

— *Final Report* —

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# Archeological Overview and Assessment and Research Design Hawai‘i Volcanoes National Park

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Prepared for:

National Park Service  
Pacific West Region—Pacific Islands Support Office  
P.O. Box 369  
Makawao, Hawai‘i 96768

Under Contract No. C8298030001  
Task Order T8306060448

August 2008

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Hawai‘i Volcanoes National Park (HAVO).

**ARCHEOLOGICAL OVERVIEW AND ASSESSMENT  
AND RESEARCH DESIGN,  
HAWAI'I VOLCANOES NATIONAL PARK**

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Pacific West Region—Pacific Islands Support Office  
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August 2008

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## PROLOGUE

Nāmakaokeahikaiāea,...a prophetess and diviner made a prophecy. She watched the skies and knew of the secrets of the earth. She told her family, the chiefs, the observers,...diviners, and orators, “A demi-god [kupua] approaches across the sea. It is a demi-goddess [kupua wahine] accompanied by her brothers..She will become a goddess [Akua wahine] of our descendants. She is Pele.”

Benjamin K. Nāmakaokeahi, *The History of Kanalu* (1900-1901 [2004]:E 10)

When Kekuaokalani died, Ku-kailimoku and all the ancient gods, except for Pele, were forever vanquished.

Joseph Feher and Edward Joesting, *Hawaii: A Pictorial History* (1969:158)

On March 21st, 1925, over two thousand persons, mostly natives, assembled at the rim of the crater to watch and encourage four venerable kahuna (witch doctors) in their efforts by prayers and offerings to induce Goddess Pele of the Volcano to return the molten lava to the pit. The presence of the lava is reassuring that explosions or severe earthquakes are not likely. When the first 92-year-old kahuna stretched his arm over the pit, he was immediately answered by an avalanch [sic] from the distant walls, whose rumble accented by the previous quiet caused a little flurry among the spectators...

*Superintendent's Report*, Hawaii National Park (NPS 1925)

The three individuals mentioned the greatest number of times in Mary Kawena Pukui's '*Ōlelo No'eau, Hawaiian Proverbs* (1983) are Kamehameha, Pele (each with 37 entries), and Pele's sister Hi'iaka (36 entries).

## **ACKNOWLEDGEMENTS**

We sincerely appreciate the never-ending assistance provided to us by the staff of Hawai'i Volcanoes National Park, the archeologists, cultural specialists, and archivist. In particular, Jadelyn Moniz Nakamura supplied critical information and management guidance and offered much appreciated support and encouragement. Laura Carter Schuster took us on an enlightening historical and archeological tour of Kahuku, and gave us insights on the history of archeological research in the park. We also wish to thank Ed and Diane Stasack, who provided the update on their petroglyph research at HAVO. That update is included here as Appendix C.

Unless otherwise credited, photographs in the report were taken by the authors.

## PREFACE

A discussion of the archeology of Hawai‘i is hardly possible without incorporating material from the remarkable body of Hawaiian traditions. The detail, quantity, and complexity of the traditions preclude, of course, any possibility of completely understanding them or of grasping with unquestioned certainty the nature of a cultural landscape that can be perceived through them. Further, the presentation of this material in the present report is best considered as interpretive, that is, interpreted through the etic lens of anthropology. There is no intent to suggest that it is an emic representation. In the end, this effort is a limited redaction or, expressed scientifically, a model. However, the intent of a redaction or model is to offer a structure that provides others with an opportunity to see things a little differently.

Hawaiian houses on the arid Ka‘ū coast, 1823 (Ellis drawing)





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**HAWAII  
VOLCANOES  
NATIONAL  
PARK**

**ARCHEOLOGICAL  
OVERVIEW,  
ASSESSMENT,  
and  
RESEARCH  
DESIGN**





## **I. INTRODUCTION**

In American archeology, Hawai'i is unique. In Hawaiian archeology, Hawai'i Volcanoes National Park (HAVO) is unique.

About Hawaiian uniqueness: the archeological resources of Hawai'i are islands in a vast sea of data—traditional cultural and historical data, quantitatively and qualitatively different from those of any other place in the United States. Further, the archeological remains extend across all regions of the islands, but are limited as sources of information by comparison to other cultural-archeological areas because traditional Hawaiian material culture had a remarkably high perishable component. It is senseless to study the islands of physical remains without reference to the context provided by the vast sea of traditional information. At the same time, these two unique aspects, richness of traditional information and single-order complexity of remains, have probably contributed to a degree of methodological and conceptual poverty in archeological research.

About HAVO uniqueness: there is no other place in Hawai'i (and few places in the world) that has a dynamic landscape like that of HAVO. In many respects, this exacerbates the already extreme characteristics of Hawaiian archeology. Volcanic action has physically destroyed much of the archeological record, and at the same time, traditions about volcanism have made archeology alive and rich with associations.

The present report is a study of this uniqueness. It is an Archeological Overview and Assessment (AOA), a National Park Service (NPS) management document that “describes and evaluates the known and potential archeological resources in an area; [and] identifies the need for additional field surveys to locate, evaluate, and document resources” (NPS 1998: Chapter 6.B.2.c; also see NPS 2004). The HAVO AOA has been prepared by International Archaeological Research Institute, Inc. (IARII) at the request of the National Park Service, Pacific West Region, Hawai'i Volcanoes National Park—Pacific Islands Support Office.

### **THE AOA PROJECT AREA**

HAVO is located at the southern end of the island of Hawai'i, which is the southernmost island in the Hawaiian archipelago (Fig. 1). Covering over 323,430 acres, the park encompasses the summits and slopes of two of the world's most active volcanoes, Kīlauea and Mauna Loa. Kīlauea has been in almost continuous eruption since 1983; the last eruption of Mauna Loa occurred just over 20 years ago in 1984.

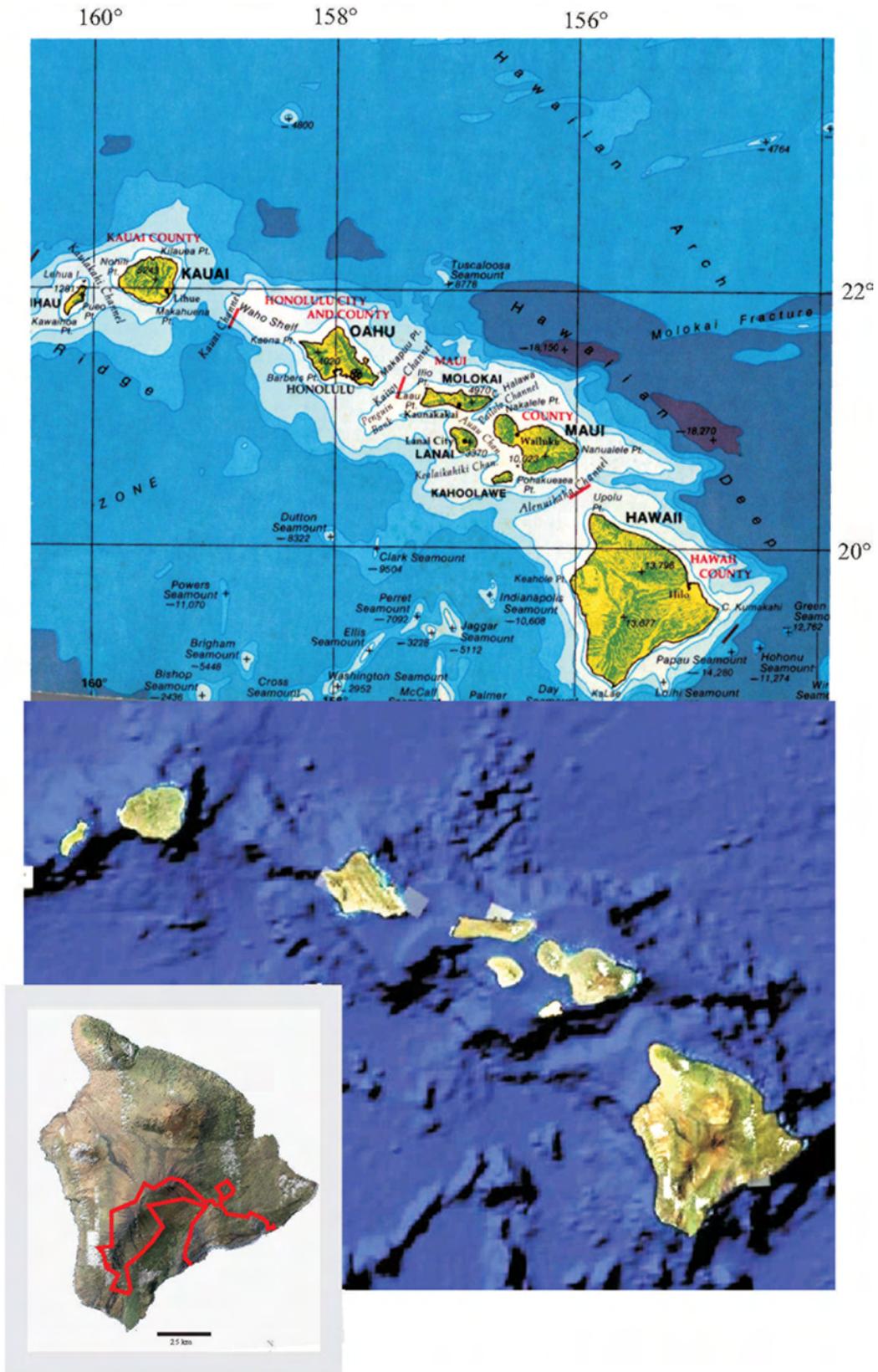


Figure 1. The location of HAVO on the island of Hawai‘i (lower left), and the island of Hawai‘i in the Hawaiian Archipelago (top: shaded relief from Armstrong 1973; bottom: NASA photo).

HAVO was established as Hawaii National Park<sup>1</sup> in 1916 as the 16th national park in the US and its territories.<sup>2</sup> The original park covered only a section of the volcano of Kīlauea. It was subsequently expanded to include much of Kīlauea and the adjacent Mauna Loa, as well as incorporating the coastal area to the south and southeast in 1938 (called the Kalapana Extension).<sup>3</sup> In July 2003, the National Park Service acquired 116,000 acres on the southern slopes of Mauna Loa, in essence doubling the size of HAVO; now called the Kahuku Management Unit (KMU), this land was formerly part of the historic Kahuku Ranch. Figure 2 shows the park boundaries and the dates of parcel acquisition.

Kīlauea Crater is the hub of activity in the eastern portion of the park. It is served by the Hawai‘i Belt Road, which provides access to Hilo to the east and Ka‘ū and Kona to the west. Subsidiary paved park roads encircle Kīlauea Crater and also extend seaward to the Puna-Ka‘ū coast and inland to the lower slopes of Mauna Loa. The Belt Road as it passes through southwestern Ka‘ū marks the seaward edge of the KMU and is the only public access to this part of the park; there are no paved roads within the KMU except in the area adjacent to the Belt Road.

The original mission of Hawaii National Park was to recognize and preserve the geological and natural resources of Kīlauea. Little attention was given to archeology and Hawaiian traditional culture until the effective addition of the Kalapana Extension in 1959. The acquisitions of the Footprints area in the 1930s and the Kalapana Extension offer sharp contrast from an archeological perspective: the Footprints area was brought into the park in recognition of this unique cultural property but with no archeological survey; the Kalapana Extension was acquired after extensive cultural, historical, and archeological study (Emory, Cox et al.1959), particularly in anticipation of the extension of the Chain of Craters Road from the Kīlauea summit to coastal Kalapana (Jackson 1972). Shortly after the initial Emory, Cox et al. (1959) studies, additional survey was carried out to “complete the assessment of the Park’s archeological resources” (Smart et al.1965:Forward; Emory, Soehren, et al. 1965). Subsequently, the passage of the National Historic Preservation Act in 1966 and interest in Waha‘ula Heiau interpretation led to a continuing series of archeological investigations that has continued to the present. Archeological research at HAVO is summarized in Section IV.

## GOALS OF THE AOA

An Archeological Overview and Assessment (AOA) is defined in Chapter 2.E.1 of the National Park Service Director’s Order 28 (DO-28; NPS 1998) in the following manner:

---

<sup>1</sup> The original park included Haleakalā on Maui, which was split off as a separate unit in 1960. HAVO was redesignated Hawai‘i Volcanoes National Park in 1961.

<sup>2</sup> With some park units going out of service, HAVO is now recognized as the 15th park. Many histories of the NPS and individual parks have been written (see e.g., Harpers Ferry Center 2005, and its list of readings). One that is of special interest because of its analytical approach to NPS goals and orientation is Anderson (2000), which, although focused on Grand Canyon National Park, provides a useful framework for review of every park’s managerial history.

<sup>3</sup> The history of the park and its expansion is presented in Apple (1954), Jackson (1972), and recent park archeology reports.

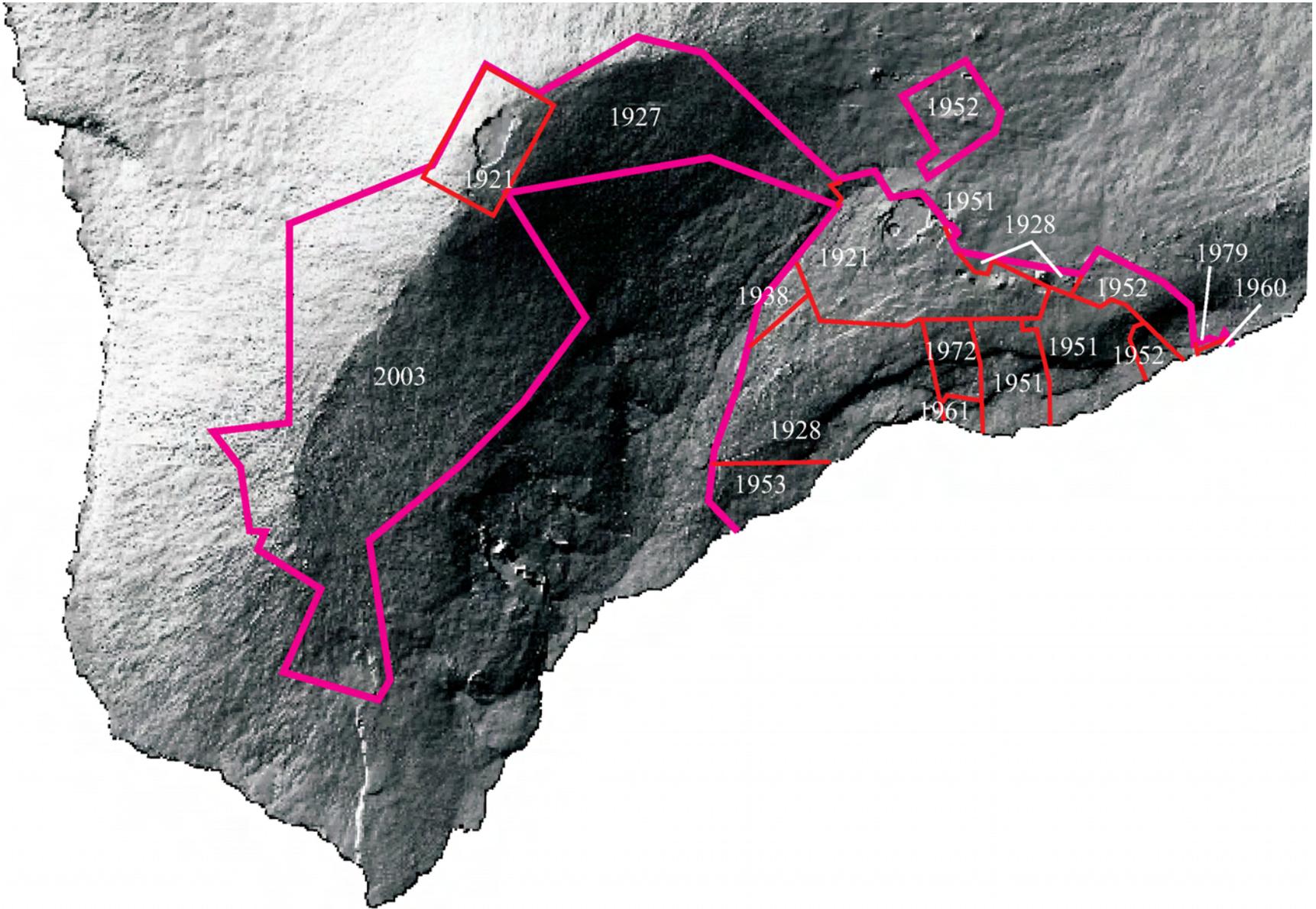


Figure 2. Acquisition history of HAVO parcels.

