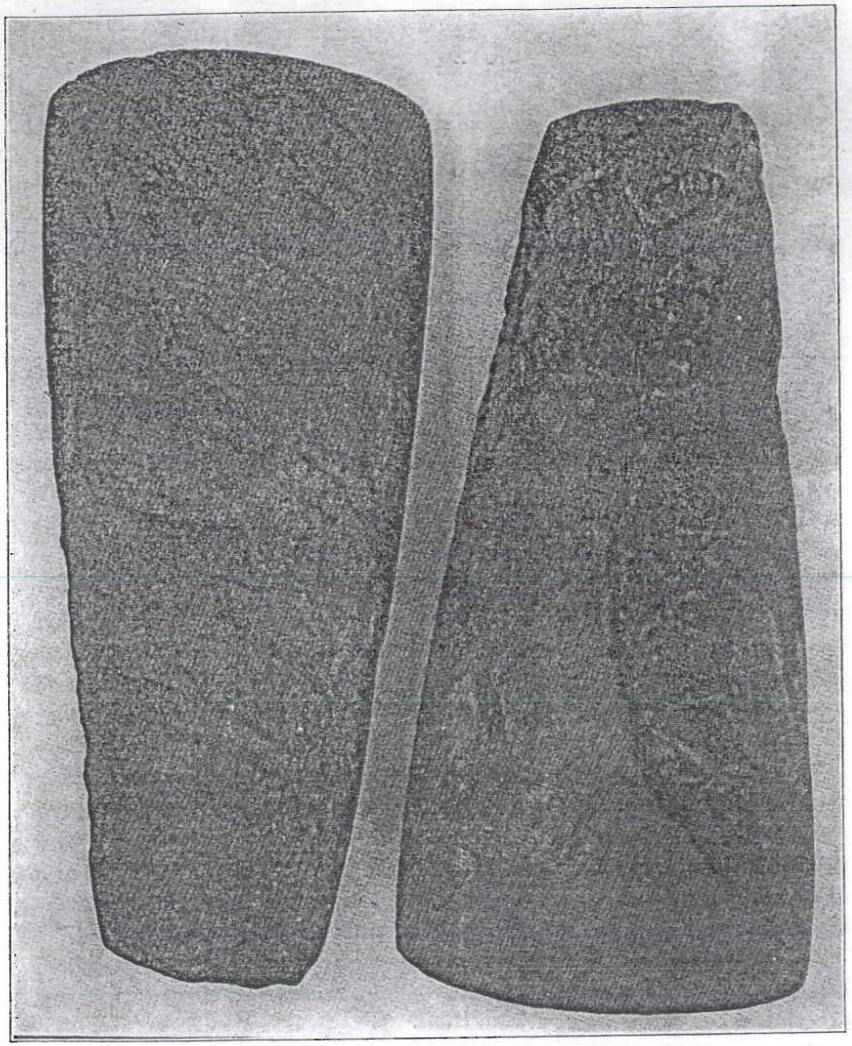

Original. Cast, Reversed.

FIG. 19. CURVED ADZE FROM KAUAI.

OCCASIONAL PAPERS

OF THE

BERNICE PAUAHI BISHOP MUSEUM OF POLYNESIAN ETHNOLOGY AND NATURAL HISTORY

VOL. V.—No. 3.

Notes on the Flora of Kahoolawe and Molokini.

An Enumeration of Niihau Plants.

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HONOLULU, H. I.
BISHOP MUSEUM PRESS.
1913.

Notes on the Flora of Kahoolawe and Molokini.

By Charles N. Forbes.

April, 1913.

