CULTIVATING SELF-SUSTAINING RURAL COMMUNITIES

A DESIGN EXPLORATION FOR DEVELOPMENT IN PUNA, HAWAI‘I

A DARCH PROJECT SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAI‘I AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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This design-research project investigates architectural and planning strategies for developing self-sustaining rural communities. With the Hawaiian Islands being the most isolated land masses in the world, indigenous settlers were not afforded the luxury of imported food or goods. These Hawaiian settlers exercised careful land-use practices, and formed close relationships with their natural environment, which they understood to be imperative for their existence.

However, in the modern globalizing economy, architecture and planning in Hawai‘i has become increasingly indiscriminate to its land and natural resources. Development has largely been driven by private economic gain, and has, in many ways, disregarded critical social, cultural, and ecological needs, which are vital to achieving sustainable communities. Community backlash in many recent highly politicized building projects has become progressively noted, and reveals the need for Hawai‘i to reconsider its architecture, planning, and land-use practices.

Although such tensions are most apparent in Hawai‘i’s urban cores, which have developed in the matter of decades, pressures have quietly shifted to Hawai‘i’s remaining rural regions. This project focuses its research investigation on Puna, a rural district on the Island of Hawai‘i, which currently outpaces the growth rate of Honolulu threefold. Puna’s historic changes in land-use are analyzed, as well as the subsequent impacts to the sustainability of its communities. From the findings of this analysis, architecture and planning principles are formulated with the intent of enabling self-sustaining rural communities. A conceptual design intervention demonstrates the applicability of these principles in the final section of this project. The theoretical design principles presented herein aim to serve as a precedent, which can be translated by other rural Hawai‘i communities to formulate and meet their own sustainability goals.

Ultimately, this project intends to contribute to a sustainable future for the people of Hawai‘i. It alludes to the idea that an existence on an islands, with limited resources, requires a unique approach that critically responds to its natural environment, an mindset which formed the roots of Hawaiian culture and allowed them to flourish in isolation for centuries.
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In honor of my mentor
Professor Spencer Leineweber…

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Dedicated to my mother…

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Sustainability is an ideology which has come to define the major architectural movement today. The sustainability movement, just as the many architectural movements preceding it, is a direct response to the pitfalls seen in previous architectural periods, and the negative effects that society perceived as a result. In this case, it was the stark realization that the built environment and all its functions, as created by the architects and planners, has become overbearing on its natural surroundings and threatens the overall human standard of living.\(^1\) Essentially, the concept of sustainability is a basic human instinct. It can primitively refer to basic human needs, such as food, water, and shelter, but for architects and planners, it is important to display a sensitivity to time and place when thinking about sustainability in the communities they design. This includes the qualitative factors which can create a healthy lifestyle, provide an adequate quality of life, and satisfy the needs of human psyche. Although sustainability as a concept reaches across many disciplines, architects and planners realize that they have a particularly significant opportunity and role to play in this widespread social movement.

Architecture at its roots is also an art, and is allegorical of culture and place. It is possibly the greatest physical manifestation of how a society functions and interacts with the environment and each other.\(^2\) The precedent set forth by indigenous Hawaiians shows a society that was intrinsically and intimately tied to sustainability. They demonstrated a precise approach to managing land and its resources, with building and planning methods that were totally responsive of, and equally as unique as, their natural

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\(^1\) Ian L. McHarg, Design with Nature (Garden City, New York: Published for the American Museum of Natural History [by] the Natural History Press, 1969).

Their island lifestyle was completely self-sustaining, allowing them to flourish on the most remote land masses in the world.

However, with modern society becoming integrally entwined in the globalizing economy, capitalism has become the sole means of human survival. With the top-down approach of the world economy, social, cultural, ecological, and other seemingly “intangible” needs of average citizens seem to be often sacrificed in order to maximize economic returns to private investors. Any other method of making a living is often considered an ‘alternative lifestyle’, including those which indigenous Hawaiians relied upon for two millennia. The shift to capitalism in Hawai`i came quickly after its relatively recent introduction to the ‘civilized’ world. Subsequently, architecture, planning, and development has become increasingly non-conforming of its land, resources, and people. In response to Hawai`i’s rapidly changing landscape, cost of living, and social dynamics, its residents have recently started to proactively voice concerns regarding development which they see as valuing economic gains above the needs of the people. Architects and planners in Hawai`i today may find themselves at the center of controversy of any highly politicized project, unless they adapt to truly reflect the true needs and concerns of the communities they design in. They must rise up and look past just sustainability, to the next yet to come architectural movement. In Hawai`i, this may mean looking to the past...
PROJECT STATEMENT

At the will of the global economy, Hawaiʻi’s natural landscapes have seen an increasing trend towards top-down modernization. Planning and development decisions in Hawaiʻi have been based primarily on short-term advancement in world trade, leaving Hawaiʻi’s economy to become dependent upon models of expansion and growth. As a result, Hawaiʻi cities have made the transformation from rural to urbanized in a matter of decades with no comprehensive or long-term planning. The same short-sighted development patterns are now being seen in Hawaiʻi’s remaining rural areas, which are now growing at much higher rates than its urban counterparts.³ This reveals the need for research which can help to develop alternative architectural design strategies and be applied specifically to Hawaiʻi’s rural regions.

This design-research project will address this gap in research and investigate design practices which can enable self-sustaining communities in rural Hawaiʻi. At the heart of this issue, drastic land changes have subjugated Native Hawaiian cultural rights and identity, which are integrally tied to the natural environment. However, this issue also affects residents of Hawaiʻi in general, as indiscriminate development has consequently escalated the cost of living, and affected the ability for the greater population to maintain a sustainable lifestyle. This project aims to promote cultural practices, both as an ethical move, and as a solution to help Hawaiʻi achieve its long-term sustainability goals.

**Define Sustainability**

The term *sustainability* can be highly biased, and varies according to person and place. Mainstream theories of sustainability will be examined in order to extract the most relevant concepts and models. A list of terms will be established to explain how sustainability will be defined and measured in this project. This definition will be important in analyzing the research findings and directing the design outcome of the project. These measurements can also be used by communities to establish their own specific development goals in the future.

**Analyze Evolution of Land Use**

From the time of western contact, long-established native landscapes have drastically changed, and continue to do so. Historic changes in land use will be investigated, focusing primarily on the Puna district, but also reflecting events elsewhere, as relevant. The way that humans historically utilize land will be analyzed, as well as the physical characteristics of the land itself, such as rates of changing conditions and qualities of ecological functions. Factors that influenced such land changes will also be investigated. This research objective is important in establishing cause and effect factors of sustainability, and will help to inform future design decisions. This objective will be investigated in *Section III: Research Findings*.

**Assess Effects of Changing Land Use**

This project will assess the effects of the drastic changes in land, in regards to its population’s well-being, and ability their ability to achieve sustainable lifestyles. This will build upon the previous objective by drawing connections
between land use and its importance to human welfare. Socio-cultural considerations will also be investigated, and parallels between cultural mindsets, land use, and sustainability will be specifically identified. This objective will be investigated in Section III: Research Findings.

**Identify Implementation**

Indigenous Hawaiians utilized all opportunities that the land presented to them. Through creative thinking, they were able to refine their daily practices to reflect the most efficient and ecologically sensitive means of living. As previously mentioned, the careful approaches that Hawaiians developed over time will be a major precedent for this project. In the modern context, however, populations, environments, and standards of living have changed, and a total reversion to a pre-contact lifestyle would be impractical. This project will identify the opportunities and constraints of implementing cultural practices as a future planning approach. It will also investigate other sustainable methods which are culturally sensitive.

**DESIGN OUTCOME**

In order to demonstrate the application of the aforementioned research objectives, a conceptual design intervention will be explored. The Maku’u Mauka tracts in Lower Puna will be used as a hypothetical design site, and its owner, the Department of Hawaiian Home Lands, will be used as a hypothetical client. The design strategies explored in the design phase will respond directly to the conclusions drawn at the end of the research investigation. It will build upon the project focus of cultivating self-sustaining communities.

The design portion aims to present theoretical methodologies, rather than definitive solutions or details. Maku’u Mauka will be used as a model to exhibit conceptual architecture, land use, and planning principles. These design principles are intended to also translate to other similar rural
communities. Some specific design strategies will be suggested, where relevant, and will be appropriately stated.

METHODOLOGY

Primary Data Sources
Census data will be analyzed from sources such as U.S. Census Bureau and the Hawai‘i Department of Business & Economic Development. Data will be used to find trends in land-use, development patterns, and demographic information.

The Geographic Information System (GIS) database will be used to overlay spatial information. This will enable spatial comparisons of factors such as land-use patterns, demographic considerations, and ecological qualities.

Historic information from reliable scholarly research will be used to compile a timeline of major social, cultural, and ecological changes, as discussed in the research outcomes.

It is important to note that all references to traditional/pre-contact Hawai‘i within this investigation refer to the time period just before western contact in 1778, unless otherwise noted. The ancient Hawaiian civilization is often classified into 5 time periods between the first century AD, and western contact in 1778, and it is the latest period where Hawaiian culture was arguably at its peak of sophistication and ability sustain itself.

Investigative Process

SECTION I: INTRODUCTION

Section I will discuss the current context of architecture, land-use, and planning in Hawai‘i. It will elucidate both the initial rationale, and the intended significance for conducting the research in this project. It will also give a brief introduction to the district of Puna, on the Big Island of Hawai‘i, where this project will focus its research on.

SECTION II: SUSTAINABILITY SEMANTICS

Section II will explore literature regarding sustainable design and development. The aim of this section is to formulate a definition of sustainability which can be used by this project to analyze land-use and planning. It can also be used by communities to establish specific development goals in the future, which will be demonstrated in Section V of this project.

SECTION III: RESEARCH INVESTIGATION

Section III presents the Research Findings. The investigation will compile a comprehensive timeline of land-use in Puna. Major historical changes in land-use will be investigated, as well as the events which led to these changes. The measurements of sustainability, as defined in Section II, will be used to direct research and draw conclusions which address the discussed project objectives.

SECTION IV: RESEARCH DISCUSSION

Section IV will draw conclusions on the research investigation and discuss how research objectives were reached. This section will outline the major findings of the research investigation which will be used to inform the design in Section V of this project. Specific opportunities and difficulties for design implementation will be also be discussed.
SECTION V : DESIGN EXPLORATION

Section V will address the conclusions discussed in Section IV and provide a specific example of how major issues can be resolved through design. Suggested design principles which were not included in the conceptual plan will be discussed. Site specific data will also be collected, as necessary.
SECTION I

INTRODUCTION
“It was an accident that Hawai`i was the last important pacific island group to be discovered by voyagers from the outer world; but it was no accident that Hawaii, because of its strategic position, was the first to achieve modernity. Only through a study of the past can we hope to image what the future may be and it is believed that a reading of Hawaii’s eventful history will give many clues to the future of America’s role in the pacific era.”

-Ralph S. Kuykendall & A. Grove Day, 1948

A CHANGING LANDSCAPE

Since Hawai`i’s introduction to the ‘civilized’ world, its has become iconic on a global level, and romanticized as an idealized paradise. The beauty of this natural landscape continues to be one of it’s most ironic features, as it also has created huge demands in housing, tourism, and development. As more subdivisions, resorts, and highways are created to accommodate the economic sectors which Hawai`i relies on, more of this natural beauty is compromised.

While developers attempt to capitalize on the huge demands, much of the western modernization favors wealthy out of state stakeholders. Between the years 2008-2014, mainland and foreign buyers spent $152,201 (31.8%) and $307,415 (64.3%) more on average than local buyers, respectively. Not surprisingly, this has caused housing prices statewide to spike.


Populations continue to rise with as out-of-state developers overlook the increasingly complex social issues fueled by continuous development pressures. In 2014, median sales prices reached a record high of $730,000, while median rental prices topped the nation at $1,448. With a lucrative housing market, attention from the state overshadows other important social issues of traffic, homelessness, and overall cost of living. With a quickly inflating cost of living and changing social dynamics, many Hawai‘i families have recently chosen to leave for the mainland.

This is of meaningful concern to the Native Hawaiian population, whose cultural identity is tied to place and natural environments. As a civilization which flourished on a remote archipelago, many things can be distilled by examining the way of life that Hawaiians formulated. Traditional practices can provide a relevant backbone for development decisions. It has potential to enhance community identity and sense of place, as a time tested method of sustainable living. However, the perpetual cost inflation and economic driven land development has endangered their cultural rights and practices. Projects such as the Kaka’ako revitalization and West O‘ahu development projects, including Ho‘opili, have at times become the topic of large debate for the apparent threats they pose to sustainability and cultural interests. This has recently begun to strengthen the public’s awareness to the fact that there is a need to re-evaluate the general development paradigm which Hawai‘i now follows. This creates difficult planning paradigm, where designers must balance social, cultural, economic needs, which have already been severely affected, while also creating economic income through sustainable methods. However,

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INTRODUCTION TO PUNA

Rural Hawai‘i regions show enormous potential to achieve sustainable objectives. But this can only if proactive measures in architecture and planning are made now. Despite a worldwide trend toward urbanization, Hawai‘i’s rural areas are developing quicker than Honolulu, leaving rural counties on the precipice of impending urbanization.

The rural Puna District, on Hawai‘i island has steadily been growing at a rate of 15% every 5 years, and is expected to reach 58,246 people by 2020, making it the most populated district on Big Island. These growth rates outpace Honolulu’s threefold, and have caused a retrospective approach to planning.

Complicated social issues, such as high poverty rates, high crime rates, and sparsely distributed homes make planning in Puna a unique challenge. Much of Puna’s population is also put at risk to being isolated from the rest of the island, as the lower Puna region is connected by only one traffic corridor. This makes self-sufficiency in this region especially important, as utilities and resources currently rely on the limited access to the rest of the island.

The 500 square miles Puna’s landscape is naturally covered with lush native rainforests, and hosts many endemic species found nowhere else on earth. This includes Wao Kele O Puna, a nature reserve, and the last remaining lowland rainforest in the United States. Wao Kele O Puna also serves as an

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10 “Projection of Resident Population by District, Hawai‘i County : 2000 to 2020” (Hawai‘i County Census Data Base, 2006).
important ecological and cultural resource. If properly respected and cared for, such natural resources could provide the means of sustainable living in rural communities.

