

The Māhele and Later in Waipi‘o Valley, Hawai‘i



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TABLE OF CONTENTS

Introduction (H.H. Leidemann)	1
The Mähele Period (D.I. Olszewski and H.A. Lennstrom)	2
Censuses and Other Records (H. H. Leidemann and J. E. Dockall)	11
Missionary Records	12
Mähele Records	19
Census Records	23
Oral History Records	44
<i>Poi</i> Production and <i>Poi</i> Factories (L.L. Hartzell and S.A. Lebo)	46
Traditional <i>Kalo</i> Cultivation	46
Traditional <i>Poi</i> Production	48
Development of a Commercial <i>Poi</i> Industry (ca. 1880s–1900)	50
Expansion and Early Mechanization of the <i>Poi</i> Industry (1900–1940s)	59
Changing <i>Poi</i> Industry	70
Supplement: Vegetation Survey of the Lower Part of Waipi’o Valley (C. Imada)	78
Introduction	78
Vegetation History	78
Results of Survey	81
References	108
Appendix A: Waipi’o Valley Plant Species List (C. Imada)	125

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Cover Photograph: *Kalo* growing in Waipi'o Valley, April 1999 (photograph by Deborah I. Olszewski).

INTRODUCTION

Two of the most important and symbolic words in the Hawaiian vocabulary—*kalo* and *'ohana*, the words for taro and family—can be used to describe the main focus of life in Waipi'o Valley. It is significant that the words are related in terms of language and legend. *Kalo* reproduces by means of underground sprouts, or *'ohä*, which are broken off the parent corm for planting. The word *'ohana* itself is composed of the word *'ohä* and the suffix *na*, and so literally means off-shoots or “that which is composed of off-shoots”; by extension, then, it means “the off-shoots of a family stock” (Handy and Pukui 1972:3). It is also of interest that



Figure 1. *Kalo* in Waipi'o Valley (photograph by Helen Leidemann).

the main plant stalk is called the *makua*, or parent, and the offshoots are sometimes called *keiki*, or children (Pukui and Elbert 1986:142, 230). So the idea of family relationships in the Hawaiian language includes various aspects of *kalo*—its planting, growth, and regeneration—as basic elements. In addition to this linguistic link between the two terms, there is also a traditional connection. In early Hawaiian history as reported and discussed by Malo (1951:244), Handy and Handy (1972:74, 80–81), and Kame'eleihiwa (1992:23–25), the

first-born child of Wäkea and Ho'ohökūkālani became Haloa-naka, the *kalo* plant; he is elder brother to the ancestor of all the Hawaiian people, also named Haloa. This legendary relationship “contains the design for the Hawaiian family and social order” (Burgess and Burgess 1993). So, the words *kalo* and *'ohana* reflect their underlying symbols: families living on the land, interrelated and sharing, cultivating *kalo*—*kalo* being, in turn, the legendary elder brother of the Hawaiians.

Changes in Waipi'o Valley over the last 150 years in the numbers and sizes of families, their ethnic background, educational and business opportunities, and planting choices have somewhat affected the *'ohanakalo* focus. This report presents “snapshots” of the valley that describe these changes from just before the Mähele to more recent generations who have maintained the cultivation of *kalo* and the structure of the *'ohana* into the present day. These sketches of life are based on missionary records starting around 1830, Mähele documents of the mid-1800s, Hawaiian kingdom and U.S. government census records for the late 1800s and early 1900s. What comes through in these primary resources are three levels of social relationship that

could be described as *'ohana* in the post-Contact period—that of the individual family, of the ethnic group, and of the larger, interrelated and interdependent community of Waipi'o Valley.

THE MÄHELE PERIOD

The documents of the Mähale period concerning land claims and awards in Waipi'o Valley provide an opportunity to “see” the valley as it was around the middle of the 1800s. These records include the testimonies associated with the Land Commission Award (LCA) system and the corroborating testimonies given in the Native Register, Foreign Register, Native Testimony, and Foreign Testimony. Each of these sources records information in a relatively standardized way, however, the types of information given often vary considerably from one claimant to the next. For example, one claimant might list specific numbers of *lo'i*, houselots, *kula*, *wauke* plots, and so forth, while another claimant might simply list the number of houselots and only mention that the claim included *lo'i* or *wauke* and so on. Summary information from the valley thus represents a minimum number for these types of details about agricultural plots, plants, houses, houselots, and so forth. Distribution maps in this report showing the location of these details indicate only those which are specifically mentioned in the claims and which can be attributed to a known *'äpana*.

A total of 114 LCAs were claimed for Waipi'o Valley during the Mähale period. Of these, 82 were awarded, 26 not awarded, and six are not actually in Waipi'o Valley but in other areas of the Hämäkua District (Figure 2; Tables 1 and 2). In some cases, the LCA claims include *'äpana* from Waipi'o Valley and also from other areas of the island of Hawai'i or other islands in the archipelago¹. The *'äpana* from Waipi'o were sometimes not awarded as part of the LCA claim, while the other *'äpana* in that claim were awarded. The discussions that follow include all information from claims in Waipi'o Valley, regardless of whether or not those claims were awarded².

¹ The Mähale databases for Waipi'o Valley are included on a CD-ROM in the CD-ROM version. These databases will be available on Bishop Museum's website (Department of Anthropology) by Spring of 2001. *Poi* directory data is hand compiled prior to 1941 and cross-checked to individual after 1941. Waipi'o residents data is hand compiled by entry.

² The index to the Hawaiian Government Survey Map of Waipi'o Valley (Emerson 1881) contains several labeling errors. No. 4 should correspond to LCA 8489B (not 8489), No. 41 to LCA 8485 (not 6485), No. 49 to LCA 8203 (not 7877), and No. 60 to LCA 8469B (not 8469). This map does not show No. 86 (LCA 4452), which is the area from the ocean to No.s 58a (LCA10416, *'äpana* 1) and 29a (LCA 7876, *'äpana* 1) in the Keone region of the valley.

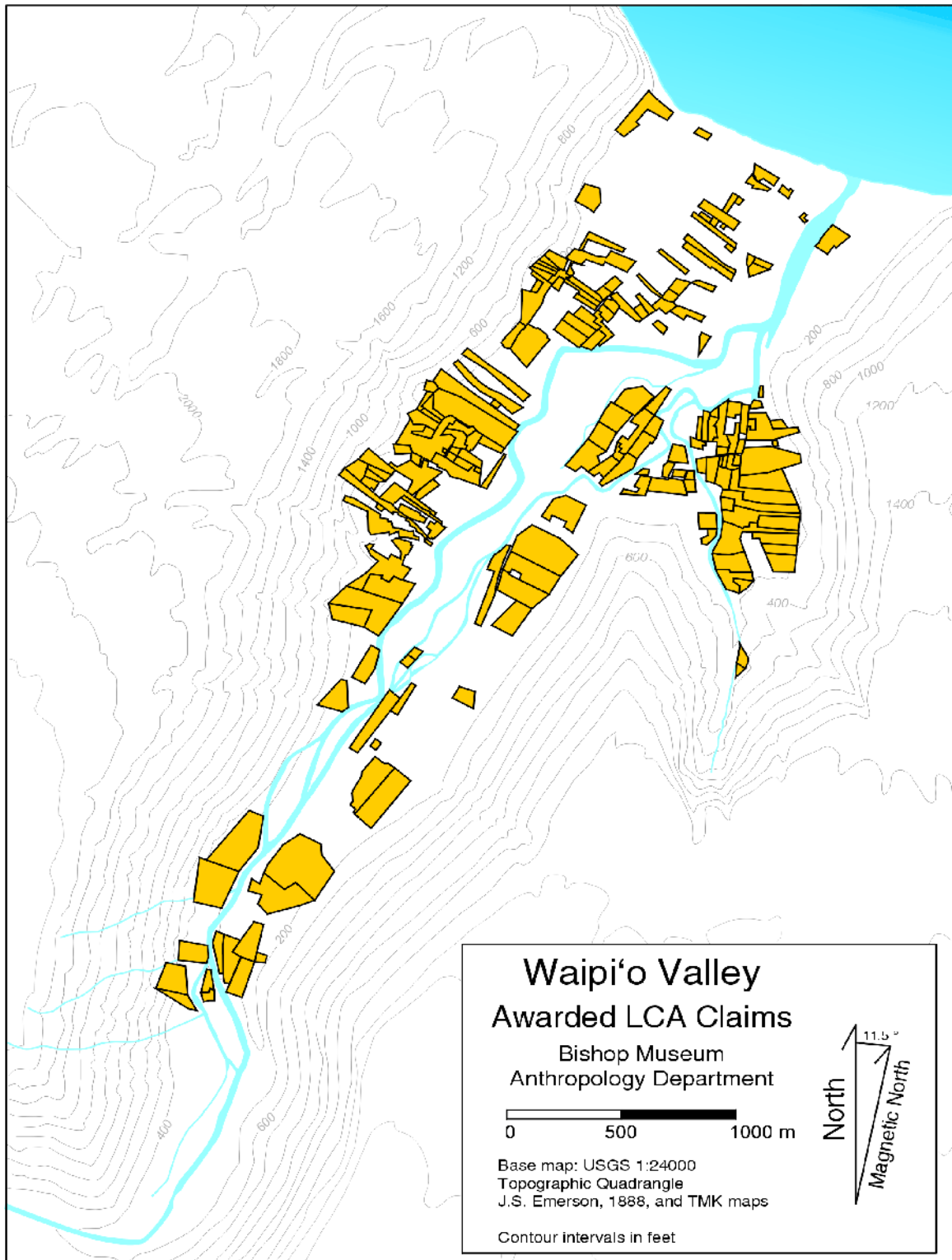


Figure 2. Distribution of LCAs Awarded in Waipi'o Valley.

Table 1. List of Awarded LCAs from Waipi'o Valley.

LCA #	Awardee	LCA #	Awardee
1278	Wood, John	8490	Kaiape
3736	Wahakane	8492	Kahili
3737	Waiokalehua	8493	Kolii
3757	Ahukini	8494	Kaoiwi
4123	Kalawaia	8495	Kaolulo
4135	Makaku, S. P.	8515B	Kaoanaeha
4135B	Kaaukai	8539	Kupele
4452	Kalama, Hazaleleponi	8539	Kupele
7856	Kamakahiki	8539B	Wailoa
7857 & 7862	Kapaka	9827	Kipapanui
7860	Kawahineainui	9828 & 7950	Kekoa
7861	Kaaeae	9829	Kahulilau
7863	Kalua	9830	Kahoomai
7871	Kaelemakule, S.	9929	Luai
7876	Kahawalu	9939	Lono
7878	Kaua	9955	Kaholo
7882	Kuaana	10066	Maka
7956	Kahulanui	10263	Makuakua
8201	Hapuu	10286	Maunakui
8202	Hamohamo	10397	Namai
8203	Hookio	10398	Nakoko
8381	Kaaeae	10399	Nalepo
8401	Keliinohopali	10415	Nuku
8469B	Keliiholomoana	10419	Nana, S.
8469B	Paele	10553	Opunui
8470	Kaoeno	10565	Ohule, B.
8471	Kaheana	10781	Puaanui
8472	Keawe	10782	Papau

LCA #	Awardee	LCA #	Awardee
1278	Wood, John	8490	Kaiape
8473	Koko	10918	Uma
8474	Kealoha	10960	Wahakole
8475	Kailikani	10961	Wailua, L.
8477	Kaiwihoua	10962	Konohiki, W.
8479	Koi	10994 & 10794	Pahee
8481	Kawilikopaa	11037	Heleihonua
8482	Kamai	11101	Keawekolohe
8483	Kaaeae	11102	Kahiamoe
8484	Kamahiaikuaaina	11104	Kaamoku
8485	Kaaniho, S.	11105	Naailuhi
8486	Kaluli	11106	Opihi
8487	Kaunaunahi	11108	Kulu
8488	Kuakahela	11109 & 03795	Leahi
8489B	Kaaukai	11110	Keliimahiai

The LCA claims often mention four specific categories including houselots, *lo'i*, *kula*, and *wauke*, in addition to a host of other data. There were 58 houselots claimed in Waipi'o Valley, of which seven were not awarded. The houselots were distributed throughout the valley, with 20 in the Nāpo'opo'o area, 13 in the Keone area, 15 in the Naalapa area, three in the Kōäuka area, and seven in the Läläkea area (Figure 3). As expected, *lo'i* in the valley were numerous, with a minimum of 1529 of which 155 were not awarded to the claimants. The Nāpo'opo'o region contained at least 410 *lo'i*, while the Keone region had at least 63 *lo'i* (Figure 4). In the Naalapa area, there were at least 295 *lo'i*, and the Kōäuka region had 118 *lo'i* at a minimum. The Läläkea area had at least 191 *lo'i*.

In the distribution of claimed *kula* in the valley, 27 claims were identified sufficiently to be shown (Figure 5). Two claims containing *kula* were not awarded. The *kula* plots are spread fairly evenly throughout the valley. *Wauke* was also occasionally mentioned. These total 14

6

claims in the valley (Figure 6), of which one claim with *wauke* was not awarded. Other claim details include a minimum of eight fishponds (*loko*) and a couple of *hala* patches.

Table 2. List of Non-Awarded LCAs and Claims not in Waipi'o Valley.

LCA #	Awardee	Status	LCA #	Awardee	Status
00100 B	Apua	Not in Waipi'o	07955	Kaholo	Not awarded
00121 B	Kuaana	Not awarded; see LCA 03732B	08424	Kaiwi	Not in Waipi'o
03043	Kapiipo	Not awarded Waipi'o land; Oahu land awarded	08425	Kahemolele	Not awarded
03731 B	Kaaeae	Not awarded	08476	Kamakahiki	Not awarded
03732 B	Kuaana	Not awarded	08480	Kuaana	Not awarded
03898	Naaukele	Not awarded	08483	Kaaeae	Not awarded
07325	Kalawaia	Not awarded	08491	Keliinohopali	Not awarded
07809	Kaaloa	Not in Waipi'o	08496	Kipapanui	Not awarded
07843	Kalauao, P.	Not in Waipi'o	09971	Leleiohoku	Not in Waipi'o
07853	Kalaokoa	Not in Waipi'o	10262	Mii, B.	Not awarded
07855	Kanaau/Apua	Not awarded	10414	Nuuanu, Silu	Not awarded
07860 B	Kawahineainiu and Palau	Not awarded; see LCA 07860	10420	Naiwi, B.	Not awarded
07862	Kapaka, G.	Not awarded; see LCA 07857	10582	Opunui, I.	Not awarded Waipi'o land; other land awarded
07869	Kapau, Nehemia	Not awarded	10794	Pahee	Not awarded; see LCA 10994
07903	Kapae	Not awarded; see LCA 07073	11103	Nalu	Not awarded
07950	Kekoa	Not awarded; see LCA 09828	11181	Kaaea	Not awarded

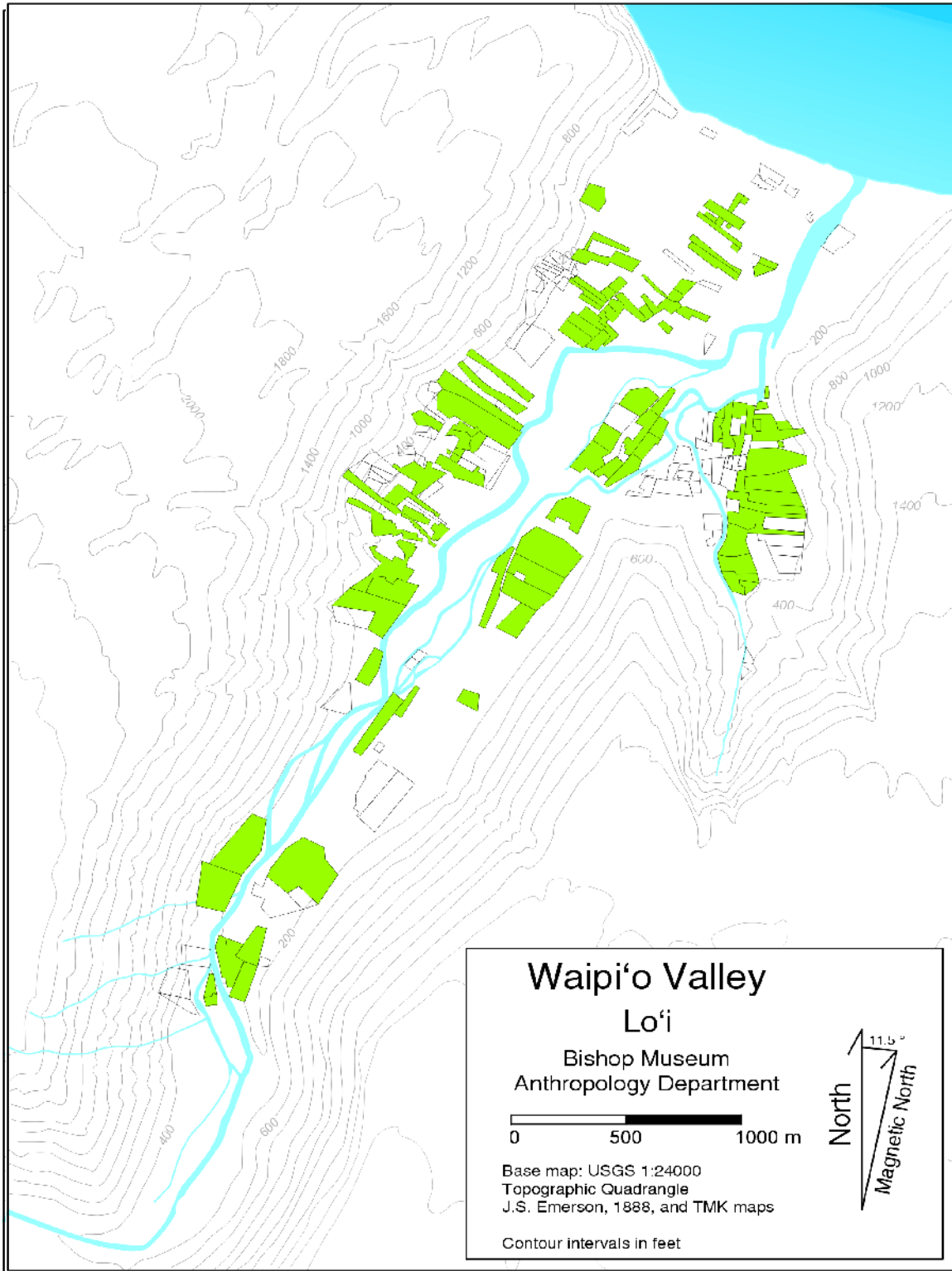


Figure 4. Distribution of Lo'i according to LCA data.

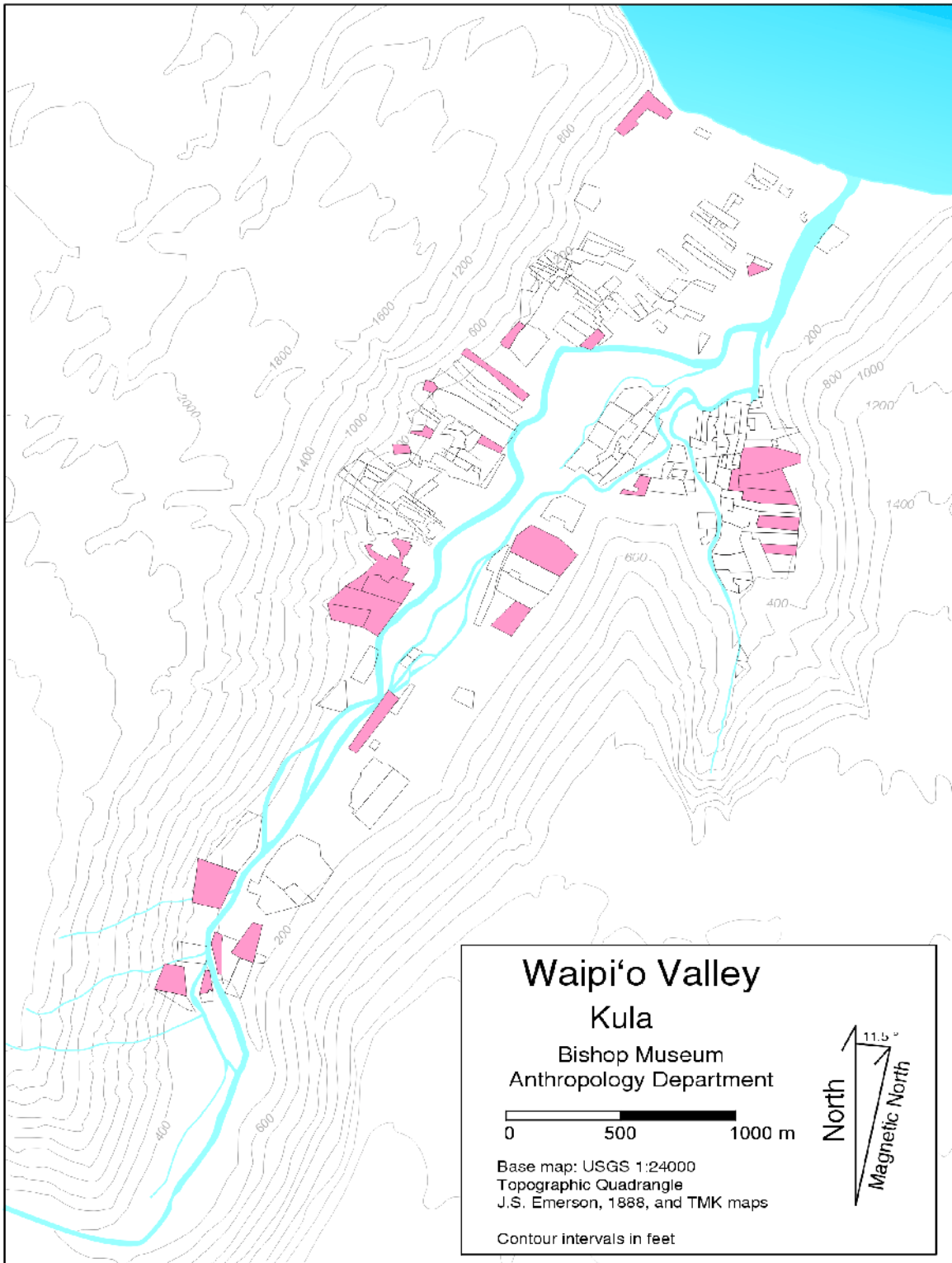


Figure 5. Distribution of *kula* according to LCA data.

~~T~~he Māhele and Later in Waipio Valley

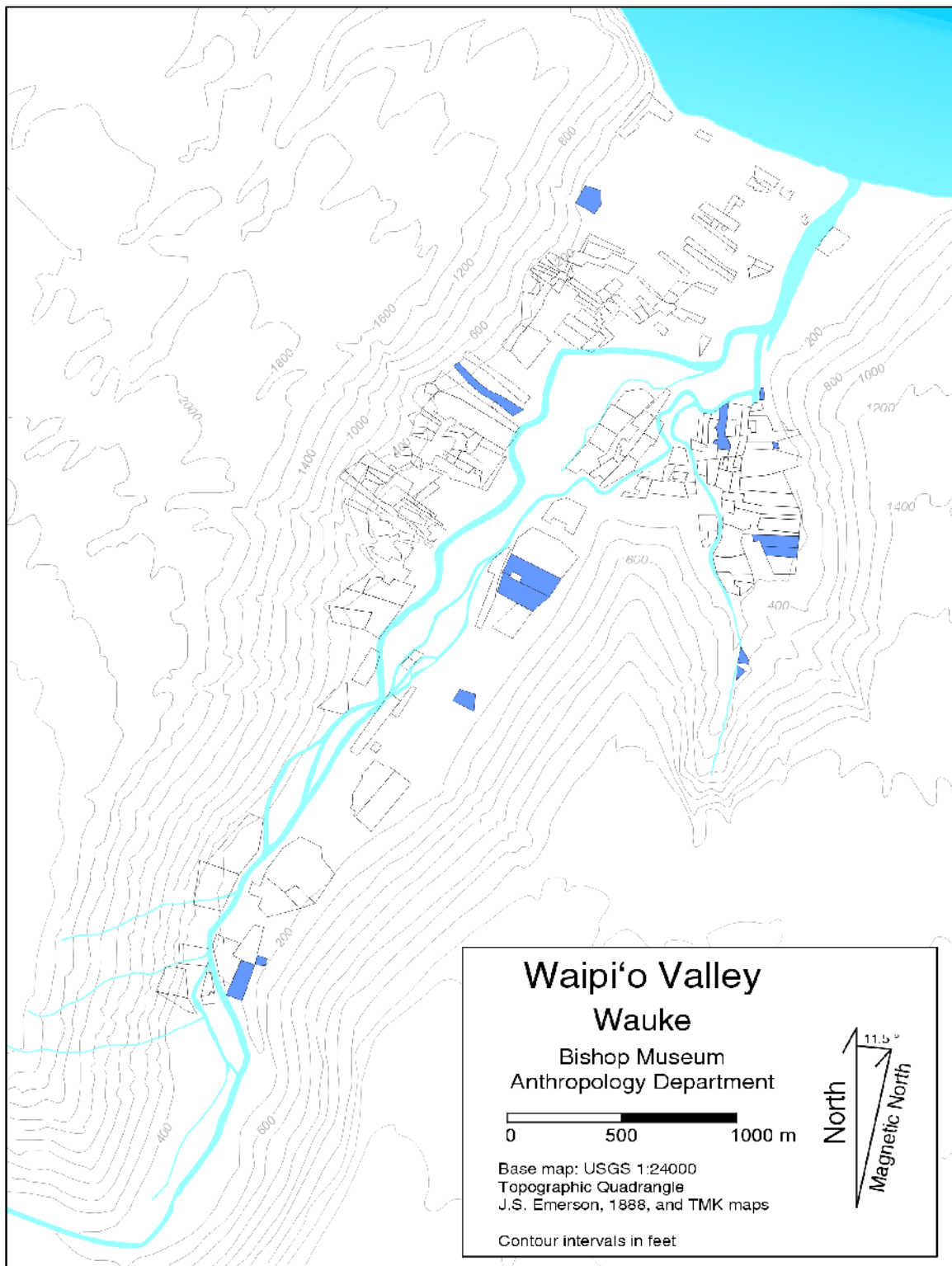


Figure 6. Distribution of *wauke* according to LCA data.

The Māhele and Later in Waipi'o Valley

The Māhele period records give us a picture of land use in Waipi'o Valley about seventy years after the arrival of Europeans in the Hawaiian Islands and about fifty years after the influx of missionaries. This picture of mid-nineteenth century land use in the valley is characterized by a way of life still largely traditional in structure and organization, and primarily Native Hawaiian in ethnicity. Two occupations mentioned in the LCAs, that of blacksmith (John Wood, LCA 1278) and schoolteacher (Nuku, LCA 10415, and L. Wailua, LCA 10961) give us an early glimpse of societal changes within the valley. Land use was mainly agricultural in focus and remained quite intensive. We know from other sources, however, that use of many parts of the valley, particularly the upper valleys, was far less intensive during the Māhele period than during either the late pre-Contact or even the 1820s (e.g., Cordy 1994:45; Ellis 1963).

CENSUSES AND OTHER RECORDS

From the mid-1800s to the early 1900s, changes in Waipi'o Valley accelerated at an increasingly rapid pace. This section examines some of the processes responsible for these changes, their impact on the valley and its residents, and the resulting alterations to the fabric of everyday life.

Schmitt's (1977:12-14) summary of the total population figures for Hāmākua District for 1831-32 to 1970 (Figure 7) shows considerable fluctuation in the numbers of inhabitants in Hāmākua, reflecting overall trends in epidemic events, out-migration, and immigration of other ethnic groups. For example, in 1860 there were 2,210 Native Hawaiians (males and females combined) for Hāmākua District (Anderson 1864:277).

Foreigners in Hāmākua District numbered 20, all male (Anderson 1864:278). The population for Hāmākua District dropped to its lowest point in the late 1870s but then rose to a pre-1970

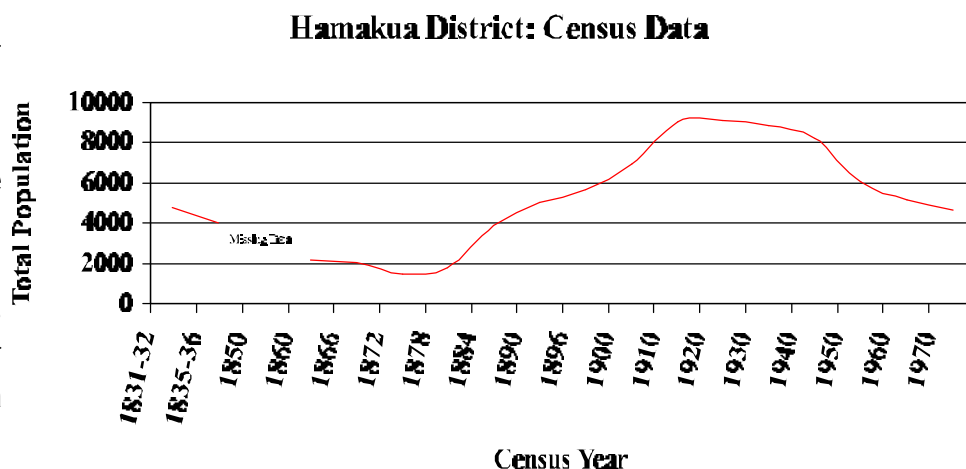


Figure 7. Hāmākua District census data (Schmitt 1977).

maximum in the period of 1910 to the 1920s. After the 1920s, there was a decline in population which may, in part, correspond to the decline in the Hawaiian rice industry and the upswing in procuring U.S. mainland sources of rice.

Research into the pre- and post-1860 census records identified differences in how individuals were named. Missionary census records (pre-1860) recorded the traditional individualized names for Native Hawaiians. This reflects, in part, the importance of names, which could influence health, life span, and happiness (Handy and Pukui 1972:98); names were treated accordingly as personal possessions. Post-1860 census records show varying, but steadily increasing, use of Hawaiian names as last names and a Christian or Hawaiianized Christian first name indicative of a person's sex. This trend developed as a response to the conversion of some Hawaiians to Christianity. Similar trends later became evident among immigrants from China and Japan. The trend toward a family name and a first name was also a direct result of the passage in 1860 of An Act to Regulate Names by King Kamehameha IV. This act was approved and passed on August 24, 1860. It reads:

AN ACT
TO REGULATE NAMES.

Be it enacted, By the King, the Nobles and Representatives of the Hawaiian Islands, in Legislative Council assembled:

Section 1. All married women now living, and all that may be married hereafter on these Islands, from and after the passage of this Act, adopt the names of their husbands as a family name.

Section 2. All children born in wedlock after the passage of this Act shall have their father's name as a family name. They shall, besides, have a Christian name suitable to their sex.

Section 3. All illegitimate children born after the passage of this Act shall have their mother's name as a family name. They shall, besides, have a Christian name suitable to their sex.

Section 4. All children up to the age of twenty years shall adopt the names of their fathers as a family name.

Section 5. All names so adopted shall be reported to the agents appointed to take the census of the people during the present year.

Section 6. It shall not be lawful to change any name adopted or conferred under this law. It shall also not be lawful to change any name adopted or conferred before the operation of this law.

Section 7. The father or mother of any children born subsequent-ly to the passage of this Act, shall report the name or names of such child to the Registrar of Births for the district in which such child was born, within three months after the birth of such child.

Section 8. This law shall take effect, and be the law of the land, from and after the date of its passage.

The Māhele and Later in Waipio Valley

Approved this 24th day of August, A.D. 1860

KAAHUMANU

KAMEHAMEHA.

MISSIONARY RECORDS

Missionary Period accounts concerning Waipi'o Valley can largely be obtained from personal letters, records, and other documents of Father Lorenzo Lyons. The majority of information comes from the Station Reports for Waimea where Father Lyons was stationed. These were published in the *Missionary Herald* beginning in 1832 (Father Lyons' first year at Waimea) and ended in 1886 (the year of his passing). Although this source pertains primarily to Waimea as a whole, there are references within it to Hāmākua, Waipi'o, and other districts and parishes for which Lyons was responsible. These writings were usually oriented toward the spiritual wants, needs, and welfare of the people of Waimea, although Father Lyons often observed and wrote of the material, cultural, and social/moral characteristics of his congregation. His observations can be used to provide a clearer idea of lifeways in Waimea, Hāmākua, and Waipi'o Valley because the conditions characteristic of Waimea usually had an effect on the other districts and parishes.

A brief background on the life of the Reverend Lorenzo Lyons is provided because of his impact and influence on Waimea and Hāmākua (Hawaii Mission Children's Society 1969:144-145). Lorenzo Lyons was born April 18, 1807, at Colerain, Massachusetts, and was educated at Union College, New York, from which he graduated in 1827. He also attended Auburn Theological Seminary, Massachusetts, and graduated in 1831. He was ordained at Auburn, New York, in 1831. Reverend Lyons married his first wife, Betsy Curtis, in 1831; she died in 1837 in Honolulu. After the death of his first wife, Father Lyons married Lucia Garratt Smith in Hilo, Hawaii, in 1838. During his many years of labor and service in Waimea, Reverend Lyons came to be well-respected and widely loved, so much so that he was referred to as *Makua Laiana* and King Kalakaua sent a Hawaiian flag as a shroud for him at the time of his death. A more detailed discussion of the life of Lorenzo Lyons and his work in Waipi'o Valley is provided by Piercy (1992:141-157).

The first fairly reliable census figures for Hawaii and Hāmākua are missionary estimates from about 1832 (Cordy 1994:9-10). Missionaries were initially responsible for censuses of the five of the larger islands in 1831-1832 and 1835-1836 (Schmitt 1968:4). Official Hawaiian government sanctioned censuses began in 1850 and exist for 1850, 1853, 1860 and then in six year increments until 1896. The first U.S. government censuses were begun in 1900. These initial surveys provide ample data for examining a variety of population and demographic trends in Hawai'i.

An intensive but not extensive search was made of the records of Father Lyons to locate data on population size in Waipi'o Valley for the period beginning in 1842 and ending in 1850. The population characteristics and fluctuations summarized by Cordy (1994:9-10) for Hāmākua are also reflected in Waipi'o Valley census data from the same time period. For the late 1700s, emigration and epidemics decreased the population of Hāmākua. In addition, Hāmākua could not compete economically with areas such as Kailua or Kealahou and later Honolulu or Hilo

The Māhele and Later in Waipio Valley

because the Hāmākua District lacked a substantial port and the financial support provided by Western shipping.

The area served by Waimea Station and Father Lyons was divided into a number of districts or parishes including Waipi'o and Nāpo'opo'o (Lyons 1842). The census and other data were maintained for the benefit and operation of Waimea Station and area churches under the guidance of Father Lyons. Some population figures for parishes and districts subsumed under Waimea Station were derived by Cordy (1994:10) from Father Lyons 1842 Statisticks Book. These are reproduced in Table 3 with additional data from Lyons' records. They show a steady decrease in population for all parishes and districts, a trend which continually concerned the missionaries. For the entire area covered by Waimea Station, Lyons (1842) documented a steady but not steep decrease in the overall population as well, from 4,062 in 1848, to 3,991 in 1849, and to 3,850 in 1850. Figure 8 graphically depicts this decline in total population.

Table 3. Population counts for Districts and Parishes associated with Waimea Station.

Population Trends Reported from Waimea Station

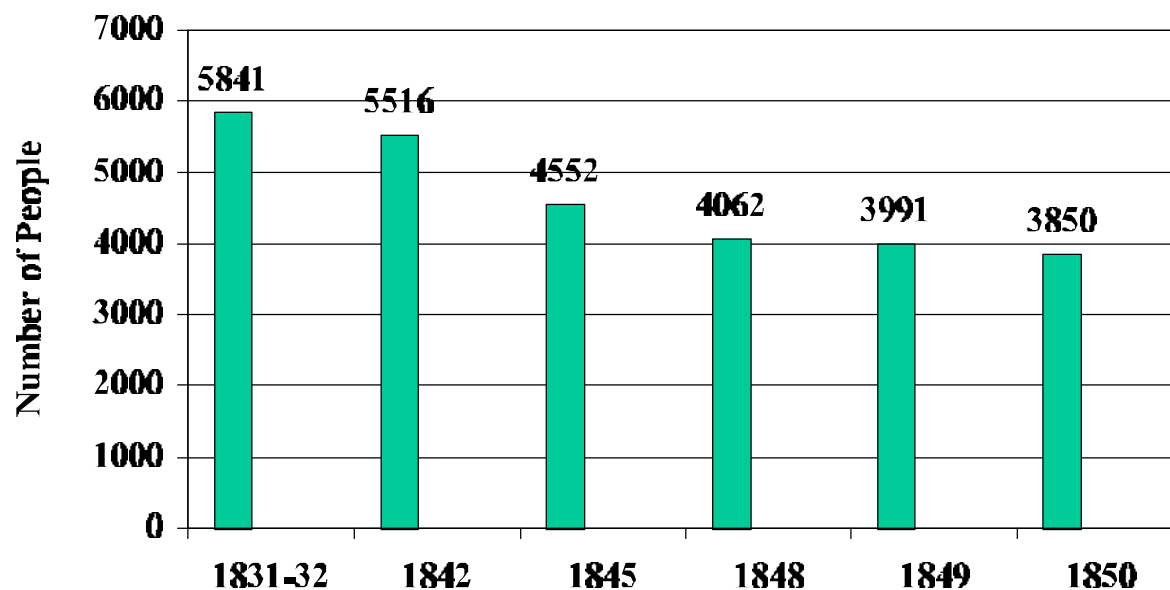


Figure 8. Waimea Station population trends.

