversified nature of modern food delivery systems and informal networks, there is a need to revisit what kinds of data are truly useful to collect, both for the use of the public to monitor progress towards food self reliance goals and for farmers to help them improve their market penetration and inform business decision making. Refining and adapting the Food Self-sufficiency Scorecard in this report may be one way to deploy a simple graphic framework for displaying progress in the future.

61 Local Food Market Demand Study of Oahu Shoppers, Ulu pono Initiative and OmniTrak Inc. December 2011

62 A Comparison of Local and Imported Foods in East Hawai'i Markets, Alexander White, UHH Department of Geography and Environmental Sciences, 12/2011

## 8.11 Land Use Regulation

Many conversations about preserving and promoting local agriculture start with a discussion of land use regulation and the need to formally designate important agricultural lands to prevent them from being developed and taken out of agricultural production. This has been a statewide concern, prompted in large part by the pressure of urbanization on the high quality A and B class soils in the central plain of O'ahu or on the south shore of Kaua'i, where some of the State's most productive farm land is located. This tension between farming and urban growth is not prevalent on Hawai'i Island, where growth patterns are more diverse and often occur on lands that have no practical role for agriculture. Real estate pricing has had an impact on who can afford to own agricultural land, but that is a different issue and is unaffected by important agricultural land designation.

The art of effective land use regulation is to understand the nature of the problems Hawai'i Island faces and to design both regulations and incentives to direct desired changes. On

Hawai'i Island, agriculture comes in many forms and is best viewed in its regional contexts where the details of available resources, climate, trends, and people can be most clearly understood. If the goal is to propel farming, and food production in particular, government needs to adopt a management approach that facilitates production, encourages new agricultural ventures, and addresses the needs of farm and ranch communities to remain productive in the future. One-size-fits-all regulatory solutions are counterproductive and often mask the important steps required to encourage new investment and diversification in the agricultural sector.

Regulatory issues extend to the building permit processes as well. The time and costs required by farmers and ranchers to meet the high standards modern building codes and to engage in long bureaucratic processes with regulators has an erosive effect on the viability of farm activities. Protecting public health and safety is an important goal and something the regulatory community needs to balance with the risk and cost associated with the need for simple, cost effective improvements to support farm activities.



## 9 100 Ways to Increase Food Self-sufficiency

The following is a list of ideas and actions that were collected during the process of preparing the Hawai'i County Food Self-sufficiency Baseline study. Collectively, these suggestions reinforce the fact that Food Self-Sufficiency is everyone's kuleana. The challenge goes deeper than just adding farm acres and increasing local production. Food Self-sufficiency requires some fundamental rethinking about how we interact with the food that we eat and how we value the local economic and nutritional value of a locally produced diet. This is an evolving list and one that should be added to by everyone who reads it.

### Where are the sweet spots?

### Which ones have a cascading effect on other actions?

### Which small actions can lead to bigger outcomes?

#### Consumers

- Learn to eat the food products Hawai'i already produces
- Look for, and purchase, locally grown food products in the market place
- Ask your retailers and restaurants to carry and clearly mark locally produced foods
- Prioritize "local" over "looks". It is what is inside the fruit that counts
- Adjust buying habits to accommodate local crop seasons
- Take personal responsibility for food safety; wash and handle food correctly, regardless of where it comes from
- Learn more about the farmers and ranchers who produce the food you eat
- Patronize restaurants that highlight the use of local food products and the creative use of Island resources
- Shop at Farmers Markets for farm fresh produce and new food ideas
- Increase purchasing of organic products to reduce the use of chemicals and imported fertilizers
- Look for and support CSA (subscription farming)

#### Institutional Buyers

- Adjust procurement methods to accommodate local purchasing
- Develop purchasing patterns to accommodate local seasonality
- Partner with local producers or groups of producers to help provide a consistent, seasonal supply of local meat and produce
- Help to develop the market for local staple foods like sweet potato, taro, 'ulu, banana, and coconut
- Promote "farm to fork" connections in advertising and on the menu

#### Restaurants

- Utilize local produce and meats in food preparation
- Continue efforts to promote Farm to Plate cuisine and to highlight the use of local ingredients on menus and in special programs
- Work with farmers and ranchers to develop sturdy supply networks for consistent, quality products year round

#### Food Retailers

- Continue efforts to deliver and label local meats and produce
- Highlight local farmers and ranchers in brand marketing
- Provide stable markets for local producers and coach to enhance product safety, quality and consistency
- Promote local food in the marketplace
- Carry locally produced organic produce
- Support innovation and new products using local ingredients
- Offer table tastings in store for local products
- Place local foods in a central, visible location

## State Government

- Develop a Food Self-sufficiency Baseline for the State of Hawai'i to help focus efforts and measure progress towards improved Food Self-Sufficiency statewide
- Continue support of Buy Local campaigns
- Develop institutional buying practices for State purchasing that encourage the use of fresh Island produce, meat, fish, and eggs
- Ensure that State-owned agricultural lands are as productive as they can be, with an emphasis on food production where it is feasible.
- Increase vigilance at harbors and airports to stem the flow of pests and invasive species that undercut local food production
- Support Hawai'i-based food safety initiatives and provide investment incentives and loan programs to help farmers fund best management practices
- Support programs that mitigate high shipping costs for grains and other inputs that undercut the viability of local poultry, pork, and beef production
- Develop new irrigation systems, where feasible, and support irrigation improvements on both State and private systems that will result in increased land available for local food production
- Create a fund for strategic investments aimed at local poultry, dairy, meat, vegetable, and fruit production and processing, including food enterprise incubators, diversified agriculture processing facilities, and small farm improvement funding
- Support the pursuit of alternative energies that will mitigate the cost of fossil fuels on local agriculture and consumers
- Explore technologies to produce non-fossil fuel based fertilizers
- Expand agricultural extension programs aimed at building Hawai'i's base of small farmers and backyard food producers
- Promote the use of local staple foods including sweet potato, taro, 'ulu, banana, and coconut

