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HAWAII ISLAND AGRICULTURAL ZONES, CIRCA A.D. 1823: AN ETHNOHISTORICAL STUDY

by

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ABSTRACT

The 1823 observations of the Reverend William Ellis of Hawaii Island are used in conjunction with modern environmental data to define the perimeters of agricultural zones on the island during the period of his tour. A fourfold classification of agricultural zones is offered, and it is argued that non-irrigated farming was more important on Hawaii Island in 1823 than irrigation farming.

This paper delineates the environmental characteristics of aboriginal agricultural lands on Hawaii Island, Hawaii, for approximately A.D. 1823 to provide a basis for better understanding Hawaiian land exploitation patterns. Little is known about the ecological variabies of early Hawaiian agricultural lands, although general data exist on Hawaiian agriculture, *per se* (such as Handy 1940).

The Approach

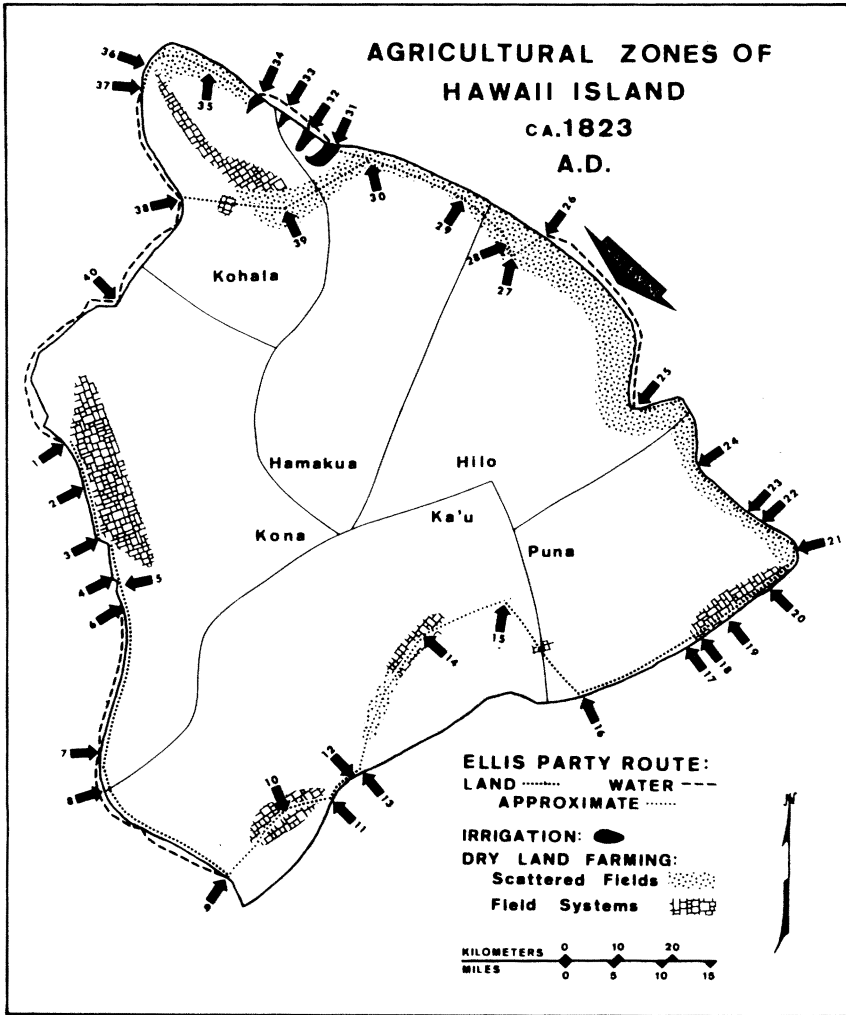
The initial task was the selection of sources on Hawaiian agriculture from early ethnohistorical literature. It was decided to rely upon the observations of the Reverend William Ellis (1963), recorded during a two month journey around Hawaii Island in 1823. His account is the first description of an entire island and includes many observations on Hawaiian agricultural areas, practices, crops and demography. References made by Ellis were used to define the perimeters of the agricultural zones on Hawaii Island during the period of his tour. Once these zones were established, modern sources on environmental data about these areas were used to give descriptions in terms of specific environmental variables.

The route Ellis and his companions took in their journey around the island was first reconstructed through the use of his journal, detailed maps, aerial photographs, and personal familiarity with Hawaii Island geography. In a few cases, sufficient descriptive material was available to reconstruct the route with an almost exact accuracy, but usually all that is known from the journal is that Ellis left point "A" and later arrived at point "B." In these instances, the precise route cannot be reconstructed because Ellis may have followed land contours instead of a straight line – although such a straight line would undoubtedly approximate his path. The distances involved are generally short so that a major deviation from a straight line between two points is unlikely. The reconstructed route was then plotted on a modern map of Hawaii Island and all references made by Ellis to Hawaiian agriculture, demography, soils, water resources, and botany were extracted and keyed to the map (see map, p. 337, and Appendix).

The next step was to match the observations of Ellis about specific agricultural areas with data from modern environmental studies of these same areas. This involved developing boundaries for the agricultural areas noted by Ellis and proved to be a major problem because Ellis did not provide enough geographical information to draw inclusive boundaries. When Ellis described fields near Kailua, for example, it is not clear whether the fields are only near Kailua or whether they extend southward to the next point where he again mentions fields.