Parish or District	*1831-1832	1842	1845	1849
Puukapu			239	
Alaohia			219	
Kokai			237	
Waimea		1012		675
Puako		104	183	171
Kawaihae Kai		185	151	125
Kawaihae Uka				388
Nakela		134	118	
Nahiku		251	220	
Honopue	59	47	30	
Laupahoehoe	101	81	80	
Waimanu	272	218	199	254
Waipio	1200	921		736
Kouka			165	
Naalapa			270	
Napopo (Napo'opo'o)			192	
Keone			199	
Eleio	424	339	320	208
Kapulena	381	305	260	221
Kawela	1252	461	340	244
Honokaa	312	250	220	197
Paauhau	422	338	270	264
Hanakamalii	530	424	280	233
Kaohe	275	220	170	139
Kaala	613	226	190	136
Totals	5841	5516	4552	3991

(Counts are from Father Lyons (1842) for Waimea churches. Data for 1831-1832 is from Cordy (1994:10). Differences between this table and Cordy are due to the inclusion of other districts or parishes from Lyons' records

The Māhele and Later in Waipio Valley

in this table.)

Taking census figures for this area often presented difficulties for the missionaries and later, others. An account by Father Lyons places these efforts into perspective:

“Our field is very large, the population being fifteen thousand, who are scattered over a wide territory. I very frequently ask what can two missionaries do among these scattered thousands. Waimea is our station, where are a thousand people. Twenty miles distant is a large meeting house, which will hold four thousand souls. This is only half of the population of that district, and another church is certainly needed. Twelve miles another way is another meeting-house holding 1,200 souls only, while 5,000 is the population. Twelve miles another way is a large school-house which answers very well for a church—1,200 people in that district. These districts are all large; some are thirty miles long and fifteen broad...” (Missionary Herald 1835:114).

Although some of the regional and parish-district specific census figure fluctuations can be attributed to disease and death, this was also a time of significant geographic shifts in population and changes in ethnic demographics (Schmitt 1968:30-32). Between 1778 and 1850, the number of full-blood Hawaiians decreased to 82,035 from an estimated 300,000. Those who were Hawaiian in-part totaled 558. There were 1,572 Americans, Europeans, and other foreigners. For Waipi’o Valley, the total population changed from 1,200 in the 1831–32 census, to 921 in 1845, and to 736 in 1849 (see Table 3). Accepting the vagaries of population estimates and census data, this represents a loss of 464 people or 38.6% of the Waipi’o Valley populace over a roughly twenty year period.

Reverend Gulick from Wailua on O’ahu visited Waipi’o and other places on Hawai’i in 1847. After his descent into Waipi’o Valley, he noted the following:

“As we descended into this verdant spot, it lay spread out before us like a map; and an interesting site it was, sprinkled here and there with human habitations, with horses, cattle and goats grazing on the margins of the brook. As we drew nearer, pigs and poultry of various kinds appeared. Here we first saw cattle trained to carry loads with pack saddles on their backs; which is quite common on this part of Hawaii. They are guided by a string attached to a ring in the gristle of the nose. When well trained, however, the string is but little used; the word of command being sufficient. The ascent from this valley is so steep in the most favorable places that the inhabitants are obliged to carry their produce up on their own shoulders, nearly half a mile. Then they load their cattle, and thence drive them to Waimea, Kawaihae, and other places” (Missionary Herald 1847:361–362).

Gulick’s comments suggest that the floor of Waipi’o Valley was only sporadically populated by 1847. This appears to be supported by information from the Māhele period records (see above) for which 58 houselots are claimed and a minimum of 109 houses are documented

The Māhele and Later in Waipio Valley

(Native Testimony data).

Reverend Lyons, in addition to being in charge of Waimea Station and the surrounding region, was also the area health commissioner. In that role, he was responsible for providing direction on small-pox and also the vaccination of the inhabitants. His Waimea Station report for 1854 provides a very detailed account of the small-pox epidemic of 1853 and the dramatic loss of general populace and his congregation. Doubtless, Waipi'o also suffered some degree of loss from the outbreak.

For the region, Father Lyons noted that the 1853 outbreak produced a widespread panic that forced many residents to leave their homes and live in heavily wooded areas for isolation from the disease. Schools closed, all work essentially ceased, and prayer meetings were begun for relief from the illness. The epidemic had broken out in four separate localities and Lyons proceeded to make a tour of the area and vaccinate as many individuals as he could and provide some instruction on measures to take to avoid the small-pox. Although he does not specify which parishes were affected he does note that the outbreak was limited to four localities. Waimea had only one case, while Kawaihae suffered the greatest losses. Lyons noted that in April of 1853 there were one hundred individuals in the congregation at Kawaihae but several months later following the outbreak there were only twenty-eight remaining members. There were no children represented. The others had either died from small-pox, were recovering from the illness, or had left the region entirely (Missionary Herald 1854:166-167).

Discussing Hawai'i as a whole, Schmitt (1968:158-159) noted that epidemics swept through with a fierce regularity. Recorded were measles and whooping cough in 1848, influenza in 1849 and 1918-1929, small pox in 1853 and again in 1881, scarlet fever in 1870, typhoid fever in 1880, measles in 1890 and 1936-1937, Asiatic cholera in 1895, the bubonic plague in 1899-1900, yellow fever in 1911, and epidemic meningitis in 1928. The effects of some of these health events are recorded in the personal observations of later inhabitants of Waipi'o Valley (Kāne 1994).

Missionary Records on Population Changes in Waipi'o Valley

The Waipi'o Valley population figures for the number of adults, children, marriages, births, deaths, and so forth, are limited to those valley inhabitants that had their names on Father Lyons' church rolls. They are thus only an indirect measure of the entire population of that valley. Nevertheless, certain trends perhaps representative of the entire valley are apparent (Lyons' 1842). The data in the Statisticks Book are quite general and vary from year to year in the level of information that Reverend Lyons recorded. For example, in some years the data were recorded by district and in other years, by parish. Overall, the data that can be best compared are the numbers of births and deaths and the total number of people in the congregation. Not surprisingly, some congregational population trends from Waipi'o Parish appear to be correlated with cycles of disease and epidemics occurring in Hāmākua District.

The frequency of recorded births and deaths for Waipi’o Parish is revealing (Figure 9). Consistently, the number of deaths are greater than the number of births. Peaks in the number of deaths in 1848–1849 and again in 1853 can be attributed, at some level, to known outbreaks of whooping cough, measles, influenza and smallpox. 1842 is the first year in which Lyons documented these congregational statistics and for that year he recorded the deaths of 139 members of the congregation for Waipi’o. It is not certain if this reflects deaths for that year alone or for an unknown period of years up to 1842. Anderson (1864:275) noted that a four year period following 1832 was marked by outbreaks of whooping cough and measles which resulted in significant mortality figures³.

Birth and Death Frequencies, Waipi’o Parish

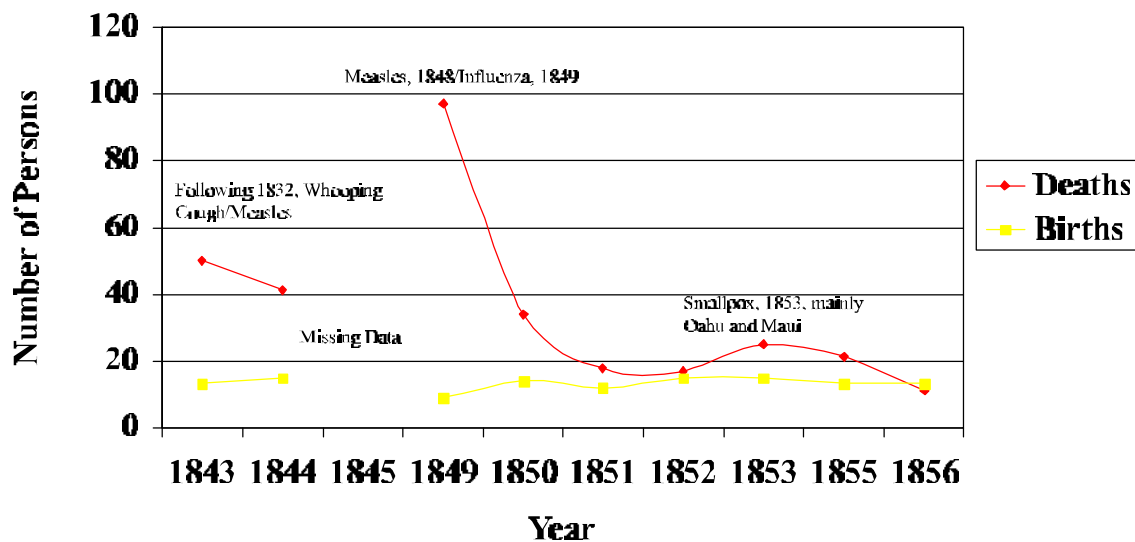


Figure 9. Waipi’o Parish trends (Lyons 1842).

³ The records of Father Lorenzo Lyons contain detailed congregational lists of all members with their place of residence, including Waipi’o Valley; they represent a valuable resource for both genealogical and more detailed population/demographic information for future studies.

MĀHELE RECORDS

The Māhele records and Land Commission Awards (LCA) are discussed elsewhere in this report, especially as they relate to aspects of the distribution of activities within the valley. Some information about families and ethnicity can be gathered from these documents as well. A total of 82 claimants were awarded land in Waipi'o in 1847 and 1848 as part of the Māhele process. An additional 26 claimants (see Table 2) received no lands. It is unclear exactly how many families or households these claims represent. At least one claimant did not live in the valley—Queen Kalama resided in Honolulu and not Waipi'o, although she was granted 5,800 acres of Waipi'o land (LCA 4452) in 1848 by her husband Kamehameha III (Klieger 1996).

At least 51 LCA are mentioned as containing houses orouselots in the Native Testimony documents, less than the number of individual claimants (Table 4); undoubtedly some claims were for agricultural lands only and not for family residences. An examination of Native Testimony documents indicates at least 103 houses listed in the Māhele records, with between 1 and 4 houses listed per property, often assigned to different, named individuals. For example, the description of LCA 8469, 'āpana 1, awarded to Paele, states that there are two houses for Paele, one house for Kupele, and one house for Kanalulu, and that Kupele and Kanalulu have house rights (NT 4:217). Cordy (1994:31–32) also noted multiple houses perouselot in his analysis of Waipi'o awards. The disparity between the number of individual land claimants and reported house sites at the Māhele period could result from having several agricultural property owners in a family living on a single piece of residential land, or from people working in the valley but claiming residences elsewhere. The Hawaiian concept of a household or family as including more than the nuclear group of parents and children can be seen in one interesting note about possible family structure found in the Native Testimony for LCA 7856, claimed by Kamakahiki, which states that “there are two houses for him and the punalua” (NT 4:176). Pukui and Elbert (1986) define this term as “Formerly, spouses sharing a spouse, as two husbands of a wife, or two wives of a husband; also, wives of brothers, husbands of sisters (no sexual privileges).” Although the various claim documents differ in how houses andouselots are reported, it appears that the number of family units (interrelated to varying degrees) residing in Waipi'o at mid-century numbered between 51 (the number of properties with house sites) and 103 (the number of individual houses).

Continuity of land use rights from parents to children is noted in the Native Testimony documents concerning several claims. For example, “Kalua's land is old from his parents, acquired during the time of Kamehameha I” (LCA 7863, NT 4:218). “This is an old land from the parents [of Koko]” (LCA 8473, NT 4:184). “This is a very old land which was acquired by his [Kahili's] parents during the time of Kamehameha I” (LCA 8492, NT 4:181). “This is an old land belonging to Nana's parents at the time of Kamehameha I” (LCA 10419, NT 4:311). Native testimony for LCA 8488 and 10553 have similar comments about the parents' previous tenure (NT 4:214, 182).

Table 4. Houses in Waipi'o listed in Native Testimony for Land Commission Awards.

LCA: 'āpana	Awardee	Description	Count
1278	Wood, John	"I have lived in my houselot . . . I have built houses. . . I am building a stone house . . ."	1
3737:1	Waiokalehua	". . . 4 houses for him [Waiokalehua] and his people . . ."	4
3757:1	Ahukini	". . . 1 houselot."	?
4123	Kalawaia	"There is a house there for Kalawaia."	1
4135	Makaku, S.P.	". . . 4 houses for Makaku and his people . . ."	4
4135B	Kaaukai	". . . 3 houses for Kaaukai and his people enclosed."	3
7660:1	Kawahineainui to Palau	". . . only house site rights: there is no lot [interest]. They have houses only on the banks . . ."	?
7856:2	Kamakahiki	". . . there are two houses for him and the punalua."	2
7861	Kaaeae	". . . there is a house for him."	1
7863:1	Kalua	". . . a houselot . . . partially enclosed. 2 houses for Kalua, 1 for Naalu, 1 for Ekaeka."	4
7863:2	Kalua	"Enclosed, 3 houses of which 1 for Kuihelani, 1 for Kami under Kalua . . ."	3
7871:1	Kaelemakule, S.	". . . there are 2 houses for him."	2
7876:1	Kahawalu	". . . there are 3 houses for him and he is now living there."	3
7878:1	Kaua	". . . there is a house for him."	1
7956:1	Kahulanui	". . . 1 house for Kahulanui	1
8201:2	Hapuu	". . . 2 houses for Hapuu."	2
8202:1	Hamohamo	". . . 2 houses are for him [Hamohamo] and his people."	2
8203:2	Hookio	". . . 1 house between Kaaonui and Kaaohiki."	1
8469:1	Paele	". . . 2 houses for Paele, 1 house for Kupele, 1 house for Kanalulu."	4
8470:1	Kaeno	". . . 1 houselot, 1 house, enclosed."	1
8477:4	Kaiwihoua	"Houselot. 4 houses for him and his people."	4
8479	Koi	". . . the houselot has been enclosed. One house is for me . . ."	1
8481:2	Kawilikopaa	"Houselot . . . 1/2 enclosed, 3 houses for Kawilikopaa."	3
8482:1	Kamai	". . . 2 houses for Kamai."	2
8484	Kamahiaikuaaina [konohiki]	"Maluae has 1 house on his lot, Kamahiaikuaaina has 3 houses on his lot."	4

The Māhele and Later in Waipio Valley

LCA: <i>‘āpana</i>	Awardee	Description	Count
8485:2	Kaaniho, S.	"He has a house site . . ."	?
8487:1	Kaunaunahi	" . . .1 house."	1
8488:1	Kuakahela	" . . .1 house for Kuakahela."	1
8491	Keliinohopali	" . . .2 houses for him enclosed."	2
8492	Kahili	" . . .there is 1 house."	1
8493:3	Kolii	" . . .House lot . . . it has a fence with a house about to be built."	?
8494:2	Kaoiwi	" . . .3 houses for him . . ."	3
8495:1	Kaolulo, [F]	"Kaolulo has one house, 1 house is for me; Kahuli and Kumauna each has one house."	4
8539B:32	Wailoa	" . . .2 houses enclosed for Wailoa."	2
9827:1	Kipapanui	" . . .there are 2 houses for him."	2
9829:1	Kahulilau	" . . .a house lot."	?
9929:1	Luai	"2 houses for Luai."	2
10263:1	Makuakua	" . . .2 houses for him."	2
10286:3	Maunakui	"2 houses for Maunakui."	2
10397	Namai	" . . .3 fenced in houses for Namai."	3
10398:2	Nakoko	" . . .1 house for Nakoko, enclosed."	1
10399:1	Nalepo	" . . .1 house for him . . ."	1
10415:1	Nuku	"1 for Nuku and 1 for Nueku, partially enclosed."	2
10419:9	Nana, S.	"3 houses, 1 of which is for Nana, 2 for Kealanahale; Nana is living there."	3
10419:10	Nana, S.	" . . .1 house for Papu, partially enclosed. Papu has house interest."	1
10419:11	Nana, S.	" . . .1 house for I and one for Nana. I has interest here."	2
10553:1	Opunui	" . . .2 houses are for him and his people."	2
10565	Ohule, B.	" . . .2 houses are for him . . ."	2
10781:1	Puaanui	" . . .1 house for him [Puaanui]."	1
10782:3	Papau	"1 house for him [Papau]."	1
10960:2	Wahakole	" . . .1 house for Wahakole."	1
10961:1	Wailua, L.	" . . .3 houses are for him . . ."	3
10961:2	Wailua, L.	" . . .2 houses are for him . . ."	2
10994:2	Pahee (NT Panu or Pehu?)	" . . .there are 2 houses for him [Pehu]."	2
Total LCA with houses = 51 (some have houses on multiple <i>‘āpana</i>) Total houses listed = 103			

In one instance the land has been in use from an even earlier generation of the same family. Comments for LCA 10918 state it is:

“Uma’s ili land which has been from his grandparents to his parents and now he has it where he is living today. They received this land for their work under Kamehameha I. They were feather cape (ahuula) makers therefore this land and its entire properties are for them ...” (NT 4:188).

Land rights from other relatives are also noted, for example, LCA 8470, “Interest from his brother-in-law during the time of Kamehameha I” (NT 4:208) and LCA 8494, “Land acquired from wife between 1836–1840” (NT 4:213). Actual transfer of lands or individual land ownership was not the case prior to the Māhele, and the idea of land being acquired or land belonging to anyone but the ruling *aliʻi* is technically incorrect, according to what is known of pre-Māhele Hawaiian land tenure (see, for example, Kameʻeleihiwa 1992). But in a practical sense it appears that as long as the *konoiki* agreed and no one objected (phrases repeated throughout the Native Testimony), then use of lands for homes and fields could and did continue in the family line prior to the Māhele.

In the mid-nineteenth century most of the Waipiʻo Valley inhabitants were Native Hawaiians, based on the list of claimants’ names. However, at least one foreigner was living or working in the valley. Among the Māhele claimants is John Wood, a blacksmith, probably an immigrant from Britain or the United States. Although he put in a claim for 30 acres of land that he said had been given to him, his awarded land was only a 1.3-acre houselot (LCA 1278; NT 10:105, NR 3:51). Another non-Hawaiian name shows up in the Native Register comments for LCA 10420 (claimed by B. Naiwi but not awarded), which states that the claim is the land of William Beckley (NR 8:364). With only two non-Hawaiian names occurring in the claim documents, it appears that foreign presence in the valley was relatively minor at the Māhele period.

CENSUS RECORDS⁴

Copies of original census records providing details of household and family structure for Waipiʻo Valley are available for the years 1878, 1890, 1900, 1910, and 1920. The decennial U. S. census data after 1920 is not yet public. Waipiʻo records from 10 other Hawaiian censuses taken between 1847 and 1896 apparently no longer exist, other than as published reports that compile general figures by island or district (see Schmitt 1968:46–78). Each census was recorded on prepared, tabulated sheets listing the names, ages, marital status, ethnicity, occupation, and property ownership, among other things, of individuals in each household. The data sets are not easy to correlate, because the 1878 and 1890 censuses ask different questions

⁴ Hawaiian translations have been checked by Mrs. Pat Bacon of the Bishop Museum.

and tabulate the data differently, and both differ from the 1900–1920 census records, which are part of the United States federal census. Nevertheless, an attempt is made here to use some of the available Waipi’o data (the 1878, 1890, and 1910 census records) to provide a statistical summary of valley residents at the end of the nineteenth century and beginning of the twentieth, a time that saw many changes from the previous way of life.

The 1878 Hawaiian Census

This census, the ninth population count taken by the Hawaiian Kingdom since 1847, was part of ongoing efforts to outline the physical condition of the people as a whole and to estimate the tax base. Census sheets were printed in English and Hawaiian (Figure 10). The following categories were enumerated: name, sex, age (in ranges of 0–6, 6–15, 15–40, and over 40 years), marital status (married or not married), occupation (with four possible categories of mechanic, agriculturist, plantation laborer, or other), and freehold land holdings (yes or no). The census included all people who slept on the household premises on the night of December 27, 1878, with printed forms or schedules left in advance at each dwelling to be filled out by the head of the household (Schmitt 1968:56–57).

The census counted 396 people in late 1878 (see Footnote 1), a figure reduced from only 11 years previously when a Waipi’o resident (in 1867) told the Reverend Elias Bond that 640 people were living in the valley (Damon 1927:208–209). A total of 75 households were enumerated. Two households were composed of foreign, unmarried, adult males and were probably work groups; the other 73 households were probably family groups. Households in 1878 range from one to 12 individuals (Figure 11), with an average household size of between 5 and 6 people. The most common household size is six members. The overall age groupings appear relatively evenly distributed between those under 15, those over 40, and those in-between (Table 5). Most households included people from a range of ages, but six households contained only people over 40, and three households combined people over 40 and children under 6 as the only residents.

CENSUS TABLE, 1878.

Under the authority conferred on the Board of Education by Sections 6 and 7 of Chapter LXXIX of the Penal Code, all persons are hereby required, under pain of a fine not to exceed \$25.00, to answer to the best of their knowledge, all of the following questions relating to their Sex, Age, Nationality, Occupation and whether or not married.

All householders, heads of families, tenants in chief, and all other persons to whom this blank shall be given, shall cause the same to be properly filled out for all persons who shall have slept on their premises on the night of Friday, the 27th of December, 1878, at 12 o'clock, P. M. 1878.

To fill this blank as required, it is requested that the head, or chief person of the household, with some of the name of every man, woman and child who shall have slept in the house on the night of Friday, December 27th, 1878, to be legibly written in the left hand margin or column of this blank, and check opposite each name the particulars required, by making in each column applicable thereto, a mark, (see examples printed on the blank.)

Sub-agents will be employed to leave the number of blanks necessary, at each house in the district, previous to the 27th of December next, the day on which the registry of the census is to be made. And it is requested that the blanks shall be safely kept by those with whom they shall be left, and delivered out at the appointed time, when they are to be delivered to the sub-agents who shall call therefor, and who will be authorized to cause such corrections to be made, or omissions to be supplied, as shall be necessary for the proper filling of the said blanks.

The registry or enumeration of persons for the census of 1878, is to be made simultaneously in every district of the Kingdom, as of the night of Friday, the 27th of December next (1878).

The proprietors or managers of estates having in their employ persons not acquainted with the nature and object of a census registry, are respectfully requested to give the Board's Agents such assistance as shall be of value in forwarding the object in view, and assisting as corrected, as appears.

PAPA HEHU I NA KANAKA, 1878.

Under the authority conferred on the Board of Education by Sections 6 and 7 of Chapter LXXIX of the Penal Code, all persons are hereby required, under pain of a fine not to exceed \$25.00, to answer to the best of their knowledge, all of the following questions relating to their Sex, Age, Nationality, Occupation and whether or not married.

All householders, heads of families, tenants in chief, and all other persons to whom this blank shall be given, shall cause the same to be properly filled out for all persons who shall have slept on their premises on the night of Friday, the 27th of December, 1878, at 12 o'clock, P. M. 1878.

To fill this blank as required, it is requested that the head, or chief person of the household, with some of the name of every man, woman and child who shall have slept in the house on the night of Friday, December 27th, 1878, to be legibly written in the left hand margin or column of this blank, and check opposite each name the particulars required, by making in each column applicable thereto, a mark, (see examples printed on the blank.)

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The proprietors or managers of estates having in their employ persons not acquainted with the nature and object of a census registry, are respectfully requested to give the Board's Agents such assistance as shall be of value in forwarding the object in view, and assisting as corrected, as appears.

NAMES. NA INOA.	SEX. Ke Kama.	AGE. NA MAKAHIKI.	MARRIED MAHELE.	NATIONALITY. OTE MANAU.	OCCUPATION. OIHANA LAWLAWE.
Name of the head of the household, and names of the persons in the house on the night of Friday, December 27th, 1878.	Male He kane. Female He wahine.	Male under 6 years of age. He kati kane i raro o 6 makahiki. Female under 6 years of age. He kati wahine i raro o 6 makahiki. Male between 6 and 14 years. He kane i waenganui o 6 me 14 makahiki. Female between 6 and 14 years. He wahine i waenganui o 6 me 14 makahiki. Male between 15 and 21 years. He kane i waenganui o 15 me 21 makahiki. Female between 15 and 21 years. He wahine i waenganui o 15 me 21 makahiki. Male 22 years and over. He kane i raro o 22 makahiki. Female 22 years and over. He wahine i raro o 22 makahiki.	Never married. He kane i raro. Married first time. He wahine i raro. Married second time. He kane i raro. Married third time. He kane i raro. Married fourth time. He kane i raro. Married fifth time. He kane i raro. Married sixth time. He kane i raro. Married seventh time. He kane i raro. Married eighth time. He kane i raro. Married ninth time. He kane i raro. Married tenth time. He kane i raro.	British born. He kane i raro. American born. He kane i raro. European born. He kane i raro. French born. He kane i raro. Portuguese born. He kane i raro. Hawaiian born. He kane i raro. Other nationalities. He kane i raro.	Farmer. He kane i raro. Merchant. He kane i raro. Carpenter. He kane i raro. Blacksmith. He kane i raro. Dancer. He kane i raro. Teacher. He kane i raro. Other occupations. He kane i raro.
Waipio					
Samuel	/	/	/	/	/
Malia	/	/	/	/	/
David	/	/	/	/	/
Helena	/	/	/	/	/
Lulu	/	/	/	/	/
Kahimahi	/	/	/	/	/
Kahoroahaa	/	/	/	/	/
Lauuli	/	/	/	/	/
George S. Lee	/	/	/	/	/
Mrs. Mary Lee	/	/	/	/	/
John A. Lee	/	/	/	/	/
William	/	/	/	/	/
Samuel	/	/	/	/	/
David	/	/	/	/	/
Helena	/	/	/	/	/
	55	32	31	45	55

Figure 10. Example of page from the 1878 census.

1878 Census: Waipi'o Valley

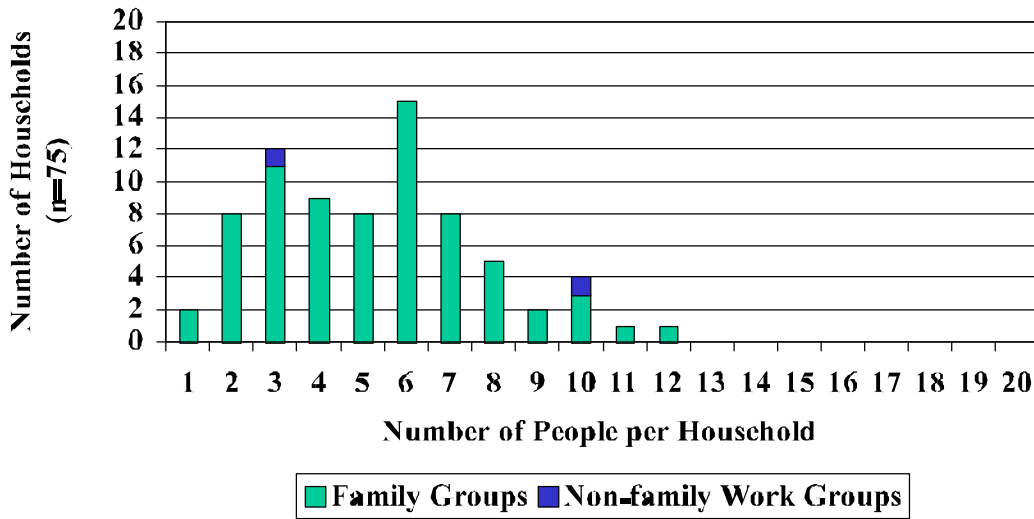


Figure 11. Waipi'o Valley data from the 1878 census.

Table 5. Age and Sex Ratios, 1878 Census.

Age ranges	Male	Female	Totals
<6	39	32	71
6-15	37	23	60
15-40	66	63	129
>40	77	56	133
Totals	219	174	393*

* Total counted population is 396; 3 women did not provide ages.

There were 353 Hawaiian residents, 20 part-Hawaiians, and 23 foreigners. A total of 58 households had all Hawaiian family members. Eleven households had either foreigners or part-Hawaiians as apparent family members. Four households had one foreign male living with a Hawaiian family, possibly not as a family member but rather as a boarder. The largest single immigrant group is from China. Two households had all Chinese residents, one consisting of ten males, the other of three males. The total of foreigners living in the valley indicates a small but significant increase in the non-Hawaiian presence in the valley from 30 years previously, not just in numbers, but also in immigrant areas represented (Table 6). No women immigrants are listed in the valley at this time. The addition of the immigrant males to the population tends to skew the overall sex ratio, with 125.8 males per 100 females; counting only Hawaiians, the ratio is 106.4 males per 100 females.

Table 6. Ethnicity, 1878 Census.

Ethnicity	Male	Female	Totals
Hawaiian	182	171	353
part Hawaiian	14	6	20
Hawaiian born, foreign parents	1		1
American	2		2
British	3		3
Chinese	13		13
French	1		1
Portuguese	1		1
Foreign, other	2		2
Totals	219	177	396

Of the four occupational categories listed in the 1878 census, agriculturists form the largest category, with 114 people listed. A total of 100 males and 4 females claimed agriculturist as their sole occupation; ten men indicated other, additional occupations. Hawaiians and part-Hawaiians account for a majority (98 of 114) in this occupation category. Slightly over half (61 of 114) of the people calling themselves agriculturists were over 40 years old, including six non-Hawaiian men. Two of the Hawaiian agriculturists over 40 were women. There were 48 agriculturists in the 15–40 year age group; eight of the nine non-Hawaiians in this age group were Chinese. The youngest category of agriculturists is the 6–15 age group, with five people listed.

The mechanic category as listed in Hawaiian on the census forms—“*He oihana hana*

The Māhele and Later in Waipio Valley

lima akamai”—indicates any activity involving working with one’s hands rather than specifically dealing with machinery as might be understood today. Interestingly, most people included in this category are adult women. Of 34 people listing mechanic as their occupation, 22 were married women and five were unmarried women; four married men and one unmarried man listed mechanic as their sole occupation, and two men listed mechanic in addition to other jobs. Not all adult women are listed as a mechanic, so the category does not seem to indicate daily domestic tasks of the individual household. These people could have been involved in such activities as weaving, sewing, or quilting—for example, the couple noted during Māhele times as makers of feather capes would have fit into this category. These specific census listings could indicate that there were contributions made by women to the household economy beyond taking care of the house, children, and garden, a contribution that is not indicated in the published business directories of the time.

There were four plantation laborers listed. This category differs from that of agriculturist in that a yearly contract was involved—“*He paahana ku makahiki*,” as stated on the census forms. Three Hawaiian males, none of them landowners, listed this category as their occupation. The other plantation laborer was a British male, who stated that he did own land.

The last category is a general one for other, unnamed occupations. An example of an occupation that could fall into this category is that of peddler, as listed in the 1880–1881 Business Directory (Bowser 1880). Although not certain, the abbreviation in front of Gulstan’s name (the only person listed with a French background) could stand for “Reverend” indicating he was a member of the clergy, another possible occupation that would fall into the “other” category.

The count of property owners is less than what might be expected based on the information from 30 years previously. Only 61 people indicated on the 1878 census form that they were freeholders, or “*He mea kuleana aina*” on the census form (*kuleana ‘āina* was a common term in wills of the 1860s meaning “owned land”, according to Pukui and Elbert [1986:179]). This figure is in contrast to the 82 people awarded lands at the Māhele. At least one person was listed as a landowner in 46 of the 75 enumerated households in 1878, and 13 of these households included multiple property owners. Nine of the mechanics (eight of them women), one foreign plantation laborer (noted above), and one person who listed “other” as his occupation owned land, as did 13 people who listed no occupation; the rest of the property owners were agriculturists. It is of interest that these 37 agriculturists claiming property—34 Hawaiians, two part-Hawaiians, and one British—comprise less than a third of the 114 agriculturists listed for the valley. No one was listed as a property owner or freeholder in 29 households, which leaves open the question regarding their economic base—on whose land they lived and whose fields they planted. Some of these non-property owning households could have been supported by labor for wages, such as the two Chinese immigrant households, or the 13 households who had at least one family member whose occupation was listed as mechanic, plantation laborer, or “other”. It is also likely that people in these households—especially the

households composed of those over age 40—were part of a larger, extended family and lived on property owned by relatives who shared their resources.

During the last half of the nineteenth century there is evidence in the Māhele and census records of a change from single, individual names for Hawaiians to multiple names including a given name and a family name, following the Euroamerican tradition. In this census, 66 Hawaiians and part Hawaiians have first names (or initials) and last names specified. Family relationships are not provided in this census so that it is not certain how these multiple names are being generated. It would seem that several processes could explain the choice of multiple names. In some cases, apparent siblings share a non-Hawaiian last name, presumably their father's. In others, similar last names indicate a wife taking a husband's last name in addition to her own. In at least one case, the single Hawaiian name of a person listed as a Māhele claimant shows up as the last name of a married couple (presumably a son and daughter-in-law) counted in the 1878 census. Children are occasionally given the same name as someone else in the household, not necessarily a parent. They are identified in the census with a "2" after their name, or by having "*opio*" (junior) or "*lilii*" (small or little) at the end of their name. Sometimes identical Hawaiian names occur in different households, which may or may not indicate a relationship between them. English names (for example, Ellen, Mary, Henry, Joseph, John) and names transliterated into Hawaiian (for example, Abikaila, Emalia, Elikapeka, Aarona, Beniamina, Wiliama) show up, either as first names or the entire listed name.

Of the 82 names listed as successful claimants for *kuleana* land during the Māhele, at least 16 similar names appear 30 years later in the 1878 census (Table 7). These census names do not necessarily represent the same person as the claimant during the Māhele—they could indicate a relative, for example a wife or child. There is added uncertainty in matching names across these years, because in 1878 these 16 names are recorded for 25 individuals (i.e., in four cases there is more than one person with the same name). Most of the matching names in the 1878 census are of males over 40 years old. Some names in the 1878 census are for females over 40 and some are to people (male and female) between 15 and 40. These younger individuals are unlikely to be the original claimant, as they would have been 10 years or younger at the time of making the claim. Of the people in 1878 who might be expected to retain land holdings, based on an assumed identity or relationship to Māhele claimants, only five claim to be property owners. Additional research into land court records could clarify how, when, and to whom land was transferred from the original Māhele claimants.

This census period represents a time of increasing change in the valley, when shifts are documented for population size, occupation, and ethnicity. An apparent loss of at least 244 people since 1867 shows that depopulation was continuing to occur, as it had since the start of the post-Contact period. This reduction happened even though increased numbers of people came from outside Hawai'i to live in the valley, in particular, the Chinese who formed a relatively large sub-group. Children of Hawaiian and foreign parents formed another substantial subgroup—most of the part-Hawaiians in 1878 were under 15 years old. Some of the people

The Māhele and Later in Waipio Valley

were working for wages rather than as family farmers, as indicated by the yearly contracts mentioned in the “plantation laborer” category. A more significant occupational change, though, was that the more recent immigrants were arriving to take part in a relatively new endeavor—growing rice. The 1880–1881 Business Directory (Bowser 1880) lists five of 18 farmers engaged in rice production (three of them Chinese), and Emerson’s 1881 map records two rice mills in the valley, marking this period as a time when *kalo* was in the process of being supplanted by rice as Waipi’o’s main crop.

The 1890 Hawaiian Census

This census, taken on Sunday, December 28, 1890, is the last one conducted by the Hawaiian Kingdom⁵. The printed sheets for collecting the 1890 information were in Hawaiian only—no translations were provided (Figure 12). Questions were asked about name, age (listed as individual years, not ranges as was done in 1878), sex, marital status (married, unmarried, widow, widower, or divorced), nationality (with columns to check whether Hawaiian, part-Hawaiian, or Hawaiian-born of foreign parents, and a separate column for foreigners to write in their place of birth), occupation (a single write-in column rather than the four categories as in 1878), number of children ever born and number surviving (asked of females over 15), voter registration, literacy, school attendance, name of school and name of teacher, real estate ownership, and amount of taxes for the year 1890. This description of the listed categories and how they were recorded for the 1890 Waipi’o census differs markedly from the description of the 1890 census in Schmitt (1968:60–61); it is possible that he was working with the published bulletin of results, which may have been presented differently than the original forms. Schmitt (1968:62, 67) generally praises the quality of this census and sees the questions comparing number of children ever born to number of children living as a major innovation in demographic statistics, one not utilized in U.S. censuses until sixty years later. Unfortunately, results related to these two questions and to real estate ownership were deemed unsatisfactory (Schmitt 1968:62). Any conclusions drawn from these data should be considered tentative.

The Waipi’o population of 1890 appears to have increased slightly since 1878, with 439 people counted (see Footnote 1), an increase of 43 people from 12 years previously. At the same

⁵ The next census, in 1896, was the only one conducted by the Hawaiian Republic; although some original documents remain of the 1896 count, none are available for Waipi’o.

Table 7. Names of LCA Holders Found in Subsequent Censuses.

