

HAWAIIAN DRYLAND AGRICULTURAL INTENSIFICATION AND THE PACIFIC ECONOMY

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Agricultural intensification is the process of increasing labor expenditure in an agricultural system to increase the level of total productivity (Kirch 1977:271-272; Brookfield 1984: 16). Archaeologists in Hawai'i have been preoccupied primarily with prehistoric episodes of agricultural intensification because of their interest in sociopolitical development prior to European contact. In a recent review of Hawaiian archaeological data, Kirch (1990) proposed that the major phase of intensification of Hawaiian dryland systems occurred during the five centuries just prior to European contact. This intensification is thought to have been a response to both an increase in population pressure and escalating demands imposed upon commoners by chiefs (Kirch 1985: 223; Hommon 1986:65). However, agricultural intensification is not solely a prehistoric phenomenon but has occurred occasionally in the historic period for reasons other than population pressure and increasing complexity of social organization (Clark 1986). With few exceptions, archaeologists have neglected the impact that historic phases of intensification might have had on the archaeological record. This article reviews the economic context of Hawai'i during the early historic period and examines how foreign influences might have affected agricultural productivity at Kalaupapa, Moloka'i, and throughout the archipelago.

During the late 1700s Hawai'i entered the world economy, and within seventy-five years of contact Hawai'i's economy had shifted from a subsistence to a mercantilist base (Kent 1983). When new markets for provisioning ships and exporting produce to the west coast of America

stimulated agricultural productivity, portions of dryland field systems throughout the archipelago were intensified to meet these new demands. The dryland field system on the Kalaupapa peninsula of Moloka'i appears to be one of the agricultural systems that flourished during the historic period, probably between 1840 and 1870.

The Agricultural Field System at Kalaupapa

An intensive archaeological survey conducted by International Archaeological Research Institute Inc. located an abandoned house and thirty-eight archaeological features containing 525 architectural components in a 12.5-acre research area just west of the Kalaupapa airport runway on the Kalaupapa peninsula of Moloka'i (Ladefoged 1990). Twenty-three test units, totaling 11 square meters, were excavated at twenty-one features. The twenty-one features included four residential features, thirteen shelters, two agricultural areas, one animal pen, and one possible shrine or special use area. The results of the excavations indicate that 57 percent of these features were occupied during a single time period (Ladefoged 1990:183).

A combination of chronometric and relative dating techniques, using evidence from temporally sensitive artifacts, faunal materials, and radiocarbon dating of seven charcoal samples, establish the period of occupation for fourteen of the features (Table 1). A radiocarbon date from a lower layer of Feature 8 indicates that the earliest period of occupation of the area could be as early as the fourteenth century. Radiocarbon dates from features 28 and 31 span the prehistoric and historic periods, but probabilities calculated by Stuiver and Reimer's (1986) computer program suggest that they were occupied during the historic era. On the basis of historic artifacts and/or faunal material from historic introductions, features 2, 8, 10, 12, 13, 14, 18, 23, and 35 appear to have been occupied during the historic period. The cultural deposit of Feature 14 contained faunal material from *Herpestes auropunctatus* (small Indian mongoose), an 1883 introduction (Ziegler 1989). The lower cultural layers of features 12 and 13 contained *Geopelia striata* (zebra dove), a 1920 introduction (Ziegler 1989). Feature 13 and the upper cultural layer of Feature 8 contained *Bufo marinus* (giant neotropical toad), a 1932 introduction (Ziegler 1989). The upper layer of Feature 29 contained faunal material from *Herpestes auropunctatus*, but its main lower cultural deposit could be earlier. Features 37 and 38 are concrete foundations that clearly date to the historic era, probably the 1930s. In sum, one feature (Feature 8) has a prehistoric component,