## County Government

- Continue financial support for Buy Local campaigns
- Continue to support community-based initiatives that build local food system capacity
- Practice Buy Local in County food purchasing
- Revisit the County's Real Property Tax policies related to Agricultural land use to insure that public tax incentives for agricultural land use result in actual public benefits and promote local food production where possible
- Expedite building permits for minor farm structures and water tanks
- Support affordable housing on or near farms for farmers and farm workers
- Support layering of agricultural and non-agricultural uses (like agrotourism) on agricultural lands to improve the economic viability of farms and ranches
- Develop individual strategies to enhance new food production with the Core Lands where farm activities are most active
- Enable the construction of commercial kitchens that will be available for value-added processing of agricultural products
- Maintain an agricultural specialist on staff to interface with the agricultural community and to broker support to address local problems and opportunities
- Research County initiatives and laws across the U.S. that have removed barriers and added incentives to redevelop local food systems
- Support the pursuit of alternative energies that will mitigate the cost of fossil fuels on local agriculture and consumers
- Support efforts by farmers, food brokers, wholesalers, and landowners to locate marshalling yards and food packing and processing facilities to serve regional farming needs
- Create an integrated permitting system that will approve a whole farm plan at one time and allow several years to complete



## **Department of Education**

- Expand institutional buying for local fresh fruits and vegetables for breakfast, lunch, and snack programs
- Continue to expand support for school gardens as a context for learning about local foods and the practice of agriculture
- Provide funds to coordinate and expand the role of school gardens and agriculture in the school system
- Develop a track from high school to the community college that provides future farmers with business skills
  - Implement the federal Wellness Policy mandate for local schools to set goals for improving nutrition and increasing physical activity.
  - Create a pilot project in one school kitchen on Hawai'i Island to pioneer the use of locally-sourced foods for school lunches and snacks

## **University of Hawai'i**

- Conduct research focused on the practical issues of Hawai'i food production
- Work closely with farmers to ensure that practical information is available
- Develop farmer training curriculum to be delivered near farm communities and in multiple languages
- Encourage the use of local foods in culinary training programs and publish recipes that support the use of local food products
- Invigorate 4-H type programming and develop new farm and outreach programs for all ages.
- Develop an extension service marketing program to build the skills of agricultural producers in how to commercially market their food products
- Support local farms and ranches by incorporating local foods into cafeteria menus and highlighting the local producers whose food is being served
- Utilize the teaching capacity of the UH Experimental Farm to educate students commercial growers and community members about innovations in home and commercial food production

## **Farmers**

- Participate with other farmers and processors in co-operative efforts to assert farm interests, organize bulk purchasing programs and share marketing and distribution efforts
- Grow crops that help to replace existing food imports
- Explore new crops and traditional targeting import replacement and the expansion of local products in the marketplace, including staple foods, animal feed, fertilizer, and biofuel stock crops
- Be creative – explore new methods and markets
- Control cost where prudent
- Diversify the farm revenue stream, plan for year round income and build diverse markets
- Explore direct sales to consumers as a means to increase farm revenues and reduce costs to local consumers
- Employ Best Management Practices (BMP's) to insure that produce is safe and free of pathogens
- Install alternative energy technologies in farm and processing facilities to reduce dependency on the rising cost of fossil fuels
- Help to teach new farmers and farm laborers about the business of farming so they can replace the current aging farmer population
- Utilize available assistance programs to improve farm practices
- Explore hydroponics
- Investigate Farm Conservation Programs

## **Ranchers**

- Sustain efforts to increase the availability of grass-fed beef and other meats in the local market place
- Support local processors and invest in efforts to expand production for local sales of beef, lamb, mutton, and pork
- Install pasture improvements to enhance forage production and management
- Improve existing agricultural water sources
- Install more water storage capacity
- Utilize financial and technical assistance programs to improve ranch operations.

## **Fishermen**

- Fish Today for Fish Tomorrow. Practice conservation and teach it to your children
- Consider fuel cooperative and/or alternative fuel options to reduce costs
- Expand on-land fish production through aquaponics and hydroponics
- Participate in public resource protection initiatives like tag and release and catch data collection, to help better understand and monitor local ocean resources
- Follow existing fishing regulations (DAR regulations: <http://Hawaii.gov/dlnr/dar/regulations.html>)

## **Food Processors and Distributors**

- Develop sustained relationships with farmers to insure product quality, consistency, and competitive value
- Brand local products clearly
- Support efforts to process off-grade produce into new products
- Work with USDA Fruit and Vegetable Program (FFVP) Schools to provide locally grown, fresh fruits and vegetables for local school snacks

## **Large Landowners**

- Make it a priority to have food produced on some portion of available land with sufficient lease term and rents to enable sustained farm investment
- Encourage sustainable farming practices
- Enable and assist farmers to install farmers improvements that will improve farm productivity and food safety
- Encourage farmers and ranchers to utilize government programs to improve farming practices
- Assist in the upkeep of water, roads, and other infrastructure that may be depended on by productive farm lessees
- Co-invest in new farm infrastructure to support farm growth
- Assist farmers to improve farm security and reduce farm theft.