During the time between February 25 and March 10, 1913, I had the pleasure of accompanying an expedition[1] to Kahoolawe and Molokini, two of the smaller islands of the main Hawaiian group, and probably the least known botanically. Kahoolawe lies six miles southeast of Maui, the island of Molokini being about midway between. It is dome-shaped and has an area of forty-four square miles. There is a central hill 1472 feet high, and two small craters a distance of a mile or more on either side. These craters during wet periods serve as natural reservoirs, the pool in the southern one often remaining for three months. The eastern and southern slopes of the island are steep but gradual, and are cut by many ravines some of which are quite deep. These slopes for the most part are rough with lava boulders. The remaining coast line is a steep sea cliff, nearly vertical in places, and has an elevation of about 900 feet in the highest place. On the top there is a large sloping plain of red earth swept smooth by the prevailing winds. Mound-like hillocks, protected by pili grass (*Heteropogon contortus*), clearly indicate that at least eight feet of earth, and probably more, has been blown off the top of the island. Much of this material settles amongst the rocks on the lower slopes forming small fertile areas, but a large quantity is blown out to sea.

As a collecting ground for plants Kahoolawe has little to offer, but to any one interested in the many factors at work changing the character of an indigenous flora there is much of interest. To within recent times this island has been overstocked with various sorts of domestic animals and wild goats. The present lessee has done all that is possible to diminish the number of goats, and the

[1] The members of the expedition consisted of Mr. J. F. G. Stokes, Dr. C. M. Cooke and C. N. Forbes, of the Museum staff; Dr. H. A. Pilsbry of the Philadelphia Academy of Sciences, Mr. Ebenezer P. Low, lessee of the island, and Rev. Henry P. Judd of Kahului, Maui.

small flock of sheep (now reduced to about 300) is to be rapidly disposed of. During a recent long period of unusually dry years these comparatively small flocks have been able to prevent any new vegetation from gaining a hold, and have also greatly retarded the growth of the few trees that there are. Goats cause considerable harm by girdling the keawe *(Prosopis juliflora)*, a tree introduced here about fifteen years ago and spread by horses and mules.

The prevailing shrub on the island is tree tobacco *(Nicotiana glauca)*, a naturalized plant, not now very common on the other islands. It grows quite plentifully on the rocky slopes and on the sides of the craters, in fact nearly everywhere except on the barren, wind-swept regions, and owes its existence to the fact that it is very rarely if ever touched by animals. The southern and eastern slopes are fairly well covered with (at this season) dried up pili grass *(Heteropogon contortus)*. In the mouths of the gulches are to be found small groves of keawe *(Prosopis juliflora)* which are slowly extending upward.

A few wiliwili trees *(Erythrina monosperma)* occurring here and there, mainly on the sides of gulches, are the sole survivals of what native forest might have existed on the island in former times. Old visitors to the island inform me that within the last twenty-five years at least they have seen the following shrubs on the island: puu keawe *(Cyathodes Tameiameiae)*, aalii *(Dodonaea viscosa)*, akoko *(Euphorbia multiformis* var.[2]), ohe *(Reynoldsia sandwicensis)*, and naio *(Myoporum sandwicense)*. The native names were given, the names in parentheses being my own substitution. From this I should judge that *Santalum ellipticum*, several varieties of *Wikstroemia*, *Pandanus odoratissimus*, perhaps scrub varieties of *Metrosideros polymorpha* and other dry land plants occurring at low elevations, must have been plentiful at one time. *Neraudia kahoolawensis*, recorded by Hillebrand[3] as the only specialty from the island, was not observed by any member of the party. In former times dry land taro, sweet potatoes and bananas were cultivated on the island, according to an old native.

[2] During a second visit Mr. Stokes has since collected two small specimens of *E. multiformis* at Kaunapou Bay.

[3] Hillebrand, W. Flora of the Hawaiian Islands. pp. 416.

On account of the unusually long period of drought the number of plants observed was very small, and the specimens collected of poor quality. Mr. Low, the lessee of the island, informs me that after heavy rains many annual grasses and weeds spring up, so perhaps the complete number of plants of the island should be three or more times what is given below. However, any one familiar with Hawaiian vegetation should gain a fairly good idea of the flora from the following list of plants actually observed. As far as possible I have tried to use the latest accepted name for the plants in the enumeration, but have sometimes failed for lack of proper references. Where different I have given the name used in Hillebrand's Flora in italic.

FILICES.

