RECORD

Published in cooperation with the National Park Service.

JULY 1, 1958

Collection and Field Note Book

No. 59

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UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

HAWAII NATIONAL PARK

Self-Guiding Nature Trail

KIPUKA PUAULU

George C. Ruhle

HAWAII · NATURAL · HISTORY · ASSOCIATION

Walking Time, 1 hour

This pamphlet is a key to the numbered stakes which you will see along the trail. You may keep it if you wish, or return it to the holder at the end of the trail. It is a service to you by the HAWAII NATURAL HISTORY ASSOCIATION that you may have greater appreciation through better understanding.

Repitition is an effective tool of the learning process. As refreshers and quick reference to the descriptive paragraphs, numbers have been frequently repeated along the trail.

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The system of 30 National Parks contains areas of highest scenic and scientific grandeur essentially in the primitive state. The National Park System, of the Department of the Interior, administers these, as well as 150 other areas of outstanding national significance. The law of the land enjoins that these be so used that they may be passed unimpaired for the enjoyment of future generations.

The story of HAWAII NATIONAL PARK is the story of active volcanism distinguished by eruptions of very fluent lava. The park is in two sections: that on the island of Hawaii embraces the summit of Mauna Loa and most of Kilauea Volcano; the section on the island of Maui includes the great crater of Haleakala.

In the maze of lava streams that pour out during Hawaiian eruptions, areas of older surface often escape cover by successive flows. An oasis thus formed is called a *kipuka*, a word that also means a loop or an open space in the forest. If a kipuka of large size is effectively isolated for a long period of time, good, deep soil forms, the plant inhabitants develop characteristics that reflect the nature of their history and environment, a distinctive flora is evolved. Such is the *Kipuka Puaulu* with its area of 100 acres. Some forty-odd species of native trees have been claimed as natural members of its flora. Many type specimens have been collected in it and described by botanists. Authorities have been drawn from faraway countries to observe its treasures. It is a significant place in the world of plants.

The name has been interpreted variously. *Pua* means flower, but is also to be translated as a collection of things bound together. *Ulu* is to grow; it is also the name for breadfruit, which appears inapplicable here. A popular nickname, Bird Park, has no significance and little to commend it.

Mamane
See No. 8

Pilo
See No. 13

To label a plant or natural specimen is too often prelude to its destruction or removal. Please respect the integrity of specimens and be thoughtful of those who follow you.

Cigarette butts and trash do not add to your enjoyment of the park. You can easily dispose of them so that they cannot be obnoxious to you and to those who come after you.

At the start of the trail is an exhibit with a map showing the outlines of the *kipuka*, surrounded by prehistoric but recent (before 1800) flows. Four common native birds, the *apapane*, *iiwi*, *amakihi*, and *elepaio*, are illustrated in color. This is a favorite haunt, giving the nickname *Bird Park*. Since the birds forage in the lofty canopy of trees, and sing little during the heat of the day, patience [illegible] are necessary qualities for see- [illegible] studying these alluring subjects.

[illegible] *Dodonaea sp.)*, one of the [illegible] shrubs to be seen along roads [illegible] Park. It grows to the [illegible] along the Mauna Loa [illegible] male flowers [illegible] The clusters [illegible] capsules [illegible] showy [illegible] for leis [illegible] dye [illegible] ther [illegible] ood [illegible] useful [illegible]

Aalii with capsules

Dodonaeas are found on all of the larger islands of Hawaii. The three chief species are *D. viscosa*, *D. eriocarpa*, and *D. sandwicensis*. *D. viscosa* is also found in other parts of the Pacific.

2. Ohia Lehua *(Metrosideros collina)*. The *ohia*, like the eucalyptus and guava, belongs to the Myrtle Family. It is found throughout Polynesia, and grows from sea-level to 9,000 feet in Hawaii. It is the commonest forest tree on the islands often growing in almost pure stands. It is a pioneer on most lava flows. The showy pompoms of bright red stamens make it attractive while in flower.

3. As you stand on this rise, look about you. You are on the threshold of Kipuka Puaulu. Note the contrasting scenes behind and before you. Almost all of the trees on the flows back of you are ohia; the shrubs mixed through them are *pukiawe (Styphelia tameiameiae)* and *aalii*.

4. Ionui *(Dryopteris paleacea)*. A rather stiff, erect fern that is common in Bird Park. Varieties or close relatives of this fern are widespread throughout the world. This and several other ferns are erroneously termed *laukahi*, the Hawaiian word for plantain, *Plantago major*.

5. Palapalai *(Microlepia setosa)*, a lacy, attractive fern, one of the commonest along the trail. It prefers open glades and edges of the woods. It grows on all of the larger islands, and elsewhere on Pacific Islands, Malaysia, India, and Ceylon. It was used to decorate the altars of Laka, goddess of the hula.

Please help preserve the primitive scene by placing refuse in containers provided for this purpose and by refraining from picking, breaking, or removing flowers, ferns, and natural specimens.

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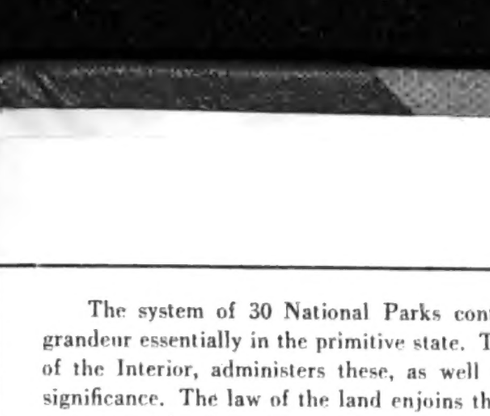
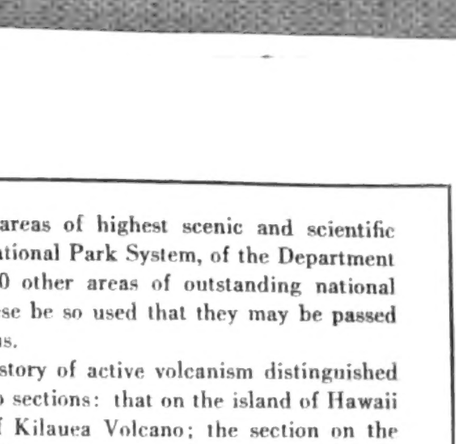


Mamane
See No. 8

Pilo
See No. 13



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1. Aalii *(Dodonaea sp.)*, one of the commonest shrubs to be seen along roads and trails in the park. It grows to the size of a small tree along the Mauna Loa Truck Trail. Male and female flowers appear on separate plants. The clusters of yellow or bright red seed capsules with papery wings make the shrub showy while in fruit. These were used for leis and for extracting a brilliant red dye with boiling water. *Kapa* and other things were colored with it. The wood of the plant is tough and durable, useful for spears and various purposes.

Aalii with capsules

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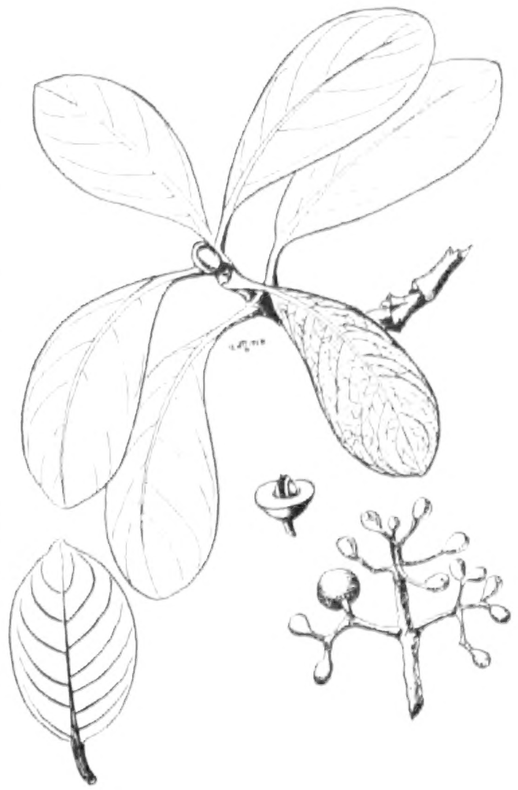
6. Sword Fern, Nianiau or **Okupukupu** *(Nephrolepis exaltata)*. Several species exist in the park. Native to tropical and subtropical climes, the sword fern is a popular house plant that exhibits many varieties. This is a pioneer plant in new lava fields and on the floor of Kilauea Crater. A very hairy variety, *N. hirsutula*, grows abundantly in steam cracks.

7. The common herbs forming a ground cover here are an introduced geranium (7A) and the native strawberry (7B), *ohelo papa (Fragaria chiloensis)*. The latter bears fruits that are small, white, and often of good flavor. This strawberry is distributed from southern Chile to the Aleutians.

The vigorous grove contains *papala kepau, kopiko, pilo, olopua, kolea, mamane, mamaki, manele* and *ohia lehua* trees. These are discussed individually along the trail.

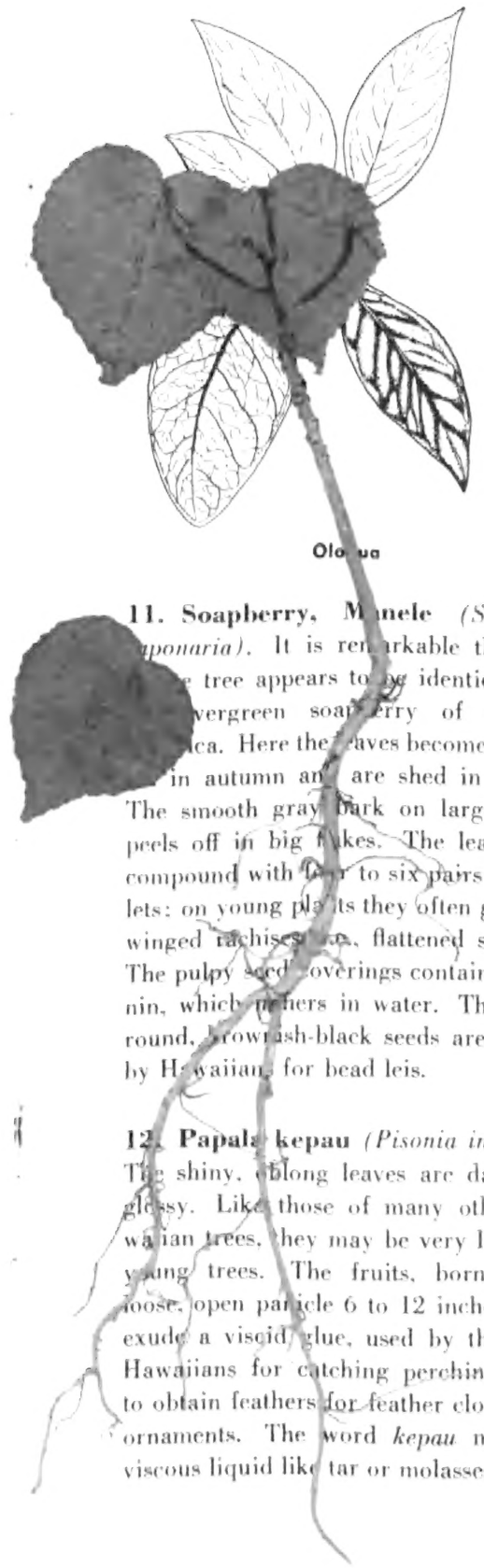
8. Mamane *(Sophora chrysophylla)*. A common shrub or small tree found from 2,000 - 10,000 feet on all islands except Molokai, this member of the bean family bears attractive yellow flowers and compound leaves. It is related to the golden shower trees. It is eagerly eaten by livestock and feral goats, that have eradicated it in many areas. The wood is very hard and durable. Note the winged pods and shiny orange or yellow seeds, if the trees are in fruit. The *mamane* is endemic to the Hawaiian Islands, but other species of the genus, more than two dozen in number, are found distributed throughout warmer regions of the world.

9. Kopiko *(Straussia Hillebrandii)* is an abundant tree in Bird Park. It belongs to the important Coffee Family, which is widespread, is mostly tropical, and has 350 genera, of which a dozen are native to the Hawaiian Islands. Of these, *Straussia, Gouldia,* and *Bobea* are endemic. *Kopiko* in Bird Park are readily identified by their dark green, opposite leaves that have conspicuous midribs and veins. A scaly aphid often infests the lower surface of the leaves.



Kopiko

10. Hawaiian olive, Olopua *(Osmanthus sandwicensis)*. The glossy, leathery leaves may be six inches long on very young trees. The hard, dense wood was used for handles of spears and adzes. *Osmanthus* belongs to the same family as the cultivated olive, *Olea europea*.



Olopua

11. Soapberry, Manele *(Sapindus saponaria)*. It is remarkable that this tree appears to be identical with the evergreen soapberry of tropical America. Here the leaves become yellow in autumn and are shed in winter. The smooth gray bark on larger trees peels off in big flakes. The leaves are compound with four to six pairs of leaflets; on young plants they often grow on winged rachises, i.e., flattened stemlets. The pulpy seed coverings contain saponin, which lathers in water. The hard, round, brownish-black seeds are sought by Hawaiians for bead leis.

12. Papala kepau *(Pisonia inermis)*. The shiny, oblong leaves are dark and glossy. Like those of many other Hawaiian trees, they may be very large on young trees. The fruits, borne in a loose, open panicle 6 to 12 inches long, exude a viscid glue, used by the early Hawaiians for catching perching birds to obtain feathers for feather cloaks and ornaments. The word *kepau* means a viscous liquid like tar or molasses.

13. Pilo *(Coprosma rhyncocarpa)*. Of the half hundred species in this genus, fifteen have been described from the Hawaiian Islands. Several species occur as trees and shrubs in the park; of these sprawling *kukaenene*, so common on barren lava fields and open forest, is best known. A member of the Coffee Family, little use appears to have been made of these small trees. The *pilo* is readily recognized by its opposite leaves with broad triangular stipules between their stems forming a loose, funnel-shaped sheath.

14. Bracken, Kilau *(Pteridium aquilinum)*. The cosmopolitan bracken, possibly the best-known fern, grows abundantly in open grassland. The native form is found from elevations of 500 to 9,500 feet. The plant has a creeping, underground stem upon which the large, coarse, triangular fronds grow. Varied use is made of the plant throughout the world such as for food, medicine, litter, and basket material. The fruiting bodies of bracken occur in a continuous band along the edges of a frond, which are partially rolled back over it.

Papala kepau

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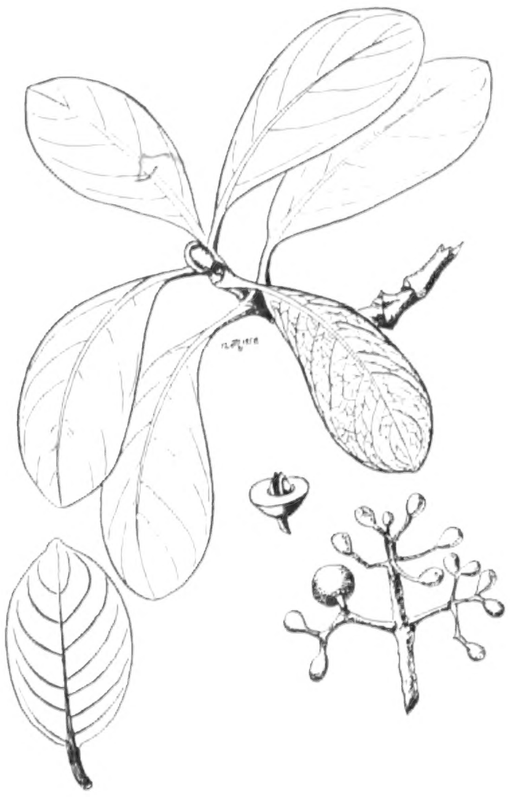

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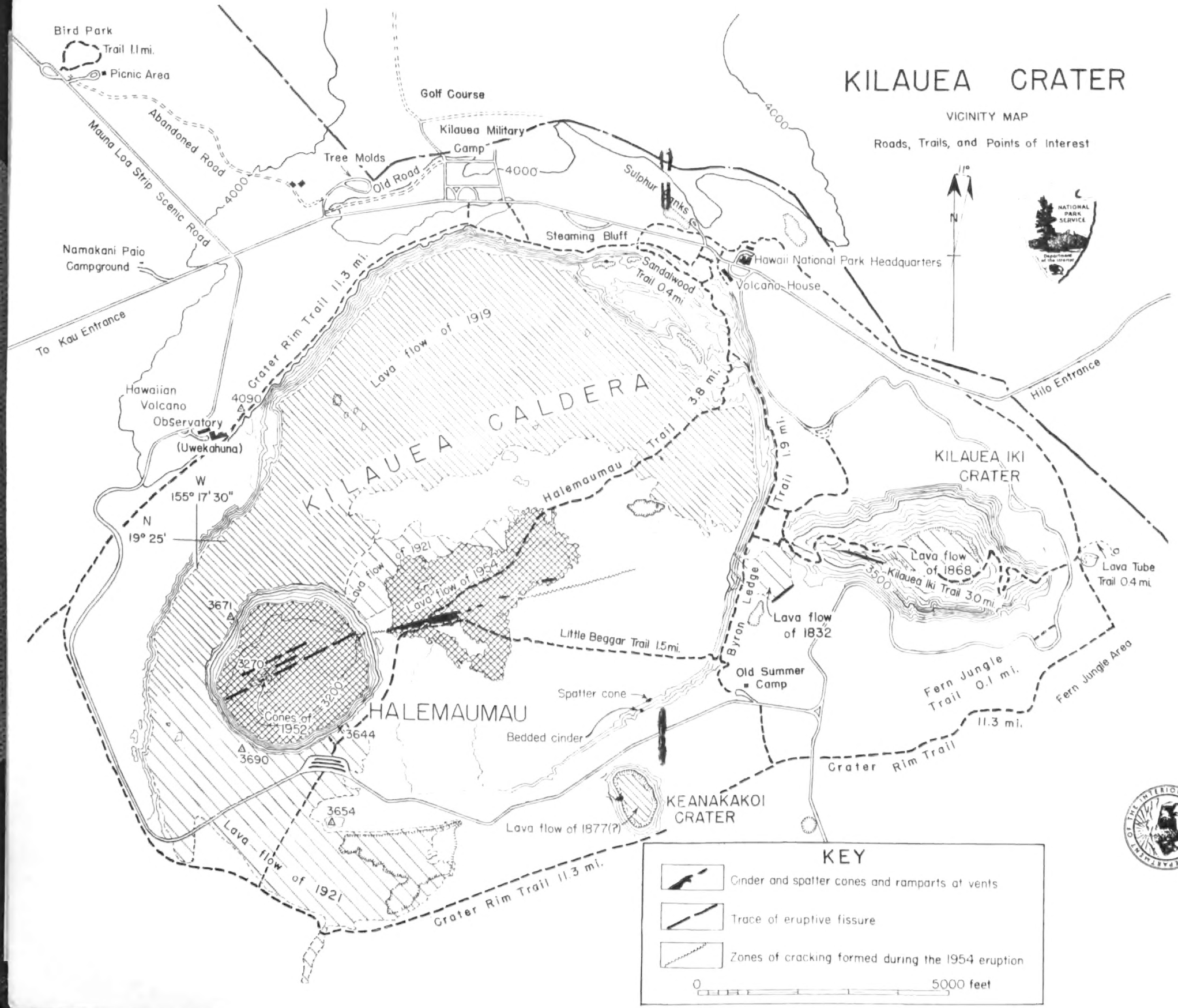
Papala kepau

KILAUEA CRATER

VICINITY MAP

Roads, Trails, and Points of Interest



KEY

- Cinder and spatter cones and ramparts at vents
- Trace of eruptive fissure
- Zones of cracking formed during the 1954 eruption

0 — 5000 feet

The *Park Museum* is in the Park Administration Building on the main highway, one mile inside the Hilo Entrance to the Park. It is open from 7:30 a.m. to 4:30 p.m. daily, and is dedicated to the wonders of the park story. Motion pictures of eruptions of Mauna Loa and Kilauea are shown daily in the Park Auditorium in the same building at 9:30 a.m. and 1:15 and 1:45 p.m. Admission is free. Information is dispensed at the counter in the lobby of the Administration Building; maps, copies of motion pictures and kodaslides, and literature are on sale at this place by the Association. All profits are used for furthering interpretive efforts of the park.

UNITED STATES
DEPARTMENT OF INTERIOR
Fred A. Seaton, *Secretary*
NATIONAL PARK SERVICE
Conrad L. Wirth, *Director*

15. Manena *(Pelea cinerea)* has slender, twining branchlets with small leaves and comparatively small fruits. Like the others of its genus, the leaves are opposite; some are fragrant.

16. Mamaki *(Pipturus sp.)*, is a member of the stinging nettle family. The inner bark of this plant was used by the Hawaiians for making *kapa* or bark cloth. It is one of the most abundant fiber plants found in the Islands.