This report describes and assesses the known and potential archeological resources in a park area. The overview reviews and summarizes existing archeological data; the assessment evaluates the data. The report assesses past work and helps determine the need for and design of future studies. It is undertaken in a park or regional geographical framework and may be a part of multi-agency planning efforts.

Based on this definition and given the nature of Hawaiian “archeological resources,” it is the inherent argument of this report that the following goals of the HAVO AOA are the appropriate way to implement the intent of the AOA as described in DO-28:

1. to provide a general overview of patterns of culture and history
2. to review the archeological information and the status of research at HAVO within the framework of landscape archeology and cultural tradition
3. to use that review as the basis for recommendations for a continuing program of archeological investigation, including development of a Research Design to guide future work
4. to recommend a framework and guidelines for organizing archeological data, information related to archeological data (such as historic maps), archeological site definition, and information recording.

## **ORGANIZATION OF THE AOA**

This report is organized in the following sections. Section I is the introduction to the AOA project. Section II provides a background summary of the environmental, cultural, and archeological framework for the AOA. Section III, titled “Landscapes of Time,” discusses analytical conclusions of the background, presented as historical landscapes. Section IV summarizes the history of archeological investigations at HAVO and discusses the site inventory in the context of the historical landscapes. Section V is an assessment of the status of archeological investigations at HAVO. Section VI is a review and set of recommendations concerning matters of archeological-cultural resource management. Section VII is the pragmatic conclusion of the AOA, the proposed Research Design; given what is known and what has been done, the Research Design suggests what more can be known about this cultural landscape and the procedures for acquiring that knowledge. References are presented in Appendix H, which includes all citations in the main text and appendices. A complete site list is provided in Appendix A. Selected photographs from the original Puna-Ka‘u NRHP district nomination form are in Appendix B. Appendix C is a review of the status of petroglyph studies by Edward and Diane Stasack. Appendix D consists of tables of resources for HAVO research, including historical maps, archeological maps, and manuscripts. Appendix E is a list of HAVO burials which can be extracted from the AOA for confidentiality purposes. Appendix F is a gazetteer of place names and glossary of Hawaiian words used in the present report. Appendix G provides definitions and discussion of the terms cultural resource, site, and traditional.

## **NOTES ON AOA PRESENTATION**

The following sections provide information on concepts and conventions used in the HAVO AOA.

## ARCHEOLOGICAL TERMS

Archeological terms used in the AOA include *resources*, *landscapes*, and *site*. The brief discussion and definitions below are expanded in Appendix G.

### Archeological Resources and Cultural Resource(s)

NPS DO-28 (NPS 1998:Chapter 1.B.2, emphasis added) employs the phrase “archeological resource” to refer to the primary subject of AOA, and defines it as:

...any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research (NPS DO-28, 1998: Glossary), and

...the remains of past human activity *and records documenting the scientific analysis* of these remains.

The *NPS Management Policies* categorizes “archeological resource” as a kind of cultural resource, and defines “cultural resource”<sup>4</sup> as (NPS 2001:Chapter 5:26, emphasis added):

...an aspect of a cultural system that is valued by or significantly representative of a culture, or that contains significant information about a culture. A cultural resource may be a *tangible entity* or a *cultural practice*.

“Archeological resource” is also included in definitions of “tangible cultural resources,” which are defined for the National Register of Historic Places (NRHP) as “districts, sites, buildings, structures, and objects” and for NPS management purposes as “archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources.”

### Archeological Landscapes

The HAVO AOA uses “landscape” as its conceptual armature. The *NPS Management Policies* (NPS 2001:Chapter 5:24, emphasis added) defines “cultural landscape” as:

a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or esthetic values. *There are four non-mutually exclusive types of cultural landscapes: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.*

These categories of cultural landscape are also listed and defined in DO-28 (NPS 1998).

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<sup>4</sup> As indicated in Appendix G, there is no statutory definition of “cultural resource(s)” in regulations at the federal level. This is also true of the State of Hawai‘i. For example, the Hawaii Supreme Court decision of *Ka Pa‘akai O Ka‘aina v Land Use Commission* (2000), refers to “valued cultural, historical, or natural resources,” but the court decision explicitly declined to define the “cultural resources,” noting that this is a “broad term.”

Given the possible confusion of these multiple NPS definitions of “cultural landscape” (“four non-mutually exclusive types”—see definition above) and the fact that the NPS produces reports that deal explicitly with cultural landscapes, this term is not used in the HAVO AOA. However, the concept of *landscape* is critical to the report as a means to keep analytical perspective from becoming too narrowly focused on “sites,” a perspective that may be argued is more consistent with the perspective of the people of the past. People did not live or work on “sites,” they lived and worked in a landscape that was partitioned in various ways, with structures and activity areas, with boundaries both physical and social. It was also a landscape that was expansive, a space with living things, with horizons, with a sky, with meaning (Photo 1). When a priest stood on a platform at Waha‘ula Heiau or a commoner stood in front of a sleeping house at ‘Āpua Point, and they looked at the skyline of the great mountain in the distance, each could name a hundred landmarks and could point out where the trails crossed. They were living in a landscape.<sup>5</sup>



Photo 1. A landscape of HAVO, a landscape with cultural meaning.

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<sup>5</sup> More academically expressed approaches to defining landscape and landscape archeology may be found in Feinman (1999) and Ladefoged and Graves (2002).

## Archeological Sites

HAVO organizes the “material remains or physical evidence of past human life or activities” (in the language of DO-28) into archeological “sites.” When definitions and discussion of DO-28 and *NPS Management Policies* are parsed, this seems to be the most appropriate term to use, as opposed to an equivalence of “resource” and “site” as the language of the DO-28 description of the AOA implies. We partition landscape into “sites” or “archeological resources,” but, at the same time, if we do so without the perspective of landscape, then how can we discuss *significance* in any meaningful way? This also allows the review to be structured by “site” as defined in the NRHP in its fundamental sense as a place<sup>6</sup> (see discussion in Section VI).

There are two primary sets of site identification numbers that are used at HAVO (not including temporary field numbers). The main set of numbers is based on the State system of unique five-digit numbers preceded by “50-” for the State of Hawai‘i, “10-” for the island of Hawai‘i, and a two-digit number for the USGS topographic quadrangle in which the site falls. The secondary set of numbers is the system used by the Bishop Museum, which carried out most of the surveys of 1960s and 1970s; this system consists of the prefix “HV-” followed by a unique number. Recent surveys have attempted to replace Museum numbers with State numbers, but not all Museum numbers have been converted to the state system. As noted by Glidden (2006:12): “In some cases sites have been separated, combined, and reassigned site numbers based on increased knowledge developed.”

## HAWAIIAN WORDS AND NAMES

Definitions of commonly used Hawaiian words are provided in a glossary (Appendix F). Hawaiian words that are critical to a discussion are defined in the text. Hawaiian words are, by policy, not italicized. Diacriticals (macrons and glottals) are used when known (primarily based on Pukui et al. 1974), except when a Hawaiian place name is used in an historical or modern name; for example, ‘Āinahou is a traditional land area in Puna district but it was subsequently used as the name of a 19th century ranch, Ainahou Ranch. Translations, provided where available and appropriate, are indicated as *literal* or *interpretive*.

## DATES AND NATURE OF TRADITIONAL SOURCES

The 19th and early 20th century sources of traditional history and ethnographic material are generally consulted in reprinted editions or in later translations, which creates a problem for citation. The original publication date may be included in the citation along with the date of the consulted publication (e.g., Kamakau [1868] 1964), but this has been criticized as awkward. Thus, assuming that most scholars are aware of the original date of publication of standard works, this citation method is not used. However, the original date of publication is included in the list of References.

The sources for traditional material are not discussed or evaluated in the present report, but detailed reviews may be found in Valeri (1985) and Cordy (2000).

Working with Hawaiian traditions has many difficulties, including the fact that so many of the texts have been disarticulated, decontextualized, and dehydrated (the water of life having been removed

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<sup>6</sup> For example, Kīlauea Crater (Site 5502) is on the NRHP as a place, i.e., a non-archeological site.

from them).<sup>7</sup> Several publications in recent years have greatly aided in restoring the life to recorded traditional texts by presenting them in their original Hawaiian (e.g., Kamakau 1996 and 2001), or original Hawaiian with new translation (e.g., Malo 1996). In addition, five long Hawaiian texts that are important for the present study have been recently published; they had previously been unknown and/or unavailable in any reasonable form: Stephen L. Desha's *Kamehameha and his Warrior Kekūhaupi'o* (Desha 2000); John Wise and John W.H.I. Kihe's *Ka'ao Ho'oniua Pu'uwai No Ka-Miki (The Heart Stirring Story of Ka-Miki)*<sup>8</sup>, *Holo Mai Pele*<sup>9</sup> (Kanahele 2001); Benjamin K. Nāmakaōkeahi's *The History of Kanalu: Mo'okūauhau 'Elua* (Nāmakaōkeahi 2004), and Ho'oulumāhie's *Ka Mo'ololo o Hi'iakaikapoliopole (The Epic Tale of Hi'iakaikapoliopole)* (Nāmakaōkeahi 2004). The last title is a version of the story of Hi'iaka and Pele and is of obviously great significance for research at HAVO; this importance is emphasized further by the subtitle of the book:

Ka wahine i ka hikina a ka lā ka u'i palekoki uila o Halema'uma'u.  
*Woman of the sunrise, lightning-skirted beauty of Halema'uma'u.*

*The History of Kanalu: Mo'okūauhau 'Elua* (literally “Genealogical Succession Two”) may be the only comprehensive genealogy of a line of priests ever written in Hawai'i. Incorporated into it is a parallel listing of the names of rulers (probably their sacred names) and a history of dramatic events that reflect the world of the kahuna who are dedicated to the cosmic protection of their kings. This is the Kanalu order of priests, one of the orders of the mo'oKū (*priestly class of Kū*, see Chun 2004:viii), who trace their lineage from the beginning of Hawaiian time to the time of Kamehameha. Kamehameha's Kū kahuna was Hewahewa.

The significance to HAVO of *The History of Kanalu* may not be immediately evident from the title. However, when its text is investigated and its theme recognized, it is clear that the goddess Pele and the priest Pā'ao have a prominent place in this history, and the value of the text to HAVO research is substantial.

### TEXT CONVENTIONS AND ABBREVIATIONS

Radiocarbon dates are given as calibrated values at two sigma, unless otherwise indicated. They are also given as BC-AD, rather than the more appropriate and preferred BCE-CE, because the older form remains in common usage in Hawaiian archeology.

The terms “pre-Contact” and “post-Contact” are used for pre- and post-1778, rather than “prehistoric” and “historic.”

Archaeology is spelled “archeology” per the convention of the NPS.

The term “king” is used in this report, rather than “ruling chief.” This is the best comparative cross-cultural translation of the Hawaiian term “ali'i nui” (see e.g., Valeri 1985; Tuggle 1990).

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<sup>7</sup> See the analysis in Nogelmeier (2003), which refers particularly to the editing and translations of the works of 19th century historian S.M. Kamakau and the resulting numerous misunderstandings of Hawaiian history and culture.

<sup>8</sup> This has been translated and published in installments in various reports by Maly (see e.g., 1993).

<sup>9</sup> This contains a translated version of a Pele tradition that was published in the 19th century newspaper *Ka Hoku o Hawaii*.

Abbreviations that are commonly used in the text include:

- HAVO: Hawai'i Volcanoes National Park
- LCS: National Park Service List of Classified Structures
- NPS: National Park Service
- NRHP: National Register of Historic Places.

## II. BACKGROUND

This section of the AOA presents background information on the environment, cultural framework, and archeology of HAVO.

### ENVIRONMENT

Information about the environment of HAVO is presented in many reports (including Emory, Cox et al. 1959; Yen 1971; Degener 1973; and Williams 1990), as well as in general studies (e.g., Juvik and Juvik 1998). Only a general summary is provided in this section; details relevant to specific research problems are presented elsewhere in the AOA.

HAVO spans over 323,430 acres of southern Hawai'i Island, encompassing leeward and windward areas from the coast to the highest points of this part of the island. It includes the summits and slopes of two of the world's most active volcanoes, Kīlauea and Mauna Loa.

The eastern portion of HAVO rises from the southeast coast of the island to the summit of Mauna Loa at around 13,680 ft asl. Kīlauea Crater lies at the 4,075 ft elevation, the approximate mid-point (by distance) of the slope to the Mauna Loa summit. Between the coast and Kīlauea Crater are several cliff lines formed by fault action, forming distinctive rises in the landscape. Hilina and Hōlei are the two principal cliffs: Hōlei runs along the 120 to 400 ft elevation across the Puna ahupua'a from Pānau Nui to 'Āpua at the Ka'ū boundary (Photo 2); Hilina falls between 200 and 600 ft asl in Kapāpala ahupua'a. Lesser fault lines occur between these two (e.g., Poliokeawe, Pu'u'eo, and Makahanu); Paliuli is at the east end of the park. The Hilina Pali fault scarp is still active, causing many small and occasionally large earthquakes (Macdonald et al. 1983:40). The coastline of this portion of HAVO is marked by low sea cliffs where lava has poured into the ocean. Small embayments offer small protection from the surging waves.

Kīlauea Crater marks a transition between wet and dry zones. To the east of the crater is a montane rainforest; to the west is a drier montane seasonal environment. The distribution and intensity of rainfall in the volcano region is tied to orographic conditions generated by northeast trade winds. Doty and Mueller-Dombois (1966:47) write:

As the wind passes over the ridge formed by Kilauea and its east rift, especially near and above the 3000 foot level, the rainfall drops markedly. Thus, while at the Park Headquarters, Station 54, there is an average rainfall of 93 inches, at Halemaumau, Station 52, scarcely a few miles to the southwest over the ridge to the sea and 300 feet lower, the average rainfall is about half that value.

In the western portion of HAVO is the Kahuku Management Unit, which covers 116,000 acres from around 2,000 ft above sea level (asl) to the summit of Mauna Loa. Three-fourths of Kahuku is covered in "rocky land and barren lava flows" (Lockwood 2003, referenced in Quiseng 2006:2). The oldest widespread landform dates from 1,500 to 3,000 years BP (identified as k2 by Wolfe and Morris 1996), and is overlain by a linear mosaic of more recent flows. Pockets of older surface occur in scattered kīpuka, islands of old landforms surrounded by more recent flows. The Southwest Rift of Mauna Loa forms the spine along the central axis of Kahuku.



Photo 2. Hōlei Pali from Kealakomo Waena.

The coastal area of Kahuku (seaward of the KMU) is a barren tract of lava. Pōhue Bay near the center of the ahupua'a offers limited protection from ocean surges. Archibald Menzies, naturalist on Captain George Vancouver's 1792 to 1794 expeditions, traveled by canoe from Kealakekua to South Point. His party sailed along the Kahuku shoreline, which he describes (Menzies 1920:181):

This part of the coast is a dreary rugged tract composed of black porous rock of lava forming here and there grotesque arches, vaults and deep caverns into which the sea pushes in by the violence and agitation of the waves with great force, and frequently gushes up again several yards inland through chinks and crevices with a hissing noise into the form of fountains, which in sunshine reflect all the colors of the rainbow.

In fact, Menzies (1920:181) bypassed the Kahuku shoreline, staying one night at Manukā to the north and anchoring the next day at Pākini to the south. He notes that the conventional Hawaiian method of travel along this coast was by canoe (Menzies 1920:182, brackets added):

The country between this [Pākini] and Manu-ka, the place we left in the morning, is one continued tract of loose, rough and peaked lava, the most dreary and barren tract that can possibly be conceived, so that it would be a tedious and fatiguing journey to come from thence by land, and such as even the natives themselves seldom attempt. For when they wish to visit the south side of the island, they generally come thus far in canoes from the west side and leave them here [at Pākini] till they return again, so that this forms a common port at which there were several arrivals to and fro in the course of the evening.

## THE NATURAL ENVIRONMENT AND HAWAIIAN LIFE

Components of the natural environment that structured basic Hawaiian life in all settings were topography, rainfall (which in turn determined vegetation patterns), and shoreline characteristics. These established the conditions for agricultural productivity, population density, and population distribution. Unevenly distributed natural resources were an overlay that affected the fundamental settlement structure in a number of ways. The most important of these resources were streams suitable for pondfield irrigation and coastal features that allowed fishpond construction.

The general environmental patterns of the island of Hawai'i are shown in Figures 3 and 4, with an overlay of the HAVO region, providing a general picture of the park's natural features.

### VOLCANISM OF HAVO

Volcanic activity distinguishes HAVO from all other areas in Hawai'i. The history of surface flows in the region is shown in Figure 5, which is derived from a recently updated map of island volcanic activity (Sherrod et al. 2007) and from articles by Swanson (2007).