Doryopteris decipiens (Hk.) J. Sm.
Pteris decipiens Hook.

Rather rare, growing under ledges and in the shade of rocks.

GRAMINEAE.

Cenchrus echinatus L.
Cynodon dactylon Pers.
Heteropogon contortus Roem & Sch.

The most abundant plant on the island.

AMARYLLIDACEAE.

Agave americana L.

About seven plants observed, which were probably planted at some time.

CHENOPODIACEAE.

Chenopodium sp.

Seedlings, material not sufficient for determination.

NYCTAGINACEAE.

Boerhavia diffusa L..

Not uncommon in various parts of the island, its somewhat enlarged roots probably aiding it to withstand the drought.

PORTULACACEAE.

Portulaca lutea Sol.
Portulaca sclerocarpa Gray.

This plant is mentioned by Hillebrand as being collected by Lydgate on the island.

PAPAVERACEAE.

Argemone mexicana L.

Three plants were observed on the eastern pali.

CAPPARIDACEAE.

Capparis sandwichiana DC.

Occurs in a few places on low cliffs of the west side.

LEGUMINOSAE.

Acacia Farnesiana Willd.

Not common.

Erythrina monosperma Gaud.

The sole remaining indigenous tree.

Meiobomia triflora (L.) Ktz.
Desmodium triflorum DC.
Mimosa pudica L.
Prosopis juliflora DC.

Small groves at the mouths of gullies. Introduced about fifteen years ago, and spread by horses and mules. The pods are one of the most important live stock foods on these islands.

Another unidentified leguminous plant was also collected.

ZYGOPHYLLACEAE.

Tribulus cistoides L.

EUPHORBIACEAE.

Euphorbia pilulifera L.
Euphorbia thymifolia L.

STERCULIACEAE.

Waltheria americana L.

MALVACEAE.

Abutilon incanum G. Don.
Gossypium tomentosum Nutt.

There is a small area of this plant on the southwest side near the shore.

CACTACEAE.

Opuntia tuna Mill.

Perhaps a dozen plants seen on the island.

CONVOLVULACEAE.

Ipomoea palmata Forsk.
Ipomoea pentaphylla Roem & Sch., var. *trichosperma.*

This plant, which has large tuberous roots, is said to be quite conspicuous after the rains.

Ipomoea pentaphylla Jack.
Ipomoea pes-caprae (L.) Sw.

A few seedlings of this species were observed on a sandy beach.

VERBENACEAE.

Lantana camara L.

A few plants were observed by Mr. Stokes.

SOLANACEAE.

Lycium sandwicense Gray.

A few specimens amongst rocks near the shore.

Nicotiana glauca R. Grah.

The prevailing shrub on the island.

COMPOSITAE.

Acanthospermum brasilum Schrank.
Sonchus oleraceus L.

On hillocks of the wind-swept plain there is another composite not yet identified. This species also occurs on Maui.

There is a striking lack of shore plants; these salty individuals which usually escape goats and sheep on the other islands are completely consumed here, at least during the recent long drought.

Much drift material is washed on the shores of bays on the north and east coasts, presumably from Maui, although one box bore a label from Kailua, Hawaii. The following seeds and fruits were picked up on the beach:

Acacia Farnesiana Willd.
Pods containing seeds capable of germination.

Aleurites moluccana Willd.
Many nuts seen, none found capable of germination.

Calophyllum inophyllum L.
Ipomoea.
Three species, all capable of germination.

Mangifera indica L.
Various sized fruits, incapable of germination.

Nicotiana glauca R. Grah.
Capsule containing seeds, perhaps washed or blown down from the cliffs above.

Mucuna gigantea DC.
Seeds capable of germination.

Pandanus odoratissimus L.
Keys rather numerous.

Terminalia catappa L.
Capable of germination.

Xanthium strumarium L, var. **echinatum.**
Several much worn capsules, none containing seeds.

Three undetermined seeds, perhaps capable of germination, and a fresh stem of *Plumieria*.