## **Small Landowners**

- Make it a priority to have some portion of your property planted in fruit trees and household gardens to supplement household consumption
- Lease or invite others to produce food on lands that are otherwise idle
- Share surplus production with your neighbors, friends, feeding programs and Food Basket
- Grow nitrogen-fixing tree and cover crops to nurture the soil
- Process and preserve surplus foods through pickling, dehydrating, canning, smoking, freezing, or fermenting

## **Parents**

- Commit time regularly to produce some portion of your family's food consumption through harvesting, gardening, fishing, or hunting,
- Practice cooking local foods with your children and their friends
- Practice "Buy Local" and teach your children the value the cultural, nutritional, and economic benefits of fresh local food
- Prepare a family meal weekly using only locally produced foods
- Get to know your local farmers
- Encourage school fund raisers to promote local products
- Volunteer time in your children's school gardens
- Increase the amount of food on hand for emergencies
- Advertise local foods with bumper stickers and t-shirts... then Walk the Talk

## **Children**

- Choose local fresh fruits and vegetables for snacks
- Learn to prepare local produce and share recipes with friends and family
- Participate in School Garden programs or ask your school to start one
- Encourage your family and friends to eat more local, fresh foods
- Encourage your family to start a vegetable garden, either in the ground or in pots
- Plant fruit trees in your yard



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## APPENDIX A - List of People Contacted and Contributing to this report

### Food Self Sufficiency Baseline Contact List

Peter	Adler	Hawaii Agricultural Mediation Program; Accord 3.0
Earnest	Alfonso	Waimea Ditch system manager, DOA
Quirino	Antonio	DWS Manager
Vivienne	Aronowitz	Kaiser Permanente, Slow Foods Advocate
Steven	Arrujo	Pig Hunter, former pig farmer
Larry	Balberde	Hāmākua farmer
Lisa	Barton	Laupahoehoe Train Museum
Lori	Beach	Hāmākua Farmer's Coop
Bill	Beach	Hāmākua Farmer
Melanie	Bondera	Kohala Center, Cooperative Program
Melissa	Bos	Conservation International: Hawaii Isl program director
Brandy	Boudet	Parker Ranch, land manager
Madi	Brunner	UH Manoa DURP GIS specialist: Kauai IAL project
Jim	Cain	Waipio kalo farmer, New Farmer Development Program
Rick	Chalmers	Meadow Gold Hilo
Betsy	Cole	Kohala Center
Mark	Crawford	Mac Farms
John	Cross	Edmund Olson Trust, land manager in Ka and Hāmākua
Tane	Datta	Adaptations, county Ag commissioner
Kyle	Datta	Ulupono Initiative
Andrea	Dean	Sustainability consultant
Keith	Dela Cruz	Hilo Farmer's Market
Steven	Dias	Hāmākua Ditch supervisor, DOA, Hāmākua Farmer
Carry	Dizon	Big Island Bee keepers Association President
Kaeo	Duarte	KS Hawaii Island Region Manager
Michael	Dupont	CTAHR Extension Agent, livestock and natural farming
Tom	English	WH Shipman
Scott	Enright	Former ADC member, O'okala resident, Deputy director DOA
Rory	Flynn	Sun Fuels
David	Fuertes	North Kohala educator, farmer
Glen	Fukumoto	UH CTAHR Pasture specialist: Kealakekua
Michelle	Galimba	Kuahiwi Ranch, Ka'u, Board of Ag Member
Adil	Ghiasi	Paradise Kava Co
Mike	Gibson	Hāmākua Harvest
Dennis	Gonsalves	Director USDA Pacific Island Research Center
Meg	Greenwell	Choicemart
Tom	Greenwell	Greenwell Farms
James	Greenwell	Palani Ranch, Cattlemen's Assoc



Richard	Ha	Hāmākua Springs owner
Randy	Hamasaki	CTAHR Extension veg crops
Bob	Hamilton	Hula Brothers owner tropical fruit grower
Susie	Hamilton	Plant-it Hawaii, owner
John	Hanson	Bee Beekeeper, consultant
Marah	Hardt	Ocean researcher
Marisa	Harmon	KS E. Hawaii Land manager
Leslie	Hill	Paradise Plants, Hāmākua Farmer
Jim	Hoillier	DOA Extension in food Safety
Dayday	Hopkins	COH R&D Ag Specialist
Kevin	Hopkins	UHH PACRC aquaculture
Mark	Hudson	USDA NASS Field Office
Julie	Hugo	Hawaii Island Board of Realtors , President
Brenda	Iokepa-Moses	Olson Trust; Ka'u
Jim	Jacobi	USFWS
Keoki	Kahumoku	Pig Hunter, wild pig processor
Leanora	Kaiaokamalie	Kauai Planning Dept, planner IAL project
Bull	Kailiawa	Ka'u coffee farmer
Neil	Kanemoto	Pacific Island Fisheries Group non-profit, POP Marine
Dru	Kanuha	KS Intern, Ulu Festival
Guy	Kaulukukui	DLNR Deputy Director
Christian	Kay	Hawaii County Planning, Hāmākua CDP
Perry	Kealoha	Kamehameha Schools, Kona Land Manager
Kanani	Keliikoa	DWS Information Officer
Troy	Keolanui	OK Farms, S. Hilo
Mark	Kinoshita	Hoea Ag Park, North Kohala farmer
Derrick	Kirisu	KTA Mountain Apple Brand
Russell	Kokobun	DOA Chairman
Randy	Kurohara	COH Research and Development Director
Thegn	Ladefoged	Univ. of Auckland archaeologist, pre-contact food print
Kraig	Lee	Ariana Farms, coffee farmer, Kona ag realtor
Bobby-Jean	Leithead-Todd	County Planning Director
Pingsung	Leong	CTAHR Ag Economist
Diane	Ley	USDA Farm Service Agency, Hawaii director
Reese	Libby	NRCS GIS specialist
Matthew	Loke	DOA/CTAHR Agricultural Economist
Ken	Love	Tropical Fruit Grower, advocate
Susan	Maddox	Friends of the Future Waipio Circle Facilitator
Karl	Magnacca	Native Bee expert UHH
Jill	Mattos	Hawaii Beef Producer, Pa'auilo slaughter House
Joey	Mello	DOFAW, East Hawaii hunting