#### Volcanism in East HAVO

The eastern portion of HAVO is the epicenter of volcanism in the park. Flows from the Southwest and East Rifts of Kīlauea Crater have mantled the park in lava. The Southwest Rift roughly forms the western boundary of HAVO below the crater; the East Rift is the inland boundary of the Puna portion of the park. The crater itself has spewed lava as well as pyroclastic explosions, the most notorious being the 1790 eruption that enveloped a large segment of the army of the high chief Keōua as it marched from Hilo to Ka'ū.

Essentially all of Puna district to the east of HAVO was covered in flows during the time of Hawaiian occupation; new land was created as well. Swanson (2007, reformatted) provides the following summary regarding Kīlauea, notably the 'Ailā'au flow that covered much of Puna district:

...lava flows built the large Observatory shield at Kīlauea's summit and destroyed surrounding woodlands, between about 1000 and 1350-1400 C.E. (Holcomb, 1987; Neal and Lockwood, 2002; D.A. Swanson and J.P. McGeehin, unpub. data)...Explosive deposits are not interbedded with the lava flows that formed the Observatory shield, the edifice built at the summit of the volcano before the caldera formed...

... Holcomb (1987) identified [a subsequent large lava flow], which he named the 'Ailā'au flow... Lava erupted from a vent just east of Kīlauea's summit and built the 'Ailā'au shield...The lava flow (called flows by previous workers, but erupted essentially continuously, so I assume only one flow) covered most of Kīlauea north of the east rift zone and reached all the way eastward to the coastline; one or two streams even spread southward from the shield to the sea... Clague et al. (1999) estimated its area as about 430 km<sup>2</sup> and its dense-rock-equivalent (DRE) volume as 5.2±0.8 km<sup>3</sup>...

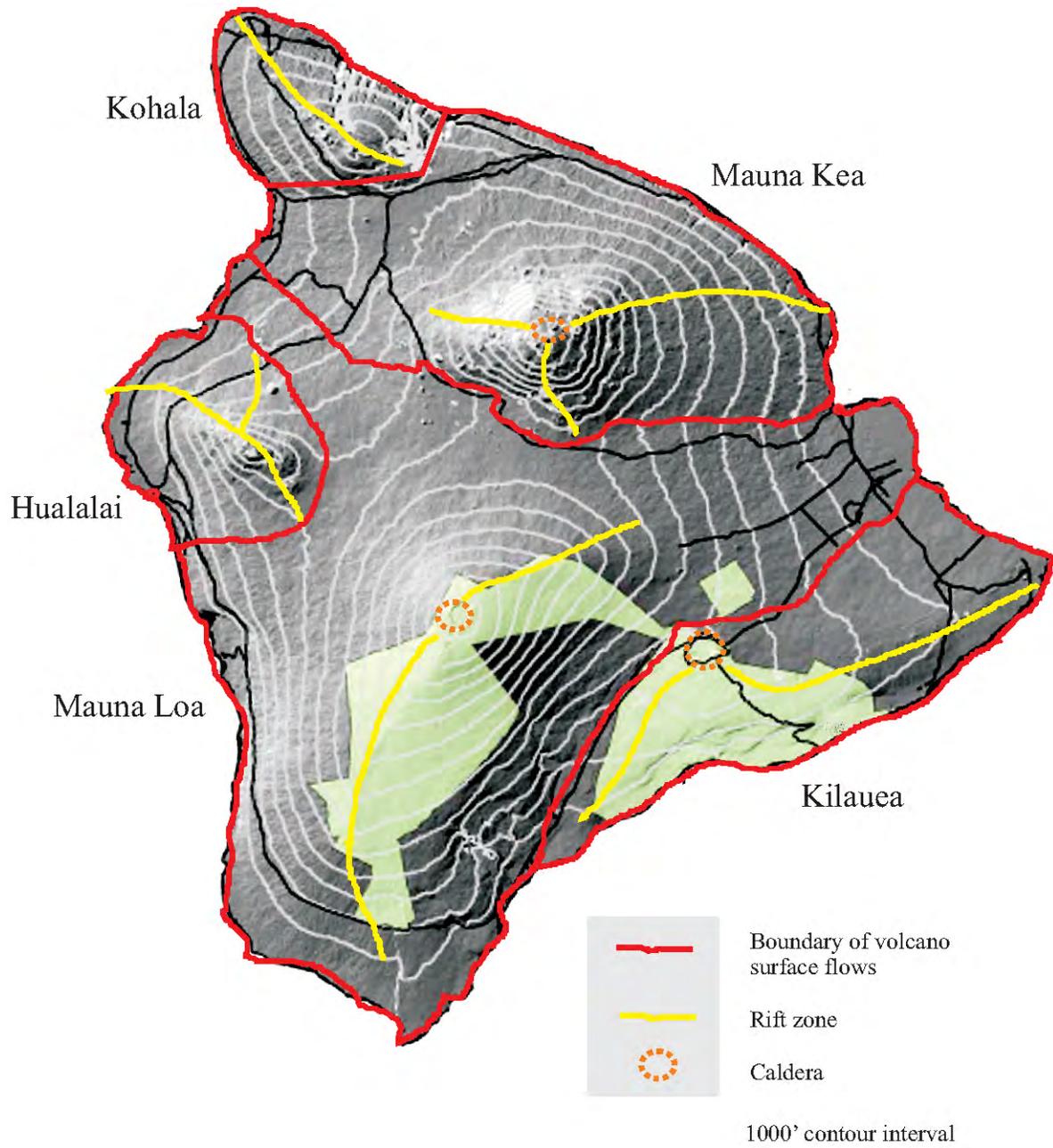


Figure 3. Island of Hawai'i (with HAVO), showing topography and volcano surface areas.

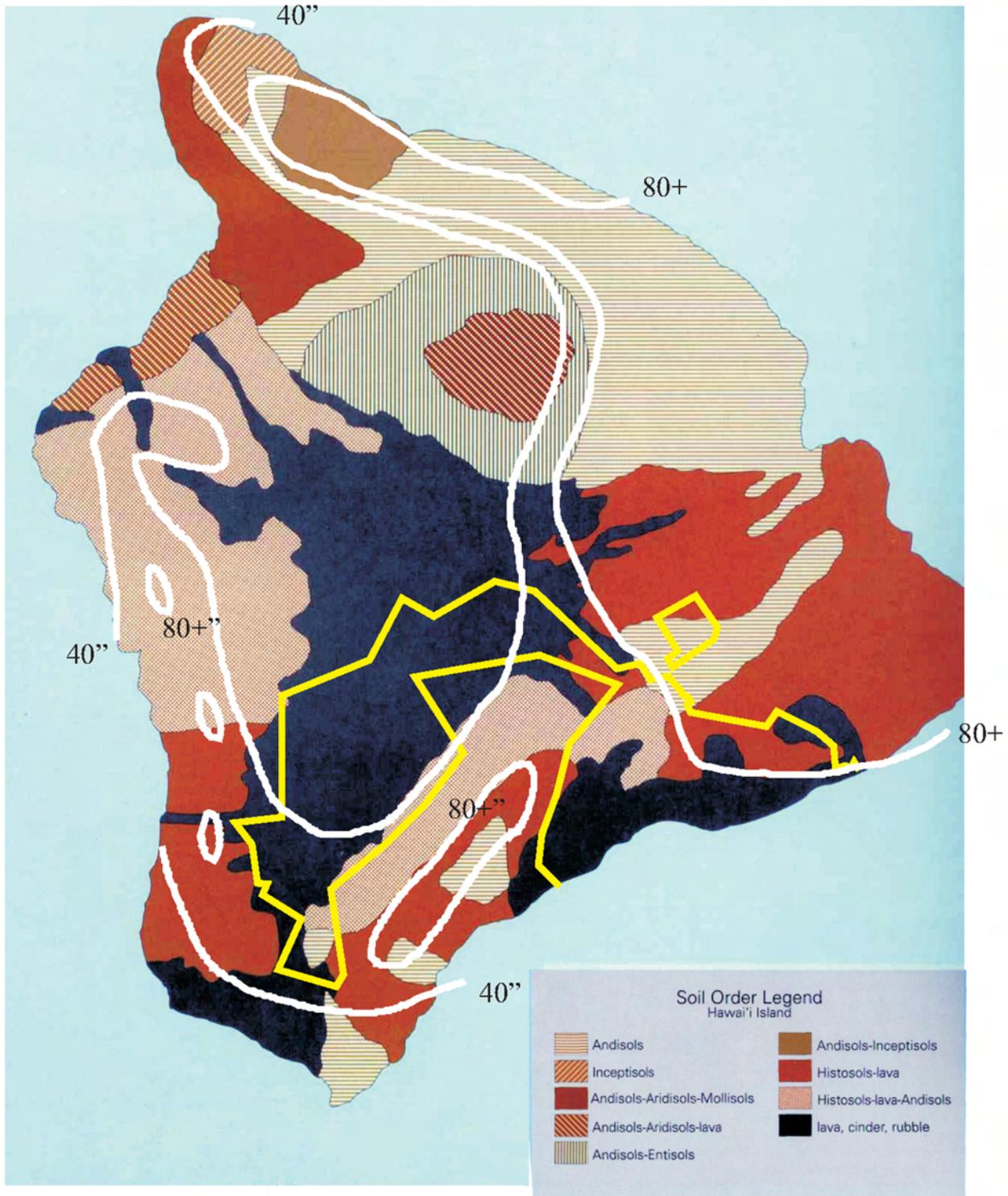


Figure 4. Island of Hawai'i (with HAVO), showing major soil regions and rainfall (soil map from Juvik and Juvik 1998).

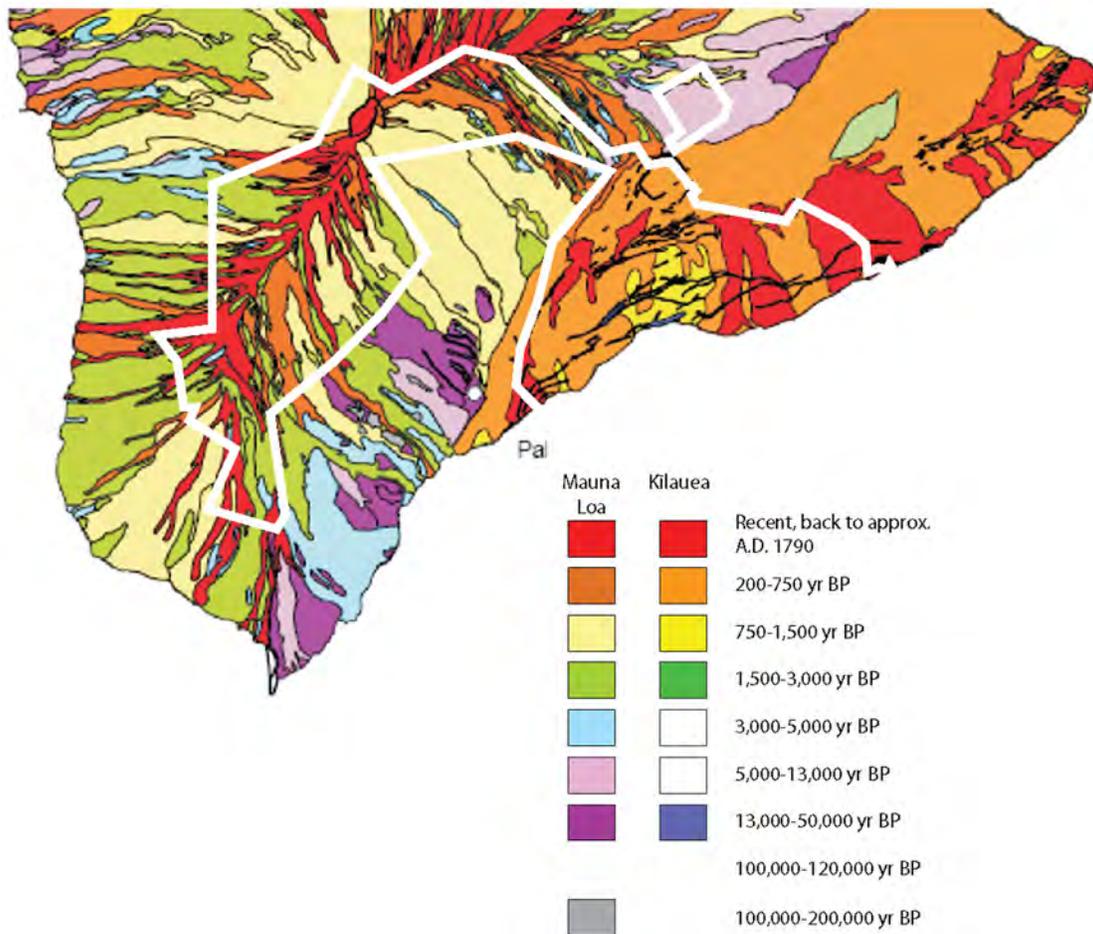
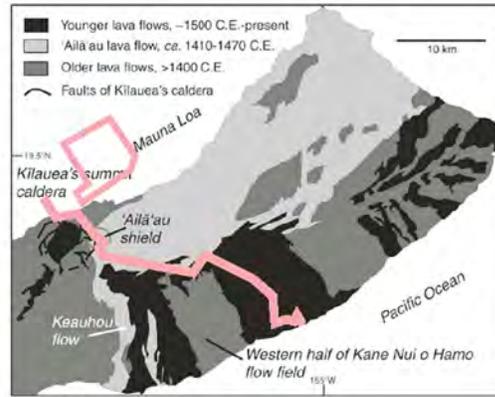


Figure 5. Dates of surface flows in the HAVO area (top: adapted from Swanson 2007:Figure 2; bottom: adapted from Sherrod et al. 2007:Figure 36).

Clague et al. (1999), through careful analysis of calibrated <sup>14</sup>C ages and paleomagnetic data, concluded that the eruption of the ‘Ailā‘au flow lasted about 60 years and ended in about 1470 C.E.... some 100 years or so after the summit shield had formed (D.A. Swanson and J. P. McGeehin, unpublished <sup>14</sup>C ages)...The morphology of the pāhoehoe suggests slow emplacement by lava tubes, and large tubes are known in the flow; one, the Kazumura, is 65.5 km long—one of the longest known lava tubes (Allred, 2001; <http://caverbob.com/usalong.htm>).

... Kīlauea’s caldera formed between about 1470 and 1500 C.E., as judged from stratigraphic and calibrated <sup>14</sup>C evidence (Swanson, 2003; Swanson et al., 2004). The outermost fault on the eastern side of the caldera cuts the ‘Ailā‘au shield ...and therefore is younger than about 1470, the estimated date that the shield stopped erupting. Vitric and lithic-vitric tephra, dated at about 1500 C.E. on the basis of several calibrated <sup>14</sup>C ages, mantles the main caldera faults at several places, so the faults must be older than about 1500... The caldera clearly did not form in 1790, as has been commonly thought (Holcomb, 1987; Decker and Christiansen, 1984), and it is even unlikely that there was substantial downdropping of its major faults then, to judge from the lack of a description of major subsidence or dreadful earthquakes in the stories told to Ellis.

The Keanakāko‘i Ash (McPhie et al., 1990), comprised of vitric, lithic, and mixed vitric and lithic deposits of ash to block size and totaling as much as 13 m in thickness, formed from multiple eruptions during a 300-yr period beginning in about 1500 and ending in about 1790 (Swanson et al., 2004). It is the deposits of the two oldest Keanakāko‘i tephra eruptions that mantle the caldera faults and constrain the minimum age of the caldera.

The evidence for the age of the Keanakāko‘i is developed from numerous calibrated <sup>14</sup>C ages as well as from physical stratigraphy, including three or four widespread erosional unconformities between successive deposits, pure ash beds interlayered with reworked windblown vitric ash in sand dunes, and archaeological evidence that Hawaiians built stone structures during periods of calm between explosions.

The 300 years of episodic explosive activity is much longer than what most late 20th-century workers interpreted (Decker and Christiansen, 1984; McPhie et al., 1990; Mastin, 1997). These researchers believed that most or all of the Keanakāko‘i was the product of a strong eruption during 1790, when the fatal explosion took place. The recognition of three centuries of sporadic explosive activity has come about slowly through careful work during the past decade.

Of the ‘Ailā‘au flow, Swanson (2007) writes:

This lava flow is the largest to be erupted from Kīlauea, and probably in all of Hawai‘i, since Polynesian settlement. If any flow were to be commemorated in oral tradition, this should be the one, because the destruction of such a large area of forest would have impacted Hawaiian life in many ways.