Ipomoea pes-caprae was the only plant seen growing on the beach which could be said to be derived from any of these stranded seeds. Most new arrivals are brought to the islands by other means. Many birds, as larks, minas, pigeons, plover, and various sea birds were observed at various times in different localities over

the island. Mr. Maiki, the caretaker, tells me that with his son he has shot many pigeons which had corn in their crops, and hence, probably had flown across the channel from Kula, Maui.

Under a more favorable period of weather conditions *Nicotiana glauca* and *Prosopis juliflora* are probably the only two woody plants whose spread could be noticed. The former will eventually spread over a much greater area than at present, especially on the rocky slopes. *Prosopis juliflora* will spread up the gulches, provided there are horses or mules to carry the seed during the fruiting season.

MOLOKINI is a small crescent-shaped island lying midway in the channel between Maui and Kahoolawe. It is the eroded remnant of an old tufa cone, somewhat comparable to Koko crater on Oahu. The greatest elevation is 160 feet, the length along the ridge being about 1000 feet. The inner slopes of the crescent have an angle of 32.25 degrees, the outer edge being a nearly vertical cliff of 73.30 degrees. The only flat area consists of a small space about twelve feet wide and fifteen feet long.

Since 1911 an intermittent flashlight has been established on the island. There is no place where floating seeds could by any means become established, and all plants must be carried to the island by other means. Land birds occasionally visit the island, one member of the expedition observing a lark. The following plants were observed. All are what one might expect to find in such a locality. They form a fairly good vegetable covering over the island.

FILICES.

Doryopteris decipiens (Hk.) J. Sm.
Pteris decipiens Hook.

GRAMINEAE.

Heteropogon contortus Roem & Sch.

CYPERACEAE.

Cyperus, sp.

NYCTAGINACEAE.

Boerhavia diffusa L.

PORTULACACEAE.

Portulaca lutea Sol.
Portulaca oleracea L.
Portulaca sclerocarpa Gray.

LEGUMINOSAE.

Meibomia uncinata (Jacq.) Ktz.
Desmodium uncinatum DC.

ZYGOPHYLLACEAE.

Tribulus cistoides L.

MALVACEAE.

Sida fallax Walp.

STERCULIACEAE.

Waltheria americana L.

CONVOLVULACEAE.

Jacquemontia sandwicensis Gray.

VERBENACEAE.

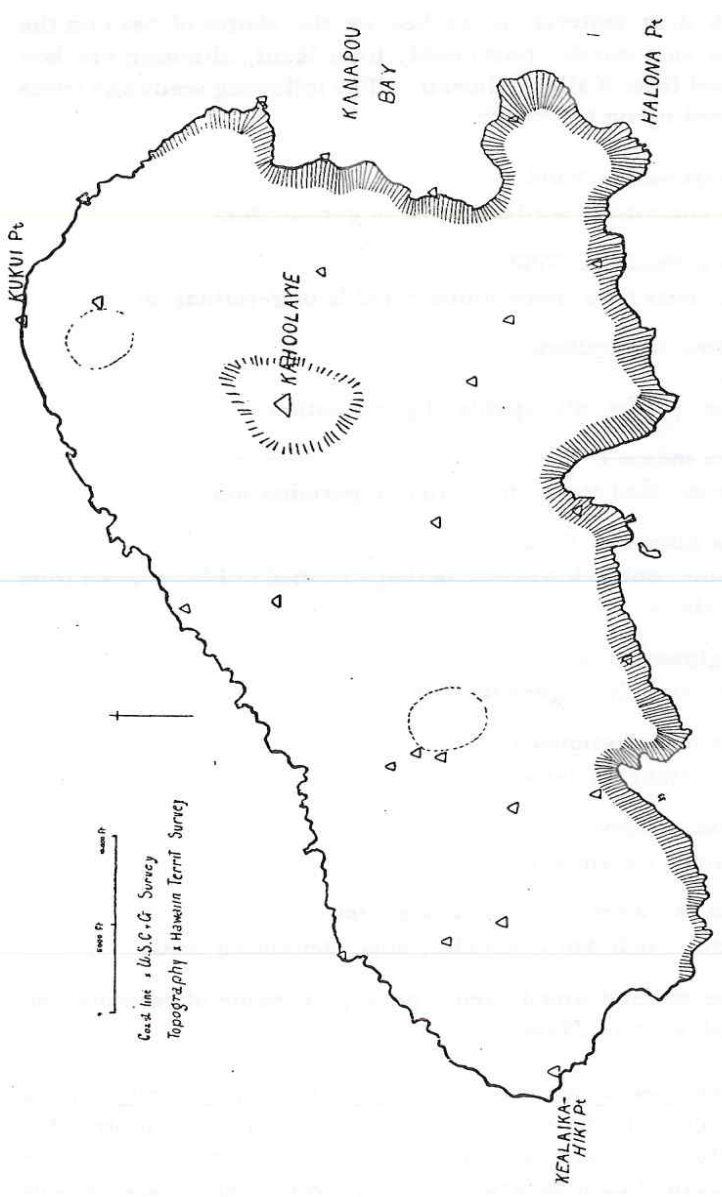
Lantana camara L.