Māhele records		1878 census				1890 census			
Name	LCA	Name	Age	Sex	Property Owner?	Name	Age	Sex	Property Owner?
Heleihonua	11037	Heleihonua, Mary	15–40	f	no				
		Heleihonua, S.K.	15–40	m	yes				
Kahawalu	7876	Kahawalu	>40	m	yes				
Kaheana	8471	Kaheana	>40	m	no				
Kahili	8492	Kahili	>40	m	yes				
Kahoomai	9830	Kahoomai	>40	m	no				
Kalawaia	4123	Kalawaia	>40	f	no				
		Kalawaia	>40	f	no				
Kalua	7863	Kalua	>40	m	yes	Kalua, S.W.	44	m	yes
		Kalua	>40	m	no				
Kamakahiki	7856	Kamakahiki	>40	m	no				
Kealoha	8474	Kealoha	>40	m	no	Kealoha	53	f	no
		Kealoha	15–40	m	no	Kealoha	22	f	no
		Kealoha	<6	m	no				
		Kealoha, Joseph	15–40	m	no				
		Kealoha, N.	>40	f	no				

Table 7. Names of LCA Holders Found in Subsequent Censuses.

Māhele records		1878 census				1890 census			
Name	LCA	Name	Age	Sex	Property Owner?	Name	Age	Sex	Property Owner?
Keawe	8472	Keawe	15–40	f	no	Keawe	36	f	no
		Keawe	>40	m	yes				
		Keawe, P.	>40	m	yes				
Koko	8473	Koko	>40	m	yes				
Luai	9929	Luai	>40	m	yes	Luai, D.K.	44	m	yes
						Luai, J.	56	f	no
						Luai, John K.	22	m	no
						Luai, ?	21	f	no
						Luai, D.W.	8	m	no
Maka	10066	Maka	>40	m	no				
Opunui	10553	Opunui	>40	f	yes				
Paele	8469B	Paele, John	15–40	m	yes				
Waiokalehua	3737	Waiokalehua, T.	>40	m	yes				

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
INOA.	NA MAKAHIEI.	EE KAKA.	Mareka.	Aole Mareka.	Whāne Kōwhiri.	Kāne Wāhiunake.	Mare i Oahu.	Kanaka maoli.	Hejō-Hauke.	Hāmāla ma Hawai'i nei, hāole ma makou.	AINA KAHU I HANAU IA AI, NA HAOLE WALE NO.	OIHA "A LAWA IA ANA.	Ehā no nima Kōkī i Hanau a?	Ehā o aha nei aho?	Ua hōlomanā aha o e Kōloa Hōloa?	He hiki iho e ke hehehele a ke kaka i hō?	He hōle no aha nei i ke Kōkī?	INOA O KE KULA.	INOA O KE KUNU.	He aha Waipoi, Pua no aha nei e?	He hōle no aha nei e? Pua no ha makahiki i 1897?		
<i>D. K. Suai</i>	44	X	1	X				1		X	<i>Waipio</i>	<i>Wah. av.</i>	X	X	1	1						1	8
<i>Mrs. J. Suai</i>	56	W	1					1		X	<i>Waipio</i>		1	1		1							
<i>D. W. Suai</i>	8	X	X	1				1		X	<i>Waipio</i>					1	1	<i>Waipio English</i>	<i>Smith</i>				
<i>A. Suai</i>	21	W	1					1		X	<i>Waipio</i>		8	2	adh	1							
<i>John H. Suai</i>	22	X	1					1		X	<i>Waipio</i>					1	1						
<i>A. M.</i>	9	W	1					1		X	<i>Waipio</i>				adh	1	1	<i>Waipio English</i>	<i>Smith</i>				
<i>Kāhe</i>	28	X	1					1		X	<i>Waipio</i>		X	X	1	1							
<i>Mrs. Kam...</i>	29	W	1	X				1		X	<i>Hawai</i>		2	adh	1								
<i>J. Kelo</i>	18	X	1					1		X	<i>Waipio</i>				adh	1							
<i>Paulina</i>	2	X	1					1		X	<i>Waipio</i>												

Figure 12. Example of page from the 1890 census.

time, however, the Hawaiian population in the valley decreases from 353 to 303 people, with the part-Hawaiian count relatively unchanged at 22. The greater 1890 population figure in the valley comes from a much increased number of immigrants; in particular, the Chinese population expanded from 13 to 107 and seven other foreigners are also listed (Table 8). At this point in time, a quarter of the enumerated people in Waipi'o Valley are immigrants.

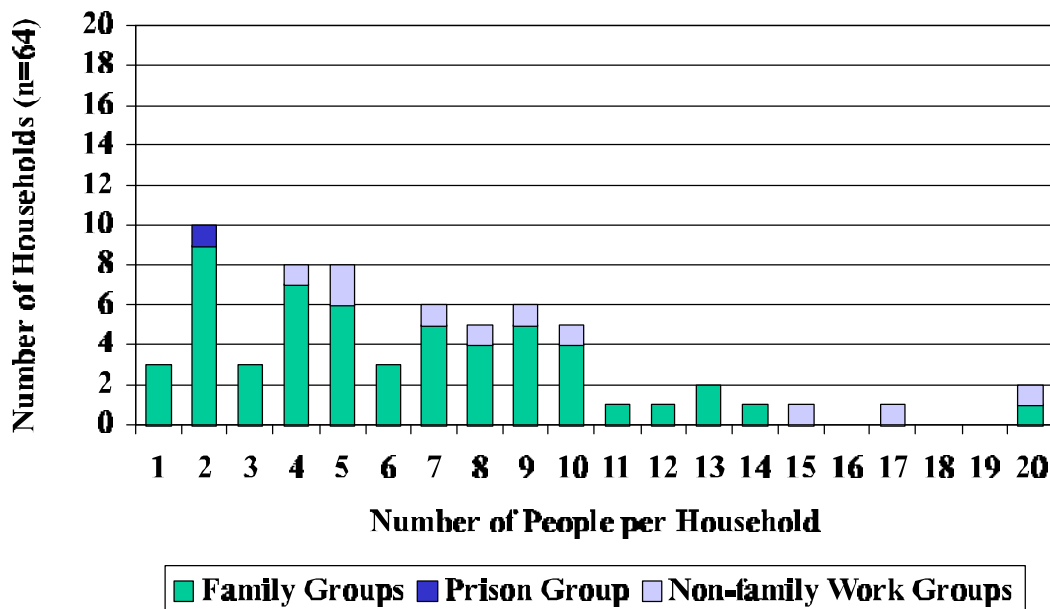
Table 8. Ethnicity, 1890 Census.

Ethnicity	Male	Female	Totals
Hawaiian	155	148	303
part Hawaiian	6	16	22
American	1		1
Chinese	104	3	107
French	1		1
Japanese	2		2
Spanish/Chamorro	2		2
Tahitian	1		1
Totals	272	167	439

Separate households are not easy to distinguish in this census but there appear to be 63 groups listed, ranging in size between one and 20 members. These appear to represent family units and communal living arrangements for work crews. An additional group consists of two men living at the "*Halepaahao*," or prison (probably as prisoners, but this is not made clear). Subtracting the prison and the 10 groups that appear to be mainly adult, unmarried males, leaves 53 probable family households. This household figure is a reduction from the number of family households in 1878. Interestingly, although the average household size seems to have increased slightly, there is a larger proportion of households having five or fewer members and the most common household size is two (Figure 13). At the same time, there are more larger groups than in the previous census, and the larger households contain more people than previously—seven households in 1890 have more than 12 people, which was the maximum number of household members listed in 1878. These changes could indicate a decreased size for some households because of catastrophic deaths or emigration to other areas, combined with an increased size for other households where widows, orphans, and elders who have lost their adult children are taken in by other families. No secure evidence exists for this scenario because family relationships are not made explicit in the census, but an examination of age, sex, and marital status combined with a comparison of names with the 1878 census suggests that some of the

larger households with Hawaiian members contain more elements than simply a married couple and their unmarried children living together.

1890 Census: Waipi'o Valley



The information

Figure 13. Waipi'o Valley data from the 1890 census.

provided in this census about number of children born to individual women is illuminating, even if the overall dataset is considered lacking (Schmitt 1968:62). It indicates that large families were fairly common and that they were started relatively early. At the same time, the corresponding information on number of living children per mother suggests that infant and childhood mortality severely diminished the size of many families. Of the 103 women 15 years old and older, 67 reported having had at least one child. The youngest mothers were 17 years old, but because some had 2 children already, they may have given birth first at age 15 or 16. Almost 40% of the mothers (26 of 67) had borne five or more children. One women had given birth to 16 children, but had lost eight of them. Many other women had similar experiences, and some had lost all or all but one of their children. Only 25 of the 67 mothers had not suffered the loss of at least one child.

Age and sex ratios for the entire Waipi'o population differ markedly from the 1878 census (Table 9). In the child and young adolescent groups, females slightly outnumber males,

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a reverse from the ratio in 1878. In the older adolescent and adult groups, males are in greater numbers. In the non-Hawaiian community in particular there is a large imbalance with 94 males (mostly unmarried) to 3 females in the 16–40 category, which translates to a ratio of 3,133 males per 100 females. This imbalance was seen as a problem by the Hawaiian government (Coulter and Chun 1937:35). Within the Hawaiian and part-Hawaiian community only, there are fewer males than females overall (98 males per 100 females), again a change from 1878. Such changes in the sex ratio could affect the available pool of marriage partners, leading to more Hawaiian women choosing non-Hawaiian men as husbands. This appears to be the case in at least three households, where Hawaiian and part-Hawaiian women are married to Chinese men (at least as far as can be surmised, based on order of the listed names within the household). In three other households there appear to be married Chinese couples. This small change from 1878, when no immigrant women were counted, is perhaps explained by Coulter and Chun (1937:35), who state that “the general feeling among Hawaiians and Caucasians that Chinese women were welcome was an incentive to the married immigrants to send for their wives and families as soon as they could afford to do so and was also an encouragement to bachelors to get wives from China.”

A relatively large and varied list of occupational categories is shown in the 1890 census. Responses were not restricted to four general occupational categories as in 1878, thus a clearer image emerges of people’s tasks and how work patterns changed. Although farmers and planters (“*mahiai*” and “*kanu*”) still form a large group, with 64 men and one woman listed, the numbers are significantly lower than previously. The 44% drop in people listing this occupation does not necessarily indicate that less land was being cultivated, because there is a large increase in the laborer (“*paahana*”) population with 85 Chinese (84 men and one woman) and three Hawaiians listed. Most if not all of these people were probably planting and harvesting Waipi’o’s many agricultural fields, working for wages rather than cultivating food for home consumption. Of the seven people listing specific crops grown, four Chinese are growing rice and two Hawaiians are growing rice in addition to *kalo*; only one person lists himself exclusively as a *kalo* grower (“*mahiai kalo*”). No specific crop information is available for the other farmers.

Various sewing and weaving occupations—“*humuhumu*”, “*humupapale*”, “*ulana ie*”, and “*ulana moena*”—were listed by six Hawaiian women. Ten Hawaiian women list “*ihiai*” as their occupation, which could translate as food peeler; they were probably working in the *poi* factories, peeling *kalo*. Carpenter (“*kamama*”) is the listed occupation for four men—one Hawaiian, one Chinese, and two Chamorro. These last must be the Perez brothers from Guam, written about in the Kāne memoirs (see Oral history records, below). All of these occupations may have come under the “mechanic” category in the earlier census.

Table 9. Age and Sex Ratios, 1890 Census.

Age ranges	Male	Female	Totals
<i>Total Waipi'o population</i>			
5 and under	26	29	55
6-15	33	40	73
16-40	145	64	209
41 and over	68	34	102
Totals	272	167	439
<i>Hawaiian and part-Hawaiian population</i>			
5 and under	26	29	55
6-15	32	40	72
16-40	51	61	112
41 and over	52	34	86
Totals	161	164	325
<i>Non-Hawaiian population</i>			
5 and under	0	0	0
6-15	1	0	1
16-40	94	3	97
41 and over	16	0	16
Totals	111	3	114

Many different occupations that were probably lumped into the "other" category in 1878 come to light in this census. Four Hawaiians are traders or merchants (*"kalepa"*) in addition to being farmers. Four other Hawaiians and five Chinese list merchant, food merchant (*"kalepa ai"*), peddler (*"maauaua"*), or shopkeeper (*"halekuai"*). One Chinese man is a fish peddler (*"kalewa ia"*), and another is a bird keeper (*"hanai manu"*). Three Hawaiian men are cooks (*"kahuai"* or *"kuke"*). Several occupations that could be considered as positions of community authority are listed in the census. One Hawaiian farmer is an attorney and judge or officer of the court (*"loio"* and *"ae mare"*), as well as being a fisherman (*"lawaia"*). The Hawaiian carpenter is also an official of some sort, a *"luna mare"*. Other occupations include a Chinese official or supervisor (*"luna nui"*) and an assistant supervisor (*"hope luna"*), a Hawaiian gate guard (*"kiai pukapa"*), and a Hawaiian policeman or guard (*"makai"*), the last possibly in charge of the

prison where two Japanese men were listed as laborers. Occupations that tend to the mind, spirit, and body are also represented, in the Hawaiian schoolteacher ("*kumukula*"), the Hawaiian and French clergymen ("*kahunapule*"), and the Hawaiian healer ("*hoola*").

Of the 439 people listed as living in the valley in 1890, only 31 noted that they owned land. One of these was an elderly American male and the others were Hawaiian, divided between seven women (between the ages of 22 and 60) and 23 men (between 14 and 75 years old). This reduction in the number of individual landowners by almost half (from 61 landholders in the 1878 census) is striking, but as noted above, Schmitt (1968) believed that the responses to the real estate questions were not entirely reliable. Of the 53 probable family households in 1890 (setting aside the prison group and the ten Chinese immigrant work groups), 26 households, or 49%, had at least one member listed as a landowner, with five households containing two landowners. Only two property owners listed in the 1890 census can be suggested as probable relatives (perhaps sons or even grandsons) of original LCA awardees: S. W. Kalua and D. K. Luai (see Table 7).

Interestingly, in the business directory for 1890–1891 (Pacific Press Publishing Co. 1890), the name George Heleihonua appears, probably a relative of the Heleihonua family noted in the Māhele records and the 1878 census (see Table 7); however, his name does not appear in the 1890 census. Indeed, of the 98 entries listed in the 1890–1891 Business Directory, 60 names do not appear in the census for 1890. Some of this discrepancy could be due to people being away from the valley during the time of the census, spelling changes or inconsistencies between the two record sets, or inaccuracy in reading and recording the handwritten census (note the number of "illegible" entries in the census database; see Footnote 1). The still considerable lack of overlap between the two records highlights the need for researching multiple sources rather than relying on any one account.

This census illustrates a time of continuing and accelerated change, following the trends noted in the previous census. The Hawaiian population continues to decline, while the valley population as a whole increases because of a greatly expanded number of Chinese immigrants, mostly living together in communal, non-family, work-related households. A new element is the small number of women immigrants in the valley. Hawaiian women continue to contribute to the household economy—the expanded occupation category in this census provides a glimpse of their activities. Rice farming continues, along with *kalo*, although there are suggestions of a further loss of individual land ownership. There are some indications that there is a trend toward stratification of the valley community, where some people own and work their own land, some lease land for planting and selling of crops, and some own no land and must work for others. In addition, some people have governmental or authority roles and some are prisoners (or at least, there is provision made in the community for prisoners). A governmental interest in education, voting and taxation, although not discussed in this report, is shown in the presence of specific census questions regarding these issues, questions that had not been put

to the people in the earlier census. There appear to be more people engaged in commercial activities, as shown by the number of shopkeepers, peddlers, and people making and selling *poi*, suggesting a market economy supplementing the more traditional family subsistence lifestyle.

United States Census Data Available for Waipi'o Valley

Population data from the United States Censuses are available for Waipi'o Valley for the years 1900, 1910, and 1920. The 1910 census figures are discussed here following a brief background on the United States censuses.

According to Schmitt (1968:81-82), the switch from censuses conducted by the Hawaiian government to those conducted by the United States government meant a change from deriving population figures once every six years to once every ten years. Following this shift was a dramatic change in overall efficiency in reporting population data and in the amount of useful information. With the United States census structure, more information was collected regarding age distribution, school attendance, and occupation, but there was less information on ethnic makeup, housing, and religion. This hinders direct comparisons between Hawaiian government census figures and United States government figures.

Information on the structure of these databases is provided by Schmitt (1968:84-90). The 1900 census included information related to "geographic distribution, sex, age, place of birth, parentage, race or color, citizenship, conjugal condition, school attendance, literacy, ability to speak English, length of residence in the United States, gainful employment, household membership, and tenure of housing" (Schmitt 1968:84). The 1910 census categories included "geographic distribution, urban places, age, sex, race, place of birth, year of immigration, citizenship, marital status, school attendance, illiteracy, inability to speak English, families, tenure, and gainful employment" (Schmitt 1968:87). Similar data categories are also provided by the 1920 census structure (see Schmitt 1968:88). The category of family includes those considered as domestically or kin-related in addition to barracks, dormitories, and institutions. This would include in Waipi'o, for example, households comprised entirely of male Chinese immigrants. One individual would be listed as "head" and the rest would have been considered as members of the household. Census statistics treated these households as a single family.

The 1910 Census

The census data presented here is limited to residences within the confines of Waipi'o Valley. The total population of Waipi'o Valley, *sensu stricto*, for 1910 was 399 people, representing 104 discrete families/individual household units (see Footnote 1). The size of households for Waipi'o Valley in 1910 ranged from one to eleven individuals. Of this total population figure, there were 264 males and 135 females. The ethnic or cultural character in 1910 was quite varied (Table 10) and reflects the continued influx primarily of Chinese immigrants involved in rice agriculture. Hawaiians and Chinese represent the two largest ethnic groups in the valley comprising 39.3 percent and 41.1 percent, respectively. Individuals of Asian Hawaiian heritage represented 12.8 percent and are mainly the children of parents in which one parent was Chinese and one parent Hawaiian. In virtually every instance the father was Chinese and the mother Hawaiian. Other ethnic groups represented in Waipi'o Valley included one individual from Spain, 11 Japanese, nine Caucasian Hawaiian, one English Hawaiian, and five Asian Other (which included one individual each from Korea and Guam).

Of the 104 individual households, nineteen of them are comprised of several Chinese men listed on the census sheets as "Partner" and one individual listed as "Head." The number of individuals associated with these partnership households ranges from two to nine. Rice farms, rice mills, and *kalo* farms were the principal occupations of members of these households.

Only 25 households of 104 are listed as owning their residence. The remainder are listed as renting. Significantly, of the households listed as owners of the home, 20 are Hawaiian, 2 are Caucasian Hawaiian, and one each are Chinese, Asian Other, and English Hawaiian. Even as of 1910, Native Hawaiians represented a significant proportion (80 percent) of residents who owned property in the valley proper.

Of 135 females, 56 (41.5 percent) were married at the time the census was taken. Married females included three Asian Hawaiian, one Caucasian Hawaiian, one Japanese, ten Chinese, and 41 Hawaiian. All Chinese wives had Chinese husbands, but of Hawaiian married women, 31 had Hawaiian husbands, seven had Chinese husbands, and one each had Canadian Hawaiian, English Hawaiian and Japanese husbands.

The age and sex groups for the 1878 and 1890 census data (see Tables 5, 6, 8 and 9) are employed for the 1910 census data for comparative purposes (Tables 10 and 11). Census counts for individuals less than 6 years of age are fairly evenly distributed between male and female. Beyond age 6, there are disproportionately more males than females, especially in age groups above 15 years. These results are irrespective of ethnicity. There is a definite scarcity of females aged 41 and over for the non-Hawaiian segment of the population. The principle reason for greater numbers of males is the influx of single Chinese males who had moved into the valley to work in rice and *kalo* agriculture.

A significant proportion of the part-Hawaiian population (71.6 percent) is represented in the 5 and under and 6 to 15 age groups as the offspring of intermarriage between Hawaiian

and non-Hawaiian individuals. Among the non-Hawaiian population, 21.9 percent are within the 5 and under and 6 to 15 age cohort and a full 45 percent are males 41 and over. Females 16 and over represent only 7.1 percent of the non-Hawaiian Waipi'o Valley population in 1910. Females of the Hawaiian population segment were the primary source of wives for Hawaiian, part-Hawaiian, and non-Hawaiian males who were married in 1910.

Table 10. Ethnicity, 1910 Census.

Ethnicity	Male	Female	Totals
Asian Other	4	1	5
Asian Hawaiian	29	22	51
Caucasian Hawaiian	7	2	9
Chinese	135	29	164
English Hawaiian	1	0	1
Hawaiian	80	77	157
Japanese	7	4	11
Spanish	1	0	1
Totals	264	135	399

Occupations were quite varied among the 1910 Waipi'o inhabitants. Of the 135 females recorded for this census, only 14 (10.3 percent) were employed or listed as having some means of income. Two women were listed as having occupations that could be considered to represent the service industries—one Chinese woman (along with her Chinese husband) is listed as a restaurant caterer and a Hawaiian women is listed as a seamstress at home. Additionally, one woman (Hawaiian) was listed as having her "own income." One Asian Other woman was listed as a flag tender on the Irrigation Ditch. Other females, representing Chinese, Hawaiian, and Asian Other were variously identified as having occupations which included laborers, work or shop hands in *kalo* and *poi* factories or farm hands on home farms.

Men's occupations typically were dominated by rice or *kalo* agriculture, farm labor, or odd jobs. There were 36 men (13.6 percent) who were employed in jobs variously related to *kalo* agriculture which included *poi* makers, laborers, farm hands, or farmers. Chinese men dominated the *kalo* industry with eighteen men listed as either farm hands, laborers, or farmers. There were two Chinese men listed as *poi* makers in *poi* factories as well. Of Hawaiian males, eleven were

Table 11. Age and sex ratios, 1910 census.

Age ranges	Male	Female	Totals
<i>Total Waipi'o population</i>			
5 and under	24	25	49
6-15	57	31	88
16-40	77	50	127
41 and over	113	22	135
Totals	271	128	399
<i>Hawaiian population</i>			
5 and under	10	12	22
6-15	18	12	30
16-40	24	32	56
41 and over	28	21	49
Totals	77	80	157
<i>Part-Hawaiian population</i>			
5 and under	9	4	13
6-15	18	12	30
16-40	9	7	16
41 and over	0	1	1
Totals	37	23	60
<i>Non-Hawaiian population</i>			
5 and under	5	9	14
6-15	14	12	26
16-40	47	12	59
41 and over	82	1	83
Totals	148	34	182

farm hands or farm laborers on *kalo* farms and one identified himself as a *kalo* farmer. One Asian Other male was included as a *kalo* farm laborer. One Japanese man was a *poi* maker in a *poi* factory and two were farm hands and laborers on *kalo* farms. Those men seeking employment as laborers through odd jobs included one Asian Other, one Chinese, eleven Hawaiian, and 2 Japanese. Some of these individuals may have been frequently employed as

farm hands as well. Data and discussion on individuals employed in occupations associated with rice agriculture are discussed below.

Several individuals listed themselves as having occupations or skills which could be considered professional. These include bookkeeper, caterer, salesman, manager, photographer, public servant in a police station, teacher and school teacher. Two Chinese men served as bookkeepers and two as salesmen with a general store and one was the manager of a rice mill (possibly Akaka's Rice Mill). Another Chinese man was a photographer in a photo gallery. Hawaiians and Asian Hawaiians served as a school teacher in a public school and teacher among Chinese, respectively. One Hawaiian man was also identified as a public servant at the local Police Station, probably a policeman.

There was a wide variety of other employments which could be considered as skilled labor or specialist occupations listed for male residents of Waipi'o Valley in 1910. Skilled craftsmen included carpenter and plasterer. Carpenters are represented by one Hawaiian and one Caucasian Hawaiian, who interestingly both share the same name of Charles Thomas. The Hawaiian carpenter was an "at home" occupation while the Caucasian Hawaiian carpenter was attached to the Irrigation Ditch. The plasterer was also a Caucasian attached to the Irrigation Ditch. Other skilled labor positions for Chinese males included: a cook for a private family, a fishman at a fishpond, a foreman at a rice mill, two gardeners associated with a truck farm/garden, one merchant in a General Store, two mill hands at a rice mill, a pailman along the Irrigation Ditch, three peddlers of fresh farm produce/fruits and vegetables, and one "at home" tutor. Other specialists/skilled laborers included two Hawaiian men serving as watermen along the Irrigation Ditch and a Hawaiian employed as a milkman along the Irrigation Ditch.

Rice in Waipio Valley

As *kalo* figures so prominently today, and for much of the early and later history of Waipi'o Valley, so too did rice as a source of economic support for the inhabitants in the later 1800s and early to mid 1900s. Data from the 1910 census is used to illustrate some aspects of rice agriculture in the valley. Significant historical events in Hawai'i included changes in economic and subsistence practices associated with the advent of the rice industry. Waipi'o Valley is listed as the largest contiguous area of land on Hawai'i where rice was cultivated with 200 acres under cultivation as of 1892 (Coulter and Chun 1937:20-21). Polulu (72 acres) and Waimanu (85 acres) were the only other two rice farming districts on Hawai'i. Waipi'o, in 1892, had 56% of the total acreage on Hawai'i under rice cultivation.

Some of the most important factors which led to the steady and increased development of the rice industry in Hawai'i included the unrestricted immigration of Chinese immigrant labor for sugar plantations and the rice industry, abundance of available land, and a strong expanding rice market both home and abroad (Coulter and Chun 1937:10-11). The first arrival of a small number of Chinese laborers for the sugar cane plantations was in 1852. In 1853 there were 364

Chinese in Hawai'i, in 1860 this increased to 700, and by 1866 there were 1,200 Chinese laborers (Coulter and Chun 1937:9). The Hawaiian government also sponsored the continuing importation of Chinese labor. These labor importations were further increased by the development of Chinese companies in Honolulu. The demand for labor became so great that the Board of Immigration and sugar cane planters paid the steamer fares (whole and part) for Chinese immigrants to come to Hawai'i. By 1884 the number of Chinese in Hawaii had grown to 18, 254.

Upon completion of their labor contracts with the sugar plantations, Chinese laborers were free to seek any other employment they could obtain or to leave the islands. As some of them had been rice farmers in southeastern China, many sought employment raising a crop with which they were familiar. Chinese readily displaced Hawaiians who had been engaged in rice farming and both Hawaiian and *haole* preferred to lease land to Chinese immigrants rather than continue this work themselves. From an economic perspective, it appears that the typical Chinese laborer did not consider his position in the Hawaiian rice industry as permanent but rather as a way to earn as much money as quickly as possible before returning to China.

Two interesting organizations of cooperative farming were characteristic of Chinese rice farming in Hawaii. These were the *fun kung* and the *hop-pun* (Coulter and Chun 1937:17-18). Both of these involved partnerships among several individuals but differed in scale. The *fun kung* involved one individual who fronted the costs of all machinery, land, etc. and several individuals who provided the labor. *Hop-pun* involved an equal partnership among all as a cost-share organization. The *hop-pun* typically involved the cooperation of two or three rice farmers. Some evidence for the presence of these organizations in Waipi'o Valley is apparent from the structure of households reflected in the 1900 and 1910 censuses. Listed in both censuses are numerous households which are comprised of several Chinese males, one listed as head of household and the remainder listed as "partner." The employment indicated is typically farm laborer on a rice farm or some association with a rice mill. These may have been organized similar to the *hop-pun* concept. In the 1910 census data all individuals associated with rice agriculture in Waipi'o are Chinese males (n=77; 29.1 percent of all males).

One of the principle tasks in rice agriculture was the construction and maintenance of often massive and complex irrigation systems, the most of which was accomplished by manual labor. In Waipi'o Valley, the bulk of this work was performed by male Chinese laborers, field hands, and farm laborers on rice farms (n=68 or 88.3 percent of all Chinese males involved in rice agriculture). Activities included construction of dikes and diversion dams from rocks and dirt, the clearing of silted streams and irrigation canals, and the opening of closed ocean outlets (see Coulter and Chun 1937:13). Other occupations performed by Chinese males included a rice mill foreman, three farmers, five rice mill laborers, one rice mill plantation manager, and two mill hands. In addition to construction and maintenance activities, rice farm laborers did the planting and pulling of seedlings, fertilizing, weeding, harvesting and dealing with pests

(primarily in the form of birds). Coulter and Chun (1937:25–34) provide a very detailed and informative description of work associated with raising a rice crop.

ORAL HISTORY RECORDS

In addition to the government sources discussed above, there are also more personal sources of a descriptive nature that add details about the Waipi'o community and everyday family life. An important source for Waipi'o Valley is the memoir written around 1953–55 by Herbert Mock "Akioka" Kane (1895–1970) and made public by his son, Herb Kawainui Käne (Käne 1994). Herbert M.A. Kane was born in Waipi'o to Chinese immigrants, possibly the two Akiokas listed in the 1890 census. The elder Akioka leased land for *kalo*, started a *poi* factory, and was a prominent businessman (see the section on the *poi* factories and *poi* production for further details). His son provides a detailed account of life growing up in the valley in the early part of the twentieth century. Another interesting source of ethnographic material on Waipi'o Valley is the collection of interviews with valley residents conducted in 1978 by the Ethnic Studies Oral History Project (ESOHP). The interviewees are of Hawaiian, Chinese, Japanese, Filipino, Portuguese, and northern European ancestry. Many were born in Waipi'o, and almost all are involved in *kalo* farming or *poi* manufacture, or related to someone who is.

Throughout the Kane memoir are references to an older, more traditional Hawaiian way of life, glimpses that do not appear in the more structured accounts already discussed. For example, Mahina, the oldest man in the valley, was the last one to make stone *poi* pounders (Käne 1994:1, 30)—a Mahina is listed in the 1890 business directory as a *kalo* planter, but the name does not appear in either the 1878 or 1890 census. Kaaiamoku (listed in the 1878 census, and possibly the same family as S.N. Kaeamoku in the 1890 census) was the last man to wear the *malo*. Kua (listed in the 1890 census and Business Directory) could read the stars and knew navigation. Kukailleike (listed in the 1890 Business Directory but not the census) knew the comic male part in hula. Penaamina (probably the Beniamina listed in the 1878 and 1890 censuses and the 1890 business directory) could chant the old chants or *oli* and knew herbal medicine. Most of these references are to traditional knowledge, areas not included in the other documents concerned with occupation, and so are overlooked in official record-keeping.

The ethnohistoric information also provides additional data about contributions to the household economy made by women and children in the early twentieth century. The children would catch fish and frogs to eat at home or to sell, and were given pocket money for chasing birds out of the rice fields (Käne 1994:19, 20, 25; ESOHP 1978:399, 558). Children also helped with *kalo* farming, cleaning the patches, pulling grass from the fields for animal feed, and planting and harvesting *kalo* (ESOHP 1978:95, 252, 383, 525, 676, 986–987, 1089). Women's tasks mentioned in the ethnohistoric accounts include collecting non-plant foods and manufacturing goods, both for home consumption and for sale. Kane recounts how Hawaiian women would collect eels and crabs and go freshwater fishing in streams, using either traps or

their bare hands (Käne 1994:4, 19). Ronald Kanekoa remembers his mother picking edible snails from the *kalo* fields, to sell to market (ESOHP 1978:676). Weaving, listed as an occupation in the 1890 census, is also noted in the Kane memoir (Käne 1994:40) and the ESOHP volumes. An indication of the economic value some of the weaving tasks could have is shown in the interview with Joe Kala, who says that while his father made 50 cents a day working for Akioka, pulling grass and tending animals, his mother made hats which sold for 25 cents each (ESOHP 1978:585). The role of women working in the *poi* shops, indicated in the 1890 census, is also shown in Käne (1994:8) and the oral history volumes (ESOHP 1978:598, 741). This aspect of Waipi'o life is discussed further elsewhere in this report as well as in Lebo et al. (1999).

These kinds of economic contributions by women are not reported in the various business directories. When women are listed in the directories they appear in more professional or governmental roles. For example, the office of postmaster was held by several women, as listed in the Business Directories for 1894–95 (Mrs. Owaanui; Husted Directory Co. 1894) and for 1896–97 (Mrs. Anna Kaahiki; Husted Directory Co. 1896). The "*luna leka*" or postmaster named in the 1890 census is also a woman. Other business directory listings for women include Grace K. Ah Choy and Mrs. Ruby K. Nakagawa as teachers (Polk-Husted Directory Co. 1924, 1926, 1927). There is some evidence that women could take over business matters in place of their husbands (ESOHP 1978:603). For example, Mrs. Akioka ran the *poi* business and paid the workers while her husband was ill. Mrs. N. Clark is listed as a landowner in 1899 and 1900 after the death of her husband, although she had not been listed previously. After the death of Charles Thomas in 1924, Mrs. Thomas is listed in the *poi* section of the business directories for 1924 and 1927 (Polk-Husted Directory Co. 1924, 1927).

The ethnohistory accounts provide much information on the various ethnic groups in Waipi'o Valley and the interrelationships among those groups. The people of Waipi'o as a whole appear to have had an emphasis on sharing food and work and helping each other, where widows and children would be taken care of and orphans adopted, whether by a member of the same ethnic group or not (Käne 1994:2, 6, 17, 24, 30, 31, 33; ESOHP 1978:596, 611, 614; 642, 649, 720). Intermarriage was common, perhaps leading to an even broader sense of family among the various groups (Käne 1978:2, 3, 37; ESOHP 1978: 153, 198, 859, 931). Rachel Thomas observed that the housing in the valley was not segregated by ethnic grouping—"They were all mixed. I mean, Chinese and Hawaiians and they were all, no difference." (ESOHP 1978:1054). Albert Kalani also stated that there was no particular area in the valley where only Hawaiians lived, but that the Hawaiian and Chinese households were mixed or side-by-side, as well as the Filipino families—"We were all close. You can yell to each other. Those days, the people know everyone." (ESOHP 1978:639). He also said that "We are like family down there, before, in Waipi'o those days. We like one family. Never had any kind of trouble. We always like one family. Always helping one another" (ESOHP 1978:620). This twentieth-century

vision, after many decades of change in the form of land ownership, economics, social structure, and ethnicity, affirms the value and stability of the focus of the people of Waipi'o on the traditional and interlinked ideas of *kalo* and *'ohana*, taro and family.

***POI* PRODUCTION AND *POI* FACTORIES**

The importance of *kalo* cultivation and *poi* production in traditional Hawaiian society was previously discussed by Lebo et al. (1999) and is elaborated here. *Poi* was the mainstay of the Hawaiian diet. In the later part of the nineteenth century and early half of the twentieth century its commercial manufacture became an important economic pursuit for residents of Waipi'o Valley. *Poi* is no longer commercially produced in Waipi'o Valley, but the fundamental importance of *kalo* cultivation for outer island *poi* markets continues to be a defining activity linking residents in the valley, regardless of their ethnicity, to their past as well as their perceived future.

TRADITIONAL *KALO* CULTIVATION

In ancient Hawai'i, *kalo* was a sacred and prized food of the *ali'i* and was held in higher regard than other staple crops, such as sweet potato. *Poi* was a staple of the *ali'i* diet and not always available to lower social ranks, particularly when droughts caused a scarcity in the harvest (Handy et al. 1991:75). Traditionally, *kalo* cultivation and *poi* production was characterized by a gender division of labor—*kalo* was planted, harvested, cooked, and pounded into *poi* by men.

Kalo wai or wetland *kalo* cultivation in Hawai'i involves carefully channeling water into terraced fields, which are surrounded by raised banks or stone facing (Figure 14). While the *lo'i* system is not unique, it is less common outside Hawai'i. It contrasts with other Pacific areas where wetland crop growing relies mainly on natural precipitation or the drainage of water into swampy areas, rather than on directed irrigation from rivers or streams into prepared terraces (Begley 1979:2; Handy et al. 1991:92).

Regions historically noted for the growing of *kalo wai* were Waipi'o and Waimanu Valleys on the Island of Hawai'i (Figure 15), Waihe'e and Wailuku districts on Maui, Wailua, Pelekunu, and Hälawa Valleys on Moloka'i, Waialua, Kahana, and 'Ewa regions on O'ahu; and the Hanalei and Kapa'a regions on Kaua'i (MacCaughey and Emerson 1914:19). *Kalo* traditionally was also grown on *kula* land—dry and inaccessible to water except through irrigation—in some patches at Waiu, on the windward side of Ni'ihau, on Maui, Hawai'i, Kaua'i, O'ahu, Moloka'i, and Lāna'i. No *kalo* was grown on *kula* lands on Kaho'olawe (Malo 1971:205-206). *Kalo malo'o*—upland or dryland *kalo*—"forms a prime article of food in those parts of the island, where there is a light soil, and but little water" (Ellis 1963:131).



Figure 14. Reconstructed *lo'i*, Hi'ilawe area, Waipi'o Valley, April 1999 (photograph by Deborah I. Olszewski).

Kalo patches are variously named on the basis of size, shape, planting method, and other factors. *Mo'o ai* are narrow strips of planted *kalo*, much longer than they are wide. *Mo'o*

kaupapa lo'i are long rows of *lo'i* or wet *kalo* patches (MacCaughey and Emerson 1914:20). Other types of wet planting mounds include *pu'epu'e hou* and *kipi* or *kipikipi*. Of the wetland methods, *lo'i* was most frequently occurring form (Handy et al. 1991:91-92; Kamakau 1976:33-34).



Figure 15. Recently planted *lo'i* in Waipi'o Valley, April 1999 (photograph by Deborah I. Olszewski).