For this reason, it was necessary to bring another set of information into the study – information gleaned from a study of aerial photos covering the potential agricultural areas of Hawaii Island. It proved possible to establish geographical boundaries for native agricultural areas of West Kohala, East Kohala valleys, and the Kona coast from Kailua to Honaunau. No evidence of native agricultural areas was visible in the airphotos for the remainder of Hawaii Island so all remaining agricultural areas were delimited as precisely as possible through the use of Ellis' comments and should provide minimum boundaries for these areas. The procedure of establishing boundaries using aerial photos makes the basic assumption that what is seen on the photo was also present in substantially the same form and extent in 1823. This assumption can be partially validated by a radiocarbon date for a field in West Kohala of 1545 ± 95 A.D. (Isotopes, Inc. sample I-4184). Once limits were established for each agricultural area described by Ellis, it was possible to proceed with matching the geographical areas with specific environmental characteristics.

The same environmental characteristics were checked for each agricultural area noted by Ellis: soil (series, type, depth, texture, color, parent material, degree of stoniness), drainage, slope, climate, mean annual rainfall, elevation, wind direction and wind velocity. All data of this nature have been extracted from Baker and others (Hawaii 1965), by using the aerial photos in the volume to trace the route of Ellis and to determine the land classifications for both the route and the areas he described. This matching produced fifty sets of data about the thirteen environmental variables.



1. Kailua; 2. Keauhou; 3. Kaawaloa; 4. Honaunau; 5. Keokea; 6. Kalahiki; 7. Kapua;
8. Kaulanamauna; 9. Kailikii; 10. Waiohinu; 11. Honuapo; 12. Hilea; 13. Punaluu;
14. Kapapala; 15. Kilauea Volcano; 16. Kealakomo; 17. Kalapana; 18. Kaimu;
19. Kamaili; 20. Keahialaka; 21. Kapoho; 22. Kahuwai; 23. Honolulu; 24. Keaau;
25. Waiakea (present city of Hilo); 26. Laupahoehoe; 27. Humuula; 28. Kaula Valley;
29. Manienie; 30. Kapulena; 31. Waipio Valley; 32. Waimanu Valley; 33. Honokane Valley;
34. Polulu Valley; 35. Halawa; 36. Awalua; 37. Mahukona; 38. Kawaihae; 39. Waimea (also called Kamuela) 40. Kiholo.

Problems

Several major problems confront any analysis of this nature and sophisticated statistical handling of the data might well obscure these problems with a spurious accuracy. One difficulty already mentioned as a problem is the assumption that the traces of aboriginal agricultural areas to be seen on aerial photographs will provide a reasonable basis for delimiting the agricultural zones seen in 1823 by Ellis. Another problem covered earlier is the imprecision in reconstructing the path of Ellis. Generally his path is known only to have been within a half mile wide corridor. This corridor width and the size of the hypothetical agricultural zones encompass a large number of diverse micro-environmental zones. Thus, both the corridor and the zones may encompass data that would not be included if the exact path of Ellis was known or if the agricultural zones derived from airphoto analysis had been delimited precisely by Ellis himself. In addition, the analysis must take into account the relative frequency of each variable over the route of Ellis, or within the agricultural zones delimited by aerial photos. If Ellis' path carried him through a narrow set of environmental characteristics for one quarter of a mile and then the next one mile was characterized by a different set of variables, then obviously the second set should receive more weight than the first in summarizing agricultural environmental variables.

In practice, however, these problems have not detracted to any great extent from the validity of the study because the general range of variables within the route corridor and the agricultural areas is actually quite similar. The data on environmental characteristics for areas on Hawaii Island are so precise that lands have been classified as unique although they cover only several thousand square feet.

One additional problem, however, presented a formidable obstacle to the logical validity of this study. This major problem is that of applying modern environmental data to observations made almost a century and a half ago. It is a standard assumption of paleoecologists that conditions of the past were substantially the same as conditions in the present; or if different, would be predictable on the basis of what is now known. In the case of Hawaii, however, such an assumption of this hypothesis is immediately compromised by a record of certain major environmental changes ensuing after European contact in A.D. 1778. Herbivores such as cattle, horses, goats, sheep, and deer were introduced and have caused large scale floristic changes, and this in turn has affected soil erosion patterns; exotic flora has achieved a virtual climax in many areas, causing the displacement of species prevalent at the time of Ellis; modern cultural demands have changed the water table and the direction of surface streams; and Hawaii Island volcanoes have continued to spew forth streams of lava which have since covered some agricultural areas described by Ellis. There is apparently no way out of this problem short of having the type of information needed dating from the time of the observations by Ellis, which is patently not possible.

It was possible, however, to side step this problem by eliminating certain environmental variables from consideration. The changes that have occurred have been primarily concerned with flora, and to a lesser extent, with soil erosion and the water resources. Only the variables which should be virtually the same now as in 1823 were used in this study. Considerations of floral distributions, erosion, and ground water have been eliminated from the analysis.

The Environmental Parameters

Through the use of the data on environmental variables specific to the areas described by Ellis, a set of generalizations was developed about the environmental parameters of Hawaii Island agricultural zones in 1823:

Climate: Virtually always humid or sub-humid; generally sub-humid.