SOLANACEAE.

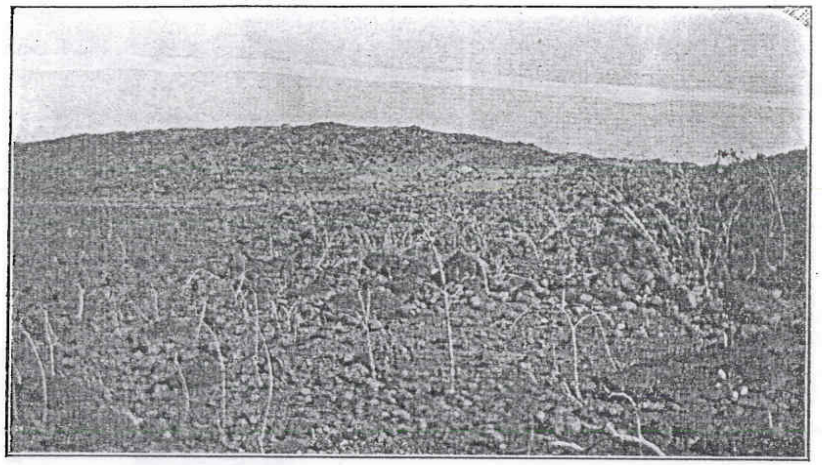
Lycium sandwicense Gray.

COMPOSITAE.

Lipochaeta lavarum (Gaud.) DC.

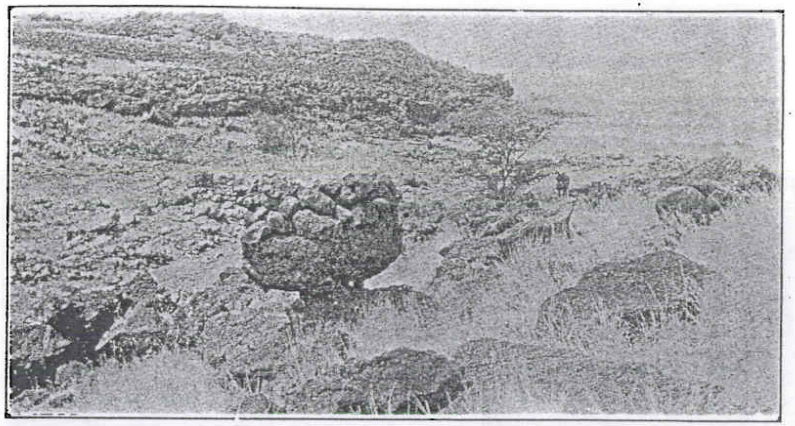


1. Map of Kahoolawe compiled from Government survey. The craters are added in their approximate positions, and the cliff outline has been changed to conform with field notes taken on the island.