An estimated 300 or more varieties and types of *kalo* were grown in pre-Contact Hawai'i (Handy et al. 1991:83; MacCauley and Emerson 1913). Some were exclusively for the *ali'i*, others were reserved for medicinal use, or for religious ceremonies (Handy et al. 1991:83, 116-117; MacCaughey 1917:266; MacCaughey and Emerson 1914:210; Whitney 1937:15, 30). For example, *'apu* was administered to the sick (Malo 1971:42) and was a general name for medicinal potions as made from *kalo*, yam, or herbs. *Kalo 'apu* is the Hawaiian term for *kalo* used for medicine (Pukui and Elbert 1986:29). In the early post-Contact period, Ellis (1832) identified *kalo* as second only to breadfruit in importance in the Hawaiian diet. He observed that thirty-three varieties of *kalo* were in use for making *poi*, and flour was produced when food supplies were scarce. By 1931, few of the more than 300 distinct varieties and strains of *kalo* once grown remained (Handy et al. 1991:83; MacCauley and Emerson 1913).

The traditional varieties of *kalo* cultivated in Waipi'o Valley *lo'i* included *uaua*, *haakea*, and *'āpi'i*. The *uaua* and *haakea* varieties require the longest growing cycle, 18–24 months, and have the strongest developed root system (ESOHP 1977:xiii). The commercialization of *poi* production resulted in a shift away from varieties that took a long time to mature. Quick producers, including new varieties of introduced *kalo*, were grown. These tended to have a weaker root system and were subject to disease and rot. The two varieties most commonly grown in Waipi'o Valley in the twentieth century were *'āpi'i* and *lehua* (ESOHP 1977:xiii).

Historically, *kalo* varieties were raised for household consumption or grown for sale either directly to a *poi* manufacturer or through an agent to *poi* mills either in Waipi'o Valley or elsewhere. Over the years a number of people who grew *kalo* in Waipi'o did not always reside there but instead lived “up top” in the town of Kukuihaele.

TRADITIONAL POI PRODUCTION

The manufacture of *poi* traditionally involved baking the *kalo* corm in an *imu* or earth oven. Once cooked, the outer skin of the root was scraped or peeled with a sharpened edge of a shell or coconut husk. A stone pounder with a broad base was used to mash the cooked, peeled corms on a troughed wooden board. Water was added at intervals, eventually creating a smooth paste. The *poi* was set aside in wooden bowls or calabashes to ferment before eating.

Numerous ethnohistorical documents provide additional details about the techniques used to make different types of *poi* and their uses. Although traditionally *poi* was prepared by first cooking the corm or root in an *imu* or *imu lua* (Begley 1979; Handy et al. 1991; Kelly 1978; MacCaughey and Emerson 1914), alternative methods were used that included boiling the corm and incubating it in a covered gourd exposed to direct sunlight (Allen and Allen 1933:3). When prepared in an earth oven, the *imu* was lined with stones and a layer of leaves

was placed over the stones. A fire was built in the pit to heat the stones. Descriptions from 1819 by de Freycinet (Kelly 1978), 1823 (Ellis 1963:147), and 1828 (Stewart 1828:39) describe how the *kalo* corm was then scraped with a shell, wrapped in banana or *ti* leaves, and placed in the *imu*, where it sometimes accompanied other traditional root crops such as sweet potatoes and yams, and other foods such as pig and dog. The *imu* was then covered with more leaves, mats, and a layer of earth to bake the contents (Begley 1979:18; Handy et al. 1991:111; Kelly 1978:59).

After baking or boiling, the outer skin or peel of the *kalo* corm was removed. A *pohaku ku'i* or stone pounder was used to mash the corms into a soft, pasty consistency in a long wooden trough or *poi* board called *papa ku'i poi*. Short *poi* boards were used by a man working alone, while long boards accommodated two men working at opposite ends (MacCaughey 1917:266; MacCaughey and Emerson 1914:116). This general method of preparing *poi* for household consumption was used by residents in Waipi'o Valley into the early part of the twentieth century (Käne 1994; ESOHP 1978:251, 400).

Different types of *poi* were made from the cooked corm. If just a little water was added during pounding, a stiff or hard *poi* was produced. If more water was added, it was worked as dough and then put into a calabash, diluted with water until it reached the consistency of paste, and set aside for fermentation (Stewart 1828:39). Hard *poi* is variously referred to as *pa'i 'ai* (hard pounded undiluted *kalo* or compact *poi*), *'ömao* (e.g., a *ki* bundle wrapped in green leaves), or *holo'ai* (e.g., a *ki* bundle of hard *poi*) (Malo 1971:42; Pukui and Elbert 1986: 77, 287, 302). When wrapped in leaves and dried in the sun, *pa'i 'ai* may be stored for several months without spoiling and was suitable as a food for long sea voyages (Begley 1979; Kelly 1978; MacCaughey 1917; MacCaughey and Emerson 1914; Stewart 1828).

Steamed and peeled corms are termed *'ai pa'a*. When ready to be eaten, the cooked and peeled *kalo* is called *'ai kupa'a*. If it is sliced and dried in the sun, as for long voyages, it is called *a'o*. Raw grated and steamed *kalo* is *piele*, while grated *kalo* with coconut milk is *külolo* (Handy et al. 1991:111). Kane (Käne 1994:4) reported that *'ai pa'a* (firm or solid *poi*) was furnished to each paniolo with a piece of roasted or dried beef to take with them into the fields and that this custom might be a practice from ancient times when Hawaiians went into the forests to hew canoes or to Mauna Kea to make stone adzes.

Begley (1979:18) reports that, "when necessary, taros of different varieties were combined according to strict, careful, time-sanctioned recipes." The two, however, should not be pounded together because their different consistencies make it difficult to obtain *poi* of good texture and smooth quality (Handy et al. 1991:112). Some people reported that *'ulu* (breadfruit) was mixed by some in the valley with *kalo*. Kane (Käne 1994:7) stated that mixed *poi* of this type was made in Puna, but not in Waipi'o, but David Makaioi recalled his family made *'ulu poi*,

while Ted Kaaekuahiwi said his family mixed *kalo* and 'ulu in making poi (ESOHP 1978:402–402, 844).

Poi was traditionally stored in *umeke* (calabashes or wooden bowls) and was eaten with the fingers. The young leaves of the *kalo* were cooked and eaten as greens like spinach, being called *luau* (MacCaughey 1917:267; MacCaughey and Emerson 1913:192). Fullaway (1938:55) reported in 1938 that Hawaiians continue to eat *luau* or "greens," which he believed to be from a particular variety of *kalo* grown for that purpose. The cooked stems were consumed as *haha* (Malo 1971:42). The eating of *luau* at feasts resulted in the feasts being known as *luau* (MacCaughey 1917:267; MacCaughey and Emerson 1913:192; Pukui and Elbert 1986:214). This usage of *luau* is not ancient, rather it dates back at least to 1856 when it was used by the *Pacific Commercial Advertiser*. Prior to this such feasts were called *pā'ina* or 'aha'aina (Pukui and Elbert 1986:214).

DEVELOPMENT OF A COMMERCIAL POI INDUSTRY (ca. 1880s–1900)

In the later part of the nineteenth century household production and consumption of *poi* expanded to commercial production for a growing market economy (Lebo et al. 1999). Trends seen throughout the Hawaiian islands were mirrored in Waipi'o Valley. *Poi* was increasingly manufactured for sale in local and regional markets on the islands. Agriculturalists in Waipi'o Valley produced wetland *kalo* that supported this market. Even with the expansion in the cultivation of rice as a new commercial crop, *kalo* continued to have a significant place in the socioeconomic life of the community.

Peak commercial *poi* production varied greatly among the islands, with the earliest peak occurring on O'ahu in 1888. Figure 16 provides a graphic view of fluctuations in *poi* production in Hawaii from 1880 to 1990, with some gaps in the available historic records. Commercial *poi* was produced on five islands: O'ahu, Hawai'i, Maui, Moloka'i, and Kaua'i. The trends among the islands appear relatively similar across years throughout much of the twentieth century. Periodic fluctuations and major declines are visible in the distributions, reflecting *poi* shortages due to various factors, including natural disasters (tidal waves and massive flooding).

There were also noteworthy early commercial efforts to market products other than *poi* from *kalo*. For example, *kalo* flour manufactured from dried and ground corms was first available in 1879 (Allen and Allen 1933:6; MacCaughey 1917:267). In 1886, King Kalakaua authorized his Minister of Finance, L. A. Thurston, to pay, over a three-year period, the Alden Fruit & Taro Co. twenty dollars per ton of *kalo* flour they manufactured for foreign markets. Two years later Kalakaua signed a second act authorizing Thurston to defray costs up to \$5,000 associated with efforts to introduce *kalo* flour and other *kalo* products to export abroad (Greaney, *Honolulu Advertiser*, April 20, 1958:C6, col. 1).

Entries in the business directories from this time period provide further information about the developing commercial market for *poi*. These include details for *poi* maker, *poi* dealer, *poi* seller, *poi* manufacturer, *poi* shop, *poi* factory, and employee at *poi* shop or factory. Most entries provide an address where *poi* was manufactured or sold, residential addresses are sometimes also provided. In the late nineteenth century, some individuals identified as *poi* makers, sellers, dealers, or manufacturers had their residence at or in the rear of their business address. For example, the earliest reference to commercial *poi* was found in a business directory for Honolulu dating to 1869—a *poi* merchant named Makalio is listed at 180 King Street (Bennett 1869:83).

The first available directory data for the other islands dates to 1880 (Table 12) and indicates 18 individuals involved in the *poi* industry for Maui, one for Kaua'i, and one for Moloka'i, as well as 11 individuals for O'ahu, (Bowser 1880). *Poi* production on the islands of Hawai'i, Lāna'i, and Ni'ihau appears to have been limited to family production for household consumption as no listings appear in the directories from these islands.

Frequencies of Poi Shops and Dealers

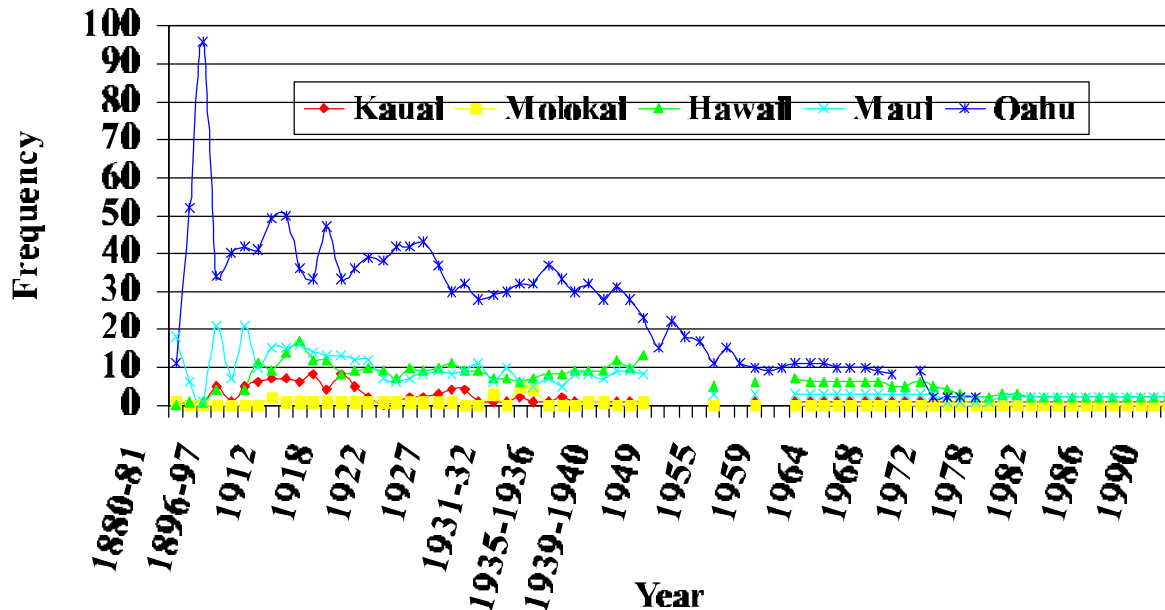


Figure 16. Trends in *poi* production in the islands, 1880-1890.

The 1880 data give some idea of the ethnicity of the people with occupations related to *poi* manufacture. The two commercial *poi* makers on Kaua'i and Moloka'i were Hawaiian as

were most of those on Maui. Hawaiians and *haoles* made commercial *poi* on O'ahu. Chinese names do not appear in the directory listings at this time, although within a few years they dominate the new industry. No factories or business establishments devoted to *poi* production were identified in the 1880 directories, suggesting that *poi* was still largely made on a small scale, probably at home, and then sold in local markets.

Few entries for "factories" appear in the listings before the early 1900s. The first mention of a factory is Prince Albert K. Kunuiakea's Poi Factory on O'ahu listed in the 1884–1885 directory (McKenney Directory Co. 1884:80h). Two other factories are known from this time period, both on Maui (Table 13). The Alden Fruit & Taro Co., Wailuku, Maui, also appears in the 1884–1885 directory, but is not explicitly identified as producing *poi* (McKenney Directory Co. 1884:323). Prince A. K. Kunuiakea's Poi Factory in Honolulu is described as:

"a representative establishment, and one of the most extensive on the islands. It is run by steam power. To give an idea of its capacity, we may mention that it has manufactured 2,500 pounds of poi in an hour and a half. It is located at Komoilili, one mile and a quarter east of town, at the corner of Waialai and Beretania Streets" (McKenney Directory Co. 1884:80h).

It is likely that few of the other *poi* manufacturers were using steam power to run their operation. Traditional production methods of hand pounding the *poi* were probably more common until the end of the nineteenth century.

By 1884, immigrant Chinese dominate the *poi* making industry (Table 14). McKenney's 1884 O'ahu directory lists 51 names for Honolulu (90% of these are Chinese); no *poi* listings are given for locales outside of Honolulu. Presumably, Hawaiians continued to largely grow *kalo* and produce *poi* for household consumption rather than for commercial markets. It is unknown if the Chinese *poi* makers listed for Honolulu in the 1884 directory were mostly producing *poi* on a similar scale to the Hawaiians reported in the 1880 directory, or were primarily working at the larger, established businesses of either Prince Albert Kunuiakea or possibly William Buckle. The 1884 directory also lists names of individuals involved in *poi*-related occupations on the islands of Hawai'i and Maui. Here too, recent Chinese immigrants make their first appearance in the directory listings for *poi*-related occupations. For example, Hawai'i island lists one person, Ah Tong, a *poi* maker in Hālawā. Three of the six listings given for Maui are also Chinese names (see Table 13).

Table 12. Directory Listings for *Poi* Makers, Manufacturers, Sellers, and Dealers, 1880*

Name	Occupation	Location
<i>Kaua'i</i> Kalaikoa J	<i>poi</i> manufacturer	Lihue
<i>Maui</i> Bailey E. H. Hune Kaai S. Kahalehau Kaihumua Kaina Kaloiele K. Kane Sam Kaohumu John K. Kanana John B. Kaoni Keakua B. Kipakuhia G. Leihoomio Mahaapaa Oina Olelo Papalimu L. W.	<i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer & 'awa merchant <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer	Wailuku Wailuku Wailuku Wailuku Waihee Waihee Waihee Wailuku Lahaina Wailuku Wailuku Wailuku Wailuku Wailuku Lahaina Wailuku Wailuku Waihee
<i>Molokai</i> Kaulaua	<i>poi</i> manufacturer	Lupehu
<i>O'ahu</i> Buckle Harry Buckle W. Senior Buckle W Jr. Buckle Wm. J. Kean J. Kuna Langhern S. Mahoe John Maui K. Poepoe Walawala J.	<i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> helper <i>poi</i> manufacturer <i>poi</i> manufacturer <i>poi</i> manufacturer & farmer <i>poi</i> manufacturer	Honolulu Honolulu Honolulu Honolulu Honolulu Kaneohe Honolulu Kailua Honolulu Kaneohe Heeia

*compiled from Bowser (1880); no *poi* listings for islands of Hawai'i, Lāna'i, or Ni'ihau.

Table 13. Directory Listings for Hawai'i and Maui Poi Makers, Manufacturers, Sellers, and Dealers, 1884*

Name	Occupation	Location
Hawai'i Ah Tong	<i>poi</i> maker	Halawa
Maui Ah Ho Ah Leong Ah Ying Alden Fruit & Taro Co. Kalamona Mekaka	<i>poi</i> maker <i>poi</i> factory <i>poi</i> maker fruit & taro company <i>poi</i> dealer <i>paiai</i> seller	Lahaina Wailuku Lahaina Wailuku Wailuku Keanae

* compiled from McKenney (1884); no *poi* listings for islands of Kaua'i, Lāna'i, Molokai, or Ni'ihau.

Earliest Commercial Production in Waipi'o Valley

The business directories provide some indication of the beginnings of commercial *poi* manufacture in Waipi'o Valley, Hawai'i during the late nineteenth century (Table 15). Ah Chong and Ahapa are the first two names that appear in the directories beginning in 1896. Both are listed as having occupations of *poi* or *poi* maker in Waipi'o Valley (Husted Directory Co. 1896:332–333; 1899:311, 313). Three other names also appear in the listing by 1899: Ah Chock, Ah Hop, and George Alika (Husted Deirectory Co, 1899: 311–312, 314). Ah Chock is listed as the manager of the Waipio Poi & Taro Company (Husted Directory Co. 1899:311) (Table 16).

The 1890 census data for Waipi'o Valley provides an additional source of information on 25 Waipi'o residents in *poi*-related occupations in the later part of the nineteenth century that do not appear in the business directories (Table 17). For example, 10 Hawaiian females, ranging in age from 15–50 with an average age of 35, are listed in the 1890 census with an occupation of *ihi'ai* (food peeler). All are married, with the exception of the 15 year old girl and the 50 year old woman who reside in the same household (#41). Three other women also share the same household (#56). It is quite possible that all were involved in commercial *poi* manufacture and had the job of peeling cooked *kalo* corms before the final cleaning, and pounding or grinding stage of the operation.

Table 14. Directory Listings for Honolulu, O'ahu Poi Makers, Manufacturers, Sellers, and Dealers, 1884*

Name	Occupation	Name	Occupation
Ah Ark	<i>poi</i> maker	Ah Sen	<i>poi</i> maker
Ah Che	<i>poi</i> maker	Ah Sheah	<i>poi</i> maker
Ah Cheong	<i>poi</i> maker	Ah Sing	<i>poi</i> maker
Ah Chin	<i>poi</i> maker	Ah Thou	<i>poi</i> maker
Ah Chong	<i>poi</i> maker	Ah Wai	<i>poi</i> maker
Ah Foo	<i>poi</i> maker	Ah Wo	<i>poi</i> maker
Ah Hee	<i>poi</i> maker	Ahum	<i>poi</i> maker
Ah Ho	<i>poi</i> maker	Angin	<i>poi</i> maker
Ah Hong	<i>poi</i> maker	Angong	<i>poi</i> maker
Ah Hou	<i>poi</i> maker	Buckle Wm.	<i>poi</i> manufacturer
Ah Hung	<i>poi</i> maker	Chin Hang	<i>poi</i> maker
Ah Kai	<i>poi</i> maker	Haawinaaupo E. H.	<i>poi</i> maker
Ah Kan	<i>poi</i> maker	Ham Vet	<i>poi</i> maker
Ah Kan (2nd)	<i>poi</i> maker	Hang Sung	<i>poi</i> maker
Ah Kee	<i>poi</i> maker	Hing Chau	<i>poi</i> maker
Ah Kim	<i>poi</i> maker	Hop Kee	<i>poi</i> maker
Ah Kung	<i>poi</i> maker	Hop Seong	<i>poi</i> maker
Ah Leong	<i>poi</i> maker	Kunuiakea, Prince Albert	<i>poi</i> factory proprietor
Ah Ling	<i>poi</i> maker	Lam Toy Gee	<i>poi</i> maker
Ah Loe	<i>poi</i> maker	Lee Yak	<i>poi</i> maker
Ah Lun	<i>poi</i> maker	Meki	<i>poi</i> maker
Ah Luu	<i>poi</i> maker	Owalani	<i>poi</i> maker
Ah Po	<i>poi</i> maker	Uu Ten	<i>poi</i> maker
Ah Pong	<i>poi</i> maker	Yet Loy	<i>poi</i> maker
Ah Sam	<i>poi</i> maker	Yong Gah	<i>poi</i> seller & coffee shop
Ah Sam (2nd)	<i>poi</i> maker		

* compiled from Bowser (1880); no *poi* listings for locales outside Honolulu found.

Table 15. Directory Listings for Waipi'o Valley Poi Manufacturers and Dealers, 1880–1990

Manufactuer or Dealer	Poi Company	Years Listed in Directories
Ah Chong		1896–1899
Ahapa		1896–1901
Ah Chock	Waipio Poi & Taro Company	1899
Ah Hop		1899
Alika, George		1899–1901
Ah Keona		1900–1901
See Lee	See Lee Poi Company	1900–1901
Kalehuawehe, Mika		1911–1912
Koko		1911
Ah Ho		1912–1912
Akaka, L (Leong Hut)		1912
Akioka, A. (Mock Chock)		1912–1914
Ak Kong		1912–1914
Mock Chew (Mock Ah Chew)		1912–1914; 1917–1930; 1954
Ah En		1914
Yong Chong		1914
Eno, John Jr		1917
Leong Akona		1917
Lum Ho		1917
Mock Chock		1917
Machado, John G		1918
Ah Wo, Ernest		1924–1942
Akioka, Ernest A		1924–1942
Ahana, Chang (Leslie Chang)		1933–1942
Chun, Nelson A		1936–1937; 1960

Manufactuer or Dealer	Poi Company	Years Listed in Directories
Kaneshiro, Seiko	Ono Ono (Kaneshiro) Poi Shop	1962-1975

Table 16. Directory Listings for Hawai'i Island Poi Companies, 1899–1990s

<i>Poi Company</i>	City	Years Listed
Waipio Poi & Taro Company	Waipio	1899
See Lee Company	Waipio	1900–1901
City Poi Company	Hilo	1914–1921
Hawaii Poi Factory	Hilo	1916–1930
Sing Wo Poi Company	Hilo	1916–1917
Wah On Poi Company	Hilo	1916
Kona Supply Company, Ltd.	Kealahou	1921
Hilo Poi Shop	Hilo	1922
City Poi Factory	Hilo	1924–1941
Chun Poi Factory	Hilo	1927–1931
Kuhio Poi Factory	Hilo	1928–1930
Kona Poi Factory	Kealahou	1931–1964
Sing Wo Poi Factory	Hilo	1933–1942
Kilauea Poi Retailer	Hilo	1939–1940
Hilo Poi Factory	Hilo	1941–1979
Puueo Poi Factory and/or Shop	Hilo	1954–1994
Ah Hee Poi Shop	Hilo	1957–1971

<i>Poi Company</i>	City	Years Listed
Higashi Poi Factory	Honaunau	1957–1972
Kohala Poi Factory	Iole	1960–1962
Ono Ono (Kaneshiro) Poi Factory	Kukuihaele	1962–1975

Other census data likely relate to the distribution or marketing of *poi*; these include the occupations of *halekü'ai* (shopkeeper), *kālepa* (trader or merchant), *kālepa'ai* (food merchant), *ma'au'auä* (peddler), and *mahi'ai & kālepa* (farmer & merchant). The 14 individuals listed with these occupations are all males ranging in age from 23–60, with an average age of 40 years old. None of the five Chinese shopkeepers and food merchants listed own property. Three of the five appear in later business directories associated with *poi* manufacture: Ahapa, Akaka (Leong Hut), and Akioka (Mock Chock) (see Table 15). Four of the five Chinese are also from the same household (#63), and the two Hawaiian peddlers are members of the same household (#6).

Table 17. 1890 Census Data for Waipi'o Valley Poi-related Occupations.

Name	Occupation	Ethnicity	Household Number	Property Ownership	Age	Sex	Marital Status
Moohila	<i>ihi'ai</i>	Hawaiian	41	no	15	female	single
Kalili	<i>ihi'ai</i>	Hawaiian	56	no	19	female	married
Aua	<i>ihi'ai</i>	Hawaiian	56	no	30	female	married
Abikaila	<i>ihi'ai</i>	Hawaiian	41	no	34	female	married
Kahinu	<i>ihi'ai</i>	Hawaiian	59	yes	35	female	married
Kalua	<i>ihi'ai</i>	Hawaiian	56	no	37	female	married
Kaiwipoepoe	<i>ihi'ai</i>	Hawaiian	58	no	42	female	married
Kumauna	<i>ihi'ai</i>	Hawaiian	35	no	45	female	married
Malaka	<i>ihi'ai</i>	Hawaiian	61	no	48	female	married
Kaneole	<i>ihi'ai</i>	Hawaiian	41	no	50	female	single
Ah Kama	<i>haleku'ai</i>	Chinese	29	no	28	male	married
Akunu	<i>haleku'ai</i>	Chinese	63	no	40	male	single
Akaka	<i>haleku'ai</i>	Chinese	63	no	60	male	single
Ahapa	<i>kālepa'ai</i>	Chinese	63	no	40	male	single
Akioka	<i>kālepa'ai</i>	Chinese	63	no	40	male	married
Kahoopii, S W	<i>kālepa'ai</i>	Hawaiian	35	no	58	male	married
Kaniuela	<i>kālepa</i>	Hawaiian	61	yes	56	male	married
Kawai, Ioane L	<i>ma'au'auā</i>	Hawaiian	6	no	23	male	single
Paoou, John	<i>ma'au'auā</i>	Hawaiian	6	no	47	male	married
Kaunamano	<i>mahi'ai & kālepa</i>	Hawaiian	14	yes	34	male	married
Haalilio, A W	<i>mahi'ai & kālepa</i>	Hawaiian	10	yes	48	male	widowed
Kaholoaa, Sol.	<i>mahi'ai & kālepa</i>	Hawaiian	8	yes	49	male	married
Kiha, Moke	<i>mahi'ai & kālepa</i>	Hawaiian	13	yes	49	male	married

These data suggest that by the end of the nineteenth century *poi* production in Waipi'o had moved from strictly household production and consumption to a commercial operation regularly employing men and women in various gender-based stages of production and distribution. With the exception of Ah Chock listed as manager of the Waipio Poi & Taro Company in 1899, the directory and census data do not make clear how many other *poi* factories were in operation or whether *poi* continued to be produced on individual farms by some combination of family members and hired workers.

EXPANSION AND EARLY MECHANIZATION OF THE POI INDUSTRY (1900–1940s)

At the start of the twentieth century, commercial *poi* production was still a fledgling industry. Few factories operated, but by the second decade new technologies were used to produce *poi*, factories were more common, and *poi* production was regulated. On Hawai'i Island changes in *poi* production, in particular in Waipi'o Valley, mirrored changes going on in larger centers of production on O'ahu, as well as Maui and Kaua'i.

Scientific studies of *kalo* in the early part of the century provided not only the impetus for and means to develop new products and new markets, they provided a wealth of information about the food value of *poi* (Allen and Allen 1933; MacCaughey 1917; MacCaughey and Emerson 1913, 1914; Potgieter 1940). These studies repeatedly revealed that *kalo*, most commonly eaten as *poi*, attributed greatly to the excellent health of the Hawaiians observed by early foreigners. Because *kalo* and *poi* are easily digested, they were often recommended for invalids, infants, and the aged.

The best known brand of *kalo* flour at the turn of century was "Taroena" or "Taro Ena." Directions for its use for infants or invalids are provided by MacCaughey and Emerson (1914:201, 204). A dried meal called "Mi O Na" was also produced and marketed on the Mainland at the turn of the century (Allen and Allen 1933:6; Greaney, *Honolulu Advertiser*, 1958:p. C6, col. 1); this amounted to only a very small percentage of the *kalo* exports (MacCaughey and Emerson 1913:189). These products failed to obtain sustainable economic markets, as did a *kalo* cracker and a macaroni product called "Taro Maloo" produced by E. H. Bailey of Wailuku, Maui (Allen and Allen 1933:6; Greaney, *Honolulu Advertiser*, 1958:p. C6, col. 1). The *kalo* flour business was revived in the 1920s with a product called "Taro Mano," which won a silver medal in the 1928 Southwest Pacific Exposition at Long Beach, California (Allen and Allen 1933:6; Greaney, *Honolulu Advertiser*, 1958:p. C6, col. 1).

Early in the twentieth century commercial *poi* factories were often small, partially mechanized operations. Most commercial *poi* made in Honolulu and its vicinity were from wetland *kalo*, although some consisted of a mixture of wetland and dryland *kalo* (Allen and Allen 1933:6). Machine-made *poi* involved washing the corms, boiling them in large drums by means of live steam under pressure, and women hand peeling them under sanitary conditions.

The peeled corms were then passed through a mechanized grinder (in place of traditional pounding) and water was added as needed. The *pa'i 'ai*, of uniform consistency, was removed from the grinder and placed in small barrels, ready for sale (MacCaughey 1917; MacCaughey and Emerson 1914).

The first *poi* factory on O'ahu to install a machine for grinding *poi* reportedly was the Kalihi Poi Factory, erected between 1890 and 1898. By 1933 practically all of the factories operating on O'ahu appear to have had grinding machines (Allen and Allen 1933:9).

The *poi* factory operated by Judge W. L. Wilcox at Kalihi on O'ahu is described in 1901 as the largest. "A paint grinder, such as is used at the large paint factories on the mainland, is run by steam power and substitutes the manual labor of pounding and kneading" (*Paradise in the Pacific*, 1901, 14(11):13). A Chinese-operated *poi* shop only required the proprietor to have a wooden tray and a stove. A square piece of white cloth waving from a small pole over the front door signified that *poi* was manufactured and sold within. The Chinese "make all the *poi* that does not come from the factory. It retails for about 25 cents a gallon" (*Paradise in the Pacific*, 1901, 14(11):13-14). "Some *poi* is sold to Hawaiian families and cheap restaurants in five-gallon wine kegs at one dollar each" (*Paradise of the Pacific*, 1904, 17(8):17).

A 1930 description of the Oahu Poi Factory, the largest on O'ahu, reveals that owner Wo Nin employed eight men and produced 6,000 pounds of *poi* daily. The factory operated two large boilers, each capable of holding 60 sacks of *kalo*, and two large grinding machines. Four delivery trucks were kept running carrying 12- to 16-pound muslin bags of *poi* for market. The *kalo* was steamed over a wood oven, cleaned with cold water, and carefully scraped and pared. It was then put through a grinder made in Philadelphia. After being stored overnight, the paste was poured onto a *poi* mixing board and churned with a little water (*Honolulu Star Bulletin*, November 22, 1930, p.1, 3; *Journal of the Pan-Pacific Research Institution* 1933, 8(2):13). The Kumalae Poi Factory, then operated by Chu Ting, employed three men in 1930. The Sun Lee Poi Factory, formerly the O. K. Poi Factory, was now under the operation of Chun Fok (*Honolulu Star Bulletin*, November 22, 1930, p.1, 3).

Earliest *Poi* Factories in Waipi'o Valley

Business directory listings from the late nineteenth century and early twentieth century, 1910 census data, historical maps, and oral histories provide information about the earliest *poi* factory operations in Waipi'o Valley. Directories indicate that Waipi'o Valley had only two *poi* companies in operation at the turn of the twentieth century, Waipio Poi & Taro Company (managed by Ah Chock) and See Lee Poi Company (managed by See Lee) (see Table 16). However, the directory listings for *poi* manufacturers and dealers indicate more people were involved in *poi* manufacture. Although no formal company name is listed with their operations, at least five other people were making *poi* for commercial markets between 1896–1901: Ah

Chong, Ahapa, Ah Hop, George Alike, and Ah Keona (see Table 15).

Census data from 1910 provides additional information about people involved in occupations related to commercial *poi* production (Table 18). Under industry, *poi*-related activities include: *poi* factory, taro culture, and taro factory. Under trade, occupations listed include: worker on taro, laborer, farmer, work hand, shop hand, and *poi* maker. As in the 1890 census data, a similar gender division of labor is evident. The eight *poi*/taro factory work/shop hands are all females ranging in age between 18 and 53 with an average age of 36. Six of the eight are Hawaiian, one is Asian Hawaiian (Anna Thomas), and the other is a 53 year old Chinese woman, Mock Ah Sin. She is married to 60 year old Mock Chock (aka Akioka) who is listed as a taro farmer. Akioka is the same person who was listed in the 1890 census under the occupation of *kālepa'ai* or food merchant. He appears in later historic records as a *poi* factory owner (Wright 1914) and *poi* manufacturer (Polk-Husted 1912, 1914, 1917).

Table 18. 1910 Census Data for Waipi'o Valley *Poi*-related Occupations

Name	Industry	Trade	Ethnicity	Dwelling Number	Property Ownership	Age	Sex	Marital Status
Keawe, Malaeka	<i>poi</i> factory	worker on taro	Hawaiian	349	not listed	32	female	married
Thomas, Anna	<i>poi</i> factory	laborer	Asian Hawaiian	323	owns	38	female	married
Mock Chew	taro culture	farmer	Chinese	300	rents	35	male	married
Alama, Keahi	taro factory	work hand	Hawaiian	356	not listed	21	female	single
Keola, Rosa	taro factory	work hand	Hawaiian	356	not listed	30	female	single
Kahimoku, Kaaka	taro factory	shop hand	Hawaiian	374	not listed	18	female	single
Kawaialoha, Mary	taro factory	shop hand	Hawaiian	389	rents	51	female	married
Mock Ah Sin	taro factory	shop hand	Chinese	298	not listed	53	female	married
Poomaikai, Kauoha	taro factory	shop hand	Hawaiian	378	owns	44	female	married
Kawaguchi, Matsudo	taro factory	<i>poi</i> maker	Japanese	358	rents	35	male	unknown
Lum Bing Wing	taro factory	<i>poi</i> maker	Chinese	364	rents	33	male	unknown
Wah Him	taro factory	<i>poi</i> maker	Chinese	364	rents	38	male	unknown
Mock Wo	taro factory	farmer	Chinese	299	rents	19	male	married

All five taro factory *poi* makers or farmers listed in the 1910 census are male Asian immigrants. Four of the five are Chinese, the other is Japanese. They range in age from 19–38 with an average age of 32. Two of the taro factory *poi* makers, Lum Bing Wing and Wah Him, are renters in the same household (#364) along with Sing Wo who heads their partnership. Although Sing Wo is listed in the 1910 census with the occupation of field laborer on a rice

farm, he later appears in business directory listings, first as the owner of the Sing Wo Poi Company in Hilo between 1916–1917 and later as owner of the Sing Wo Poi Factory in Hilo between 1933–1942 (see Table 16). Another notable person is Mock Chew (aka Ah Chew Mock) who is listed as a 35 year old married male with the occupation of farmer involved in taro culture. He is the younger brother of Akioka. Mock Chew's name appears intermittently over the next 40 years as a prominent figure in Waipi'o Valley *poi* manufacture (ESOHP 1978:C-19).

Wright's 1914 map of Waipi'o Valley for Bishop Estate provides additional data on early *poi* factory operations in Waipi'o Valley. Sometime prior to 1914 four *poi* factories were established in Waipi'o Valley in the Nāpo'opo'o area on LCA 10782, Lot 1, which was awarded to Papau in the Māhele on October 17, 1848 (Wright 1914) (Figure 17). At that time the parcel was owned by John A. Maguire and leased to Akaka (Lebo et al. 1999:37). The structures do not appear on a map of this parcel drawn over thirty years earlier (Emerson 1881).

The 1914 map shows Factories #1 and #4 as having the most elaborate drain systems running from the northeastern corner of each structure (Figure 18). A flume entered the east wall of Factory #4 from a line that branched off a water line that ran along the west side of the Rice

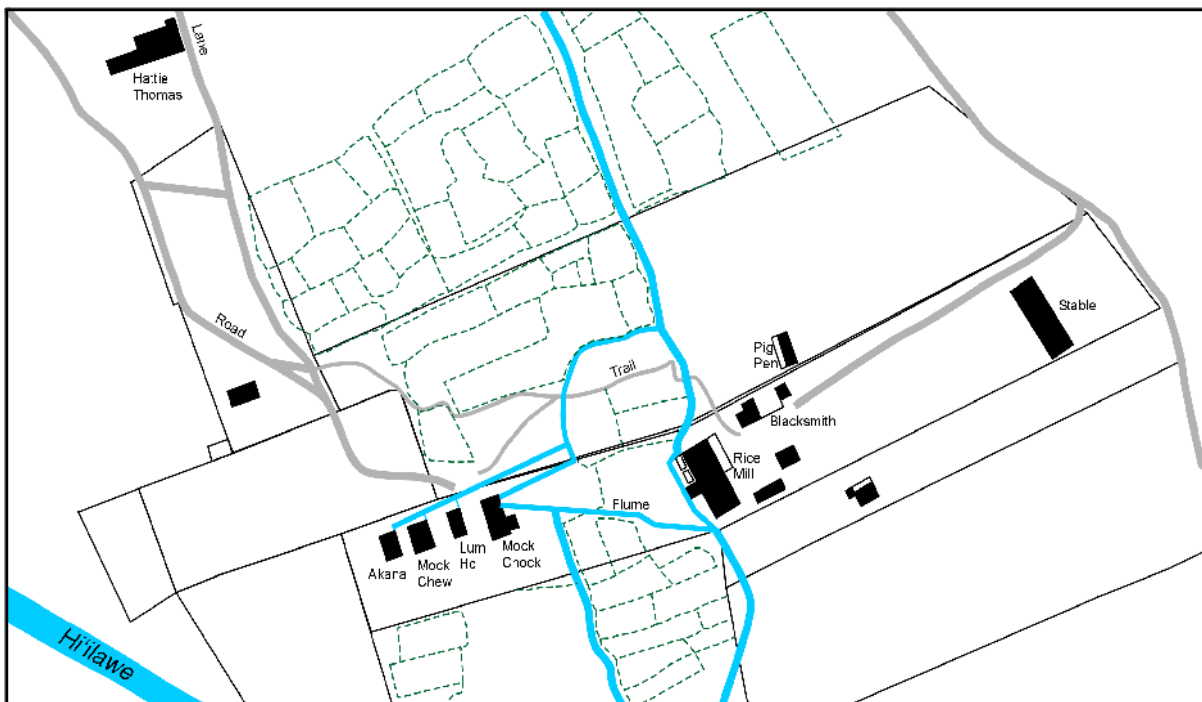


Figure 17. *Poi* factories in Nāpo'opo'o, Waipi'o Valley (adapted from Wright 1914).