The unique challenges and landscape in rural Hawai‘i regions, such as those seen in Puna, requires an equally unique planning approach. Future planning must carefully use the resources provided to them to achieve an equitable and sustainable future.

Figure 1: Roadblocks in rural Hawai‘i

Fallen Albezia trees and branches block the route near Lava Tree Park. Source: Author
SECTION II

SUSTAINABILITY SEMANTICS
DEFINING SUSTAINABILITY

Sustainability, and all its related aspects, encompass many interpretations, and have taken on very preconceived and loaded concepts. Sustainability has become an all-encompassing catchword, largely utilized as a public-relations strategy and marketing tool. There are many buzzwords that can be associated with it, but these terms may also need to be examined for their true meaning. Many associate it with climate change issues and alternative energies, but what does it mean in today’s society? According to the Merriam-Webster dictionary, sustainability is defined as something that is “able to be used without being completely used up or destroyed”. This may seem like a generally agreeable statement to apply to land-use issues, but it still leaves much room for interpretation. Even when narrowed to the disciplines of architecture and planning, it is a multifaceted and subjective concept.

RATIONALIZING SUSTAINABILITY

In 1987, Gro Harlem Brundtland, the Norwegian Prime Minister at the time, made the first known attempt at defining the term sustainability, as it applies to humans, and society. In that year, in her research report titled Our Common Future, she defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”11 The document, which has since then has also largely been referred to as The Brundtland Report, discusses conserving environmental resources to be an important factor in economic growth, relieving poverty, and overall healthy human progression. The report does not act to point blame in any direction, nor does it go into possible solutions for the observed environmental degradation. Rather, it serves to

commence an open-ended conversation, and call for action for what has become a very widely publicized topic since its release. The definition given by The *Brundtland Report* is also a very general one, leaving the task of interpretation to localized planning officials.

The movement leading to environmentalism and *sustainability* largely stemmed from the theories of prominent landscape architect Ian McHarg, in his book *Design With Nature*. McHarg observed that the field of planning was totally separate with the fields of geology, and physical sciences, and that the interplay between humans activities and the natural environment were completely overlooked.\(^{12}\)

Sustainable communities must first realize what sustainability means to them, their own sustainable needs, and how to achieve them. The goal of this literature review is to clearly define sustainability. This will be achieved by researching theories regarding sustainability and extracting the concepts which define how to measure sustainability. These concepts and terms will be used as an assessment tool for architecture and planning in the subsequent sections of this investigation. In order to classify sustainability in Hawai`i context, the term itself may need to be replaced.

**SUFFICIENCY**

One of the most basic ways to understanding sustainability is to refer to the term *sufficiency*. *Sufficiency*, sometimes also referenced as *self-sufficiency*, is the most basic and understood function of *sustainability*. According to the Merriam-Webster dictionary, the definition of sufficiency is “to meet one’s needs” or “a modest but adequate scale of living”. This usually refers to the ability to acquire necessary goods for humans to survive, as provided by the earth. According to Thomas Princen, Ph.D and Professor of *Natural\(^{12}\)

\(^{12}\) Ian L. McHarg, Design with Nature (Garden City, New York: Published for the American Museum of Natural History [by] the Natural History Press, 1969).
Resources and Environment, sufficiency underscores the understanding that avoiding over-consumption is a necessary variable in being self-sufficient.\textsuperscript{13} However, sufficiency can be seen as a subjective definition, as the standard of living and idea of overconsumption can vary greatly from person to person, even amongst those within the same community.

CARRYING CAPACITY

Carrying capacity is a crucial concept to consider in measuring sustainability, and is one way to quantify the concept of sufficiency. It adds to the definition of sufficiency, defining the variables what goods are being acquired, and who is acquire the goods. Carrying capacity is defined as the maximum population of a species which a given area of land can support indefinitely.\textsuperscript{14} The understanding that the resources used by the given population does not cause major changes to the ecological functions is therefore inherent to the term. Traditionally, carrying capacity applied to animals in studies of natural sciences. However, it is a term that has become increasingly discussed in planning, as most developed regions are seen to be living beyond their carrying capacity.\textsuperscript{15}

Joel E. Cohen states that measuring carrying capacity in a given areas is a complex idea, and a single absolute number can never be concluded on. Similar to the concept of sustainability, people have many different ideas of what carrying capacity is, and calculating carrying capacity is both dynamic


and depends on different cultural standards of living.\textsuperscript{16} While Cohen suggests that carrying capacity should be quantified by many considerations, others argue that there is a single determining factor, such as Russell Hopfenberg, who argues that the population is dependent on the availability of food.\textsuperscript{17} However, Hopfenberg also alludes to the fact that the availability of food is also dependent on a number of other variables such as available water resources, soil composition, and type of crop being grown.

Because human needs also incorporate qualitative factors as standards of living, a theoretical approach can also be taken to examining carrying capacity. It can be expanded to include factors such as cultural, political, and other sociological needs.\textsuperscript{18} In order to formulate an appropriate carrying capacity for a community, these variables must also be considered.

**ECOLOGICAL FOOTPRINT**

* Sufficiency can be further expanded upon by the term *ecological footprint*. An ecological footprint is also directly related to carrying capacity. It is the measure of land that is required in order to sufficiently provide all necessary resources for a person to live. Paul and Anne Ehrlich describe that an ecological footprint, referred to here as impact (I), is a function of the population (P) multiplied by *sufficiency*, referred to here as per capita consumption (F). However, it should be noted that per capita consumption today exceeds the bounds of *sufficiency*. This means that an increase in either population or per capita consumption, or both, will result in a higher


impact on the environment.\textsuperscript{19} While this concept may seem relatively straightforward, it is still largely ignored. This means that in order to lower our impact, we must either lower our population, or our per capita consumption. Ehrlich also discusses the idea of technology as a way to decrease the effect of per capita consumption. In theory, this seems like a logical idea. However, L.M. Rees argues that technology and trade has actually proven to increase our consumption rates. The convenience provided through technological efficiency and global trade, have caused false notions of surplus, leading humans to become unaware of their actual impact on the environment. The ability to obtain foreign goods at low costs no longer requires environmental consideration at the local level, and a mindset that our and carrying capacity can be endlessly increased has been adopted.\textsuperscript{20} Increasing the population of an area must not make it exceed its carrying capacity. If this happens, one of two things must take place; either the per capita impact must decrease, or the population must decrease.

**TRIPLE BOTTOM LINE**

Kenny and Meadowcroft discuss a paradigm shift in the complex term sustainability, arguing it does not only “consider everything in relation to nature”\textsuperscript{21}, as widely viewed by the public. Today, sustainability takes on a much more holistic approach, which also considers balancing ecological concerns with social and economic aspects. This idea is widely known as the triple-bottom line approach. The triple bottom-line was first explored by renown economist John Elkington, who realized that the social bottom-line is dependent on the financial bottom-line, and that likewise, the financial


\textsuperscript{21} Michael Kenny and James Meadowcroft, eds, Planning Sustainability (London: Routledge, 1999), 4.
bottom-line is dependent greatly on the environmental bottom-line. Saha and Paterson, who refer to this approach as ‘the three E’s, also examine multiple case studies on how governments have attempted to classify development issues in relation to the three E’s. The ‘triple bottom line’, or ‘three E’s’ approach is a holistic and multi-disciplinary way of measuring sustainability. These three factors have become the bottom line of human survival, and new measure of carrying capacity.

GREEN BUILDING CERTIFICATION PROGRAMS

Green have been It may be influential in gaining awareness and recognition. L.E.E.D and the Living Community Challenge initiatives claim that their certification programs constitute the “greenest” building standards. They provide good benchmark indicators and provide a platform to promote, share and progress sustainable mindsets. Such certification programs, by no means, automatically render buildings sustainable, and there are many criticisms. However, a unique approach to these certification programs, as made possible by Hawai`i’s unique conditions, could bring unforeseen recognition worldwide.


Avoiding Sprawl

Sprawl is the embodiment of the American culture of consumerism and excess, and is often perceived to be the ultimate adversary to sustainable land-use. It is one of the most widely recognized land-use problems, most certainly by those in the planning and architecture fields, but also amongst some members of the general public. As defined by Delores Hayden, sprawl is unplanned, unregulated, careless development which takes over land and resources. According to Hayden, sprawl is not only “environmentally unsustainable and fiscally shortsighted”, but it also is “socially destructive”. It is primarily driven by construction, banking, real estate industries seeking quick economic gains and completely negates social and environmental concerns.

4 Causes of Sprawl

According to Delores Hayden, the government actually helps to encourage sprawl through housing and development subsidies. There are four government programs which are widely seen to naturally advancing sprawl. These government issued subsidies are aimed at boosting construction jobs and developing raw land.25

1. The first is Federal Housing Administration (FHA) insurance for mortgages
2. The second is Federal income tax deductions for home mortgage interest, points, and property taxes
3. Third is federal corporate tax deductions called accelerated depreciation for Greenfield commercial real estate
4. Fourth is federal funding for highways

While sprawl suggests an indiscriminate and unplanned explosion of growth, there have been several distinct planning models that recognize the importance of creating limits and bounds for development.

25 Ibid, 7-10.
DISCUSSION

With the continually expanding concept of *sustainability*, new policies and approaches are being explored by designers and policy makers. The literature review conducted shows that there is no single definition of *sustainability*. It is also not a single fixed goal or target achievement. Rather, *sustainability* is a measurement of multiple varying concepts, whose standards can be highly subjective, and therefore should be further defined by communities to formulate specific development goals. The concepts reviewed in the literature review have accomplished the objective of defining what factors make up sustainability. Each community will need to further define what these factors mean to them. There will undoubtedly be differences in opinions, and trade-offs will be unavoidable. The complex task in achieving *sustainability* expands the traditional role of architect and planner, who must now consider many more layers of how their work impacts society and how architecture takes on a larger role in its surroundings.
SECTION III
RESEARCH FINDINGS
"To be a state of pono is to invoke the path of ancestral understanding, which is achieved only by being willing to be open to the source of ancestral knowledge. An individual must place their trust in the guide of ancestral knowledge for it will reveal understanding never comprehended in sole intellectual pursuits."

-Mark Kāwika McKeague,26 2005

The Hawaiian Islands, collectively, are the most isolated land masses in the world. A total awareness of this isolation allowed Native Hawaiian settlers to flourish for centuries. As the Hawaiian civilization progressed over time, they were guided by an absolute awareness that a continued existence on remote islands with limited resources was dependent on their respect and stewardship of the land that supported them. The Native Hawaiian inhabitants developed a unique lifestyle where daily practices symbiotically responded to their natural surroundings. Examining these mindsets reveal an intrinsic culture of sustainability and the ability to thrive within their own microcosm.

LŌKAHI

The concept of lōkahi shows the intimate connection that Hawaiians felt with the land and natural surroundings, and the role they believed they played within everything of the known universe, physical and spiritual. In order for the world to be in a state of lōkahi, all things in existence must be

26 McKeague, Mark Kāwika, “I Loko o Nā Kipona o Ke Kuli: The Accession Beyond Legal Boundaries” (Department of Urban and Regional Planning Area of Concentration Paper, University of Hawai`i at Mānoa, 2005), 2-6.
harmoniously balanced, with *kanaka* (man), *akua* (natural gods), and ʻā*ina* (land/nature) forming the cornerstones of the universe.\(^{27}\)

To Hawaiians, a continual existence on the islands could only be achieved through an equitable and intertwined connection of kanaka, akua, and ʻāina.

*This frame of mind gives similar understanding to that of the triple bottom line approach. Both viewpoints realize that man is not separate of earth or its functions, but integrally connected, and plays a vital role in the cycling of energy. It is also understood that man must strive to play a balanced part in this universal continuum.* (See Figure 3: Lōkahi and the Triple Bottom Line

Source: Author)

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Akua

Existential values of Hawaiian culture were manifested through the extensive ancestral beliefs that were developed through time. Hawaiian beliefs and rituals reflected their brilliance in understanding the environment and allowed them to make climatic and ecological connections that transcend modern-day scientific studies. Natural elements, from physical plant and animals, to climatic behaviors including wind and rains, were believed to be embodiments of ancestral gods. When gods were manifested in these physical forms, they were referred to as *kinolau*, and were viewed as spiritual guides that were provided to kanaka for subsistence in everyday life. Not only was this a way to comprehend the precise observations of the environment, but it was also a way to instill the information for future generations. Professor of ethnic studies and historian of Hawai`i and the Pacific, Davianna Pōmaika`i McGregor, describes the intimate connection of Hawaiians to the life forces of nature. Ancestral akua were cherished through mythologies and their important values were thereby eternalized for future generations. The continued presence of akua allowed Hawaiians to be guided by ancestral knowledge encoded within their stories.