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Tom	Menezes	Farmer South Hilo
Peter	Mills	UHH Anthropology, archaeologist
Nicole	Milne	UHM PhD candidate, Hāmākua farm resource person
Loren	Mochida	WH Shipman Ag manager
Jason	Mock Chew	Waipio Taro farmer
Russell	Nagata	CTAHR Extension Service
Bobby	Nakamoto	PuuKapu vegetable Farmer: Vacuum cooling Plant
James	Nakatani	Former DOA Deputy Director
Julia	Neil	Ka'u Calendar publisher
Lorie	Oba	Rusty's Hawaiian Ka'u Coffee, county Ag Commission
Edward	Olson	Olson Trust, Ka'u, S. Hilo landowner, ag investor
Mahina	Patterson	UHH student intern
Delan	Perry	Puna Papaya farmer, Water Board Member
Lani	Petrie	Kapapala Ranch
Georgia	Pinski	Downtown Improvement Association
Kathy	Pomeroy	County Ag commission Chair
Garner	Puett	Big Island Bees
Tom	Pulusak	ChoiceMart produce buyer
Ted	Radovitch	CTAHR Organic program
Collette	Rapoza-Yamamoto	COH R&D Librarian
Nancy	Redfeather	Kohala Center, School Garden Network
David	Reitow	Agro Resources, Macadamia Association President
Sally	Rice	Agro consultant
Tim	Richards	Kahua Ranch/Cattlemen Association
Monty	Richards	Kahua Ranch
Christine	Richarson	North Kohala Community Resource Center
Peter	Risley	North Kohala Farmer
Chris	Robb	Robb Farms , Organic vegetable farmer, Lalamilo
Rick	Robinson	Farm Bureau, Kona
Tom	Ruff	Rivertop LLC, ag waste treatment
Craig	Severance	UHH Professor in Marine Biology
Hans	Sin	DOFAW hunting program, Waimea
Stanley	Sitco	COH Real Property Tax Administrator
Richard	Snitzler	Hāmākua Macadamia Co CEO
Richard	Speigle	Volcano Honey owner
Bill	Stiener	UHH Nat'l Resources and Forestry
Wayne	Subica	Retires NRCS, Hilo historian
April	Suprenant	COH Planning Long-range Division
Roy	Takemoto	PBR Hawaii: Hāmākua CDP
Pedro	Tama	Home Garden Network
Nimr	Tamimi	Atebara Potato Chips, S. Hilo farmer, engineer



Eric	Tanoue	Green Point Nursery, County Ag Commission
David	Tarnes	Malama Kai Foundation, Hoesa Ag Park, County Ag Commission
Randy	Teruya	DOA Ag Irrigation systems Manager
Morgan	Toledo	Waipio taro grower, poi maker
Grant	Tomita	DOA Milk Control Program Specialist
Lorna	Tsutsumi	UHH School of Ag bee person
Nick	Turner	UHH grad GIS support
Pono	Von Holt	Ponoholo Ranch
Bill	Walters	WH Shipman
Debbie	Ward	Hawaii Organic Farmers Assoc
Coralee	Watters	Asst. Prof UH Manoa, Family Nutrition
Eric	Weinert	CalAvo
Drake	Weinert	Natural Farming practitioner
Kaika	Welch	Dragon Eye Learning Center: sustainable Farming
Stephen	Wheat	Alembic Int'l food distributor in Hāmākua
Alex	White	UHH Intern
Ron	Whitmore	Hawaii county Planning, Ka'u CDP
Lyle	Wong	DOA
Keoki	Wood	Parker Ranch stock manager
Chris	Yuen	N. Hilo Farmer, former Planning Director
Susan	Yugawa	UHH Graphics Department

## Appendix B. Department of Agriculture, Statistics on Fresh Fruits and Vegetables in 2008 and 2009



### MARKET SUPPLY: FRESH VEGETABLES

#### MARKET SUPPLY: Fresh Market Vegetables, State of Hawaii, 2004-2008 <sup>1</sup>

Commodity		2004	2005	2006	2007	2008	Hawaii market share 2008
----- 1,000 pounds -----							Percent
Beans, snap:	Inshipments	531	619	592	460	<b>540</b>	
	Hawaii	900	700	600	700	<b>700</b>	<b>56</b>
Bittermelon:	Inshipments	66	149	108	123	<b>74</b>	
	Hawaii	250	250	180	150	<b>140</b>	<b>65</b>
Broccoli:	Inshipments	5,478	5,794	5,830	5,535	<b>5,205</b>	
	Hawaii	500	600	330	390	<b>360</b>	<b>6</b>
Burdock:	Inshipments	82	94	79	73	<b>71</b>	
	Hawaii <sup>2</sup>						
Cabbage, Chinese:	Inshipments	1,528	1,027	949	625	<b>818</b>	
	Hawaii	<sup>4</sup> 5,300	<sup>4</sup> 5,700	<sup>4</sup> 6,100	6,300	<b>5,600</b>	<b>87</b>
Cabbage, head:	Inshipments	4,022	3,054	2,930	2,540	<b>2,329</b>	
	Hawaii	9,000	9,800	10,100	10,400	<b>9,400</b>	<b>80</b>
Cabbage, mustard:	Inshipments	207	237	262	223	<b>282</b>	
	Hawaii	1,400	1,400	1,400	1,400	<b>1,300</b>	<b>82</b>
Carrots:	Inshipments	11,400	12,607	12,767	11,667	<b>11,144</b>	
	Hawaii <sup>2</sup>						
Cauliflower:	Inshipments	1,340	1,076	1,167	1,378	<b>1,350</b>	
	Hawaii <sup>2</sup>						
Celery:	Inshipments	5,065	4,931	5,497	5,192	<b>5,133</b>	
	Hawaii	900	830	670	510	<b>360</b>	<b>7</b>
Corn, sweet:	Inshipments	1,390	1,169	712	806	<b>611</b>	
	Hawaii	1,800	1,700	1,800	2,400	<b>2,200</b>	<b>78</b>
Cucumbers:	Inshipments	920	1,543	1,118	1,795	<b>1,383</b>	
	Hawaii	5,900	6,000	5,400	5,000	<b>4,800</b>	<b>78</b>
Daikon:	Inshipments	<sup>2</sup> 3	<sup>2</sup> 6	<sup>2</sup> 6	<sup>2</sup> 2	<sup>2</sup> 6	
	Hawaii <sup>3</sup>						
Dasheen:	Inshipments	746	659	680	887	<b>716</b>	
	Hawaii <sup>2</sup>						
Eggplant:	Inshipments	675	986	821	970	<b>734</b>	
	Hawaii	1,050	1,200	1,000	760	<b>900</b>	<b>55</b>
Ginger root:	Inshipments	591	224	105	394	<b>928</b>	
	Hawaii	6,000	5,100	4,300	2,800	<b>1,800</b>	<b>66</b>
Lettuce <sup>5</sup> :	Inshipments	9,116	8,065	8,232	8,824	<b>8,089</b>	
	Hawaii	1,300	1,100	1,200	1,000	<b>1,000</b>	<b>11</b>
Lotus root:	Inshipments	53	58	70	51	<b>73</b>	
	Hawaii <sup>2</sup>						
Onions, dry:	Inshipments	17,982	21,210	20,562	19,595	<b>18,654</b>	
	Hawaii	1,600	2,300	1,400	1,400	<b>1,400</b>	<b>7</b>