Mill, east of the *poi* factories. Factories #2 and #3 had smaller drains on the northeast corner of their buildings that ran north and connected to the drainage running east from Akona's factory (#1). The configuration of flumes and drains shown on the 1914 map may reflect changes that

were made in 1911 to comply with the Session Laws regulating *poi* manufacturing. It should not be assumed that the configuration illustrated on the 1914 map is the original design.

While it was originally thought that the factories were established on this site in or shortly after 1911 in compliance with the Session Laws, Act 77 in Section 3, regulating *poi* manufacturing (see below), recent mapping of the ruins of the *poi* factories by a three-person survey crew on December 12, 1999, noted two dates carved in concrete blocks at the front of the foundation ruins of Factories #2 (Aug 2_, 92) and #3 (July 24, 92). If this information accurately reflects when the buildings were first constructed, then their operations pre-date the first business directory listings for commercial *poi* manufacture in Waipi'o Valley by several years.

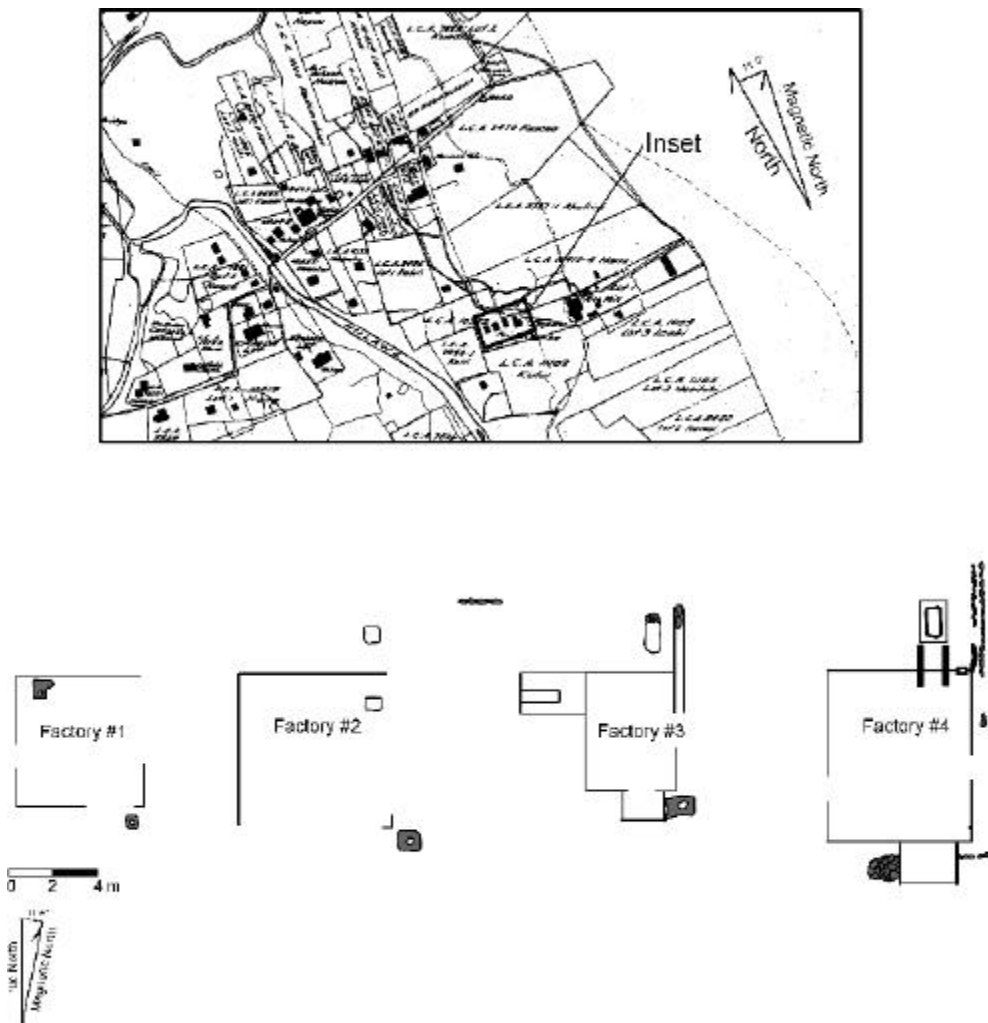


Figure 18. Ruins of *poi* factories in Nāpo'opo'o, Waipi'o Valley as they are today.

Wright's 1914 map includes notations as to who owned/operated the factories at that time. It lists Akona (aka Akana) as owner of Factory #1, Mock Chew as owner of Factory #2, Lum Hoe (aka Lum Ho) as owner of Factory #3, and Mock Chock (aka Akioka) as owner of Factory #4. If some or all of the factories were constructed in the 1890s, over 20 years earlier, it is quite possible that the ownership changed over the intervening years. This is suggested by the changes in conveyances and

leases recorded for the parcel between 1883 and 1915 (Lebo et al., 1999:37–38). It seems unlikely that Mock Chew, for example, would have been the owner of Factory #2 if it was built in 1892 as he would have been 17 years old at the time. His older brother Akioka (aka Mock Chock) may well have been the original owner, however. Oral histories indicate that Mock Chew bought his



first *poi* factory from his older brother, Akioka (Table 18). Mock Chew's son, Samuel,

Figure 19. Mock Chew's second *poi* factory in Waipi'o Valley, 1978 (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

described it as being an "old, broken down *poi* shop" (ESOHP 1978:883). He noted that water was piped into the structure from Hi'ilawe stream and engines were used to run the machinery. Samuel Mock Chew recalls that it was operated for approximately four years and the building was abandoned and operations transferred to a new structure built on the family property (ESOHP 1978:889). The new structure was still standing at the time of the oral interviews in 1978, although it had not been used to produce *poi* for some years (Figure 19). It is possible that the "old *poi* shop" Samuel Mock Chew is referring to is Factory #2 as indicated on the Wright's 1914 map.

The oral interviews provide useful information about the configuration and operation of the small *poi* factories in Waipi'o. *Poi* was produced in small, often single room buildings. The *kalo* was cooked in a big wooden box with an iron bottom. The box was air tight and the heat was provided by firewood gathered from the hillsides (Kāne 1994:8; ESOHP 1978:215). Nelson Chun recalled that while the majority of the individuals working in the *lo'i kalo* were Chinese, lots of Hawaiians pounded *poi*. He remembered one Hawaiian man still working in Akioka's *poi*

Table 18. Poi Manufacturers mentioned in Waipi'o Valley Oral Histories, 1978

Poi Manufacturer	Owner/Manager	Island	City	Years Listed in Directories
Ah Hee Poi Shop (Factory)	Tuck Lee Chang	Hawai'i	Hilo	1957–1971
Ah Puck Family Poi Factory		Hawai'i	Waipio	not listed
Ahana Poi Factory	Ahana Chang (aka Chang Hung)	Hawai'i	Waipio	1933–1942
Akioka Poi Factory	Ernest A. Akioka	Hawai'i	Waipio	1912–1914, 1924–1942
Haleiwa Poi Factory		O'ahu	Haleiwa	1947–1948
Hilo Poi Factory	Mrs. Mae Higashi	Hawai'i	Hilo	1941–1979
Honokaa Poi Factory	Fred Olepau's father	Hawai'i	Honoka'a	not listed
Honolulu Poi Company, Ltd.	Ernest Tottori (current owner)	O'ahu	Honolulu	1916–1935, 1946–?
Kailua Poi Factory		Hawai'i	Kailua-Kona	not listed
Kapoho Poi Factory		Hawai'i		not listed
Ka'u Poi Factory		Hawai'i	Ka'ū	not listed
Kona (Sakai) Poi Factory	George I. Sakai	Hawai'i	Kealakekua	1931–1964
Lehua Poi Factory		O'ahu	Honolulu	not listed
McCabe's Poi Factory		O'ahu		not listed
Mock Chew Poi Factory	Mock Chew	Hawai'i	Waipio	1912–1914, ?–1954
Molokai Poi Factory		Moloka'i		not listed
Oahu Poi Factory	Wong Nim	O'ahu	Honolulu	1914–1942
Ohana Poi Factory		Hawai'i	Kona	not listed
Ono Ono (Kaneshiro) Poi Shop	Seiko Kaneshiro	Hawai'i	Kukuihaele (Waipio)	1962–1974
Poi Shop	Kigashi	Hawai'i	Kona	not listed
Kona Poi Factory	Jas K. Sugai	Hawai'i	Keauhou	1960–1964
Puna Poi Factory		Hawai'i	Puna	not listed
Pueo Poi Factory and/or Shop	Leslie (Ahana) Chang	Hawai'i	Hilo	1954–1994
See Wo Poi Factory		O'ahu	Honolulu	1921–1948
Waiahole Poi Factory		O'ahu	He'eia, Kāne'ohe, Honolulu	1937–1942
Waimea (later Kalihi) Poi Mill	Masato Yokotake	O'ahu	Honolulu, Kalihi	1930–1948
Waipio Taro Cooperative	Ginji Araki and Edward Loo	Hawai'i	Waipio	not listed
Waipio Taro Growers Association Poi Factory	Merrill Toledo	Hawai'i	Waipio	not listed

factory after traditional pounding was replaced by a grinding machine. Käne (1994:8) recalled that his father also hired individuals to pound *poi* in a traditional manner. When labor became hard to get and after hearing of the successful use of a sausage grinder and grist mill in a Honolulu *poi* factory, his father bought a water-powered grist mill for his factory. Later, he purchased a kerosene engine to power it.

Leslie Chang (aka Leslie Ahana) reported that his family used a Model-T truck engine to operate the *poi* grinder in their factory and, because it did not work reliably, they replaced it with a gear engine. Instead of removing the engine and placing it in the factory, a garage was built to house the truck and a pulley was attached to the rear wheel. An engine was purchased from Sears Roebuck in the late 1930s (ESOHP 1978:100).

Additional ethnohistoric and historical archaeological research is needed to answer questions regarding the building sequences for these early *poi* factory structures, and changes in the configuration of the *poi* factories' operations through time. This information would be particularly enlightening because the dates of construction and operation of these factories span the time when significant changes were occurring in the manufacturing techniques for *poi* both in smaller-scale operations like in Waipi'o Valley and in larger factories like some of those in Honolulu.

Early Regulation of *Poi* Factories

Poi making became regulated by law in 1911 with the passage of Act 77 in Section 3 of the Sessions Laws, which was revised in 1925. General sanitary measures were enforced by *poi* inspectors who regularly visited the factories (Allen and Allen 1933; *Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1). Two *poi* samples were collected monthly from each city factory and once every three months from the country factories. The samples were submitted to the food commissioner for residue and solidity analysis. *Poi* dealers and restaurants serving *poi* also were subjected to inspection at intervals (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1).

According to Chapter 78, pp. 461-462, Sec. 1011, *poi* may not be manufactured in unauthorized factories. Section 1012 stipulates:

“every such shop or building shall be laid with cement floors, with cement walls to a height of at least two feet and draining to a trap connected with a cesspool, sewer, or such other means for the proper disposal of drainage, as may be approved by the board of health. No such shop or building shall be maintained, used or operated in any place where there is not available an adequate supply of pure water, or which is incapable of proper drainage, or which is so situated that the *poi* or *paiai* manufactured thereat might, in the opinion of said board, be contaminated or infected by reason of proximity to any stable, laundry, abattoir or other place at which any business or process is carried on or condition maintained which, in such opinion, might be a source of such contamination or infection . . . No such shop or building

shall be maintained, used or operated for any other purpose than the manufacture of poi or *paiai*; nor unless only pure water shall be used thereat and proper drainage maintained thereof; nor unless it shall be kept so screened as to prevent flies and insects from entering therein; nor unless all implements, tools, machinery, containers, and all other utensils used for or in connection with the manufacture, distribution or storage of poi or *paiai* shall be sterilized each time before being so used . . ." (Allen and Allen 1933:28)

Practically all operating *poi* factories on O'ahu in 1932 used machines for grinding *kalo*, but hand crushing and hand grinding were not uncommon (Allen and Allen 1933:9-10, 27-28). Traditional Hawaiian *poi* making was strictly governed by rituals and rules of behavior. "Cleanliness in poi making was imperative, and until it became a commercial commodity, strainers were unknown" (Pukui 1967:428). These traditions were not observed in many commercial factories operated by non-Hawaiians. Hand grinding in factories was thought to be unsanitary. MacCaughey (1917:267) reported that "due to the unsanitary conditions under which hand-pounded poi is often made, many persons, especially Americans, prefer the machine-made poi."

Suggestions for improving the *poi* industry in 1932 included upgrading one-room factories into multi-room operations with different rooms for various stages of the manufacturing process. Under the conditions of the time, steaming, peeling, washing, crushing, and other preparations of *kalo* took place in a single small room (Allen and Allen 1933:28).

Factories on O'ahu in 1932 are described as steaming the *kalo* in a large boiler, some of which were capable of holding 60 sacks or more. The *kalo* was then rinsed with cold water, cleaned, scraped, and pared. Afterwards, it was ground in a grinder "especially manufactured on the mainland for the poi factories of Hawaii." Finally, it was placed on a *poi* mixing board where it was mixed with a little water (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1).

Coming during a *poi* shortage, efforts to pass a "*poi* bill" aimed at legalizing the sale of *poi* containing less than 30 percent solids failed in 1944. The bill was designed to make the city-county ordinance conform with Territorial regulations pertaining to *poi* quality (*Honolulu Advertiser*, August 21, 1944, p.5; *Honolulu Advertiser*, August 26, 1944, p.5). Opponents argued that passage of the bill would lower the quality of *poi* and reduce its food value. Poor quality *poi* was fed to pigs, so that lowering the standards would allow what currently was "pig food" to be sold to humans (Benyas, *Honolulu Advertiser*, July 7, 1944, p.7). *Poi* Inspector Charles Lui presented objections from various societies, claiming "the proposal was an insult to the Hawaiian people and a temptation to poi manufacturers who might profit more from sub-standard produce" (Benyas, *Honolulu Advertiser*, 1944:7).

***Poi* Production During the Depression and World War II**

In 1930, *poi* was as "the principal dish on the tables of thousands of Hawaiians just as it was

in the days before" Western contact (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1). *Poi* was also widely available; it was sold at most Honolulu markets for five to seven cents a pound (*Paradise of the Pacific*, 1930, 43(10):12). Markets also occasionally sold traditional Hawaiian dishes, such as *luau* (leaves) and *haha* (stem).

In 1932, 15 varieties of dryland or Japanese *kalo* and 32 varieties of Hawaiian or wetland *kalo* were being cultivated:

"Among those being used by factories are *piialii*, *pikokea*, *piko*, *hapuupuu*, *makapio*, *ipuolono*, *kaolea*, *kaielele*, *laulea*, *haakea*, *apuwai*, *palai'e*, and *lehua*. The common red poi, made from the *piialii* variety instead of from the *lehua* variety as is generally thought, is the most popular product in the factories" (Allen and Allen 1933:4).

Poi consumption began to decline after 1930, a trend that is thought to reflect the lower prices of rice and flour, the Americanization of the younger generation of Hawaiians (Allen and Allen 1933:10), and the Depression (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1). In addition, the expansion of *kalo* cultivation following the decline of rice helped create an overabundance of *kalo* relative to consumer demands. *Poi* inspector, Charles Liu reported in 1932 that:

"rice is cheaper than poi and so people living on a small budget have turned from poi to rice. . . the prevailing price of taro since last April was \$1.25 to \$1.40 per bag. Retail prices of poi were from 32 to 40 pounds of poi for \$1 cash at the factory or dealer, with the choicest quality selling 25 to 30 pounds for \$1." (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1).

Figures provided by the O'ahu *poi* inspector indicate that from January to July 1932, rural district factories manufactured 92,175 pounds of *poi* and the city factories produced 3,017,283 pounds, compared to 3,113,109 pounds manufactured in the city during the same months of 1931. The Oahu Poi Factory, the largest on O'ahu, produced 231,00 pounds of *poi* in August, 1931. The second largest, See Wo Co. averaged between 100,000 and 125,000 pounds per month. The average 1932 monthly production of *poi* by the 13 O'ahu factories varied between 2,500 pounds at the smallest factory to 162,710 pounds at the largest. The average production by month for these factories was 517,540 pounds, averaging 20,700 per working day (Allen and Allen 1933; 9-10; *Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1).

Nine *poi* factories operated in Honolulu in 1932; six were operated by Chinese, and one each by a Chinese-Hawaiian, a Japanese, and a Korean. The country districts had four *poi* factories, two at Laie operated by Hawaiians, one at Waialue operated by a Japanese, and one at Kailua operated by a Chinese (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1). In Honolulu, *poi* could be purchased to take home from 127 establishments. Seventy-seven cafes and restaurants served *poi*, along with two hotels. The rural districts of O'ahu reported 16 dealers, one cafe, and one restaurant providing *poi* (*Honolulu Star Bulletin*, September 3, 1932, Sect.3, p.1).

Hawaiian Taro Products, Ltd. was established as a manufacturing enterprise in 1937 by a local industrial group to develop and commercially market various *kalo* products. The major products were *kalo* flour, *kalo* beverage powders, *kalo* cereals and *kalo* infant and invalid foods. The flour and beverage powders were marketed under the trade name "TA RO CO" (*Hawaiian Annual for 1938*, p.96-97). Some of these products were successfully used in Mainland hospitals. *Kalo* flour replaced 15 to 20 percent of the wheat flour in bread and other bakery products in other markets (Potgieter 1940:538-539).

In 1938, sample servings of *kalo* products were offered at a special table in the cafeteria at the Department of the Interior, Washington, D.C. This was an experiment to establish *kalo* products, developed through research by food chemists in Hawai'i, in mainland markets. The Department of the Interior was attempting to assist farmers in Hawai'i to become more self-sustaining through incentives provided by expansion into mainland markets (*Honolulu Advertiser* 1938a:1, 6). Increased costs of field labor, along with product research and advances in the manufacture of *kalo* flour, *kalo* chips, and other products, however, increased competition among producers and *kalo* prices rose over one hundred percent in less than a year (Fullaway 1938:56).

During World War II, the Office of Price Administration (OPA) declared only a fraction of Kauai's *poi* as surplus, allowing it to be shipped off island. When these wartime controls were lifted, *kalo* could be shipped in unlimited quantity. With more lucrative markets in Honolulu, Y. Yokotake, the owner of the Waimea Poi Factory began shipping his *kalo* there. The other two factories, both small, closed. Yokotake's factory which manufactured about 90 percent of the *poi* for wholesale distribution, survived because of his investment in a Honolulu *poi* factory and his ability to ship his *kalo* or *poi* to Honolulu. The ceiling price for *kalo* on Kauai at the time was \$3.35 a bag, while in Honolulu it was \$3.60. The ceiling price on *poi* was 10 cents a pound on Kauai and 13 cents a pound in Honolulu. These price differences more than offset the shipping charges (Purdy 1946, *Honolulu Star Bulletin*, April 25, 1946, Front Page).

CHANGING POI INDUSTRY (1950s–1990s)

In 1948, the acreage under *kalo* in the valleys of Waipi'o, Hanalei, Keanae, and Wailua exceeded by a small amount the total *kalo* acreage of O'ahu. *Kalo* was grown in the valleys of Mānoa, Kalihi, Kāne'ohe, Kahuluu, and Kapalama, and on the flatlands of Moili'ili-Pawaa. Urban encroachment decreased this acreage as *lo'i* were replaced by residential and commercial development (Begley 1979:2).

In an effort to weather the volatile *kalo* market characterized by periods of shortages and gluts, with corresponding price fluctuations, the Honolulu Poi Factory began producing *kalo* flour. Owned by the Tottori family, the factory turned out nearly 100 tones of flour a year, virtually all of which went into *kalo* bread. Flour had the advantage that unlike *poi* it could be stored without refrigeration and when manufactured in periods of surplus, it could be marketed year round (Greaney, *Honolulu Advertiser*, April 20, 1958).



Figure 20. Merrill Toledo weighing sacks of Waipi'o Valley *kalo* before shipping to market (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

In the 1950s, the Tattori's reported they still used water buffalo in their *kalo* fields because they were more maneuverable than tractors (*Honolulu Advertiser*, April 20, 1958). Field tending and harvesting included the use of wooden sticks or poles, similar to traditional 'ō'ō digging sticks to pry the *kalo* loose during weeding, and a machete or broad knife to cut the stalk and leaves. After harvesting, the *kalo* was put into large sacks and weighed (Figure 20). It was subsequently loaded into trucks and delivered to agents of processing factories, or a local processor, or a trucker. Some of the *kalo* in Waipi'o Valley continued to be loaded onto the backs of mules (Begley 1979:15-17) (Figure 21).

In 1958, 10 million pounds of *kalo* were harvested. About 6 million pounds were processed into *poi* and sold in the islands. About 106,000 pounds of *poi* were exported to the Mainland (Miller, *Honolulu Star Bulletin*, February 21, 1960:3).

A May 10, 1959 report in the *Honolulu Advertiser* reported that flooding in Waipi'o Valley in November of 1958 had led to a *poi* shortage. Several factories were affected. In Hilo, the Puueo Poi Factory had to ration *poi* to retailers and the general public. It was unable to continue



Figure 21. Ted Kaaekuahiwi leading mules carrying sacks of *kalo* to the truck loading platform in the town of Kukuihaele outside Waipi'o Valley (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

to supply the Honolulu and Mainland markets. The Waipio Poi Factory closed in February of 1959 and the Hamakua Poi Factory closed in May of 1959 (*Honolulu Advertiser*, February 21, 1984:120).

Heavy flooding in Waipi'o Valley again in 1963 washed out the road and led to reports that *poi* costs likely would rise. Nearly half of the *kalo* patches were destroyed in the flooding. Similar flooding inundated *kalo*

fields on Kaua'i. The Puueo Poi Factory in Hilo had difficulty keeping up with demand (*Honolulu Star Bulletin-Advertiser*, November 10, 1963, p.1). A *poi* shortage in the markets was again reported in 1967 (ESOHP 1968:C-31). In 1972 another flash flood hit Waipi'o Valley. Samuel Mock Chew's truck load of *kalo* was caught in the rising waters of the stream, damaging the crop and his truck (*Honolulu Star Bulletin*, September 1, 1972, p. A13:1).

In the 1970s, commercial growing of wetland *kalo* was concentrated in four lowland river valleys with year-round supplies of water: Waipi'o, Hanalei, Ke'anae, and Wailua. It was found also in two or three smaller valleys on Kaua'i and Maui. These valleys are distant from market centers, requiring *kalo* to be loaded into sacks and trucked out of the valleys where it is grown. The *kalo* was shipped to local processors who made *poi*, to neighbor islands, or to O'ahu (Begley 1979:2, 4). Over 60 percent of the *kalo* grown on Kaua'i, Hawai'i, and Maui was shipped to O'ahu for processing into *poi* (Begley 1979:16).

Modern dryland *kalo* cultivation lends itself more readily to large-scale commercial production, with such *kalo* being suitable for baking, steaming, and making *kalo* chips, *kalo* bread, and *kūlolo*. *Kūlolo* is a semi-hard, sweetened product made from *kalo*, coconut, and sugar (Begley 1979:5, 25, 27).

In 1979 less than 150 farmers were commercially growing *kalo* on approximately 500

acres. Most were Asian or part-Asian and utilized both traditional Hawaiian and modern cultivation methods and equipment (Begley 1979:7-8). Among the equipment introduced from rice paddy agriculture in Japan after World War II were riding tractors or walking rotovators. They were used in the initial preparation of commercial *lo'i*. Walking rotovators were used less frequently in Waipi'o Valley on the Island of Hawai'i than in the Hanalei and Hanapēpē Valleys on Kaua'i. They were infrequently used on Maui, which was characterized by smaller *lo'i* (Begley 1979:8).

In the first half of the twentieth century processing techniques used by large- and small-scale commercial *poi* factories were relatively similar. The primary distinction between early commercial *poi* factories was the size of the labor force used to produce *poi*. Once operations were mechanized with motors used to power grinders, most factories, large or small, employed the same basic technology for cooking and grinding *poi*.

In the second half of the twentieth century, however, larger operations had access to sufficient capital to purchase new equipment that sped the process of cooking and grinding *kalo* into *poi*. For example, in 1958 at one of the largest commercial *poi* operations, the Honolulu Poi Company, in Kalihi, O'ahu, they operated a six-ton capacity pressure cooker that reduced the cooking time to an hour and a half. The manager, Ernest Tattori noted that the "old-style open box for cooking taro, with water and steam coils providing heat from underneath, takes 11 hours and doesn't kill as much bacteria as an enclosed cooker." Washing and peeling continued to be done on an assembly line. A converted meat grinder was used to grind the *kalo*, which was then strained in a converted laundry extractor and finally packed in polyethylene bags. The finished *poi* was shipped to Hawaiian stores, Mainland distributors, and construction workers on Guam and Midway. The factory was the only *poi* factory producing *kalo* flour and was the largest of eight *poi* factories operating on O'ahu at the time (Greaney, *Honolulu Advertiser*, April 20, 1958).

In contrast, smaller operations employed fewer people and used equipment similar to what was used since the first half of the twentieth century. For example, the Ono Ono Poi Factory in Kukuihaele, Hawai'i, was started by Seiko Kaneshiro in the 1960 and used a high proportion of manual labor to produce its *poi* (ESOHP 1978:740). Gradually, Mr. Kaneshiro bought some new and second hand equipment that helped automate the process and shorten the production time. For instance, over the years he purchased a peeler, new stainless steel grinder parts, and a packaging machine (ESOHP 1978:740). Initially the factory employed two workers in addition to Mr. Kaneshiro. In the first few years more manual labor was involved and the crew

would work up to 10 hours to manufacture 1,000 pounds of *poi* from 10 bags of *kalo* corms. They would produce between 2,000–4,000 pounds of *poi* in two to four days a week, depending on the demand (ESOHP 1978: 742). Mr. Kaneshiro would deliver the *poi* to Hāmākua and Kona, as well as sell freshly harvested *kalo* corms from his *kalo* patches in Waipi'o Valley for delivery to the Hilo Poi Factory.

The factory was in a small wood-framed building with a concrete slab foundation. The building design was modeled after the Hilo Poi Factory run by Mrs. Mae Higashi until the late 1970s (ESOHP 1978:740). Machinery was set up around the main room to systematically process the *kalo* through each manufacturing stage. The raw *kalo* corms were dumped out of their bags through a chute on the side of the building (Figure 22). The chute funneled the dirty corms into a machine connected to a water line that washed the corms. A door was opened on the side of the machine to allow the cleaned corms to drop down into a large metal bucket. The bucket of washed corms was transferred to the cooker/steamer. Between 10 and 20 bags of *kalo* corms were cooked for about four hours in the morning then left to steam over night (ESOHP 1978:746). Corms were lined up on shelves inside the large wooden or metal cook box (ESOHP 1978:884).

The next morning the processing began. The cooked corms were put through the automatic peeler to remove the skin (ESOHP 1978:748). Peels were separated into a bag; full bags were emptied into a slop can and dumped outside (ESOHP 1978:987). The corms were then put into long stainless steel sink with water (Figure 23). Additional hand-peeling, to scrape the black spots and get the corms clean in preparation for grinding, was then done (ESOHP 1978: 748). The corms were transferred in batches to a stainless steel bin and directed down into the electric motor-driven grinder (ESOHP 1978:884). Water was added to make the mix thinner so that it flowed (Figure 24). The *poi* was transferred into a strainer machine and then put into a long stainless steel sink that held “about 450 pounds of *poi*” and the workers mixed it to give it an even texture (ESOHP 1978:740) (Figure 25). The *poi* was then transferred to a large bucket that

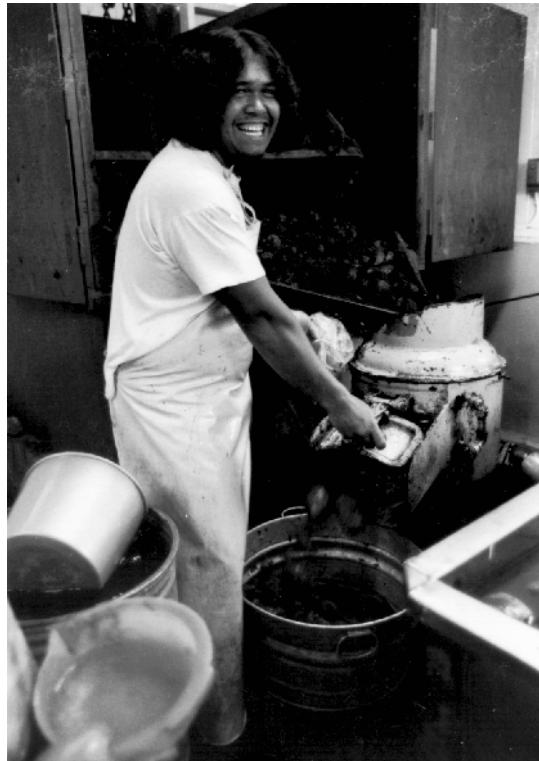


Figure 22. Robert Revilla washing *kalo* corms before cooking (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).



Figure 23. Robert Revilla washing *kalo* corms; foreground has stainless steel trough with cleaned corms (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

By 1988, the State Agricultural Statistic Service reported a total of 68 *kalo* farms on the Island of Hawai'i, producing 1.25 million pounds of *kalo* valued annually at \$465,000 (*Hawaii Tribune Herald*, September 18, 1988, p.20). Flooding from a December rainstorm in 1987 caused moderate to serious damage to many *kalo* fields in Waipi'o Valley, but this was a short-term loss with production soon recovering. Chinese or dryland *kalo* prices averaged 41.6 cents, the highest price on record (*Hawaii Tribune Herald*, September 18, 1988, p.21).

was hoisted on a chain from the ceiling and positioned over a funnel above the packaging machine (Figures 26 and 27). As a check on the packaging, the workers weighed the bags of *poi* before packing up for shipping to customers (Figure 28). The Ono Ono Poi Factory ceased operations not long after the Ethnic Studies Oral History Project was completed in 1978.



Figure 24. Seiko Kaneshiro grinding cooked and peeled *kalo* corms (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).



Figure 26. Strained *poi* transferred to bucket suspended above packaging machine funnel (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).



Figure 27. *Poi* packaging machine (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).



Figure 28. Workers checking weight of bags prior to shipping (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

In 1990, the U.S. Army Corps of Engineers announced that a recently issued general permit authorized restoration of any place where there was evidence (e.g., berms, dikes, 'auwai) that *kalo* was cultivated in the past (Command, *West Hawaii Today*, March 17, 1997). Also in 1990, weather, disease, the retirement of a key *kalo* grower in Waipi'o Valley, and the growing of Chinese *kalo* more suitable for making *kalo* chips resulted in less *kalo* for making *poi* (Witty, *Hawaii Tribune Herald*, June 20, 1990, p.1, col.1). The shortage resulted in empty shelves in local grocery stores.



Figure 25. Strained *poi* in stainless steel trough being mixed before packaging (photograph courtesy of the Center for Oral History, University of Hawai'i at Mānoa).

Today there are at least 13 commercial *kalo* processors and millers, and the Honolulu Poi Company, Ltd., now known as HPC Foods, Ltd., is still the largest *poi* producer in the islands (Table 19). There are an additional seven commercial *kalo* chippers and producers of other *kalo* products in operation today on Kauai, O'ahu, Maui, and Hawai'i⁶. Innovations continue to be made to reduce the amount of time required to make *poi* and improve the sanitary conditions for its manufacture. Many of these companies are start-up ventures working on developing new products to market *poi* worldwide. *Poi* manufacturers continue to be challenged by threats to *kalo* crops, such as the blight that severely affected crop production in the 1970s. The future success of *kalo* farmers and the *poi* industry will depend on the ability of growers to produce a reliable supply for commercial producers to meet a growing market demand.

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See <http://www2.ctahr.hawaii.edu/misc/taro/> for more information.

Table 19. World Wide Web Listing of Commercial *Poi* Processors or Millers, 2000.

<i>Poi</i> Processors or Millers	City	Island
Aloha Poi Factory, Inc.	Wailuku	Maui
Haleiwa Poi, Inc.	Aiea	O'ahu
HPC Foods, Ltd.	Honolulu	O'ahu
Kapaa Poi Factory	Kapahi	Kauai
Ka'upena Ono Hawaiian Foods	Hilo	Hawai'i
Kona Ohana Poi	Honokua	Hawai'i
Makaweli Poi Mill, Inc.	Waimea	Kauai
Molokai Brand Poi	Kaunakakai	Molokai
Pa'i'ai Poi Systems	Hilo	Hawai'i
The Poi Company	Kalihi	O'ahu
PR Maui	Lahaina	Maui
Puueo Poi Shop	Hilo	Hawai'i
Waiahole Poi	Waiahole	O'ahu

SUPPLEMENT: VEGETATION SURVEY OF THE LOWER PART OF WAIPI'O VALLEY

INTRODUCTION

Through funding from the Native Hawaiian Culture and Arts Program (NHCAP) and the request from the Edith Kanaka'ole Foundation (EKF), the author was able to explore some of the lowland areas of Waipi'o Valley on 12–13 April, 17–20 June, and 10–13 December 1999. The goals of the survey were as follows:

- 1) To do a comprehensive walk-through inventory of the natural (native and weedy) vegetation of the front part of the valley (basically the inhabited part of the valley), concentrating on but not restricted to the following priority sites: a) area surrounding the Nāpo'opo'o *kalo* restoration site; b) areas surrounding Kia Fronda's and Uncle Billy's properties; c) coastal and wetland areas surrounding Paka'alana Heiau; d) roadside vegetation in the valley; and e) steep roadside vegetation leading down into the valley. Cultivated plants were not included unless they were also found growing outside of cultivation (i.e. naturalized).
- 2) To present this inventory as a list organized by botanical family and scientific name, along with Hawaiian/English common names (if available), status (native, Polynesian-introduced, naturalized), and habitat noted in. This is included as an appendix to this report.
- 3) To present an annotated listing of selected plants organized alphabetically by common name (Hawaiian names first, if available). This list includes simple plant descriptions to aid in identification (and in a number of cases a drawing or photo of the plant); the native geographical range of the plant; ethnobotanical uses here and elsewhere; and an indication of where these plants were seen in the valley.

VEGETATION HISTORY

The vegetation history of Waipi'o Valley in many respects mirrors that of the Hawaiian Islands in general. Through the period of Polynesian settlement and later Western contact, Waipi'o Valley has undergone the same kinds of profound vegetational transformations experienced by a variety of habitats throughout the Hawaiian Islands (see Cuddihy & Stone 1990).

This transformation did not result from callous misuse of the land. On the contrary, the wide, flat, gently sloping valley floor and abundant fresh running water made it a superb site for the development

of a thriving prehistoric *kalo*-farming community that supported a sizable population and was the seat of royalty. Historically, from around 1880 to the 1920s, rice was intensively cultivated in the valley (Lennox 1954).

It has been suggested that the original Polynesian settlers brought about 30 plant species to the Islands (Nagata 1985), and many of these (e.g., *noni*, *'ape*, *ki*, *kalo*, *niu*, *mai'a*, *'awapuhi*, *kukui*, *'ulu*, *'ōhi'a 'a*) are readily seen today in Waipi'o Valley. More common, though, are plants introduced since the rediscovery of the islands by Captain Cook. Many of these, such as common guava, strawberry guava, Christmas berry, ironwood, Java plum, rose apple, bulrush, and California grass, are aggressive species that have taken over much of the uncultivated land in the valley. Only a few native species, such as *hala*, *hau*, *māmaki*, and *koali 'awa*, can still be spotted on the valley floor.

Because the landscape has been so highly modified, reconstruction of the original vegetation relies much on speculation. Various sources and methods, though, can assist in re-creating a picture of past vegetation patterns; these include reviews of Hawaiian oral tradition sources (e.g., chants, mythology), historic archival sources (e.g., personal journals, histories, photos), and scientific studies (e.g., field survey reports, herbarium collections, analysis of pollen/wood/seed samples).

ORAL TRADITIONS

Because Waipi'o Valley had such a prominent role in Hawaiian prehistory, a lengthy oral tradition is associated with it. Plants mentioned in chants and mythology serve as the earliest form of documentation for the vegetation of the valley. Fornander (1916) tells of a great drought during which

“great famine was experienced over all the lands from Hawaii to Kauai, all the wet lands were parched and the crops were dried up on account of the drought, so that nothing even remained in the mountains. Waipio was the only land where the water had not dried up, and it was the only land where food was in abundance; and the people from all parts of Hawaii and as far as Maui came to this place for food.”

Fornander also recounts that the great high chief 'Umi “built large taro patches in Waipio, and he tilled the soil in all places where he resided.” So it is readily apparent that the valley was intensively cultivated from long ago.