The consequences for the archeological record are enormous. The lava that poured over Waha‘ula Heiau in 1999 represents only one of the most recent and most dramatic destructions of the physical remains of the Hawaiian past at HAVO. However, this is by no means a new phenomenon; as indicated in Figure 5, the vast ‘Ailā‘au flow and other pre-modern flows certainly destroyed large areas of

Hawaiian activity. Also, if there was a basalt quarry at the crater of Keanakāko‘i, as suggested by the name (*the adze-making cave*), it was destroyed by a flow in 1877.<sup>10</sup>

### Volcanism in the Kahuku Management Unit

The KMU is dominated by the Southwest Rift, a geologically active zone that has seen major lava flows in historic times. The spine of the Southwest Rift is marked by an almost continuous fissure and a line of large cinder cones from the Mauna Loa summit to Pu‘u o Keokeo at around 6,900 ft asl. Near the summit are Sulphur and Red Cones at the head of the ‘Alalā lava flow. At about the 8,000 ft elevation is ‘Alikā Cone, source of the 1919 ‘Alikā flow that spilled lava westward into south Kona. Between 5,000 and 7,000 ft asl are a cluster of cinder cones: Ihuanu, Pōhakuloa, ‘Ōhohio, Kapu‘ala‘ala, and Pu‘u o Ke‘oke‘o. Fissures extend south and downslope of Pu‘u o Ke‘oke‘o along the 1887 flow.

At the east edge of the park just above the Belt Road are ‘Akihi, Pu‘u o Kahuku, and Pu‘u o Lokuana cinder cones. These are situated above Pali o Ka‘eo, the inland extent of the prominent fault line that marks the divide between eastern and western Ka‘ū; just west of the pali is the fissure marking the head of the devastating 1868 eruption. Seaward of the Belt Road, the fault line is called Pali o Māmālu; the prominent craters of Lua Pō‘ai, Lua Palalauhala, and Lua Pū‘ali are just seaward of the Belt Road at the top of the pali.

There have been 39 Mauna Loa eruptions since 1832, and the Southwest Rift has been the source for 25 percent of these events, covering 233 sq km of land (<http://www.soest.hawaii.edu/GG/HCV/mloa-eruptions.html>) (see Fig. 5). Historic eruptions along the Southwest Rift has sent lavas flowing east into central Ka‘ū, west into southern Kona, and south toward Ka Lae (South Point). Near summit eruptions occurred in 1851, 1926, 1940, 1949, 1950, 1975, and 1984. Flows that originated above Pu‘u o Ke‘oke‘o occurred in 1916, 1919, 1926, and 1950, with the 1926 and 1950 eruptions generating most of the lava streams. Below Pu‘u o Ke‘oke‘o, lava flowed southward in 1868, 1887, and 1907. Lipman (1980:abstract) writes:

The sequence of historic eruptions along the southwest rift zone, beginning in 1868, shows a general pattern of uplift migration and increasing eruptive volume, culminating in the great 1950 eruption. No event comparable to 1950, in terms of volume or vent length, is evident for at least the previous 1,000 years. Rates of lava accumulation during the historic period were several times higher than the average rate for the preceding few thousand years along the southwest rift zone and adjacent flanks.

Although smaller than the 1950 event, the 1868 eruption and associated earthquakes and tsunamis were cataclysmic (Handy and Handy 1991:566). Between March 27 and April 10, Ka‘ū was the scene of earthquakes (an estimated 3,000 temblors), lava flows, and tidal waves that resulted in major damage and disruption to the region. Handy and Handy (1991:566-568) quote a lengthy descriptive account by C.J. Waiialoha (*Ka Nupepa Ku‘oko‘a*, April 11, 18, 1868) which details the 15-day disaster. The Kahuku area saw stone houses shifted off their foundations, the collapse of the Kahuku church and, on the evening of April 7, “a shower of ashes [that] fell on the houses from Kahuku to Ninole;” “no less than a thousand cattle and horses” were killed by the lava at “Kahuku and Pakini and all the way to Kama‘oa.”

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<sup>10</sup> There is on-going research at HAVO to determine if basalt used for tools can be associated with this crater.

April 7 also marked the beginning of an eruption of lava along a 4.5 km long fissure just west of Pali o Ka'eo, pouring lava in multiple streams to the ocean (Waialoa 1868, quoted in Handy and Handy 1991:567):

Five small craters (puka ahi) opened up at Pu'u-o-loku-ana, between the sea and the mountain. The height of the leaping of the fire in some of these craters reached five hundred feet or more ... streams of lava ran from Pu'u-o-loku-ana to the sea. Flashes of lightning were seen in the dark clouds, red, silvery, green and white in color. The explosions heard were louder than the roar of a cannon.

The missionary Titus Coan (1882, brackets added) gives this description of the 1868 eruption at Kahuku:

On the 7th of April the lava burst out from the ground in Kahuku, nine miles from the sea, and flowed rapidly down to the shore. The place of outbreak was in a wood on one of the foot-hills of Mauna Loa. Travelers bound to Hilo came up to this flow on the west side, and were not able to cross it, but were obliged to return to Kona and come *via* Waimea, a circuit of one hundred and seventy miles. A fissure of a mile long was opened for the disgorgement of this igneous river, and from the whole length of this orifice the lava rushed up with intense vehemence, spouting jets one hundred to two hundred feet high, burning the forest and spreading out a mile wide. The rending, the raging, the swirling of this stream were terrific, awakening awe in all the beholders.

Flowing seaward, it came to a high precipice [the Kahuku Fault] which ran some seven miles toward the shore, varying in height from two hundred to seven hundred feet, and separating a high fertile plain, of a deep and rich soil on the left or eastern side, from a wide field of pahoehoe hundreds of feet below on the right or western side.

Before the flow reached this precipice it sent out three lateral streams upon the grassy plain above, which ran a few miles, and ceased without reaching the sea. But the larger portion of the igneous river, or its main trunk, moved in a nearly straight line toward the shore, pouring over the upper end of the precipice upon the plain below, and dividing into two streams which ran parallel to each other, some hundred feet apart, until they plunged into the sea. These streams flowed four days, causing the waves to boil with great violence, and raising two large tufa cones in the water at their termini. They formed a long, narrow island, on which they enclosed thirty head of cattle, which were thus surrounded before they were aware of their danger, and it was ten days before the lava was hard enough to allow them to be taken out of their prison. During this time they had no water, and were almost maddened by the smoke and heat. Several cattle were also surrounded on the upper grassy plain, where they were lying down to ruminate or to sleep.

The owner of the ranch [Captain Robert Brown of Kahuku Ranch], with his wife and a large family of children, was living in a pleasant house surrounded by a wall, with a fine garden of trees and plants, near the center of this beautiful grassy plain, and while sleeping at night, unconscious of danger, one of these lateral streams came creeping softly and silently like a serpent toward them, until within twenty yards of the house, when a sudden spout of lava aroused them and all fled with frightened precipitation, taking neither "purse or scrip," but leaving all to the devouring fire. The lady was so overwhelmed with terror that had it not been for her husband on one side and another gentleman on the other, she must have fallen and perished in the lava.

The family, crossing a small ravine, rested a few moments on a hill near by. In ten minutes after crossing the ravine it was filled with liquid fire. Their escape was

marvelous. In a few minutes the house was wrapped in flames, the garden was consumed, and all the premises were covered with a burning sea.

A little farther down this green lawn was the hut of a native Hawaiian. As the fiery flood came within fifty feet of it, it suddenly parted, one arm sweeping around one side of the house and the other around the opposite side, and uniting again left the building on a small plat of ground, of some three-quarters of an acre, surrounded by a wall of fusion. In this house five souls were imprisoned ten days with no power to escape. All their food and water were exhausted. Small fingers of lava often came under the house; it was a little grass hut, and they were obliged to beat out the fire with clubs and stamp it with their feet.

Piles of burning scoria were heaped around this house, as high as the eaves, and in some places within ten feet of it. I afterward visited this house, and found its inmates alive and rejoicing in their deliverance.

A little further on, and this lava stream came near the ruins of a stone church, which had been shaken down by the earthquake of April 2d. The walls were a heap of ruins, and the roof and timbers were piled upon the stones. Again the flood opened to the right and left, swept close to the *débris* of the church, and united again below, leaving all unconsumed.

The same earthquake demolished a large stone church in Waiohinu, the central and most important mission-station in Kau, and so rent the house of the pastor, the Rev. John F. Pogue, that he, with his family, fled to the hills, and soon after left the district to return no more. Other homes also were left desolate, the terrified inmates seeking abodes elsewhere.

### **Volcanism and the Archeological Record**

The 19th century drawings in Varigny (1981) of the 1868 eruption and flow in Ka‘ū vividly illustrate the nearly incomprehensible destructive power of volcanism (Fig. 6). The 1868 event brought together the dynamic elements of the volcanic environment: lava flows, earthquakes, and tsunami<sup>11</sup> (Fig. 7). This conjunction of elements resulted in one of the most damaging sets of natural disasters to strike Hawai‘i in the post-Contact period. It had a major impact on the Puna-Ka‘ū region. The tsunami wiped out coastal villages: “The houses at Ka‘alu‘alu, Paiaha‘a, Honu‘apo, Hokukano, Ka‘alaiki, the two Hilea, Ninole, Wailua, Punalu‘u and as far as Keauhou, were all swept away by the sea” (Handy and Handy 1991:567). Varigny’s (1981:215) description of the effects of the tsunami on ‘Āpuia is particularly telling:

The ocean had withdrawn from the normal shoreline for a distance of more than a kilometer. He could see it boiling furiously, covered over with red foam and surging columns of water, tossed hither and thither, propelled upward from the sea’s floor by submarine volcanoes. ... After its movement of withdrawal, the sea began to flow back coastward again, rolling powerful billows into the shore, piling one wave upon another,

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<sup>11</sup> A related destructive element of the environment that cannot be judged by historical writings is a potentially acidic atmosphere. This would affect archeological resources through the disintegration of marine shell on the surface of sites.

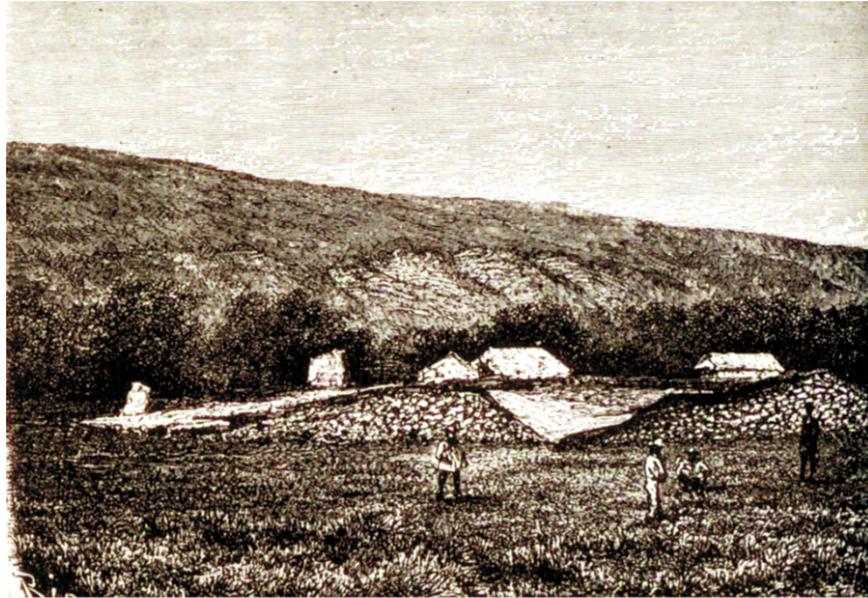


Figure 6. Two drawings of the 1868 lava flow (Varigny 1981 [1873]): “Ruins of the Catholic Church at Keauhou” (top) and “Cattle and goats caught in the lava” (bottom).

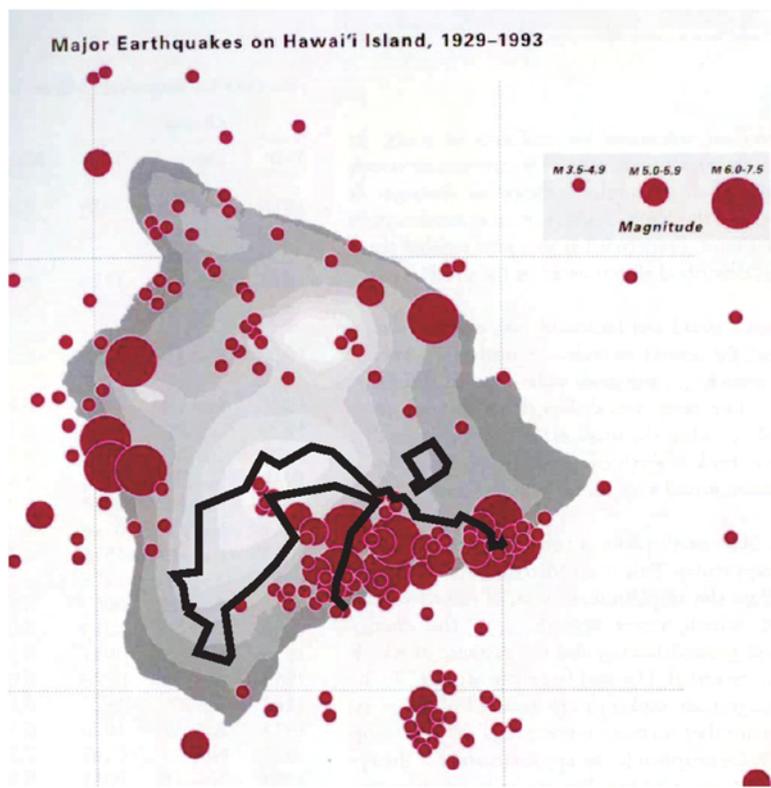
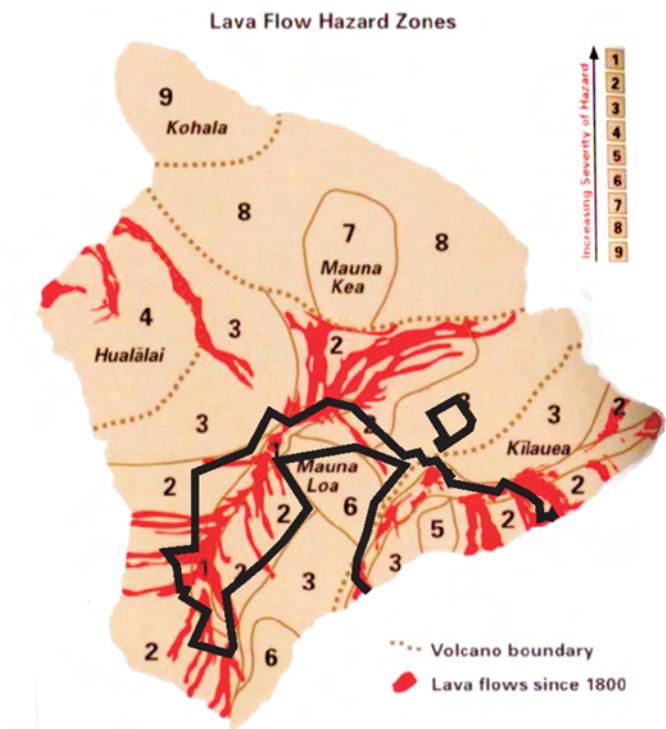


Figure 7. Geological hazards at HAVO: “Lava flow hazard zones” (top, adapted from Juvik and Juvik 1998:72); and “Major earthquakes on Hawai’i Island, from 1929-1993” (bottom, adapted from Juvik and Juvik 1998:69).

so that, traveling with incredible speed, they finally broke against the island, submerging and engulfing everything. Indeed, this gigantic rush of seawater surpassed by more than ten meters the level of the highest earlier tides. ... Men, women, children, canoes, dinghies, houses—all disappeared within the wink of an eye in a confused mass of uprooted trees, collapsing cliffs, boards floating at random, human beings and animals struggling against death like playthings in the grip of an irresistible force. Several times the sea subsided and then returned, hurling here and there all sorts of debris, in which cadavers collided and became locked with the bodies of the dying. Then, little by little, the ocean grew calm. As far as the eye could penetrate, one found no trace of fishing villages. Everywhere one saw only waste, desolation, ruin.

The destructive environmental history presents three obvious concerns for the archeological record. The first is the question of what percentage of the physical remains of human activity are left from the original archeological universe. The second is that the human settlements and structures that were not completely destroyed have to be evaluated in regard to this and similar events as part of site formation analysis. The third is the pragmatic problem of acquiring as much information as possible about this remnant percentage of the archeological record before it too is destroyed.

This factor of drastic past and continuing environmental destruction alone should be sufficient to allow HAVO to determine its needs and establish its priorities independent of general NPS service-wide concerns. The Research Design of the AOA proposes recommendations relevant to this concern (see Section VII).