See footnotes at end of table.

Continued



**MARKET SUPPLY: FRESH VEGETABLES****MARKET SUPPLY: Fresh Market Vegetables, State of Hawaii, 2004-2008<sup>1</sup> -- Continued**

Commodity		2004	2005	2006	2007	2008	Hawaii market share 2008
		----- 1,000 pounds -----					Percent
Onions, green:	Inshipments	896	590	777	776	<b>589</b>	
	Hawaii	1,600	1,700	1,500	1,400	<b>1,600</b>	<b>73</b>
Parsley, American:	Inshipments	167	178	204	231	<b>271</b>	
	Hawaii	280	250	250	140	<b>100</b>	<b>27</b>
Peas, Chinese:	Inshipments	257	260	256	287	<b>209</b>	
	Hawaii <sup>2</sup>						
Peppers, green:	Inshipments	2,489	2,997	3,402	4,864	<b>4,790</b>	
	Hawaii	3,200	3,000	2,800	1,800	<b>6</b>	
Potatoes:	Inshipments <sup>4</sup>	34,629	39,032	39,191	24,392	<b>22,291</b>	
	Hawaii <sup>2</sup>						
Potatoes, sweet:	Inshipments	1,357	1,337	1,530	1,715	<b>1,616</b>	
	Hawaii	4,600	6,300	6,000	7,100	<b>8,100</b>	<b>83</b>
Pumpkins:	Inshipments	833	363	203	419	<b>903</b>	
	Hawaii	250	80	290	470	<b>90</b>	<b>9</b>
Radish:	Inshipments	11	9	5	9	<b>0</b>	
	Hawaii <sup>2</sup>						
Romaine:	Inshipments	9,336	10,465	10,355	10,937	<b>9,334</b>	
	Hawaii	1,500	1,700	1,300	1,200	<b>1,000</b>	<b>10</b>
Squash, Italian:	Inshipments	1,130	1,259	1,722	1,845	<b>1,738</b>	
	Hawaii	1,700	1,500	1,100	1,200	<b>1,480</b>	<b>46</b>
Squash, Oriental:	Inshipments	55	139	492	600	<b>640</b>	
	Hawaii	650	450	400	500	<b>350</b>	<b>35</b>
Taro:	Inshipments	1,002	705	962	305	<b>232</b>	
	Hawaii <sup>3</sup>	100	100	100	100	<b>100</b>	<b>30</b>
Tomatoes:	Inshipments	3,538	5,624	4,877	4,265	<b>4,157</b>	
	Hawaii	16,800	14,200	14,700	14,300	<b>6</b>	
Watercress:	Inshipments	45	41	60	13	<b>4</b>	
	Hawaii	850	700	750	770	<b>750</b>	<b>99</b>
All other vegetables:	Inshipments	28,974	30,639	32,624	33,204	<b>31,967</b>	
	Hawaii	20,020	18,300	21,100	<b>6</b>	<b>6</b>	
Unspecified vegetables:	Inshipments <sup>7</sup>	12,902	11,540	14,226	15,648	<b>13,376</b>	
Total:	Inshipments	158,816	168,686	159,147	160,650	<b>150,257</b>	
	Hawaii	87,450	84,960	84,770	83,650	<b>77,485</b>	<b>34</b>
	All	246,266	253,646	243,917	244,300	<b>227,742</b>	

<sup>1</sup> Inshipment data was provided by the Market Analysis and News Branch of the Hawaii Department of Agriculture.<sup>2</sup> Data not shown separately to avoid disclosure of individual operations but combined and included with "All other vegetables".<sup>3</sup> Fresh market only.<sup>4</sup> For processing and fresh market.<sup>5</sup> Processed lettuce, both local production and inshipments, are included in "All other vegetables".<sup>6</sup> Data not shown separately to avoid disclosure of individual operations but combined and included in the State total.<sup>7</sup> Vegetable data received without commodity names specified.