TABLE 1. **Chronological Estimates of Features**

Feature	Functional Type	Morphological Type	Chronological Estimate	Type of Evidence ^a
2	residential	platform	historic	3
8 lower layer	agricultural	alignment	prehistoric	1
8 upper layer	shelter	alignment	historic	2, 3
10	residential	platform	post-1830	3
12	animal pen	enclosure	post-1920	1, 2, 3
13	shrine	enclosure	post-1932	1, 2, 4
14	shelter	enclosure	post-1883	2
18	shelter	c-shape	historic	1, 2
23	shelter	c-shape	historic	1, 2
28	residential	enclosure	prehistoric/ historic	1
29	shelter	c-shape	historic	2
31	shelter	c-shape	prehistoric/ historic	1
35	shelter	c-shape	historic	2
37	residential	concrete foundation	historic	4
38	residential	concrete foundation	historic	4

^aTypes of evidence:

- (1) radiocarbon date
- (2) faunal material from historically introduced species
- (3) historic-period artifacts
- (4) historic-building materials

two features (features 28 and 31) could be prehistoric but based on the probabilities calculated by the radiocarbon calibration program are probably historic, six features (features 2, 8, 10, 18, 23, and 35) were occupied after 1778, one feature (Feature 14) was occupied after 1883, and four features were occupied during the twentieth century (features 12, 13, 37, and 38). The occupation period of Feature 29 and all the other features in the research area is uncertain. Although chronological ages assigned to archaeological features on the basis of introduced faunal material should be considered tentative, the dating methods indicate that twelve of the fourteen dated features (features 2, 10, 12, 13, 14, 18, 23, 28, 31, 35, 37, and 38) were probably occupied exclusively during the historic period, one feature (Feature 8) had both a prehistoric and a historic component, and one feature contained historically introduced faunal material in an upper layer with the lower main cultural layer remaining undated (Feature 9).

On the basis of the presence or absence of a surrounding enclosure, and the density of alignments within a given area, two classes of agricultural complexes were distinguished in the research area. The first class of agricultural complex consists of an enclosure surrounding a high density of alignments. These complexes are dated by association to the historic period. A variety of historic artifacts including cut square nails from a residential feature (Feature 10) contiguous with one of the enclosures (Feature 5b) suggest utilization sometime after 1830 (Hume 1970: 243). The second class of agricultural complex lacks a surrounding enclosure and contains a relatively lower density of alignments. These alignments could have been used either prehistorically, historically, or both, but the presence of historical shelters throughout these areas suggests historic occupation.

It is apparent that portions of the Kalaupapa field system were used during the historic era, but the question remains whether or not the system was actually intensified during the mid-nineteenth century. In two separate test excavations conducted behind agricultural alignments within an enclosure (Feature 5b), buried alignments were observed. A calibrated one-sigma radiocarbon date associated with one of these alignments (Feature 8) is clearly situated within the prehistoric period, A.D. 1327-1442. Without further intensive areal excavation it is impossible to determine if the earlier field system was more or less developed than the historic field system. However, a comparison of the historic field system at Kalaupapa with prehistoric systems throughout Hawai'i indicates that intensification did occur on the peninsula. The density of alignments within the enclosures of the Kalaupapa system appears to be much higher than the density observed at prehistoric dryland systems on Hawai'i island such as Lapakahi (Rosendahl 1972), Kona (Schilt 1884), Kawaihae (Clark 1987; Clark and Kirch 1983), and Kawela, Moloka'i (Weisler and Kirch 1985). The disparity in density of alignments between prehistoric systems throughout Hawai'i and the historic system at Kalaupapa indicates that, relative to prehistoric dryland agricultural systems, labor was expended at Kalaupapa to increase the level of total productivity during the historic period.