Annual Mean Rainfall: 20 to 150 inches; generally 40 to 80 inches.

Elevation: Sea level to 3,000 feet; Windward (eastern) zones vary generally from 200 to 1,000 feet; Leeward (western) zones generally vary from 1,000 to 2,500 feet.

Slope: 0 to 35 percent; normally from 0 to 20 percent.

Drainage: Almost all lands are well drained.

Soil Parent Material: Almost always volcanic ash.

Soil Type: Generally alluvial, reddish brown, humic latosol or hydrol humic latosol, although reddish prairie and lithosol may have been included.

These agricultural lands lie as a band around the lowland sections of the island. The interior of the island and much of the lowland non-agricultural areas are nothing but expanses of barren lava, completely unsuited for agriculture. It would appear that although Hawaii Island is the largest of the Hawaiian Islands, it had relatively little land that was well suited for aboriginal agriculture.

These agricultural lands encompass a variety of different sub-types. Differences in agricultural lands and the accompanying cultural practices appear to be closely correlated with differences in the type, duration, amount, and periodicity of moisture. These aspects of moisture are, in turn, controlled by three broad sets of variables: elevation, topography, and geographical location in relation to the prevailing northeastern tradewind (or lowland-upland; valley-tableland; and windward-leeward). Virtually all other ecological factors such as biocenosis, climatology, and physical environment are a function of these three sets of variables.

It proved possible to synthesize these broad variables, the environmental characteristics of each agricultural area, and cultural information derived from Ellis into a tentative classification system for ordering the diversity of agricultural zones on Hawaii Island. The initial division is made geographically between valleys and tableland areas, and culturally between irrigated and dryland farming.

Irrigation

1. *Location*: Eastern Kohala in the Waipio, Waimanu, Honokane, and Pololu valleys (and possibly small areas in the little valleys along the Hamakua coast from Waipio to Hilo).
2. *Demography*: Greater population density than occurs with other areas but a rather low total population in a clustered settlement pattern.
3. *Crops*: Irrigated taro; bananas; sugar-cane.
4. *Distinctive Agricultural Practice*: Irrigation of taro.
5. The major factor in setting up this type is that valley agriculture stands alone in all Hawaii Island in being irrigated. It also encompasses the only alluvial soils and the only virtual 0° slope and 0 to 100-foot elevations.

Dryland Farming

1. *Location*: Tableland areas along the lower slopes of Hawaii Island.
2. *Demography*: Lower population density than in valleys or in major coastal fishing villages; settlement pattern is apparently a generally dispersed arrangement of single family dwelling areas; there is little or no clustering into concentrated villages in the agricultural areas themselves, although such clustering does occur with associated coastal fishing villages.
3. *Crops*: Un-irrigated taro, sweet potatoes, bananas, yams, breadfruit, *olonā* (a fiber plant), sugar cane, and the paper mulberry.
4. *Distinctive Agricultural Practices*: Un-irrigated taro and the raising of sweet potatoes.
5. The major factor in setting up this type is the occurrence of un-irrigated taro in conjunction with an emphasis on sweet potato cropping.

Tableland dry farming areas may be further refined by a division into areas of scattered and somewhat isolated farms, primarily on the windward regions (generally the eastern side of the island) and areas of patterned and contiguous fields making up cohesive systems (generally on the western, or leeward, side of the island).

Scattered Farms

1. *Location*: Northeast Kohala, Hamakua coast from Waipio to Hilo, the Puna coastal strip from Hilo to Kapoho, sections north of Punaluu, and inland on the Ka'u-Puna district boundary.
2. *Demography*: Less concentration of population in the agricultural areas than occurs with areas of field systems, and with few fishing villages on the coast (except possibly for parts of the Puna area). The settlement pattern is characterized by scattered fields or gardens with scattered small villages or family habitations.
3. *Crops*: Same as the general dry land farming type.
4. *Distinctive Agricultural Practices*: Scattered fields, gardens and habitations; generally less intensive cultivation of available land. No major field systems occur.

5. The major factors in setting up this category are the lower population density, dispersed settlement and scattered field/garden pattern.

Field Systems

1. *Location:* West Kohala, an area to the west of Waimea, the Kona coast from Kailua to Honaunau, the Ka'u area to the west of Punaluu and another to the north of Punaluu, and possibly portions of the Puna coast southwest of Kapoho.
2. *Demography:* Fairly dense population along the coast, particularly in fishing villages associated with inland agricultural field systems. The density is greater in both the coastal villages and the inland agricultural areas than occurs with the scattered farm area, generally to windward, but probably less dense than in the valleys where irrigated agriculture was practiced.
3. *Crops:* Same as the general dry land farming category.
4. *Distinctive Agricultural Practices:* Massive field systems in contradistinction to the scattered fields generally found to windward. The Kohala system, for example, measures about two by thirteen miles while the Kona system measures about three by eighteen miles. No remains of the Ka'u and Puna field systems are visible in aerial photography but were reported by Ellis.
5. The major factor in setting up this category is the occurrence of integrated and extensive field systems.