`Āina

Today, `āina is usually roughly translated as land, but this is a simplified meaning which undermines the relationship that Hawaiians had to the land and its resources. Hawaiians were a resource based economy. They did not have any monetary or capitalist system, and relied on the `āina to provide means of living. When the term `āina is broken down, its true significance is

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revealed. `Āi meaning to feed, with the nominalizing suffix na,\textsuperscript{30} reveals the translation as \textit{that which feeds}. Practices of mālamaʻāina (care for the land), and aloha ʻāina (love, respect, for the land) are close translations to interpret the traditional understanding that Hawaiians viewed of ʻāina as their source of sustenance and survival. As understood by Hawaiians, the land is, in itself, an entity, and was not owned but communal.\textsuperscript{31} The disconnection Hawaiians to their ancestral lands can also cause a disconnect of cultural identity, and therefore, a loss of ancestral knowledge. Edward L.K. Kanahele explains the important relationship that Native Hawaiians feel toward their land. He describes a ‘spiritual wisdom’ that gives an innate sense of identity to Native Hawaiians, but can only be felt with a close relationship of land and place.\textsuperscript{32}

\textbf{TRANSFERING KNOWLEDGE}

\textit{Mana}

\textit{Mana}, or spiritual energy, is what bounded the intimate connection between akua, kanaka, and ʻāina. It was believed that everything possessed and emanated mana, a common belief throughout many Polynesian cultures. When Hawaiians chose a term to translate \textit{religion} into the context of western understanding, they chose the word \textit{ho`omana} (which literally translates to \textit{possessing mana}),\textsuperscript{33} showing the understanding that their akua (the gods which formed their religion) transferred energy and ancestral knowledge to them. Mark Kāwika McKeage discusses the importance of

\begin{footnotesize}
\begin{enumerate}
\item E. S. Craighill Handy, Elizabeth Green Handy, and Mary Kawena Pukui, Native Planters in Old Hawaii: Their Life, Lore, and Environment (Honolulu: Bishop Museum Press, 1972), 18.
\item George S. Kanahele, Kū Kanaka, Stand Tall: A Search for Hawaiian Values (Honolulu, HI: University of Hawaii Press, 1986), 155-9.
\end{enumerate}
\end{footnotesize}
the continuation of mana and the cycling of ancestral knowledge carried by it. The proper burial of `iwi underscores the concept of ultimate cycling of energy. Although the body may return back to the earth, the `iwi will remain and the mana it possess will stay forever as a guide for ancestral direction for future generations.\textsuperscript{34} The same is true for all aspects of the `āina and akua. A disconnection of Hawaiians from their land also means a disconnection from the mana of their akua, and the ancestral knowledge therein possessed.\textsuperscript{35}

Oral traditions

Because Hawaiians were an oral based culture, place names and terms were given for important characteristics, and revealed a significance in their use and meaning. However, many important place names are no longer used, and many Hawaiian terms now translate to cater to American ideals. One significant example is the understanding of the importance of wai, or fresh water to their society’s survival. Traditionally, to express fortune, they used the term waiwai. Settlements with the most access to fresh water were considered waiwai, the closest translation wealth possessed by Hawaiians.\textsuperscript{36} However, today, it is often translated as capital and economic wealth. The value of water fresh water that waiwai implies no longer are considered significant. Such changes in language are symbolic of the changes seen in the Hawaiian Islands today, from a society which carefully intertwined within the natural world to ensure a self-sustaining existence, to one based on

\textsuperscript{34} McKeague, Mark Kāwika, “I Loko o Nā Kipona o Ke Kuli: The Accession Beyond Legal Boundaries” (Department of Urban and Regional Planning Area of Concentration Paper, University of Hawai‘i at Mānoa, 2005), 2-9.


\textsuperscript{36} Handy, E. S. Craighill. The Hawaiian Planter Volume I: His Plants, Methods and Areas of Cultivation. (Millwood, NY: Kraus Reprint, 1985), 128.

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capitalism, expansion, and an indiscriminate approach to living within the land.

Mo`olelo

Hawaiians developed as an oral based civilization. Similar to other oral based cultures, histories, knowledge, and conventional wisdom were passed through generations by mythologies and divine beliefs, referred to by Hawaiians as mo`olelo. Most mo`olelo were specifically place-based. Within them, lessons, values, and traditions were encoded and perpetuated the importance of maintaining cultural practices and traditions. Through mo`olelo, the values of Hawaiian culture were passed on to future generations. As George Hu`eu Sanford Kanahele so elegantly states:

“The language of myth is wrapped in metaphors, poetic images, similes, allegories, word play, or kaona--symbolism that can convey the mystical experience through what we might call its ‘subliminal reach,’ that is, its ability to tap the subconscious faculty of understanding.”


LAND DIVISIONS

Ahupua`a and Carrying Capacity

The ahupua`a is commonly referred to as the most important land division within the Hawaiian land settlement patterns.\textsuperscript{39} The ahupua`a divisions were the significant measurements to allocate resources and political oversight. Taxes were also collected at the ahupua`a level. The ahupua`a land divisions, and the social hierarchy which developed from it, was a way to ensure that the populations were living within their carrying capacity. It was intended that within each ahupua`a the population had the ability to independently function and survive off the resources within it.

Within a defined ahupua`a, it was essential that there was an adequate water source for drinking and cultivating food, as well as the basic living needs for the population of the area to manage a reasonable living, such cultivars for crafts, clothing, structures, and utilities.\textsuperscript{40} (See Figure 5: Typical Ahupua`a) There is some evidence of trade for items including vegetables, tapa, and other various needs not available within Puna.\textsuperscript{41}

\textsuperscript{39} E. S. Craighill Handy, Elizabeth Green Handy, and Mary Kawena Pukui, Native Planters in Old Hawaii: Their Life, Lore, and Environment (Honolulu: Bishop Museum Press, 1972), 46-50.


\textsuperscript{40} Samuel Manaiakalani Kamakau, The Works of the People of Old : Na Hana a Ka Po'e Kahiko (Honolulu, Hawaii: Bishop Museum Press, 1976), 6-7.

E. S. Craighill Handy, Elizabeth Green Handy, and Mary Kawena Pukui, Native Planters in Old Hawaii: Their Life, Lore, and Environment (Honolulu: Bishop Museum Press, 1972), 48-9.

Although water was an important characteristic to contain within a typical ahupua`a, not all had running streams of water features. The ahupua`a found within Puna were such an example. The only ahupua`a with a significant stream was the Kea`au ahupua`a. However, the ample rainfall throughout the rest of Puna allowed for sufficient cultivation nevertheless.

It is also interesting that early records show that āina was sometimes used interchangeably with the term ahupua`a.\(^{42}\) In this context, the true meaning of `āina , as that which feeds and devours\(^{43}\), takes on a very specific meaning, and not one that is generalized with the entire understanding of land itself. Each ahupua`a, when transplanted with the term `āina, was understood to have a very place-based meaning of providing and giving back.

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\(^{43}\) McKeague, Mark Kāwika, “I Loko o Nā Kipona o Ke Kuli: The Accession Beyond Legal Boundaries” (Department of Urban and Regional Planning Area of Concentration Paper, University of Hawai`i at Mānoa, 2005), 2-2.
SOCIAL HIERARCHY

The Hawaiian method of land divisions and settlement patterns were fundamental in managing the resources within the land, allowing ruling chiefs to carefully distribute the. The Hawaiian land division system and ahupua`a were able to function only in conjunction with the social hierarchy that accompanied it. Working in conjunction, the land divisions and political oversight ensured that all populations within Hawaiian society were sufficiently appropriated resources, and living within their carrying capacity. Although political power was distributed through a pyramidal-like structure, the approach was not one that was considered top-down. Instead, members at the “top” of the hierarchy also relied upon a careful monitoring of those who were at the “bottom”. (See Figure 4 : Social Structure of Land Management)

Mōī and Ali`i
Each major land division, usually mokupuni, or major Hawaiian island, was managed by a single and absolute king, or Mōī. The Mōī was to carry out the will of the akua, and was believed be a descendant of akua himself. He was responsible for making all major decisions that affected the well-being of his mokupuni, including food production, warfare, taxes, and religious duties.44 He also appointed ali`i or chiefs, allocating management through the subsequent levels of the land division system to ensure proper oversight.

Konohiki and Maka`āinana
The konohiki were the class of ali`i who were responsible for overseeing work and resources at the ahupua`a level. They worked directly with the maka`āinana, or commoners, who did the physical labor of cultivating the

land. Konohiki were not necessarily from the ahupua’a to which they appointed by the Mō‘ī, and were expected to be fair and equitable in the overseeing maka‘āinana. Maka‘āinana were afforded the peace of mind that they would be provided all necessary resources to live, including food, animals and clothing, as long as they contributed to the work of the land.

Figure 4: Social Structure of Land Management


Figure 5: Typical Ahupua`a

Figure 6: Moku O Hawai‘i

Figure 7: Ahupua‘a O Puna
Summary of Major Land Divisions

<table>
<thead>
<tr>
<th>LAND DIVISION TERM(S)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pae moku / Pae`aina</td>
<td>Archipelago</td>
</tr>
<tr>
<td><code>Apapa</code>aina / `Apapa mokupuni</td>
<td>Close group of islands</td>
</tr>
<tr>
<td>Mokupuni</td>
<td>Island</td>
</tr>
<tr>
<td>Moku / Moku`aina / Moko-o-loko / Apana</td>
<td>Districts or groupings of Ahupua`a</td>
</tr>
<tr>
<td>Okana / Kalana</td>
<td>Large land division within a Moku</td>
</tr>
<tr>
<td>Ahupua`a</td>
<td>Land unit within Moku</td>
</tr>
<tr>
<td><code>Ili / </code>ili`aina</td>
<td>Subdivisions within Ahupua`a</td>
</tr>
<tr>
<td>Kuleana</td>
<td>Ancestral lands tended by `ohana</td>
</tr>
<tr>
<td>Kauhale</td>
<td>Clusters of households</td>
</tr>
</tbody>
</table>

Figure 8: Land Divisions

Applying Mindsets to Sufficiency

The first ancient settlers to Hawai`i arrived at around the first century A.D., and were supplied only with what they could carry on double hulled canoes, which sustained them for month-long voyages from Tahiti. As they began to inhabit the Hawaiian Islands, they applied their understanding of their universe, planting the seeds of their knowledge on cosmology, climatology, and ecology, the roots of their culture and beliefs.

By the time the first European sailors arrived, the complex yet efficient use of land was noted. Captain Cook himself praised the Hawaiians for their sophistication and ingenuity shown in agricultural practices, even in comparison to other indigenous island nations he had previously witnessed and closely observed. It is also noteworthy that Puna was once thought to have been, at one time, “Hawai`i’s richest agricultural region”.

Canoe Plants

For Hawaiians, life revolved around food cultivation, subsistence practices gave way to a masterful approach to sufficiently supply the populations. The early settlers who voyaged to Hawai`i did not come unplanned. Since there were very little natural food sources, they began to carry with them on their voyages plants and animals. These resources were picked for the ability to provide subsistence, with the intention to cultivate once at their destinations, but it was also used as a supply on their long voyages. They brought pigs,

47 Andrew W Lind, An Island Community; Ecological Succession in Hawaii (Chicago, Ill.: University of Chicago Press, 1938) 24-6.
48 Handy, E. S. Craighill. The Hawaiian Planter Volume I: His Plants, Methods and Areas of Cultivation. (Millwood, NY: Kraus Reprint, 1985), 128.

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dogs and chickens which they could breed, as well as important staple foods including taro, sweet potato, banana shoots, breadfruit, yams, kawa and ipu. These plants are commonly referred to “canoe plants”. Many of these plants continued to be extensively cultivated throughout the 19th and 20th centuries, although undoubtedly diminishing over time.

“What is not so clear is whether or not Hawai‘i will continue to be able to sustain future population growth and the kinds of economic development that have occurred in the past few decades, and still remain, in essential ways, Hawai‘i. Change can no longer be measured in the course of what happens in one generation. The rapid rate of Hawai‘i’s economic ‘progress’ seems to have compressed several lifetimes of change into the forty-year period since Hawai‘i became a state in 1959.”

Dana Naone Hall, 2004

After Hawai‘i’s introduction to the western world, the Hawaiian civilization underwent drastic changes occurring in rapid fashion. The interaction with sailors coming from all corners of the world brought many diseases, which Hawaiians had never been exposed to. Populations across the islands were decimated, a crisis which early Christian missionaries used to convert many Hawaiians away from their traditional religions. The traditional ahupua‘a systems were largely abandoned, and Hawaiian ways of life were forever changed.

COLONIZATION OF HAWAI‘I

Immediately after the discovery of Hawai‘i to the western world, it became a stop for trade, mostly fur traders between the Pacific Northwest and China. The sandalwood trade proved to weaken the subsistence economy in Hawai‘i as the workforce, controlled by the ali‘i, shifted manpower away from

cultivating food, and into harvesting sandalwood. Many natives were forced to forgo their traditional lifestyle of cultivation to support the sandalwood trade, and new economic system. It was evident to early European sailors that Hawaiians were unfamiliar with normal trade and export processes and values. Often times, sandalwood, which sailors turned over for huge profits in China, was unfairly traded in turn for items of virtually no value. The culminating result of the sandalwood trade was a Hawaiian society that was indebted to the foreign capitalism system, and faced with famine.

During the early 1800’s, whaling was one of the biggest industries in the world, as oil was the main source of lighting at the time. Honolulu was the best port for whalers en route, and Hawai‘i saw increasing numbers of foreigners stopping on its coasts to stock up on supplies during trips over the Pacific. This not only changed the function of the society, but also the patterns of development, as port cities grew, and influxes of foreign populations arrived. Honolulu grew quickly, doubling in size between 1820 and 1840, causing economic activity to increase. Many businesses, houses, public buildings, schools, churches were established. Many westerners realized the potential investment opportunities in Hawai‘i, and incessantly fought to alienate its land.

1848 Māhele

The Māhele introduced concepts that were likely incomprehensible to native Hawaiians in 1848. It served to be one of the definitive signs which showed the ahupua‘a systems, as systems for managing land, were replaced by individual management of privately owned land. All Native Hawaiians were provided the opportunity to own their own land, which was a completely foreign concept, but in order to obtain this right, Native Hawaiians had to travel to more inhabited towns, and go through a complicated legal process.

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By the deadline given to undergo this process, many tracts remained unclaimed by Hawaiians. Puna saw the lowest amount of land awards given during the māhele, 311,754 acres of Crownlands were awarded to chiefs who were not from the Puna moku, and only 3 Kuleana claims were given to commoners. Davianna Pōmaikaʻi discusses four possible reasons for the extreme low amount of land claims: ⁵²

1. Puna’s extreme isolation may have caused a delay, or possibly even complete lack, in the passing of information. With most of Puna’s population living in on the isolated southeast coast, travel was limited to the port city of Hilo.

2. Puna’s Hawaiian residents did not earn enough money to afford the necessary provisions required to make a claim. Subsistence practices endured longer in Puna than in most Hawai`i regions. Economic activity at the time very was limited, and any existing commerce was largely unprofitable.

3. Volcanic activity, physically unfit lands, or spiritual reverence for pele honuamea caused Hawaiians to purposefully reject their offered claims.

4. Claims were submitted were done so after the deadline set. This also may be due to the isolation of Puna, and the long distance that Hawaiians in this area would have to travel. After the 1848 deadline, 526 claims were submitted, and in 1951, a petition was filed to consider late claims.