The Impact of Hawai'i's Integration into the Pacific Economy on Agricultural Production during the Early Historic Period

High densities of enclosed agricultural alignments in association with historic artifacts and shelters and residential features occupied during a single episode indicate that agricultural intensification at Kalaupapa

occurred during a relatively short time in the historic period. One impetus for the historic intensification was Hawai'i's entrance into the world economy and the creation of new markets for provisioning ships and exporting produce. Hawai'i's economic development during the historic period has been described as peripheral in nature, a reflex of expansionist needs in some far-off metropolitan core (Kent 1983:14). The catalysts and directions of Hawaiian economic transformations were not endogamous, but were the result of foreign individuals promoting political and economic changes at the core (Trask 1987:158). As a peripheral country, Hawai'i has primarily served as an exploited resource base for dominant foreign interests. In response to the changing demands of foreign powers over time, a variety of Hawaiian resources have been exploited. A brief review of the various economic demands during the first seventy-five years of the historic era indicates that not until the mid 1800s did external economic pressures stimulate an increase in dryland agricultural productivity.

During the late 1700s Hawai'i became a major provisioning station for U.S. and British traders bound for China. Despite dramatic changes in Hawaiian social structure at this time, the economic subsistence base remained relatively unaltered. Given new demands for provisions, the elite could convert the subsistence surplus produced by the commoners into new avenues of wealth and commodities such as firearms (Ralston 1984), but such activities appear to have had a minimal impact on agricultural productivity.

The foreign demand for sandalwood from 1810 to 1818 adversely affected agricultural productivity. Commoners were often sent into the upland forests to harvest the valuable wood, resulting in the neglect of their agricultural plots (*The Missionary Herald* 1823:184). The demand for this export in conjunction with the massive depopulation of the native community (Stannard 1989) caused agricultural productivity in the Hawaiian Islands to plummet to a level lower than it had been for centuries.

By 1830 the sandalwood trade had collapsed, and the major economic stimulus in the islands was as a provisioning port for the booming whaling industry. Large increases in the number of visiting whaling ships after 1840 stimulated a corresponding increase in the demand for agricultural products. The provisioning of whaling ships had a much greater impact on the Hawaiian people than either the earlier provisioning or the sandalwood trade. For the first time the Hawaiian populace was drawn into the cash economy as workers and producers on a regular basis (Kent 1983:21). These transactions were still controlled by

the elite, who, according to the early missionaries, retained two-thirds of the gross receipts (Richards 1841; Dibble 1843).

Although the elite retained the majority of the agricultural revenues, their income was rapidly diminishing because of massive depopulation and emigration of rural people to urban centers (La Croix and Roumasset 1988). In order for the chiefs to retain their rurally based tenants in the face of new economic alternatives located in urban centers, wages had to be increased. Several legislative changes were enacted to promote agricultural productivity and increase the profits of the actual producers (La Croix and Roumasset 1988:14). The "Laws of 1842" shifted the burden of the tax base from rural farmers to families residing in urban areas. The laws lowered the number of days per year that tenants worked for the landlord and the king from 104 to 72. Furthermore, these laws prohibited tenants from leaving the land with undue cause.

During the same period the missionaries were encouraging native Hawaiians to increase their agricultural productivity. According to the minutes from an 1838 delegate meeting, it would be desirable for the missionaries "to devote a portion of their time to instructing the natives into the best method of cultivating their lands, and of raising flocks and herds, and of turning various products of the country to the best advantage" (Kuykendall 1938:179).

By the late 1840s there was an economic shift in Hawai'i from provisioning ships in transit to actual exportation of produce. The west coast of America experienced an unprecedented economic boom during the California gold rush. The massive influx of prospectors and merchants had to be fed. Hawai'i proved to be an excellent resource base for food staples because of its geographic proximity and low production costs. For example, Irish potatoes could be purchased for \$2 a barrel in Hawai'i and sold for \$27 a barrel in California (Morgan 1948: 155).

Figure 1 depicts the dramatic increase in exports between 1844 and 1850, which reflects the height of the California gold rush, and a tailing off of exports into the later 1850s. A corresponding graph shows the number of barrels of Irish and sweet potatoes exported from 1848 to 1854 (Figure 2). This graph clearly demonstrates the influence of the California gold rush in stimulating Hawai'i's agricultural productivity.