17. Manono *(Gouldia terminalis)*. The lone tree ten paces above the sign is another member of the Coffee Family. The genus is one of the three endemic to the Hawaiian Islands.

Manono

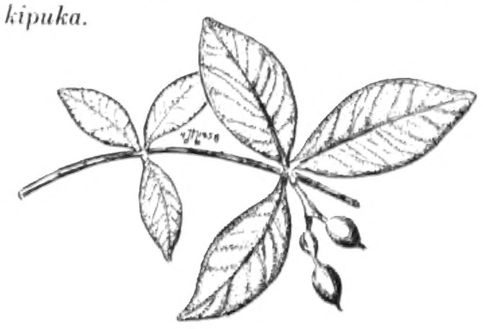
18. Kolea *(Myrsine sp.)*. The red color of the young leaves is an interesting feature of this plant. It is due to the chemical anthocyanin that protects new, tender leaflets from the brilliant sun of the tropics. Wood from this tree was used for houseposts; a dye for *kapa* was made from the sap. *Kolea* is also the name given to the golden plover, the bird that completes a remarkable migration to the Arctic Circle and back to Hawaii each year.

19. Nasturtium *(Tropaeolum majus)*, a native of Peru, that has escaped from gardens, finding the environment very suitable for its spread. Here it drapes a prostrate *ohia* log, ten paces below the trail.

20. Koa *(Acacia koa)*. The trees in the glade below the trail are *koa*. Like the *mamane*, the *koa* is a member of the legume or pea family and is native only to the Hawaiian Islands. The genus *Acacia* has 450 species in the tropics and subtropics throughout the world; those growing in Australia, are called wattles. The bark of the young *koa* is smooth; the bark on the older trees is coarse.

21. Maua *(Xylosma Hillebrandii)*. This small tree is ten paces behind the sign. It is uncommon in Bird Park, but prefers drier lands on leeward slopes of all the major islands except Kauai and Oahu. It is a handsome tree with shiny, toothed, crenulate leaves whose color often gives the tree a reddish cast.

22. Kipuka Boundary. This ridge is the edge of the prehistoric lava flow from Mauna Loa that surrounded this *kipuka* but failed to cover it. Notice the difference between the forest growing on the relatively recent lava flow ahead and that growing on the rich soil of the *kipuka*.



Maile No. 36

23. Papala *(Charpentiera obovata)*, an endemic tree, rare in the park. Do not touch or disturb this planted specimen. Its small red flowers hang in large loose panicles from the ends of branches. The wood is soft, fibrous, very light, and inflammable. The Hawaiians heaped it into bonfires which they pushed over cliffs and vantage points. Because of their buoyancy, rising air currents would buffet the glowing torches in brilliant display upward, downward, and sideways like so many shooting stars.

Papala

24. Alaalawainui *(Peperomia reflexa)*. A large number of species of this widespread genus of the Pepper Family grow in Hawaii. Condiment pepper is made from *Piper nigrum*, native to the Oriental tropics. The celebrated Polynesian drink, *awa* or *kava*, was made from the root of *Piper methysticum* which grows 6 to 12 feet tall.

25. Alani *(Pelea volcanica)*. The great botanist, Asa Gray, named this genus of the Rue (Citrus) Family after the goddess Pele. The leaves are opposite, often notched at the apex. When crushed they emit a fragrant odor. The fruiting capsules are large, usually over one inch in diameter, and open into four parts, each bearing two shiny black seeds.

Naio

26. False Sandalwood, Naio *(Myoporum sandwicense)*. When the supply of true sandalwood *(Santalum* sp.), a chief item of trade in the early days, began to run low, *naio* was used as an inferior substitute. Since demand for it never became great, *naio* trees are still abundant in these islands, to which they are native. In Bird Park old trees develop deeply furrowed, knobby boles, with heartwood much decayed so that only strips of living tissue remain. (See illustration on page 12). Despite this, they cling tenaciously to life, sending out vigorous shoots from their tops. These are the most picturesque objects along the trail.

27. Tarweed, Pukamole *(Lythrum maritimum)*. A sticky, hairy undershrub of the American tropics grows rank here. It bears small, magenta flowers. It belongs to the Crape Myrtle Family.

Alani

Geranium

28. Open Forest Growth. In this locale, the trees do not compete with each other in their efforts to obtain sunlight. Compare the symmetry of the spreading ohia in the distance to the crowded *koa* on the left skyline. Note also the fallen *ohia* twenty paces to the left. Its branches have turned upward and in time may become independent trees as the old tree decays. Curiously shaped *ohia* may be seen on the right of the trail beyond sign 39, and on the left of the trail 30 paces before reaching sign 42. Similar contorted individuals are especially conspicuous at Kipuka Nene campground.

This is an excellent spot for observing birds. The frequent crowing of pheasant cocks is a complementary sound.

29. Collapsed Lava Tube. Many layers of volcanic ash have accumulated through the centuries, some of them from eruptions of distant Mauna Kea. Such ash forms much of the topsoil in Kipuka Puaulu. This collapsed lava tube and the lava above it provide opportunity for gauging the depth of the soil. DANGER—DO NOT APPROACH THE TUBE.

30. Kookoolau *(Bidens pilosa)*, an introduced weed from tropical America. Its annoying, black needles, less than one-half inch long, are pronged so that they readily cling to clothes and to fur of animals. The many species of *Bidens* have been given appropriate popular names: Spanish needles, beggar ticks, sticktights, tick seed, bur marigolds. Over sixty blander native Hawaiian species have been described. Leaves and tips of young plants, fresh or dried, are steeped for a beverage, often in preference to commercial tea. In season, a large undershrub native to Puuwaawaa glitters with thousands of golden flowers in big panicles, a glorious sight indeed. Kokoolau Crater on Chain of Craters Road was named for the species growing within it.

31. Ae *(Zanthoxylum dipetalum)*. The *Zanthoxyla*, represented by three species in Bird Park, are very rare in numbers of individuals. This is an unusually large specimen. Like the *Pelea*, this belongs to the Rue (Citrus) Family.

Ae leaf

32. Akala *(Rubus hawaiiensis)*, a giant among raspberries. A half dozen berries fill a bowl. The bearing season, which is in midyear, like the taste and color of the fruit, varies with plants and location. Usually the berries are purple, but the blossoms and juice are pink. *Akala* means *pink* in Hawaiian.

A short trail to the left leads to a huge *koa* whose base is seven feet in diameter.

Olapa

33. Huehue *(Cocculus ferrandianus)*, a native climber widely distributed from sea coast to 5,000 feet. The tough flexible stems are useful as natural twine. Hawaiians wove them into baskets with funnelform mouths that were used as fish traps.

34. Alani *(Pelea Zahlbruckneri)*. Named by the great Hawaiian dendrologist, Joseph Rock, for his celebrated friend, Dr. A. Zahlbruckner, Director of the Viennese Botanical Museum. It has the largest leaves of any *Pelea*, and large, curious fruiting capsules like four-pointed stars.

35. Olapa *(Cheirodendron Guadichaudii)*. One of the commonest, most conspicuous of forest trees. Its bright green, shiny leaves are palmately compound and constantly flutter in the breeze. When bruised, all parts of the tree emit a strong turpentine odor. The name *olapa* was applied to those hula dancers with lithe, supple bodies and most graceful motions, who could best imitate the dancing of the *olapa* leaves. The tree is twenty paces behind this sign, growing in the big patch of *Microlepia*.

36. Maile *(Alyxia olivaeformis)*. This twining, native, vinelike shrub is the laurel of old Hawaii. Its fragrant stems and shiny leaves carry a faint odor of vanilla. They were a favorite and an indispensable adjunct to every festive occasion, being used for decoration and for leis.

37. Mint *(Mentha spicata)*. This large patch of non-native mint affords an example of how native plants are often crowded out by hardy foreigners. Please do not pick the mint and drop it along the trail, as this aids in spreading it and in choking out desirable plants.

38. Large Koa *(Acacia koa)*. In regions in which growing seasons are indefinite, the age of a tree cannot readily be determined by a count of annular rings. This tree is probably several hundred years old. The koa was used more than any other tree in making Hawaiian canoes, both the single *kaukahi* and the double *kaulua*. The hard, beautiful wood is suitable for the manufacture of furniture and other objects, such as bowls and trays.

39. Opuhe *(Urera sandwicensis)*, like the *mamaki*, is a member of the stinging nettle family and is used for making *kapa*. It is a medium-sized tree with male and female flowers growing on separate plants. The large, oblong, dark green leaves have prominent veins; the stems exude a watery, milky fluid when broken. Fibers from the bark are tough, useful for making cord for fish nets.

40. Large Ohia Lehua *(Metrosideros collina)*. An idea of the size to which these trees grow may be obtained from this specimen. It is approximately 80 feet high, and about five feet in diameter at the base. The flower of the *ohia*, the *lehua*, is the flower of the Island of Hawaii. Many birds, particularly the red *apapane*, feed on the nectar of these flowers. The wood of *ohia* is hard and durable; it was used for making gunwales of outrigger canoes, timbers for housing, and poi boards.

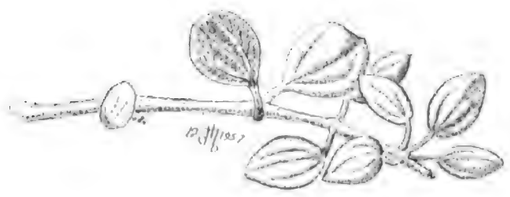
41. Ti, Ki *(Cordyline terminalis)*, is a very useful plant to Hawaiians. The leaves are used in wrapping food, either for storage, for handling, or for cooking in the earth. They formerly served for thatch and for skirt material. A crude musical instrument is made by rolling up a leaf. *Okolehao*, a potent alcoholic beverage, is brewed from the roots of this plant.

42. Young Koa Leaves *(Acacia koa)*. Both the fernlike, juvenile leaves and the adult, sickle-shaped phyllodea may be seen on the lower branches of these trees. A young *koa* starts growth with compound leaves only. As it grows, the petioles (leaf-stalks) expand and replace the leaflets. The resulting leaflike organ, termed a *phyllode*, may be a clue to the evolutionary history of the *koa*. Finely divided leaves are characteristic of plants that are nôt exposed to loss of life-sustaining moisture through surface evaporation. A leathery, smaller-surfaced appendage is better adapted to withstand the strain of drought. Despite heavy rainfall in the islands, supplies of moisture stop abruptly with a shift of winds: the soil and atmosphere quickly assume a desert character which, if of long duration, is critical to poorly adjusted plants. The *koa* has become neatly adjusted to its environment.

Naio trunk

43. Grassland. Many grasses not native to the island grow in Kipuka Puaulu. Most of these were introduced with stock feed brought from the mainland. In some areas the grasses are growing so densely that it is impossible for native plants to get a start.

44. Avocado *(Persea americana)*. Somebody thoughtlessly tossed aside a seed. Well above optimum range for the plant, it has grown into a robust tree that cannot bear fruit.

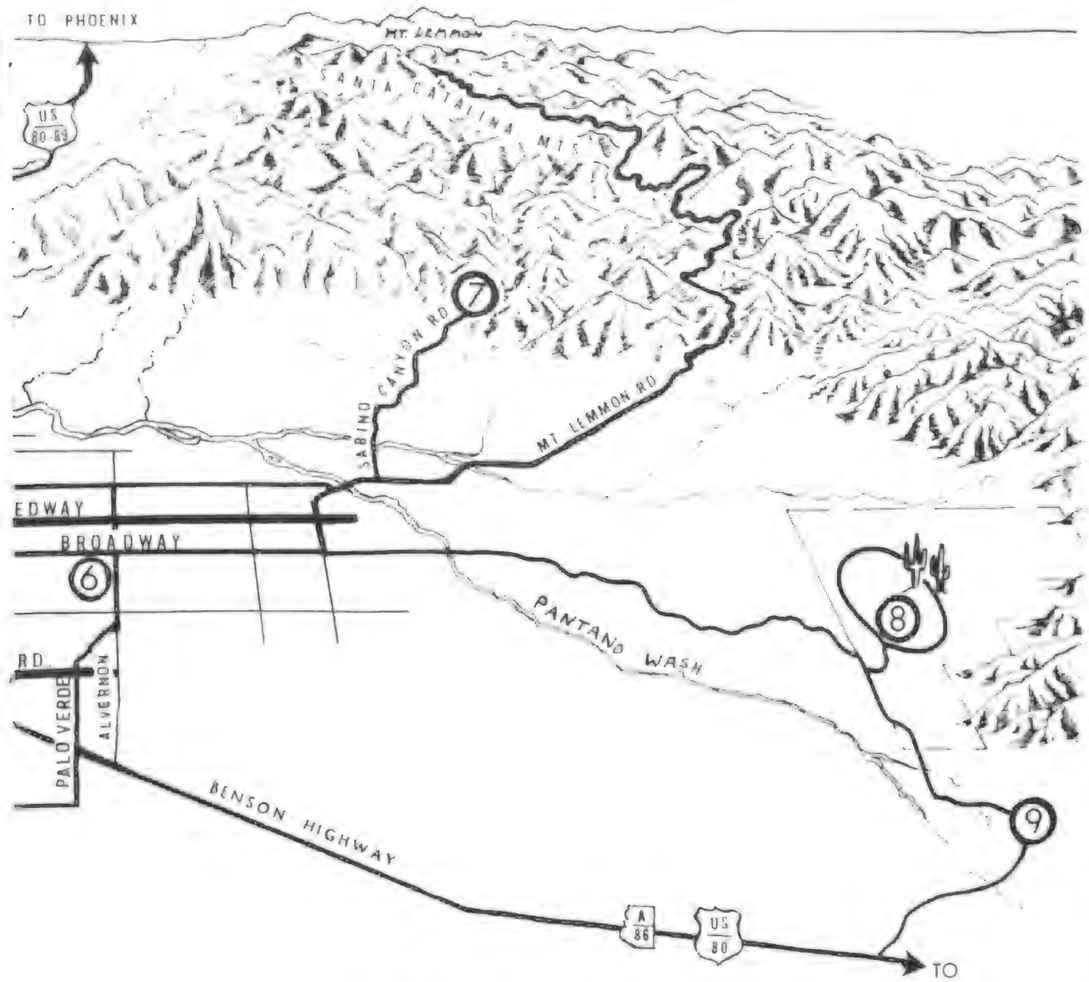


Alaalawainui

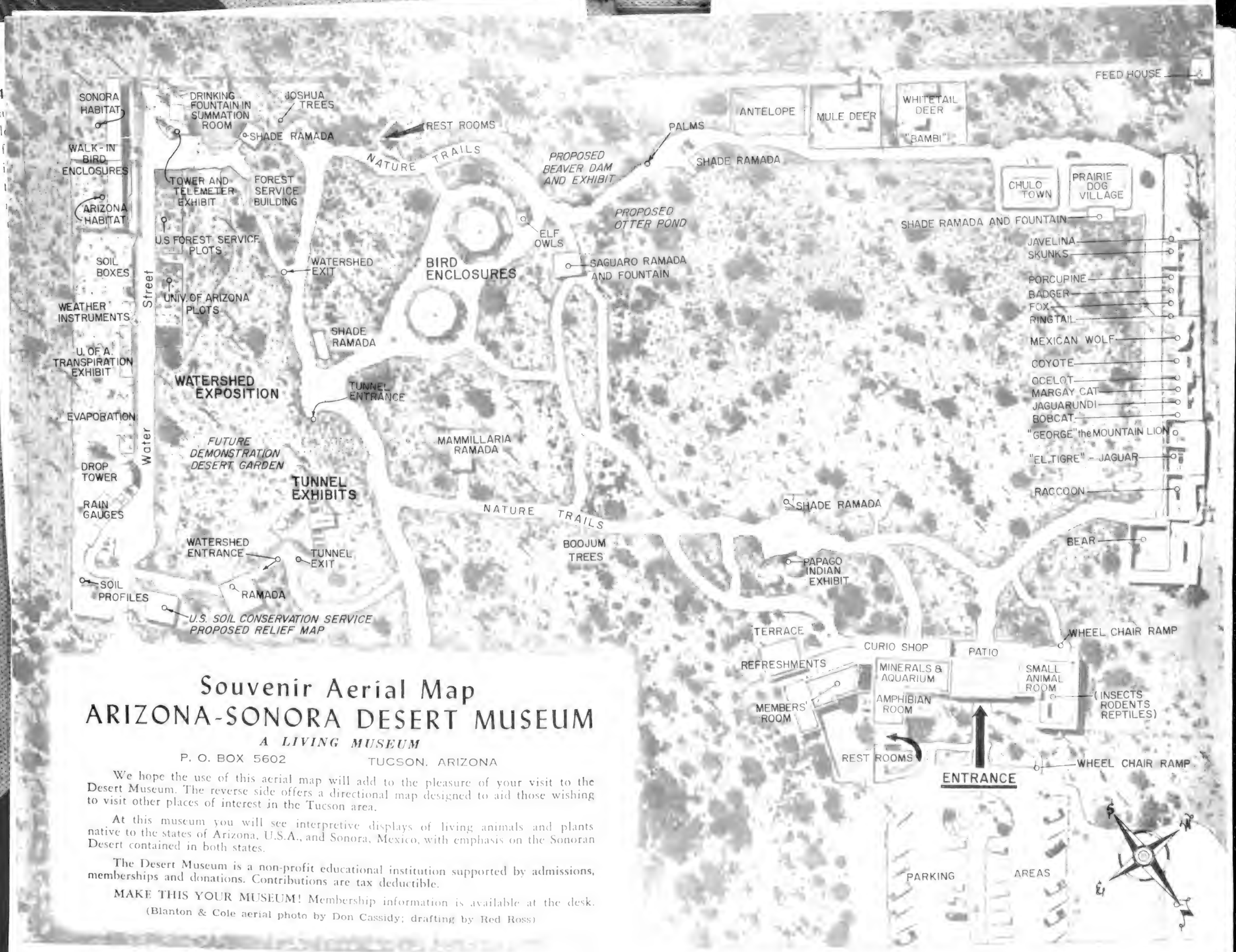
DESERT MUSEUM

Tucson Area

AT THE DESERT MUSEUM
one admission charge
covers all exhibits:
Adults — 75c
Children 6 to 12 — 25c
Under Six — Free



ADAPTED BY
DAVID F. CARSWELL
FROM A MAP BY
THE CITY - COUNTY
PLANNING DEPT.



Souvenir Aerial Map
ARIZONA-SONORA DESERT MUSEUM

A LIVING MUSEUM

P. O. BOX 5602 TUCSON, ARIZONA

We hope the use of this aerial map will add to the pleasure of your visit to the Desert Museum. The reverse side offers a directional map designed to aid those wishing to visit other places of interest in the Tucson area.

At this museum you will see interpretive displays of living animals and plants native to the states of Arizona, U.S.A., and Sonora, Mexico, with emphasis on the Sonoran Desert contained in both states.

The Desert Museum is a non-profit educational institution supported by admissions, memberships and donations. Contributions are tax deductible.

MAKE THIS YOUR MUSEUM! Membership information is available at the desk.

(Blanton & Cole aerial photo by Don Cassidy; drafting by Red Ross)

THE DESERT MUSEUM IS
open every day of the year —
from 10 A.M. to 5 P.M.
(until sundown on Sundays
and holidays).