HISTORIC ARCHIVAL SOURCES

Reports of early travelers in Hawai'i, such as William Ellis and Isabella Bird, provide tantalizing glimpses of the vegetation of Waipi'o at the time of their visits, primarily confirming that the valley floor was already largely cultivated. William Ellis (1963) in 1823 described valley walls that “were nearly perpendicular, yet they were mostly clothed with grass, and low straggling shrubs were here and there seen amidst the jutting rocks.” The valley floor he described as “one continued garden, cultivated with taro, bananas, sugar-cane, and other productions of the islands, all growing luxuriantly.” Workers

were seen carrying back “loads of sandal wood, which they had been cutting in the neighbouring mountains.” Isabella Bird (1964), viewing the valley from the *pali* above in 1873, described “a fertile region perfectly level...watered by a winding stream, and bright with fishponds, meadow lands, *kalo* patches, orange and coffee groves, figs, breadfruit, and palms.” On a hike to a waterfall, her group pushed “with eyes shut through wet jungles of Indian shot [*Canna indica*, *ali'ipoe*], guava, and a thorny vine.” She describes seeing “some very fine fig trees and thickets of the castor-oil plant” and she “rode among most extensive *kalo* plantations, and large artificial fish-ponds...and came back by the sea shore, green with the maritime convolvulus [probably *pōhuehue*, *Ipomoea pes-caprae* subsp. *brasiliensis*].”

Archival photos can be useful in tracking historic vegetation patterns. Older photos of Waipi'o show a coastal sand dune zone that is now largely occupied by common ironwood, as well as farmlands that are now overgrown.

SCIENTIFIC STUDY

All too often, the best a botanist can do when asked to speculate on the original vegetation of a long-altered site is to make an educated guess based on comparisons with similar but less altered sites. In the case of Waipi'o, the windward coast of Hawai'i has other similar broad valleys (e.g., Pololū, Waimanu), but they have both also experienced much vegetation alteration.

Similarly, the site can be compared with descriptions of plant communities in vegetation classification systems. One such system, published in the *Manual of the Flowering Plants of Hawai'i* (Wagner et al. 1999) describes 106 native and weedy Hawaiian communities based on a combination of elevation (coastal, lowland, upland, etc.), rainfall (dry, semi-wet, wet), and plant form (herbland, grassland, shrubland, forest), complete with a list of native and alien species typical of that vegetation type. Existing vegetation communities in Waipi'o can be placed in various of these categories, and remnant native plant species can sometimes be used as cues (“indicator species”) to predict which of the native vegetation communities might once have inhabited the area. In the lower part of Waipi'o Valley, for example, current vegetation communities include Hala Forest (p. 63 in the *Manual*), Common Ironwood Coastal Forest (p. 64), a disturbed Coastal Wet Sedgeland (p. 65), Hau Shrubland (p. 65), Kukui Forest (p. 83), Guava Forest (p. 84), and Alien Forest (p. 92). Of these, only the *hala* and *hau* are native vegetation types. Other native communities that may have existed there in the past—based on the environmental settings—include 'Aka'akai/Kaluha/Makaloa Sedgeland (p. 65), 'Uki Sedgeland (p. 86), semi-wet and wet forests dominated by 'ōhi'a and *koa*, Pāpala kēpau/Pāpala Riparian Forest (p. 83), and Māmaki Riparian Shrubland (p. 89).

Lennox (1954) classified the vegetation of the valley floor and noted 4 dominating overstory trees: common guava, *kukui*, monkeypod, and *hala*. In his report he noted the “nearly complete removal

of native vegetation from all areas suitable for cultivation or limited land use.”

Other methods of vegetation analysis that can provide more conclusive evidence of past vegetation cover—both spatially and through time—are the province of the palaeobotanist and palaeoethnobotanist. These include archaeological sampling, analysis, and identification of seeds, plant fragments, and wood from habitation sites, which can reveal economic plants used by the inhabitants; and pollen analysis of sediment cores, which can help reconstruct the vegetation history of an area once the strata are dated and pollen identified. Studies of these types have not been done in Waipi’o Valley. Those conducted in other sites have often provided fascinating and sometimes unexpected glimpses into an area’s past (for example, see Athens & Ward (1993) for their results in Kawainui Marsh, O’ahu). Because the best pollen sampling locations are in permanently waterlogged sites, where the lack of oxygen slows decomposition of pollen grains, the valley floor of Waipi’o provides an ideal study site.

RESULTS OF SURVEY

A total of 154 taxa were noted during the survey: among the native species, 4 were endemic and 13 indigenous (or possibly naturalized); there were also 124 naturalized (or possibly indigenous) species and 13 that were Polynesian-introduced (or possibly introduced in historic times). Thus, only 11% (17 of 154) of all plant taxa seen were native. The endemic, indigenous, and Polynesian introductions are enumerated below for ready reference.

(Endemic plants are defined here as those that arrived long ago and, cut off from their mother populations, have since evolved to become uniquely Hawaiian; *indigenous* plants also arrived here by natural means long ago, but are usually readily dispersible by ocean or seabirds (the case with many coastal plants) and are also naturally occurring in other parts of the world; naturalized plants have been introduced in historic times, either intentionally or accidentally, and are now reproducing on their own in the wild; Polynesian introductions include plants believed to have been brought by the original settlers.)

Endemic species

kikawaiö, kikawaioa, pakikawaiö (Christella cyatheoides)

māmaki, māmaka, waimea (Kaua’i) (Pipturus albidus)

nелеau, neneleau (Rhus sandwicensis)

‘ōhi’a, ‘ōhi’a lehua, lehua (Metrosideros polymorpha var. polymorpha)

Indigenous species

hala, pū hala, screwpine (Pandanus tectorius)

hau (*Hibiscus tiliaceus*)

huehue, hue, hue'ie, 'inalua (*Cocculus orbiculatus*)

kaluhä (*Schoenoplectus juncooides*)

koali 'awa, koali 'awahia, koali lä'au (Ni'ihau), *koali pehu* (*Ipomoea indica*)

naupaka kahakai, aupaka (Ni'ihau), *huahekili, beach naupaka* (*Scaevola sericea*)

pākahakaha, 'äkaha 'äkōlea (*Lepisorus thunbergianus*)

pala'ä, palapala'ä, pala'e, p'ä'ü-o-Pala'e (*Sphenomeris chinensis*)

pöhuehue, puhuehue, beach morning glory (*Ipomoea pes-caprae* subsp. *brasiliensis*)

sedge (no common name) (*Pycreus polystachyos* subsp. *holosericeus*)

uluhe, unuhe (*Dicranopteris linearis* forma *linearis*)

'ülei, eluehe (Moloka'i), *u'ulei* (*Osteomeles anthyllidifolia*)

wäwae 'iole, hulu 'iole, huluhulu a 'iole (*Palhinhaea cernua*)

Polynesian introductions

'ape, elephant's-ear (*Alocasia macrorrhizos*)

'awa, pü'awa, kava (*Piper methysticum*)

'awapuhi, shampoo ginger (*Zingiber zerumbet*)

'ihi 'ai, 'ihi 'awa, 'ihi maka 'ula, 'ihi mäkole, yellow wood sorrel (*Oxalis corniculata*)

kalo, taro (*Colocasia esculenta*)

kämole, alohalua, primrose willow (*Ludwigia octovalvis*)

ki, ti (*Cordyline fruticosa*)

kukui, kuikui, candlenut tree (*Aleurites moluccana*)

mai'a, banana (*Musa xparadisiaca*)

niu, lolani, coconut (*Cocos nucifera*)

noni, Indian mulberry (*Morinda citrifolia*)

'öhi'a 'ai, 'öhi'a, mountain or Malay apple (*Syzygium malaccense*)

'ulu, breadfruit (*Artocarpus altilis*)

Vegetation types

For the purposes of this survey, plants noted were placed in one of four vegetation categories, briefly characterized below.

1) Roadside vegetation along steep road at valley mouth. The road descending into Waipi'o Valley hugs a steep cliff face. Not surprisingly, this undevelopable zone yielded the most diverse vegetation and the highest percentage of native species. Native trees included neleau (*Rhus sandwicensis*), 'öhi'a lehua (*Metrosideros polymorpha*), and hala (*Pandanus tectorius*). Other scattered natives included the straggling shrub 'ülei (*Osteomeles anthyllidifolia*); the vines huehue (*Cocculus*

orbiculatus) and *koali 'awa* (*Ipomoea indica*), a morning-glory. Native ferns and fern allies included *pala'ä* (*Sphenomeris chinensis*), *uluhe* (*Dicranopteris linearis* forma *linearis*), and *wäwae 'iole* (*Palhinhaea cernua*). Still, the vegetation was primarily a non-native mix that included the trees Java plum (*Syzygium cumini*), common guava (*Psidium guajava*), strawberry guava (*Psidium cattleianum*), and Christmas berry (*Schinus terebinthifolius*). The steeper slopes throughout the valley can be expected to be relatively richer in native plant species.

2) Wetland vegetation (kalo lo'i, ponds, streambanks). This category included the natural vegetation of fishponds, *kalo* fields, and marshy areas. A portion of Läläkea Fishpond (valley mouth on the east side) was visited. It was dominated by extensive stands of the tall, reedlike *kaluhä* or bulrush (*Schoenoplectus californicus*), accompanied by the other largesedges 'ahu'awa haole or umbrella plant (*Cyperus involucreatus*) and papyrus (*Cyperus papyrus*). Water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) were among the floating water plants seen. California grass (*Brachiaria mutica*) was a common rank grass on water-saturated soils.

Wet, muddy, or marshy areas were often dominated by *paco* or *hö'i'o* (*Diplazium esculentum*). Also seen in such habitats were Job's-tears (*Coix lachryma-jobi*), 'ahu'awa haole, and Hilo grass (*Paspalum conjugatum*). Weeds in flooded *kalo lo'i* included honohono (*Commelina diffusa*); *lëkö* or watercress (*Rorippa microphylla*); mosquito fern (*Azolla filiculoides*); *kämole* or primrose willow (*Ludwigia octovalvis*), an upright herb with yellow flowers; water smartweed (*Polygonum punctatum*); *kohekohe* or spikerush (*Eleocharis radicans*), a small clumping sedge; lesser duckweed (*Lemna aequinoctialis*), with minute floating leaves; barnyard grass (*Echinochloa crusgalli*); and cordate monochoria (*Monochoria vaginalis*), a tiny relative of the water hyacinth.

3) Valley floor vegetation. This category included all of the relatively flat, uncultivated lands away from the coast and not influenced by wet substrates. Most of these lowland areas were completely dominated by non-native species. The most common overstory trees included monkeypod (*Samanea saman*), Java plum (*Syzygium cumini*), *kukui* (*Aleurites moluccana*), mango (*Mangifera indica*), and 'öhi'a 'ai (*Syzygium malaccense*). Smaller trees and shrubs included noni (*Morinda citrifolia*), Arabian coffee (*Coffea arabica*), dog-tail (*Buddleia asiatica*), and *pikake hohono* (*Clerodendrum chinense*). Basketgrass (*Oplismenus hirtellus*) was a common groundcover in in shady areas; *pipili* (*Drymaria cordata* var. *pacifica*), a groundcover with sticky fruits, was common in open areas.

4) Coastal vegetation. The black sand shoreline was only sparsely vegetated with groundcovers of *pöhuehue* (*Ipomoea pes-caprae* subsp. *brasiliensis*) and *wedelia* (*Sphagneticola trilobata*), small trees of tree heliotrope (*Tournefortia argentea*), and trees and seedlings of common ironwood (*Casuarina equisetifolia*). Backing the shoreline was a large grove of tall common ironwood, with a sparse understory of herbs and grasses.

AN ANNOTATED LIST OF SELECTED PLANTS OF WAIFI'O VALLEY

The following is a set of profiles of selected plants seen in Waipi'o Valley. Because time and funding did not allow for similar treatment to be provided all the plants seen during the survey, attention was generally focused on species that were fairly common but perhaps not widely known to residents or visitors, or those that had interesting stories to tell. The plants are organized alphabetically by common name (preferably by Hawaiian common name, if available); the latter were taken from Wagner et al. (1999), which drew upon the *Hawaiian Dictionary* (Pukui & Elbert 1986) as a guide. A drawing or photo accompanies many of the plants (drawings adapted from Wagner et al. 1999). Also included are simple plant descriptions to aid in identification, the native geographical range of the plant, ethnobotanical uses here and elsewhere, and locations for the plants in the valley. Primary sources used in compiling this list were Little & Skolmen (1989), Neal (1965), Staples & Herbst (in prep), and Wagner et al. (1999). Many of the ethnobotanical uses in Asia were gathered from Perry (1980).

African tulip tree, fountain tree

Naturalized

Scientific name: *Spathodea campanulata*

Description: Tree up to 80 ft. tall; leaves divided into 9–17 leaflets; flowers bright orange with yellow margins, 4 in. long, flattened-tubular; empty pods canoe-shaped, up to 10 in. long.

Distribution & Habitat: Native to tropical Africa and widely cultivated in tropical areas; in Hawai'i introduced before 1900, widely cultivated and now naturalized in low-elevation semi-wet to wet areas, spreading because of its thin, papery, wind-dispersed seeds; in Waipi'o an occasional tree in disturbed forest, conspicuous when in flower.

Uses: Widely used in reforestation efforts in Hawai'i, with over 30,000 trees planted, mostly on Maui and Hawai'i; in 1928 aerially seeded in Pana'eua and lower Waiākea Forest Reserves. The wood is soft and lightweight and of no commercial value. The unopened flower buds squirt an ill-smelling liquid when opened under pressure, thus the name "fountain tree." In Indochina the flowers are applied to heal ulcers.



'Ahu'awa haole, pu'uka'a haole, umbrella plant

Naturalized

Scientific name: *Cyperus involucratus*

Description: Densely clumping leafless sedge with stems up to 4.5 ft. tall, topped by inconspicuous spikelets and 15–30 radiating bracts, each up to 8 in. long, mimicking an open umbrella.

Distribution & Habitat: Native to tropical Africa and widely naturalized; in Hawai'i introduced around 1900, now common in marshy areas and along streambanks; in Waipi'o common, forming clumps in ponds and on wet soils elsewhere.

Uses: Cultivated ornamentally in tropical water gardens. The stems and inflorescences are sometimes used in lei,

and the trimmed umbrella-like bracts are used as greenery in floral arrangements. The stems and bracts are used in plaiting and braiding in the Philippines.

Ali'ipoe, li'ipoe, poloka, Indian shot

Naturalized

Scientific name: *Canna indica*

Description: A clumping, 3–5 ft. tall herb with ginger-like leaves; flowers usually with narrow yellow petals; mature fruiting capsules brown, warty, filled with round, hard black, “bb”-sized seeds. Cultivated forms have very showy red to pale orange flowers.

Distribution & Habitat: Native to tropical America and widely cultivated; introduced to Hawai'i soon after Western rediscovery, now occasional in disturbed semi-wet to wet forests; in Waipi'o occasional in clumps on the valley floor.

Uses: The seeds are used to make seed lei and are placed inside hula rattles (*'uli'uli*). Elsewhere, the seeds are used in rosaries by Buddhists; starch from the rootstock is used in Indochina for swellings and bee stings; a decoction from the rhizome is used as a diuretic in the Philippines.



'Ape, elephant's-ear

Polynesian introduction

Scientific name: *Alocasia macrorrhizos*

Description: A large kalo relative up to 6 ft. tall with basally attached, glossy green, heart-shaped leaf blades up to 4 ft. long and 2.5 ft. wide; the blades are erect or arching, the blade tip pointing upward (especially on young leaves). It can be confused with a similar-looking *'ape* (*Xanthosoma roseum*) treated in the next entry.

Distribution & Habitat: Origin unknown, but widely cultivated and naturalized from India and Sri Lanka through southeastern Asia and Polynesia; in Hawai'i occurring in valleys along streams and in other wet sites; in Waipi'o a common roadside plant.

Uses: The underground stems are a source of starch, but require much preparation to remove calcium oxalate crystals that can cause intense burning and swelling of mucous membranes; thus, in Hawai'i it was used only as a famine food. The leaves were sometimes used to wrap a patient for sweating to reduce a fever. Elsewhere, the milky sap was used to treat nettle stings and other skin irritations.



'Ape

Naturalized

Scientific name: *Xanthosoma roseum*

Description: Like the previous *'ape*, a large *kalo* relative up to 8 ft. tall with basally attached, arrowhead-shaped blades, except that the blades are dark green and dull (not glossy) above, the leafstalks and undersides of the blades covered with a whitish powder, and the blades generally angled downward in relation to the leafstalk.



Distribution & Habitat: Native to Central America; in Hawai'i introduced in the 1920s, cultivated and now naturalized in moist to wet sites; in Waipi'o found in same habitats as *Alocasia macrorrhizos*, but not as common.

Uses: The stems are peeled, then thinly sliced and eaten as a vegetable in soups

Arabian coffee

Naturalized

Scientific name: *Coffea arabica*

Description: Shrub or small tree up to 15 ft. tall with shiny, dark green, opposite leaves up to 6 in. long; flowers white, 5-petaled, produced in fragrant clusters, usually in spring, followed by fleshy green berries that turn dark red at maturity.

Distribution & Habitat: Native to northwestern Africa and now extensively cultivated and naturalized in the tropics; introduced into Hawai'i in 1813 by Don Francisco Marín, now naturalized in wet disturbed sites, such as moist valleys; in Waipi'o occasional in disturbed forest.

Uses: By far the most widely cultivated coffee-producing species (Kona coffee is this species). Elsewhere, also used as a honey plant.

'Awa, pū'awa, kava

Polynesian introduction

Scientific name: *Piper methysticum*

Description: Swollen-jointed shrub up to 12 ft. tall; leaves broadly heart-shaped, up to 8 in. long, with 9–13 veins radiating from the base. Plants are either male or female: male spikes are narrow and up to 2.5 in. long; female plants are very rare and apparently never set seed. A related but still unidentified species of *Piper* was pointed out to me by Kia Fronda. It had light green stems and narrower leaves, with just a single major vein from the base and minor veins arranged along it. The plant was aggressively spreading into an existing 'awa patch. The crushed leaves smell of root beer or licorice. Interestingly, the Association for Hawaiian 'Awa Newsletter (January 1999, vol. 1(3)) recently reported on 2 counterfeit 'awa relatives seen in Hawai'i—neither containing active kavalactones—one identified as *Piper auritum* (golden 'awa) and the other as yet unidentified. The latter was described as a rapidly spreading pest in Fiji, Samoa, Tonga, and other South Pacific islands, and was observed forming dense monocultural communities. Called 'awa Tonga in Fiji and Samoa and 'awa Hawai'i in Tonga, the safrole that causes the leaves and stems to smell of root beer is reportedly considered to be a carcinogen by the FDA.



Zingiber zerumbet

Distribution & Habitat: Thought to be originally from Papua New Guinea, the Solomon Islands, and Vanuatu, and spread by voyagers; in Hawai'i cultivated and still persisting in shady semi-wet gulches and more open, windward, semi-wet sites; in Waipi'o noted only in cultivation.

Uses: The fresh or dried roots and lower stems are used to make a drink widely used in special ceremonies and social life in Polynesia and Micronesia. The effects range from mild euphoria to complete muscle relaxation. A resurgence of interest in 'awa has been spurred by the health food industry. Also used elsewhere to treat gonorrhoea.

'Awapuhi, shampoo ginger

Polynesian introduction

Scientific name: *Zingiber zerumbet*

Description: Low-growing ginger up to 2.5 ft. tall; leaves yellowing and dying back in winter; in summer a red, club-shaped inflorescence emerges from the ground on a stalk 1 ft. tall, with small, white to yellow flowers appearing singly from among the red bracts; copious sudsy fluid is released by squeezing the inflorescence.

Distribution & Habitat: Perhaps native to India, long-cultivated in Southeast Asia, now found throughout the Pacific; in Hawai'i common in shaded, semi-wet disturbed forests; in Waipi'o noted in the understory of disturbed forest.

Uses: In Hawai'i the sudsy fluid was used as a shampoo and thirst quencher, the rhizomes powdered and used to scent *kapa*, the leaves used to flavor meat, and the leaf ashes used medicinally. Currently, 'awapuhi extracts are used in hair-care products. Elsewhere, the underground stem is used medicinally for asthma, rheumatism, diarrhea, skin diseases, coughs, and stomach aches.

Bitter melon

Naturalized

Scientific name: *Momordica charantia*

Description: A climbing vine of the cucumber family with small, deeply 5-lobed leaves; flowers single, yellow, 5-petaled; fruits cylindrical, warty, 3-ridged, ripening orange and splitting into 3 valves, exposing red pulp. Cultivated forms produce larger leaves and fruits.

Distribution & Habitat: Native from tropical Africa through Asia to Australia; in Hawai'i first collected in 1909, now naturalized in lowland disturbed sites; occasional in Waipi'o Valley and on the road heading down into the valley.

Uses: The fruit of domesticated forms is popular in Chinese and Filipino cooking, and the young shoot tips are eaten as a vegetable and salad green. All parts of the plant are used medicinally in Asia and the Caribbean to treat various external skin ailments, intestinal worms, fever, delirium, and liver problems. While domesticated plants appear to be non-toxic, the seeds and fruit wall of wild plants are more or less toxic.

Busy Lizzy, Patient Lucy

Naturalized

Scientific name: *Impatiens wallerana*

Description: A fleshy herb up to 2 ft. tall with red, orange, purple, pink, or white, 5-petaled flowers; fruit spindle-shaped, up to 1 in. long, fleshy green, exploding to release its seeds when pressed.

Distribution & Habitat: Native from Tanzania to Mozambique and widely cultivated; in Hawai'i first collected in 1939, now commonly naturalized in fairly moist, shady disturbed forests; locally common roadside plant in Waipi'o and on the road heading down into the valley.

Uses: Many cultivated forms are available.

California grass, Para grass

Naturalized

Scientific name: *Brachiaria mutica*

Description: Large, sprawling, mat-forming grass with stems up to 6–8 ft. long, the leafstalks hairy; blades up to 10 in. long; flowering stalk 5–12 in. long, usually purplish, with several to many branches.

Distribution & Habitat: Native range unknown, now found throughout the tropics; in Hawai'i first collected in 1924, now naturalized on wet soils in marshy areas, along streambanks and drainage ditches, and in other disturbed sites; in Waipi'o commonly bordering streams and ponds and also on the road heading down into the valley.

Uses: Sometimes used as a fodder grass.

Chinese taro

Naturalized

Scientific name: *Alocasia cucullata*

Description: *Kalo* relative up to 2 ft. tall; leaves dark green, shiny, leathery, heart-shaped, 10–16 in. long, with raised veins clustered and radiating from near the blade base.

Distribution & Habitat: Native from India and Sri Lanka to Myanmar; in Hawai'i cultivated since at least 1930; in Waipi'o a common roadside plant, especially on moister soils.

Uses: In Taiwan the leaves are applied to wounds and ulcers, and in India the stems are used as a food source.

Cordate monochoria

Naturalized

Scientific name: *Monochoria vaginalis*

Description: Smaller, rooted aquatic relative of water hyacinth with hollow leafstalks up to 1 ft. long; leaves shiny, heart-shaped, up to 4 in. long; flower spikes with small blue, 6-lobed flowers.

Distribution & Habitat: Native to tropical and warm-temperate Asia and widely naturalized; in Hawai'i first collected in 1934, found in *kalo lo'i* and slow-moving streams; in Waipi'o a common weed in *lo'i*.

Uses: All parts except the roots are edible raw, steamed, or boiled. In Asia the rootstocks are used medicinally for asthma, toothaches, and liver and stomach ailments. Sold commercially as an aquatic ornamental.

Fountain grass

Naturalized

Scientific name: *Pennisetum setaceum*

Description: A large perennial bunchgrass up to 4 ft. tall with stiff, narrow, rough-margined leaves and feathery, bottlebrush-like, rose to purple or white, 4–12 in. long flower spikes.

Distribution & Habitat: Native to northern Africa, now a widely cultivated ornamental; in Hawai'i first collected in 1914, cultivated and now a serious weed pest in open, dry to semi-wet habitats such as barren lava flows, where it aggressively outcompetes other species and provides fuel for forest fires; in Waipi'o forming extensive patches on the western slope of the valley, noticeable as yellow bands among the green vegetation.

Uses: Ornamental; not a good pasture grass. A noxious weed.

Hammock fern

Naturalized

Scientific name: *Blechnum occidentale*

Description: Low-growing fern with pinnate fronds up to 20 in. long that unfurl pink to red, then turn dark green; spores forming a pattern of 2 lines on either side of each blade segment.

Distribution & Habitat: Native to tropical America; in Hawai'i first collected in 1950 and now widespread in low-elevation forests, such as along shaded trailside banks; in Waipi'o common along road banks.

Uses: A garden ornamental. In China the young shoots are pounded and applied as a compress to swellings and boils.

Hau

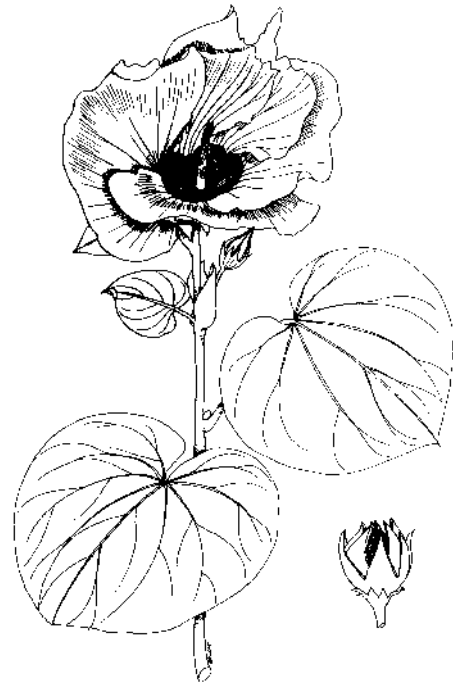
Indigenous or possibly a Polynesian introduction

Scientific name: *Hibiscus tiliaceus*

Description: Often a sprawling tree 10–30' or more tall with an impenetrable network of branches; leaves orbicular, the base heart-shaped; flowers like a typical hibiscus, with 5 petals that change from yellow (often with a dark red base) to orange to red during the day.

Distribution & Habitat: Native to tropical and subtropical coastal regions worldwide; in Hawai'i frequently growing in dense thickets along coasts, stream courses, and other wet lowland habitats; in Waipi'o commonly seen along watercourses and in disturbed forest.

Uses: It is thought by botanists that hau may have arrived in Hawai'i on its own (and is thus indigenous), but the plant was so useful that the original settlers probably also brought it with them. Uses include fiber for cordage; the light wood for booms and floats of canoe outriggers, fishing net floats, kite cross-sticks, and creation of fire by friction in combination with the harder *olomea* (*Perrottetia sandwicensis*) wood; the bark for making sandals; and the flowers and bark for medicinal purposes. The plant has many uses elsewhere in its geographic range.



Hibiscus tiliaceus

Hō'i'o, paco, edible fern, vegetable fern

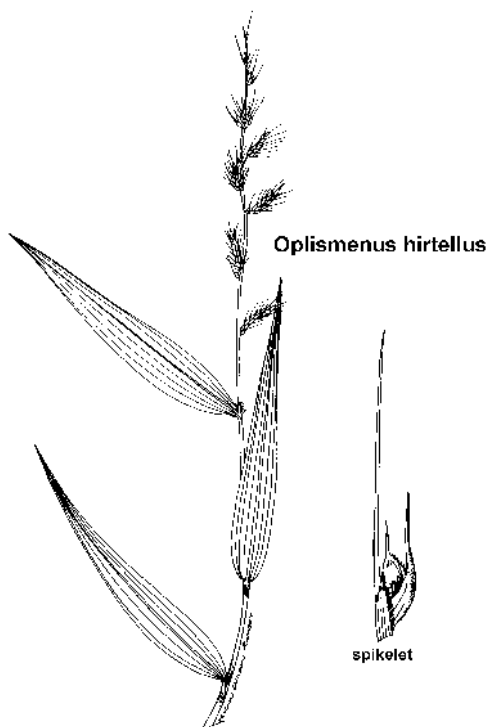
Naturalized

Scientific name: *Diplazium esculentum*

Description: Upright fern with shiny green, crisp-textured, divided fronds up to 6 ft. long; young edible fronds unfurling on long stalks. The Hawaiian common name (*hō'i'o*) applied to this species is actually borrowed from a native wet forest fern relative (*Diplazium sandwichianum*) with the same food uses.

Distribution & Habitat: Native to tropical Asia and islands of the South Pacific; in Hawai'i first collected in 1910, now widely naturalized in low-elevation open, disturbed wet sites, such as along streambanks; in Waipi'o common on wet soils along the main road.

Uses: The most commonly eaten fern in its native range, the tender young fronds are eaten raw or cooked. In Taiwan the plant is used to reduce fever and depression, and in Indochina it is applied in a plaster to pimples and skin eruptions.



Oplismenus hirtellus

spikelet

Honohono kukui, honohono, honohono maoli, basketgrass

Naturalized

Scientific name: *Oplismenus hirtellus*

Description: A sprawling, thin-stemmed grass with thin, lance-like, 2–4 in. long blades.

Distribution & Habitat: Native to tropical regions worldwide; in Hawai'i first collected in 1819, now widely naturalized in open to shady semi-wet forested habitats; in Waipi'o a commonly seen understory grass, as under *kukui* forest cover.

Uses: Cultivated forms are sometimes used in hanging baskets, hence its English common name.

Honohono, honohono wai, mākolo-kolo

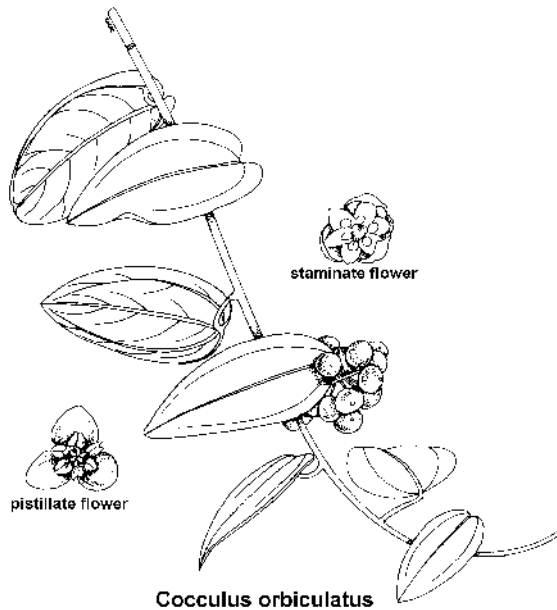
Naturalized

Scientific name: *Commelina diffusa*

Description: A member of the wandering Jew family with trailing to weakly ascending succulent stems rooting at the nodes; leaves broadly lanceolate, 1.5–4 in. long; flowers small, blue, 3-petaled.

Distribution & Habitat: Native to the Old World tropics and now widely naturalized; in Hawai'i first collected in 1837, now a common groundcover on wet soils in disturbed lowland to upland sites; in Waipi'o common in and around *kalo lo'i*.

Uses: Sometimes used raw or cooked as food. Good cattle fodder.



Huehue, hue, hue'ie, 'inalua

Indigenous

Scientific name: *Cocculus orbiculatus*

Description: Thin-stemmed sprawling vine; leaves alternate, widely spaced along the stem, usually ovate, 1–4 in. long, with usually 3 major veins radiating from the leaf base; flowers produced in clusters (plants are either male or female and only produce one type of flower), small, yellowish white, followed by small dark blue berries (on female plants).

Distribution & Habitat: Native from Southeast Asia, the Himalayas, the Malay Peninsula, the Philippines, and the Pacific; in Hawai'i a common vine in dry and semi-wet forests, as well as on open lava beds, grasslands, and talus slopes; in Waipi'o noted on the cliff face heading down the road into the valley.

Uses: The flexible stems were reportedly used in Hawai'i to make fishtraps and cordage. In Asia used as a diuretic and a remedy for dropsy, gonorrhoea, and fever.

Huelo 'ilio, dog tail, butterfly bush

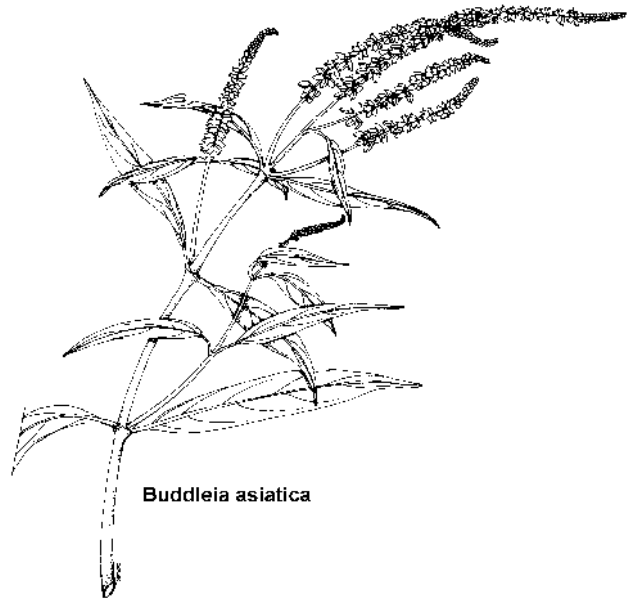
Naturalized

Scientific name: *Buddleia asiatica*

Description: Shrub 3–6 ft. tall with narrowly lance-like leaves 2–7 in. long; flowers small, white, on drooping spikes 3–9 in. long, followed by small brown capsules (the effect resembling a dog's tail).

Distribution & Habitat: Native to Pakistan, India, China, Taiwan, the Malay Peninsula, and the Mariana Islands; in Hawai'i first collected in 1908, now found in semi-wet to wet disturbed sites, open lava fields, and wet forests; in Waipi'o occasional in disturbed forest and on the road heading down into the valley.

Uses: Used medicinally in its native range as a tonic, abortifacient, and skin disease remedy, and as a fish poison.



'Ihi 'ai, 'Ihi maka 'ula, 'Ihi mākole, yellow wood

sorrel

Polynesian introduction, possibly indigenous

Scientific name: *Oxalis corniculata*

Description: Small, clover-like herb with each leaf composed of 3 inverted heart-shaped leaflets; flowers small, 5-petaled, yellow, followed by erect, columnar green capsules that explode when pressure is applied, scattering abundant sticky seeds.

Distribution & Habitat: A wide-ranging species of unknown origin; in Hawai'i collected by David Nelson (botanist on Capt. Cook's voyage in 1779), but possibly arrived naturally attached as seeds on migratory birds, now a ubiquitous weed in open disturbed sites from the coast up to subalpine regions; in Waipi'o a common groundcover weed. A larger relative, the pink wood sorrel (*Oxalis corymbosa*), has larger, pinkish purple flowers.

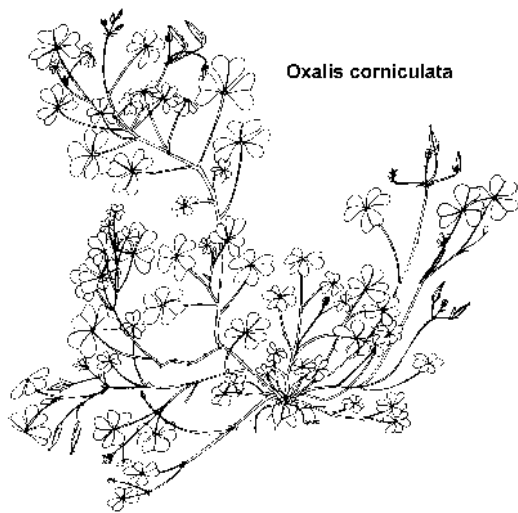
Uses: Reportedly used medicinally in Hawai'i. Elsewhere in Asia it is widely used to treat a variety of medical problems, including scurvy, dysentery, poisonous insect wounds, fever, and stomach ache. Contains oxalic acid, which is poisonous in large doses.

'Inia, 'ilinia, chinaberry, pride-of-India

Naturalized

Scientific name: *Melia azedarach*

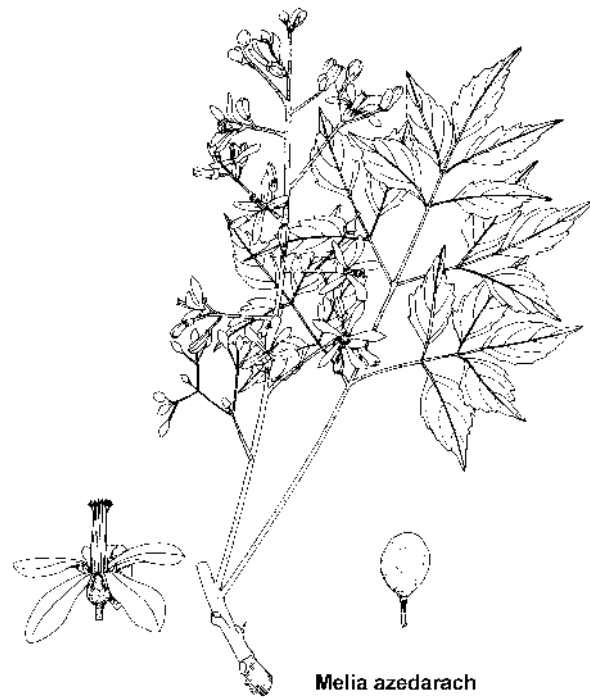
Description: Fast-growing but short-lived tree up to 60 ft. tall; leaves finely divided feather-fashion; flowers 5–6-petaled, appearing from March to June in pale lavender sprays, followed by clusters of round yellow fruit,



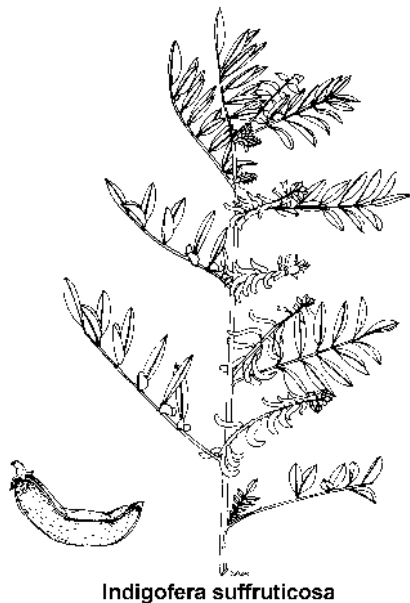
each less than 1 in. across and persisting on the tree.