Conclusions

This research, although beset with certain formidable problems, seems to have been successful in providing a general outline of the environmental factors characteristic of Hawaiian agricultural zones for the time period A.D. 1823. An initial typology has been developed to facilitate further studies. Certain other conclusions of a more general nature may also be drawn from these data:

1. The agricultural eco-zones, in general, seem to have been larger and contributed to a larger population in the areas of field systems.
2. The particular crops grown in an area were most dependent upon the type of moisture available, its quantity, and its periodicity. These factors, in turn, were dependent upon the geographical location of the area in terms of three dyadic sets of variables: windward-leeward location; lowland-upland elevation; and tableland-valley topography.
3. The geographical areas most intensively cultivated in 1823 are not those most intensively cultivated today. Leeward areas with massive field systems were the largest agricultural areas in 1823 but today the West Kohala and Ka'u areas are pasture lands while the Kona system is only partially under coffee cultivation. On the other hand, the leading sugar cane cultivation in

the entire state lies between Waipio Valley and Hilo where only scattered fields were present in 1823. The controlling factor seems to be the ability of modern farming to use machinery and to provide the necessary fertilizers to supplement the water rich, but highly leached windward soils. The Kona system lies in an area that is difficult to cultivate with modern mechanized methods and hence has been agriculturally abandoned except for coffee, which is a non-machine crop.

4. Habitation settlements mentioned in the Ellis account and those known from personal inspection to exist in the agricultural areas were virtually always located on non-agricultural ground. In the West Kohala area, for example, this means the habitation areas were found in places too steep or rocky for good cultivation, while in Waipio Valley, Ellis (1963:256) noted the villages to be scattered along the sides of the valley.
5. The impression of Hawaiian agriculture that one gets by reading the general Hawaiiana literature is that of large scale irrigation systems over the state and a primary cultural dependence upon irrigated taro. Very few sources even mention non-irrigated farming. It is possible to state categorically that the culturally most important agricultural areas of Hawaii Island in 1823 were not those that were irrigated, but rather the field systems in the Leeward areas. Irrigation may well have played a more dominant role in the agricultural production on the other islands, but Hawaii Island, on the basis of this study, must be exempted from this generalization. Further, until the relative importance of irrigated and non-irrigated areas has been considered for aboriginal agricultural areas on the other islands, it will be best to be cautious in accepting the traditional axiom that irrigation was the major Hawaiian agricultural technique.

An ethnohistorical approach has been used in this paper to study the ecology of early Hawaiian farming on Hawaii Island. It proved possible to reconstruct the broad environmental constraints limiting and channeling Hawaiian agriculture and demography in A.D. 1823. Another paper has extended this coverage back to the time of initial European contact in A.D. 1778, showing that the same general factors were in evidence at that time as were shown in this paper (Newman 1970).

This approach has proven fruitful for studies of the interaction of man and nature in early Hawaii. It is hoped that other scholars will also find it useful.

APPENDIX: EXTRACTS FROM ELLIS (1963)

Note: The orthography of Ellis has been retained in the text while the modern place names have been substituted in the headings. The numbers appearing in parentheses refer to entries on the map, p. 337.

KAILUA (1):

"Kairua, though healthy and populous, is destitute of fresh water, except what is found in pools, or small streams, in the mountains, four or five miles from the shore" (p. 29).

"The houses, which are neat, are generally built on the sea-shore, shaded with cocoa-nut and kou trees, which greatly enliven the scene.

"The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots.

"The next morning, Messrs. Thurston, Goodrich, and Harwood, walked towards the mountains, to visit the high and cultivated parts of the district. After travelling over the lava for about a mile, the hollows in the rocks began to be filled with a light brown soil; and about half a mile further, the surface was entirely covered with a rich mould, formed by decayed vegetable matter and decomposed lava.

"Here they enjoyed the agreeable shade of bread-fruit and ohia trees. . ." (p. 31).

"The path now lay through a beautiful part of the country, quite a garden compared with that through which they had passed on first leaving the town. It was generally divided into small fields, about fifteen rods square, fenced with low stone walls, built with fragments of lava gathered from the surface of the enclosures. These fields were planted with bananas, sweet potatoes, mountain taro, paper mulberry plants, melons, and sugar-cane, which flourished luxuriantly in every direction.

"Having travelled about three or four miles through this delightful region, and passed several valuable pools of fresh water, they arrived at the thick woods, which extend several miles up the sides of the lofty mountain that rises immediately behind Kairua.

"Among the various plants and trees that now presented themselves, they were much pleased with a species of tree ferns, whose stipes were about five feet long, and the stem about fourteen feet high, and one foot in diameter" (p. 32).

"Numbering the houses for one mile along the coast, they found them to be 529; and allowing an average of five persons to each house, the inhabitants in Kairua will amount to 2645 persons. This certainly does not exceed the actual population, as few of the houses are small, and many of them large, containing two or three families each" (p. 36).

"Leaving Kairua, we passed through the villages thickly scattered along the shore to the southward.

"The sides of the hills, laid out for a considerable extent in gardens and fields, and generally cultivated with potatoes, and other vegetables, were beautiful."

KAILUA (1) TO KEAUHOU (2):

"During our walk from Kairua to this place we counted six hundred and ten houses, and allowed one hundred more for those who live among the plantations on the sides of the hills.

"Reckoning five persons to each house, which we think not far from a correct calculation, the population of the tract through which we have travelled today will be about 3550 souls." (p. 76).

KEAUHOU (2) TO KAAWALOA (3):

"During our journey today, we have numbered 443 houses. . ." (p. 109).