ARIZONA-SONORA DESERT MUSEUM

Guide Map of Tucson Area

AT THE DESERT MUSEUM
one admission charge
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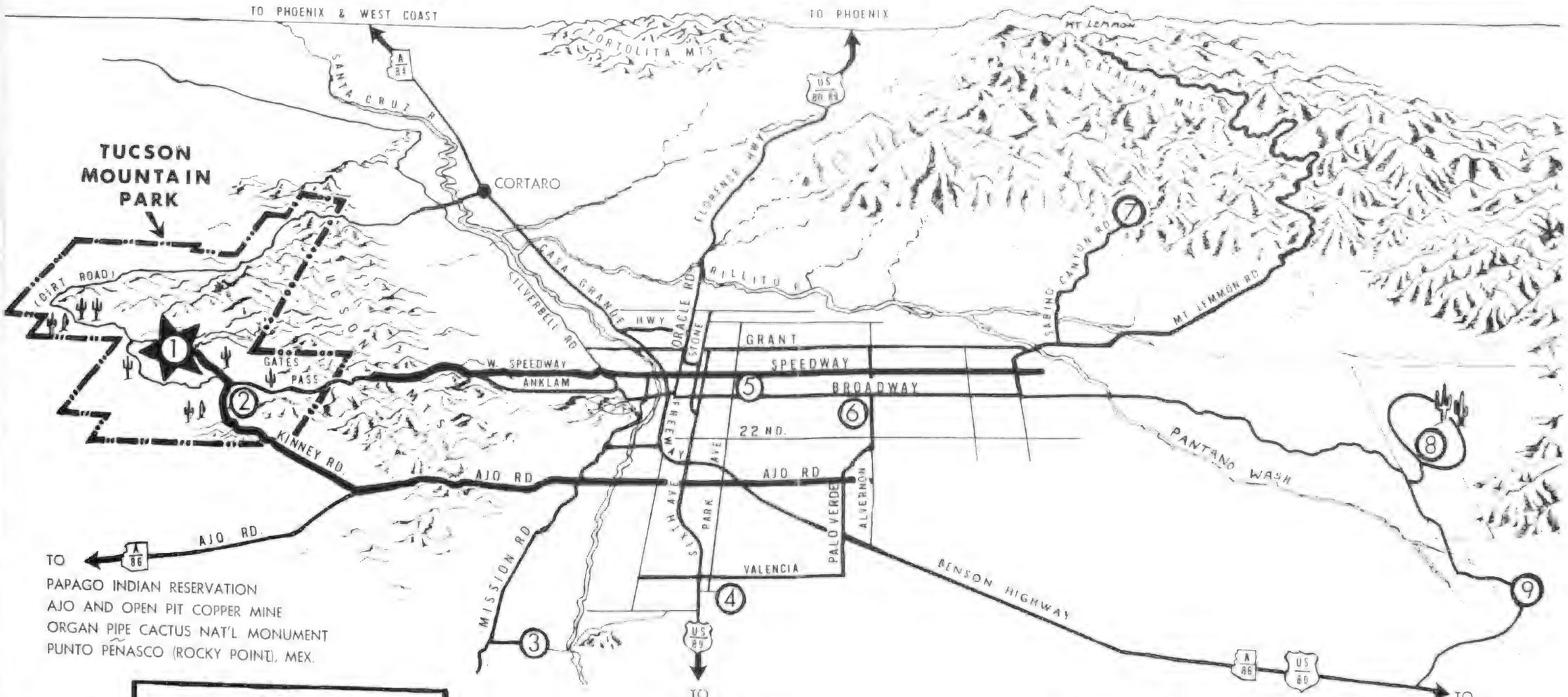


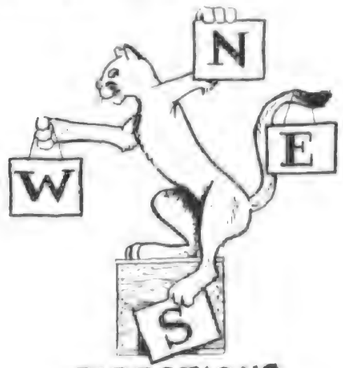
TO
PAPAGO INDIAN RESERVATION
AJO AND OPEN PIT COPPER MINE
ORGAN PIPE CACTUS NAT'L. MONUMENT
PUNTO PEÑASCO (ROCKY POINT), MEX.

TO
TUBAC PRESIDIO HIST. MON.
TUMACACORI NAT'L MONUMENT
NOGALES AND OLD MEXICO

TO
BENSON
TOMBSTONE
FORT HUACHUCA
CORONADO NAT'L. MEM.
BISBEE (OPEN PIT MINE)
CHIRICAHUA NAT'L MON.
AND POINTS EAST

KEY

1. ARIZONA-SONORA DESERT MUSEUM
2. "OLD TUCSON" MOVIE SET
3. SAN XAVIER MISSION
4. MUNICIPAL AIRPORT
5. UNIVERSITY OF ARIZONA
   ARIZONA STATE MUSEUM
   ARIZONA PIONEERS' HIST. SOC.
6. RANDOLPH PARK
7. SABINO CANYON
8. SAGUARO NAT'L. MONUMENT
9. COLOSSAL CAVE



DIRECTIONS
(By George!)

(ADAPTED BY
DAVID F. CARSWELL
FROM A MAP BY
THE CITY-COUNTY
PLANNING DEPT.

Tucson, AZ. U.S.A.

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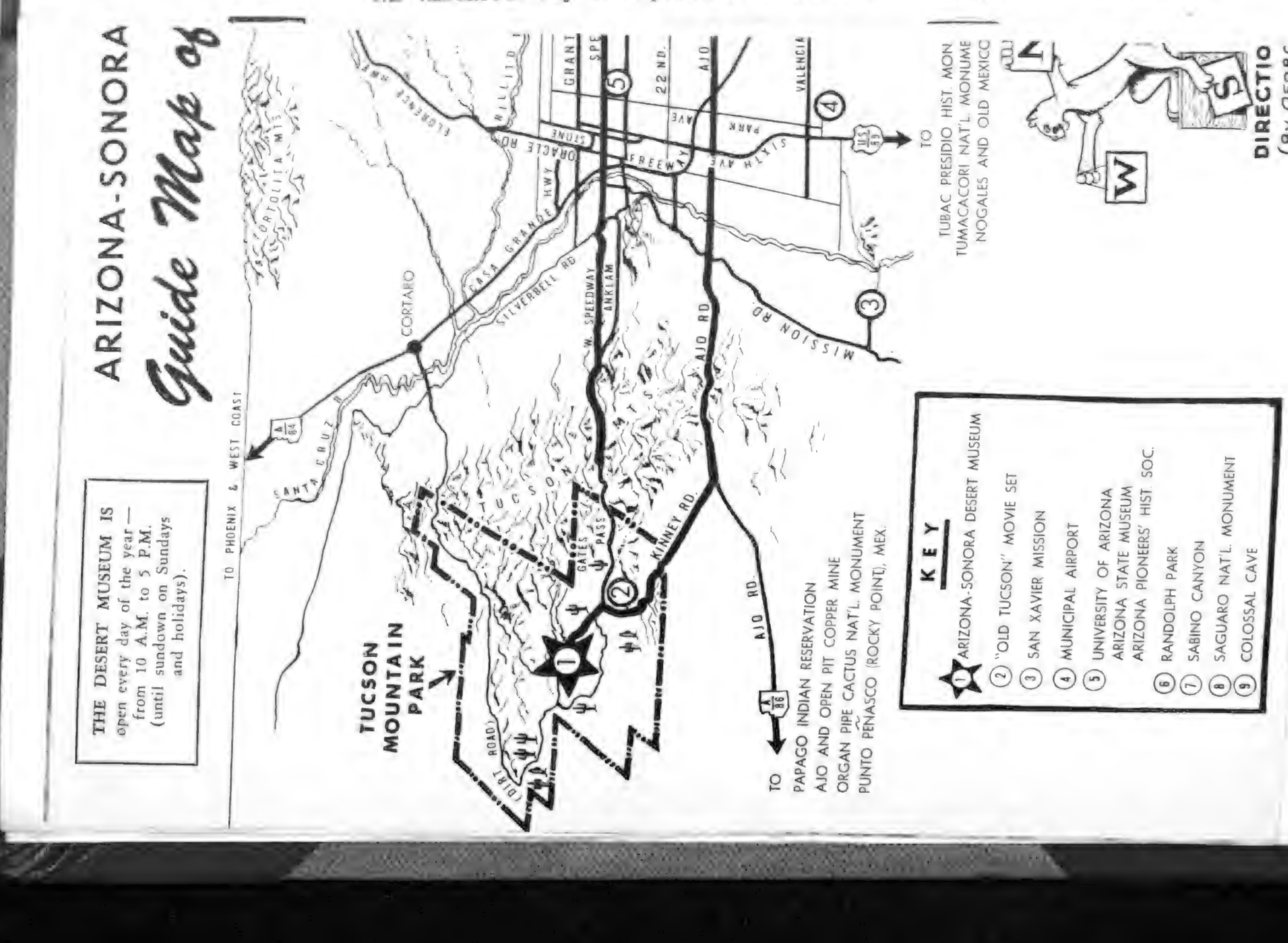
(I keep finding odd monocot pollen grains and must get more comparative material as soon as possible. I need Zingiberaceae(one may be a Curcuma), Taccaceae (I have two, but need more) , Commelinaceae and Musaceae.....Marie Neal isn't too good at sending samples at present, but Eddie Bryan would help, he says. He might peek out a few scarps and send them along with you. All he has sent so far has been most useful. Annetta Carter(Berkeley) has also sent pollen of 13 spp. Unfortunately most of her Rapa material--which seems to be extensive-- has no pollen.

Can you get any samples of flowers of Balanophora ? This may be important. Any Balanophora--the more the better.. I have B. fungosa, but must check that as I believe Croizat lists a different species for Rapa.

The Rubiaceae may be important: I think that family should be treated



Mrs.

WATSON SMITH
5045 EAST GRANT ROAD
TUCSON, ARIZONA

Sunday

Dear Ray:

Al Mead rang a short time ago to say that you would cor
at Easter time. He wasn't too sure whether you would arrive on A
He said he would write you and arrange to meet you at the airpor
told him to bring you here.You can have the guest-room, if you don't mind
one in a Museum.It has all be cleaned up for friends due today,and others due
from Malaya at the end of April. I cannot offer much except talk, but I think
that is what you have come for. We can see that you get in to see Al or Paul
Martin and so make good use of your time.

You have not heard from me because I have been sick and am in the frustrated
frame of mind that makes me wish to underline everything.I am wholly better this
week; but have had recurrent influenza all of Jan.and Feb. Never had anything
like it: next Feb. I think we'll go away to a more equable climate and dodge
this odd spring climate here. We had snow on the mts. today, after 84° temperatures
two days ago: that is typical. I think I got run down before Xmas, and tried to
do too much with the microscope at night.

I got a friend to make prints of the Hawaiian negatives, but they are
only so-so.I enclose some. I could still send you the negatives, of course. Un-
fortunately my helper lost my treasured negative of Selling stick in a mucky
path on Kauai: that has been bad luck.

Congress: I sent in the proposed annangement, changing the title to:--
POLLEN CLUES TO ANCIENT PACIFIC FLORAS. That has seemed to suit everyone better.I
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that, but plan to stick to them myself. Dr. A.C.Smith says he has sent off the title
to Honolulu, so you may know all this...Jane Gray is to do Pacific NW coast; a Jap

I have a sketch of N.Z.
and Hawaiian bog forests
(Oreobolus and Donatia)if
you wished to use it...
It was prepared for Ver-
doorn when he planned to
bring out a book on Past
Deforestation of the World.It never
never been printed. I.

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Sunday

Dear Ray:

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something about genera that survive in Japan(it turned out he could not tackle fossil material), Muller will contribute a paper--to be read by Jane Gray--on pollen evidence to do with the history of the mangrove formation -- and then Balme of W.Australia(if he can come) will give a survey of pollen and spore work for older deposits of Australia. I end up with "THE CRETACEOUS ROLE OF NOTHOFAGUS".

It will thus be a sort of progress report on pollen work in the Pacific.

To my chagrin Dr. Smith wrote last week to say that he thought I wanted a four hour session. I have been told, I understood, to arrange one of 2 hours with 3-4 speakers. He left the matter open, so I wrote back at once accepting the longer time and explaining that it would help greatly in developing the arguments. Chaney will now have more time to introducem to lead comments after papers or at the end , and I have suggested that he give his introductory comments a title* something like a"Macropalaeontologist looks at Fossil Pollen" . He can be as critical or as appreciate as he likes and thus inform the audience about what is going on in general in palaentonology.He has been most co-operative so far,and all will be well, if he turns up. I have heard that he can change plans without much warning.

He wants to add in a Dr. Tokunaga from Japan. He has offered to read his paper--on Eocene pollen from Japan, so I have now accepted. He says neither Tokunaga nor Ueno(the other man, whom he recommended first and whom,unfortunately, we invited) should try to deliver papers(in English).

Thus there is some chance to compare the northern and southern deposits and microfossils over a considerable period....The mangroves will be of general interest as a lot of attention is now being paid to them in Europe, in this country,and by Croizat. The southern hemisphere is a little short just now, and I am worried as Balme has not written since term began at the beginning of March. He had had no word then about getting any financial aid. Without aid from the N.S.F. he is in a bad position in seeking aid from his University or his Govt...He went to India two years ago and is afraid the Univ. won't help now,as they are so short of funds. He suggests very aimably that I could read his paper if he failed to turn up, but it is rather beyond me. He is a to-notcher, and most highly spoken of by Dr. Edna Plumstead, who is just about to come out with a strking contribution on the older fossil deposits from which the Fuchs-Hillary Exped. collected....You

should watch for her papers on Glossopteris too: they are used by Melville in his theories about the devt. of the angiosperm flower(Nature, Oct.1, 1961: long article).(Or was it Feb.1: I cannot remember). She agrees with me about Antarctica but has far more evidence than I have had for somewhat revolutionary views.I have offered her some of my new evidence, and have told her I intend to send a note in to Nature about it as soon as possible.

With two hours extra in hand,we may be in difficulties, if Balme does not come, so I have reinvited Dr.Isabel Cookson by cable,and have also asked Vishn-Mittre(Birbal Sahni Institute) by cable.I am waiting for their replies now. Cookson might come, as she indicated too late that she would have accepted my first invitation if there had been any suggestion that help would be available. Vishnu-Mittre might be able to come, as he has been asking questions about it for some time.Florin backs him very strongly, so I have asked him to do a short paper on trisaccate grains: this brings in the Pacific area, Antarctica,and Kerguelen; and then the Gondwana areas/ He has plenty to say as he has been telling me his views in recent letters/

If neither can come I am afraid I could not have more papers read,as that would throw too much on Chaney, Jane Gray and myself.

This is a suggestion--not just an alternative: Would you be willing to collaborate with Stella Leopold and myself in giving a piece on Rapa? I did not invite Stella originally as I did not know of her work on the western borings, nor that she had that Rapa sample. I think I shall telephone her and get an opinion from her. I'd then ask her to deliver the paper, if she could come to the Congress.She may, of course, be going to the INQUA one in Poland.....If she cannot do it, perhaps you and I could do it, and you could deliver it. The pollen side would be slight, comparatively,and you could handle it if I got slides ready. By then you will have the note in Nature to refer to. (I am sure they will accept it,as they like controversial things). PLEASE SEND ME A CABLE OR AIRMAIL LETTER AS SOON AS POSSEBLE, AS SMITH GIVES ME ONLY UNTIL MARCH ~~31ST~~ 31st. to inform him about full list of speakers , titles, times, summaries, etc. I think this would be a

chance to stake out our claims on Rapa.

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The total of species for Rapa is still not high, so don't let me raise your hopes too much. This is odd, somehow, as some delicate grains are marvellously well-preserved. Bailey did not agree that my tracheids were from an Araucarian: I have lost faith in identifiying this family from wood elements, anyway: most of the literature is conflicting....

The conifer pollen remains, but is now more difficult to handle. You will see what I have done about it in the Nature article: I did not attempt to hang the whole story on it, as I had Hoped to do . The title now is(if approved by Nature):- "RAPA NEGLECTA: A Thimbleful of Continentality". The previous one was " A Rapa Conifer?: Contaminant, endemic, or Gift of the West Wind Drift?" We may still use that title/Tell me at once if you ~~xxxxxxxxx~~ prefer the second title.

My guests are overdue, so this letter has grown longer.

Best wishes,

Lucy

P.S. If you send a cable you can use our Tucson Tel. number: East 6.9607.That helps get it to use quickly. Address it to me as MRS. WATSON SMITH.

Les

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Best wishes,

Harry

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JALUIT

1 0 1 2 3 4

Statute Miles

Bogenaga I
Shabunaren I (88)
Namotaru I
Kaishin I
Aenamin I
Ryam I (55)
Lyeron I
Rua I (39)
Harappu I
Dagaya I (78)
West Pt
Ringlap I
Bikeryman I (85)
Arubae I (82)
Namolairu I (69)
A. I
Elizabeth I (92)
Merge I
Oan I
Ennelder I
Bogenadick I
Ren I
Namoren I
Urbelt I
Gusen I
Naimadj I
Naruahi I
Pokeshia I
Rabjeru I
Chaibaru I
Piegn I
Megar I
Bogorabwapu I
Medjadu I (86)
Ambere I (78)
Agridyan I
Reve I
Emidj I
Point
Aineman I
Emidor I (82)
Southwest Pass
Jaluit I
Sydney Harbor
Panoramya I
Southwest Pass
Rara I
Santa Pe
U.S.C.& G. Survey

FRANK ABNER HECHT
8263 DIAMOND HEAD ROAD
HONOLULU 15, HAWAII

74 2 imp

monographically (for pollen types)...

The total of species for Hapa is still not high, so don't let me raise your hopes too much. This is ...

374

8th NATIONAL WATERSHED CONGRESS

RAMADA INN

TUCSON, ARIZONA

APRIL 17, 18, AND 19, 1961

THEME: COUNT DOWN ON WATER

PROGRAM

CONDITIONS UPON WHICH THIS COLLECTING PERMIT IS ISSUED

It is the intention of the National Park Service to further scientific research within the areas administered by it, and to cooperate with technical workers to the fullest extent compatible with its charge to preserve all species of flora and fauna and all geologic material in a natural state insofar as is possible.

THEME: COUNT-DOWN ON WATER

PROGRAM

SUNDAY, APRIL 16

3:00 p.m. Registration
Lobby, Ramada Inn

8:00 p.m. Special Motion Picture Program
Ramada Room

MONDAY, APRIL 17

8:00 a.m. Registration
Lobby, Ramada Inn

SESSION 1
Ramada Room

Theme: Planning for Water Use

9:50 a.m. Formal Opening
C. R. Gutermuth, Chairman, Steering Committee, National Watershed Congress

10:00 a.m. Water Needs of the Nation 1980-2000
Hon. Robert S. Kerr
United States Senator from Oklahoma

10:30 a.m. Discussion

10:40 a.m. Soil and Water Conservation Needs Inventory
Donald A. Williams, Administrator, U. S. Soil Conservation Service, Washington, D.C.

11:10 a.m. Discussion

11:20 a.m. Legal Barriers in Water Use Planning
Frank J. Trelease, Dean, College of Law, University of Wyoming, Laramie

11:50 a.m. Discussion

12:00 noon Recess

12:15 p.m. Luncheon, ***Plantation Room***
James B. Craig, Presiding

Address of Welcome
Arthur N. Pack, President, Charles Lathrop Pack, Forestry Foundation, Tucson

Development of "Water Street U.S.A."
William H. Carr, Founder and Director Emeritus, Arizona-Sonora Desert Museum, Tucson

SESSION 2

2:00 p.m. Buses leave Ramada Inn for meeting on "Water Street U.S.A."

5:30 p.m. Buses leave for "Old Tucson"

6:00 p.m. Reception, chuck wagon dinner, and entertainment at "Old Tucson"

TUESDAY, APRIL 18

8:00 a.m. Registration
Lobby, Ramada Inn

SESSION 3
Ramada Room

Theme: Multiple Use of Watersheds

William E. Richards, Presiding

9:00 a.m. Opportunities in Multiple Use of Watersheds
Harold G. Wilm, Commissioner, New York State Conservation Department, Albany

9:30 a.m. Discussion

9:50 a.m. Water for Agriculture, Industry and Recreation
Hon. Frank J. Welch, Assistant Secretary of Agriculture, Washington, D. C.

10:20 a.m. Discussion

10:40 a.m. Motivating Multiple Use of Watersheds
Marvin Melton, President, Arkansas State Chamber of Commerce, Little Rock

11:10 a.m. Discussion

11:30 a.m. Recess

11:45 a.m. Luncheon, ***Plantation Room***
John H. Jones, Presiding

Life Zones in Evidence on Spectacular Mt. Lemmon
Norman P. Weeden, Supervisor, Coronado National Forest, Tucson

1:30 p.m. Buses leave Ramada Inn for Mt. Lemmon tour

5:00 p.m. Buses return to Ramada Inn

7:00 p.m. Reception, ***Plantation Room***

7:30 p.m. Annual Dinner, ***Ramada Room***

Toastmaster:
C. R. Gutermuth, Chairman, Steering Committee, and Vice-President, Wildlife Management Institute, Washington, D. C.

Presentation of Awards:
Watershed of the Year
Watershed Man of the Year

Principal Speaker:
"How Small Watershed Programs Help Communities Grow"
L. L. Males, President, Security State Bank, Cheyenne, Oklahoma

"Desert Ark" live animal demonstration by Hal Gras, Tucson. Music will conclude the program

WEDNESDAY, APRIL 19

SESSION 4
Ramada Room

Theme: Water for a Thirsty Land

John I. Taylor, Presiding

9:00 a.m. Arizona Water Management Programs
Andrew L. McComb, Head, Department of Watershed Management, University of Arizona, Tucson

9:30 a.m. Discussion

9:45 a.m. Water Yields from National Forests
Richard E. McArdle, Chief, U. S. Forest Service, Washington, D. C.

10:15 a.m. Discussion

10:30 a.m. Watershed Management on Public Lands
Karl S. Landstrom, Director, Bureau of Land Management, Washington, D. C.

11:00 a.m. Discussion

11:15 a.m. Watershed Management to Serve Reclamation Needs
LaSelle E. Coles, President, National Reclamation Association, Prineville, Oregon

11:45 a.m. Discussion

12:00 noon Recess

12:30 p.m. Luncheon, ***Planation Room***
William E. Richards, Presiding

Future Water Needs for Recreation
Francis W. Sargent, Executive Director, Outdoor Recreation Resources Review Commission, Washington, D. C.