### VEGETATION HISTORY OF HAVO

The pre-Polynesian vegetation of the HAVO area has not been studied in detail, but paleoenvironmental research elsewhere on the island of Hawai‘i suggests that the coastal region probably included *Pritchardia*, *Dodonaea*, *Kanaloa*, *Cibotium*, *Chamaesyce*, and *Chenopodium* (Fig. 8; see Athens et al. 2006). Some pre- or early Polynesian plants have been identified from carbonized plant material used for radiocarbon dating of volcanic flows at HAVO, including ‘ōhia lehua (*Metrosideros polymorpha*) and tree fern (hāpu‘u, *Cibotium glaucum*) (Kelly et al. 1979). It is probable that many more identifications could be made from the archived charcoal of the volcanic-dating studies.

Plants identified from archeological deposits in excavations at HAVO include *Bobea timoniodes*, *Chamaesyce* spp., *Diospyros sandwicensis*, *Dodonaea viscosa*, *Metrosideros polymorpha*, *Myrsine* sp., *Osmanthus sandwicensis*, *Pandanus tectorius*, and *Pritchardia* (Carter and Somers 1990:15; Glidden 2006: Table 3).

### RESOURCES IN HAVO

For archeology and history, generalized environmental description has little meaning in itself until it is translated into environment as conditions for life and as culturally perceived resources.

Described from this standpoint, HAVO has four areas of subsistence (that is, food-producing areas): the coastal zone of littoral collection and fishing; a zone of agricultural potential (based on rainfall and elevation); the upland wet forest zone for plant collection; and the alpine region for collection of nesting birds (Fig. 9, constructed from Emory, Cox et al. 1959; Armstrong 1973; McEldowney 1979; Clark 1985; Cuddihy and Stone 1990; Juvik and Juvik 1998). These areas also have potential for resources to be used for tools, construction, medicine, and ornamentation. The following summary is a generalization, with recognition that conditions change a great deal from lava flows and earthquakes. The resource zones (shown in Figure 9; also see Figure 10) are:

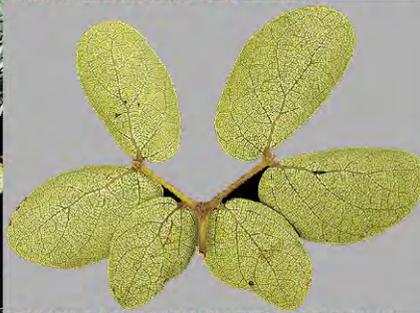
*Pritchardia*



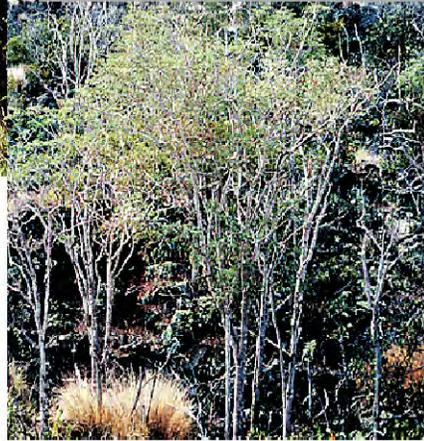
*Dodonaea*



*Kanaloa*



*Cibotium*



*Chamaesyce*

Figure 8. Modern examples of the larger plants found on Hawaiian coastlines in the pre-Polynesian era; paleoenvironmental studies indicate that *Pritchardia* was the dominant species of these plants.

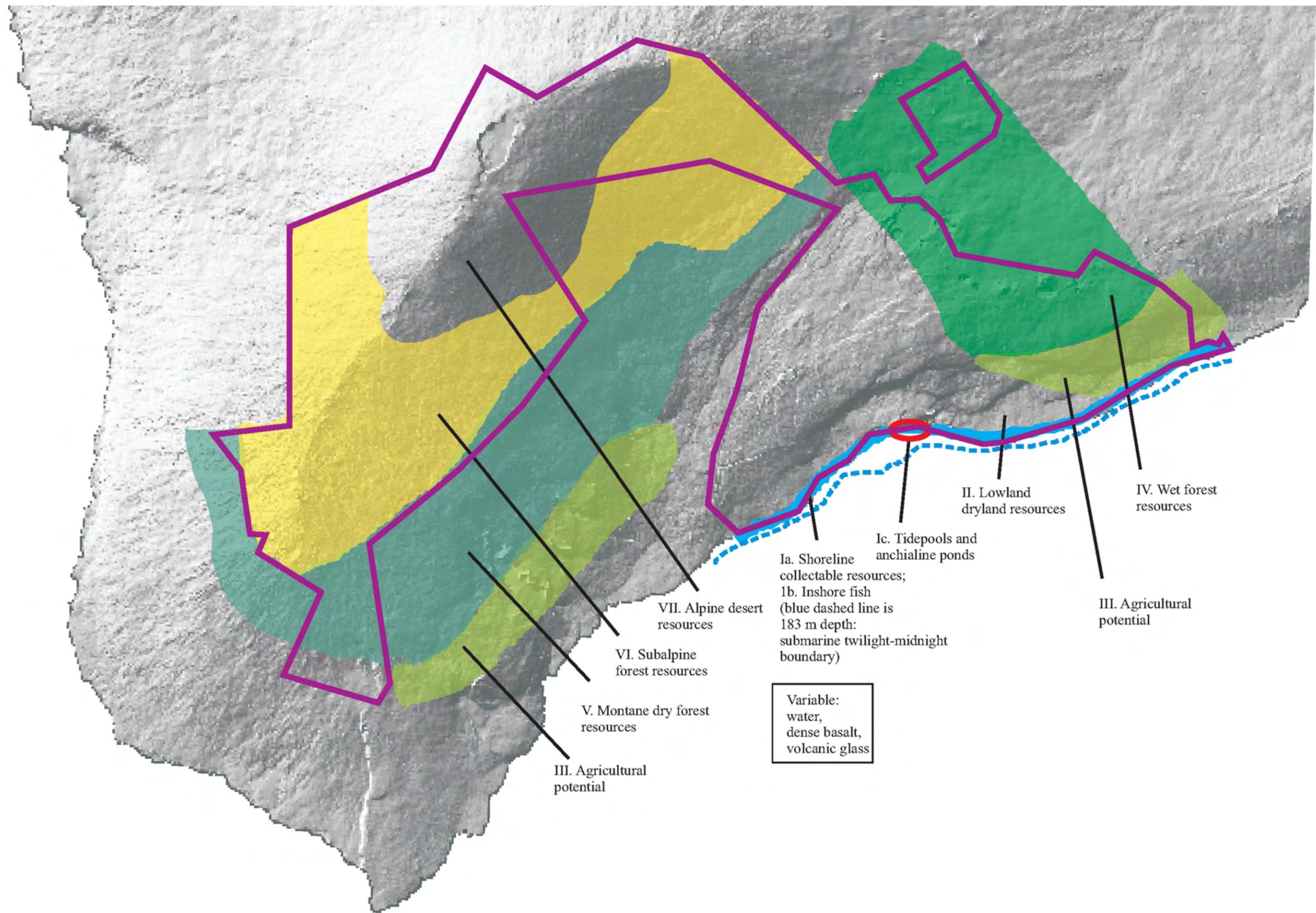


Figure 9. Biogeography (resource areas) of the HAVO region, interpreted for potential for traditional Hawaiian exploitation (based on the map of “Native Ecosystems before Human Settlement” in Juvik and Juvik 1998:122).



- I. **Zone of littoral collectables and in-shore and near-shore fish.** This zone consists of predominantly rocky or cliff shorelines, with resources that include mollusks, crustaceans, shore-dwelling birds, coastal plants, and fish. There are no significant reefs on the HAVO coastline, which drops off quickly to the deep ocean; there are no places suitable for construction of fishponds; there are no large dune formations; there is no surface running water (although there may be submarine springs); locations suitable for easy canoe landings and for surfing (primarily ‘Āpua, Keauhou, and Halapē) are limited.
- II. **Lowland dryland resource zone.** This is a region of low rainfall (generally under 25 inches annually) that is generally unsuitable for most cultivation, but which could support dryland forest that has usable wood and medicinal plants, and supports bird life. However, the active volcanism in HAVO has limited this form of forest development.
- III. **Zone of agricultural potential.** This zone includes areas with over 25 inches of annual rainfall, below an elevation of about 2,000 ft asl, the effective limiting conditions for the primary Hawaiian cultigens, sweet potato and taro.
- IV. **Wet forest resource zone.** The wet forests in the HAVO area are generally above the 2,000 ft elevation in areas that receive high rainfall. These are generally dense forests dominated by ‘ōhi‘a lehua, with some koa (*Acacia koa*) and ‘ōlapa (*Cheirodendron* sp.), but with a great range of other trees, ferns, and shrubs. Lower areas have the potential for small areas of cultivation of taro and banana, but in general they provide a rich resource zone for wood, medicinal plants, fiber and bark; it is also the major region for birds with prized feathers.
- V. **Montane dry forest resource zone.** A transitional zone between lower elevation wet forests and the higher, dry sub-alpine zone; this area is one of the main regions of koa growth, along with open-canopy ‘ōhi‘a and mesic forest trees. This zone also is habitat for bright feather-producing birds.
- VI. **Sub-alpine forest resource zone.** The sub-alpine area is characterized by a thin canopy of dry forest trees such as māmane (*Sophora chrysophylla*) and naio (*Myoporum sandwicense*), with some dwarf ‘ōhi‘a. It is thus a resource zone for wood and medicinal plants. Potential animal resources include forest birds and several species of seabird that nest in this region.
- VII. **Alpine desert resource zone.** This zone lies above the treeline and has sparse vegetation, generally limited to shrubs, grasses, and lichen. This is a prime habitat for the Hawaiian dark-rumped petrel (‘uwa‘u, *Pterodroma phaeopygia sandwicensis*).

For Kahuku ahupua‘a specifically, Handy and Handy (1991:Figure 39) identify zones of land use and resources along elevational gradients, similar to the above described elevation/rainfall zones. Table 1 describes these zones.

Other resources are found scattered throughout the HAVO area, unrelated to vegetation and elevation. Of particular importance for human occupation is water. As noted by Smart (1965:5), “water is a scarce commodity in the park.” There is no surface water in the form of permanent streams, although areas at the east edge of the Ka’ū desert around Hilina Pali show evidence of storm water run-off (see e.g., Roper 2005). At the coast, brackish water collects in cracks and fissures; Smart (1965:Figure 1) shows the locations of brackish water sources along the HAVO coastline. Emory, Cox et al. (1959:12) identify waterholes in the area of Kalapana Extension, with names such as ‘Ilea (“a hidden water inland of Waha’ula in a cave named Wai-pouli”) and “Ka-ula-wai (The Red Water).”

At upland elevations, rainwater could have been collected, and in the immediate area of the craters, steam vents provide drinkable water. In his 1823 visit to Kīlauea, Ellis (1963:166) found pools of “perfectly sweet, fresh water” near the steam vents at the north end of the crater; he surmised that, from the earthquake cracks, “a volume of steam ascended, which was immediately condensed by the cool mountain air, and driven, like drizzling rain, into hollows in the compact lava on the leeward side of the chasms.” In addition, historic and current USGS identify numerous “waterholes” in the sub-alpine and alpine zones, many of which have names. An upland swamp, Na Manua Haalou,<sup>12</sup> is located at the boundary of Kahuku and inland Ka’alāiki ahupua’a.

Caves are another feature of the region that are an important resource. They provided shelter on cross-mountain treks and during resource collecting; they are often a source of water (by seepage). Many named caves were important landmarks on the mountain landscape, as evidenced by native testimonies in the 1870s Boundary Commission proceedings. One of their most important potentials was as a place for burial and for religious ceremony. As argued elsewhere (see Tomonari-Tuggle and Tuggle 2006b), caves were probably not used as wartime “refuge” in the HAVO region or elsewhere in Hawai‘i.

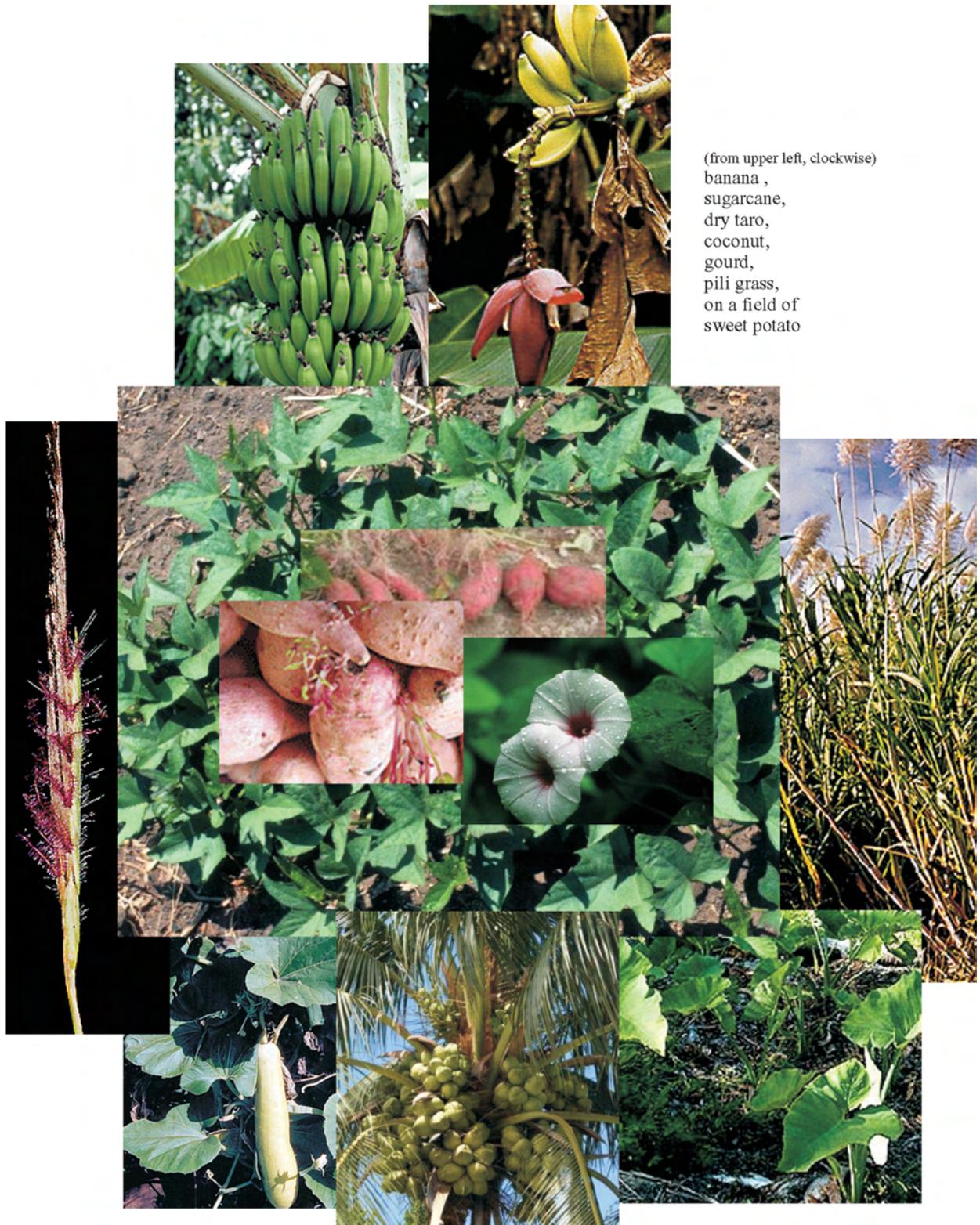
Table 1. Elevation/Resource Zones in Kahuku Ahupua’a.\*

Elevation (ft asl)	Physiographic	Cultural	Natural Resources	Cultivars
below 500	—	kula kai	—	sweet potato, gourds
500 to 1000	—	kula kai	—	sweet potato, gourds
1000 to 2000	—	kula uka	sugar cane, pandanus	dryland taro, sweet potato
2000 to 3000	—	wao ilima	forest taro, wild banana, wauke, yams, olona, pia	mulched taro, mamake, banana**
3000 to 4000	montane dry forest	wao ama’u or kanaka	forest taro, wild banana	—
4000 to 5000	montane dry forest	wao nahele or la’au	fern tree, canoe timber (koa**)	—
5000 to 6000	sub-alpine forest	wao akua	rain forest	—
6000 to 9000	sub-alpine forest	ma’ukele	—	—
above 9000	alpine desert	kua lona	—	—

\* from Handy and Handy (1991:Figure 39), except as noted.

\*\* from Cordy (1988).

<sup>12</sup> This is the spelling used on the USGS topographic maps. Haupū, a Boundary Commission witness for Kahuku, refers to a place called Na Manu o Haalou that “is the name of the ohia grove, which is on Kaalaiki.” It is possible that the name could be “Nā Manu o Ha’alou” (the birds of Ha’alou).