Distribution & Habitat: Native to tropical Asia and widely cultivated; in Hawai'i cultivated since the 1830s, now naturalized in dry disturbed gulches and pastures; in Waipi'o occasional in disturbed forest.

Uses: A popular shade and ornamental tree with many uses throughout its range. The wood is used elsewhere for musical instruments, furniture, and tool handles; the leaves and dried fruits to protect stored material from insects; and many plant parts are used medicinally. The leaves and fruits are poisonous to humans, pigs, and domestic poultry, although it is reported that wild birds and cattle are unaffected. Fortunately, the fruits are distasteful and unlikely to be eaten in harmful quantities.



Melia azedarach



Indigofera suffruticosa

'Inikö, 'inikoa, kolü, indigo

Naturalized

Scientific name: *Indigofera suffruticosa*

Description: Legume shrub 3–7 ft. tall; leaves divided into 9–17 leaflets; flowers pea-like, clustered, small, salmon pink to red, followed by curved, green to brown pods resembling small bunches of bananas.

Distribution & Habitat: Presumably native to the American tropics, now pantropical; in Hawai'i apparently first introduced in 1836 for commercial purposes, now naturalized mainly in dry disturbed sites; in Waipi'o occasional in disturbed roadside vegetation.

Uses: This is one of several species of indigo used commercially to produce a deep blue permanent dye, although the industry did not succeed in Hawai'i. The process for obtaining the dye involves fermenting the plants in water for 12–16 hours and later collecting the settled indigo paste. The plant refuse is a good mulch rich in nitrogen. In India a decoction of the leaves is drunk for stomach aches.

Java plum, jambolan plum

Naturalized

Scientific name: *Syzygium cumini*

Description: Tree up to 60 ft. tall; leaves smooth, with fine parallel venation, up to 7 in. long, 3 in. wide, with a pointed tip; flowers small, clustered in powderpuffs of white, thread-like stamens; fruits dark purple to black, resembling olives. Closely related to 'ōhi'a lōke (rose apple) and 'ōhi'a 'ai (mountain apple).

Distribution & Habitat: Perhaps native to India, Sri Lanka, and the Malay Peninsula, Indonesia, the Philippines, and now widely cultivated and naturalized; in Hawai'i cultivated prior to 1871, now widely naturalized in semi-wet valleys and disturbed forests; in Waipi'o one of the dominant forest tree species and also on the road heading down into the valley.

Uses: The fruit is edible but sour. Sometimes used as a windbreak tree, but less so as an ornamental because of messy fallen fruits. Used on a small scale locally in woodworking. In Asia, the leaves, bark, fruit, and seeds have been used to treat diarrhea and dysentery.



Kaluhā

Indigenous

Scientific name: *Schoenoplectus juncooides*

Description: A bulrush resembling a large makaloa (*Cyperus laevigatus*), with erect, bladeless green sheaths 0.5–2.5 ft. tall; near the tips of the sheaths are groups of 2–10 cone-like spikelets, green to straw-colored. *Kaluhā* differs from *makaloa* in the arrangement of the bracts on the spikelet: in *kaluhā* they are overlapping around a central axis; in *makaloa* they are arranged in 2 rows on either side of a central axis.

Distribution & Habitat: Native from Japan to the Malay Peninsula, Indonesia, the Philippines, and India, with disjunct populations in Fiji and Hawai'i; in Hawai'i a plant of bogs, pond margins, and wet forest trails, only on Kaua'i and Hawai'i; in Waipi'o occasional in *kalo lo'i*.

Uses: None recorded.

Kaluhā, 'aka'akai (Ni'ihau)

Naturalized but possibly indigenous

Scientific name: *Schoenoplectus californicus*

Description: A much taller, coarser bulrush than the previous species, with cylindrical, green, bladeless sheaths 3–12 ft. tall, often forming thick patches; spikelets cone-like, brown, in nodding groups near the sheath tips. This species closely resembles the indigenous 'aka'akai (*Schoenoplectus lacustris* subsp. *validus*), but the sheath in the latter is round throughout, while in *kaluhā* it is 3-sided, at least near the tip.

Distribution & Habitat: Native to coasts of the southeastern U.S. and south to Argentina and Chile in low-elevation saltwater and freshwater marshes; in Hawai'i first collected in 1912, now common in lowland marshes; in Waipi'o common in the marshy coastal zone behind the beach.

Uses: None recorded.

***Kamani haole*, tropical or Indian almond,
false kamani**

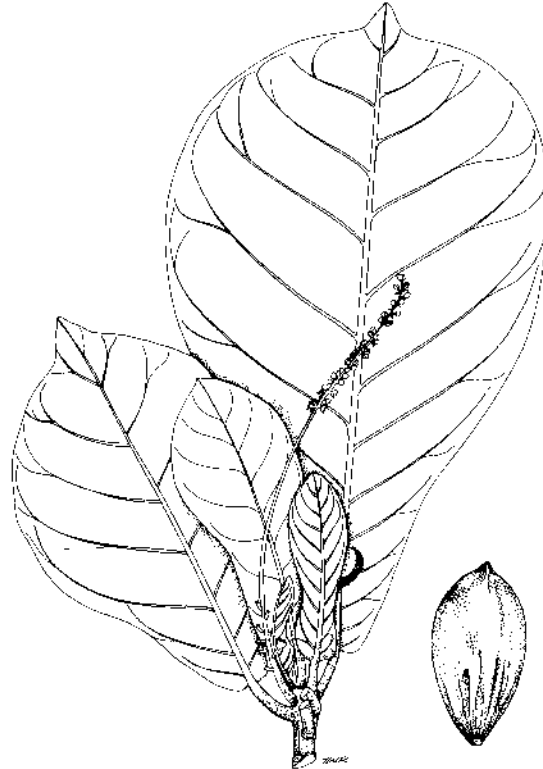
Naturalized

Scientific name: *Terminalia catappa*

Description: A large, 25–100 ft. tall tree with horizontal branches borne in tiers; leaves large, green, spatula-like, up to 1 ft. long, the older leaves turning reddish before falling; flowers tiny and unpleasant-smelling; fruit flattened-football-shaped, 1–2 in. long, green to red-tinged, drying brown, with a tough rind enclosing 1 or 2 kernels.

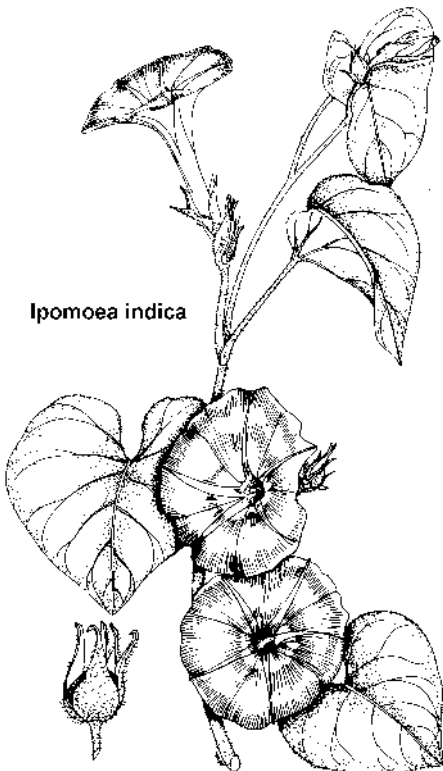
Distribution & Habitat: Probably native to Indonesia and Malaysia, now widely cultivated in the tropics; in Hawai'i cultivated prior to 1871, now commonly seen in coastal areas; in Waipi'o occasional in the valley interior, more common near the coast.

Uses: The reddish timber is durable and has been used for boat and house construction, woodworking, bridge timbers, flooring, and crates; the leaves, bark, roots, and



Terminalia catappa

fruits are used medicinally (commonly for dysentery) and in tanning; the kernels are edible raw or roasted; and a black dye is obtained from the leaves, bark, and fruits.



Ipomoea indica

***Koali 'awa*, *koali 'awahia*, *koali lä'au* (Ni'ihau),
morning-glory**

Indigenous

Scientific name: *Ipomoea indica*

Description: A clambering vine with typically funnel-form morning-glory flowers up to 2.5 in. long, 3 in. across, blue or violet in the morning, turning pink by day's end.

Distribution & Habitat: Widespread throughout the Pacific; in Hawai'i common in low-elevation dry to semi-wet areas; in Waipi'o occasionally seen clambering on shrubs roadside and on the road heading down into the valley.

Uses: The roots, stems, and leaves were applied as plasters and poultices on wounds and broken bones; the roots and seeds are powerful cathartics. The vines were used as swings.

Koali pehu, moon flower

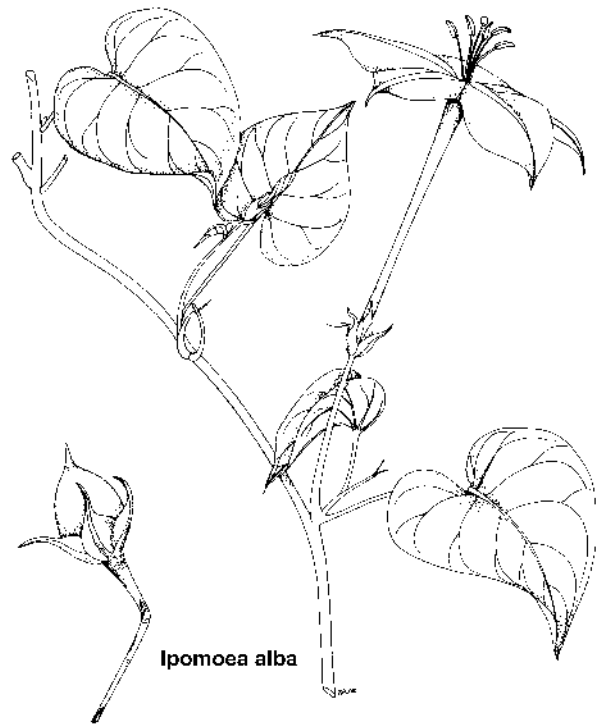
Naturalized

Scientific name: *Ipomoea alba*

Description: Aggressive morning-glory vine; flowers night-blooming, with a long narrow tube that flares open at the top, 3.5–6 in. long, up to 4 in. across, white with light green nectar guides.

Distribution & Habitat: Probably native to Mexico, now widely cultivated and naturalized in the tropics; in Hawai'i first recorded in 1819, now a common vine in usually moist areas; in Waipi'o an occasional roadside vine.

Uses: The roots and seeds are used as a cathartic in Indochina.



Kukui, kuikui, candlenut tree

Polynesian introduction

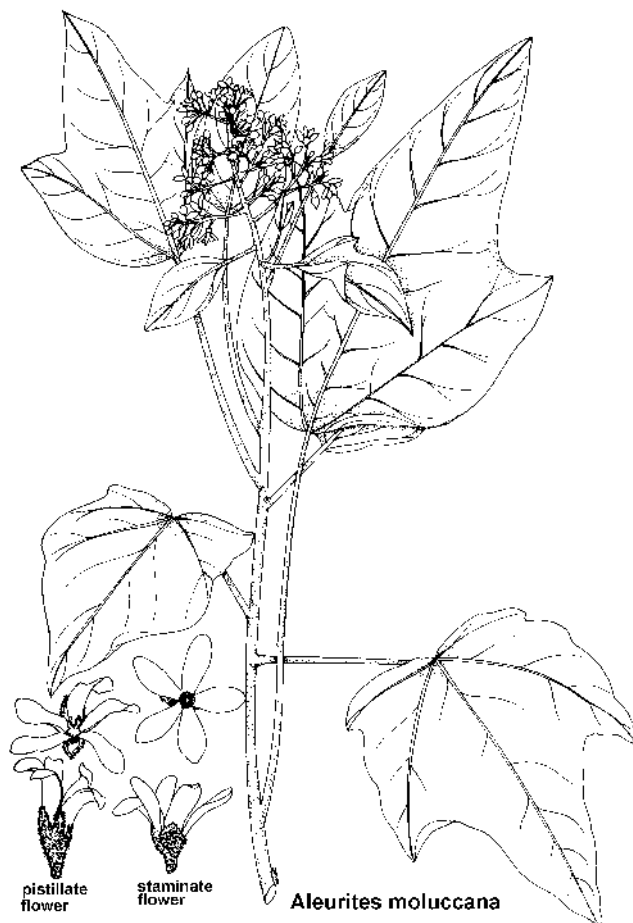
Scientific name: *Aleurites moluccana*

Description: Tree up to 80 ft. tall, conspicuous from a distance because of its light grayish green foliage; leaves maple-like, usually 3–5-lobed, white mealy-hairy,

becoming hairless with age; flowers numerous, small, 5-petaled, white; fruits rounded, about 2 in. across, green to brown, containing 1 or 2 black, hard-shelled seeds. A member of the euphorbia family.

Distribution & Habitat: Native to the Malay Peninsula, Indonesia, the Philippines, and widespread in the tropics; in Hawai'i a common tree in semi-wet valleys and slopes; in Waipi'o one of the most common forest trees and also on the road heading down into the valley.

Uses: Declared the state tree by the 1959 Hawai'i State Legislature for its many uses and beauty. The wood was used for canoes and fishnet floats; the oily seeds strung on coconut midveins as candles or eaten after roasting in a condiment called 'inamona; oil from the seed burned in stone lamps, mixed with soot and used as paint, and used medicinally; the white latex used medicinally, as glue, and used to waterproof kapa; the nuts used to make lei, as well as the leaves and flowers; and the green fruit husk and root bark used to produce a black dye, the latter



used to stain canoes. The raw seeds are highly purgative. In historic times, the oil was extracted commercially as a drying oil for paints and varnishes.

Large-leaved hau

Naturalized

Scientific name: *Hibiscus macrophyllus*

Description: Tree up to 50 ft. tall, most parts covered with brownish yellow hair; leaves heart-shaped (like *hau*); flowers of hibiscus type, yellow with purplish red basal spot, drying greenish yellow; capsules beaked, up to 1.5 in. long, yellow hairy.

Distribution & Habitat: Naturalized; native from India through Java; in Hawai'i cultivated sparingly since before 1917, now sparingly naturalized on O'ahu and in the Kohala Mountains of Hawai'i; in Waipi'o a single large tree noted on the seaward side of the Nāpo'opo'o *kalo* restoration site.

Uses: None recorded.

Laua'e, maile-scented fern

Naturalized

Scientific name: *Phymatosorus grossus*

Description: Usually ground-dwelling fern, sometimes on tree trunks, with creeping rootstocks; fronds divided in similar fashion to 'ulu (breadfruit) leaves with 2–8 pairs of lobes, usually 1–2 ft. tall; spores impressed on underside of frond, appearing as raised bumps on upper side.

Distribution & Habitat: Native to tropical Africa, Asia, Australia, and the Pacific islands; in Hawai'i first collected in 1922 but probably cultivated well before then, now widely naturalized in a variety of habitats from the coasts to wetter forests; in Waipi'o an understory element in disturbed forest and on the road heading down into the valley.

Uses: Very common in cultivation and used as greenery in floral arrangements. Some forms have a maile-like fragrance and are popularly used in *lei*.

Malayan ground orchid, Philippine ground orchid

Naturalized

Scientific name: *Spathoglottis plicata*

Description: Ground orchid with broad, pleated leaves 1–3 ft. long, up to 4 in. wide; flowers produced on an erect stalk, purple to pink, 1 in. across, followed by 6-ribbed capsules, green turning brown.

Distribution & Habitat: Native to southeastern Asia, the Malay Peninsula through Indonesia, and some Pacific islands; in Hawai'i first cultivated in the 1920s, now widely naturalized in open, disturbed, semi-wet to wet forests; in Waipi'o noted on the cliff face heading down into the valley.

Uses: Ornamental.



Māmaki, māmaka, waimea (Kaua'i)

Endemic

Scientific name: *Pipturus albidus*

Description: Shrub to small tree up to 20 ft. tall; leaves variable, ovate, 2.5–8 in. long, the margins notched, upper surface green, lower surface white to gray, with 3 usually red main veins radiating from the blade base, leaves

of young plants often up to 1.5 ft. long, 1 ft. wide; flowers inconspicuous, clustered in leaf axils, followed by whitish fleshy balls of fruit. A member of the nettle family.

Distribution & Habitat: Found on all of the main Hawaiian Islands except Ni'ihau and Kaho'olawe in semi-wet to wet forests, especially on forest margins and in clearings; in Waipi'o an infrequent component of disturbed roadside vegetation.

Uses: The inner bast fibers of the stem served as an important source of *kapa* (bark cloth), along with *wauke* (*Broussonetia papyrifera*); *māmaki* cloth was second in preference to *wauke* because it was not as warm, flexible, or durable, tearing when wet. Like its relative *olonā* (*Touchardia latifolia*), its fibers were used for cordage. The edible fruits were used in home remedies and the leaves used in a tonic tea, which are sold commercially today for that purpose. *Māmaki* is the favored host plant of the native Kamehameha butterfly.

Ma'o, hairy abutilon

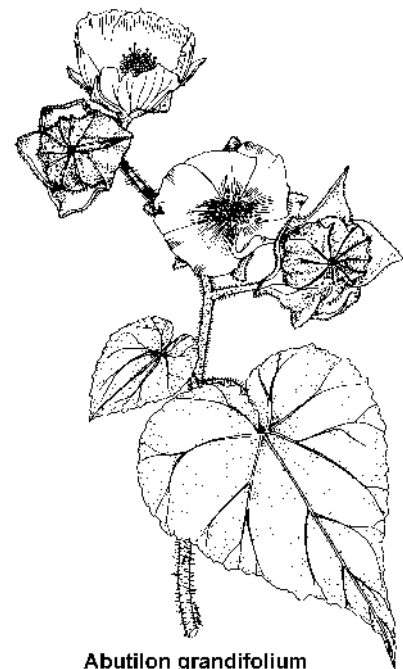
Naturalized

Scientific name: *Abutilon grandifolium*

Description: A hairy shrub usually up to 6 ft. tall; leaf size variable, 3–8 in. long, the base heart-shaped, the tip narrowed; flowers like a small hibiscus, yellow, 'ilima-like; capsule brown, yellowish hairy, with usually 10 compartments.

Distribution & Habitat: Native to the New World, now a widespread tropical weed; in Hawai'i first collected in 1903, a common weed of waste areas and roadsides, especially in dry areas; in Waipi'o an occasional weed in open areas.

Uses: The flowers are used as a substitute for 'ilima in lei; a cultivated double-flowered form (called triple 'ilima locally) is now popular. The plant is cultivated elsewhere for its bast fibers.



Abutilon grandifolium

Mau'u Hilo, Hilo grass, sour paspalum

Naturalized

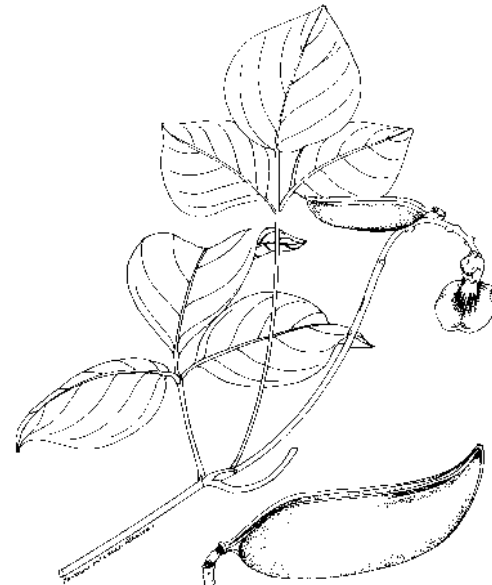
Scientific name: *Paspalum conjugatum*

Description: A coarse, 1–2 ft. tall grass spreading by wiry stems; blades up to 5 in. long, 0.5 in. wide; spikelets forked into 2 long, narrow branches topping foliage.

Distribution & Habitat: Native to tropical America; in Hawai'i first introduced around 1840 in Hilo District, where it quickly spread as a weed, now widespread on most of the main islands, mainly in semi-wet to wet, disturbed sites such as roadsides and open fields; in Waipi'o a common groundcover grass.

Uses: Often used as a groundcover by default in wet areas because of its rapid growth. Not palatable to livestock. In the Philippines the fresh roots are used to treat diarrhea; in the Solomon Islands the plant is used to treat sore throats and stomach ache.

Canavalia cathartica



Maunaloa

Naturalized

Scientific name: *Canavalia cathartica*

Description: Climbing vines; leaves divided into 3 leaflets; flowers pea-like, pink to rose; pods inflated, up to 5 in. long, 3-ridged on one edge, with about 6 flattened, dark brown seeds inside.

Distribution & Habitat: Ranging along seacoasts from East Africa to India, the Ryukyu Islands through the Malay Peninsula, Indonesia, the Philippines, and Polynesia; in Hawai'i first collected in 1908, now naturalized in dry to semi-wet, disturbed, low-elevation sites; in Waipi'o occasionally clambering on shrubs roadside and on the road heading down into the valley.

Uses: The flowers are used in beautiful *maunaloa lei*. No reported ethnobotanical uses, although the species name suggests that some part of it is cathartic.

Naupaka kahakai, aupaka (Ni'ihau), huahekili, naupaka kai, beach naupaka

Indigenous

Scientific name: *Scaevola sericea*

Description: Mounding shrub 3–6 ft. tall with shiny green, succulent leaves 2–8 in. long, 2–3 in. wide, downy hairy; flowers white to pale yellow, 5-petaled, appearing as though torn in half; fruit white, succulent, corky, about 0.5 in. long. Also known by the name *Scaevola taccada*.

Distribution & Habitat: Native throughout the coasts of the Indo-Pacific basin and Indian Ocean; in Hawai'i a common coastal shrub above the high-tide mark; in Waipi'o common in the sandy coastal zone.

Uses: A commonly cultivated native plant widely used as a shrub. A primary species anchoring coastal sand dunes. *Naupaka kahakai* has several native upland forest relatives also with half-flowers, resulting in various stories based on separated lovers. Plant parts are used medicinally in Asia: the bitter leaves used for indigestion, a leaf poultice is applied to headaches, the charred pith is used in a remedy for diarrhea, and a decoction of the roots is used to treat syphilis and dysentery. The leaves are cooked as greens. Rice paper is made from the pith.



Rhus sandwicensis

Neleau, neneleau

Endemic

Scientific name: *Rhus sandwicensis*

Description: Small tree 10–25 ft. tall with whitish sap; leaves divided feather-fashion, 1–1.5 ft. long, with usually 3–5 pairs of leaflets with notched margins, young leaves often red; flowers tiny, produced in dense terminal clusters, reddish brown hairy, followed by tiny red fruits. Related to mango, poison oak, poison ivy, and cashew.

Distribution & Habitat: Found especially along roadsides and in pastures in semi-wet to dry, disturbed sites, uncommon on Kaua'i, O'ahu, Moloka'i, and Maui, common on Hawai'i, especially around Hilo, the Hāmākua coast, and Waimea; in Waipi'o easily seen on the dropoff side of the road heading down into the valley.

Uses: The lightweight, coarse-textured, tough wood was used for saddle trees, ox yokes, and plows, and the bark

was used locally to tan goat hides.



Noni, Indian mulberry

Polynesian introduction

Scientific name: *Morinda citrifolia*

Description: Small tree up to 20 ft. tall; leaves thick, glossy, ovate, 8–15 in. long, with prominent venation; flowers white, 5-petaled, borne in globose heads, followed by an enlargement of the head into a breadfruit-like multiple fruit 2–4 in. long, warty, hard and green at first, eventually becoming whitish yellow, ripening as a soft, foetid pulp. A member of the coffee family.

Distribution & Habitat: Native from southeastern Asia to Australia; in Hawai'i often seen in dry to semi-wet disturbed forests and moist gulches; in Waipi'o a component of disturbed forest and on the road heading down into the valley.

Uses: Noni had many uses in old Hawai'i. A red dye was obtained from the bark and a yellow dye from the roots; the ripe fruit used as a poultice and as a famine food either raw or cooked; the leaves, bark, and fruit used medicinally; an extracted foetid oil from the fruit used as a hair insecticide; and fruit juice used in a remedy for tuberculosis (*aumiki 'awa*). There is much current commercial use of noni for various purported medicinal virtues.

'Ohai, pū 'ohai, monkeypod, rain tree

Naturalized

Scientific name: *Samanea saman*

Description: Large leguminous tree up to 80 ft. tall with a characteristic umbrella-shaped crown; leaves divided feather-fashion, closing up and drooping near day's end and on cloudy days, usually all falling and leaving tree leafless in February and March; flowers clustered to form pink powderpuffs; pods dark brown to black when ripe, 6–8 in. long, flattened, filled with sweet, sticky pulp surrounding the seeds.

Distribution & Habitat: Native to the New World tropics from Mexico to Peru and Brazil and now widely cultivated in the tropics; in Hawai'i said to have been introduced in 1847, now a ubiquitous shade tree and naturalized in low-elevation disturbed areas; in Waipi'o a common overstory tree in disturbed forest.

Uses: The wood is used to carve beautiful carved bowls and plates; elsewhere it is popular for boat frames, and is also suitable for furniture, flooring, veneer, and crates. The nutritious pods are used as cattle and hog feed and the pulp is sometimes eaten by children. The seeds are strung into *lei*. In the Philippines a decoction of the inner bark and fresh leaves is drunk for diarrhea, and another using the bark is taken for stomach ache.

'Ōhi'a, 'ōhi'a lehua, lehua

Endemic

Scientific name: *Metrosideros polymorpha* var. *polymorpha*

Description: Shrub to tree up to 80 ft. tall, bark rough, flaky; leaves very variable, crowded, 0.5–3 in. long; flowers clustered, forming conspicuous, attractive powderpuffs of red, pink, yellow, or orange stamens; capsules

filled with tiny seeds.

Distribution & Habitat: The most common and widespread native tree species in Hawai'i, with a variety of forms ranging from near sea level to subalpine habitats, from barren lava fields through dry, semi-wet, and wet forests and bogs; in Waipi'o noted along cliff faces along the road heading down into the valley.

Uses: Hawaiians used the wood for religious images, household implements, construction, and on canoe gunwales. Modern day uses include flooring and fenceposts. The flowers and young red leaves (*liko lehua*) are used in *lei*. The liko are also brewed in a tea.

'Ōhi'a 'ai, 'ōhi'a, mountain apple, Malay apple

Polynesian introduction

Scientific name: *Syzygium malaccense*

Description: Tree up to 60 ft. tall with leathery, glossy leaves 7–12 in. long, 3–5 in. wide, upper side dark green, lower surface light green; flowers in purplish red to pink powderpuff clusters borne directly on upper trunk and main branches, stamens often carpeting the ground during March and April; fruit maturing dark red, pear-shaped, up to 3 in. long, with a crisp white, watery flesh.



Not related to true apples, which are in the rose family; 'ōhi'a 'ai is in the myrtle family, along with eucalyptus, 'ōhi'a, 'ōhi'a lōke, and Java plum.

Distribution & Habitat: Probably native to Indo-Malaysia; in Hawai'i long cultivated and naturalized in low-elevation semi-wet to wet sites, especially moist valleys; in Waipi'o a common tree in moist disturbed forest.

Uses: The fruit is eaten raw, cooked, or pickled. Hawaiians used the trunks as house posts and rafters and to build temple enclosures, the wood to carve religious images, and an infusion of the astringent bark as a sore throat remedy.

'Ōhi'a lōke, rose apple

Naturalized

Scientific name: *Syzygium jambos*

Description: Many-branching tree up to 35 ft. tall, creating a dense canopy; leaves dark green, lance-shaped, up to 8 in. long, 2 in. wide; flowers large powderpuffs dominated by yellowish white stamens, produced at branch ends, followed by round, rose-scented fruits, pale yellow flushed pink, with firm edible flesh surrounding a large cavity containing a single large seed.

Distribution & Habitat: Probably native to Indo-Malaysia, now widely cultivated and naturalized; in Hawai'i introduced in 1825, now commonly naturalized in low-elevation semi-wet to wet valleys; in Waipi'o forming thickets in disturbed forest.

Uses: The fruit can be eaten fresh or used in jellies or preserves. Elsewhere, the young branches have been used to make coarse baskets and barrel hoops. In Asia, plant parts have been used medicinally for toothaches, fever, diarrhea, dysentery, and itches.

'Oka kilika, ha'ikū ke'oke'o, silk oak, silver oak, he oak

Naturalized

Scientific name: *Grevillea robusta*

Description: A tree 40–70 ft. tall; leaves fern-like, deeply dissected, 6–12 in. long, lower surface usually white hairy; flower clusters comb-like, conspicuous, up to 7 in. long, dominated by orange-yellow sepals of individual flowers (usually blossoming from May–July), followed by black, boat-shaped, 2-valved capsules.

Distribution & Habitat: Native to northern Australia; in Hawai'i introduced in 1851 and the second most widely used tree for reforestation here (after swamp mahogany, *Eucalyptus robusta*), now naturalized in dry to moist disturbed forests; in Waipi'o an occasional tree in disturbed forest.

Uses: An occasional ornamental and windbreak tree. The wood is used for furniture, cabinetry, and paneling. However, the sap, wood, and sawdust can cause contact dermatitis, and all parts of the plant should be regarded as potentially toxic. The dried foliage, old fruit clusters, and flower clusters are sometimes used in floral arrangements, and the fresh flowers are used in hat lei or wreaths.

Öla'a, 'ākala, 'ākalakala, thimbleberry,**Mauritius raspberry**

Naturalized

Scientific name: *Rubus rosifolius*

Description: Weak shrub 3–6 ft. tall with prickly stems; leaves divided feather-fashion, margins notched; flowers white, 5-petaled, followed by red edible fruit about 0.75 in. long, hollow on the inside. Member of the rose family and relative of the native 'ākala (*Rubus hawaiensis*, *R. macraei*).

Distribution & Habitat: Native to Asia; in Hawai'i first introduced in the 1880s, now a common weed in disturbed semi-wet to wet forests; in Waipi'o occasional in disturbed forest.

Uses: In the Philippines a decoction of the roots was given as an expectorant. It is also reported that the fruit was given to children to prevent urination at night.



Rubus rosifolius

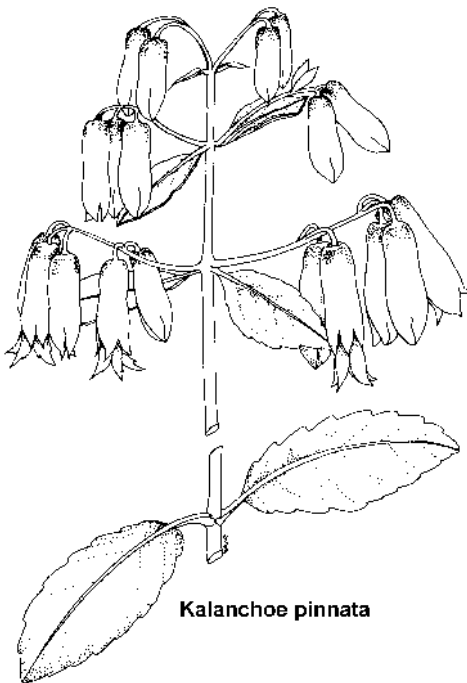
'Oliwa kū kahakai, air plant, life plant

Naturalized

Scientific name: *Kalanchoe pinnata*

Description: Succulent herb 1–6 ft. tall; leaves up to 8 in. long, 4 in. wide, margins scalloped, often bearing plantlets; flowers produced above the foliage, dangling, lantern-like, 2–3 in. long, with a papery, yellowish green calyx surrounding a maroon corolla.

Distribution & Habitat: Native range unknown, now widely naturalized in the tropics and subtropics; in Hawai'i introduced prior to 1871 and now an abundant weed in low-elevation dry to semi-wet, disturbed areas; in Waipi'o noted on the road heading down into the valley, in the coastal zone, and roadside in the valley.



Kalanchoe pinnata

Uses: The crushed are used to reduce are considered disinfectant, and southern China they are used on wounds, skin burns, and are on the forehead headaches and chest for coughs. The plant is said poisonous to



Stachytarpheta australis

leaves external fever and to be a from to Guam boils, diseases, placed to treat on the and pain. to be livestock

Ōwi, oi

Naturalized

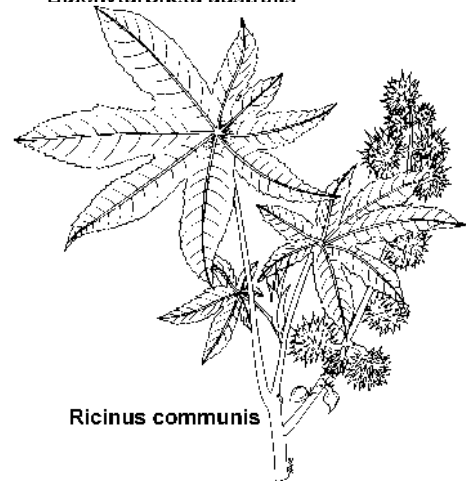
Scientific name:

Stachytarpheta australis

Description: Herb or small shrub usually 2–4 ft. tall; leaves usually 1.5–2.5 in. long, margins notched; flowers small, 5-lobed, pale blue to violet, blooming along slender terminal spikes 0.5–1.5 ft. long. Member of the verbena family that includes *pikake hohono* (which see).

Distribution & Habitat: Apparently native from Cuba and Mexico south to Peru and Argentina, now widely naturalized in the tropics and subtropics; in Hawai'i introduced prior to 1871, now a common weed usually in semi-wet disturbed areas; in Waipi'o seen on the road heading down into the valley and roadside in the valley.

Uses: The leaves are brewed in a tea.



Ricinus communis

Pā'aila, ka'apehā, kamākou, koli, lā'au 'aila, castor bean

Naturalized

Scientific name: *Ricinus communis*

Description: A coarse shrub to small tree 6–20 ft. tall; leaves somewhat papaya-like, large, 8–24 in. long and almost as wide, dark green, 7–11-lobed; capsules 0.5–1 in. long, green turning black, covered with soft spines, containing usually 3 seeds, black mottled gray or brown.

Distribution & Habitat: Native to Africa and now widely cultivated and naturalized in the tropics and subtropics; in Hawai'i introduced before 1819 and weedy in low-elevation dry, disturbed sites; in Waipi'o noted in open disturbed sites.

Uses: Besides the well-known use of the seed oil as a cathartic, the crushed seeds are used in China for a variety of ailments: deafness, headache, swellings, ulcers, and rheumatism. The leaves are also applied externally. The seeds are poisonous and their ingestion can be fatal. They have been used in lei, a practice that is not recommended. The seed oil is also used as a lubricant, for lighting, and in soaps, paints, inks, and plastics.

Paina, common ironwood, she oak, beefwood

Naturalized

Scientific name: *Casuarina equisetifolia*

Description: A fast-growing tree 50–100 ft. tall; foliage resembling pine needles but are actually jointed branchlets (the true leaves are tiny, scale-like, and ring the branchlet at each joint); male and female flowers produced in different parts of the tree: males are inconspicuous and produced in brown clusters on ends of branchlets, females are in short clusters at the branchlet bases, dominated by the dark red styles; female flowers followed by woody cones up to 1 in. long, containing small winged fruits.



Casuarina equisetifolia

Distribution & Habitat: Native to Australia, now widely cultivated and naturalized in the tropics and subtropics; in Hawai'i introduced in 1872, a popular tree for reforestation, now a common tree in dry coastal and low-elevation forests; in Waipi'o the dominant tree in the sandy shoreline zone.

Uses: The tree is a good windbreak and can be trained as a hedge or topiary. The wood is hard (ironwood) with often dark red heartwood (beefwood), and is used elsewhere for fenceposts, poles, oxcart tongues, and firewood; in Fiji tapa beaters are made from it, as are war clubs in Australia. The bark is used in tanning, and a red or blue-black dye is extracted. Medicinally, in Asia an infusion of the bark is used as an astringent, tonic, and emmenagogue, and to treat dysentery and diarrhea. Known as toa (warrior tree) in southern Polynesia. The tree is able to fix free nitrogen, allowing it to thrive on infertile substrates where few other plants can survive, often allowing it to form dense stands that exclude all other plant species. It is also believed that the roots and needle litter exude a chemical into the soil that prevents other plants from growing, a plant defense called allelopathy.

Palmgrass

Naturalized

Scientific name: *Setaria palmifolia*

Description: A grass 2–5 ft. tall, with broad, pleated leaves resembling those of the Malayan ground orchid; leaves up to 24 in. long, 3.5 in. wide; stems covered with short, white, irritating hairs that break off in the skin and itch; flowering panicle rising above the foliage, 1–2 ft. long, open, tassel-like.

Distribution & Habitat: Native to tropical Asia; in Hawai'i first collected in 1903, cultivated and now a common trailside weed in semi-wet valleys, wet forests, and along streams; in Waipi'o a common trailside weed.