3:30 p.m. Special meeting for representatives of participating organizations, ***Ramada Room***

THURSDAY, APRIL 20

Post-Congress tour of the Agricultural Research Service's Walnut Gulch Watershed. The 65-square-mile experimental project is located near Tombstone. This guided tour will take the greater part of the day. A luncheon stop will be made in Tombstone.

8:00 a.m. Buses leave Ramada Inn

HOTELS & RATES

RAMADA INN
Single: $8.00-10.00
Double: $9.00-12.00
Twin Beds: $9.00-12.00

TUCSON DESERT INN
Single: $8.00-10.00
Double: $9.00-12.00
Twin Beds: $9.00-12.00

SANDS MOTOR HOTEL
Single: $8.00-10.00
Double: $9.00-12.00
Twin Beds: $9.00-12.00

HOLIDAY INN
Single: $8.00
Double: $9.00
Twin Beds: $11.00

TO: WATERSHED CONGRESS HOUSING BUREAU
c/o Tucson Convention Bureau
P. O. Box 991
Tucson, Arizona

1st Choice Hotel .....
2nd Choice Hotel .....

I plan to attend the Eighth National Watershed Congress on April 17-19, 1961.

Name ..... Title .....

Organization ..... Address .....

Please reserve me a single room ☐, Double ☐, Twin beds ☐ for arrival on .....
and departure on ..... (Reservations will not be held after 6:00 p.m.)

Send confirmation to ..... persons (at $5 each) named below:

Enclosed is $ ..... for **ADVANCE REGISTRATION** for *Eighth National Watershed Congress*

(Make checks payable to the Eighth National Watershed Congress)

C. R. GUTERMUTH
Chairman
Vice-President, Wildlife Management Institute
Washington, D. C.

JAMES B. CRAIG
Editor
American Forests
The American Forestry Association
Washington, D. C.

JOHN H. JONES
Secretary-Treasurer
American Watershed Council
Fairmont, West Virginia

WILLIAM E. RICHARDS
President
National Association of Soil Conservation Districts
Holdrege, Nebraska

JOHN I. TAYLOR
Assistant Legislative Director
American Farm Bureau Federation
Washington, D. C.

American Farm Bureau Federation
American Fisheries Society
American Forestry Association
American Nature Association
American Planning and Civic Association
American Pulpwood Association
American Watershed Council
Chamber of Commerce of the United States
Intern'l Ass'n of Game, Fish and Conservation Comm'rs
Izaak Walton League of America
National Association of County Officials
National Association of Manufacturers
National Ass'n of Soil Conservation Districts
National Audubon Society
National Farmers Union
National Grange
National Parks Association
National Reclamation Association
National Wildlife Federation
Nature Conservancy
Outdoor Writers Association of America
Society of American Foresters
Soil Conservation Society of America
Sport Fishing Institute
Wilderness Society
Wildlife Management Institute
Wildlife Society

Dr. Andrew L. McComb, Chairman, University of Arizona
Joseph Arnold, Arizona State Land Office
Robert V. Boyle, U. S. Soil Conservation Service
William Carr, Pack Forestry Foundation
Mrs. Hoyd Deckard, Arizona Federation of Women's Clubs
Hon. Lewis H. Douglas, Valley National Bank, Tucson
Mrs. H. Earle, Arizona Federation of Garden Clubs
C. Edgar Goyette, Pioneer Hotel, Tucson
Hal Gras, Arizona-Sonora Desert Museum
Dr. Reuben G. Gustavson, University of Arizona
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Robert J. Smith, Arizona Game and Fish Commission
Dr. Lyle K. Sowls, University of Arizona
Jack Weadock, Arizona Daily Star, Tucson
Mrs. Mabel Weadock, Tucson
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William H. Woodin, III, Arizona-Sonora Desert Museum

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Registration	$ 5.00
Luncheon, Monday, April 17	2.50
Session II, Monday, April 17	7.00
Includes all transportation and visit to "Water Street U.S.A." at the Arizona-Sonora Desert Museum; Reception, Chuck Wagon Dinner, Admission, and Entertainment at "Old Tucson"	
Luncheon, Tuesday, April 18	2.50
Mt. Lemmon Bus Tour	2.00
Reception and Annual Dinner	6.00
Luncheon, Wednesday, April 19	2.50
Total when purchased individually	$27.50
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Post-Congress Tour of Walnut Gulch Watershed, Thursday, April 20	$ 3.00

Eighth National Watershed Congress
709 Wire Building • Washington 5, D. C.

8th NATIONAL WATERSHED CONGRESS

RAMADA INN

TUCSON, ARIZONA

APRIL 17, 18, AND 19, 1961

THEME: COUNT DOWN ON WATER

PROGRAM

374 & King

CONDITIONS UPON WHICH THIS COLLECTING PERMIT IS ISSUED

It is the intention of the National Park Service to further scientific research within the areas administered by it, and to cooperate with technical workers to the fullest extent compatible with its charge to preserve all species of flora and fauna and all geologic material in a natural state, insofar as is possible.

1. This permit applies only to animal life, plants, rocks and minerals. Archeological and paleontological materials may not be collected under this permit.

2. The collections shall be used for scientific or educational purposes only, shall be dedicated to public benefit, and shall not be used for commercial profit.

3. All collecting must be done away from roads, trails, and developed areas, unless such localities are specified in the permit. The collecting shall be conducted in such a manner as not to attract attention or to cause damage to the environment. Because of the scarcity or importance of some specimens, Service officials may designate the kind, number and sizes of specimens which may be collected, and any other restrictions necessary to the preservation of the area.

4. The National Park Service reserves the right, in the interest of science, to designate the depository of all specimens removed from a national park or monument and to approve or restrict transfers of specimens between depositories. The National Park Service also reserves the right to designate the U. S. National Museum as the depository of any type specimen removed from a national park or monument, after the collector has made necessary studies and published the results of his research thereon.

5. The Superintendent may require the permittee to furnish an inventory and locality description of any or all specimens proposed to be collected before they are removed and, after the collection is assembled, to submit it for examination.

6. Use or Disposition of Preserved Specimens: The collected specimens shall be deposited in a permanent public museum or in the exhibit, study or type collections of scientific or educational institutions. They must be suitably recorded in a permanent file and must be available to the public.

19568

Eighth National Watershed Congress
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P.S. If you send a cable you can use our Tucson Tel. number: East 6.9607. That helps get it to use quickly. Address it to me as MRS. WATSON SMITH.

Mrs. Watson Smith, Project Supervisor, National Research Council, Washington 25, D. C. U.S.A.

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United States Department of the Interior
National Park Service

COLLECTING PERMIT

CLASS B

In Accordance with the Conditions and Restrictions Appearing on the Back Permission is Granted

Name of Collector	Area	Date Issued
F. Raymond Fosbert	Hawaii National Park	March 27, 1961

To Collect the Following Specimens
Plants, including one flower only from Hibiscalphus

Locality of Collecting Limited to	Expiration Date
Hawaii National Park	April 10, 1961

Special Conditions or Restrictions
Do not collect along trailside or roadside

Approved (Signature)	Title
Fred S. Johnston	Superintendent

* Two classes of collecting may be conducted under this permit:

Class A - That required for public exhibits and for research undertaken by persons who can establish their connection with public museums or other scientific or educational institutions. Specimens collected may be insects (Hexapoda), spiders (Araneida), plants, rocks, or minerals, as designated in the permit.

Class B - That undertaken by Federal employees only for scientific or educational purposes. Specimens collected may be plants, rocks, minerals or animal life as designated in the permit.

The collecting of endangered or vanishing species of animals, if permitted at all, will be allowed only where the required approval has been obtained from the Director of the National Park Service

THIS PERMIT MUST BE CARRIED AT ALL TIMES WHILE COLLECTING. SEE REVERSE FOR CONDITIONS AND RESTRICTIONS.

F. R. Fosbert
Books # 59
Specimens with 41374
(Nos. 41[illegible]-5799 and
six books 58 starting
No. 5821)

Standard
Miniature Blank
Book

Standard B&P Blank Books

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Smithsonian Project
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United States Department of the Interior
National Park Service

COLLECTING PERMIT

CLASS 8

In Accordance with the Conditions and Restrictions Appearing on the Back Permission is Granted

Name of Collector	Area	Date Issued
P. [illegible]	Hawaii National Park	March 27, 1961
To Co[illegible]		
P[illegible]		Expiration Date
Loca[illegible]		April 10, 1961
S[illegible]		
Spec[illegible]		
D[illegible]		
Appr[illegible]	Superintendent	
[illegible]		
* Two[illegible]		

undertaken by persons who can establish their
r educational institutions. Specimens collected
nts, rocks, or minerals, as designated in the

ientific or educational purposes. Specimens
life as designated in the permit.

if permitted at all, will be allowed only where
he National Park Service

SEE REVERSE FOR CONDITIONS AND RESTRICTIONS.

THIS [illegible]

7. A. Fosberg
Burtz # 59
Lexington, Kentucky 41374
(Nov. 41 600 - 599 and
in book 58 starting
no. 500)

Oneida Vegetation Project
c/o National Research Council
Washington 25, DC USA.

F. A. Forsberg
Book # 59
begins with 41374
(Nos. 41500-599 are
in book 58 starting
p. 52)

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Pacific Vegetation Project
c/o National Research Council
Washington 25, DC. USA.

1960 Johnston Island 1

Oct 17 Visited at night - Terminal.
Thespesia populnea - planted in front of Terminal, D 3 m. Calf.
Terminalia catappa - planted in Terminal area, 2 m
Cocos nucifera - planted
Tree(s) less than 1 m.
Chloris inflata - abundant
Cynodon dactylon - abundant
Pluchea indica - one seen.
Pluchea odorata - " "
Canavalia sclerocalyx - common
Clerodendrum inerme - occasional
Cyperus rotundus

Kwajalein
ask to see Entomology
Lt. Col. Mr. Clegg - Preventive Medicine
Unit 6, Pearl Harbor.
Rhinocerus Control Program in P.I.
Two Cpl, second term, by ad
after entering

Mr. Newsom, Hospital Administrator says there are very few black widow spiders here now.

District Public Works Office
Fourteenth Naval District
memo to Commanding Officer,
Pacific Missile Range Facility, Kwajalein
no. 3755 dated 26 May 1960
signed R. M. Mortensen

? ??: subterranean termites
1 dry wood termite

Heterotermes marshi

Cryptotermes megacephala
Blatella germanica (L.)
Periplaneta americana (L.)
Rhodolia cardinalis

Pg. 1 termite
scale
beetle, 3 orchid pests
rats mice

1960 Johnston I. — Kwajalein Atoll

Oct. 17 - Johnston Island

41374 Cyperus rotundus L.
locally forming patches around Terminal area.

Oct. 19 - Kwajalein Islet

on ~~soil~~ filled coral soil

1 75 Psilotum nudum (L.) occasional between cobbles bordering walks around chapel

5 76 Nephrolepis cyrtomioides (+ Nom abundant, forming lawn in places near Terminal

2 77 Eleocharis geniculata R. & S. abundant very locally in marshy ~~area~~ spots

4 78 Pluchea indica × odorata very common locally with both parents in open flats and roadsides.

Oct. 21 - Kabbenbock Islet, Jaluit Atoll

3 79 Hibiscus tiliaceus L.
very local, probably planted on coral sand and small gravel

1 {80 fungus
{81 fungus
on dead coconut log

1 82 ~~alga~~
abundant on slopes of strongly brackish pond

41378a Cyperus distans L. in meadow

prostrate, flowers very pale pink

rather low, compared with both parents, stems tending to branch corymbosely; flowers mauve.

small twisted tree, 5 m. tall; leaves rather chlorotic; flowers bright yellow with maroon centre

1960 Kwajalein – Marshall Is.

Oct. 19 – Kwajalein Islet
General appearance more luxuriant than I have seen it previously. Coconut trees standing around old admin. bldg. site.

Planted or Cult. plants (a.w. = odd wild)
Hymenocallis littoralis
Thespesia populnea
Pseudanthemum carruthersii
var. atropurpureum
Codiaeum variegata
Hibiscus rosa-sinensis (a hybrid)
Ficus sp.
Pandanus tectorius
Cocos nucifera
Casuarina equisetifolia
Crinum asiaticum
Catharanthus roseus
(a.w.) Ipomoea pes-caprae var. brasiliensis
(a.w.) Tournefortia argentea
Terminalia catappa
Ochrosia oppositifolia
Pedilanthus tithymaloides
Vitex trifolia
Cordiaeum variegatum
Clerodendrum inerme

Native plants not planted:
Vigna marina
Scaevola sericea
Fimbristylis cymosa
Triumfetta procumbens
Weddelia biflora
Cassytha filiformis

Weeds (* common at Laura Islet)

* Desmodium canum
\+ Tragia hederacea
\+ Phyllanthus amarus
\+ Euphorbia prostrata
\+ Euphorbia thymifolia
\+ Fimbristylis
\+ Eragrostis tenella
\+ Cyperus polystachyos
var. distichum
* Cyperus esculentus
\+ Cyperus compressus
\+ Fimbristylis cymosa
Cenchrus echinatus
* Eclipta alba
\+ Stachytarpheta jamaicensis
\+ Kyllinga odorata
\+ Boerhavia diffusa
Dactyloctenium aegyptium
\+ / Chrysopogon aciculatus
* Heliotropium anomalum
var. depressum
Portulaca oleracea
Cynodon dactylon
* Eupheorbia Pluchea indica
\+ / Physalis angulata
Conyza canadensis
* Bidens pilosa
\+ / Pluchea odorata
* Centella asiatica
Euphorbia cyathophora

1960 Marshall Is.

On a trip in van in flames (35c pm) 2 cultivars (probably wholesale from chem sple), a number of golden fulvous, and a considerable perch of Tournefortia. Golden flowers common generally.

Old nursery in former terminal - now being used otherwise only a Euphorbia pulcherrima bush, a clump of tiny alocasia, and a vine of Epipremnum pinnata (?) climbing on a coconut tree left of nursery stock.

Physalis angulata abundant.

A patch of Ipomoea batatas cultivated in old native area.

Generally, the weeds that were previously found only in the old terminal area have spread throughout the island e.g. Bidens radiata, Cyperus compressus, Paspalum conjugatum, Heliotropium anchusoides, etc. Some, such as Conyza canadensis, Pluchea indica, P. odorata, Hedyotis corymbosa, + Chrysopogon aciculatus have remained localized though most of these are very abundant locally. The hybrid between Pluchea indica and P. odorata has

become very common between the old and new terminals. Some variation evident, but not much.

Few of the ornamentals from the old nursery seem to have persisted in the planting around the island. Hymenocallis is abundant. Vitex and Pedilanthus somewhat so.

Oct. 20 flight Kwajalein – Majuro.

Passed Namu in night. Most atolls are on the east side.

Passed Jaluit – a very fine passable, too far away to see clearly, sailing lagoon also.

Reef north from Majuro has a ridge exposed at low tide about ½ back from seaward side. Small coral patch is rock scattered seaward in lagoon. ~~Reef on south, rocky~~ Mere numerous, eastward, esp. on south side. Coral patch with sand flats at low tide, about ½ way east on north side where north reef & reef in North reef is with many islets and coral patches of exposed rock at low tide. Island on south side almost continuous.

Majuro - Jaluit flight
Reef flat very narrow along southeast coast of Majuro. No very appreciable algal ridge. Along south coast the reef flat is rather narrow. There seem to be an elongate pond occupying the place of the inlets in the intervals between islets on the south reef.

Circled Jaluit, clockwise from n of Majuro
~~from n of Majuro~~ inside.
Bars along lagoon reef flat

close to lagoon very common, scattered patches but no bare or water reef flats. Large channels all around, but very little development of algal ridge.
Very striking bifurcating channels with fingers. Photos beginning slightly after - we first crossed reef - mostly coarse east side from Majuro to Jaluit, but a few on south side, first and (given) last time of submerged coral heads in ~~a~~ a great band of north and near Majuro.

Marshall Is.

Oct. 10 - Jaluit, south of old radio station.

Almost entire denuded area has become covered by a mat of Wedelia, Vigna, and Ipomoea, extending almost to the low cobble ridge which is the ridge that runs on the reef flat. The Ipomoea has sent a thin runner outward, strandy rooting in long out toward the cobble ridge. The denuded reef flat just back of the ridge is only very thinly covered, in places a bit bare.

Low scattered Tournefortia and Scaevola locally on this area. This mat extends to the height 2 m. beyond the old radio tower. Beyond this there is little herbaceous growth, except a few small patches of Portulaca and Canavalia. There are scattered small Tournefortia and Scaevola, and abundant clumps of sprouts from the old Pemphis stumps, there and a few small Lepturus patches ~~on~~ roots covered by sea water at high tide. Many Pandanus seedlings.

Between the Japanese weather tower and Sydneytown there is not a single standing coconut tree & stump, dead or alive and only two or three dead Pandanus snags, no living ones.

Rough platform remnants about midway between Jaluit and Sydneytown are not very much indurated. ~~To~~ Sample 11 from about 1 m. above high high tide level. This layer is being undercut in various places, especially on lagoon side, where loose layer ~~is~~ between two indurated ones is exposed.

Very little loose material on the crest of land strip here, for some hundreds of yards. The ~~reef~~ ridge that runs on the reef has vanished at least from sight at ~~the~~ high tide, and it is not obvious where the material have gone. The vegetation is of sparsely and irregularly distributed Tournefortia bushes to m. tall, a few small Scaevola and a

1940 Marshall Is.

few dense clumps of Pemphis sprouts along lagoon edge
A few seedlings —
Scaevola Tournefortia,
Sporobolus virginicus (?)
Two wandering tattlers on lagoon reef.

Oct. 21 Jabwor —
Some rudely fluted stone on lagoon beach.
Polypodium scolopendria
Euphorbia hirta common
on Wedelia mat on
loose boulder deposit
along lagoon near
old radio station.
Terminalia catappa
trees here are growing
vigorously, better
than a mile of beach
appearance, with
some dead branches, not
showing any effects
of typhoon.
A few Pandanus
trees alive and normal,
a few rather broken, but
still alive. Some old snags.
Clumps of Casuarina seen
in very good shape.
Coconuts (Cocos) planted generally
in pits. Mostly very
healthy, some are yellowish.

Jaluit

Oct. 21 — Kabbenbah ?
south part of reef is
of very coarse broken
coral, with locally some
bars of finer gravelly but
sharp light colored material
piled on top.
Islet said to have been
two islets, joined by an early
typhoon.
Inner end of islet
surrounded by coarse
beach rock, some fine
broad beach ridge of coral
gravel.
Trees seen:
Pemphis
Calophyllum
Tournefortia
Pandanus
Scaevola
Cordia
Barringtonia asiatica (seedlings)
Morinda citrifolia
Guettarda
Hernandia
Terminalia
Hibiscus tiliaceus
Crinum
Fimbristylis
Hedyotis biflora
Wedelia
Ipomoea tuba
Polypodium scolopendria
Asplenium nidus
Canavalia microcarpa
Vigna marina
Lepturus
Euphorbia hirta
Taeca

1910 reversals Dr.

1 mull. wiped earlier
2 fairy terns
3 common noddies
4 tattlers
5 reef herons, one speckled, one white with

On seaward side is a small embayment that has been dammed off probably by the typhoon by a ridge of coral enclosing a pond. water not quite salty as sea water, abundant green algae, some blue green.

Cordia. Typed out reversals and [illegible] Healthy upright seedling of Terminalia.

Front reef facing passage was a broad relatively smooth fine grained planation surface, perhaps 100 m. wide, sloping off rapidly, seaward, with active coral growth for 5-6 m. down. Then debris to flat sandy [illegible] (see key to photos). Landward a very flat erosion ramp up to 100 m. wide (in embayment) much narrower elsewhere fairly rough, [illegible] at edge (see photos). a few and in layers.

wall boards
[illegible]
[illegible]

remnants of back-reef to south.

Platform here at about high tide level

Scattered medium size boulders of reef rock and sands. up to 0.5 m. diam. irregular.

Some fair sized areas of old surface that seems to be an old growth surface of ~~sta~~ Acropora.

Scattered boulders of vesicular lava from ballast of wrecked ship

On inner shore there are extensive low-tide level flats with a rather narrow platform, perhaps 8-10 m. wide, protruding from ~~reef~~ islet, with narrow erosion ramp, peeling off in 2 layers. Undercutting + collapse. (see photo.) (rest of platform) seems somewhat resistant beach

Pieces of volcanic rock up to 20-25 cm. long scattered on boulder beach on inner side, apparently carried around from the wreck on the outer ~~reef~~ reef. abundant on outer beach.

Very few coconut trees left on this islet, a few of those lying down [illegible] turned up at tips

1960 Marshall Is.

I spent began about 3 standing coconut trees mostly in vicinity of typhoon shelter mostly around tanks.

Jaluit

1 schooner in seaward side

Hermaphrodite schooner around old masonry foundations, barely holding on.

Many memorable silhouettes very common when viewed covered by sea spray at high Tide.