HONAUNAU (4):

"After breakfast, Mssrs. Thurston and Goodrich examined the inland part of the district, and found, after proceeding about two miles from the sea, that the ground was generally cultivated.

"They passed through considerable groves of breadfruit trees, saw many cocoa-nuts, and numbers of the prickly pear (cactus ficus indicus), growing very large, and loaded with fruit. They also found many people residing at the distance of from two to four miles from the beach, in the midst of their plantations, who seemed to enjoy an abundance of provisions, seldom possessed by those on the sea shore" (p. 109).

"The town contains 147 houses. . ." (p. 109).

KAILUA (1) TO HONAUNAU (4):

"The coast for twenty miles to the northward, includes not less perhaps than forty villages, either on the shore or a short distance inland, and contains probably a population of 20,000 souls, among whom a missionary might labour with facility" (p. 116).

KEOKEA (5) TO KALAHIKI (6):

"They passed through two villages, containing between three and four hundred inhabitants, and reached Kalahiti about four in the afternoon" (p. 118).

KAPUA (7):

". . . about five in the afternoon landed at Kapua, a small and desolate-looking village, on the southwest point of Hawaii, and about twenty miles distant from Kalahiti" (p. 124).

"At this place we hired a man to go about seven miles into the mountains for fresh water; but he returned with only one calabash full; a very inadequate supply as our whole company had suffered much from thirst, and the effects of the brackish water we had frequently drank since leaving Honaunau.

"Nothing can exceed the barren and solitary appearance of this part of the island, not only from the want of fresh water, but from the rugged and broken tracts of lava of which it appears to be entirely composed.

". . . we knew of no village before us containing more than five or six houses for nearly thirty miles' distance" (p. 125).

GENERAL DESCRIPTION OF THE KONA DISTRICT (1 to 8 plus more to the north):

"Kona is the most populous of the six great divisions of Hawaii, and being situated on the leeward side, would probably have been the most fertile and beautiful part of the island, had it not been overflowed by floods of lava.

"The northern part, including Kairua, Kearake'kua, and Honaunau, contains a dense population; and the sides of the mountains are cultivated to a considerable extent; but the south part presents a most inhospitable aspect. The population is thin, consisting principally of fishermen, who cultivate but little land, and that at the distance of from five to seven miles from the shore" (p. 126).

KA'U DISTRICT:

"On entering it, the same gloomy and cheerless desert of rugged lava spread itself in every direction from the shore to the mountains. Here and there at distant intervals they passed a lonely house, or a few wandering fishermen's huts, with a solitary shrub, or species of thistle, struggling for existence among the crevices in the blocks of scoriae and lava. All besides was 'one vast desert, dreary, bleak, and wild' " (p. 126).

KAILIKII (9):

"At 10 A.M. Mr. Thurston preached to the people of Tairitii, and the neighbouring village of Patini, all of whom are fishermen" (p. 128).

KAHUKU BLUFF (Above the cliff to the northeast of Kailikii):

"A beautiful country now appeared before us, and we seemed all at once transported to some happier island . . .

"The rough and desolate tract of lava, with all its distorted forms, was exchanged for the verdant plain, diversified with gently rising hills, and sloping dales, ornamented with

shrubs, and gay with blooming flowers. We saw, however, no stream of water during the whole of the day; but, from the luxuriance of the herbage in every direction, the rains must be frequent or the dews heavy.

"About noon we reached Kalehu, a small village, upwards of four miles from Tairitii" (not located; p. 130).

"We . . . resumed our journey over the same beautiful country, which was partially cultivated, and contained a numerous, though scattered population" (p. 131).

"The path led us through several fields of mountain taro (a variety of the arum), a root which appears to be extensively cultivated in many parts of Hawaii. It was growing in dry sandy soil, into which our feet sank two or three inches every step we took.

"It is, however, very palatable, and forms a prime article of food in those parts of the island, where there is a light soil, and but little water" (p. 131).

KAULU (Not found, but between Kailikii and Waiohinu):

". . . we reached Kauru, a small village environed with plantations . . .

"During the evening, a baked pig, with some potatoes, and taro, was brought for our supper, of which we made a hearty repast" (p. 131).

KAULU TO WAIOHINU (10):

". . . we left Kauru, and, taking an inland direction, travelled over a fertile plain, covered with a thin yet luxuriant soil. Sometimes the surface was strewn with small stones, or fragments of lava, but in general it was covered with brushwood.

"The population in this part did not appear concentrated in towns and villages, as it had been along the sea-shore, but scattered over the whole face of the country, which appeared divided into farms of varied extent, and upon these houses generally stood singly, or in small clusters, seldom exceeding four or five in number" (p. 132).

WAIOHINU (10):

"Our path running in a northerly direction, seemed leading us towards a ridge of high mountains, but it suddenly turned to the east, and presented to our view a most enchanting valley, clothed with verdure, and ornamented with clumps of kukui and kou trees. On the southeast it was open towards the sea, and on both sides adorned with gardens, and interspersed with cottages, even to the summits of the hills.

"A fine stream of fresh water, the first we had seen on the island, ran along the centre of the valley, while several smaller ones issued from the rocks on the opposite side, and watered the plantations below" (p. 133).