(from upper left, clockwise)  
 banana ,  
 sugarcane,  
 dry taro,  
 coconut,  
 gourd,  
 pili grass,  
 on a field of  
 sweet potato

Figure 10. Primary plants of traditional Hawaiian use.

The presence of resources does not necessarily mean that they were exploited by humans. However, the question of exploitation is an empirical one that can be addressed through archeological and ethnographic investigation. For example, information about potential resources can be used as site predictors and as a basis for interpreting site function. Modified rock areas in the alpine zone are interpreted to be related to enhancing petrel nesting areas (Glidden et al. 1997; Moniz Nakamura 1997). Camps in the high forest zones where prized feather birds were abundant have been interpreted as temporary shelters for traditional bird-catchers (Tomonari-Tuggle 1996). In koa forests, there is the question of what cultural remains could be expected from the highly ritualized activity of acquiring koa logs for canoes and images. And as an example of “expectation,” many dry areas and rough terrain that look unusable to the modern eye have been found by archeological investigation to be places where Hawaiians found ways to make cultivation successful.

## **THE CULTURAL ORGANIZATION OF ENVIRONMENT**

Differing cultural systems could have organized the HAVO environment in many different ways and it might be instructive to examine the environment through the perspectives of different cultures (game theory could be applied to this setting by modeling how varying cultural systems would have structured this environment—Melanesian, Anasazi, and Australian come to mind as interesting possibilities). At a minimum, it may be valuable to employ this approach to appreciate how Hawaiians used this environment, based on the well-developed Polynesian hierarchical lineage-power structure that was the essence of the first colonizers of the Hawaiian chain. Anthropologists (Goldman 1970 and Kirch and Green 2001, among others) have analytically described this structure as an adaptive mechanism for long-distance voyaging. It has been characterized in a similar manner by Polynesian authors: Peter Buck (Te Rangi Hiroa; 1938) titled his history of Polynesians, *Vikings of the Sunrise*; Herb Kane (1998:98; 2005:35) describes Hawaiian culture as a “canoe culture,” where the long-distance sailing canoe symbolically embodies the essence of traditional culture.

### **SPACE: HAWAIIAN ISLANDS**

In the island world, space was hierarchically segregated into discrete units of political control and management (kingdom, district, ahupua‘a, and ‘ili) whose organization at the time of Contact is shown in Figure 11. These units were also integrated by a concept of time that was ritualized in the Makahiki, and by the fact that in Polynesian tradition, essentially all things come to the islands by sailing, by voyaging—or they come by the metaphorical equivalent of sailing (i.e., by flying or by such devices as a bending tree kupua). Space and time thus converge, as expressed in the *Kumulipo*, the Hawaiian creation chant: “horizontal” time and space converge at the horizon, the pillars of Kahiki; and “vertical” time and space also converge where mother earth and father sky approach one another at the peaks of great mountains.

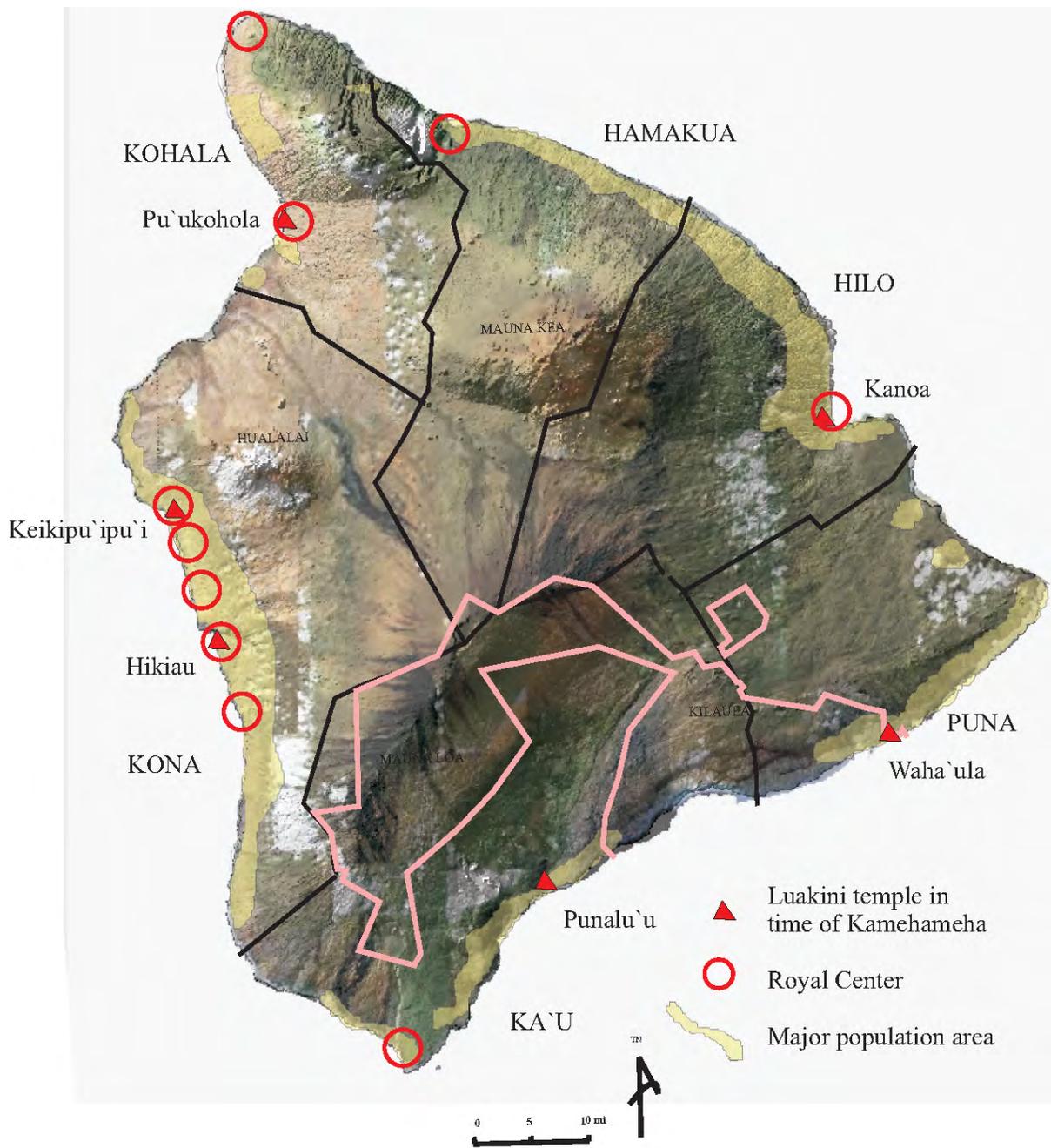


Figure 11. Hawai'i Island in the late traditional era, showing districts, luakini temples, royal centers, and population density.

## SPACE: HAVO AND THE CULTURAL ORGANIZATION OF RESOURCES

HAVO occupies space in the traditional ahupua‘a of the districts Ka‘ū and Puna (Fig. 12). In the eastern section, HAVO encompasses all or portions of (from east to west) Kahauale‘a, Poupou, Pūlama, Kamoamoā, Lae‘apuki, Pānau, Kealakomo, Kahue, and ‘Āpua in Puna district (Fig. 13), and Keauhou, Kapāpala, and Ka‘ala‘ala in Ka‘ū. In the KMU in the western section of the park, HAVO occupies almost all of Kahuku ahupua‘a.

Keauhou, Kapāpala, and Kahuku are large land areas. Kapāpala and Kahuku reach into and across the high alpine zone to meet at the summit of Mauna Loa. Keauhou also extends into the high mountain area but is particularly significant in encompassing the crater of Kīlauea at about the mid-point between the coast and Mauna Loa summit. The three ahupua‘a also cover lengthy stretches of coastline: Keauhou and Kapāpala together have a coastline that is roughly 21 km (13 miles) long; the Kahuku shoreline (outside the park boundaries) is 10 km (6 miles) long. Of the three land areas, Keauhou has the only good landing along the rugged, lava-strewn shoreline; Handy and Handy (1991:614) describe Keauhou “as the most isolated community in Ka‘ū ... one and a half miles from the Puna boundary and about three and a half miles from Apua Point. Many miles of barren coast separated Keauhou from Punalu‘u, with no settlements between ... not even a fisherman’s house;” they add that there was a small, wide bay at Keauhou, good fishing, and possibly springs.

Eight of the nine Puna ahupua‘a that fall within HAVO are relatively small, linear land units whose inland boundaries range from 1,640 ft asl (Poupou/Pūlama) to 3,600 ft asl (Pānau); the inland boundaries roughly follow the East Rift of Kīlauea. Kahauale‘a ahupua‘a, at the eastern border of HAVO, stretches inland to the east edge of Kīlauea Iki crater at around 3,900 ft asl; this ahupua‘a cuts off inland access for the smaller land areas.

There is no significant traditional reference to the district of Ka‘ū until the era of explicit island unification under the king Līloa (nine generations before Kamehameha), whose political center was Waipi‘o Valley in the east coast district of Hāmākua. The district of Puna had little distinction throughout its entire history, which was “bound up with the fortunes of the ruling families on either side”—that is, the families of Ka‘ū and Hilo. Mary Pukui (in Barrère 1959:17) notes that Ka‘ū was known as “Ka‘ū Makaha” (*Ka‘ū-the-savage*) and Puna as “Puna Kumakaha” (*Puna-resembling-the-savage*), indicating the ties of the two (see Fig. 12).

The ahupua‘a pattern<sup>13</sup> of Ka‘ū generally follows that of the rest of Hawai‘i in that land size is roughly correlated to population (that is, the denser the population, the greater the number and the smaller the size of the ahupua‘a), and population is related to resources (Tuggle 1979; Cordy 1994). The relationship of the land divisions of the HAVO region to the general resource zones is shown in Figure 14, with estimated population density (major temples are also shown). The western section of Ka‘ū has two large ahupua‘a, Manukā and Kahuku. The eastern section of Ka‘ū has the ahupua‘a of

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<sup>13</sup> The ahupua‘a boundaries are generally from 19th century records, and are assumed to represent traditional, late pre-Contract patterns, although there are questions about the specific location of many of these boundaries (see e.g., Carter and Somers 1990:25). This is an important research problem.

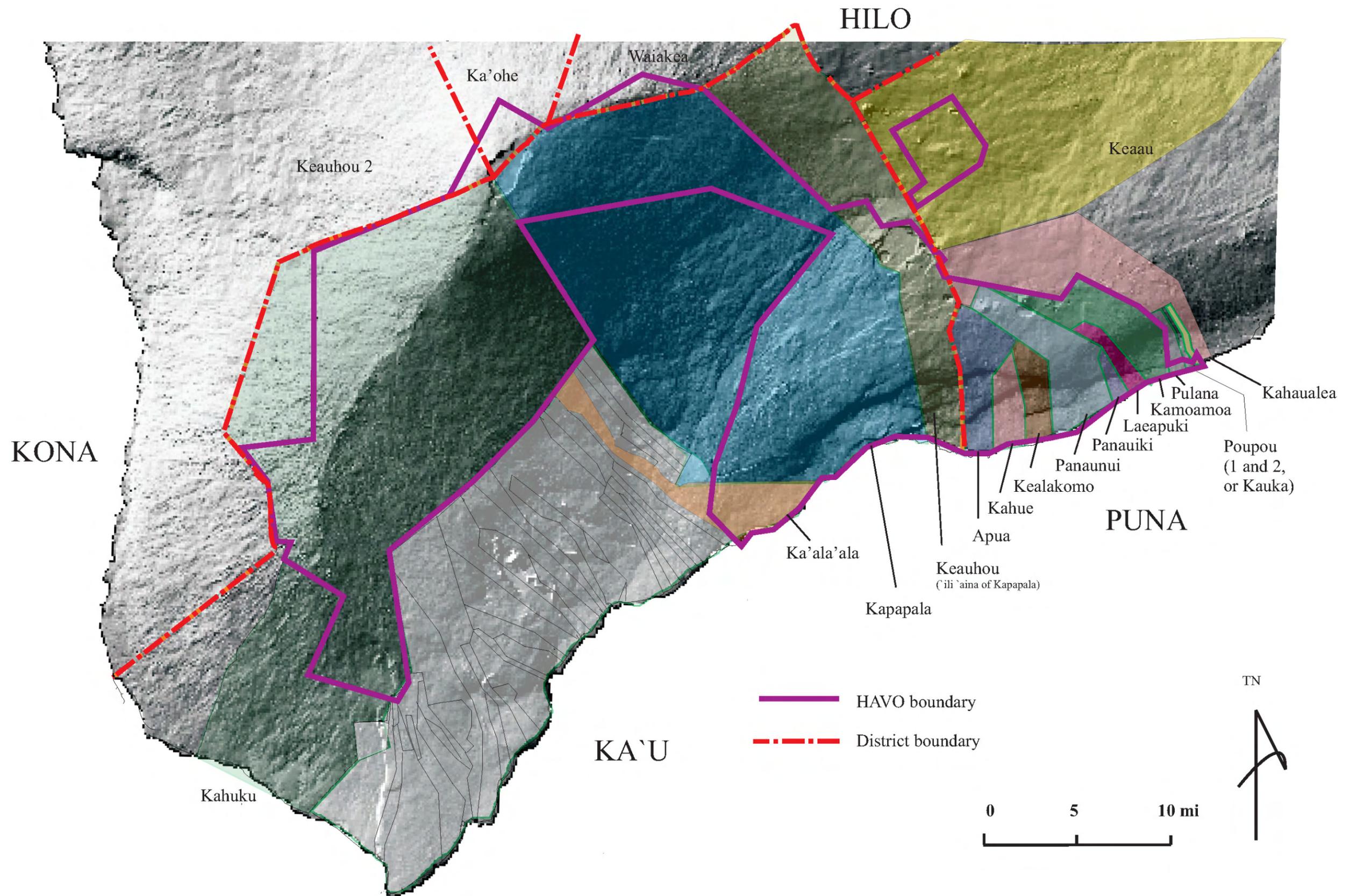


Figure 12. The traditional ahupua'a of the districts of Ka'u and Puna in the HAVO area.



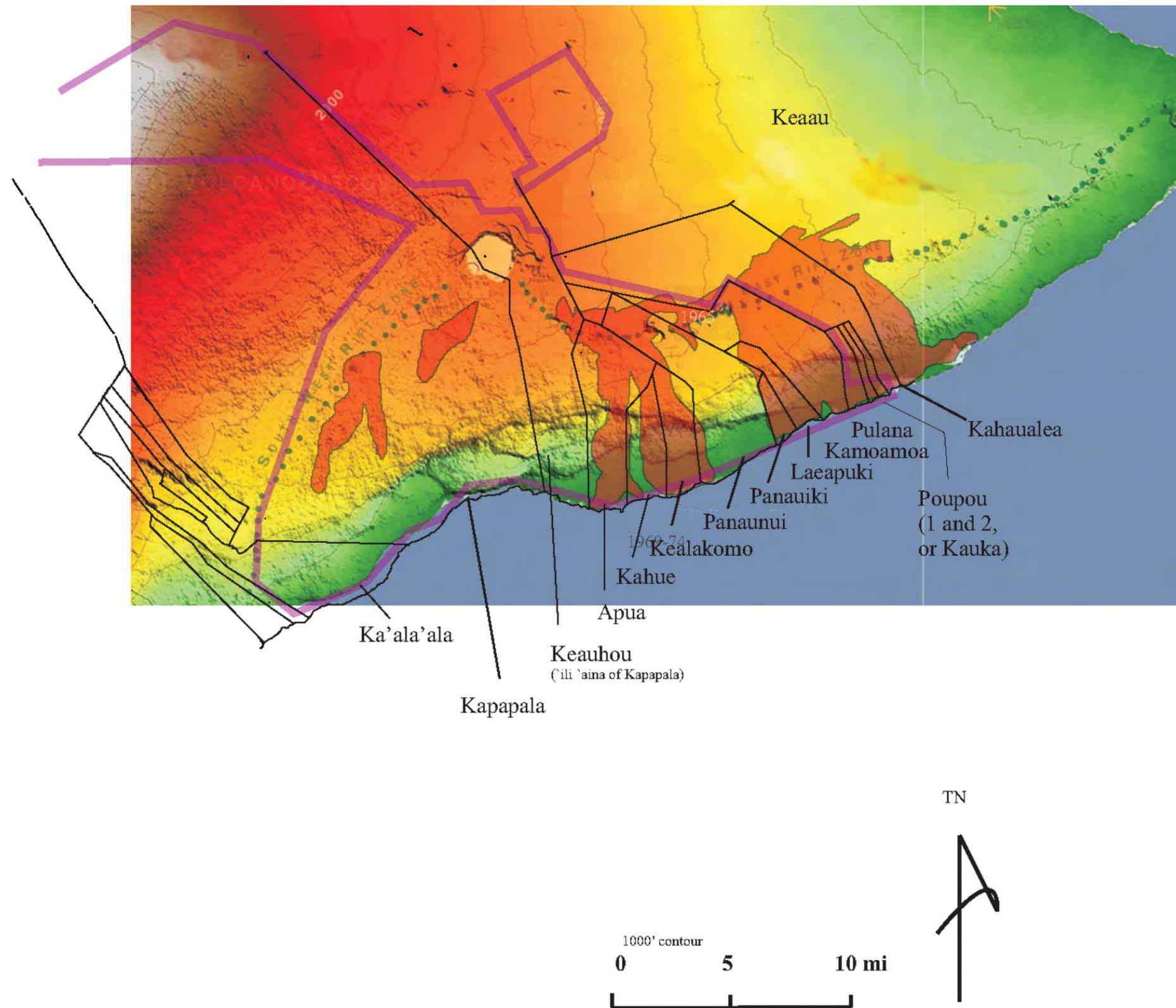


Figure 13. The ahupua'a of eastern HAVO, shown on schematic landform.