## MARKET SUPPLY: FRESH VEGETABLES

### MARKET SUPPLY: Fresh Market Vegetables, State of Hawaii, 2005-2009 <sup>1</sup>

Commodity		2005	2006	2007	2008	2009	Hawaii market share 2009
		----- 1,000 pounds -----					Percent
Beans, snap:	Inshipments	619	592	460	540	1	
	Hawaii	700	600	700	700	6	
Bittermelon:	Inshipments	149	108	123	74	1	
	Hawaii	250	180	150	140	<b>360</b>	
Broccoli:	Inshipments	5,794	5,830	5,535	5,205	1	
	Hawaii	600	330	390	360	<b>300</b>	
Burdock:	Inshipments	94	79	73	71	1	
	Hawaii <sup>2</sup>						
Cabbage, Chinese:	Inshipments	1,027	949	625	818	1	
	Hawaii <sup>3</sup>	<sup>4</sup> 5,700	<sup>4</sup> 6,100	6,300	5,600	<b>5,500</b>	
Cabbage, head:	Inshipments	3,054	2,930	2,540	2,329	1	
	Hawaii	9,800	10,100	10,400	9,400	<b>8,700</b>	
Cabbage, mustard:	Inshipments	237	262	223	282	1	
	Hawaii	1,400	1,400	1,400	1,300	<b>1,300</b>	
Carrots:	Inshipments	12,607	12,767	11,667	11,144	1	
	Hawaii <sup>2</sup>						
Cauliflower:	Inshipments	1,076	1,167	1,378	1,350	1	
	Hawaii <sup>2</sup>						
Celery:	Inshipments	4,931	5,497	5,192	5,133	1	
	Hawaii	830	670	510	360	6	
Corn, sweet:	Inshipments	1,169	712	806	611	1	
	Hawaii	1,700	1,800	2,400	2,200	6	
Cucumbers:	Inshipments	1,543	1,118	1,795	1,383	1	
	Hawaii	6,000	5,400	5,000	4,800	6	
Daikon:	Inshipments	6	6	2	6	1	
	Hawaii <sup>4</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	2	
Dasheen:	Inshipments	659	680	887	716	1	
	Hawaii <sup>2</sup>						
Eggplant:	Inshipments	986	821	970	734	1	
	Hawaii	1,200	1,000	760	900	<b>1,300</b>	
Ginger root:	Inshipments	224	105	394	928	1	
	Hawaii	5,100	4,300	2,800	1,800	<b>1,600</b>	
Lettuce <sup>5</sup> :	Inshipments	8,065	8,232	8,824	8,089	1	
	Hawaii	1,100	1,200	1,000	1,000	<b>950</b>	
Lotus root:	Inshipments	58	70	51	73	1	
	Hawaii <sup>2</sup>						
Onions, dry:	Inshipments	21,210	20,562	19,595	18,654	1	
	Hawaii	2,300	1,400	1,400	1,400	<b>1,500</b>	

See footnotes at end of table.

Continued



## MARKET SUPPLY: FRESH VEGETABLES

MARKET SUPPLY: Fresh Market Vegetables, State of Hawaii, 2005-2009<sup>1</sup> -- Continued

Commodity		2005	2006	2007	2008	2009	Hawaii market share 2009
----- 1,000 pounds -----						Percent	
Onions, green:	Inshipments	590	777	776	589	<sup>1</sup>	
	Hawaii	1,700	1,500	1,400	1,600	<b>1,400</b>	
Parsley, American:	Inshipments	178	204	231	271	<sup>1</sup>	
	Hawaii	250	250	140	100	<sup>6</sup>	
Peas, Chinese:	Inshipments	260	256	287	209	<sup>1</sup>	
	Hawaii <sup>2</sup>						
Peppers, green:	Inshipments	2,997	3,402	4,864	4,790	<sup>1</sup>	
	Hawaii	3,000	2,800	1,800	<sup>6</sup>	<sup>6</sup>	
Potatoes:	Inshipments <sup>4</sup>	39,032	39,191	24,392	22,291	<sup>1</sup>	
	Hawaii <sup>2</sup>						
Potatoes, sweet:	Inshipments	1,337	1,530	1,715	1,616	<sup>1</sup>	
	Hawaii	6,300	6,000	7,100	8,100	<b>8,300</b>	
Pumpkins:	Inshipments	363	203	419	903	<sup>1</sup>	
	Hawaii	80	290	470	90	<sup>6</sup>	
Radish:	Inshipments	9	5	9	0	<sup>1</sup>	
	Hawaii <sup>2</sup>						
Romaine:	Inshipments	10,465	10,355	10,937	9,334	<sup>1</sup>	
	Hawaii	1,700	1,300	1,200	1,000	<b>800</b>	
Squash, Italian:	Inshipments	1,259	1,722	1,845	1,738	<sup>1</sup>	
	Hawaii	1,500	1,100	1,200	1,480	<b>1,170</b>	
Squash, Oriental:	Inshipments	139	492	600	640	<sup>1</sup>	
	Hawaii	450	400	500	350	<b>340</b>	
Taro:	Inshipments	705	962	305	232	<sup>1</sup>	
	Hawaii <sup>3</sup>	100	100	100	100	<b>100</b>	
Tomatoes:	Inshipments	5,624	4,877	4,265	4,157	<sup>1</sup>	
	Hawaii	14,200	14,700	14,300	<sup>6</sup>	<sup>6</sup>	
Watercress:	Inshipments	41	60	13	4	<sup>1</sup>	
	Hawaii	700	750	770	750	<b>820</b>	
All other vegetables:	Inshipments	30,639	32,624	33,204	31,967	<sup>1</sup>	
	Hawaii	18,300	21,100	<sup>6</sup>	<sup>6</sup>	<sup>6</sup>	
Unspecified vegetables:	Inshipments <sup>7</sup>	11,540	14,226	15,648	13,376	<sup>1</sup>	
Total:	Inshipments	168,686	159,147	160,650	150,257	<sup>1</sup>	
	Hawaii	84,960	84,770	83,650	77,485	<b>79,498</b>	
	All	253,646	243,917	244,300	227,742	<b>NA</b>	

NA = Not available.

<sup>1</sup> Inshipment data was provided by the Market Analysis and News Branch of the Hawaii Department of Agriculture. Data for 2009 is not available due to reduction-in-force eliminating all Market Analysis and News Branch positions.<sup>2</sup> Data not shown separately to avoid disclosure of individual operations but combined and included with "All other vegetables".<sup>3</sup> For processing and fresh market.<sup>4</sup> Fresh market only.<sup>5</sup> Processed lettuce, both local production and inshipments, are included in "All other vegetables".<sup>6</sup> Data not shown separately to avoid disclosure of individual operations but combined and included in the State total.<sup>7</sup> Vegetable data received without commodity names specified.