"Between three and four o'clock we took leave of them, and pursued our journey towards the sea-shore. Our road, for a considerable distance, lay through the cultivated parts of this beautiful valley: the mountain taro, bordered by sugar-cane and bananas, was planted in fields six or eight acres in extent, on the sides of the hills, and seemed to thrive luxuriantly" (pp. 133-134).

WAIOHINU (10) TO HONUAPO (11):

"The country appeared more thickly inhabited than that over which we had travelled in the morning. The villages, along the sea shore, were near together, and some of them extensive.

". . . we found tall rows of sugar-cane lining the path on either side. . ." (p. 136).

HONUAPO (11):

". . . Honuapo, an extensive and populous village, standing on a level bed of lava which runs out a considerable distance into the sea" (p. 137).

HILEA (12):

"The head man then asked us to stop till he could prepare some refreshment; saying he had hogs, fish, taro potatoes, and bananas in abundance" (p. 143).

PUNALUU (13) TO KAPAPALA (14):

"We now left the road by the sea-side, and directed our course towards the mountains. Our path lay over a rich yellow-looking soil of decomposed lava, or over a fine black

vegetable mould, in which we occasionally saw a few masses of lava partially decomposed . . . There was but little cultivation, though the ground appeared well adapted to the growth of all the most valuable produce of the islands" (p. 146).

"We . . . then resumed our journey over the same verdant country, frequently crossing small valleys and water-courses, which, however, were all dry.

"The surface of the country was covered with a light yellow soil, and clothed with tall grass, but the sides and bed of every watercourse we passed were composed of volcanic rock. . . .

"The land, though very good, was but partially cultivated, till we came to Kaaraara [Kaalaala], where we passed through large fields of taro and potatoes, with sugarcane and plantains growing very luxuriantly.

". . . we passed on through a continued succession of plantations, in a high state of cultivation" (p. 148).

KAPAPALA (14):

"In the neighbourhood of Kapapala we noticed a variety of the paper-mulberry, somewhat different from that generally cultivated, which grew spontaneously, and appeared indigenous" (p. 149).

PONAHOAHOA (Not found, but about five miles from Kapapala):

"After travelling about five miles, over a country fertile and generally cultivated, we came to Ponahohoa. It was a bed of ancient lava, the surface of which was decomposed; and in many places shrubs and trees had grown to a considerable height" (p. 150).

"The lava is decomposed, frequently a foot in depth, and is mingled with a prolific soil, fertile in vegetation, and profitable to its proprietors. . ." (p. 153).

"The road by which we returned lay through a number of fields of mountain taro, which appears to be cultivated here more extensively than the sweet potato" (p. 153).

KAPAPALA (14) TO KILAUEA VOLCANO (15):

"The path for several miles lay through a most fertile tract of country, covered with bushes, or tall grass and fern, frequently from three to five feet high, and . . . heavily laden with dew. . ." (p. 157).

"Leaving the wood, we entered a waste of dry sand, about four miles across" (p. 158).

KILAUEA VOLCANO (15) TO KEALAKOMO (16):

"As we approached the sea, the soil became more generally spread over the surface, and vegetation more luxuriant.

"The natives ran to a spot in the neighbourhood, which had formerly been a plantation, and brought a number of pieces of sugar-cane, with which we quenched our thirst, and then walked on through several plantations of sweet potato, belonging to the inhabitants of the coast. . ." (pp. 182-183).

"Down this [the cliff] we descended, by following the course of a rugged current of ancient lava, for about 600 feet perpendicular depth, when we arrived at the plain below, which was one extended sheet of lava, without shrub or bush, stretching to the north and south as far as the eye could reach, and from four to six miles across, from the foot of the mountain to the sea" (p. 183).

[Note: Ellis' direction must be wrong because the coastline runs east-west here, or at most, northeast-southwest.]

"The population of this part of Puna though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find the desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is generally shallow.

"We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their poe and sweet potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea-coasts of the north and south parts of the island" (p. 190).

[Note: This reference to north and south sea coasts was not very helpful because it is not known which coasts were under consideration.]

KALAPANA (17) VICINITY:

“When we had passed Punau, Leapuki, and Kamomoa, the country began to wear a more agreeable aspect. Groves of cocoa-nuts ornamented the projecting points of land, clumps of kou-trees appeared in various directions, and the habitations of the natives were also thickly scattered over the coast” (p. 190).

“Shortly after, we reached Kupahua, a pleasant village, situated on rising ground, in the midst of groves of shady trees, and surrounded by a well-cultivated country” (p. 191).

KAIMU (18):

“We next traced its course [a volcanic fissure] through the fields of potatoes” (p. 196).

“Kaimu is pleasantly situated near the sea shore, on the S. E. side of the island, standing on a bed of lava considerably decomposed, and covered over with a light and fertile soil. It is adorned with plantations, groves of cocoanuts, and clumps of kou-trees. It has a fine sandy beach, where canoes may land with safety; and, according to the houses numbered today, contains about 725 inhabitants.

“Including the villages in its immediate vicinity, along the coast, the population would probably amount to 2000; and, if water could be procured near at hand, it would form an eligible missionary station.

“There are several wells in the village, containing brackish water, which has passed from the sea, through the cells of the lava, undergoing a kind of filtration, and is collected in hollows scooped out to receive it.

“The natives told us, that, at the distance of about a mile there was plenty of fresh water.