Bananas planted abundantly and growing luxuriantly around old wells.

Breadfruit - vigorous sprouts from old uprooted tree, small upright tree in very good shape.

Cyperus thyrsiger locally abundant but dwarfed.

O crinum asiaticum, Cathranthus roseus, Mirabilis and yellow-leaved Canna planted in front of houses doing well.

A few patches of sweet potatoes in sheltered spots doing very well.

Jaluit

Oct. 2 – Majuro/f. (Elizabeth)
Aspect in village not strikingly different from typhoon aftermath – trees and cultivated plants generally young
Plants seen:

pl.c Plumeria rubra
pl.c Polyscias scutellaria
c Premna obtusifolia
a Pandanus tectorius
pl.c Nerium (shrunting from stalk)
pl.c Musa sapientum
pl.a Cocos nucifera
a Fimbristylis cymosa
pl.c Artocarpus altilis
c Morinda citrifolia
a Polypodium scolopendria
a Lepturus repens
l a Nephrolepis acutifolia
l a Bruguiera gymnorrhiza
c Canna flaccida
pl.c Cucurbita pepo (round fruit, spotted leaves)
pl.c Xanthosoma sagittifolia (chlorotic)
c Tacca leontopetaloides
lc Clerodendrum inerme
l a Triumfetta procumbens
c Pteris tripartita
l c Canthium ecbinatum
l a Eragrostis amabilis (in graffiti)
pl. Alocasia macrorrhiza (planted)
(two very erect the angle with blade.)
a Vigna marina
pl.r Codiaeum variegatum (Tr. 21-22)

get it to me as MRS. WATSON SMITH.

1960 Marshall Is.

Oct. 21 - Jabwor

413 83 Stachytarpheta urticifolia
3 one plant in open herb feat

84 Herpiragella reptans [Forst. f Arth.
rare around old masonry
ruins.

Oct. 22 - Majuro (Elisabeth) I.

~~near lagoon just below high~~

85 algae
~~near~~ just below high
tide level in tidal pond.

86 [algae]
epiphytic on Pemphis trunks
near high tide level around
tidal pond.

1 87 more
88 more
same

Oct. 22 - Jaluit I.

1 89 [parasite] on rotting coconut trunk

4 90 Luminitzera littorea
locally abundant in
swamps.

6 91 Sonneratia alba
locally common in swamp

2 92 Vittaria incurvata Cav
rare, epiphytic on tree
trunk in moist forest

Jaluit Atoll

branched tree 3 to 8 m. tall,
— flowers deep purple.
prostrate. chloris.

tree 4 m. tall (others taller);
leaves sub-fleshy to leathery;
— flowers scarlet "kimeem"
tree 6 m. tall, spreading
(others erect, to 10-12 m. tall);
petals linear, white,
stamens white "palabl"
= sweet nectar from flowers
eaten by Marshallese

1960 Marshall Is.

Several young coconut trees (nuts from Majuro) the leaves, after the first 2 or 4, not completely opening up - pinnae adhering at margin, separating along midrib. 2 seen in immediate area of village, many fine seedlings noted.

In coconut groves the general ground cover mostly Leptura is complete. Much Z imbricata Patches of Nephrolepis hirsutula, scattered Pteris tripartita + c. umbrosa & Polypodium. patches of Pemphis

Many young breadfruit trees planted, some nurseries about 1-9" tall. Appeared to produce fruit in from 4 to 11 years.

Many small trees of Morinda, Premna scattered in coconut groves mostly appearing to be from old cut stubs, possibly from clearing for coconut planting. Bananas bearing, fruits healthy except occasional slight chlorosis.

Plants seen (ctd)

- st Pseuderanthemum carruthersii
- lc Digitaria pruriens v. macrochaeta
- sa Cassytha filiformis
- sa Wedelia biflora
- so Euphorbia chamissonis
- sa. Tacca pinnatifida
- l Portulaca oleracea
- lo Guettarda speciosa
- lc Scaevola sericea
- r Allophylus timoriensis
- so Cordia subcordata
- r Terminalia samoensis
- r Asplenium nidus
- r Calophyllum inophyllum
- r Procris pedunculata
- l. Pemphis acidula
- l Pisonia grandis
- l Peperomia fenixensis

Patches of pumphis planted, also small patch of Alocasia Some Pandanus planted for food. Volunteer Pandanus used for hats + mats.

On ~~end~~ side of islet near passage to e. Polypodium, Cassytha, Triumfetta, Nephrolepis abundant in ground cover. Some Euphorbia, Wedelia, Digitaria, Tacca, Tournefortia, aspect drier.

~~Wedelia generally not abundant.~~ Tacca in rocky places ~~on the passage side~~

get it to use quickly. Address it to me as MRS. WATSON SMITH.

1960 Marshall Is.

plants in open area back of lake, filled with Wedelia, also an area of young coconut and screw pine, all grown over after (cont. side)

Patch of Pemphis around edge of lake.

Algae not conspicuous in lake as before, but still present.

Seedlings of Pemphis and Bruguiera abundant around margin of lake more in lake borders, though it is almost dry at low tide (photos)

Wedelia is abundant and forms blanket in open areas toward seaward end, & especially near east [illegible]

In semi-open area with coconut trees will bushes 1-1.5 m. tall, Polypodium scandens and Cassytha most abundant. Cassytha thicket in open. Also seedlings Messerschmidia common here.

Cordia trees occasional along beach ridge not inland, no seedlings. Guettarda not common inland from sea or passage

(next to 23)

(planted before typhoon)

photos

Pelagonium (Pelagonium zeilii Dona)

fruit

There are still many coconut trees of young or mixed ages, some rather well rotted, others still fairly tall but in general rather well cleared away after the typhoon.

Back of Pemphis zone back of lake in open area generally covered by Wedelia and coppice-like clumps of seedling Guettarda possibly cut off once but abundantly sprouting about 1.5-2 m tall (photos)

Bottom of lake hard, pan-like, level, marly, but with pits near center with water at low tide (photos)

No mud except very near edges around mangrove and Pemphis patches (sample 12)

On old gnarled Pemphis trunks epiphytic algae, grasses, Nephrolepis acutifolia, young Polypodium. On older Bruguiera epiphytic Nephrolepis acutifolia, large clumps.

1960 March 20.

On n.w corner, even in rather open areas, no Wedelia. Pole & rotten Neph. trees & seedlings. Pandanus from here forward over, sparse as in. Tree Tournefortia Fern, Polypodium, Nephrolepis, seedlings Asplenium, seedlings & shoots of Scaevola seedlings just above reef flat.

In area with several closed cone of coconuts & Terminalia & Calophyllum & Neph. trees about, no Wedelia, large black shrubs seen.

In n. new corner is a patch of thicket with tall coconut trees, Copp. like Pandanus to 4" in. considerable shrubby Abutilon, much Asplenium and Probris, Peperomia, etc growing on deposit of large sharp boulders. Fern luxuriant. Some shrubby Ipomoea, Scaevola. This area is a boulder tract fea-

in. above general level of island.

Just inside this is grass-like coconut grove, Pandanus forming dense ground cover, seedlings & large clumps of Nephrolepis on fallen coconut trunks, surrounded by thickets of Pipturus, Morinda, Pemphis, Pandanus seedlings, small Bruguiera, Lepturus, this filled with rotting coconut trunks, probably left by typhoon. Pandanus trunks pretty well rotted. Coconut trunks mostly still rather firm, but bark coming off.

Southeast corner, rather open, several well formed coconuts, a few young Pandanus, one or two fair sized Terminalia, mostly scattered coconuts. General sense of wind swept Nagare Thus rather Chlorotic (photos). One small patch of Wedelia (dark green)

19 Fernandia seemannii

Plants seen (22)

BC Tatea huegelii

Lc Guaiacum officinale

pl.o Cocos nucifera

pl.o Morinda citrifolia

pl.n Hibiscus tiliaceus

pl.n Calotropis gigantea

pl.n Tacca

n Physalis angulata

pl.n. Zephyranthes rosea

Asclepias curassavica (in lots)

Polyscias fruticosa (in lots)

Coconut planting has been fairly general regardless of whether there were trees not damaged by Typhoon, except for very young ones.

Several turnstones on bottom of pond

2 reef herons, one white, one almost white.

Flocks of white-capped noddies in lagoon

Several white terns inland.

Jaluit.

smaller islets on south reef, mostly have a tangle of scrub with a few coconut trees, none of these very tall. Much of tangle, at least on lagoon side, seem to be Scaevola.

Large islands mostly well covered by coconuts, some leaning at odd angles, but mostly looking quite normal

Considerable sand on lagoon sides.

Bokan - islet nearest Jaluit I. seems to be 2 small islets joined together - rather few coconuts except on west end. Those on east end among thorny irregular thickets of small trees and shrubs

Reef between islets very wide, inner slope rather steep, covered with rubbly debris. Opposite islets more sandy, gently sloping, much live coral in shallower parts.

Wide shallow area opposite Jaluit I.

Oct. 27 - Jaluit). e end.

Plants seen
Pandanus tectorius
Cocos nucifera
Plumeria rubra
Carica papaya
Scaevola repens
Messa sapientum
Cucurbita
Mirabilis jalapa
Hymenocallis littoralis
Crinum asiaticum
Artocarpus altilis
Bophorianthes rosea
Phyllanthus amarus
Gomphrena globosa
Euphorbia hirta
Cassia nodosa
Ficus prolixa
Dioscorea pentaphylla
var. macrodactyla
Canavalia ensiformis
Wedelia biflora
Solanum nigrum
Polypodium nectandrae
acta fa Leonilopetaloides
Nephrolepis hirsutula
Fagraea racemosa
Pemphis acidula
Clerodendrum inerme
Tournefortia argentea
Guettarda speciosa
Fleurya ruderalis
Asplenium nidus
Nephrolepis acutifolia
Vittaria elongata
Pisonia grandis
Gallophyllus timorensis
Lumnitzera littorea known
Tournefortia alba published
Morinda citrifolia
Vigna marina
Cassytha filiformis
Centella asiatica
Blechnum pyramidatum
Cyperus javanicus
Cibotium spectabile
Calophyllum inophyllum
Portulaca oleracea
Terminalia catappa

several golden plover island
(whimbrel in swamp)
white tern in swamp

East of road is a
completely open area with regular
and alternating rows of
Cocos nucifera, ~~[illegible]~~
from seedlings.

West of this is an area
of cultivation where all
the coconut trees have
been cut down - even
apparently those in the
growing ones - in order to let
in more sun for the newly
planted young coconuts. (photo 44)
A few tall Pandanus left
standing. Surrounded
more or less by Pemphis
forest. The Pemphis forest
is really a tidal swamp
irregular, mostly
about 5 m. tall. No
undergrowth at all.
Here characteristic sand, in
adjacent areas [illegible]
In these some old Bruguiera
but most of these
were apparently destroyed
by the typhoons. (photo here)

~~Next~~ East of this a
rather extensive
strip of a Cocos nucifera
sprouts about 2-3 m.
tall. Often there are large
areas that were Bruguiera
swamp, but all cut down

removed by typhoons -
root and all, and now
remaining. Most of
this now covered by young
Bruguiera saplings 1-3 m.
tall. (photo here)

Between this and beach
a sheet of coarse
gravel perhaps 20 m. wide
with a few standing
coconuts or many fallen
ones. Here and there
groves & clumps of
Pemphis and Scaevola
about 1 m. tall or less
planted to coconuts. Some
patches of Cocos nucifera,
Tournefortia
argentea from 6 cm. to
few meters. Wedelia.
(photos - bad. here)

This gravel sheet
merges into edge of
swamp near mouth
margin of reef, about
1-2 m. thick here.

Trees here have fallen
either east or west
or generally ~~this~~ ~~that~~ both
these directions

Considerable acreage of
Bruguiera saplings, a few
old trees left in s.e. corner
of swamp.

Wedelia is abundant toward s.e. corner of islet extends swamp. Aspect here generally swampy, more luxuriant Asplenium lucens, Pteris comanchei, Nephrolepis communis. On south side of swamp Lumnitzera is common and a few of Bruguiera Much of the swamp is bare bottomed. Trees covered by small fruticose algae.

In this area Lumnitzera is locally dominant over ground.

Not much damage by hurricane.

This area of swamp, tidal flats, locally higher ground extends westward through middle of islet. Locally Lumnitzera is abundant, with some Bruguiera, Lumnitzera, Pemphis. Locally Bruguiera & Pemphis more abundant. Pemphis usually on slightly higher ground.

One area between swamp and lagoon almost treeless, grassy.

Back of lagoon ridge in places are marshes, mostly dominated by Cyperus, Fimbristylis and Lepturus not at all abundant on this islet.

Long islet.

Low arcuate gravel bar along lagoon shore, interrupted a few scattered young Scaevola, Tournefortia & Cocos seedlings.

Convolvulus vine here.

Pemphis abundant along lagoon shore — clumps of sprouts.

1960 Marshall Is.

Oct. 23 Enyebor I.

Plants seen

ec Artocarpus altilis
ca Cocos nucifera
c Pandanus tectorius
c Pisonia grandis
a Wedelia biflora
ca Vigna marina
ec Asplenium nidus
ec Physalis angulata
ca Pemphis acidula
r Alocasia macrorrhiza
o Polypodium scolopendria
r Kalanchoe pinnata
ca Leptonia sp.
r Alophylus timoriensis
r Pisonia grandis
o Guettarda speciosa
ca Hibiscus tiliaceus
ec Scaevola sericea
r Calophyllum inophyllum
ec Ficus obtusifolia
c Tournefortia argentea
ec Flemingia rubadis
e Portulaca oleracea
ec Lygodium
e Cyperus javanicus ?
ec Fimbristylis cymosa
e Digitaria pruriens v. muricata
r Caesalpinia bonduc
r Vigna lecontopetaloides
ec Thuarea involuta
r Cenchrus echinatus
r Eleusine indica

Jaluit Atoll

35

Small flock of common noddies on old tree skeleton near wrecked pier, and generally flying around passage end of islet.

Grove of breadfruit trees perhaps 20-25 cm dbh. Broken off part way up by typhoon - almost all had sent out vigorous sprouts from upper part of trunks and formed full crowns - well-formed trees, now flowering.

Ground cover generally Wedelia, locally Vigna. Has been cleared out some time ago.

Some Breadfruit trees nearer sea have not recovered, are completely dead.

Lined skinks abundant

Wedelia seedlings in great abundance especially where there is decomposing trash and on nothing branches.

Pisonia sprouting vigorously from stumps where trees have been cut during clearing. Uncut trees commonly 5-8 m tall. Many of sprouts chlorotic. These heavily infested with red mites. (coll.) Ades abundant (coll.)

In the pass between Longon and Kabbenbock is a Y shaped reef with very long arms the right one perhaps ½ mile on it are a number of very large boulders and much large rubble. A reef patch in the right hand channel about even with the end of the above branch of the Y shaped reef. These all bare at low tide. Acre

A considerable number of large volcanic stones from wrecks or Kabbenbock were around landing, probably brought by people.

Descriptions.

Hibiscus tiliaceus, Ngie around small trees, zizno not. Certain branches very chlorotic mostly normally green

Most of the area of this islet has been almost completely cleared, except a few clumps of Pemphis, Tournefortia, occasional headland trees covered mostly by a blanket of Wedelia.

One area has had the Wedelia chopped away, rolled up and burned recently. Here the gravelly black clay soil is being colonized by millions of seedlings of Wedelia.

Many tiny crater filled with water, green with microscopic algae.

Several white terns flying around, mostly near Hibiscus thickets.

Common noddies by far the most frequent birds.

Many young coconut trees, from recent typhoon, along pass and lagoon sides.

The cleared area has been staked out for planting coconuts but very few have been planted.

On sand flat bordering into lagoon are seedlings of Scaevola, Tournefortia, Tournefetta, Pandanus, Wedelia, Leptaena, Vigna, Sporobolus pyramidalis (chloris)

Plants seen (cont)

R.d. Pseudanthemum carruthers
Hernandia sonora
Tephrosia tomentosa
Sporobolus pyramidalis
Cenchrus echinatus
Cassalpinia ——— bonduc
Musa sapientum
Lumnitzera littorea

1 reef heron and 1 tattler seem to be companions, when no flags or adults, also 1 white. 1 white with black wing tips
1 white heron, 1 blue, 1 gray with white shoulder patch
Several wandering tattlers on seaward reef flat
1 turnstone on lagoon beach

Young coconut trees seem mostly decumbent at base, then erect.

In lagoon where many small Rattus exulans running around in broad daylight scarcely afraid of humans

One row on crest of reef a long mounding stone wall about 0.7 m. high running from place where reef + narrows almost to first cluster of buildings. On seaward side of wall is piled against it + part way up is vegetation.

On lagoon side a narrow reef flat, sloping up a slight accumulation of sand at edge on edge. Vegetation of Lipochaeta small Euphorbia, Sesuvium small Tournefortia bushes, some Scaevola, Cocos seedlings, a few Pandanus seedlings, some Tephrosia, esp on sandy places. Also a few Ipomoea pes-caprae

A few larger coconut trees a few Cocos seedlings.
Thick bare rock
Beyond end of wall we step on bare eroded platform except 1 small Tournefortia + United cluster of buildings.

Pandanus seedlings

lagoon reef flat

at end of sea wall the platform work as eroded, a few scraps of upper surface left this indurated below this merely compacted - form but crumbles easily when hammered. Beach with algae. Top most part of this platform must be 3 m + above l.t.

sample #13 - indurated flat surface

sample #14 - softer material below.

sample #15 - hard material from rough surface of seaward erosion rang cut in coarse platform breccia

Oct 27 Jaluit

Terminalia catappa fairly well leafed out on sprouts all over old trunks and broken branches. a few Pandanus with big tufts of leaves & branches that were not broken. No sprouting from broken branches.

Fairly extensive sweet potato patches that look pretty good along main street north of radio station. Along path

a Euphorbia prostrata
a Phyllanthus amarus
a Vernonia cinerea
a Euphorbia hirta
a Lilaea microphylla
Portulaca oleracea
Cyperus rotundus
Portulaca oleracea
Boerhavia diffusa
Chtalaria incana
Stachytarpheta urticaefolia
Blechum pyramidatum
Cyperus pennatus
Wedelia biflora
Chaetocline cumingiana
Leucaena glauca
Cyperus compressus
Elensine indica
Hedyotis corymbosa

Ornamentals
Cantana canna
Pseuderanthemum carruthersii
and var. atropurpureum
Zephyranthes rosea
Plumeria rubra
Hymenocallis littoralis
Mirabilis jalapa
Zinnia elegans
Catharanthus roseus
Gomphrena globosa
Ricinus communis
Canna hybrid

Ageratum, very rare before.
now common on distal
part of islet. Cyperus
cotundus observed as a
small patch in village,
now scattered around
trails fairly generally.
Catalpina still very common
but by no means as much as
as before - largely overlaid
by Wedelia. Blechum very
abundant, especially where
Wedelia has been cleared off.

Terminalia, Hernandia,
Calophyllum, Artocarpus, Ficus,
have recovered very well, filling
out crowns with sprouts (except
Artocarpus which too damaged,
then it died)

Fr old botanical garden
Pithecommium pinnatum
Cycas circinalis
Ficus elastica
Veronia regia
Erythrina variegata
Scindapsus aureus
Tournefortia argentea
Cassia occidentalis
Hibiscus tiliaceus
Calophyllum inophyllum
Tamarindus indica
Rhoeo spathacea

Distal part of island
almost completely cleared,
covered by a clipped weedy
growth of Blechum, Stachy-
tarpheta, Leucaena, Vigna
etc. about 2-3 dm high. Widely
scattered trees - Carica,
Terminalia, Artocarpus,
Pipturus, Pandanus, Ficus,
Hernandia.

2 whimbrels flew up,
near radio tower,
heard a bristle-thighed
curlew.

Oct. 23 - Engebi Islet

41393 Caesalpinia bonduc (L.) Roxb.
2 single plant on narrowing point of islet in deep tangled Wedelia

9 94 Phyllanthus amarus Schum. & Thonn.
abundant in recently disturbed places

6 95 Hernandia sonora L.
occasional

2 96 Pandanus sp.
common

Oct. 23 - Japtan
on waste spots and along paths

2 97 Dentella repens
abundant along paths

3 98 Hedyotis corymbosus
abundant along paths

2 99 Euphorbia thymifolia L.
very local in patch

4 1000 Cyperus bulbosus
2 very local along trail

2 01 Digitaria pruriens var. microlaena
very local in trail

1 02 Euphorbia prostrata
very common in trail

02a Euphorbia glomerifera (Millsp.) Wheeler
Oct 23 small spreading
Oct 24 long slict bet hydnetorn
and Lelud

1 03 Hibiscus tiliaceus
rare seedlings on bare gravel

1 04 seedling

young plant three
vine-like branches 1-2 m
long; stems.

sprouting fallen tree;
fruiting envelope inflated,
sepals not toothed at all
tall tree; fruit, on
ground.

prostrate, forming a
mat, corolla pale buff flesh,
lobes with white margins
prostrate, forming a mat,
corolla white.
stems and leaves green,
flowers white.
heads white

(P. of Feb) culms spreading

whole plant purple.

erect

Oct 24 - Long Islet Jat. Jaboun and Jalut

In the area where the ridge of boulders on the seaward reef flat (from photo) has disappeared, at low tide it becomes obvious that it has largely just spread out and become a rubble tract.