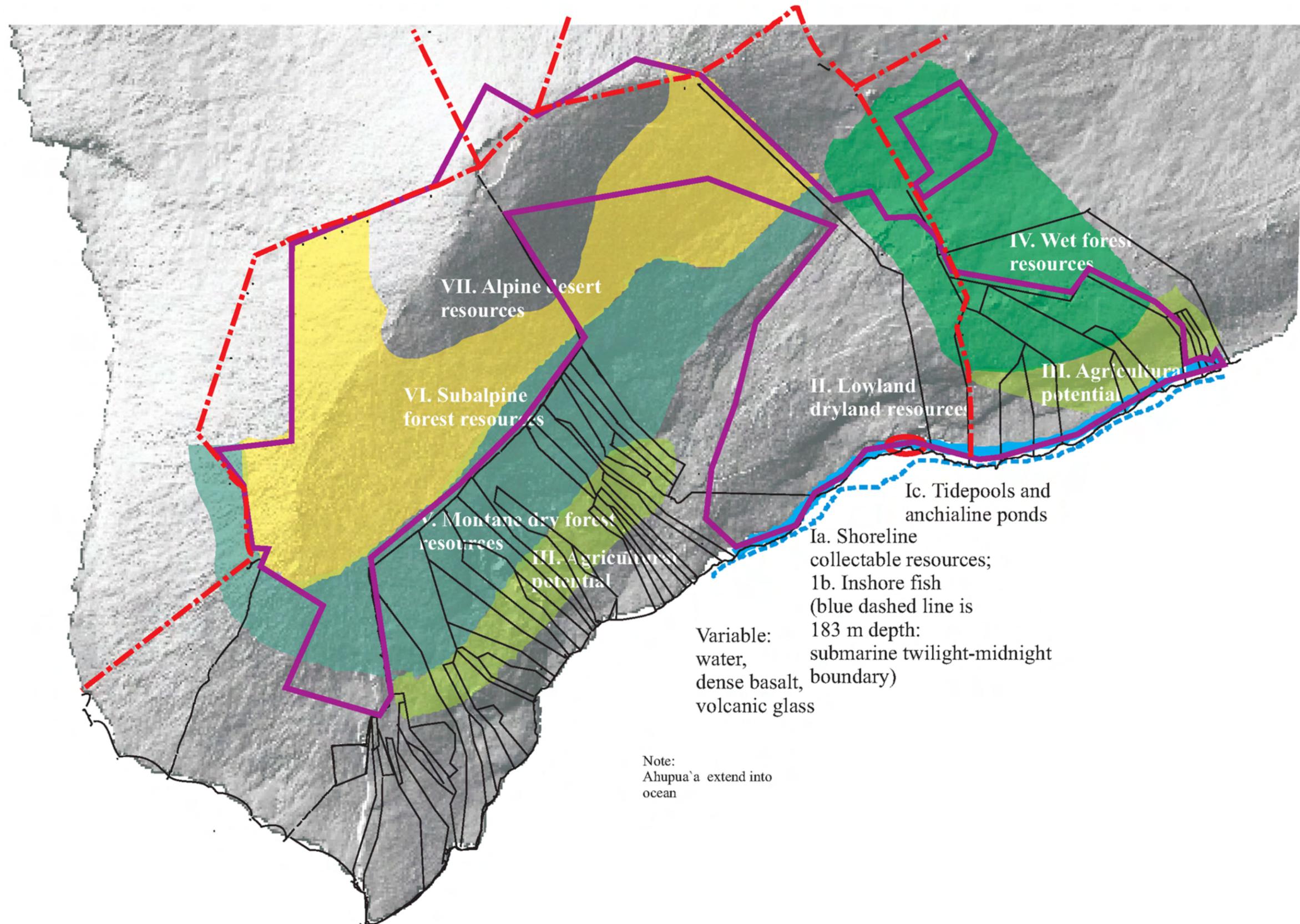


Figure 14. Resource areas of the HAVO area, with ahupua`a distribution.



Kapāpala and the ‘ili‘āina<sup>14</sup> of Keauhou (the latter containing Kīlauea Caldera). Between these two areas of large ahupua‘a is the central section of Ka‘ū with 70 narrow land units.

One nearly unique aspect of Ka‘ū is several clusters of small, inland ahupua‘a that reflect unusual environmental regions. One of these clusters is in the area of Wood Valley at the eastern end of Ka‘ū. Another cluster occurs at the east boundary of Kahuku at Pali o Māmalu (the section of the Kahuku Fault near the present Belt Road). In the area of this cluster, which includes Kī‘ao, Mānienie, Nāpu‘ulena, and Keke‘ekai ahupua‘a (Cordy 1988:Table 1), the eastern Kahuku boundary jogs east to encompass Pāhala ash-rich lands at the top of Pali o Māmalu. In 1793, Archibald Menzies, naturalist on George Vancouver’s expedition, and his party left their canoes at the coast and scaled the pali to the top of the Kahuku Fault. He describes the contrasting landscapes of barren, lava-covered coast at the base of the pali and upland grasslands at the top of the pali (Menzies 1920:182):

On gaining its summit, ... an extensive tract of the most luxuriant pasture we had yet seen amongst these islands rushed at once upon our sight, extending itself from the south point to a considerable distance inland. It was cropped with fine soft grass reaching up to our knees, and naturally of a thick bottom that would afford excellent feeding for cattle.

... Close by us was a fine plantation belonging to Kamehameha, called Kahuku.

The other common ahupua‘a pattern is that areas of low population (that is, relatively barren zones) are the regions where district boundaries are located. Thus, the boundary between Ka‘ū and Puna falls in the rugged terrain of volcanism. However, a unique aspect of Ka‘ū and Puna is that the dividing element is also a focus. Kīlauea and the deity Pele were a dominating factor in the lives of the people of both districts—and there is the possibility that this was not the traditional district boundary. Political structure often overrode district boundaries, and western Puna was under the control of the chiefs and kings of Ka‘ū until the time of Kamehameha (see Fig. 12). The district has been called Greater Ka‘ū (Cordy 1988) extending to the present Puna ahupua‘a of Poupou.

At the western edge of Ka‘ū, Manukā and Kahuku are large land areas dominated by the Southwest Rift of Mauna Loa, again emphasizing a dividing focus of the district of Ka‘ū from Kona to the northwest.

Although the lowland area of eastern HAVO is a region of agricultural potential, it is a largely barren zone that is at the lower end of such potential. This is reflected in the larger ahupua‘a size and lower population density of Kapāpala ahupua‘a and the ‘ili‘āina of Keauhou; Kahuku in western Ka‘ū is similarly large with low population. What is striking is that all three land units have claim to the uplands, a significant departure from other districts where the uplands are an inland extension of a central, high population, politically important ahupua‘a (e.g., Keauhou in Kona and Ka‘ohe in Hāmākua). These inland extensions “cut off” access to mountain resources for other Ka‘ū ahupua‘a; Kahuku also cuts off access for ahupua‘a in south Kona. Kapāpala and Kahuku had access to a vast section of the upland forests of Mauna Loa and the alpine region, areas providing the important koa and other woods, as well as birds for feathers and food; these two ahupua‘a were the only Ka‘ū land units with access to the ceremonial focus of Moku‘āweoweo, the summit crater of Mauna Loa. The ‘ili‘āina of Keauhou contains Kīlauea, the primary home of Pele. This emphasizes the importance of these large boundary ahupua‘a and raises questions about their role in the overall political and religious system of the district.

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<sup>14</sup> An ‘ili‘āina was a semi-independent land unit within the ahupua‘a. It can be considered as equivalent to an ahupua‘a in many respects.

## TIME: TRADITIONAL ORGANIZATION OF HISTORY

A sense of historical or linear time<sup>15</sup> pervades Hawai'i traditions, as expressed in the *Kumulipo* and other creation stories and in royal genealogies. It is also expressed in the manner of presentation of individual events, which nearly always includes a temporal reference point such as the era of a particular king. The traditions are commonly divided into three general eras: the mythic past (the time of creation and the activities of the gods); the voyaging era (which is a period of active long-distance travel between the Hawaiian Islands and other places in the Pacific); and for the island of Hawai'i, the traditional era of kings—often referred to as the dynastic era—from the time of Lā'au and Pili to Kamehameha.

This linear time is often characterized as a trajectory of increasing historicity, and while this has a certain analytical value, it should not be taken in an absolute sense. It is perhaps more useful to consider this trajectory as one of multiple layers of metaphorical meaning—that is, the further into the past, the more multi-layered history becomes: Papa and Wākea established the paradigm for society (Kame'eleihiwa 1992); the *Kumulipo* is an expression of evolution, history, and human realization (Johnson 1981); Pele has a reality as a personification of lava flows and as an ancestor (Pukui, in Handy and Pukui 1958:26); Pā'ao was a great voyager and a priest (Masse 1995); the kings and their birth stars were intertwined entities (Johnson 1993).

The physical world includes elements of this traditional time in landscape, archeological remains, the record of physical events (such as lava flows and tsunamis), and the record of celestial events. This is augmented by the traditional record that provides specific ties to the physical world by means of place names and by reference to physical and celestial events.

### Genealogical Time

The primary temporal unit embedded in Hawaiian time is the genealogical generation, of which three referred to for this chronology. Reconciling variations in these genealogies and developing methods to convert the genealogical generations to calendar years have been proposed from the early years of western Contact to the present (see e.g., Fornander 1969; Hommon 1976; Cordy 2000). The average time span assigned to a genealogical generation has ranged from 20 to 30 years. Masse and Tuggle (1998) use an astronomical event that is identifiable in Hawaiian tradition to establish a fixed calendrical point, and thus calculate about 23 years as an average generation span.

### Traditional History in the Area of HAVO

Table 2 provides a working framework for the present report that uses the Ulu-Hema genealogy (Fornander 1969:I:188-189) and a 20-year generation span as a means of providing a general estimate of

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<sup>15</sup> There are many forms of non-linear time (see e.g., Parmentier 1987).

calendrical time. Included in this table are events from *The History of Kanalu* (Nāmakaokeahi 2004)<sup>16</sup> that are relevant to HAVO. The table is presented in two parts:

- Part 1 is the era before the time of dynastic kings, starting with Wākea, the mythical ancestor of all Hawaiians, and continuing for 45 generations to Lanakawai (just after the arrival of Pā‘ao); it includes only the Ulu-Hema genealogy and events from *The History of Kanalu*.
- Part 2 covers the dynastic era of Hawai‘i Island kings from the time of Lā‘au-Pili; it includes the area of rule by island and district, and specifies who ruled Ka‘ū and Puna; information on the district chiefs who have been identified in the historical record is also provided; the last column continues the Ulu-Hema and Kanalu events from Part 1.

The information from *The History of Kanalu* (Nāmakaokeahi 2004) in Table 2 has been selected for its relevance to HAVO. The history begins with Kanalu, the first priest after the great flood (that is, the sea or tsunami called Kahina-ali‘i; see Ellis 1963:172), and to the chief of that time; both individuals lived and died in Puna. Kanalu refers to the coming of Pele and Pā‘ao and to many events in the history of Pele and her family.

During the dynastic era, Ka‘ū was an independent kingdom only twice, once under Kalani‘ōpu‘u and for nearly a decade under Keōua during the war with Kamehameha.

This information establishes the traditional historical-chronological context for HAVO, which is employed in Section III in the discussion of landscapes and sites.

## **ARCHEOLOGICAL ORGANIZATION OF TIME AND HISTORICAL EVENTS**

Correlation of the archeological record with events of traditional Hawaiian history has been attempted with a variety of archeological remains, such as changes in temple construction and the history of rebuilding (e.g., at Pu‘uhonua o Hōnaunau), with burn layers and references to “scorched-earth” warfare (e.g., on Kaho‘olawe), and with general archeological patterns of cultural change related to the Hawaiian traditional cultural sequence (e.g., Hommon 1976; Dye and Komori 1992; Cordy 2000). However, except for the parallel of general patterns, these efforts have not produced convincing results. More often than not, the traditional information is used only to identify and supplement archeological remains, such as providing the names of temples and a record of the kings associated with them.

Three archeological patterns that can be understood in relation to Hawaiian traditions are colonization, population growth and expansion, and the intensification of agriculture in leeward areas with associated shift of political power.

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<sup>16</sup> *The History of Kanalu* has a section in Hawaiian and a section that is the English translation. The Hawaiian section has standard pagination; the English section is paginated with the word “English” before each page number. The present document cites the English translation as “E page number” (e.g., Nāmakaokeahi 2004:E 10).

Table 2. Part 1—Pre-Dynastic Genealogy and Chronology for Hawai‘i and the Ka‘ū-Puna Area (Ulu-Hema and *The History of Kanalu*).

Ulu-Hema Genealogy*		
Gene-ration	King	Information from <i>The History of Kanalu</i> **
01	WAKEA	—
02-18		—
19	<i>Kueleimoana</i>	Pi‘ikuali‘i Kanalu (first chief). Lived in Puna, Hawai‘i, at the opening of a sacred ledge. The opening was “closed” when the Sun appeared. When Pi‘ikuali‘i Kanalu, first chief after the Flood, and Kanalu died, their bodies were taken to “the vast ocean of Lilana. (This is directly upland of Kuki‘i, where there is a secret cave.)” (Nāmakaokeahi 2004:E 8, parenthesis original)
20	<i>Konohiki</i>	—
21	<i>Wawena</i>	Namakaaokehikaiakea, sister of high priest: prophecy of Pele (Nāmakaokeahi 2004:E 10)
22	<i>Akalana</i>	Pele appears; districts are formed and the chief of Ka‘ū is Kauhikau and his wife is Laukalie; ‘Opoike is the priest and his wife is Kealoali‘i. (Nāmakaokeahi 2004:E 13)
23	<i>Mauiakalana</i>	—
24	<i>Nanamaoa</i>	Pele and family make their home at Kīlauea. (Nāmakaokeahi 2004:E 13)
25	<i>Nanakulei</i>	—
26-28		—
29	<i>Aikanaka</i>	—
30	<i>Puna</i>	Battle of Pele and Kamapua‘a as prophesied. (Nāmakaokeahi 2004:E 39)
31	<i>Hema</i>	—
32	<i>Kahai</i>	Pilika‘aka‘a, a prophet arrives. “The prophets and the priests said, ‘We know this person. [What we know of this person is that], the lands he knew of are gone. This is the reason [he is coming]: to bring us his gods, Kū and Lono on that journey here and to live on our islands. Some of his gods are Pele, Kamohoali‘i, and Kahuilaokalani...His stature as a prophet is because he is a guardian of Pele...’” (Nāmakaokeahi 2004:E 62, brackets original)
33	<i>Wahieola</i>	About Pilika‘aka‘a, the prophet: “He loved his flesh and blood, Kamohoali‘i, Pele, ...” (Nāmakaokeahi 2004:E 67)
34	<i>Laka</i>	—
35-39		—
40	<i>Huanuikalalailai</i>	—
41	<i>Paumakua</i>	Coming of Pā‘ao as prophesied and realized (Nāmakaokeahi 2004:E 95, 99) [AD 1240]
42	<i>Haho</i>	—
43-44		—
45	<i>Lanakawai</i>	—

NOTE: Continued in the last column of Part 2 of Table 2.

\* Numbered generations and names of kings from Fornander (1969:I:188-189).

\*\* Information from *The History of Kanalu* (Nāmakaokeahi 2004).