The Reverend W. N. Armstrong wrote in 1850 that "every bean, onion, potato or squash that we have to spare is at once snatched away to California to feed the hungry multitude there." In the same year the Reverend W. Alexander noted that "every lot and garden is planted and the islands will be able to freight a great number of vegetables during the coming year" (Alexander 1934:303). One center of potato produc-

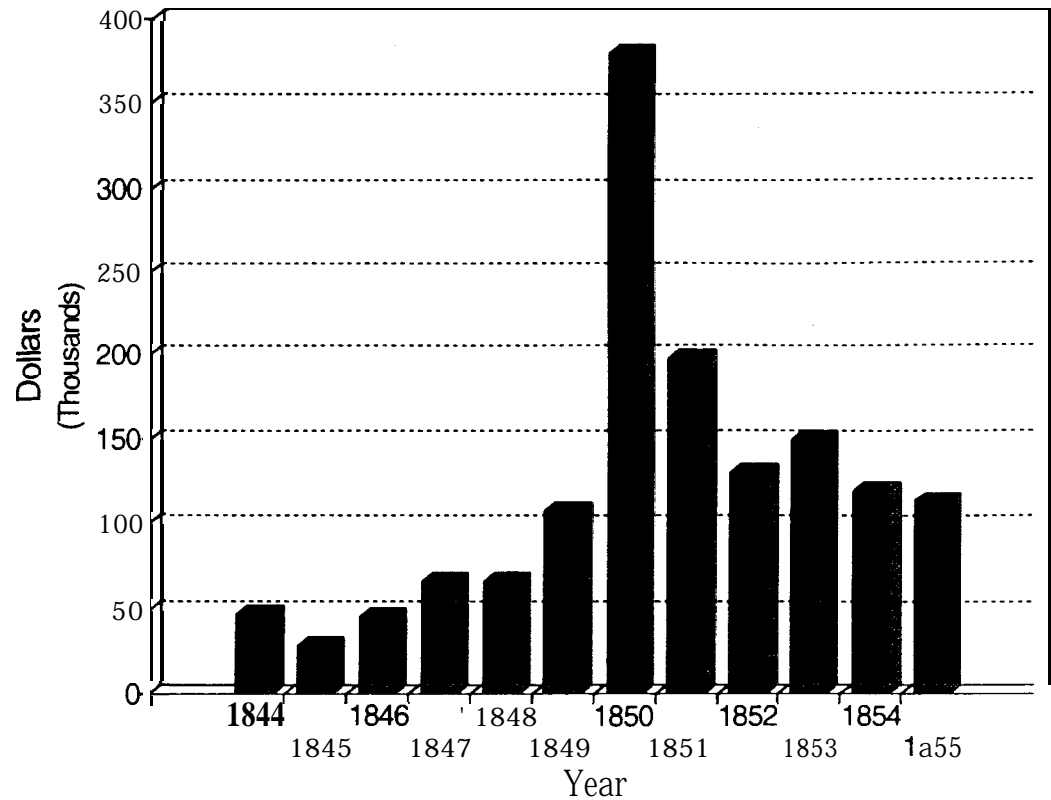


FIGURE 1. **Hawaiian commerce from 1844 to 1855.** (Data from Custom House reports, cited in Kuykendall 1938:305)

tion was the dry, open country of the slopes of Haleakala on Maui, which was often referred to as “Nu Kalifonia” (Morgan 1948:156), but other regions throughout the archipelago, such as the Kalaupapa peninsula of Moloka‘i, were also export centers. An article written in 1857 for a Hawaiian newspaper states: “Kalaupapa is a good land because the crops planted are successful and the gain is large. . . . Many sweet potatoes are being planted now, four or five patches to each man. . . . Be on the watch you traders, for Kalaupapa is the best in all the islands for good prices and fast work. All the California ships come to Kalaupapa” (Napihelua 1857, quoted in Handy and Handy 1972:518).

Other descriptions of Kalaupapa indicated that agricultural activities on the peninsula peaked from the late 1840s to the late 1860s. Jules Rémy visited Kalaupapa in 1854 and noted that the fields surrounding the villages were planted in sweet potatoes (1893:20, 22). King Kamehameha IV visited Kalaupapa sometime during his reign from 1855 to 1863 and wrote: “I was glad that those men, by their hard work, had plenty of potatoes, and I was glad that from their abundance they wanted to give” (Curtis 1966:174).