“The extent of cultivation in the neighbourhood, together with the decent and orderly appearance of the people, induced us to think they are more sober and industrious than those of many villages through which we have passed” (p. 197).

KAMAII (19):

“Leaving Kehena, we walked on to Kamaili, a pleasant village, standing in a gently sloping valley, cultivated and shaded by some large cocoa-nut trees.

“The hospitable inhabitants, at the request of our guide, soon brought us some fresh fish, a nice pig, with potatoes and taro, and a calabash of good water.

“The people who were not employed on their plantations, or in fishing, afterwards assembled. . .” (pp. 199-200).

KAIMU (18) TO KEAHIHALAKA (20):

“The country had been much more populous than any we had passed since leaving Kona. . .” (pp. 201-202).

KEAHIHALAKA (20) TO KAPOHO (21):

“A most beautiful and romantic landscape presented itself on our left, as we travelled out of Pualaa. The lava was covered with a tolerably thick layer of soil, and the verdant plain, extending several miles towards the foot of the mountains, was agreeably diversified by groups of picturesque hills, originally craters, but now clothed with grass, and ornamented with clumps of trees.

“We soon left this cheerful scenery, and entered a rugged tract of lava, over which we continued our way till about two p.m., when we reached Kapoho” (p. 205).

KAPOHO (21):

“A cluster, apparently of hills three or four miles round, and as many hundred feet high, with deep indented sides, overhung with trees, and clothed with herbage, standing in the midst of the barren plain of lava, attracted our attention.

“We walked through the gardens that encircled its base, till we reached the S. E. side, where it was much lower than on the northern parts. Here we ascended what appeared to us to be one of the hills, and, on reaching the summit, were agreeably surprised to behold a charming valley opening before us. It was circular, and open towards the sea.

“The outer boundary of this natural amphitheatre was formed by an uneven ridge of rocks, covered with soil and vegetation. Within these there was a smaller circle of hills, equally verdant, and ornamented with trees. The sides of the valley, which gradually sloped from the foot of the hills, were almost entirely laid out in plantations, and enlivened by the cottages of their proprietors.

“In the centre was an oval hollow, about half a mile cross, and probably two hundred feet deep, at the bottom of which was a beautiful lake of brackish water, whose margin was in a high state of cultivation, planted with taro, bananas, and sugar-cane.

“The steep perpendicular rocks, forming the sides of the hollow, were adorned with tufts of grass, or blooming pendulous plants, while, along the narrow and verdant border of the lake at the bottom, the bread-fruit, the kukui, and the ohia trees, appeared, with now and then a lowly native hut standing beneath their shade” (pp. 205-206).

KAPOHO (21) TO KAHUWAI (22):

“Our way now lay over a very rugged tract of country. Sometimes for a mile or two we were obliged to walk along on the top of a wall four feet high and about three feet wide, formed of fragments of lava that had been collected from the surface of the enclosures which these walls surrounded” (p. 210).

“The shore, which was about a mile to the eastward of us, was occasionally lined with the spiral pandanus, the waving cocoa-nut grove, or the clustering huts of the natives” (p. 211).

HONOLULU (23) TO KEAAU (24):

“The country was populous, but the houses stood singly, or in small clusters, generally on the plantations, which were scattered over the whole country. Grass and herbage were abundant, vegetation in many places luxuriant, and the soil, though shallow, was light and fertile” (p. 212).

KEAAU (24) TO WAIAKEA (25: present city of Hilo):

“At half-past ten we resumed our walk, and passing about two miles through a wood of pretty large timber, came to the open country in the vicinity of Waiakea.”

WAIAKEA (25: Hilo):

“The light and fertile soil is formed by decomposed lava, with a considerable portion of vegetable mould. The whole is covered with luxuriant vegetation, and the greater part of it formed into plantations, where plantains, bananas, sugar-cane, taro, potatoes, and melons, grow to the greatest perfection” (p. 239):

“Groves of cocoa-nut and breadfruit are seen in every direction loaded with fruit, or clothed with umbrageous foliage. The houses are mostly larger and better built than those of many districts through which we had passed. We thought the people generally industrious; for in several of the less fertile parts of the district we saw small pieces of lava thrown up in heaps, and potato vines growing very well in the midst of them, though we could scarcely perceive a particle of soil” (p. 239).

“There are 400 houses in the bay, and probably not less than 2000 inhabitants. . .” (p. 240).

HILO COAST UP SLOPES OF MAUNA KEA:

“There appear to be three or four different regions in passing from the sea-shore to the summit. The first occupies five or six miles, where cultivation is carried on in a degree, and might be to almost any extent; but, as yet, not one-twentieth part is cultivated.

“The next is a sandy region, that is impassable, except in a few footpaths. Brakes, a species of tall fern, here grow to the size of trees; the bodies of some of them are eighteen inches in diameter” [Dr. Blatchely and Mr. Ruggles’ publication on a trip from Hilo up the slopes of Mauna Kea, quoted by Ellis; p. 291].

WAIAKEA (25) TO LAUPAHOEHOE (26) BY CANOE:

“The country, by which we sailed, was fertile, beautiful, and apparently populous. The numerous plantations on the eminences and sides of the deep ravines or valleys, by which it

was intersected, with the streams meandering through them into the sea, presented altogether a most agreeable prospect" (p. 244).