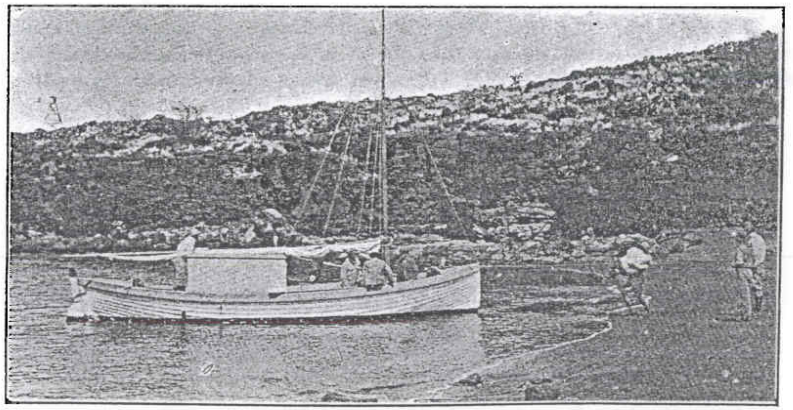


2. Inside slopes of north crater showing growth of tree tobacco (*Nicotiana glauca*).

3. Unique example of erosion on the barren wind-swept plains of the uplands. The ring of stones is the bottom of a former imu or underground baking oven of the old natives.

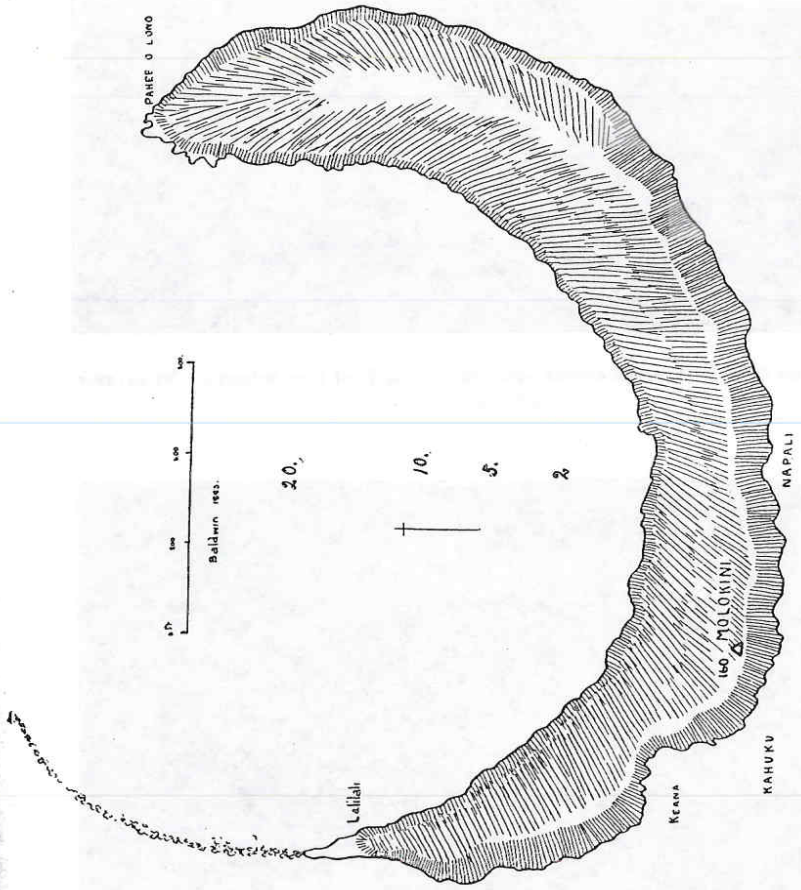


4. Lower slopes, showing growth of pili grass (*Heteropogon contortus*) and keawe (*Prosopis juliflora*) in the mouth of a gully.



5. Landing at Kahoolawe, showing pili grass on the lower slopes and a few plants of keawe and *Opuntia tuna*.

6. Beach at Kanapou Bay where much wreckage and many plant seeds are washed ashore. View also shows the high cliffs which are characteristic of this portion of the island, and which are practically barren of vegetation.



7. Map of Molokini from survey by Baldwin.