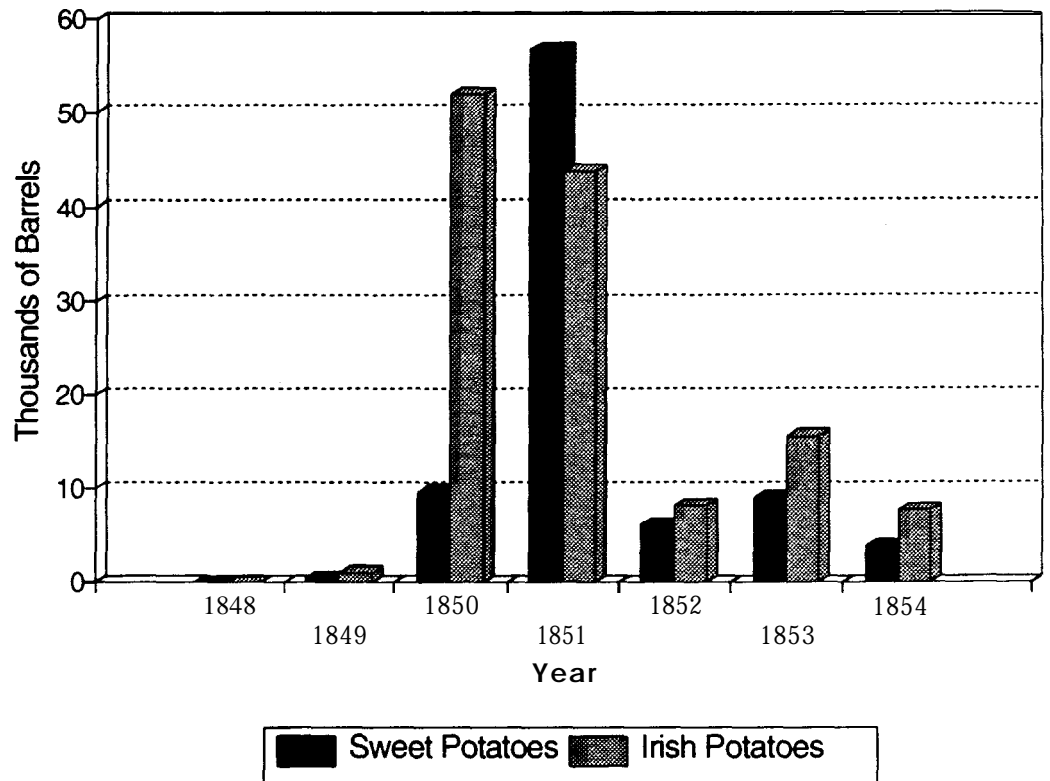


FIGURE 2. **Hawaiian potato exportation from 1848 to 1854.** (Data from *The Polynesian*, cited in Morgan 1948:155)

Twenty years later the situation at Kalaupapa had drastically changed. In 1873 Peter Kaeo, a patient at the settlement and a cousin of Queen Emma, wrote that there were a large number of abandoned sweet potato patches (Korn 1976:7, 17, 35). Similarly, Charles Nordhoff, who visited Kalaupapa in the 1870s reported: "Here lived, not very many years ago, a considerable population, who have left the marks of an almost incredible industry in numerous fields enclosed between walls . . . and . . . long rows of stone . . . to plant sweet-potatoes. Yet on this apparently desert space, within a quarter of a century, more than a thousand people lived contentedly and prosperously" (1974:100).

The agricultural decline at Kalaupapa can be attributed to two factors. The first is an abrupt halt of the export boom stimulated by the California gold rush as competition from local producers in Oregon and California pushed Hawai'i out of the market (Morgan 1948:156). The second influence was the growing concern over Hansen's disease, a post-contact introduction. In 1865 the Hawaiian government purchased two

of the three *ahupua'a* (land divisions) on the peninsula, Kalawao and Makanalua, to establish an isolated settlement. In 1873 the final *ahupua'a*, Kalaupapa, was acquired (Fortunato de Loach 1975:82).