## MARKET SUPPLY: FRESH FRUITS



### MARKET SUPPLY: Fresh Market Fruits, State of Hawaii, 2004-2008<sup>1 2</sup>

Commodity		2004	2005	2006	2007	2008	Hawaii market share 2008
		----- 1,000 pounds -----					Percent
Apples:	Inshipments	13,392	15,320	15,431	16,269	<b>15,413</b>	
Avocados:	Inshipments	1,780	2,130	2,349	2,332	<b>1,971</b>	
	Hawaii	740	800	1,020	1,160	<b>1,000</b>	<b>34</b>
Bananas:	Inshipments	13,929	13,017	15,408	16,028	<b>19,552</b>	
	Hawaii	16,500	20,900	22,000	25,600	<b>17,400</b>	<b>47</b>
Cantaloupe melons:	Inshipments	6,149	7,658	7,736	7,410	<b>6,241</b>	
	Hawaii <sup>3</sup>						
Grapefruit:	Inshipments	1,719	1,488	1,561	1,600	<b>1,307</b>	
	Hawaii	<sub>3</sub>	40	50	30	<b>46</b>	<b>3</b>
Grapes:	Inshipments	8,360	9,831	9,506	9,584	<b>9,149</b>	
Honeydew melons:	Inshipments	2,773	2,570	3,813	3,905	<b>3,204</b>	
	Hawaii <sup>3</sup>						
Lemons:	Inshipments	3,915	4,196	4,154	4,035	<b>3,501</b>	
	Hawaii	<sub>3</sub>	54	45	33	<b>55</b>	<b>2</b>
Limes:	Inshipments	1,456	1,678	1,749	2,139	<b>1,957</b>	
	Hawaii	<sub>3</sub>	59	121	69	<b>76</b>	<b>4</b>
Nectarines:	Inshipments	2,593	2,260	2,219	2,379	<b>2,513</b>	
Oranges:	Inshipments	13,683	15,740	14,824	10,671	<b>12,381</b>	
	Hawaii <sup>3</sup>						
Papayas:	Inshipments <sup>3</sup>						
	Hawaii <sup>4</sup>	20,400	18,755	16,740	18,650	<b>16,960</b>	
Pears:	Inshipments	5,109	3,971	4,873	5,018	<b>4,776</b>	
Pineapples:	Hawaii	30,900	<sub>5</sub>	<sub>5</sub>	<sub>5</sub>	<sub>5</sub>	
Tangerines:	Inshipments	902	1,254	1,893	1,460	<b>2,000</b>	
	Hawaii	<sub>3</sub>	51	85	89	<b>98</b>	<b>5</b>
Watermelons:	Inshipments	3,165	3,946	5,174	4,007	<b>3,772</b>	
	Hawaii	10,100	11,300	10,400	13,100	<sub>6</sub>	
All other fruits:	Inshipments	13,148	15,507	16,382	17,010	<b>12,478</b>	
	Hawaii	4,697	5,601	7,612	7,709	<sub>6</sub>	
Unspecified fruits:	Inshipments <sup>7</sup>	8,362	7,391	9,817	11,751	<b>10,463</b>	
Total:	Inshipments	100,435	107,957	116,889	115,598	<b>110,678</b>	
	Hawaii	73,337	57,560	58,073	66,440	<b>52,744</b>	<b>32</b>
	All	173,772	165,517	174,962	182,038	<b>163,422</b>	

<sup>1</sup> Excludes pineapples, guavas, papayas, and passion fruit used for processing, and quantities shipped out-of-State.

<sup>2</sup> Inshipment data was provided by the Market Analysis and News Branch of the Hawaii Department of Agriculture.

<sup>3</sup> Data not shown separately to avoid disclosure of individual operations but combined and included with "All other fruits".

<sup>4</sup> Fresh intrastate sales only. Excludes mainland and foreign fresh sales.

<sup>5</sup> Data not available.

<sup>6</sup> Data not shown separately to avoid disclosure of individual operations but combined and included in the State total.

<sup>7</sup> Fruit data received without commodity names specified.