Additionally, the very concept of land ownership was an unfamiliar concept for Hawaiians, and the complex process for making a claim may have deterred many commoners. At the time, the consequences of not filing claims may not have been perceived as a huge threat, although in hindsight, the true implications that panned out since would be unfathomable to Hawaiians living in that era.

The unclaimed land proved to be a vital asset in the development of Hawai`i down the line, as these lands were later made available for ownership to future foreign investors. With 260,878 acres of land unclaimed, and available to foreigners, traditional practices of subsistence living were unable to be upheld after 1848. This marked the final dissolution of the traditional way of life, as there were no konohiki to oversee production, leaving the ahupua`a abandoned.

AGRICULTURE

The Reciprocity Treaty of 1875

In 1874, King Kālakaua became the first elected Hawaiian monarch. He was quickly faced with mounting political pressures from foreigners wanting to acquire land. Less than a year into his rein, he signed the Reciprocity Treaty, which made Hawai`i a major player in the global economy, and proved to be one of the major factors in Hawai`i’s transformation. It was enacted on September 9, 1876, and established exclusive free trade agreements with the United States, which Hawai`i’s economy was now bound to. The economic infrastructure created through the Reciprocity treaty enabled Hawai`i-produced sugar to dominate the world market, after decades of relatively small-scale production. However, as Noel J. Kent describes, it caused Hawai`i to focus its full attention on the production of sugar, and “precluded Hawaii’s ability to develop into an autonomous, self-directed, somewhat self-sustaining economic entity.”

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54 Noel J. Kent, Hawaii, Islands under the Influence (Honolulu, Hawaii: University of Hawaii Press, 1993) 47.
The notorious “Big 5”, who had been producing sugar on the islands for decades before, were elevated to a level of economic supremacy. They began to establish banks, insurance companies, and railways, monopolizing many sectors of Hawai’i’s economy. With the isolation from banking entities that oversaw the economy of the mainland U.S., the Big 5 dominated control over much of Hawai’i’s land and development, an attainment that is still evident in the 21st century.

Immigrant Workers

As the sugar industry in Hawai’i exponentially grew, huge immigrant populations were brought as laborers to tend the fields. After the signing of the Reciprocity Treaty, the total population in Hawai’i grew from 55,000 people in 1876 to 154,000 people in 1900. In 1876, approximately 90% of Hawai’i’s population were full or part Native Hawaiian, but by 1900, the Hawaiian population only accounted for approximately 26% of the population.55

Although considerable later than the statewide immigration movement, a huge jump in population can be seen in Puna immediately after the establishment of the Puna Sugar Company in 1900. The Puna Sugar Company and sugar growers on Hawai’i Island brought immigrants from Japan, Puerto Rico, and the Philippines. Throughout the islands, many towns started to develop around sugar plantations, including Kea‘au and Pāhoa. Small business were established to support the immigrant settlements.56

The masses of immigrants not only changed the social dynamics at the ground level, but also at the constitutional level, as immigrants who became naturalized citizens were allowed to vote on affairs in the Kingdom of Hawai‘i.
Agricultural Activity in Puna

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CULTIVATION</th>
<th>AREA</th>
<th>PLACE DESCRIPTION</th>
<th>NOTES ON CULTIVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1840</td>
<td>Breadfruit</td>
<td>N/A</td>
<td>Kapoho</td>
<td>&quot;Abundance of&quot;</td>
</tr>
<tr>
<td></td>
<td>Banana</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sugarcane</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taro</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sweet Potato</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aquaculture</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1851</td>
<td>Pulu</td>
<td>N/A</td>
<td></td>
<td>Hair from Hapu‘u, 736,000 lbs in 1862</td>
</tr>
<tr>
<td>1895</td>
<td>Coffee</td>
<td>168 acres</td>
<td>Oia‘a</td>
<td>Following Land act of 1895</td>
</tr>
<tr>
<td>1899</td>
<td>Coffee</td>
<td>272 acres</td>
<td>Oia‘a</td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td>Sugar</td>
<td>N/A</td>
<td>Ke‘au</td>
<td>Replaces former coffee land</td>
</tr>
<tr>
<td></td>
<td>Pineapple</td>
<td>N/A</td>
<td>Ke‘au</td>
<td>Export to California</td>
</tr>
<tr>
<td>1908</td>
<td>Lumber</td>
<td>N/A</td>
<td>Pahoa</td>
<td>'Ohio</td>
</tr>
<tr>
<td>1931</td>
<td>Cabbage</td>
<td>N/A</td>
<td>Volcano</td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>Dryland Taro</td>
<td>N/A</td>
<td>&quot;Along Coasts&quot;</td>
<td>Along coasts</td>
</tr>
<tr>
<td></td>
<td>Taro</td>
<td>N/A</td>
<td>Ke‘au</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sweet Potato</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sugarcane</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taro</td>
<td>N/A</td>
<td>Northeast Puna</td>
<td>Burning/digging process</td>
</tr>
<tr>
<td></td>
<td>Dry taro</td>
<td>N/A</td>
<td>Kapoho Crater</td>
<td>&quot;A few small patches&quot;</td>
</tr>
<tr>
<td></td>
<td>Pandanus</td>
<td>N/A</td>
<td>Kapoho, Pohoiki, Ophikao</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9: Agricultural Products in Puna


Figure 10: 1906 Coulter Map


Figure 11: 1930 Coulter Map

"The booming financial and real estate activity has left little time to reflect on the current growth-led model for Hawai`i, its appropriateness, present affordability, and long-term sustainability. An examination must be made to see whether basic needs are met and whether the island ecology is protected in the quest for suitable jobs and affordable housing for local people."

Luciano Minerbi\textsuperscript{57}, 1994

REPRESSION OF THE HAWAIIAN KINGDOM

The overthrow of the Hawaiian Kingdom came at a particularly interesting time of changing American values. Distinguished professor of Modern History, Gary Cross, explains that by the turn of the twentieth century, the American Landscape had been thoroughly vanquished. The exploitation of the American landscape caused America to be the “richest country in human history”, and standards of living were greatly lifted.\textsuperscript{58} There was nothing unattainable, as long as you could produce the money. A focus of wants took over the focus of needs. The consumer culture was rising, and Hawai`i had great potential to invest in.

1887 Bayonet Constitution

The success seen after the Reciprocity treaty proved to increase foreign interest in permanent control of Hawai`i’s land. The 1887 Constitution greatly infringed upon the power of the Hawaiian monarchy, and paved the


way to eventual American control of Hawai`i. The “Hawaiian League”, a
group consisting of westerners and plantation owners, was led by Lorrin A.
Thurston. They opposed Hawaiian Nationalism with the interest of
expanding their own economic interests. With hundreds of supporters, as
well as the backing of the “Hawaiian Rifles”, who were deployed around
Honolulu, the Hawaiian League imposed the 1887 Constitution, which was
reluctantly signed by King Kālakaua in order to avoid any violent conflict.
This was later referred to as the “Bayonet Constitution”, and drastically
reduced the executive power of the monarchy.

Under the Bayonet Constitution, the king no longer had the ability to appoint
his executive cabinet, the House of Nobles. Instead, they were elected into
office by voters who were required to either own a minimum of $3,000
taxable property, or have an annual income of at least $600, among other
still requirements. Under these requirements, the ability of the Hawaiian
population to vote for their own representatives in the House of Nobles was
cut in half. Only non-native voters of American or European descent could
vote, and Asian citizens were not able to vote, although under previously
established constitutions they could.

After the Bayonet Constitution, the Reciprocity Treaty was also renewed and
amended to give the U.S. outright control of Pearl Harbor. This had been a
goal of Hawaiian League supporters for some time, as it allowed them
further military backing. Hawaiians clearly recognized this as a threat to their
sovereignty, and previous to the Bayonet Constitution, was something that

59 Jon M. Van Dyke, *Who Owns the Crown Lands of Hawaii?* (Honolulu, HI: University of Hawaii
Press, 2008), 145-149.
60 Ralph Simpson Kuykendall and Arthur Grove. *Day, Hawaii: A History from Polynesian Kingdom to
61 Jon M. Van Dyke, *Who Owns the Crown Lands of Hawaii?* (Honolulu, HI: University of Hawaii
Press, 2008), 145-149.
King Kālakaua, firmly denounced. Kālakaua enduringly pursued an overturn of the 1887 Bayonet Constitution, exercising all powers that he retained, and uniting all Hawaiians who still supported him. He continued to make progress against the imperious reform party until his abrupt passing on January 20, 1891 while in San Francisco.

1893 Overthrow of the Hawaiian Kingdom

Queen Liliʻuokalani, was the first female Hawaiian ruler, and successor to Kālakaua. She was also his sister. Along with the Hawaiian crown, she also inherited the same unrelenting pressures seeking annexation of Hawaiʻi to the United States. Like her predecessor, she carried on the efforts to restore autonomy to the Hawaiian people amid revolutionist opposition, proposing constitution to give back the ability to appoint cabinet members. However, annexation parties gained momentous support of the U.S. House of Representatives. In 1889, U.S Minister John L. Stevens arrived in Hawaiʻi with the intent to aggressively carry out the annexation goals supported by the U.S. With 160 armed U.S. troops surrounding ʻIolani Palace, the Queen forfeited all executive powers to a U.S. Provisional Government. She did so with the belief that she would be presented the opportunity to regain control, and like Kālakaua, Liliʻuokalani endlessly fought to regain Hawaiian rights with little effect. Even the support of President Grover Cleveland did little to reverse the illegal overthrow of the Hawaiian Kingdom, as Hawaiʻi progressively transformed under control of the U.S. The Provisional Government eventually gave way to the Republic of Hawaiʻi, annexation, territory status, and eventual U.S. state.

The Māhele, Reciprocity Treaty, Bayonet Constitution, and overthrow of the Hawaiian Kingdom was aimed to eventually allowed foreigners to buy, sell, and develop land in Hawai‘i. With the formation of Republic of Hawai‘i in 1894, all previous land agreements were superceded, including the 1865 Statute, which recognized the Crown Lands as inalienable. Land that remained unclaimed after the Māhele was eventually made available to be exploited for capital ventures, mostly agricultural purposes, which changed the landscape and the way land was thought of.

**ECONOMIC DEVELOPMENT**

Post war America saw a huge bump in consumer sales, an increase of 20% in just one year after WWII.\(^{65}\) The economy was now driven by consumer spending. At the time of statehood in 1959, and into the 1960, the sugar industry in Hawai‘i gradually declined. Pineapple industries were also starting to see a significant decline as companies were beginning to look outside of Hawai‘i for cheaper labor.\(^{66}\) New methods of capital income were needed. At this point, there was a shift in views about land use in Hawai‘i away from agricultural, and more toward serving the growing consumer market.

**Legislative Land Reform**

A series of legislative bills in the 1960’s raised taxes on large land owners, who were still using land primarily for large scale agricultural purposes. Taxes were raised on large landowners, who then began to phase out agriculture activities and develop their lands into subdivisions where land was either sold or leased. Newly subdivided lands were reclassified, and


prices were determined according to their “highest and best use” for economic gains to the state. Development of these lands would be focused around capitalize on the growing tourism industry.  

The advancement of Hawai‘i’s economic development agenda was largely intensified under the candidacy of three-term Governor John Burns, an active member of the democratic reform party. He campaigned with the vision of turning Hawai‘i into the trade and economic focal point of the Pacific, and the connection between U.S. and Asia. Under Burns’ term, Hawai‘i saw many public development projects on all islands, which adhered to the political momentum regarding development practices first initiated with the democratic land reforms and statehood.  

**Economic Maladies**  
Luciano Minerbi argues that pointless economic growth does not inhibit an equitable or sustainable future in Hawai‘i. Conversely, it only “mechanically responds” to needs of developers and does not address such social issues of local jobs, affordable housing, cultural and environmental degradation, or quality of life for residents. This was made clear as Governor John Burns’ push for Hawai‘i industrialization was short lived, and by the mid-1970’s, economic growth had nearly stagnated at under 1%, causing huge unemployment and welfare rates. State spending and debt became of prominent concern, and the cost of living was up to 25% higher than the

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U.S. Industrial innovations also displaced many plantation workers, such as those in the Puna Sugar company, who went out of business in the 1982.

Tourism

A large part of the development after the 1960’s land reforms was focused on capitalizing on the growing tourism in Hawai‘i. On the Big Island, Governor Burns focused tourism development in Kona. Today Kona still remains a dominant target for Big Island tourism, with ever developing golf courses, timeshares, and resorts. Puna also sees a steady stream of tourists, who visit natural attractions such as hiking trails in the unique rainforests and the lava flows in Kalapana. There is also a large market for vacation rentals, many of which are concentrated near the Kapoho area. However, many of advertised vacation rentals function without proper licenses, so exact figures can’t currently be determined.

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70 Noel J. Kent, Hawaii, Islands under the Influence (Honolulu, Hawaii: University of Hawaii Press, 1993) 140-63.
“The beauty of these natural kūpuka is not only their ability to resist and withstand destructive forces of change, but also their ability to regenerate life on the barren lava that surrounds them.”

Davianna Pōmaika‘i McGregor, 71 2007

CULTURAL KĪPUKA

Throughout the changes that many places in Hawai‘i experienced throughout the mid 1900’s, Puna’s vast and isolated landscape allowed it to be relatively low on the priority of developers. The Hawaiians in Puna, and other similar isolated rural areas throughout Hawai‘i, were able to maintain the close relationship with the land they live on. Cultural identity was maintained through continued traditional practices, including subsistence food production and cultural gathering in the Natural Landscapes.

These few cultural strongholds of Hawaiian practices and lifestyle are referred to as a ‘cultural kūpuka’ 72 by Native Hawaiian practitioner and professor of ethnic studies at the University of Hawai‘i, Davianna McGregor who conducted extensive ethnographic surveys in such regions. Within these cultural kīpuka, distinct populations choose to live practicing the traditional models of subsistence living.

The significance of this term is derived from natural kīpuka, which are patches or “islands” of forest that is left intact as the surrounding landscape is covered by lava. These resilient kīpuka are responsible for regenerating

72 Ibid.
entire tracts of native forests and their ecologies. The remaining Puna forests, including Wao Kele O Puna, are part of a natural kīpuka, making this region particularly important asset. The provisions of the natural and cultural kīpuka in Puna have enabled Hawaiians, a way of life and sustenance that resisted the dependence of capitalism.