Table 2. Part 2—Dynastic Era Genealogy and Chronology for Hawai‘i and the Ka‘ū-Puna Area.\*

Gen	Dyn	King	Area of Rule	Greater Ka‘ū	Puna	Generational Date AD	Ulu-Hema Genealogy/History of Kanalu (continued from Table 2, Part 1)
01		LA‘AU	Island**		Pauahilani-nui ( <i>great heavenly fire</i> ), traditional chief of Puna; “convert of priest Pa‘ao” (Barrère 1959:41)	1340-1360	46. <i>Laaui</i> “Laukahikukupua said to Lanaahaloa and the high priest in charge of the re-population effort, Poki‘ikeanahulu, ‘The island is completely full of the worshipers of Pele, who rules as chief [over] Kihawahine and Kunawahine, the guardian angels of Kāne, Kanaloa and Keali‘ikapuhunaikaouli.’ Poki‘ikeanahulu said to Laukahikukupua and the chief, Lana‘ahaloa, ‘The great Pele’s guardian is Lumahihea, the one who has the adjudgement of life and death’” (Nāmakaokeahi 2004: E 120).
02		PILIKA‘AIEA	Island^			1360-1380	47. <i>Pili</i>
							48. <i>Ko</i> 49. <i>Ole</i> “Young Kauhikeali‘i issued his challenge that he had been so carefully taught by his grandparent, the great war chief of Pele. Kauhikeali‘i” (Nāmakaokeahi 2004: E 133).
03		KUKOHOU	Island^			1380-1400	50. <i>Kukohou</i> “Pele ordered Kuli‘a‘ikekua, her war chief to expel the people of Ho‘laniku” (Nāmakaokeahi 2004: E 136).
04		KANIUHI	Island^			1400-1420	51. <i>Kaniuhi</i>
05	1	KANIPAHU	Island^			1420-1440	52. <i>Kanipahu</i>
05	2	KAMAI‘OLE	Island^			1440-?	—
06	3	KALAPANA	Island^			?-1460	53. <i>Kalapana</i>

Table 2. Part 2—Dynastic Era Genealogy and Chronology for Hawai‘i and the Ka‘ū-Puna Area (continued).\*

Gen	Dyn	King	Area of Rule	Greater Ka‘ū	Puna	Generational Date AD	Ulu-Hema Genealogy/History of Kanalu (continued from Table 2, Part 1)
07	4	KAHA‘IMOELE‘A (Mahaimoeleikaikupou)	Island^			1460-1480	54. <i>Kahaimoeleikaikupou</i> “The ranks of those in charge of the re-population effort were disgusted with the priests of Pele and Hi‘iaka and the lesser gods. Across the land they buried Kamaunuaola in fiery, glowing underground oven.... While the ranks of the priests were watching, Kamaunuaola led several warriors to battle the ranks of priests in charge of the re-population effort. ... The chiefs and priests in charge of the re-population effort rose up to battle those who worshiped Pele, the goddess of the earth” (Nāmakaokeahi 2004: E 148-149).
08	5	KALAUNUIOHUA	Island			1480-1500	55. <i>Kalaunuiohua</i> “Prayer was chanted by Kaniakauahi, one of the priests of Pele who lived by her yam mounds of La‘a. The guardian of Pele used this appeal to worship the fire gods in accordance with the traditions of the many gods” (Nāmakaokeahi 2004:152).
09	6	KUAIWA	Island			1500-1520	56. <i>Kuaiwa</i>
10	7	KAHOUKAPU	Island			1520-1540	57. <i>Kohoukapu</i>
11	8	KAUHOLANUIMAHU	Island			1540-1560	58. <i>Kauholaninuimahu</i>
12	9	KIHANUILULUMOKU	Island			1560-1580	59. <i>Kiha[nuilulumoku]</i>
13	10	LĪLOA	Island	‘Imaikalani, a member of the I family line	Huaa	1580-1600	60. <i>Liloa</i>
14	11	HAKAU	Island	‘Imaikalani		1600-?	—
14	12	‘UMI A LILOA Kulukulu‘a Hua‘a ‘Imaikalani ‘Ehunuikaimalino	Island Hilo Puna Ka‘ū Kona	‘Imaikalani		1600-1620	61. <i>Umi [a Liloa]</i>

Table 2. Part 2—Dynastic Era Genealogy and Chronology for Hawai‘i and the Ka‘ū-Puna Area (continued).\*

Gen	Dyn	King	Area of Rule	Greater Ka‘ū	Puna	Generational Date AD	Ulu-Hema Genealogy/History of Kanalu (continued from Table 2, Part 1)
15	13	KELI‘IOKALOA Keawenui a ‘Umi	Island** Hāmākua, Hilo, Puna	Kahalemilo, son of ‘Imikalani	Lililehua, son of Huaa	1620-?	62. <i>Kealiiokaloa</i> 63. <i>Kukailani</i>
				Kahalemilo, slain as rebel by Keawe	Lililehua, slain as rebel by Keawe		64. <i>Makakaulii</i>
15	14	KEAWENUI A ‘UMI	Island	Pupuakea, son of king Keawe		?-1640	65. <i>Keawenuiaumi</i>
16	15A	<i>KAIKILANINUI</i> KANALOAKUA‘ANA	Island** Island (Kona, and Kohala?)	Pupuakea, district chief of Ka‘ū, remained loyal to Līloa during major revolt		1640-1660	66. <i>Kanaloaku[A]Ana</i>
	15B	LONOIKAMAKAHIKI ‘Umiokalani Makua a Kumalae	Island Kona Hilo				
17	16	KEAKEALANIKANE Keaweakai ‘I	Island** Kohala Hilo			1660-1680	67. <i>Keakealanikane</i>
18	17	<i>KEAKAMAHANA</i> Kanaloauo‘o/Mahi‘ololi Kua‘ana a ‘I	Island** Kohala Hilo			1680-1700	—
19	18	<i>KEAKEALANIWAHINE</i> Kuahu‘ia	Island** Hilo			1700-1720	—
20	19A	KEAWEIKEKAHIALI‘IO KAMOKU	Island	Kalaninui‘iamamao son of king		1720-1740	68. <i>Iwikauikaua</i>
	19B	KALANIKAULELEIAIWI ^^ Kauauaamahi Mokulani	Island^^ Kohala Hilo	Keaweikekahiali‘io kamoku			
21	20B	KALANINUI‘IAOMAMAO	Ka‘ū	Kalani‘ōpu‘u, son of Kalaninui‘iao mamao		1740	69. <i>Kanaloakapulehu</i>
20	20A	MOKULANI	Hilo				
21		KALANIKE‘EAUMOKU	Kona, Kohala				

Table 2. Part 2—Dynastic Era Genealogy and Chronology for Hawai‘i and the Ka‘ū-Puna Area (continued).\*

Gen	Dyn	King	Area of Rule	Greater Ka‘ū	Puna	Generational Date AD	Ulu-Hema Genealogy/History of Kanalu (continued from Table 2, Part 1)
22	21	ALAPA‘INUI Kalani‘ōpu‘u	Island Ka‘ū and Puna (after Alapa‘i)	<i>Ka‘ū independent</i> under Kalani‘ōpu‘u, who later conquered whole island		1740-1760	70. <i>Kaneikauaiwilani</i>
23	22	KEAWE‘OPALA	Island **			1760	71. <i>Keawe[ikehahialiiokamoku]</i> 72. <i>Keeaumoku</i>
22	23	KALANI‘OPU‘U	Island	Keōua Kuahu‘ula, son of Kalani‘ōpu‘u (Ka‘ū chief Nuuanu -paahu, from Na‘alehu, joined with Imakakola)	Imakakola (descendant of Imaikalani?), rebelled against Kalani‘ōpu‘u; defeated	1760-1782	73. <i>Kekela</i>
23	24	KIWALA‘O	Island			1782	74. <i>Kalanikupuapaikalaninui</i>
23	22	KEOUAKUAHU‘ULA	Ka‘ū (Puna, part)	<i>Ka‘ū independent</i> for 9 years under Keōua Kuahu‘ula; 1 of 3 independent divisions of the island; remained separate in wars with Kamehameha; finally Keōua gave himself up in sacrifice		1782-1791	—
22		KEAWEMA‘UHILI	Hilo (Hāmākua, Puna, part)				
23		KAMEHAMEHA	Kona, Kohala (Hāmākua, part)				
23	25	KAMEHAMEHA	Island, Kingdom	Keaweaeulu		1791-1819	75. <i>Kamehameha</i>
24	26	LIHOLIHO	Kingdom			1819	76. <i>Liholiho</i>

NOTE: This table is based primarily on Cachola Abad (2000), with additional information from Hommon (1976), Johnson (1993), and Cordy (2000).

Key to Column Headings: Gen = Generation beginning from Lā‘au

Dyn = Dynastic Sequence from Hommon (1976)

Area of Rule (Cachola Abad 2000): ^ = Increasing authority over time; \*\* = Nominal ruling authority

King (Cachola Abad 2000): name in CAPS = ali‘i nui; name in Lower Case = ali‘i ‘ai moku

The last column is a continuation of Part 1 of Table 2; italicized information is from the Ulu-Hema genealogy (Fornander 1969:I:188-189) and the non-italicized information is from *The History of Kanalu* (Nāmakaokeahi 2004).

Around AD 800 is the beginning of Hawaiian archeological time; that is, the date of Polynesian colonization of Hawai'i as based on a number of lines of evidence (Masse and Tuggle 1998; Tuggle and Spriggs 2001; Green 2005). This date is not inconsistent with Hawaiian traditions and a time-line that can be inferred from genealogies. Unfortunately, this conclusion falters from a critical deficiency—there is not a single component of any archeological site in Hawai'i that can be reasonably identified as an early colonizing settlement, a situation unique among the major island groups of Polynesia (Tuggle and Spriggs 2000).<sup>17</sup> This is a function of two factors:

- Hawaiian coastlines are generally unprotected by reefs and thus more susceptible to natural destruction than most places in Polynesia
- the more probable coastal areas for early settlement were largely destroyed by intervening development long before they could be adequately explored for archeological remains.

Rapid population growth and expansion from core areas began to take place around AD 1250 for the Hawaiian archipelago, as shown in Figure 15. This has been attributed to the introduction of the sweet potato, which allowed expansion into dryland regions (as summarized by Green 2005). As indicated below, recent research suggests that population increase on Hawai'i Island may have occurred somewhat later.

There have been few substantial excavation projects at HAVO, and the analyses of the excavations that have been conducted remain incomplete. Thus, there is limited stratigraphic information and radiocarbon dating available for understanding the chronology of the Hawaiian occupation of this area. The radiocarbon dating that is available for sites, as well as the radiocarbon dates of the lava flows on which sites were built, indicate coastal occupation by around AD 1250 (Holcomb 1987; Carter and Somers 1990:15). However, because of the extent of natural destruction (e.g., tsunami and subsidence) in the coastal areas of HAVO, the chances for identifying and dating early settlement sites is very limited. Nonetheless, this is an important research question and it is addressed in the Research Design (see Section VII).

The general environmental conditions of the HAVO area suggest that agricultural-based settlement was late, and probably date to after the introduction of the sweet potato. A working hypothesis of around AD 1450 is proposed for permanent settlement, although there were certainly fishing camps

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<sup>17</sup> There are some arguments for an earlier date of colonization (see e.g., Cordy 2000:108), but the authors of the present document believe such arguments are based on a misunderstanding of radiocarbon dating (see one discussion of this issue in Tuggle and Spriggs 2001), and there is a great deal of evidence in favor of a late date. Whatever the arguments may be regarding radiocarbon dates, an undeniably early settlement *site* has yet to be found in Hawai'i (as the comment in the main text indicates). A recent article by Kirch and McCoy (2007) acknowledges this fact as well as the probability of post-AD 800 Hawaiian colonization; it proposes a change in the cultural sequence proposed by Kirch in 1985, eliminating the Settlement Period (AD 300-600) and calling the first period in Hawaiian cultural history the Foundation Period (AD 800-1200).

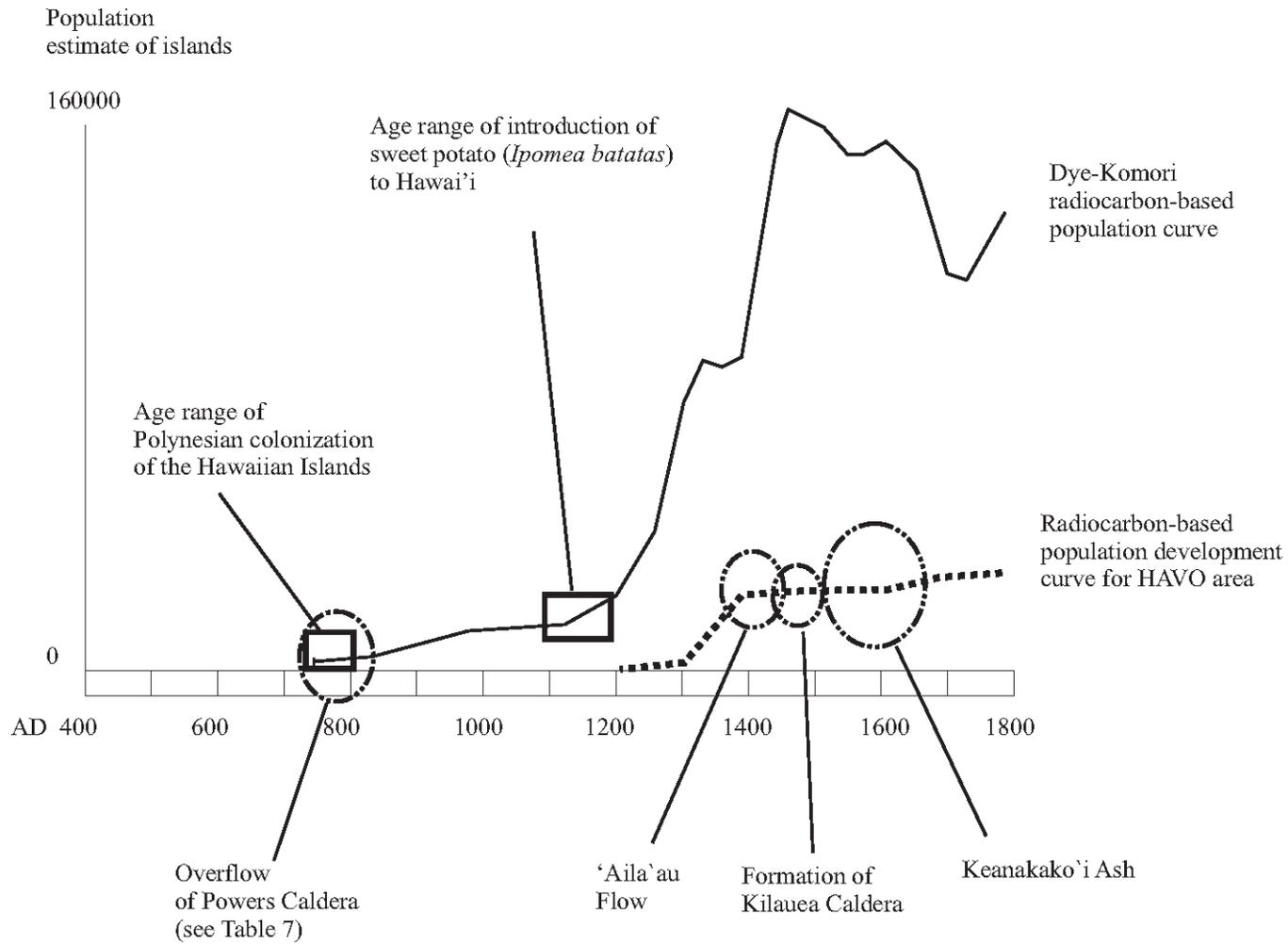


Figure 15. Hawaiian settlement and population growth, with an estimate of the comparative place of the HAVO area. The Hawai'i radiocarbon-based curve is derived from Dye and Komori (1992); the HAVO curve is based on HAVO radiocarbon dates, plotted relative to the Hawai'i curve.

along the coastline at a much earlier time.<sup>18</sup> This relatively late date is proposed because evidence accumulating from paleoenvironmental and agricultural field research in Kona indicates that major population growth there did not occur until around AD 1400 (Athens et al. 2006; Tomonari-Tuggle 2006). In Figure 15, radiocarbon dates available for HAVO are superimposed over the Dye and Komori (1992) radiocarbon-based population curve.

However, the volcanic activity in the HAVO region means that this area does not fit into the general environmental pattern of the island and so raises the question of how the changing volcanic landscape affected Hawaiian occupation. Were the volcano deities (however they may have been conceived in the era of early settlement) addressed with ritual and shrines as soon as this area was explored? And as a related question, how quickly were formal trails established for access to the volcanic mountains?

Answers to these questions may be found in the intensive study of the mountain shrines on Mauna Loa and in ritual caves, one of the most important research problems (in our view) at HAVO.

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<sup>18</sup> The chronological data for the once proposed “early” sites at South Point have been re-evaluated (Dye 1992) and are now considered to indicate occupation of these sites as late as the AD 1500s.