On lagoon reef flat there is a broad flat strip of gravel separated from the land-strip by 30 to 50 m. in the surface of this blackened rather stable mass is a ridge of smaller material obviously more worked, whiter, forming a sharp-topped low ridge. photos

This is more clear the situation, the length of this strip between Jaboun and Jalut.

Seedlings of Calophyllum deeply rooted, healthy, in bare gravel sheet.

Pemphis forest - bare trees still standing, trunks

sometimes sprouting, clumps of sprout up to 1-1.5 m tall at bases (photos)

Just north of Sydney town an area of low platform awash at high tide quite eroded. As inside this the lagoon bar is missing, outside the gravel ridge on the reef flat is still mostly separated by 15 m. or so of water from the land strip. This ridge is at least 2-2.5 m high in places, quite abrupt on inner side, imbricated slabs on outer side (photos)

This outer ridge is lacking of porites but a sharp ridge is piled up on the outer edge of the land-strip just in by Sydney town.

Several wandering tattlers on outer reef flat.

On lagoon reef flat opposite a cut through the breccia platform is an aromatic inner gravel bar, inside the main ma (photo - bird)

The end of the main outer bar head is just opposite the cut in the breccia platform, and is rounded, embraced seaward around the end. ~~The~~ and the opposite side of the cut is swept very clean, suggesting that the currents of waves come through this channel from a dominantly n.e. direction, exerting their force against the south side of the channel, and arranging the gravel slabs on the lobe of the ridge in imbricate fashion with less energy involved than not carrying this loose material clear into the lagoon.

Channel ~~deep~~ deep across land strip by Jalpaiguri south of Lyalinga town in three layers, successively broader downward (photos - b & w), samples 17, 18, 19 (downward).

To lagoon side of this is a circular sedge bar, surrounding a pool (photos), this ~~immediately~~

lagoonward of which a true reef flat ~~of~~ lagoonward of this. Then a well developed bar on lagoon edge of this. The flat well strewn with large boulders.

Seaward the boulder ridge is separated from the erosion ramp and lies for a ~~plain~~ distance of perhaps 100 m. loops out away from ~~beach~~ shore and is higher than in either direction, where it is spread out and low.

South of here a very low strip, about 100 m. w., scoured off except for remnants of an old breccia platform. Lagoonward is a concentration of debris - a high crooked place in the debris ridge (photos - b & w) a number in several directions. Seaward from this wash another loop of high ridge, again extending a bit south of breach in land strip.

South to here on land strip from Lyalinga town vegetation mostly a low irregular scrub of Tamarix and Acacia. Pamphis on seaward ~~side~~ side of lagoon. Southward same but much lower and thinner. (photos)

Enormous boulders
thrown up on lagoon slope
of lagoon ridge. up to
2 x 2 x 3 m. but irregular.
Many of them, thus the
largest loose are large
Millepora colonies, most
are very complex. A few
of these are erosion remnants
of a former platform.
This lagoon ridge
here is broad and thin
and lies on a planation
surface that is much
like an erosion ramp,
sloping slightly lagoonward
for ample 10 m from top of
seaward edge of this.
(Photo showing an remnant
on left, boulders on it.
Just beyond, a track
in dark strip (of a former erosion ramp)
that the reef flat continues
under the consolidated
debris ridge to lagoon
side. much denser
and harder than the
material lying on it.
(with this dissected partially
consolidated material
there are clad stubs of
Pemphis on lagoon side.
Young plants of Tournefortia
and Scaevola maturing

upon open sand,
with ~~a few~~ ~~one~~ small
mats of Tournefortia
seedlings & Scaevola,
Tournefortia, Pemphis,
Cocos, Vigna, Hibiscus
tiliaceus, Barringtonia
asiatica, Pandanus (in
loose debris)
Two white terns flying.
Boobies,
Pemphis, Scaevola, Tournefortia,
Cocos. Tinospora can
clearly grow where inundated by very high tides.

More vegetation on
higher spots, also larger
Tournefortia and Scaevola
plants, Patches of Triumfetta.

Plants of broad erosion
ramp and rubble tracts
on seaward reef flat,
also of sand & debris mostly
on land strip beyond concrete
building, toward washhouse.

On debris ridge seedlings
of Guettarda, Casuarina?
Barringtonia, Cocos.
Some of Tournefortia
& Scaevola 1-2 m. high.
Ipomoea tuba on it.
Young coconuts.

sharp ridge near lagoon and full of large coloniz. Pemphis, Pemphis Tabernaemontana, Scaevola, Vigna, Hibiscus tiliaceus Tournefortia seedlings. Pandanus fruits thrown up but not seen germinating

Wide place at warehouse with open sand of Tournefortia, Scaevola, Triptrum, a little Clerodendron, patches of Weddelia occasional Pemphis & Allophylus.

Some dense scrubby growth of ragged Pandanus, Pisonia, Guettarda, Tournefortia, Cocoanut.

This area seems to be a large gravel sheet laid down by the typhoon, the residual vegetation not quite buried. Most of the rest representing colonization. Surprising thing is number of bushes of all sizes of Triptrum. Some of the smallest ones seem to be dying up, but mostly not

Here a sheet of very rounded flat gravel extends from the landstrip out onto the lagoon flat with a broad margin.

Much open gravel between bushes, but some large mats of Weddelia, Vigna, Triumfetta, Canavalia and Ipomoea pes-caprae (dune) some small patches of Tournefortia.

Red herons seen - 3 white, 1 blue, 2 white with some grey, 1 whimbrel.

1 reef heron chasing or playing with a tattler.

Beyond warehouse we went by boat. Generally the vegetation is a strip of ~~Scaevola~~ and irregular scrub, mostly Tournefortia, on platform and debris, with sparse Pemphis on denuded flats & erosion ramp.

Standing coconuts very few around warehouses, even fewer down the land strip, then becoming

slightly more abundant
tall low come to a wider
place, where a considerable
number are left standing.
Here at this wide place,
a high gravel ridge, nearly
above, and on beach of the
huge coral blocks scattered.
2 whimbrels here (?)
Here the gravel ridge
has mostly moved
onto the shore, making
a typical boulder ridge,
but to north it is still
a bit separated.

On the flat is an
open to closed scrub of
Tournefortia, some beach
some Guettarda, many
stunted seedling around
incomplete ground cover
of Tournefortia, some
Ipomoea tuba, some
Pandanus seedlings,
some Cocos. Standing coconuts
Part of this that was shore
scoured by typhoon
is pretty well vegetated,
with even some residual
sprouting Guettarda, etc
Part covered by grand
sheet has scattered
bushes of Tournefortia,

Scaevola up to 2 m tall.
Lagoonward flat become
smaller, up to 0.5 m
Pemphis seedlings and
clumps of sprouts on
hard rock near lagoon,
some curved gravel bar
near lagoon shore, being
colonized by Pemphis,
Ceriops, Tournefortia,
Scaevola, Pandanus(s.)
Wedelia(n.s.), the plants
up to 1 - 1.3 m. tall
Pandanus trunks on ground rotten.
Southward a similar
sand with scattered
standing coconut trees continues,
becoming lower and more
sparse in places, the
Pemphis along the lagoon
varying from dense to
absent, always principally
on bare erosion ramps
or platforms rock.
Many bare Pandanus
trunks still standing.
Lagoon bar discontinuous,
high in places
One stretch of it has
many great boulders
strewn on its lagoon slope
Clearly from lagoon bottom.

Oct. 24 Jaluit -
Photos (b & w) of trees along lagoon shore of Jaluit
1 bene, gray & white reef heron on end of Jaluit.

Oct. 24 - Ceylon -
Photos - b & w, Kod. of recovered bread fruit trees on N. W. corner of islet.

Oct. 25 - Crossing lagoon Jaluit to Pinlap - one brown booby flying over lagoon. returning in evening & one booby.

Oct. 25 - Pinlap
Plants seen
la Leptaena repens
c Cassytha filiformis
c Centella asiatica 'manko'
c Triumfetta procumbens
c Fimbria involuta
c Pandanus tectorius
la Digitaria pruriens v. microstachya
a Cocos nucifera
lc Canna pedata
a Vigna marina
la Phyllanthus amarus
o Scaevola echinata
lc Desmanthus virgatus
la Euphorbia hirta
lc Eragrostis amabilis
c Artocarpus altilis
M. Calharanthus roseus
pl Cirsium procerum?
M Musa sapientum
a Wedelia biflora
lc Tacca leontopetaloides
a Pipturus argenteus
la Fimbristylis cymosa
la Euphorbia prostrata
M Cucumis pepo
M Plumeria rubra
M Gomphrena globosa
20 Lygodesmia rostellata
c Morinda citrifolia
lc Portulaca oleracea
M Zephyranthes rosea
lc Pilea microphylla

pl Asclepias curassavica
c Flemingia rudenalis
sc Paspalum conjugatum
a Nephrolepis hirsutula
a Polypodium scolopendria
pl Ocimum sanctum
~~Asclepias curassavica~~
cla Leucaena leucocephala
ca Tournefortia argentea
pl Tagetes
pl a Hibiscus mutabilis
l Clerodendrum inerme
pl Hymenocallis littoralis
pl Crinum asiaticum
pl Polyscias trichochlaena (chlorotic)
lc Alphitonia zizyphoides
lc Calophyllum inophyllum
c la Asplenium nidus
lc Ipomoea batatas
lp Guettarda speciosa
^ Premna obtusifolia samoensis
^ Boerhavia tetrandra
lc Intsia bijuga
^ Vitex ovata elongata
lc Nephrolepis acutifolia
la Elaeocharis geniculata
c Alocasia macrorrhiza
lc Hibiscus tiliaceus
la Thelypteris goggiodes
^ Ophioglossum pendulum
^ Pteris tripartita
pl Codiaeum variegatum
pl Acalypha wilkesiana
pl Pseuderanthemum carruthersii
var. atropurpureum

Pisonia trees that are chlorotic have very few roots.
Jatropha terminalia supposed to have been brought from Tahiti, to which it was introduced by the Japanese.
Monarch butterflies and larvae abundant around milkweed patch in village.
Many part of reef dredged out for planting in December.
Whimbrel on pass reef.
White-capped noddie

Mangrove swamp near north end almost clear. Scattered clumps of very slender Bruguiera to 5 m. tall. Many seedlings. Has been cleared somewhat to plant coconuts. Many volunteer coconut seedlings. Many fallen and standing trunks covered by epiphytic ferns. This cleared swamp is adjacent to an open-water pond, strongly brackish, great masses of blue-green algae of a watery yellow-green color. Apparently rather little tidal fluctuation. A few big Bruguiera around

ground, some saplings
mainly covered seedlings
Elaeocharis in mud
beach from edge. Ground
seedlings somewhat
a very chlorotic.
Much trash in pond.
~~several~~ fish about 20-25 cm.
long, mud over with
black fins yellow tail
caudal shape.
Several white terns.
one or two tattlers.
White capped noddies.
~~and~~ golden plover.
Red cellula, large.
are a ~~few~~ common noddies?
Big greenish tachina Gonyia
Large area of this
swamp, mostly semi-
open. Around this,
especially southward,
is a tall scrub or low
forest of Pipturus argenteus,
slender, 5-6 cm. dbh maximum,
to 4-5 m. tall. Has been cleared
beneath. Varies from
soil of some depth to
boulderfield. Ferns
abundant.
In interior are considerable
open areas with scattered
breadfruit trees, covered by a
blanket of Wedelia.

o Premna obtusifolia
pl Polyscias scutellaria
pls Citrus aurantifolia
l Euphorbia chamissonis
l Triperas paranum
lo Cyperus compressus
o Physalis angulata
lo ~~Ipomoea~~ Ipomoea littoralis
la Cyperus odoratus
pl l Cyclosperma chamissonis
pl Colocasia esculenta
lr Jussiaea suffruticosa
c Canavalia microcarpa

Other areas have grown
up to the low forest type
dominated by Pipturus.
In places this is cleared
out locally. Some are
the average height is
6-8 m.

The breadfruit trees injured
by the typhoon either died or
have recovered remarkably
well, branches as large
as 10 cm diam. have grown
since the storm, crowns
well filled out, symmetric.
Leaves dark green.
Some infestation of cottony

cushion scale. Ctenopsis has been died of a peculiar disease. Knudsen described it in report to Dr Com.)

Taro pit - generally dominated by Rhelyptelis glandulosus, locally by Cyperus odoratus or Ischaemum, locally invaded by Pandanus, Vigna, etc. Fuirenas common. Very little taro cultivation - two rows and scattered plants of Cyrtosperma, scattered small patches of stunted Colocasia.

Another pit Rhelyptelis even more general dominant, almost exclusive over most of the area. Small patches of Eleocharis, Fimbristylis, open water with blue-green algae, Ipomoea invasive by Pandanus. Occasional Fuirenas. No Echinochloa. Only a very small part of the pit occupied by Cyrtosperma, no or very little Colocasia.

Of total area of Taro pits perhaps not more

than 1/10 occupied by either taro, Colocasia or Cyrtosperma.

Cedar common.
Wedelia blankets all openings in thin woods and margins of taro pits.

Paspalum conjugatum is very locally common along trails in semi-shade, nowhere really abundant.

Mangrove swamp between taro pits and village dense all large Bruguiera. Tree dead and broken off part way up. Ascribed to typhoon.

Many well grown seedling coconuts generally. Pandanus trunks mostly rather well rotted. Coconut less so.

Along seaward side a well-developed Scaevola fringe 2-3 m. tall.

Epiphytes common to abundant on older trees in interior.

1960 Marshall Is.

Oct. 25 - Dunlap Islet,

41405 Thelypteris glyciphylla
I dominant in semi-abandoned taro pit.

16 06 Fuirena umbellata
common in semi-abandoned taro pit

3 07 Echinochloa crusgalli (L.) Beauv. var. hispidula
locally dominant in semi-abandoned taro pit

½ 08 Zoysia tenuifolia
locally planted in home yards of coral gravel

2 09 Sphagneticola pseudochina (L.) Pruski
rare, epiphytic in wet forest

erect form rhizome roots slightly in mud.

herb 1 m. tall, branched; petals 4, yellow; caducous

erect.

forming a close dense mat.

sterile

Oct. 26 - Kirayon I.

1 10 Allophylus timoriensis DC.
common in dense scrub on raised beach ridge.

large shrub 4 m. tall, seedlings abundant beneath it.

1 11 Eutaxia pursaetha DC.
one plant on beach ridge.

seedling

Oct. 26 - Ivaluj I.

4 12 Vigna marina (Burm.) Merr.
abundant on new gravel

prostrate, sterile; note unpalatable leaves, these seem to be characteristic of at least rabid-growing shoots in this area.

Oct. 28 - Ribon I.

7 13 Vittaria angustifolia Cav.
rare, epiphytic on tree trunks

Oct 26 - Trip Jabucoa to Limon
Crested tern flying over
lagoon.

Oct 26 - Limon Islet
Plants seen

M Gomphrena globosa
a Polypodium scolopendria
M Plumiera acutifolia
C Carica papaya
Ma Musa sapientum
M Zinnia elegans
M Mirabilis jalapa
a Cocos nucifera
M Jacobinia carnea
o Casonia grandis
Ma Citrus aurantifolia
Ma Hibiscus hybrid (very showy)
Ma Cordyline terminalis
M Cucurbita 2 sp.
a Centella asiatica
Mq Ipomoea batatas
M r Cucumis sativa
bc Barringtonia asiatica
a Physalis angulata
C Morinda citrifolia
M Xanthosoma sagittifolia
lq Tournefortia argentea
C Clerodendron inermis
C Artocarpus altilis
la Digitaria pruriens v. microstachya
c Canavalia lactoreus
la Scleria scrobiculata
c Alocasia macrorhiza

Bananas very luxuriant
around house
Centella is remarkably
abundant on gravel sheets
in full sun.
Young Ipomoea batatas 2-3 in. tall.
Sweet potato patches
very common.

Phosphate bed covered
by an open scrub of
Scleria with some
areas closed, some Clerodendron
much Sesbania and Digitaria
filling interspaces
Tournefortia and Polypodium
prominent on rocks,
here and there Wedelia
mats, a little Nephrolepis
Toward Locality 2 we pass thru
becoming closed 3 m. tall,
and composed of Acacia sp.
Tournefortia, Guettarda,
Barringtonia (from old stubs)
Thuarea and Sesbania in
openings.

Two former mangrove
depressions at north end -
one is completely bare. The
other has many Pemphis
seedlings and a few large
but still small plants.
1 Graptophyllum mottled red, yellow

Plants seen (cld.)

pl Crinum asiaticum
pl Hymenocallis littoralis
pl Polyscias scutellaria
o lc Cerbera schinata
la Leptaus repens
p Angelonia angustifolia
pl Catharanthus roseus
pl Jyphyranthes rosea
la Limnocharis cymosa
a Vigna marina
lc Hedyotis biflora
o Calophyllum inophyllum
la Scaevola sericea
o Eragrostis amabilis
c la Heliotropium ruderale
lc Thuarea involuta
a Wedelia biflora
c la Ipomoea procumbens
lc Nephrolepis biserrata
lc Nephrolepis biserrata
c Guettarda speciosa
r Peperomia pomapanensis
r Euphorbia chamissonis
pl Codiaeum variegatum
c Allophylus timorensis
la Bruguiera gymnorhiza
lc Kalanchoe pinnata
r Caesalpinia
lc Ipomoea littoralis Bl.
lc Lygodium microphyllum
r Vernonia cinerea
pl Rhoeo spathacea
pl Canna hybr.

Broad gravel ridge running parallel to depression is still partly bare but much colonized by fair sized Pemphis, Scaevola, large loose mats of Leptaus, a few Pemphis, Lantana, Scaevola, abundant seedlings of Euphorbia, Limnocharis, Vigna, clumps of Allophylus, some Thuarea, seedlings of Terminalia + Casuarina, Hibiscus.

(to p. 73)

In central pool back from lagoon beach, is an open forest mostly Pemphis 8-10 m. tall, some Scaevola, Intsia, some Allophylus, some Pipturus. Great deal of dead trunk, trunks chopped Pipturus which must have formed a dense scrub 3-5 m. tall. Sprouts from stubs of this, and from other species also esp. Pemphis and Allophylus abundant 1-1.5 m. tall. This is a small gravel. Seedling headplants 1-½ m. tall common.

Oct. 21 - Kenyon I.
Plants seen

s Portulaca oleracea
w Ocimum sanctum
la Phyllanthus amarus
lc Cyperus javanicus
o Alocasia macrorhiza
la Euphorbia hirta
c Cocos nucifera
c Artocarpus altilis
la Leptonus repens
a Cocos nucifera
a Polypodium scolopendria
n Pteris tripartita
la Nephrolepis hirsutula
a Pipturus argenteus
a Vigna marina
pl Xanthosoma sagittifolia
a Wedelia biflora
pl Bougainvillea
c Pandanus tectorius
pl Musa sapientum
lo Cordia subcordata
lc Morinda citrifolia
c Guettarda speciosa
pl Cocos nucifera
la Cassytha filiformis
o Physalis angulata
lc Triumfetta procumbens
a Fimbristylis cymosa
pl Pseudoranthemum carruthersii
var atropurpureum
slc Jacca communis
n Pilea microphylla

Planted area back of house to dominated by Nephrolepis locally Vigna, Polypodium, becoming overgrown by Wedelia. Some shrubs still covered by Fimbristylis and or Leptonus
Farther back toward sea Polypodium and Leptonus and codominant, a little Wedelia. (Photos)

Fairly common woody many w/ water coconuts strip along beach in mixed scrub - Scaevola, Suriana, Guettarda, a little Allophylus tangled in places with Canavalia and Wedelia Cocos nucifera Cordia
This strip varies, up to 40 m. wide. 2 - 4 m. high
Two house sites, one at landing on lagoon shore one opposite on seaward side.

Gravel sheet opposite rounded indentation on seaward side - bordered by algae. Colonized by seedlings of Guettarda, Scaevola, Leptonus

Plants seen/collected

- c Tournefortia argentea
- c Alloplectus tinnaeicus
- c Canavalia microcarpa
- la Thuarea involuta
- lc Calophyllum inophyllum
- r Ochrosia oppositifolia
- c Asplenium nidus
- o Pisonia grandis
- la Ipomoea tuba
- r Pseudelephantopus spicatus?
- l Hibiscus tiliaceus
- l Kalanchoe pinnata
- l Barringtonia asiatica
- r Terminalia samoensis
- r Cleome viscosa

Morinda, Pandanus tinnaeicus, Wedelia.
Morinda very abundant grainer plant. Some Lycopodium.
Ragged but well-recovered calophyllum trees scattered along top of gravel beach here.