However, pervasive and non-conforming development within Puna have endangered the cultural rights and needs of those who continue to chose the subsistence lifestyle. As development in Puna indiscriminately expands, the constant destruction of natural and cultural resources threatens the existence and functions of these important kīpuka.

Land Speculation in Puna

In the Post-war era, a new age of consumerism was flourishing in mainland America, and the notion of excess and luxury had fully taken over American society.73 American citizens started to inhabit vast sub-divisions which adhered to this culture the American car culture. In 1958, Puna also became a victim to the “American Dream”. Two Denver businessmen partnered with locally-based politicians and businessmen to purchase huge tracts of undeveloped land which had little economic value to the state. These lands were then subdivided into individual properties, usually 1-3 acres in size. With incredibly low prices and a strategic marketing plan to mainland buyers, many of these plots were quickly bought up, even though many were without basic infrastructure. Approximately 80,000 lots were eventually speculated by 1975, mostly in the Puna, Ka`u, and South Kona districts, setting the population growth and development trends seen in these regions today.74


Figure 12: Changing Population in Puna


“Projection of Resident Population by District, Hawai’i County: 2000 to 2020” (Hawai’i County Census Data Base, 2006).
Figure 13: Puna Subdivisions

Figure 14: Subdivided Lots
The availability of very cheap subdivided lots after land speculation have caused a steady increase in population since, and individual lots continue to be purchased ala carte. Notably, very few of the properties bought initially went to Big Island residents. According to geographical surveys, an approximate 57,200 properties of the 80,000 subdivided lots created in the land speculation movement in Puna were purchased by outside residents before 1975. This caused a drastically expanding population which quickly outgrew the available resources and public provisions available.

**Population Growth**

This trend continues on today, as rural areas across Hawai`i, are still seeing many houses going to out of state residents. In Hawai`i county, approximately 43.1\% of the houses purchased between 2008 and 2015 were bought by out-of state residents. Kaua`i County and Maui County experienced similar trends, where 45.4\% and 52\% of households were purchased by out of state buyers, respectively.\(^{75}\) Puna is one of the most rapidly growing districts in the state and has seen a steady 17\% population increase every 5 years since 2000. If this trend continues, the population 5 years from now, in the year 2020, the population is estimated to grow to 58,246, an additional 8,445 people from today’s population total of 49,801.\(^ {76}\) (See Figure 12: Changing Population in Puna)

Many district improvements have been undertaken to alleviate the affects of rapid growth. With growing traffic concerns in Puna, there has been a major focus on highway improvements to Kea`au-Pāhoa Road, the only byway connecting the Lower Puna area to the rest of the island. Additional Road networks have also been proposed. However, more proactive approaches

\(^ {75}\) State of Hawai`i, Department of Business, Economic Development and Tourism, Research and Economic Analysis Division, *Residential Home Sales in Hawai`i*, 2015.

\(^ {76}\) “Projection of Resident Population by District, Hawai`i County : 2000 to 2020” (Hawai`i County
are needed, as retrospective actions have many times been forced to tradeoff one unfavorable complication for another.

**Cost of Living**

Out of state homebuyers have also aided in Hawai‘i’s perpetual cost inflation. According to Luciano Minerbi, speculative economic projections in industries such as tourism, real estate development, military, and agribusiness, have allowed simultaneous population and job growth. This has created an economic system which must be maintained by continual growth. However, while the economy in Hawai‘i grew between the 1960’s and 1990’s, the wages did not, and current dollars heavily outweighed constant dollar projections.\(^77\) The wealth distribution gap has been expanding since, and is sustained by a constant in-migration of workers with higher skill sets and incomes who are better suited to take advantage of, and invest in, economic trends.

Between the years 2008-2014, the average residential sales price was $478,189. Out of state buyers paid a considerable amount more on average. During the same period, mainland buyers, on average, spent $630,390, an increase of $152,201(31.8%), while foreign buyers, on average, spent $785,604, an increase of $307,415 (64.3%) compared to local home buyers.\(^78\)

**Poverty Rates**

According to Hawai‘i’s Department of Business, Economic Development & Tourism (DBEDT), 5-year estimates taken from US census data show that


the median household income in the Pahoa census tract is $29,821, with 33.6% of the population living in poverty. Comparatively, the median household income in the state of Hawai‘i and Hawai‘i county is $67,402 and $51,250 respectively, while the poverty rates of these areas are 11.4% and 19.5% respectively.

**Homeless**

Hawai‘i also has a severe homeless problem. As of February 2016, Hawai‘i had the largest homeless population per capita. In October 2015, Governor David Ige declared an emergency declaration to address the homeless situation. The efforts have primarily been in urban Honolulu, where effects are clearly visible, and considered harmful to Hawai‘i’s business and tourism industries. Puna also has a large population of homeless, but the situation is far less conspicuous, as many homeless individuals find refuge in the natural forest, or squat in the many unoccupied plots.

**Food**

With an approximate 360,000 acres of prime agricultural land in Puna, and a climate which allows cultivation year-round, it is theoretically possible that the population could be fully sustained by local agricultural activities. However, it is approximated that 85% of food consumed in Hawai‘i is shipped. The added transportation measures account for food prices that are 25% higher on average than prices on the mainland U.S. There are 4 grocery stores in the Puna district; Foodland in Kea‘au; Sure Save Supermarket in the Orchidland Estates Subdivision; Malama Market in Orchidland Estates Subdivision; Malama Market in

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80 Ryan Kam, *Estimating Carrying Capacity in Puna: The Importance in Rural Hawai‘i*, University of Hawai‘i at Mānoa Department of Urban & Regional Planning, April 30, 2015.

Pāhoa town center; and Island Naturals, also in Pāhoa. These four grocery stores are the primary source for Puna’s estimated 50,000 residents to acquire fresh foods. As populations grow in Puna, more land is at-risk, with some lands classified for prime agricultural uses already being re-zoned to build houses.\textsuperscript{82}

**Crime**

The district of Puna has one of the highest crime rates, not only on Big Island or the state of Hawai‘i, but also in the entirety of the United States. When compared to other districts of similar size, violent crimes and property crimes were exceptionally high.\textsuperscript{83} The Hawai‘i Tribune Herald reported that 2013 showed record highs for both violent crimes and household crimes in Hawai‘i County, the later of which accounted for 90.6% of total crimes. Citing the official report released by the state Attorney General's Research and Statistics Branch, and Paul Perrone, the attorney general’s chief of research and statistics, the article states that the high household numbers could in part be due to the dispersed households and thick surrounding vegetation.\textsuperscript{84}


NATIVE SPECIES

It cannot be overstated how much the Hawaiian culture was integrally tied. Before the widespread colonization to introduced species, many early to mid 20th century studies conducted on Hawaiian plants concluded that approximately 66-80% of plants in Hawaii were endemic, and found nowhere else in the world. The large majority of the rest were indigenous. The plants and animals are one of the main draws to Hawai`i.

**Biomes**

The large number of native species found in Hawai`i is due both to the isolation of the Hawaiian archipelago, and to the unique terrain. Part of the unique characteristics of the landscape in Hawai`i is that it possesses such a wide range of terrestrial zones, or biomes. Hawai`i possesses a range of biomes, from mesic forest, tropical forest, tundra. These zones are found within a relatively small amount of space, whereas continental regions may include only one biome classification for hundreds of miles.

**Wao**

This means that an extensive and diverse range of natural material goods were available to the Hawaiians, who delineated these zones accordingly. The precise observation of varying zones was also integrally tied with the functions of the ahupua`a system, as they understood the resources that

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were afforded to them. Puna consists of mostly rainforest and mesic forest. However, these zones are not typically highly productive for cultivation using traditional methods, so in the old days, settlement occurred primarily nearer to the coast.

PELE’S PRESENCE

Pelehonuamea, or Pele, goddess of fire, was traditionally held with particular regard throughout the Hawaiian Islands. Her active presence in Kīlauea volcano, one of the most active volcanoes in the world, meant that she was particularly respected and revered Puna. The constant volcanic activity had a considerable role in shaping the culture of Hawaiians, similar to many other civilizations which lived in the vicinity of such eruptive power. They recognized the dualistic ability of Pele to both create land, and destroy it.

Pelehonuamea

In traditional times, Pele was so respected, that many feared improper worship and offerings to her might result in destructive consequence. Early 19th century explorer of the islands and missionary, William Ellis wrote in his journal about the deep embedded deference of Natives toward Pele. Ellis wrote of the unwillingness of Natives in the Puna area to trek too close to certain areas of Kilauea, and freely eat ohelo berries. He described the

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uneasiness displayed when he and his crew began to consume them without first offering a tribute to Pele.\textsuperscript{90}

Like many other aspects of Hawaiian culture that were deemed mythological beliefs, Pele actually revealed a distinct understanding of volcanic behavior and knowledge of tectonic patterns. The story of Pele travelling across the pacific to evade her sister, goddess of the sea, while stopping, forming volcanic craters, and eventually creating the Hawaiian islands, actually precisely reflected how the islands geologically formed over time.\textsuperscript{91}

Absolute respect for Pele also meant respect for the land and animals.

\textit{Historic Lava Flows}

Pele is regarded as perhaps the only deity that has survived and worshiped even after centuries of western contact.\textsuperscript{92} Kiläuea volcano is one of the most active volcanoes in the world, and Pu’u O’o crater has repeatedly caused unpredictable disruptions which, at times, have directly affected residents and nearby communities.

\begin{itemize}
\item \textsuperscript{90} William Ellis, \textit{Journal of William Ellis: Narrative of a Tour of Hawaii, or Owhyhee : With Remarks on the History, Traditions, Manners, Customs, and Language of the Inhabitants of the Sandwich Islands. Rutland, Vt.: Tuttle, 1979.}
\end{itemize}
Figure 15: Lava Threat Zones
**THREATS TO NATIVE BIOTA**

*Habitat Destruction*

Because of the fragile state of Hawai‘i’s native species, humans can make a huge difference in conserving or threatening them. Human population increase has, and always will, pose a huge threat to the existence of tropical rainforests. Important native species in Puna are threatened by continual growth and development and proper management of human impacts is dependent on a thorough understanding of its ecological systems.  

Although Hawaiians undoubtedly also changed the native environments, they maintained the ability to sustain themselves with the resources, regenerative, gave back, established kapu. Admittedly, they were also responsible for some and habitat changes species extinction, which may be understood of many animal species, but on a large scale, the island ecosystems were maintained, and species not directly affected were given the opportunity to adapt.

Charles P. Stone and J. Michael Scott suggest 8 reasons to preserve Native ecosystems, all of which have the ability to enhance sustainability in rural Hawai‘i regions.  

1. Aesthetic and recreational values which may help generate revenue from tourism activities

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2. Hawaiian cultural values
3. Genetic diversity for Utilitarian purposes
4. Preserve natural processes and gene pools
5. Provide environmental baselines for research and educational activities to inform land-use decisions
6. Watershed and climateic values
7. Ethincal considerations
8. Constitutional, statutory and planning mandates

**Fragmentation**

The careless use of land in Puna is perhaps most apparent when displayed in relationship to its natural climatic zones. Puna subdivisions clearly sever and isolate large portions of forest zones, creating a threat to biodiversity known as *fragmentation*. Fragmented rainforests cause limited accessibility of plants and animals naturally occurring within certain climatic habitats. When combined with global warming effects, overharvesting, in this case to make way for housing and development, and fragmentation of important habitats has profound effects on species and stressors can largely effect the resilience of native plants and animals.  

Heterogeneous gene pools increase the ability of native systems for both short and long-term adaptability in with changing climates. However, fragmentation isolates portions of habitats, leading to higher rates of species inbreeding, and therefore, more homogenous gene pools. These confined populations of species have higher likelihood of genetic mutations, and are more vulnerable to climate change.

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**Invasive Species**

Human activity and environmental manipulation has caused an increased threat of invasive species. In addition to the implications to biodiversity and cultural needs, invasive species have caused severe economic loss to the U.S.\(^98\)

Because Hawai`i’s native plants and animals evolved over time in such a unique niche, and in such isolation from newly introduced species, alien invasive species that have become naturalized in Hawai`i today have been a major threat to native species. Today, Hawai`i contains the highest rates, by far, of endangered species of plants and animals in the country.\(^99\) Forest habitats studied on Hawai`i island show nearly no recolonization of native species once invasive plants have become the dominant species.\(^100\) Albezia trees are one of the most pervasive threats to forest ecosystems on Big Island. Albezia trees grow extremely fast and tall. However, they are also extremely brittle, and have a very shallow root system. It is common for large branches to fall, or even entire trees to topple during during strong winds. (See Figure 16: Fallen Albezia Branch)

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\(^{98}\) David Pimentel et al., *Environmental and Economic Costs Associated with Non-indigenous Species in the United States*, (Ithaca, NY: Cornell University, College of Agriculture and Life Sciences, 1999).


Figure 16: Fallen Albezia Branch

Source: Author
Figure 17: Fragmentation in Puna

Source: GIS Database
Figure 18  Threatened and Endangered Plant Zones

Source: GIS Database
Figure 19: Conservation Zones

Source: G.I.S. Database
"The quest for an environmentally sustainable, economically affordable, and just development will succeed only by redefining the planning principles of public health, safety, and welfare using quality of life and sustainable economic development indicators, island by island and community by community."

Luciano Minerbi

HAWAI`I 2050 SUSTAINABILITY PLAN

Amid growing concerns of residents in a changing Hawai`i, a task force was created through a legislative bill that was passed in 2005. The Hawai`i 2050 Sustainability Task Force, as it came to be called, set out to provide goals, indicators, and action steps for Hawai`i’s development through 2050, and replace the outdated Hawai`i State Plan, which was formulated in the 1970’s. The Hawai`i 2050 Sustainability Plan was created to address the long-term needs and concerns of Hawai`i residents, and reflect the preferred future of the community. Neighborhood outreach events engaged the public on all islands, which were used to develop general guidelines which contribute to a sustainable and equitable Hawai`i.