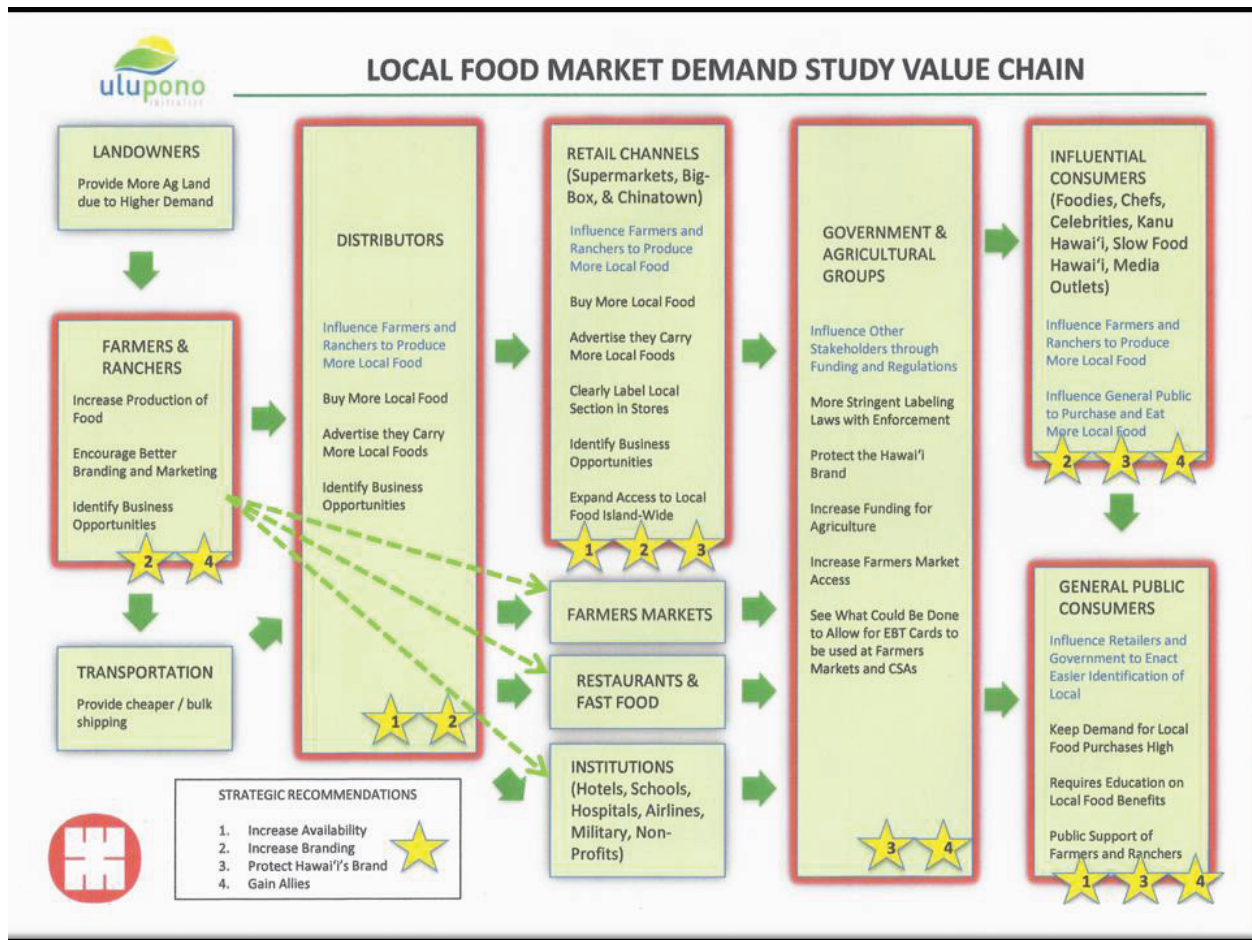
## MARKET SUPPLY: FRESH FRUITS

MARKET SUPPLY: Fresh Market Fruits, State of Hawaii, 2005-2009<sup>1 2</sup>

Commodity		2005	2006	2007	2008	2009	Hawaii market share 2009
		----- 1,000 pounds -----					Percent
Apples:	Inshipments	15,320	15,431	16,269	15,413	<sup>2</sup>	
Avocados:	Inshipments	2,130	2,349	2,332	1,971	<sup>2</sup>	
	Hawaii	800	1,020	1,160	1,000	<b>1,040</b>	
Bananas:	Inshipments	13,017	15,408	16,028	19,552	<sup>2</sup>	
	Hawaii	20,900	22,000	25,600	17,400	<b>18,500</b>	
Cantaloupe melons:	Inshipments	7,658	7,736	7,410	6,241	<sup>2</sup>	
	Hawaii <sup>3</sup>						
Grapefruit:	Inshipments	1,488	1,561	1,600	1,307	<sup>2</sup>	
	Hawaii	40	50	30	46	<sup>4</sup>	
Grapes:	Inshipments	9,831	9,506	9,584	9,149	<sup>2</sup>	
Honeydew melons:	Inshipments	2,570	3,813	3,905	3,204	<sup>2</sup>	
	Hawaii <sup>3</sup>						
Lemons:	Inshipments	4,196	4,154	4,035	3,501	<sup>2</sup>	
	Hawaii	54	45	33	55	<sup>4</sup>	
Limes:	Inshipments	1,678	1,749	2,139	1,957	<sup>2</sup>	
	Hawaii	59	121	69	76	<sup>4</sup>	
Nectarines:	Inshipments	2,260	2,219	2,379	2,513	<sup>2</sup>	
Oranges:	Inshipments	15,740	14,824	10,671	12,381	<sup>2</sup>	
	Hawaii <sup>3</sup>						
Papayas:	Inshipments <sup>5</sup>						
	Hawaii <sup>6</sup>	18,755	16,740	18,650	16,960	<b>17,170</b>	
Pears:	Inshipments	3,971	4,873	5,018	4,776	<sup>2</sup>	
Pineapples:	Hawaii <sup>7</sup>						
Tangerines:	Inshipments	1,254	1,893	1,460	2,000	<sup>2</sup>	
	Hawaii	51	85	89	98	<sup>4</sup>	
Watermelons:	Inshipments	3,946	5,174	4,007	3,772	<sup>2</sup>	
	Hawaii	11,300	10,400	13,100	<sup>8</sup>	<sup>4</sup>	
All other fruits:	Inshipments	15,507	16,382	17,010	12,478	<sup>2</sup>	
	Hawaii	5,601	7,612	7,709	<sup>8</sup>	<sup>4</sup>	
Unspecified fruits:	Inshipments <sup>9</sup>	7,391	9,817	11,751	10,463	<sup>2</sup>	
Total:	Inshipments	107,957	116,889	115,598	110,678	<sup>2</sup>	
	Hawaii	57,560	58,073	66,440	52,744	<b>50,239</b>	
	All	165,517	174,962	182,038	163,422	<b>NA</b>	

NA = Not available. <sup>1</sup> Excludes pineapples, guavas, papayas, and passion fruit used for processing, and quantities shipped out-of-State. <sup>2</sup> Inshipment data was provided by the Market Analysis and News Branch of the Hawaii Department of Agriculture. Data for 2009 is not available due to reduction-in-force eliminating all Market Analysis and News Branch positions. <sup>3</sup> Data not shown separately to avoid disclosure of individual operations but combined and included with "All other fruits". <sup>4</sup> Estimates not published due to staff reduction-in-force but combined and included in the total. <sup>5</sup> Data not shown separately but combined and included with "All other fruits". <sup>6</sup> Fresh intrastate sales only. Excludes mainland and foreign fresh sales. <sup>7</sup> Data not available. <sup>8</sup> Data not shown separately to avoid disclosure of individual operations but combined and included in the total. <sup>9</sup> Fruit data received without commodity names specified.

## Appendix C - Ulupono Initiative Food Market Demand Study Value Chain



*Ulupono Initiative and OmniTrak Group Inc. produced this graphic as part of their report “Local Food Market Demand Study of O’ahu Shoppers”, December 2011. The graphic depicts a way to visualize the flow of local produce into the market place, and identifies points in the process that could be strategically improved.*