HUMUULA (27) TO KAULA (28):

"The high land over which we passed was generally woody, though the trees were not large. The places that were free from wood, were covered with long grass and luxuriant ferns. The houses mostly stood singly, and were scattered over the face of the country.

"A rich field of potatoes or taro, five or six acres sometimes in extent, or large plantations of sugar-cane and bananas, occasionally bordered our path. But though the soil was excellent, it was only partially cultivated. The population also appeared less than what we had seen inhabiting some of the most desolate parts of the island" (pp. 249-250).

KAULA (28):

"When a drawing had been taken of this beautiful valley, where kukui trees, plantains, bananas, and ti plants were growing spontaneously with unusual richness of foliage and flower, we took leave of the people, and, continuing our journey, entered Hamakua" (p. 251).

HILO DISTRICT (25 to 28):

"Hiro, which we had now left, though not so extensive and populous as Kona, is the most fertile and interesting division on the island.

"The habitations of the natives generally appear in clusters at the opening of the valleys, or scattered over the face of the high land. The soil is fertile, and herbage abundant" (p. 251).

HILO AND HAMAKUA DISTRICTS:

"... the inhabitants, excepting at Waiakea, did not appear better supplied with the necessaries of life than those of Kona, or the more barren parts of Hawaii. They had better houses, plenty of vegetables, some dogs, and few hogs, but hardly any fish, a principal article of food with the natives in general" (p. 252).

MANIENIE (29) TO KAPULENA (30):

"... we left Manienie, and travelled over a well-cultivated tract of country, till we reached Toumoarii . . ." (p. 252).

KAPULENA (30) TO WAIMEA (39) BY BISHOP AND GOODRICH:

"... taking an inland direction passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants.

"About noon they reached the valley of Waimea, lying at the foot of Mouna-Kea, on the northwest side. Here a number of villages appeared on each side of the path, surrounded with plantations in which plantains, sugar-cane, and taro were seen growing unusually large" (p. 253).

WAIPIO (31):

"Viewed from the great elevation at which we stood, the charming valley, spread out beneath us like a map, with its numerous inhabitants, cottages, plantations, fishponds, and meandering streams. . ." (p. 254).

"The bottom of this valley was one continued garden, cultivated with taro, bananas, sugar-cane, and other productions of the islands, all growing luxuriantly.

"A number of small villages, containing from twenty to fifty houses each, stood along the foot of the mountains, at unequal distances on each side, and extended up the valley till projecting cliffs obstructed the view" (p. 256).

"According to the number of houses which we have seen, in all 265, there are at least 1325 inhabitants in this sequestered valley, besides populous villages on each side along the coast, which might be easily visited. This circumstance, together with the fertility of the soil, the abundance of water. . ." (p. 261).

WAIMANU (32):

"The valley, though not so spacious or cultivated as Waipio, was equally verdant and picturesque . . ." (p. 264).

THE "HAMAKUA COAST" (25-31):

"The coast is bold and steep, and the cliffs, from three to five hundred feet high, partially covered with shrubs and herbage, intersected by numerous deep ravines and valleys, frequently in a high state of cultivation. . ." (p. 273).

HONOKANE (33):

"The valley contained fifty houses" (p. 273).

POLOLU (34):

"Pololu is a pleasant village, situated in a small cultivated valley, having a fine stream of water flowing down its centre. . . .

"The houses stand principally on the beach. . ." (p. 273).

POLOLU (34) TO HALAWA (35):

"The country was fertile, and seemed populous, though the houses were scattered, and more than three or four seldom appeared together. The streams of water were frequent, and a large quantity of ground was cultivated on their banks, and in the vicinity" (p. 274).

[Note: This was from the top of Pololu bluff to Halawa; it does not describe the valley itself.]

HALAWA (35) AND VICINITY:

"A wide tract of country in the neighbourhood was divided into fields of considerable size, containing several acres each, which he used to keep in good order, and well stocked with potatoes and other vegetables" (p. 277).

"The soil was fertile and vegetation abundant" (p. 283).

"The tract we passed over today seemed more populous than that through which we had travelled yesterday. . ." (p. 283).

AWALUA (36; near Paho):

"About three p.m. we reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fishermen" (p. 285).

HALAWA (35) TO MAHUKONA (37):

"Though we had numbered, in our journey today, 600 houses, we had not seen any thing like four hundred people, almost the whole population being employed in the mountains cutting sandal wood" (p. 286).

*BY CANOE AT NIGHT TO KAWAIHAE (38):**KAWAIHAE BACK NORTH TOWARD MAHUKONA BY THURSTON:*

"The coast was barren; the rocks volcanic; the men were all employed in fishing; and Mr. Thurston was informed that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than on the shore" (p. 288).

[Note: This distance is erroneous for that would place them on the other side of the Kohala Mountains – probably more like 2-3 miles.]

KAWAIHAE TO SOUTHWEST OF WAIMEA AND RETURN BY THURSTON:

"The soil over which he had travelled was fertile, well watered, and capable of sustaining many thousand inhabitants. In his walks he had numbered 220 houses, and the present population is probably between eleven and twelve hundred."

KIHOLO (40):

" . . . I landed at Kihoro, a straggling village, inhabited principally by fishermen" (p. 294).

ON TO KAILUA BY CANOE

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