The state defined as sustainable Hawai`i by the following measurement indicators:

- Respects the culture, character, beauty and history of our state’s island communities
- Strikes a balance among economic, social and community, and environmental priorities
- Meets the needs of the present without compromising the ability of future generations to meet their own needs

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The Hawai‘i 2050 Sustainability Plan also named 5 main areas to focus sustainability efforts on:

1. A sustainable “way of life”
2. The economy
3. Environment and Natural Resources
4. Community and Social Well-Being
5. Kanaka Maoli Culture and Island Values

Together, these focus areas formed one overarching vision of the Hawai‘i 2050 Sustainability Plan. It also included education as an important imperative to tie all 5 aspects together. The guidelines formed in the plan serve as a general framework, which can be further defined at the community level.\(^{102}\)

\(^{102}\) State of Hawai‘i, Hawai‘i 2050 Sustainability Task Force, *Hawai‘i 2050 Sustainability Plan: Charting a Course for Hawai‘i’s Sustainable Future*, 2008.
COMMUNITY DEVELOPMENT PLAN

VISION: “Residents of Puna live in harmony with the ‘āina while promoting a sustainable vibrant local economy, healthy communities, and a viable transportation system that is accessible, friendly and safe for now and future generations.”\(^\text{103}\)

Background

In 2008, a regional community plan for the Puna district was released, highlighting overall approaches to future development, major considerations, and stakeholders. It was also amended several times throughout 2010 and 2011. It acknowledges the fact that Puna is subject to several major influences of change in the future. The *Puna Community Development Plan (Puna CDP)* shows a general understanding of some of the problems that were also outlined in this research investigation.\(^\text{104}\)

Challenges

The Puna CDP lists the following planning considerations as current development challenges. These are also used as objectives to drive planning actions.

- Lack of utility infrastructure to residences
- Un-even settlement patterns in subdivisions
- A poor transportation infrastructure
- Mis-use of agricultural soil
- Impacts to native forest

\(^\text{103}\) County of Hawai‘i Planning Department, Puna Development Plan Steering Committee, *Puna Community Development Plan*, 2008.

Amended: November 4, 2010 by Ordinance No. 10-104; June 8, 2011 by Ordinance No. 11-51, 11-52, & 11-53; & December 6, 2011 by Ordinance No. 11-117 & 11-118.

\(^\text{104}\) Ibid.
The plan lists three main areas of focus to guide future development in Puna:

**Mālama I Ka `Aina**
The primary goal of this section in the Puna Community Development Plan is to protect natural environmental areas. A major objective listed is to adopt a Biosphere Reserve Buffer Zone (BRBZ), which will allow more space between forest reserve areas and developed sub-divisions.

**Growth Management**
The plan intends to build community centers in existing communities as a way to mitigate sprawl. This will focus activity of the community around village centers and provide improved access to resources and commerce, decreasing automobile usage. The plan also calls for rezoning.
measures of the existing un-used sub-divisions.

**Transportation**

This section expands upon the growth management section. Town centers will need to have pedestrian infrastructure, and bicycle routes for schools. The plan also calls for implementing mass transit. More major roadways are requested to be implemented.

*Figure 23: Transportation Networks*
W.H. Shipman, Ltd. is one of the largest private land holders in Puna, holding approximately 17,000 acres, including some small property in Oregon. The majority of land in Kea`au is owned by W.H. Shipman, who was responsible for the development of W.H. Shipman Business Park and Kea`au Village Market, which provides the community with grocery stores, small businesses, and a newly constructed medical center. W.H. Shipman has also been closely involved with the continued development of Kea`au town and its public amenities, such as Kea`au Elementary, Middle, and High Schools.

The near-future plans include medium density urban development in Kea`au. In order to do this, W.H. Shipman is currently undergoing the process to amend the zoning of the County of Hawai`i General plan. Under this amendment, 475 acres of land that is classified as Low Density Urban, and 112 acres of land that is classified as Important Agricultural Land, will be reclassified to an Urban Expansion Area. The Urban Expansion area would allow high density development of residences, industrial, and commercial uses. The zoning change is necessary for W.H. Shipman’s vision of a “walkable town” where “Economic growth will come through the promotion of diversified agriculture, encouraging tourism, the addition of new community and education facilities, and the protection of important environmental and cultural assets.” In W.H. Shipman’s petition to

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Official website of W.H. Shipman Limited

reclassify these lands, it also states that the action is necessary in order to adhere to the Puna Community Development Plan’s objective of creating central town centers.

THE DEPARTMENT OF HAWAIIAN HOME LANDS

The Department of Hawaiian Home Lands (DHHL) is one of the major land holders in Puna as well as throughout the Hawaiian Islands. In 1921, Prince Johah Kūhiō Kalanianaʻole conceptualized the Hawaiian Homes Commission Act (HHCA), which designated a land trust of over 200,000 acres of land to put back into the hands of native Hawaiians. Originally, the Hawaiian Homes Commission (HHC) was also conceived as a way to manage these lands, but upon statehood in 1959, the responsibilities of the HHC was transferred to the state, and the DHHL was formed. The DHHL functions to assess, and organize the lands granted under the HHCA for best-use practices. These lands are awarded to Native Hawaiians in need, in the form of 99-year leases for homesteads at the cost of $1 per year. In order to qualify, applicants must be 50% Native Hawaiian, and must undergo an application process, declaring the island of choice for award, as well as choice for type of land lease.\(^{108}\)

The Hawaiian Homes Commission Act

The intent of Prince Kūhiō for the HHCA was to “provide self-sufficiency of native Hawaiians through the provision of land.”\(^{109}\) Kūhiō set aside land specifically for the benefit of commoner class of Native Hawaiians, who were unfairly affected following the enactment of the Māhele.\(^{110}\) It was also aimed as a step toward Hawaiian autonomy and self-governance.\(^{110}\)


EXISTING DHHL PLAN IN PUNA

There are four tracts managed by the DHHL in the district of Puna. These 4 tracts are part of the East Hawai‘i Island plan, which also includes tracts in Hilo. Currently, all four tracts within Puna are listed as low-priority in the Hawai‘i Island Plan Final Report, signifying that there is low desire from awardees to be placed in these tracts, and therefore are not planned to be developed within the next 20-year phase of DHHL’s General Plan. However, the DHHL has already conducted surveys of these tracts, and made general recommendations for future development.111 (See figure 24)

`Ōla‘a is the only tract that is in the upper Puna district. The `Ōla‘a tract is recommended for pastoral land, alternatively sustainable forestry, since it is currently covered with `ōhi‘a.

Keonepoko Nui consists of 100 acres recommended for general agricultural purposes and is currently undeveloped.

Maku‘u Makai consists of 500 acres recommended for general agriculture purposes. It is currently undeveloped, and water and sewage utilities are not available.

Maku‘u Farmlots consists of 868 acres, and is recommended for supplemental agricultural purposes. It has already been fully subdivided, but largely remains undeveloped.

Maku‘u Mauka consists of 640 acres recommended for mixed use development including residential, subsistence agriculture, community, and cultural uses. It is currently partially subdivided, and minimally developed.

111 Department of Hawaiian Home Lands, Hawai‘i Island Plan Final Report, by PBR Hawaii (Honolulu, HI, 2002), 1-8.
and DHHL is undergoing the process for a new community center and further development in the near future.

Maku`u Mauka will be discussed in more detail in Design Introduction of Section V. Any reference to the Maku`u Mauka tracts herein will also include reference to the Maku`u Farmlots to form one entity.

Figure 24: Existing DHHL Plan, Puna

Source: Department of Hawaiian Home Lands, Hawai`i Island Plan Final Report, by PBR Hawaii (Honolulu, HI, 2002).
EXISTING DHHL LAND DESIGNATIONS

Tracts leased to awardees are typically for residential, agricultural, pastoral purposes. The Big Island has a total of 116,963 Acres of land, with 494 agricultural leases, 277 pastoral leases, and 1,277 residential leases available. On the Big Island, agricultural leases had the largest waiting list, with 5,588 applicants as of 2001. Residential and Pastoral waiting lists had 4,864 and 1,353 applicants on the waiting list, respectively.112

Residential

According to the DHHL Hawai‘i Island Plan, residential land use is defined by Residential subdivisions with personal plots less than 1 acre, and with access to potable water, all utilities, and paved roads.113

The Hawaiian Home Lands Strategic Plan for 2012-2017 states that diversifying homestead leases are desired, as overall, single family residences were the focus. Alternative residential units are desired, such as kauhale, kupuna, multi-family, rental, and transitional housing options.114

This means providing more agricultural and pastoral uses, as well as aquaculture and community agriculture opportunities.

Subsistence Agriculture

Subsistence agriculture land use is defined as “lifestyle areas” which allow beneficiaries land to cultivate agricultural products for personal home consumption. Aquaculture is also allowed. Lots are less than 5 acres, with marginal to good soil. Residential occupation is required with access to water and unpaved roads. The existing Maku‘u Development Plan includes

[Sources are listed at the end of the document.]

80
50 2-acre subdivided lots for subsistence leases, with plans to increase by subdividing remaining undeveloped land in the Maku’u Mauka tract.\textsuperscript{115}

**Supplemental Agriculture**

Supplemental agriculture land use is defined as lots for commercial-level agriculture which supplies supplemental income to the beneficiaries. Lots are less than 40 acres, with marginal to good lands. Residential occupation is optional, but requires access to a water source and unpaved road. Beneficiaries must actively utilize 2/3 of land within one year of occupation, and have a farm plan. The existing Maku’u Development Plan includes 127 5-acre subdivided lots for supplemental leases, with plans to increase by subdividing remaining undeveloped land in the Maku’u Mauka tract.\textsuperscript{116}

**General Agriculture**

General agriculture land use is defined as lots for commercial level agriculture. Land sizes, residential, and infrastructural requirements are not defined.\textsuperscript{117}

Keonepoko Nui and Maku’u Makai tracts are both designated for general agriculture use, but lack of infrastructure currently stop these tracts from being developed.

**Pastoral**

Pastoral land use is defined as marginal lands used specifically for pastoral uses. Lots with irrigation are less than 100 acres, while lots without are more than 100 acres, up to 1,000 acres. A farm plan, fencing, and unpaved access is required. 708 acres in `Ola`a are designated for pastoral use, but are is currently subdivided.\textsuperscript{118}

\textsuperscript{115}Department of Hawaiian Home Lands, Hawai’i Island Plan Final Report, by PBR Hawaii (Honolulu, HI, 2002) 7-8, 20-22.  
\textsuperscript{116}Ibid.  
\textsuperscript{117}Ibid.  
\textsuperscript{118}Ibid.
Community

Community land use includes public amenities such as parks and spaces for recreation or cultural activities. Land sizes are not defined, and are to be built to county standards.\textsuperscript{119}

Commercial

Commercial land use includes leases for retail and business. Land sizes are not defined, and are to be built to county standards. The DHHL leases no more than 1\% of its land for traditional commercial or industrial uses as a way to gain revenue.\textsuperscript{120} The DHHL General Plan lists the goal of providing economic opportunities and business guidance for residents within their communities. Alternative methods of gaining revenue for the DHHL are therefore desired.\textsuperscript{121}

Additional Land Use Designations

Land use designations that are not found within the Puna district include conservation, industrial and special districts.

\textsuperscript{119} Department of Hawaiian Home Lands, Hawai`i Island Plan Final Report, by PBR Hawaii (Honolulu, HI, 2002) 7-8, 20-22.
SECTION IV

RESEARCH DISCUSSION
The research conducted in this project leads to the conclusion that a complete change in Hawai‘i’s land-use paradigms have caused severe impacts to the sustainability of Hawai‘i’s populations. Changes since western contact have historically occurred extremely rapidly, and were done without any coordinated long-term vision. Honolulu developed from rural to urban, in a matter of decades, and now rural areas are facing pressures which put it on the same track.

This project has identified some of the threats that rapid unplanned development has posed to rural Hawai‘i communities, using Puna as a focus to find specific examples. It has investigated major land-use changes in Puna, the factors and motivations behind these changes, and how these changes have directly affected the sustainability of its communities. In doing so, it has also elucidated critical design considerations which have been either been poorly addressed, or ignored altogether. This section will discuss and summarize the major findings revealed in the research investigation, and will be the point of departure for the next section, which explores specific design strategies to address major issues discussed herein.

HAWAI‘I’S CURRENT LAND-USE PARADIGM

From the time of its discovery in 1776, Hawai‘i has been subjected to high pressures of change. Its fertile lands, iconic beauty, and position in the Pacific instantly put a premium economic value on its land to the outside world. Foreign pressures have been unrelenting in changing Hawai‘i’s land to capitalize on the economic trends of the time, historically using imposed political systems to do so. Most recently, Hawai‘i has subsequently been a major player in, and become fully dependent on, the fluctuating and unreliable global markets of trade, agriculture, tourism, and eventually, real
estate. These industries follow a model of continual expansion, and have caused drastic land changes statewide. Despite Hawai‘i’s success in such markets, economic gains have largely benefitted only a handful of well-suited private stakeholders who still continue to be major drivers of Hawai‘i’s economy and development today.

Hawai‘i’s rural areas have taken over as the main focus of such development today, where growth rates are projected to be more than triple the rate seen in Honolulu. Recent trends also indicate that in these rural areas, about half of the total residential sales are by out-of-state buyer, who pay significantly more. In the last few decades, Puna has experienced drastically changing landscape and social dynamics, and its residents, have had little control in resisting implications seen from capitalist-driven land-use and development. With the availability of large cheap lots, growth is expected to continue.

EFFECTS TO SUSTAINABILITY

Section II of this project introduced several important concepts, which outlined how sustainability was defined throughout this project. The terms sufficiency, carrying-capacity, ecological footprint, and triple-bottom-line were discussed, and can be used as measurement tools to assess the sustainability of a community. It can also be used to help communities formulate specific sustainability goals in the future. Contradictory to a society that balances these concerns. It is apparent that the shift to full-blown capitalism has caused a disregard of the sustainability indicators listed above. The planning paradigm in Hawai‘i has caused increasingly complex issues to the population in Hawai‘i.