In 1840 the population of the peninsula was approximately one thousand, but once the Hansen's disease settlement was established in the 1870s only forty nonpatients lived there (Fortunato de Loach 1975:82). With the much diminished population, agricultural production throughout the peninsula declined. The superintendent of the Hansen's disease settlement noted that the residents of the peninsula were not interested in agricultural activities and that the majority of the food consumed by the settlement came from the neighboring valleys of Wailau, Pelekunu, and Halawa (Hawaii Board of Health 1886: cxxviii).

Although patients have lived throughout the peninsula since the settlement was established, an 1895 map drawn by Monsarrat depicts no structures or roads in the research area. Similarly, no structures or roads are shown on a map drawn by Wall in 1905. A United States Geological Survey topographic map dated 1921-1922 shows at least four structures and a road in the general vicinity, but none of these were in the research area. These maps suggest that the abandoned house, the cement foundations (features 37 and 38), and features 12 and 13 were not occupied until after the early 1920s. Frank notes that in the 1930s several patients had beach houses in the general area (1937: 191). There is no mention of agricultural activities, and it is assumed that the intensive field system dates to the mid-nineteenth century and not to the twentieth-century occupation of these beach houses.

Conclusions

Dryland field systems in Hawai'i have traditionally been interpreted as predominately prehistoric phenomena (Rosendahl 1972; Schilt 1984; Clark and Kirch 1983). Kirch suggests that the three main dryland field systems on Hawai'i island began to develop around A.D. 1300 and that by A.D. 1600 limits to their expansion were experienced (1990:333-334). From A.D. 1600 to A.D. 1800 further intensification took place, and increasingly smaller plots were created. The impetus for this phase of intensification has been attributed to prehistoric population pressure and the escalating demands of stratified political organization (Kirch 1985:233; Kirch 1990:334; Hommon 1986:65).

Although Kirch's outline of prehistoric dryland intensification may be substantially correct, more attention should be given to how a later

phase of historic intensification affected the surviving archaeological remains of field systems. Clark notes that portions of the Waimea-Kawaihae field system were used during the historic period (1986, 1983: 50), and Kelly notes the same for the Kona field system (1983). The archaeological and ethnohistorical evidence from Kalaupapa suggests that the intensive field system found throughout the peninsula was not primarily a prehistoric phenomenon but was extensively elaborated during the historic period. In the research region of the peninsula, there is a high density of agricultural alignments associated with early historic shelters and residential features containing a single occupational component. Written descriptions indicate that agricultural production on Kalaupapa peaked in the 1850s or 1860s, and by the 1870s many of the fields were lying fallow and food supplies were imported from other parts of Moloka'i.

The nineteenth-century agricultural intensification at Kalaupapa was affected by massive postcontact depopulation, the introduction of free-ranging animals, and Hawai'i's entrance into the Pacific economy. The postcontact depopulation of Kalaupapa and other parts of Hawai'i decreased the number of farmers and created an economic environment where the remaining farmers were encouraged to maximize their productivity through agricultural intensification. The practice of enclosing a relatively small area was probably a strategy used to protect crops from free-ranging animals. Although these two factors were influential in the historic intensification, a more significant stimulus was Hawai'i's entrance into the Pacific economy. Initially Hawaiian produce was grown to provision visiting ships. It was not until the 1840s that exportation became profitable and agricultural productivity increased significantly. Due to the relatively smaller number of farmers, agricultural productivity never reached precontact levels, but certain regions throughout Hawai'i were growing large quantities of produce. Recognizing the reasons for a historic-period episode of agricultural intensification creates alternatives to the often-cited interpretation that the extensive surface remains of dryland field systems throughout Hawai'i are solely the result of prehistoric population pressure and the escalating demands imposed by stratified political organization.

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