Uses: The young flowering stalk is eaten with rice in Java and New Guinea; a decoction of the leaves is used for coughs and to purify blood in China.

Pikake hohono, pikake wauke (O'ahu)

Naturalized

Scientific name: *Clerodendrum chinense*

Description: Shrub up to 7 ft. tall; leaves broadly ovate, up to 12 in. long, 8 in. wide, bad-smelling when bruised;

flowers white to pink, many-petaled, like miniature roses, fragrant. No fruit produced; the plant instead reproducing vegetatively by suckers from the roots.

Distribution & Habitat: Native to subtropical China, now a widespread ornamental; in Hawai'i first collected in 1864 or 1865, now naturalized in disturbed, open to partly shaded areas on moist soils, near streams, or at the margins of semi-wet or wet forests; in Waipi'o a common roadside plant on wetter soils.

Uses: In China the roots are used medicinally to strengthen weak leg muscles, and a decoction aids with skin troubles; elsewhere in Asia the plant is used to treat rheumatism, smallpox, swellings, and aids in childbirth.

Pipili, pilipili

Naturalized

Scientific name: *Drymaria cordata* var. *pacifica*

Description: Small prostrate trailing herb; leaves small, opposite, orbicular, usually about 0.5 in. long and a little wider; flowers inconspicuous, followed by small, sticky (*pipili* = sticky) green fruit that readily attach to fur and clothing.

Distribution & Habitat: A pantropical species; in Hawai'i first collected in 1895, naturalized in moist, shady sites; in Waipi'o a common weed in fallow *kalo lo'i*.

Uses: In Taiwan, the stems and leaves are pounded for use on poisonous snake bites; in Indonesia, they are ground with lime and applied to boils, and the sap drunk as a laxative; in New Guinea it is eaten raw or cooked as a stimulant.

Pöhuehue, puhuehue, beach morning glory

Indigenous

Scientific name: *Ipomoea pes-caprae* subsp. *brasiliensis*

Description: Trailing morning-glory vine with thick green stems; leaves shiny green, succulent, up to 4 in. long, 3 in. wide, usually folded upward at midrib, tip notched (leaf shape resembling a goat's foot = *pes-caprae*); flowers funnel-shaped, pink to lavender with a purple throat, up to 3 in. long.

Distribution & Habitat: Pantropical; in Hawai'i a common beach plant just above the high-tide line; in Waipi'o noted on the sandy beach.

Uses: Hawaiians ate the roots and stems as a starvation food, but they are cathartic and dangerous if eaten in quantity. The seeds are also cathartic. The vines were used to drive fish into nets, and were slapped on the ocean by surfers to request high surf. The vine was part of a *lei* worn around the necks of new mothers to induce milk flow. The plant was also believed to have magical powers. There are a variety of medicinal uses elsewhere in Asia and the Pacific.

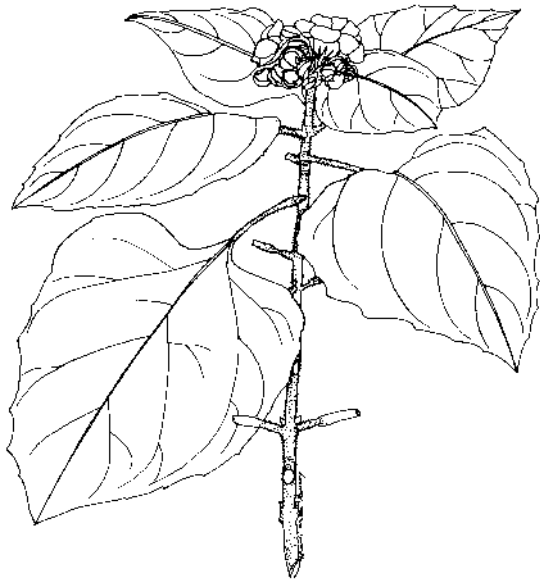
Pü'ohē'ohē, kūkaekōlea, 'ohē'ohē, pūpū kōlea, Job's-tears

Naturalized

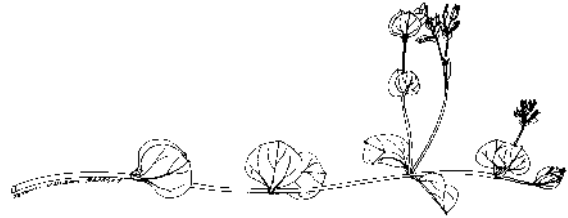
Scientific name: *Coix lachryma-jobi*

Description: Tall, coarse grass 3–10 ft. tall; foliage resembling that of a corn plant, 4–16 in. long, up to 1.5 in. wide; fruits hard, nut-like, up to 0.5 in. long, black, blue-gray, or white.

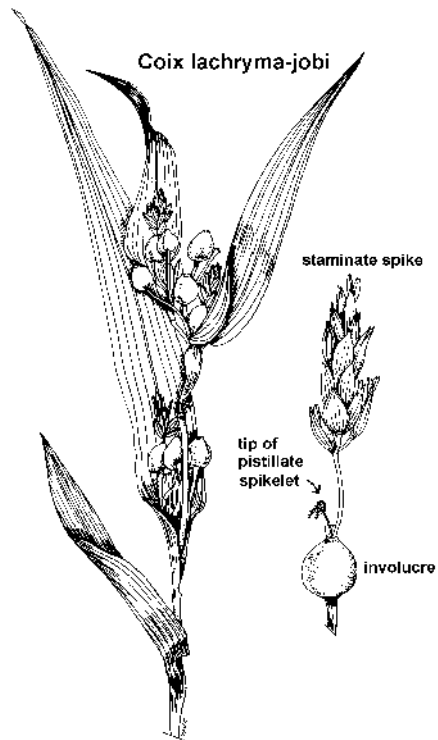
Distribution & Habitat: Native to Asia and now naturalized throughout the tropics; in Hawai'i first collected in 1903, most commonly naturalized along streams and ditches; in Waipi'o occasional on wet soils.



Clerodendrum chinense



Drymaria cordata var. pacifica



Coix lachryma-jobi

Uses: The nuts are used to make *lei*, table mats, and other crafts. They are strung into rosaries and are worn for their supposed curative powers. In China, Japan, India, and the Philippines the kernels are removed from the shells and used as food and medicine for a variety of ailments, including rheumatism, gonorrhea, wart removal, and dropsy. It is a diuretic, stomachic, and tonic. The skin is said to become smooth when the kernels are cooked and eaten daily.

***Pua hilahila*, sensitive plant, sleeping grass**

Naturalized

Scientific name: *Mimosa pudica* var. *unijuga*

Description: Creeping or clambering legume herb with prickly purplish stems; leaves divided into 2–4 pinnae, each of the latter with 10–25 small, closely spaced, narrow, dark green leaflets; pinnae quickly drooping and closing when touched, then slowly reopening; flowers in globose, stalked clusters, dominated by pink to lavender filaments; pods small, brown, clustered.

Distribution & Habitat: Probably native to South America, now a pantropical weed; in Hawai'i introduced at least by the mid-1860s, now a common weed in open, dry to wet disturbed areas, such as lawns; in Waipi'o an occasional roadside weed.

Uses: The plant is cultivated as a curiosity for its animated foliage. An infusion of the leaves is a bitter tonic that can be toxic and cause hair loss in strong dosages. In Indonesia the leaves are pounded and applied as a poultice to swellings. In the Philippines the root is used as a diuretic. Reportedly poisonous to cattle, especially after cut and left to dry.



Mimosa pudica* var. *unijuga

‘Ūlei, eluehe (Moloka’i), u’ulei

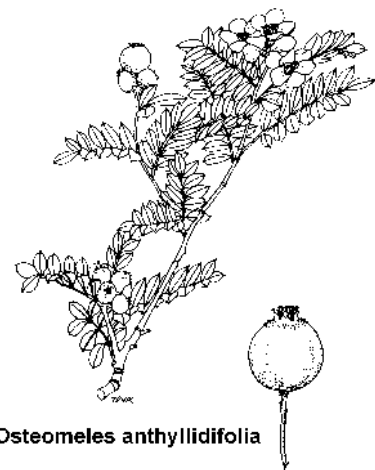
Indigenous

Scientific name: *Osteomeles anthyllidifolia*

Description: Low shrub with arching, trailing branches (in some areas, such as at Manukā State Park, they are small trees); leaves glossy green, up to 2.5 in. long, divided feather-fashion into 15–25 leaflets; flowers in loose clusters, white, 5-petaled, 0.5 in. across; fruit white, round, 0.33 in. across, with white to purple, sweet-tasting flesh and 5 seeds.

Distribution & Habitat: Native to the Cook Islands, Tonga, and Hawai'i; in Hawai'i common on coastal cliffs and lava fields, and in dry shrublands and dry to semi-wet forests; in Waipi'o noted on the cliff face above the road heading down into the valley.

Uses: The tough wood was made into digging sticks (‘ō’ō), fish spears, and ‘ukēkē (a type of musical bow); the flexible stems were formed into fish net hoops.



Osteomeles anthyllidifolia

Waiawi 'ula'ula, strawberry guava

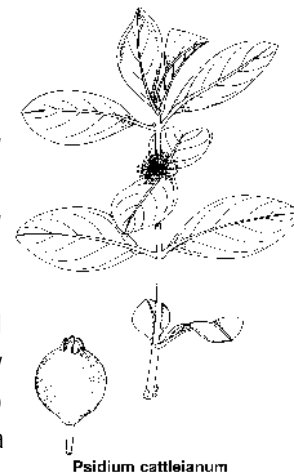
Naturalized

Scientific name: *Psidium cattleianum*

Description: Small tree 10–20 ft. tall (yellow-fruited form a tree up to 50 ft. tall), with smooth, flaking bark (like that of common guava); leaves glossy dark green, 1.5–4.5 in. long, up to 2 in. wide; flowers produced singly in leaf axils, white, 4–5-petaled, less than 1 in. across, with many stamens; fruit red to purplish red, round, about 1 in. across, with white, juicy flesh and many seeds (the yellow-fruited form is more football-shaped).

Distribution & Habitat: Native to the New World tropics, now widely cultivated and naturalized in the tropics and subtropics; in Hawai'i first introduced in 1825, now cultivated and a weedy tree forming extensive thickets in disturbed semi-wet to wet forests; in Waipi'o noted on the road heading down into the valley and a component of disturbed forest in the valley.

Uses: The sweet fruit is eaten raw or made into jams and jellies (the yellow-fruited form is tart even when ripe). The wood is used as fuelwood. The tree is one of the most invasive weed species in Hawai'i.

**Water hyacinth**

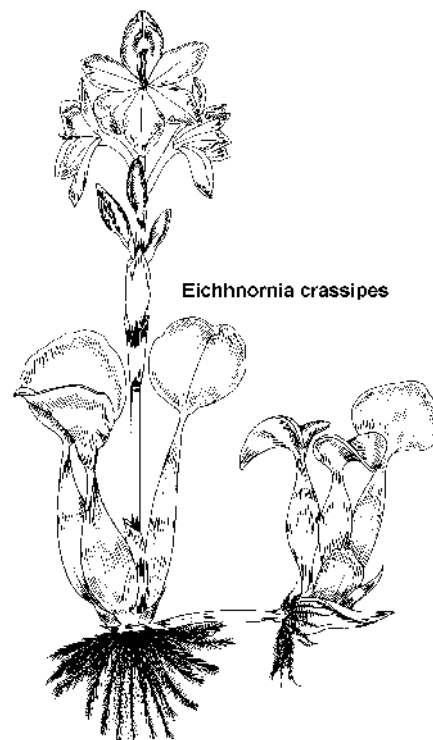
Naturalized

Scientific name: *Eichhornia crassipes*

Description: Free-floating aquatic herb; leaves clustered, roundish, 1.5–6 in. long and nearly as wide, glossy, leathery, the base swollen, air-filled; flowers large, orchid-like, on a spike above the foliage, light purple or blue, the uppermost lobe with a dark blotch surrounding a yellow spot. Reproduces vegetatively by keiki from the side of the plant.

Distribution & Habitat: Native to Brazil, now widespread throughout the tropics; in Hawai'i introduced in the 1880s as an ornamental, now naturalized and locally abundant in low-elevation ponds and slow-moving streams; in Waipi'o noted in Lālākea Fishpond.

Uses: A noxious weed of waterways; dredged biomass has been used as a livestock and hog feed and mulch, and fermented to produce methane gas. Because the trailing roots efficiently absorb dissolved nutrients in the water, water hyacinth has been used to clean polluted or organically enriched waters. The green parts and inflorescences are said to be eaten in Java but cause itching.



Water lettuce

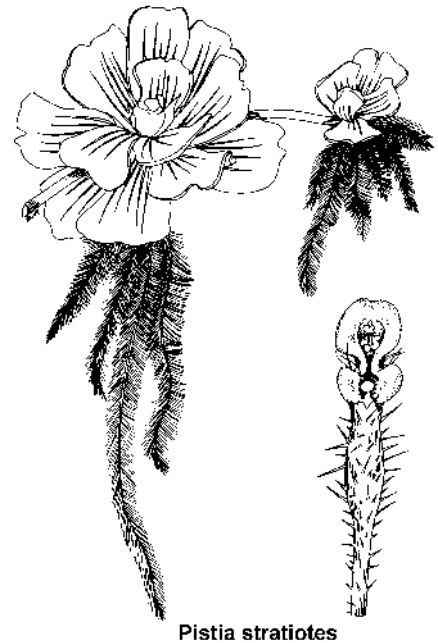
Naturalized

Scientific name: *Pistia stratiotes*

Description: Free-floating aquatic herb resembling a rosette of lettuce; leaves wedge-shaped, light green, 1–6 in. long, spongy, water repellent, flattened and notched at the tip, with 5–7 conspicuous parallel veins running the length of the blade; the leaves flattened horizontally by day and standing erect by night.

Distribution & Habitat: Possibly originally from Lake Victoria in central Africa, now pantropical, and like water hyacinth now a serious pest in still or slow-moving bodies of freshwater; in Hawai'i introduced around 1932, cultivated and now naturalized in low-elevation ponds, ditches, and other watercourses; in Waipi'o noted in Lālākea Fishpond.

Uses: A member of the aroid family (which includes kalo and 'ape), the plant is toxic if eaten. It is said that the plant imparts a bitterness to the water it grows in; if the water is drunk, it will cause intestinal hemorrhaging. In China a decoction of the plant is used as an emmenagogue, and externally is applied to skin eruptions, contusions, and swellings.



Pistia stratiotes

Wilelaiki, nani o Hilo (Moloka'i), Christmas berry

Naturalized

Scientific name: *Schinus terebinthifolius*

Description: Many-branched shrub to small tree 3–25 ft. tall; leaves divided feather-fashion into usually 5–9 elliptic leaflets, each 1–3 in. long with notched margins, crushed leaves resinous-smelling like mango (to which it is related); flowers clustered, tiny, followed by masses of red fruit, each about 0.25 in. across, produced during autumn and winter. Also related to poison ivy and poison oak.

Distribution & Habitat: Native to South America from Venezuela to Argentina; in Hawai'i first collected in 1911, now widely naturalized in usually disturbed semi-wet habitats; in Waipi'o noted on the road heading down into the valley and a component of disturbed forest on the valley floor.

Uses: Often used ornamentally. The wood is used as firewood and chipped mulch, but the resinous sap is poisonous to some people, producing a rash or dermatitis. The fruit are also poisonous, and the pollen can cause allergic reactions. The fruiting branches are often used in Christmas wreaths. The name wilelaiki was bestowed in reference to local politician Willie Rice (possibly William Hyde Rice), who often wore a hat lei of the berries.



pistillate flower

staminate flower

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Appendix A:

WAIPI'O VALLEY PLANT SPECIES LIST

The following is a list of vascular plant species noted during walk-through surveys of the lowland areas of Waipi'o Valley on 12–13 April, 17–20 June, and 10–13 December 1999. The focus was on noting naturally occurring (native and naturalized) plants; cultivated species were not included unless they were also seen growing outside of cultivation (i.e. naturalized). A total of 154 species are included.

Plants are divided into 3 main groups: ferns and fern allies, dicots, and monocots. Within these groups, plants are arranged alphabetically by family, genus, and species. Each entry includes scientific name with author citation, biogeographic status, common name (if available), and presence or absence in each of 4 vegetation categories. Taxonomy, status, and common names are in accordance with Wagner et al. (1999) or Staples and Herbst (in prep). A number of specimens were collected and are being deposited in the Bishop Museum Botany Department herbarium; some unknown species were collected and compared with herbarium collections to secure correct identifications. I thank Dr. Derral R. Herbst for assistance with identifications. An explanation of abbreviations used in the list follows.

Biogeographic Status

- end Endemic: native, occurring only in the Hawaiian Archipelago; species that have evolved into something uniquely Hawaiian after arriving naturally from elsewhere.
- ind Indigenous: native, occurring naturally in the archipelago but also outside of Hawai'i; many of these species inhabit the coastal zone, where they can be readily dispersed by water or seabirds.
- nat Naturalized: introduced to the archipelago directly or indirectly by humans since Western contact and reproducing and spreading vegetatively or from seed.
- pol Polynesian introduction: introduced by original Polynesian settlers, either intentionally or unintentionally, and now naturalized.
- ind? Questionably indigenous: probably indigenous, possibly naturalized.
- nat? Questionably naturalized: probably naturalized, possibly indigenous.
- pol? Questionably a Polynesian introduction; possibly introduced in historic times.

Vegetation categories (more fully described in main part of report)

- 1 Roadside vegetation along steep road at valley mouth
- 2 Wetland vegetation (*taro lo'i*, ponds, streambanks)
- 3 Valley floor vegetation
- 4 Coastal vegetation

Family/Scientific Name	Status	Common Name	1	2	3	4
Ferns & Fern Allies						
Adiantaceae						
<i>Adiantum hispidulum</i> Sw.	nat	five-finger maidenhair, rosy maidenhair	x		x	
<i>Adiantum raddianum</i> C. Presl	nat	maidenhair fern			x	
Athyriaceae						
<i>Deparia petersenii</i> (Kunze) M. Kato	nat				x	
<i>Diplazium esculentum</i> (Retz.) Sw.	nat	<i>hō'i'o, paco</i> , edible fern, vegetable fern		x	x	
Azollaceae						
<i>Azolla filiculoides</i> Lam.	nat	mosquito fern		x		
Blechnaceae						
<i>Blechnum occidentale</i> L.	nat	hammock fern			x	
Dryopteridaceae						
<i>Tectaria incisa</i> Cav.	nat	incised halfbred fern			x	
Gleicheniaceae						
<i>Dicranopteris linearis</i> (Burm f.) Underw. f. linearis	ind	<i>uluhe, unuhe</i>	x			
Lindsaeaceae						
<i>Sphenomeris chinensis</i> (L.) Maxon	ind	<i>pala'ā, palapala'ā, Pala'e, p'ā'ū o Pala'e</i>	x			
Lycopodiaceae						
<i>Palhinhaea cernua</i> (L.) Vasc. & Franco	ind	<i>wāwae 'iole, hulu 'iole, huluhulu a 'iole</i>	x			
Nephrolepidaceae						
<i>Nephrolepis multiflora</i> (Roxb.) F. M. Jarrett ex C. V. Morton	nat	Asian swordfern	x		x	
Polypodiaceae						
<i>Lepisorus thunbergianus</i> (Kaulf.) Ching	ind	<i>pākahakaha, 'ēkaha 'ākōlea</i>			x	
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	nat	<i>laua'e, maile-scente fern</i>	x		x	x
Pteridaceae						
<i>Pteris vittata</i> L.	nat	ladder brake, cliff brake, Chinese brake			x	
Salviniaceae						
<i>Salvinia auriculata</i> Aublet	nat	salvinia		x		
Thelypteridaceae						
<i>Christella cyatheoides</i> (Kaulf.) Holttum	end	<i>kikawaiō, kikawaioa, pakikawaiō</i>			x	
<i>Christella dentata</i> (Forssk.) Brownsey & Jermey	nat	<i>pai'i'ihā</i> , downy maiden fern		x	x	
<i>Christella parasitica</i> (L.) Leveille	nat		x		x	
<i>Macrothelypteris torresiana</i> (Gaudich.) Ching	nat	Mariana maiden fern			x	

Family/Scientific Name	Status	Common Name	1	2	3	4
Dicots						
Acanthaceae						
<i>Justicia betonica</i> L.	nat	white shrimp plant, squirrel's-tail	x			
Aizoaceae						
<i>Tetragonia tetragonioides</i> (Pall.) Kuntze	nat	New Zealand spinach				x
Amaranthaceae						
<i>Amaranthus spinosus</i> L.	nat	<i>pakai kukū</i> , spiny amaranth			x	
Anacardiaceae						
<i>Mangifera indica</i> L.	nat	<i>manakō</i> , <i>manakō meneke</i> , <i>meneke</i> , mango	x		x	
<i>Rhus sandwicensis</i> A. Gray	end	<i>neleau</i> , <i>neneleau</i>	x			
<i>Schinus terebinthifolius</i> Raddi	nat	<i>wilelaiki</i> , <i>nani-o-Hilo</i> (Moloka'i), Christmas berry	x		x	x
Annonaceae						
<i>Artabotrys hexapetalus</i> (L. f.) Bhandari	nat	climbing ylang-ylang			x	
Asteraceae						
<i>Ageratum conyzoides</i> L.	nat	<i>maile hohono</i> , <i>maile honohono</i> , <i>maile kula</i>		x	x	
<i>Cirsium vulgare</i> (Savi) Ten.	nat	<i>pua kala</i> , bull thistle			x	
<i>Conyza canadensis</i> (L.) Cronquist var. <i>pusilla</i> (Nutt.) Cronquist	nat	<i>lani wela</i> , <i>ilioha</i> , 'awi'awi, <i>pua mana</i> , horseweed			x	
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	nat			x	x	
<i>Eclipta prostrata</i> (L.) L.	nat	false daisy		x		
<i>Emilia sonchifolia</i> (L.) DC. var. <i>javanica</i> (Burm. f.) Mattf.	nat	Flora's paintbrush				x
<i>Montanoa hibiscifolia</i> Benth.	nat	tree daisy		x	x	
<i>Pluchea carolinensis</i> (Jacq.) G. Don	nat	sourbrush, marsh fleabane	x	x	x	x
<i>Senecio madagascariensis</i> Poir.	nat	German ivy, Italian ivy			x	
<i>Sonchus oleraceus</i> L.	nat	<i>pualele</i> , sow thistle				x
<i>Sphagneticola trilobata</i> (L.) Pruski	nat	<i>wedelia</i>	x		x	x
<i>Xanthium strumarium</i> L. var. <i>canadense</i> (Mill.) Torr. & A. Gray	nat	<i>kikānia</i> , cocklebur			x	
<i>Youngia japonica</i> (L.) DC.	nat	Oriental hawkbeard			x	
Balsaminaceae						
<i>Impatiens wallerana</i> Hook. f.	nat	busy Lizzy, patient Lucy	x		x	
Begoniaceae						
<i>Begonia hirtella</i> Link	nat	<i>pikonia</i> , begonia	x		x	
Bignoniaceae						
<i>Jacaranda mimosifolia</i> D. Don	nat	jacaranda			x	
<i>Spathodea campanulata</i> P. Beauv.	nat	African tulip tree, fountain tree			x	
Boraginaceae						
<i>Tournefortia argentea</i> L. f.	nat	tree heliotrope, <i>tahinu</i>				x
Brassicaceae						

Family/Scientific Name	Status	Common Name	1	2	3	4
Rorippa microphylla (Boenn. ex Rchb.) H. Hyl. ex A. Löve & D. Löve	nat	<i>lêkô</i> , watercress		x		
Buddleiaceae						
Buddleia asiatica Lour.	nat	<i>huelo</i> , 'ilio, dog tail, butterfly bush	x	x	x	
Cactaceae						
Hylocereus undatus (Haw.) Britton & Rose	nat	pänini-o-ka-Punahou, päpipi pua, night-blooming cereus	x			
Caprifoliaceae						
Sambucus mexicana C. Presl ex A. DC.	nat	Mexican elder			x	
Caricaceae						
Carica papaya L.	nat	<i>mikana</i> , <i>hē'i</i> , <i>milikana</i> , <i>papaia</i> , <i>pawpaw</i> , <i>papaya</i>			x	
Caryophyllaceae						
Drymaria cordata (L.) Willd. ex Roem. & Schult. var. pacifica M. Mizush.	nat	<i>pipili</i> , <i>pipilili</i>			x	
Stellaria media (L.) Vill.	nat	common chickweed, stitchwort			x	
Casuarinaceae						
Casuarina equisetifolia L.	nat	<i>paina</i> , common ironwood, she oak, beefwood				x
Combretaceae						
Terminalia catappa L.	nat	<i>kamani haole</i> , <i>kamani 'ula</i> , tropical or Indian almond, false <i>kamani</i>			x	x
Convolvulaceae						
Ipomoea alba L.	nat	<i>koali pehu</i> , moon flower		x	x	
Ipomoea aquatica Forssk.	nat	swamp cabbage, ung choi		x		
Ipomoea indica (Burm.) Merr.	ind	<i>koali 'awa</i> , <i>koali 'awahia</i> , <i>koali lä'au</i> (Ni'ihau), <i>koali pehu</i>	x		x	
Ipomoea pes-caprae (L.) R. Br. subsp. brasiliensis (L.) Ooststr.	ind	<i>pöhuehue</i> , <i>puhuehue</i> , beach morning glory				x
Crassulaceae						
Kalanchoe pinnata (Lam.) Pers.	nat	'oliwa kü kahakai, air plant, life plant	x		x	x
Cucurbitaceae						
Momordica charantia L.	nat	bitter melon	x		x	
Euphorbiaceae						
Aleurites moluccana (L.) Willd.	pol	<i>kukui</i> , <i>kuikui</i> , candlenut tree	x		x	
Ricinus communis L.	nat	<i>pä'aila</i> , <i>ka'apehä</i> , <i>kamäkou</i> , <i>kolī</i> , <i>lä'au 'aila</i> , castor bean			x	
Fabaceae						
Canavalia cathartica Thouars	nat	<i>maunaloa</i>	x		x	x
Falcataria moluccana (Miq.) Barneby & J. W. Grimes	nat	albizia			x	
Indigofera suffruticosa Mill.	nat	'inikō, 'inikoa, kolū, indigo			x	
Mimosa pudica L. var. unijuga (Duchass. & Walp.) Griseb.	nat	<i>pua hilahila</i> , sensitive plant, sleeping grass		x	x	
Samanea saman (Jacq.) Merr.	nat	'ohai, pū'ohai, monkeypod, rain tree			x	x

Family/Scientific Name	Status	Common Name	1	2	3	4
<i>Senna pendula</i> (Humb. & Bonpl. ex Willd.) H. S. Irwin & Barneby var. <i>advena</i> (Vogel) H. S. Irwin & Barneby	nat				x	
Goodeniaceae						
<i>Scaevola sericea</i> Vahl	ind	<i>naupaka kahakai</i> , <i>aupaka</i> (Ni'ihau), <i>huahekili</i> , beach <i>naupaka</i>				x
Lauraceae						
<i>Persea americana</i> Mill.	nat	avocado, alligator pear	x		x	
Lythraceae						
<i>Cuphea carthagenensis</i> (Jacq.) J. F. Macbr.	nat	tarweed, Colombian cuphea		x		
Malvaceae						
<i>Abutilon grandifolium</i> (Willd.) Sweet	nat	<i>ma'o</i> , hairy abutilon	x		x	
<i>Hibiscus macrophyllus</i> Roxb. ex Hornem.	nat	large-leaved <i>hau</i>			x	
<i>Hibiscus tiliaceus</i> L.	ind?	<i>hau</i>		x	x	
<i>Malvastrum coromandelianum</i> (L.) Garcke subsp. <i>coromandelianum</i>	nat	false mallow			x	
<i>Malvastrum penduliflorum</i> DC.	nat	<i>aloalo pahūpahū</i> , Turk's-cap			x	
<i>Sida acuta</i> Burm. f. subsp. <i>carpinifolia</i> (L. f.) Borss. Waalk.	nat				x	
<i>Sida spinosa</i> L.	nat	prickly sida			x	
Meliaceae						
<i>Melia azedarach</i> L.	nat	' <i>inia</i> , ' <i>ilinia</i> , chinaberry, pride-of-India			x	
<i>Toona ciliata</i> M. Roem. var. <i>australis</i> (F. Muell.) C. DC.	nat	Australian red cedar	x		x	
Menispermaceae						
<i>Cocculus orbiculatus</i> (L.) DC.	ind	<i>huehue</i> , <i>hue</i> , <i>hue'ie</i> , ' <i>inalua</i>	x			
Moraceae						
<i>Artocarpus altilis</i> (Parkinson ex Z) Fosberg	pol	' <i>ulu</i> , breadfruit			x	
<i>Ficus microcarpa</i> L. f.	nat	Chinese banyan, Malayan banyan	x			
Myrtaceae						
<i>Eucalyptus robusta</i> Sm.	nat	swamp mahogany	x		x	
<i>Eugenia uniflora</i> L.	nat	Surinam cherry, pitanga			x	
<i>Metrosideros polymorpha</i> Gaudich. var. <i>polymorpha</i>	end	' <i>ōhi'a</i> , ' <i>ōhi'a lehua</i> , <i>lehua</i>	x			
<i>Psidium cattleianum</i> Sabine	nat	<i>waiawi</i> ' <i>ula'ula</i> , strawberry guava	x		x	
<i>Psidium guajava</i> L.	nat	<i>kuawa</i> , <i>kuawa ke'oke'o</i> , <i>kuawa lemi</i> , <i>kuawa momona</i> , common guava	x	x	x	
<i>Syzygium cumini</i> (L.) Skeels	nat	Java plum, jambolan plum	x		x	x
<i>Syzygium jambos</i> (L.) Alston	nat	' <i>ōhi'a lōke</i> , rose apple			x	
<i>Syzygium malaccense</i> (L.) Merr. & L. M. Perry	pol	' <i>ōhi'a 'ai</i> , ' <i>ōhi'a</i> , mountain or Malay apple			x	
Nyctaginaceae						
<i>Mirabilis jalapa</i> L.	nat	<i>nani ahiahi</i> , <i>pua ahiahi</i> , <i>puahiahi</i> , four-o'clock, marvel-of-Peru				x
Onagraceae						
<i>Ludwigia octovalvis</i> (Jacq.) P. H. Raven	pol?	<i>kāmole</i> , <i>alohalua</i> , primrose willow		x		

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Ludwigia palustris (L.) Elliott	nat	marsh purslane		x	x	
Oxalidaceae						
Oxalis corniculata L.	pol?	'ihi 'ai, 'ihi 'awa, 'ihi maka 'ula, 'ihi mäkole, yellow wood sorrel			x	x
Oxalis corymbosa DC.	nat	'ihi pehu, pink wood sorrel			x	

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Piperaceae						
Piper species	nat				x	
Piper methysticum G. Forst.	pol	'awa, pū'awa, kava			x	
Polygonaceae						
Polygonum punctatum Elliott	nat	water smartweed		x		
Portulacaceae						
Portulaca oleracea L.	nat	'ākulikuli kula, 'ākulikuli lau li'i, 'ihi, pigweed				x
Proteaceae						
Grevillea robusta A. Cunn. ex R. Br.	nat	'oka kilika, ha'ikū ke'oke'o, silk oak, silver oak, he oak			x	
Macadamia integrifolia Maiden & Betche	nat	macadamia			x	
Rosaceae						
Osteomeles anthyllidifolia (Sm.) Lindl.	ind	'ūlei, eluehe (Moloka'i), u'ulei	x			
Rubus rosifolius Sm.	nat	ōla'a, 'ākala, 'ākalakala, thimbleberry, Mauritius raspberry			x	
Rubiaceae						
Coffea arabica L.	nat	Arabian coffee			x	
Morinda citrifolia L.	pol	noni, Indian mulberry	x		x	x
Solanaceae						
Cestrum species	nat				x	
Physalis peruviana L.	nat	pohā, pa'ina (Hawai'i), Cape gooseberry			x	
Solanum seafortianum Andrews	nat				x	
Sterculiaceae						
Melochia umbellata (Houtt.) Stapf	nat	melochia			x	
Urticaceae						
Pilea microphylla (L.) Liebmann	nat	artillery plant, gundpowder plant			x	
Pipturus albidus (Hook. & Arn.) A. Gray	end	māmaki, māmake, waimea (Kaua'i)			x	
Verbenaceae						
Clerodendrum chinense (Osbeck) Mabb.	nat	pikake hohono, pikake wauke (O'ahu)		x	x	
Stachytarpheta australis Moldenke	nat	ōwi, oi	x			
Monocots						
Agavaceae						
Cordyline fruticosa (L.) A. Chev.	pol	kī, ti	x		x	
Furcraea foetida (L.) Haw.	nat	malina (Ni'ihau), Mauritius hemp			x	x
Alismataceae						
Sagittaria latifolia Willd.	nat	arrowhead, duck potato		x		
Araceae						
Alocasia cucullata (Lour.) G. Don	nat	Chinese taro		x	x	
Alocasia macrorrhizos (L.) Schott	pol	'ape, elephant's-ear		x	x	
Colocasia esculenta (L.) Schott	pol	kalo, taro		x	x	
Epipremnum pinnatum (L.) Engl.	nat	taro vine, pothos			x	
Pistia stratiotes L.	nat	water lettuce		x		
Xanthosoma roseum Schott	nat	'ape			x	

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Arecaceae						
<i>Cocos nucifera</i> L.	pol	<i>niu, lolani</i> , coconut			x	x
Cannaceae						
<i>Canna indica</i> L.	nat	<i>ali'ipoe, li'ipoe, poloka</i> , Indian-shot			x	
Commelinaceae						
<i>Commelina diffusa</i> Burm. f.	nat	<i>honohono, honohono wai, mākolokolo</i>		x		
Cyperaceae						
<i>Cyperus involucratus</i> Roxb.	nat	<i>'ahu'awa haole, pu'uka'a haole</i> , umbrella plant		x		x
<i>Cyperus papyrus</i> L.	nat	<i>kaluhā, papulo, papyrus</i>		x		
<i>Eleocharis radicans</i> (Poir.) Kunth	nat	<i>kohekohe, pipiwai, spikerush</i>		x		
<i>Fimbristylis miliacea</i> (L.) Vahl	nat			x		
<i>Kyllinga brevifolia</i> Rottb.	nat	<i>kili'o'opu, kaluhā, manunēnē, mau'u mokae</i>		x		
<i>Pycreus polystachyos</i> (Rottb.) P. Beauv. subsp. <i>holosericeus</i> (Link) T. Koyama	ind			x		
<i>Schoenoplectus californicus</i> (C. A. Mey.) Palla	nat?	<i>kaluhā, 'aka'akai</i> (Ni'ihau)		x		
<i>Schoenoplectus juncoideus</i> (Roxb.) Palla	ind	<i>kaluhā</i>		x		
Lemnaceae						
<i>Lemna aquinoctialis</i> Welw.	nat?	lesser duckweed		x		
Musaceae						
<i>Musa x paradisiaca</i> L.	pol	<i>mai'a</i> , banana	x		x	
Orchidaceae						
<i>Arundina graminifolia</i> (D. Don) Hochr.	nat	bamboo orchid	x			
<i>Spathoglottis plicata</i> Blume	nat	Malayan ground orchid, Philippine ground orchid	x			
Pandananaceae						
<i>Pandanus tectorius</i> Parkinson ex Z	ind	<i>hala, pū hala</i> , screwpine	x		x	x
Poaceae						
<i>Brachiaria mutica</i> (Forssk.) Stapf	nat	California grass, Para grass	x	x		
<i>Coix lachryma-jobi</i> L.	nat	<i>pū'ohe'ohe, kūkaekōlea, 'ohe'ohe, pūpū kōlea</i> , Job's-tears		x	x	
<i>Cynodon dactylon</i> (L.) Pers.	nat	<i>mānienie, mānienie haole</i> , Bermuda grass				x
<i>Digitaria ciliaris</i> (Retz.) Koeler	nat	<i>kūkaepua'a</i> , Henry's crabgrass			x	x
<i>Echinochloa crus-galli</i> (L.) P. Beauv.	nat	barnyard grass		x		
<i>Eleusine indica</i> (L.) Gaertn.	nat	<i>mānienie ali'i</i> , wiregrass	x	x	x	
<i>Oplismenus hirtellus</i> (L.) P. Beauv.	nat	<i>honohono kukui, honohono, honohono maoli</i> , basketgrass			x	
<i>Panicum maximum</i> Jacq.	nat	Guinea grass	x		x	
<i>Paspalum conjugatum</i> P. J. Bergius	nat	<i>mau'u Hilo</i> , Hilo grass, sour paspalum		x	x	
<i>Pennisetum setaceum</i> (Forssk.) Chiov.	nat	fountain grass			x	
<i>Sacciolepis indica</i> (L.) Chase	nat	Glenwood grass		x		
<i>Setaria palmifolia</i> (J. König) Stapf	nat	palmgrass			x	
Pontederiaceae						

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<i>Eichhornia crassipes</i> (Mart.) Solms	nat	water hyacinth		x		
<i>Monochoria vaginalis</i> (Burm. f.) C. Presl	nat	cordate monochoria		x		
Zingiberaceae						
<i>Hedychium flavescens</i> N. Carey ex Roscoe	nat	' <i>awapuhi melemele</i> , yellow ginger			x	
<i>Zingiber zerumbet</i> (L.) Sm.	pol	' <i>awapuhi</i> , shampoo ginger			x	