The method of import/export economies endangers the general population, as 85% of food is imported, and not readily available in case of natural disaster or port shut down. It has proven to continually increase the cost of living, leaving communities unable to have any significant role in bettering
the situation infrastructurally. Because the real estate holds a higher value to the state than agricultural uses, it often becomes victim to capitalism. Habitat loss, fragmentation, climate change, and invasive species prove to threaten the adaptability and existence of native ecologies. Continued development of the subdivided lots in Puna would further devastate the landscape and isolate large portions of fragile forest ecosystems.

Similar to many other indigenous civilizations, cultural practices of ancient Hawaiians reveal an intrinsic connection with nature. Native Hawaiians developed these practices slowly over the course of two millennia, and allowed a self-sustaining existence on the Hawaiian Islands. The natural landscape and culture therefore became one and the same, and it cannot be overstated enough how such drastic land changes have marginalized the cultural rights and identity of Native People. Adverse effects seen by development may soon become irreversible as the natural resources and ecologies are severely degraded. The devastation to Hawai‘i’s native species have subjugated the rights and identity of the Hawaiian people. Not only has it caused adverse and possibly permanent damage to ecologies which are fundamental to perpetuating and preserving Hawaiian values, but in some cases, it has endangered their ability live their preferred lifestyle and provide sustenance to their families.

Similar stories of colonization and development have been seen time and time again to indigenous people all around the world. However, the rapid pace that this occurred in Hawai‘i has caused severe injustices to its culture, ecologies, and societies. The system of perpetual growth not only continually shifts power away from those at the bottom of the economic scale, but it also establishes the fact that such negative implications will be continue to be a mounting threat to Hawai‘i, its people, and its ecologies. At a certain point, there are only two pathways to break such a system: either a total collapse, or a profound revolution.
ACHIEVING SUSTAINABILITY IN THE FUTURE

Development should be aimed at the community level to bring well-informed collective interests together and give power to communities built on similar values. Local development is needed to establish a secure and healthy fresh food supply. Green jobs and ecotourism can cater to existing market, but also provide educational opportunities which promote and share the importance of conserving natural and resources, and sharing an authentic and rich cultural experience.

Drawing inspiration from traditional mindsets may be influential in supporting modern Hawai‘i residents in living a more sustainable healthy lifestyle, but translating such ideals into a modern context is a complex task for designers.

Grassroots movements, as well as official Hawaiian organizations such as OHA, DHHL, The Queen Emma Foundation, and Bishop Estate are gaining strength and influence by helping to promote these types of community values. They have also provided assistance to at-risk populations in attempt to integrate them into the modern society using traditional ways. Hawaiians have also been building legislative ground toward self-determination and control of land to benefit the people of Hawai‘i. The 1993 “Apology Bill”, formation of the Aha Council have not only shown a refined approach, but also has built interest and awareness of everyday Hawaiians and residents.

This momentum, along with creative collaboration from architects, planners, developers, governments, and most importantly, communities, may give way the the type of revolution needed to achieve a sustainable future for all Hawai‘i residents.
SECTION V

CONCEPTUAL DESIGN: MAKU‘U MAUKA
Figure 25: Maku'u Location Map

Replace with 11x15

Location map
“The Maku`u Farmers Association will work together to create a vibrant recreational, cultural and civic center that demonstrates their cultural values and way of life to improve the quality of life and diversify the economic base of the community.”

-Maku`u Farmers Association

MAKU`U MAUKA

The Maku`u Mauka tracts present a perfect opportunity to demonstrate a self-sustaining community. Maku`u Mauka is at the gateway of what is considered lower Puna, which is connected to the rest of the island by only one major street. This makes these communities vulnerable to isolation, and the need for self-sufficiency even greater. Natural disasters have shown an eminent threat of isolating the Lower Puna region from the rest of the island, leaving residents unable to access goods or services.

Maku`u Farmers Association

The vision of the community is led by the Maku`u Farmers Association (MFA). The MFA is a non-profit organization which was founded in 1986 by beneficiaries of DHHL’s Maku`u Farmlots. Since its grassroots conception, the MFA has been the major stakeholder in the long-term development of the Maku`u tracts. Integrating itself within DHHL’s overarching vision, the

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Prepared for: Maku`u Farmer’s Association
MFA aims to become self-sufficient in its production of food, energy, and capital, using its shared cultural heritage as a guide.  

**Maku`u Mauka Tracts**

The Maku`u Mauka tract consists of 640 acres. The final report of Hawai`i island lists this tract as viable for residential, subsistence agriculture, community, and cultural uses. The dense `Āinaloa subdivision lies to the Northwest border of the Maku`u Mauka tracts, and land owned by the State of Hawai`i border all other sides. The lands owned by the State of Hawai`i are primarily undeveloped, and no future plans have been released.

**Maku`u Farmlots Tracts**

The Maku`u Farmlots, lies on the Makai side of Kea`au-Pahoa Road from the Maku`u Mauka plots. It consists of 868 acres, and includes 127 agricultural tracts, 181 acres leased to the Federal Aviation Agency (FAA), and 38 acres used by the Maku`u Farmers' association (MFA). The Maku`u Farmers' Market, which is held every Sunday. Agricultural awards on this tract are for supplemental agricultural use. This means that the awardees of these 5-acre plots must utilize 2/3 of their award for cultivation, develop an agricultural farming plan, and start agricultural activities within a year. The Hawaiian Paradise Park subdivision lies to the Northwest border of the Maku`u Mauka tracts, and land owned by the State of Hawai`i border all other sides. The lands owned by the State of Hawai`i are primarily undeveloped, and no future plans have been released.

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**CONCEPTUAL DESIGN GOALS**

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Prepared for: Maku`u Farmer's Association

124 Department of Hawaiian Home Lands, *Maku`u Regional Plan (Kapolei, HI, 2010)*, 8.
The conceptual design presented in this section aims to build upon the work of the MFA and provide a pathway to fulfilling its vision. It will draw upon the research findings outlined in the previous sections, and translate theoretical design principles into a conceptual community design.

The design seeks to enable Makuʻu Mauka homesteaders to make a self-sustaining living. This will be achieved through an organized planning strategy and a careful use of land which allows the planning strategy to efficiently be carried out and promoted. The following design objectives will be fundamental to formulating self-sustaining design strategies:

- Enable cultural practices to be perpetuated and shared
- Demonstrate careful use and respect for the land and its natural resources
- Build a sense of community identity driven by an agricultural lifestyle
- Assist new farmers and at-risk populations to be integral contributors
- Strengthen the base for local economic development
- Strive toward food and energy independence

As previously stated, this conceptual design aims to present theoretical methodologies, rather than definitive solutions or details. Makuʻu Mauka will be used as a model to exhibit conceptual architecture, land use, and planning principles which were alluded to in the research conclusions. These design principles may also translate to other similar rural communities, with the overall intent of contributing to a sustainable Hawaiʻi in the future.
CONSTRAINTS

As discussed in the research investigation, many unique social and cultural issues make planning a complex task. In addition, there are also many physical constraints which require careful consideration and creative planning to achieve the community vision of the Maku`u residents.

Specific Demographics

Even when compared to other communities in Puna, the residents of Maku`u have an exceptionally high poverty rate, with 50% of its families living below the poverty line as of the 2000 census. At the time, Maku`u had 22 households with 59 total residents, earning a median household income of $23,125. 87.7% of the population had received a high-school diploma or equivalent, but none had received a higher learning degree.125

Limited Business Opportunities

The MFA lists the lack of economic opportunities in the area as a major limiting factor to expanding operations. This applies both to farmers running businesses, and to individuals seeking jobs. The Maku`u Regional Development Plan also states that farmers currently do not have the entrepreneurial skills required to independently run businesses activities, and recommends assistance for new farmers.126

Marginal Soils

Soil on the Maku`u tracts are currently listed as marginal. This may inhibit diversification of agricultural products and yields. Marginal soils, as well as overgrowth and lack of infrastructure, also inhibit development in the neighboring DHHL tracts Maku`u Makai and Keonopoko, which otherwise

125 Department of Hawaiian Home Lands, Maku`u Regional Plan, Honolulu, HI, 2010. Compiled from U.S. census data
126 Department of Hawaiian Home Lands, Maku`u Regional Plan, Honolulu, HI, 2010.
would be useful connections to include in a larger planning design strategy.\textsuperscript{127}

\textbf{FUDS}

During World War II, portions of land within Maku’u were used by the Navy as practice bomb sites, referred to as \textit{formerly used defense sites (FUDS)}. The FUDS in Maku’u, which is also known as the Former Popoki Target Area, covers approximately 640 acres, and includes two specific areas of concern, a bombing target area, and troop training area.\textsuperscript{128} FUDS also affect an estimated 472 land lessees in other Hawai’i Island DHHL tracts including; Kuhio Village, Puukapu Agricultural and Pastoral Lots, Lalamilo Residents Lots, and Kawaihæ Residents Lots.\textsuperscript{129} Remediation and public educational outreach efforts have been put forth, although many tracts have already been built upon.

\textbf{Existing Awards}

Despite the 127 land awards already given in the Maku’u farmlots, only a handful have actively moved onto their land. These households are mostly concentrated along Niaulani and Kaoluwalu Streets. The empty lots are a serious security concern to those living in Maku’u who feel their security and safety are compromised, especially considering the high crime rates seen in the region. Maku’u residents also want these lands to be occupied to increase the sense of community vitality. In the Maku’u development plan, they call for an enforcement of land provisions.\textsuperscript{130}

\textsuperscript{127} Department of Hawaiian Home Lands, Maku’u Regional Plan, Honolulu, HI, 2010.

\textsuperscript{128} U.S. Army Corps of Engineers, Former Popoki Target Area Fact Sheet and The 3 Rs for UXO Safety, Honolulu.


\textsuperscript{130} Department of Hawaiian Home Lands, \textit{Maku’u Regional Plan (Kapolei, HI, 2010)}, 26.
Figure 27: Conceptual Community Plan

Replace with 11x15

Conceptual community design
Figure 28: Protracted Kuleana Areas

Figure 29: Former Popoki Target Area

Figure 30: Distance to Agricultural Plots

Replace with 11x15 Diagrams
LAND RE-ADJUSTMENT

Currently, the Maku`u Farmlots are subdivided into 127 5-acre lots. However, due to water and infrastructure needs, most plots are vacant. On the Maku`u Mauka side, only 100 acres of the total 640-acres have been subdivided, and only 3 of these tracts have been occupied. The vacant lots are concerns for the existing community, but reveals an opportunity to exercise more design freedom. All undeveloped land will be re-adjusted into a more efficient and wise use of land.

Protracted Awards

In order to avoid the moral complications of exercising eminent domain, the re-adjustment will honor the beneficiaries already cultivating their lands in Maku`u. They will be allowed to carry out the remainder of their land lease, and will have the option to relocate to conform to the adjusted community plan at will. (See Figure 28: Protracted Kuleana Areas

COMMUNITY CENTER

The community center will be vital to carrying out the community vision of the MFA. The future community center will be the central point, or piko, of Maku`u and will serve to be the connection between Maku`u residents and the greater Puna community. A permanent Community Center has been in planning stages since 2006. It is intended to function as a “cultural learning center” and community gathering place, not only for Maku`u, but also for the greater Puna region. The planned Community Center aims to share the farming lifestyle of the MFA as a way to perpetuate Hawaiian values,
establish a stronger local food and economic base, and provide assistance to populations at risk to poverty or homelessness.\textsuperscript{131}

The community center will be situated with direct access to Kea`au-Pāhoa Road, the only traffic artery leading to lower Puna, and will be the physical embodiment to make Maku`u the gateway to lower Puna. It will greet traffic and create a sense of identity for the community.

Since a design has already been in the works, this project will not focus on specific design details or the physical design of the community center. However, the following should be considered:

\textit{Maku`u Farmers Market}

The Maku`u farmers market has been hosted by the MFA every Sunday and has provided business opportunities to farmers and the general public. Revenue generated by the weekly farmers market has been crucial to building a new community center. It serves as a place for local commerce and public engagement, and is now one of the few regular community events. The Maku`u Farmers Market is widely referred to on tourism blogs, and currently has a 4.5 star rating (out of 5) on Yelp.\textsuperscript{132} A new community center in the future will undoubtedly add to the momentum gained by the MFA and expand the operations of the Maku`u farmer's market.

Prepared for: Maku`u Farmer's Association

Outreach

The community center should include community agriculture components. These can serve to host educational outreach events and programs. It will also support transitional housing with a way to acquire food and housing in turn for work. Food produced here can also be used to generate revenue for community resources.

LEED Certification

If economically feasible, the planned community center should be designed within standards to achieve Living Building Challenge or L.E.E.D. certification. With Maku`u being a flagship agricultural community, such recognition has great potential to bring increased awareness to the community and their vision. Additional grants may need to be pursued, but the may provide a valuable return on investment to the DHHL and Maku`u community.

NATURAL GROWTH CORRIDOR

The most prominent design gesture is the natural growth corridors which embraces the community. It integrates the natural world into the community, a vital aspect of creating a sense of cultural connection for Hawaiians, and establishes a balance between akua, kanaka, and `āina.

Conserve Cultural Resources

The Natural Growth Corridor will be used as a cultural resource for the community. It aims to promote the conservation of natural resources for ecological and cultural resources.

First and foremost, it will stop further fragmentation and better connect the native species of the bordering areas. It will function as a conservation areas for native plants, which can be used for native gathering rights. It will also provide a connection to the bordering areas. The growth corridor may
also connect to the Maku`u Makai tract, and Wao Kele O Puna tract, providing the mauka-makai orientation.

**Development Buffer**

The mauka growth corridor was a direct response to the dense `Aīnaloha Subdivision which borders the northern property line of the Mauka tract. Rather than continuing with more dense subdivisions, the growth corridor establishes a physical relief. Similarly, the Eastern corridor is aimed to establish a buffer in the case of future development which directly borders the Maku`u property. In this way, it also stops the further fragmentation of the forest habitats, and allows some migration and dispersal routes for plants and animals.

**Eco-tourism**

Pedestrian trails will create an opportunity to utilize the Natural growth corridor as an educational tool, providing the opportunity to share the importance of its functions with the community. Visitors will be able to learn about cultural resource utilization, native ecological functions, watershed management. By doing so, it will also create a supplemental source of money for the community to use and further promote conservation.