Where shore bulges out, south of bay, there has been some clearing out of brush, resulting in a scattered stand of small ragged trees, tangled dead brush, coconut seedlings.
Fruiting seedling on gravel ridge.
South or curve most exposed to sea, is a dense tangled scrub of recent growth of alloplectus, Guettarda, Calophyllum, Scaevola, an Ochrosia sapling a little Tournefortia but dominantly alloplectus. This on beach ridge of gravel. Asplenium nidus common here.
Seedlings of alloplectus abundant. Guettarda less so.

This scrub is apparently left as a wind break on the beach ridge of medium poorly sorted gravel, as it is only a few m. wide. Inside the coconut plantation has been cleared of brush, but is reprouting it.

Large mangrove depression has dead trees in it. 8 m. tall rather scattered, ~~but~~ middle layer about 1-2 m. also shrubs, lower layer, 0.5 m. mostly clear.

Where brush is cleared an interior Wedelia growing from stubs, also seedlings of Wedelia seedlings.

Scrub belt very dense on outer beach ridge changes to Wedelia with bushes of Suriana, Scaevola, etc. 2 m. high as coast swings round toward south. Passage beach.

White reef heron. Noddies.

Coconut plantation recently cleared in from bay. Many young trees, but probably dating from before typhoon.

This belt of scrub continues around on beach ridge in passage beach. Reef platform of breccia is very well exposed (photos 6+7)

Inside this beach ridge is a swamp that was almost completely cleared of Bruguiera by the typhoon is still open except for a few small Bruguiera saplings. Bottom is rather soft mangrove peat with a layer of fine coral gravel on top of it. Numerous small holothurians.

Inside this is a concentric ridge with sparse coconut trees. Then another Bruguiera swamp, this one not so damaged in fact, part completely dead.

In outer swamp, about half way from edge to pool in center the peat is 9" deep, with about an inch of mixed sand, gravel and peat on top. Below is gravel.

(Samples # 21, 22)

Ridge behind swamp cleared and staked but not yet planted to coconuts.

Lagoon end of inner swamp, open, with only a few living small Rhizophora, old trunks lying all in one direction, to northwest.
(photos of this and cleared ridge.)

Lagoonward end of outer swamp half filled by a thick gravel sheet that comes in from seaward greater part of passage beach, ending abruptly, with an irregular steep slope about 1.5 m. high to very flat. Bottom of swamp here of sharp irregular boulders.
This gravel sheet lines the coast, extending well around on passage beach proper, varying to a typical boulder ridge. Its top is in part covered by Wedelia, in part by widely spaced Pemphis bushes about 2 - 2.5 m. high & some Scaevola, but open

and flat shelves of fine gravel with white tests and white - walled nodules.
Inside the seaward mangrove swamp is a thicket of Hibiscus tiliaceus, then a limited more extensive Rhizophora swamp, the tall trees dead, but a thicket of smaller ones, 3 - 4 m. tall. Much debris in margin, esp. old Rhizophora poles, all lying one direction more to southwestward, not quite same as coconuts lying in swamp which are more south. Much rough cobble size coral gravel + boulders swept into swamp here from passage beach as edge of thin gravel sheet, overlying mangrove peat and sinking into it when stepped on. In swamp on a few older trees are a few epiphytic Asplenium nidus, Polypodium scolopendria, and one Nephrolepis acutifolia(?) (too young & at least small, to be sure it is this sp. but probably.)

around ed gen. sp. swamp on seaward edge, reeds (Bruguiera about 3-4 m. tall) abundant to the high tide mark but do not look especially healthy. Around edge, above h.t. are patches of Leptonia. Then, extending to lagoon a bank of Wedelia, at least 1 m thick, partly cleared inland with scattered trees, and to all seaward. Sand, Scaevola, Pisonia, Guettarda, Leptonia, Pandanus, and Cocos

Land staked for planting but not planted

East of last swamp is another small pond, only a few m across, with 2 or 3 Bruguiera not more than 1-1.5 m tall. Hibiscus tiliaceus tangle on one end.

(insert here part from p 69, part there by metals)

Boulder + small gravel ridge lying on beach

to Seaward platform in lagoon and, then grove of small Barringtonia (plots here)

Scaevola sericea occasional along lagoon gravel ridge

Weathered spathe of epicate coconut on lagoon beach.

Cocos occasional.

Lagoon shore and beach at toward north part much more sandy than elsewhere.

Oct. 26 - Sunny.

~~north~~, southward from landing.

Bananas very dense and in good shape, few coconuts.

Then sweet potato area - boulders and coarse gravel piled up to clear sweet potato patches.

Then open gravel ~~sheet~~ sheet not yet cleared off for plantation.

Tall Scaevola, Pemphis, Suriana, Wedelia scrub.

Then high ground planted to coconut seedlings, otherwise grassy toward lagoon 7 m. slant toward sea. This tapers off toward end of islet into Wedelia ~~grass~~ with scattered Pemphis, Suriana, Scaevola

Then ~~[illegible]~~ open sandy ~~[illegible]~~ with Wedelia

Plants seen (ctd.)
Pseudoranthemum carruthersii var atropurpureum
Pteris tripartita
Cordia subcordata
Cassytha filiformis
Ochrosia oppositifolia

3 gull terns in outer reef.

On outer edge of ~~[illegible]~~ scrub is very ~~[illegible]~~ and about 1 m. high. Some Tournefortia and some Wedelia on ground between Scaevola, Suriana and (a) Guettarda bushes, some on ground. Low Pandanus seedlings. Some patches of Pemphis. The Guettarda ~~[illegible]~~ mainland for some distance north, then sandy beach, but locally the bushes are 2 m. tall

Hernandia, Allophylus, Pandanus seedlings, rare on fresh gravel ridge at top of beach, Ricinocarpus, Scaevola, Vigna

Some living coral
as well as rock ward.
Then reached,
fresh beach-rock at
about mid-tide,
hardened and the surface
abraded, but appears
quite fresh (sample # 23).
Sample #24 is sand from
the upper part of beach -
a rather thin deposit.
for examination as to
nature of material. Seaward
reach near south end.

North from landing
Bananas around village
then sweet potato patches,
then open scrub
of Pipturus, Pandanus,
much Wedelia, some
Digitaria patches, Vigna
some Tournefortia and
Scaevola.
This gave way abruptly
to a grassland of Thuarea
Pipturus and Digitaria
with scattered coconuts,
all sizes and tall bushes
of Premna, Tournefortia,
Pipturus, Allophylus,
Morinda, Terminalia samoensis,
clumps of Musa, & Alocasia
Seaward is a tangle

of Wedelia and shrubs
sloping northward to
a beach ridge with
Tournefortia
The grass becomes
more and more dominant
northward, with few
shrubs except young
coconut and an occasional
Morinda. In places
Polygonum almost
replaces grass. Impatiens
and Plumbago common
Along lagoon beach
receding but eroded
and distorted (but apparently
abundantly) Cordia trees
in small colony of 5 shrubs
on beach ridge at end
of reef, with Scaevola,
Suettarda, Tournefortia
(about a mile) getting
lower and more open
seaward, with seedlings
and sprouts of Barringtonia
in grassy opening.
Two almost white
reef herons on mangrove
depression.
Wandering tattler on both
beaches and in mangrove
depression.

1960 Marshall Is.

Oct. 27 - Ligan Islet.

Species observed in 1958:	1960
Asplenium nidus	✓
Lepturus repens	
Cocos nucifera	✓
Pisonia grandis	✓
Canavalia microcarpa (?)	✓
Ipomoea biloba	
Vigna marina (?)	
Galophyllum inophyllum (?)	
Pemphis acidula	✓
Terminalia samoensis	✓
Barringtonia asiatica (?)	
Cordia subcordata	✓
Tournefortia argentea	✓
Guettarda speciosa	
Scaevola	✓
Pandanus (?)	✓

Birds

	Frigate bird	100–200'
nesting	White capped noddy	many
one egg	white tern	fairly common
	Brown booby	a number
	Bristle-thighed curlew	20?
	turnstone	medium flock
	tattlers	one a second
	plovers ?	
	Reef heron	1 specimen

Some of boobies were white beneath, only seen flying. Could not see other features.

Islet presents a solidly vegetated appearance covered with a few coconuts and several other taller trees as emergents. Pemphis patch still present, a weatherbeaten appearance but is generally leafy.

Generally a mass of Pisonia forest with complete canopy at perhaps 8 m. many saplings & sprouts from fallen trees. some standing trees with tops broken and masses of sprouts, others standing out as emergents.

Around margin, Terminalia and Tournefortia are common, forming a zone. one clump of Scaevola 2.5 m tall in this, a small tangle of Canavalia here also with the Scaevola, fruiting. 9 fair standing coconut many seedlings and young trees. one fallen Cordia with abundant sprouts on beach.

Asplenium common on fallen trunks and ground, many very old dead bases. locally forming a ground

Thurnia beds nearly
fringing well developed
to 5½' on thick. Very locally
up to 1 cm² of poorly consolidated
phosphate rock.

Tournefortia seedling
common on sand flat

1 green turtle nest 180 eggs.

Logs and branches are much
more rotted than on other
islets, possibly from N in
queens.

Two long sand horns
extending north and
south from lagoon corner.
Between these active beach
erosion is taking place
undercutting the shrubs
on shore.

Oct 27 Second islet north of
Megatto is bare sand
with about 2 coconuts near
and a few bushes.

From lagoon south end
of Megatto almost densely
vegetated, quite a few
coconuts thick undergrowth.
Between very sparse
coconuts low scrub
undergrowth

Oct. 27th Megatto, 4th north end.
To south.

Plants seen

Do Pemphis acidula
L Artocarpus altilis
Le Leptinus repens
N Cucumbita
N Carica papaya
N Ipomoea batatas
L Pandanus tectorius
Le Digitaria pruriens + weeds
N Portulaca oleracea
N Mirabilis jalapa
N Cirsium arvaticum
N Alocasia macrorhiza
N Clerodendrum inerme
Le Fleurya ruderalis
N Plumeria rubra
N Musa
Wedelia biflora
Le Fimbristylis cymosa
L Polypodium scolopendria

o Morinda citrifolia
n Nephrolepis biserrata
lo Tournefortia argentea
n Ipomoea pes-caprae
lo Vigna marina
o Wedelia biflora
o Scaevola sericea
a Pisonia umbellifera
c Guettarda speciosa
n Ochrosia oppositifolia (S)
lc Allophylus timoriensis
n Intsia bijuga (S)
l: Hibiscus tiliaceus
lo Triumfetta procumbens
o Terminalia samoensis
lc Barringtonia asiatica
lc Pisonia grandis
lo Physalis angulata
o Tournefortia argentea
lo Cordia subcordata
lc Cassytha filiformis
lc Canavalia microcarpa
n Centella asiatica
w Pseudoranthemum [illegible]
Calophyllum inophyllum (S)
"kugui"
n Peperomia acuduta
n Hernandia sonora (S)
n Boerhavia tetrandra
n Euphorbia chamissonis
Lo Bruguiera gymnorhiza
n Nephrolepis exaltata

north end of Mejatto
large clearing, grassy
with Digitaria and
some Neptunia and
Fimbristylis, scattered
coconuts, many bread-
fruit saplings, seedlings,
up to 2.5 m. tall.
Area stands forward
slightly away to the sea. Then
a dense jungle of
Scaevola, etc. about
3-4 m. tall, with Wedelia.
Then with a clean
forest trunks (Ca.
extends to near the
outer beach, which
is low and becomes
lower, becoming open
on beach ridge. Here
the beach ridge is
of cobbles & boulders,
perhaps 2.5 m. high.

A few Terminalia seedlings
on bare beach ridge. Ipomoea
taba numerous out onto it.
Extensive gubbly tracts
on reef flat.

Flock of 6 white terns
fishing just outside
outer reef. 2 white reef herons.
one gray-white one.

Southward from here a lagoon skirts the old clearing becomes more and more overgrown with Vigna and Wedelia, and the space between the scrub belt and lagoon beach narrows.

Then, where islet abruptly narrows down, weed areas are covered by a blanket of Vigna, creeping on a sandy gravel flat. This extends along the lagoon coast a bit, changing inland to an open stand of Pisonia, Tournefortia etc. tangled with Vigna and Wedelia.

Along lagoon beach and reef flat there are weed rather than rubbish sheets with a lot of old tree trunks and rubbish.

South of the Vigna area is a flat of gravel with scattered Tournefortia bushes 1-1.5 m. tall, then Leptonia, then Vigna, then Wedelia presenting a rather arid aspect. Appears

to be an area scoured by typhoon. Inland a coarse gravel sheet with low margin, flat, much of it open, scattered Tournefortia and Scaevola about 2 m tall. Ground either bare blackened gravel or thin Wedelia mat, some Trumpetta. Seaward Tournefortia become lower, Wedelia denser and thicker, forming a closed vegetation. Become open again and irregularly grassy, with Trumpetta, open grave, Vigna and scattered low Tournefortia and Scaevola in patches 50-75 m. A low bare gravel ridge outside this. Steep gravel beach about 2 m high. Then a rubble-reef running perhaps half the length of the island. Photos. This rubble tract, uncovered at low tide, has several sandy strips across it, perpendicular to beach.

On the gravel sheet back of the beach ridge about half way up where the open scrub starts is

2 lines of debris - F.d
Cucurbs, sticks, coconuts
etc on subsect. a dense
low stand of vegetation
about 1-3 m. wedelia has
developed - mostly headed
ends to 2½ m tall, numerous
young coconuts. Little taller
Scaevola, Tournefortia,
Casuarina. Tournefortia
(random nesting)
is abundant dominant
on the adjacent inland
and as numerous as
Scaevola (receding)
on the gravel sheet
seaward to the gravel ridge.
Scattering coconuts and
very sparse on this
section of the islet.

Gravel sheet rather
thin here - old coconut
root masses occasionally
protrude through, covered
with Lepturus and Fimbri-
stylis.

A little further south,
at perhaps the narrowest
part of the islet the outer
portion - gravel sheet, plunge
holes, scoured areas etc
has only a strand mat of
Tournefortia and Lepturus
some Scaevola, Sporobolus tuba,

Wedelia, etc with scattered
very small Tournefortia
about 3-5 dm tall. Further south
flat was very stony.

Thin thickens lagoon-
ward to a scattered
scrub of Tournefortia
in a thin blanket of Wedelia.
South of this an area
of tall dense scrub of
Pisonia, Tournefortia, a
Scaevola, Wedelia, etc.
Then a scoured open
area of Thuarea, Lepturus,
Tournefortia, Polycarpon
etc with scattered shrubs
Southward again thickens to an open scrub
and Wedelia blanket.

Outside all of the
gravel sheet in from the
gravel ridge, along
all of this, is covered
by a sparse scrub
of Tournefortia, Scaevola,
some young coconuts, etc
with patches of Lepturus
Tournefortia, etc

Gravel ridge bare, white.
Southward this ~~zone of~~ ~~sand~~
strip narrows considerably.
the low scrub, with Wedelia
or Lepturus extends across the
widths of the islet, dominated

mostly dry Tournefortia, locally Pisonia + Scaevola. Some open gravel spaces. Virgin toward lagoon. Southward much open Thuarea and Lepturus, a Vigna, with scattered Pisonia bushes 2-3 m. tall, rounded and Tournefortia 1-2 m. tall. Inland a large bare gravel sheet of slabby boulders, rather blackened; parts of this with old coconut trunks lying around and scattered shrubs. Seaward a narrow strip of thicker lower scrub ranged with Wedelia. Then the typical sparse Scaevola Tournefortia about 3-4 dm. tall of the seaward gravel sheet and ridge, some Guettarda and scattered stunted coconut seedlings. This strip at this is about 1/3 the length of the islet, north to south and has almost no standing coconuts, but

some stubs. Just south of it taller and denser scrub, considerable Vigna on seaward side, the open low scrub even very narrow.

Then a badly scoured area across the islet, much open gravel, scattered bushes, some grass (Thuarea + Lepturus), some Wedelia + Triumfetta, scattered Tournefortia Lepturus, Scaevola shrubs 1-2 m. tall. This extends some distance south and open gravel in varying proportions. Trimming out and becoming more clear of appearance southward, with scattered shrubs mostly about 1 m. tall, of Tournefortia, patches of Lepturus, Wedelia, Vigna, Thuarea, etc., but mostly bare gravel with coconut roots exposed, logs moved, old bases, fallen trunks, etc. Many plunge holes. This area shows only the beginnings of recovery. Bounded southward by a

depression running across the islet with practically no vegetation at all. except along north side a scattering of seedlings of Tedecoia and Tournefortia. a very few around a couple of old cement bases in the middle. across the seaward side is a gravel ridge. An Eyam reef flat is a pond surrounded by a circular gravel bar.

1 crested tern on lagoon beach. 2 blue herons lagoon beach
1 white on seaward beach
2 rattlers on seaward reef flat.

Several enormous dead Calophyllums on lagoon beach. uprooted.

Oct. 27 - 1 mile along seaward beach from north end -
Low open scrub of Scaevola Tournefortia, Pisonia with mats of Trianfetta, Portulaca, Tribulus, and Eragrostis.
Varying greatly from place to place in width density and height

4 turnstone and a plover

Oct. 28 Reboul

seedlings on ground from
Scaevola, Pandanus,
Calophyllum, Guettarda,
Barringtonia, Morinda
Cordia, Vigna, Tournefortia

Plants seen

2 Cassytha filiformis
a Asplenium nidus
o Wedelia biflora
a Pisonia grandis
c Polypodium scolopendria
1c Cordia subcordata
c Morinda citrifolia
r Vittaria elongata
1c Canavalia rhizocarpa
1c Tournefortia argentea
r Nephrolepis acutifolia
1 Fleurya ruderalis
o Scaevola sericea
1a Vigna marina
c Guettarda speciosa
2 1c Calophyllum inophyllum
4 1c Pandanus tectorius
2 1c Barringtonia asiatica
1c Cocos nucifera
1a Pemphis acidula

1 shrub - Unidentified endem. egg, also

Flock of 15-20 flash-mixed terns around end of grand tour, one baby grown young, 2 common noddies, and quite a few #white terns breed not grown young in trees Reeles troublesome.

Bottom of enclosed pond now about half covered by low Pemphis scrub perhaps 1.5 m. tall. some new seedlings or sprouts from old roots. A little Leptuna, some has roots Bar surrounding it largely covered by scrub of Scaevola with a little Tournefortia, some Canavalia Ficus vine. from 1 - 2.5 m tall a little Terminalia. Vigna around edge

Plants seen (ctd)

1c Leptuna repens
c Terminalia samoensis
r Psilotum argenteum

and south.
The west end is forest a solid mass of vegetation, largely Pisonia up to 15 m tall, maximum width 5-6 m. Cordia, Scaevola, Morinda occasional Tournefortia. Guettarda tangled with Wedelia and occasional Pandanus.

Interior dominated by Guettarda and Pisonia saplings about 4 m tall with an undergrowth of Asplenium nidus 2 m tall on large root masses, from of these old root masses dead but covered by countless young Asplenium plants. Thick clay mixed w. lg coconut husks, loose. Asplenium also epiphytic on lower parts of trees, as is Polypodium

A few Coconut trees in north part of islet.
This part generally is a low irregular mass mostly Pisonia about Scaevola and Guettarda tangled with Wedelia.

Keep a small cover of Tournefortia on gravel under a Pisonia tree. Wedelia on base of tree.

The base of west beach a belt of Scaevola and Guettarda. distally from this a mat of Tournefortia with many seedlings of Pandanus Caloph Callophyllum & Barringtonia. Distally from this a mat of Vigna.

On this islet the largest Pandanus is a single stem about 1 m & 6m tall, others very small seedlings. Calophyllum, Barringtonia only seen as seedlings.

This islet has become very luxuriantly overgrown up to about 5-6 m. with Coconuts and a few Pisonia trees as emergents.

28. VII - Megatto. north point and passage beach.

Well developed beach ridge, ridge 3 m high along passage beach. Back of this a sheet of coarse gravel with a few scattered bushes of Scaevola & Tournefortia an old cocospalm. Scattered mats of Cassytha. Wedelia a little Tournefortia, very sparse tufted Lepturus. this especially but not exclusively, in sandy patches. Cassytha on Wedelia and Lepturus. Scattered seedlings of Scaevola & Tournefortia. This was formerly a sandy area where coconuts were always yellowing as the boys who live here.

Inland sea the Wedelia and Cassytha become abruptly absent and the ground cover complete. The coralline rock at end of gravel sheet and great sandiness of ground. Lepturus and Fimbristylis also more abundant, and Thuja.

Toward seaward corner the beach ridge is interrupted by a broad sheet of coarse gravel, partly bare sparsely covered by irregular Scaevola scrub fading inward. It is mixed open scrub with Pisonia and Wedelia.

Passage beach lined generally by a low narrow ridge of pebble gravel.