**FUDS**

The most critically affected areas from FUDS activity will be covered by the natural growth corridor and community center rather than using it for awarded land. By placing community uses over FUDS, they can be another educational aspect to share with the public. This will also protect farmers, some who may be using heavy equipment, from exposure to unexploded ordinances. (See Figure 29: Former Popoki Target Area)
SUGGESTED PLANNING STEPS

Community-Owned Agriculture
Community-owned agriculture land can be used as a way to generate additional revenue to benefit the Maku’u community. This type of land currently does not exist in the DHHL land designations. Community-owned agriculture will be owned by the DHHL, and agricultural products produced on these lands can be sold to profit DHHL and the Maku’u community. This type of agriculture is aimed to help at-risk populations, who can acquire food in turn for agricultural work, although any member of the public can also do work for food. It can also be a form of eco tourism, which generates additional revenue by hosting activities, programs, or events which support community education for agriculture and cultural practices. There will be a community owned agriculture component at the community center, and at each of the residential clusters. Additional research should be done directly with the community to determine exact agricultural sizes and functions.

Community Leased Agriculture
Community-leased agriculture land can also be used to generate revenue for the DHHL and Maku’u community. This type of land currently does not exist in the DHHL land designations. Community-leased agriculture will be owned by the DHHL, and will be available to the general public for small-scale agricultural production. Small plots can be short-term leased at a cost determined by the MFA. This type of agriculture aims to expand agricultural opportunities to neighboring communities, building a bridge between Maku’u and the greater Puna district. There will be one community leased agricultural designation. Additional research should be done directly with the community to determine exact agricultural sizes and prices.
Aquaponic systems

Aquaponic systems are becoming increasingly popular for agricultural production. Aquaponic yields are believed to be greater and more reliable, and technological advancements are still making progress. Water usage is also decreased due to the fact that plants are cycled on a closed system loop, rather than daily watering of soil. This may be especially beneficial in the Maku`u area, considering that most of the soils is considered to be marginal. Aqua culture systems also have the potential to be simultaneously implemented. Since traditional loko i`a systems are largely impractical along the Puna coastline, modern aqua culture systems may be a practical solution. Additional research should be done directly with the community to determine feasibility and buy in.

Business Development Department

The community should create a permanent setup for agricultural products to be sold. An established department should be created, in order to develop and manage systems which sell food and goods on a more consistent basis. A middle-man distributor for Maku`u farmers will allow more agricultural products to be available to the public, and a steadier stream of income for producers. Price limits and regulations should be set up to deter price gauging and exploitation of the system. It is important that farmers should not be required to sell their agricultural products through such a distributor, but the option of doing so may help improve efficiency and production, and farmers will be able to focus on daily agricultural activities while also generating revenue. Farmers may still participate in the weekly farmers markets, if desired. Currently, there is no such existing agency or system within the DHHL, but with increased agricultural and pastoral production by beneficiaries, it is important that there is also a system to help manage farming outputs and provide stable business opportunities. Creation of such a system would take careful coordination to implement, but once put in place, it may also help with a reliable source of revenue for the DHHL.
Figure 31: Residential Cluster
RESIDENTIAL CLUSTERS

Rather than a dispersed pattern of individual residences and agricultural plots, the homesteads will be consolidated into designated clusters. Similar to Kauhale organizations, some resources and spaces will be shared, creating a sense of community cohesion and interaction while also adding a sense of security. The overarching concepts of the larger Maku’u community will be translated to the residential clusters, which will blend the natural environment with the social and living spaces. Similar to the larger community, natural growth will embrace these smaller clusters, to give a connection to nature and some defined sense of privacy. Assuming that all Maku’u beneficiaries choose to build a homestead, there will be a total of 908 residential units, which will be divided amongst 5 equitably spaced residential clusters.

KAUHALE DISTRIBUTION

Efficiency
Clusters will minimize impact on the natural environment, and help to maximize efficiency by consolidating roads and infrastructure. These clusters can also function on a micro-grid system, rather than relying on external electrical lines, although further research must be done to address precise implementation. This may also be a way to share equipment, as listed under the needs of the MFA.

Social Spaces
An ancillary agricultural office / center will be located at the entrance of each residential cluster to help manage its community agriculture lands, and open business opportunities of each residential cluster on a daily basis. This will also increase connectivity of the separate residential clusters, which each specialize in a particular agricultural activity.
A gathering space in the piko of each residential cluster will function as a small scale community center, and can be used for recreation, meetings, and events. It will have a park, pavilion, and imu for.

**Community Agriculture**

Each residential cluster will contain some amount of community agriculture. This agricultural land will be worked by residents living in transitional housing as a way to trade work to acquire food and goods. Similar to the main community agriculture plot at the community center, the residential community plot will be used to generate income for the community. Each community agriculture tract will grow a single designated “specialization” plant.

**RESIDENTIAL TYPES**

A wider variety of residential types will be available. This is aimed at increasing the annual awards given, as stated by the DHHL. Multiple housing options will also create equitable housing opportunities to more people of varying household incomes, and provide a way to move up the economic ladder. Homesteaders will be provided the opportunity to choose their housing preference, regardless of their award type.

**Single Family Residences**

The majority of homesteads will be single family residences. These plots will be 20,000 s.f. which is the size that DHHL set for its residential-only homestead awards. This design will be discussed in further detail in the next chapter.

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133 Department of Hawaiian Home Lands, *Maku’u Regional Plan (Kapolei, HI, 2010).*
Low-Rise Apartments
Low-rise units can offer more affordable housing and possibly rentals. Apartment style units will follow a similar construction of the residential homesteads, but units will be condensed and physically connected. A shared utility grid and less personal space will allow apartment homesteads to be bought or leased at a lower price. An detailed design for low-rise units will not be presented in this project. Figure xxx displays some possible conceptual configurations which expand upon single family residences.

Transitional Housing
Transitional housing will be included in each residential cluster as a way to integrate working members into the community. Transitional housing units may simply be low-rise units which are slightly modified to hold multiple residents. The MFA and DHHL will need to determine their willingness to provide transitional housing within their communities. However, it is intended that these units be integrated within the residential clusters rather than isolated and disconnected from the community.
OVERALL DESIGN INTENT

In all aspects of life, Hawaiians approached their environment with careful approaches which minimized impact to their environment and served multiple utilitarian functions. Ingenuity was their sharpest tool. It is important that homes reflect the socio-cultural values of the community they reside in, and enable the preferred lifestyle of its residents. The homes in Maku‘u will take a simple approach, using construction techniques that will reduce costs and serve multiple functions. Materials will be carefully chosen to minimize environmental impacts and aim to create a regenerative lifestyle. The design will provide off-the-grid capabilities by incorporating passive design strategies and utilize the latent value of the natural elements.

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Figure 34: Roof Construction
**INTERMODAL STEEL BUILDING UNITS**

*Intermodal Steel Building Units (ISBU), commonly referred to as shipping containers,* present a huge opportunity to make a statement of embracing a self-sustaining lifestyle and renouncing the reliance on imports. ISBU’s are readily available and will function as a second life.

**Affordability**

Used ISBU’s can be bought relatively cheap, typically ranging in Hawai’i from $3,500 to $4,000 for a 40-foot high cube. Some websites also offer lower prices when ISBU’s are bought in bulk. Minimal construction processes are needed to make ISBU’s habitable, since it is already structurally sound. However, modifications are virtually limitless, and can also be fashioned to higher “luxury” standards, as desired. Further cost analysis will need to be conducted once a specific design has been developed in order to determine exact cost estimates.

**Structure**

ISBU’s are made from corten steel, and are available in a variety of lengths. Homesteads will use the 40-foot high-cubes, which have the dimensions of 40’x8’x9.5’, and weigh approximately 4.5 metric tons. ISBU structures are also easy to expand upon and remodeled in the future, with possible stacking options. Unaltered, they can be stacked up to 6 high, although manipulation of the sides will decrease its strength.

The rigid frame structure make ISBU’s able to withstand seismic loads, and the bathroom can be used, in extreme cases, as a hurricane-safe room. In such a situation, the structure of ISBU’s could prove to be especially useful to protect against falling tree branches.

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**Ability to re-locate**

In the possible case of lava flow, ISBU’s have the ability to retain their structure while being moved. This allows the residents to keep, and move belongings, and still have a habitable structure for either temporary or permanent re-location.

**Heating**

Large heat gains of are one of the biggest criticisms in using ISBU’s for building. Because steel conducts heat quickly, it is important to protect the ISBU’s from direct sun exposure. This will be addressed through a series of methods,

**ARCHITECTURAL STRATEGY**

Openings can be cut out of the ISBU’s to expose up to 60% of its entire broad side. The steel panels cut out can then be fashioned into sliding panel doors. This will allow the house to be totally open to the outside, or to be totally closed for security purposes. Screen doors can also provide an intermediate option, which allows light and breezes through, but still physically closes off the interior. The steel doors can also protect the interior in the case of high winds or hurricanes.

The single story plan includes approximately 1,000 square feet, and can comfortably accommodate a family of 3, based on the average household size of the Pāhoa census tract. It will include a full kitchen with bar seating, living room, laundry room, outdoor dining area, A.D.A. accessible bathroom, master bedroom, and study which can be configured for additional bedrooms. The floor plan of the house can easily be modified to accommodate specific needs, and the ISBU’s allow for future renovations or add-ons, possibly even second stories.
Passive Cooling Design

Building orientation should be the first line of defense against solar heat gains. In order to mitigate heating, individual units will be oriented with the broad side of the container facing south. This will minimize the low angles of the western sun exposure, traditionally the most problematic to heat gains in Hawai`i climates. The ISBU’s are also positioned to catch optimal cross-breezes, with predominant winds coming from the northeast or southwest all year round. A stilted foundation, central atrium breezeway, and elongated envelope will also optimize ventilation throughout the building. A spray-on insulation is also recommended to be applied to the inside of the ISBU’s. If required, ceiling fans may also assist with additional cooling, but should be avoided unless absolutely necessary.

Roof Uses

The roof will aid in minimizing the direct sun exposure to the ICBU’s. There will be 3 distinct components to the roof, which will serve regenerative functions, aside from a radiant barrier.

The largest component will function as a water catchment. It will span across both ICBU’s and provide some shelter for the breezeway, laundry area, and front yard. It will also catch the abundant 157 inches of annual rainfall, which will be diverted to a 10,000 gallon storage tank in the rear of the house.

22 standard sized photovoltaic panels will cover the remainder of the front ICBU, and provide some overhang shading.

An extensive green roof will cover the remaining exposed roof area, and vegetation will carry down to the sides of the ISBU’s. The vegetation can function as personal agricultural production, such as herbs or vine growing plants such as sweet potato. An EPDM or some form of water-resistant barrier will need to be placed under the vegetative layer.
**Connecting to the Outside**

Home lifestyle is the biggest defining factor in the quality of life. The natural aesthetics and that characterize the identity of the community will also be brought within the residence itself. Panoramic views to the surrounding forests, will provide a constant connection to place and identity. Dedicated exterior spaces, a central atrium, and a flowing open floor plan create a light indoor-outdoor quality which subdues the architectural structure itself.

**Albezia**

The use of albezia wood has the potential to eradicate the invasive plant and use a locally sourced material. Unfortunately, it is an abundantly fast growing plant. Although not structurally sound for building loads, it may be a cheap source for finished surfaces that helps in the preservation of native species.
Figure 38: Exterior Living Spaces
Figure 39: Exterior Views

SOUTH WEST ELEVATION

NORTHEAST ELEVATION
<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahupua`a</td>
<td>Land division which manages natural resources, political oversight, and population sufficiency on a community level</td>
</tr>
<tr>
<td>`Āina</td>
<td>Land, Earth, Country</td>
</tr>
<tr>
<td>Akua</td>
<td>Natural Gods, Deities, Spirits</td>
</tr>
<tr>
<td>Ali`i</td>
<td>Chiefs</td>
</tr>
<tr>
<td>Canoe Plants</td>
<td>Plants brought by Polynesian Settlers</td>
</tr>
<tr>
<td>DHHL</td>
<td>The Department of Hawaiian Home Lands</td>
</tr>
<tr>
<td>Endemic</td>
<td>Native species found no where else in the world</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>The splitting, severing, disconnection, or isolation of continuous natural habitats</td>
</tr>
<tr>
<td>Indigenous</td>
<td>Native species also found in other regions of the world</td>
</tr>
<tr>
<td>Konohiki</td>
<td>Ali<code>i class who oversaw ahupua</code>a work and resources</td>
</tr>
<tr>
<td>Lōkahi</td>
<td>Unity, Agreement, Accord, Unison, Harmony, Connection; traditionally pertaining to that between Man, Gods, and Nature</td>
</tr>
<tr>
<td>Maka`āinana</td>
<td>Common class workers who labored in cultivation and crafts</td>
</tr>
<tr>
<td>Makai</td>
<td>In the direction of the Ocean</td>
</tr>
<tr>
<td>Mana</td>
<td>Spiritual power, energy, or essence</td>
</tr>
<tr>
<td>Mauka</td>
<td>Toward the Mountains</td>
</tr>
<tr>
<td>Mō`ī</td>
<td>Absolute King or high ruler of an island</td>
</tr>
<tr>
<td>Moku</td>
<td>Large land division of an island</td>
</tr>
<tr>
<td><strong>Mokupuni</strong></td>
<td>Island</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Sprawl</strong></td>
<td>“Unplanned, unregulated, careless development which takes over land and resources” [Delores Hayden]</td>
</tr>
<tr>
<td><strong>Waiwai</strong></td>
<td>Rich in water, resources, goods, wealth</td>
</tr>
</tbody>
</table>


County of Hawai‘i Planning Department. Puna Development Plan Steering Committee. 
*Puna Community Development Plan*. 2008.
Amended: November 4, 2010 by Ordinance No. 10-104; June 8, 2011 by Ordinance No. 11-51, 11-52, & 11-53; & December 6, 2011 by Ordinance No. 11-117 & 11-118.


Compiled from FBI and the U.S. Justice Department data and statistics


Department of Hawaiian Home Lands, Maku‘u Regional Plan, Honolulu, HI, 2010.


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U.S. Army Corps of Engineers. Former Popoki Target Area Fact Sheet and The 3 Rs for UXO Safety. Honolulu.