1 white heron
2 turnstones
1 white tern

Middle of Megatto where I left off yesterday. South of big ocean an area is heavy covered by Scaevola and some Tournefortia. a few stunted yellow cocospalms, none of this over 0.5 m. mostly less. sparse. Toward lagoon in remnants of soil is irregular scrub & grass. a few standing cocospalm trees and many stubs.

Then for a stretch there

is an irregular, very low sand spit, remnants of sand filled with coconut roots, a few trees of Pemphis, patches of Scaevola seedling of Pandanus & Barringtonia but main components Scaevola & Tournefortia. A few seedlings of Guettarda, Hernandia, Ipomoea, Wedelia, Pemphis, Calophyllum

Then another deep scour

The entire area between this & deep scour channel has been scoured off except for remnants of sand held by coconut roots. (5-in photo)

The second scour also has a gravel ridge on seaward side, not so complete. No vegetation except on several areas of firm sand not entirely scoured off. Here a sparse Scaevola, Tournefortia about 0.7 m. tall.

Southward after a bottom up area of sand remnants and small

scour channels, now very irregular mixed sand and grass patches, a taller mixed scrub of Tournefortia, Pisonia, Scaevola etc. (Photos)

This very open with patches of grass (Digitaria) and bare gravel sheet. Bushes rounded. 1 - 2 m. tall

[Pisonia = a common tree. Sometimes used for cordage.]

Southward, shows more open Digitaria mat on lagoon side, Thuarea and Wedelia seaward.

Small mangrove swamp, sand bottom, with irregular but pure stand of Bruguiera 1 - 1½ m. tall near lagoon, separated from lagoon by sand ridge, encroached upon from seaward by gravel ridges. No large Bruguiera trees, but a few dead skeletons lying lagoonward, pointing toward lagoon.

Gravel sheet to seaward, very sparse scrub, mostly Pisonia, with grass mat and gravel. Tournefortia (photo)

seedlings, locally abundant
Pisonia + Tournefortia more abundant + scrubby on gravel and on sand only along lagoon.
Local patches of Euphorbia Chamaesyce, one storm reason - from Tournefortia

Then tall open scrub of Pisonia + Tournefortia with grass, Triumfetta Wedelia + open gravel patches.

Erected form on lagoon side. Sparse sprawling ash.
Tall scrub becomes lower, 1 - 1,5 m. tall, thick solid grass, Pisonia + Thuarea, ground layer occasional mat of Wedelia
Seaward lower, more open, little grass, Triumfetta and Vagna form sparse ground cover. Some Canavalia occasional mats of Cassytha occasional Euphorbia + Morinda seedlings.
This scrub, both zones, continues for some distance but gets somewhat lower and sparser, ground cover more irregular, more bare

sheet gravel. Seedlings of any kind rather scarce a few of Pisonia.
One Terminalia bush.
Ground rd battered but sprouters clumps of Barringtonia are abundant Barringtonia seedlings, Ground seaward side.
Land gets denser again but ground cover less.
Then a badly scarred section little ground cover, but open Tournefortia Pisonia scrub 1 - 3 m tall.
One Pacea plant, one Asplenium nidus, on gravel sheet in openings, a few Guettarda seedlings.
Then an open area with very sparse and irregular scrub 1 m. tall, mostly Tournefortia, with almost complete ground cover of Thuarea, Triumfetta, some Wedelia.
The same almost across the inlet except for a strip of open small Scaevola just back of seaward beach ridge.
Southward the scrub gets lower, 1 - 2 m. tall Triumfetta becomes dominant

in ground cover with some Tussock tufts.

Southward scrub becomes lower and dense in places almost closed, Leptos mostly emergent but with Pomaderris. Wet gravel sheet waved with scattered very small Leptos and Pomaderris almost no ground cover except scattered Pimelea prostrata mats.

Then open area to Pomaderris scrub with Olearia and Leptos ground cover. Some bare gravel sheet. Some Vegetated along fagon. Some Pimelea prostrata and Wedelia in bad. also there mixed ground cover of Olearia Pimelea Euphorbia chamaesyce Tussocks, a little Coprosma, Carex other ground is sandy gravel. Pimelea locally dominant.

? Cover 70% Leptos forming arround together.

On ocean side the very open low scrub continues Pomaderris and Olearia inland some. Left 7-8 m bed of Pimelea prostrata with closed Leptos open to seaward.

In lagoon side a small depression, sand bottom no mangroves no veg except a couple of small mats of Leptos on side.

Then southward an area of grass with few shrubs back of it and southward tall scrub tangled with luxuriant Wedelia. Open scrub with little ground cover seaward becoming almost dense southward. Then somewhat open again, very coarse loose boulder - cobble gravel. Thin ground cover of Leptos, Pimelea, a more Coarse substratum Pandy generally. Much Tetragonia in open parts of scrub. Locally dense scrub and Wedelia.

Scrub thick and tall 2 m. Tournefortia + Scaevola, - with Wedelia, Tournefortia. Then watered mangrove swamp, with Pemphis around edge; some tall Bruguiera, 6 m. some small Bruguiera, some open depression with much debris. Southward flat area of debris, filled depression, some of it with dense stand of small Bruguiera sapling. Pemphis irregularly peripheral.

Southward a notch, small depression with Bruguiera sapling, Some Templ. Hay, some open gravel + debris bottom.

Key surrounded mostly by a rounded tall scrub of mixed composition, Some Allophylus, Pemphis, Scaevola, Wedelia to Potters end + on gravel beat partly covered by a dense + open low scrub. Only

Tournefortia, Pemphis, Scaevola. Tangled mat. Some Lantana among Pemphis + Scaevola, Wedelia, Tournefortia, Sida, Heliotropium, Cyperus, but Tournefortia dominates, interlaced with Wedelia. - in front

Seaward a dense to open scrub of Scaevola and Tournefortia 1-2 m. tall

Half dozen white terns flying over this area.

The scrub types on this island mostly give the impression of being even-aged stands, regardless of density, and most remarkably poor seedlings in openings. Little correlation with substratum, only broad correlation with place on island. Generally sparse and low toward seaward side

1960 Marshall Is.

Oct. 28 — north end of Majuro I.
on open sand gravel sheet from 1958 typhoon
4/14/14 Fimbristylis cymosa R. Br. common
2' 15 Scaevola sericea var. subulata Fosb
2' 14 Scaevola sericea var. stylocuneata Fosb
2' 17 Scaevola sericea var. stylocuneata Fosb
1/5' 18 Boerhavia tetrandra Forst. rare
2 19 moss
on old rotting coconut husk in scrub back of beach.

Coconut plantings on Majuro atoll in form of a grid over most islets, and generally regardless of soil and terrain - swamp, rock, gravel, etc., and regardless of existence of standing trees. Three feet wide and deep square holes dug - ~~trees~~ vegetable trash thrown in, then hole nearly filled with sand and a grafted coconuts planted later in these holes, not completely buried.

One rather thorough weeding out done at time holes are dug. Trash allowed

roots fragrant with pepper fragrance
(but crowds out subulata)

To not on ground, very little evidence of burning seen. Addition of human to soil is notable.

In general exposed gravel sheets are dark gray a almost black from algae.

General notes —

Lizard population seemed large on most islets visited except Ruk and Lejeun where only a very few lizards were seen. Most seen generally were the barred skink. Black skinks were seen on Majuro and Jaluit and slender skinks on ~~Jaluit~~ Kwajalein and Majuro, but rarely. However, no special effort was made to examine lizard population.

Rats were seen in abundance only on Eniu Island, apparently R. exulans. Rats around the radio station on Kwa were a larger rat, but some small ones & mice were there too. Judging by reports of Kwajalein and from abundant droppings seen.

Cat abundant on Ivory, seen also on Jaluit. A few dogs generally also chickens. Two dogs on Kwa said to be left on atoll.

A pet Micronesian finch on Ivory.

Wedeira leaves rather generally consumed at extremities by noctuid larvae (similar to armyworms) but not by any means defoliated.

Flies, mosquitoes, common. Ants common. Scattering abundance of insects anywhere. Bees occasional on all islets, but not abundant. Some Culex on Jaluit, not many.

Very few insects came to lights.

Beetle soft grubless islets, common on Landanus leaves on Majuro.

House flies and a smaller similar fly occasional, annoying but not at all abundant.

Large land crab holes prominent on most islets, and Lejeun, where the land crabs mix sand with the humus in places much as the shearwaters do on Heron. (These holes are presumably those of land crabs, but may be coconut crabs or even shearwaters (but a bit small).

Hard hermit crabs not specially abundant.

1960 Marshall Is.

Data on breadfruit disease on Ponlap Islet from report by Eric Knudson based on information gathered May 5, 6, 7, 1960.

	seedlings	headed
Total Trees living	307	73
dead trees	34	
diseased trees	29	
Trees died last 3 mo.	26	4
Trees diseased last 3 mo.	10	0

Four areas of infection and a third development - in the latter ~~the~~ tree is in last stages before leaves drop off and surrounding trees are beginning to turn yellow.

	dead	yellow
site # 1	1	4
site # 2	2	3
" 3	0	4

Symptoms

Trees become progressively chlorotic: approximately four months after symptoms are obvious leaves fall rapidly (except for half dozen that turn green suddenly and then almost immediately yellow and fall - not personally observed).

and, as no new growth appears, rots set, etc. the tree is presumed dead.

Leaves: Top leaf - light green, yellowing starting from leaf margin, random spotting (nutrient?) and occasional "burning" necrosis along the leaf margin.

2 leaf necrosis more in evidence. Leaf tips steadily curled, necrotic spotting, and definite yellowing over-all.

3. increased necrosis and darker yellowing

4 similar to 3 but leaf began to die rapidly.

Roots: A tree in the final stages before death roots completely dug up and pulled down. Tertiary roots immediately underneath the trunk and those roots 5 - 5 mm in diameter showed the following deformities:

1 Root was twisted, wrinkled, and often constricted.

2 Galls were evident - approximately twice size of root diam.

3 These galls appear to be "strung" (attached at each end from which

streaks radiated. The root xylem on cut ends of the galls usually had a stained appearance, described as

4 The galls themselves had origins of not within the tissues. In the galls the xylem remained unaffected but the surrounding tissues were definitely discolored

5 In stuffing the roots black streaks were random but consistently found.

6 Where root was constricted the xylem remained relatively unaffected.

Surface roots within 1 ft of the trunk appeared normal. Small holes just to expose the surface roots were dug around several trees to a depth of 1 - 1.5 ft. There was a relationship between the degree of yellowing and the occurrence of diseased roots. Also a greater number of roots were found to be abnormal near the path than were found at an equal radius opposite the path.

Trunk: The tree was sawed in three places

at base, at middle, and near top. The xylem and phloem appeared normal except for a definite black 'shadow' merging, but penetrating the xylem tissues. The discoloration had a fairly definite border in the xylem but in the phloem it slowly faded without any clear limit. The condition was found only in the tree trunks

6 Leaves appeared normal.

Summary

There appears to be sufficient evidence for a conclusion:

1 The majority of the diseased trees are situated along the path.

2 The disease is spreading most rapidly along the path.

3 The roots nearest the path show malformation beyond those farther away.

4 Once a tree yellows and dies in a recognized manner those trees nearby tend to display identical symptoms.

5 The time intervals between yellowing and

death yellowing and subsequent infection of nearby trees. Death and subsequent yellowing of nearby trees are uniform.

b. The trees show symptoms easily recognized and can be attributed to a common factor.

[Thus far from report]

The tree that I looked at that was affected was sprouting a fruit from base, upper part. Dead fruit Knudsen says this is not generally the case, surrounding smaller trees somewhat chlorotic.

When asked if some coconut trees still retaining leaves after typhoon had died later several Marshallese replied in affirmative have different periods of time, from 4 months to two years.

"Faune" - from coconuts.

Paul Morris, agriculturist on Guam studied the breadfruit disease further.

Oct 29 - plane trip Jaluit to Majuro - ~~reef~~ ~~Jaluit~~ ~~Island~~ expand down s.e. reef of Jaluit Island

Down Lone Islet - surge channels abundant

On Jaluit - swamps on only in east end.

Up Lone Islet
Taboe - 4 photos
Tuss - 4 photos

N. channel in depressions and an "island" reef in channel.

Strip ~~of~~ mulch from Cryptos. Temples about recovered. Beyond there near angle in reef ~~reached~~ many denuded area scarcely recovered.

All along the lagoon reef flat bars are a very frequent feature, mostly near the ~~edge~~ lagoon edge but also many small accreta out near shore. Many remnants of consolidated material also, out on flat in various positions.

Majuro - 3 miles Corner lagoon reef flat wider than seaward on N. north east and north side.

Marshall Is. Majuro

The second flat is much wider. Margin of second flat on ocean more broad than that of lagoon, very much scalloped on both sides.

Almost no coral patches or pinnacles in east end of Majuro lagoon.

Lagoon bottom, flat, [illegible] with [illegible] sand. Asked Wackenge to send me specimen. (sent + received later)

Wedelia seems to be generally the most abundant plant. Tribulus odorata has become related by seams except along an atoll where it is still abundant.

Trees ornamentals in administrative town.

at 19½ photos on hod. roll L as aerial shots along north and west edge of Majuro climbing from 4 to 6 000 ft. (last shot of coral patches in west end.)

Oct. 31 - Kwajalein Islet, Kwajalein Atoll

N 41420 Dentella repens Forst.

common in weedy lawn near school building construction

Tabwot

Oct. 31 Tabwot - flew over very low several times.

Scaevola sericea
Calophyllum inophyllum
Tournefortia argentea
Pisonia inermis ?
Intsia bijuga (= I. retusa)
Cocos nucifera
Carica papaya
Pandanus ? species ?

Generally planted to coconuts, some patches of breadfruit (several dead and dying breadfruit trees some dead Tournefortia bush of beach ridge on one side. Fairly broad strip of native vegetation on one side (east ?) narrow on others. A large taro pit near west end, extending almost across island. This apparently has Cyrtosperma but does not look well tended. Flame on several houses and huts. Took about 13 Kodachromes. Breadfruit & cocos = most prevalent a very dense and even level canopy.

prostrate, forming dense mats, flowers white.

Marshall Is Nama - Kwaj
Wake

Oct. 24 - Nama also flew by at a little distance except very near south end only one time only to enter west reef. Many on east reef, well distributed except for a considerable area some of reef mean with end near has only 2 tiny specks of land. The largest islets are at the north and south points and in a group to the east on the east reef.
A little surf is breaking along entire east reef. none on west reef.

Oct. 29 - Kwajalein
Waterhen cat playing with a mouse in front of hotel.

Mr. Boyd, U.S. Weather Bureau, says that when he left Wake 2 years ago there were 50-100 wild cats in the woods in Wake; a few rats at that time.
He says also that the various weather stations, such as Kwaj, Eniwetok, Majuro, Johnston, etc. which have recently been taken over by the Weather Bureau now publish monthly and annual summaries. Also there is a Pacific summary.

work of
Crowl, P.A. + Love, E.J.
Geology of the Gilberts and Marshalls.
1-414, Washington, 1955.

Oct. 31 - Kwajalein - beach and edge of reef at salvage boat dock
13 Turnstones
1 whimbrel
3 plovers

1950 Marshall Is.

Oct. 31 – Trip on S&R
airplane plane around
Kwajalein atoll
left field 8:40

Change – most of trees
gone from north end.
many coconut trees
along lagoon shore of
settled part.

Center part of ~~Bogey~~ Bikeri:
cleared. Two small well
wooded. Construction

Bogey north well wooded
but the old ramp has
no woody vegetation.
Thoroughly green with
Wedelia & Ipomoea.

Small islet n. of
first pass has trees
but no coconuts. Also next
one. well up reef.

Reef flat finely and closely
striated transversally. Some
Channels more coarsely striated.

Next small islet also has
no natural scrub, no coconuts.
Also the next (prob. Ivoma?)
also reef

1 – It is large, some coconuts
on south half, north half
scrubby forest.
Next islet scrub forest.
Next scrub forest with
a few coconuts.
Next, ivoma or. very few coconuts,
scrub.
Next one scrub forest with
much Pandanus.
Next scrub.
Next coconuts
Next scrub.
Rey: Namur scattered
coconuts down in places towards
tip strip usable. Much
of ground on other old
strip grassy with scattered
brush

Next islet with few coconuts.
Then another with coconuts.
Then a pass with a bare
sand bar inside it about
~~one half mile~~ 500 m. or more.
Then a small densely
wooded islet
Large islet with coconuts.
Then a pass with – good
bifurcating channel
4 bifurcation on st. 3 on left.
(photos but not from good
position – end of roll)

Small scrap of
denuded veg. platform
veg & trees.
Small islet densely
wooded.
Another Isl. with group of coconuts
along inner beach.
Next solid forest,
wind-sheared on east side.
Shallow pass.
Small wooded islet.
Reef on both sides
of reef. Less wind,
Larger islet, well
cultivated coconut
plantations.
Cross striations on
much of the reef here.
Large islet about ½
planted to coconuts, some
food on seaward side,
some of plantation extending
to sea side.
Shallow wide gap.
Then reef with initial
bowl shaped black gravel
bar - boundary consolidated.
Small forested islet.
Reef with irregular
forest and a few coconuts
Then another with
about half an acre of
small bush with a
dozen coconuts & other plants

Small islet, mainly
bush, open sand,
then belt of coconuts
then narrow rocky beach
in front.
Many patches reefs.
Then large reef
1 islet with a dog
1 islet with open sea,
west and and lagoon
shore, coconuts on both
sides. Then 2 small
islets with much land, low
ground & little trees
Then large islet mostly
open two patches of
coconuts small islet
outside this with
coconuts connected by line of
small islets with
open sand. Inner bay
to outside of reef.
Then long western
islet, irregularly
planted to coconuts, a
band of sand with
open scrub ground south
and west side. Low
forest in centre.
Reef much broader than
islets in this western
prolongation. Islets
look as though on typhoon
had swept them except the
end one.

Marshall Is.

Reef flat and a number of islets. Lagoon deep. One or at least seems to be beaches on islets scarcely.

Reef much of outer reef type. Inner and here seems to be a small development of an algal ridge on the inside. Reef some rock breaking over it.

Reef along south, west, some remains of reef, shallow here with broad coarse striations.

Islet partly planted by coconuts some forest, some very yellow scrub.

Then reef of 4 or 5 with shallow areas and 3 deep but narrow ones channels. This reef well submerged in parts. Part does not seem to have large channels. Has sandy areas at different depths. Then a deep channel with

long V shaped reef mass, each fork bifurcates.

Islet of right hand number of patches of not forming a very good pattern. None of this would be awash at lowest tides probably. Well submerged.

Then a shallow stretch with a patch of reef. Then a narrow deep channel Then more well submerged reef.

Then a rather long islet with some forest and a few patches of coconut trees, some open sand or so.

Then a small islet with open sand, a few grasses, a sand beach with a few coconuts and bushes.

A wooded small islet.

A long islet with coconuts and a long reef extending lagoonward along a deep bifurcated channel.

A coconut planted islet with a long reef extending east along reef.

Another long coconut planted islet. A deep pass with

an islet inside,
very sandy, with
coconut trees.

Then a long coconut
planted islet with
a narrow brushy eastern
extension with a
sand on it.

Then a long islet
irregularly planted
to coconuts, a fringing
fringing reef, another islet
in reef in coconuts
and wooded and a mooring
to a spit. Then brushy

Then a very long reefy
islet with a spit westward
a reef pass with three
islets inside at a wooded
in a bifurcating
system. Then one reefy
sandy. Coconut trees.

Then a long islet
the middle most part
planted in coconuts, very
elongate eastern part
in front. One or two
patches of coconuts. Then
almost a reef. Then more
spit and sandbank enlargement
with coconuts. Then
irregular interrupted
sandbank enclosing
in inside. Then a small
islet inside with
some coconuts.

A shallow pass
round to on reef
no vegetation
Then an islet planted
coconuts
A reef. Then one islet,
a reef with sandbank
inside
Then an islet with
coconuts narrowing
eastward, low part
brushy
Scattered bare sand
or grave bars on reef,
to patches of irregular
wooded platforms.
no bar with a coconuts
More bare
Then long, flat, reefy
inside, but no pass
into very shallow
reef. Elongate more
bare and much
bank with a wooded
platform
Then a long wooded islet
with a shoal in inside
east end, then a
wide bare
Parapet, sandy
planted in coconuts
islet for a couple of miles

sands with coarse grass
and flowers
[illegible] with
[illegible] and end
a deep [illegible]
[illegible] planted by
coconuts, narrowed
eastward to point
[illegible] with
a coconut [illegible]
[illegible] enlarged at mid
a [illegible] down with
[illegible]. Complicated
[illegible] [illegible]
[illegible] [illegible]
with coconut plantation
[illegible] a deep channel,
with a wide bay,
shallowing eastward
An inlet [illegible] on
coconuts, [illegible]
[illegible] sandspit, mostly
sandy on east half and
a [illegible] on
east end, with a [illegible]
inside vegetated [illegible]
a sand or sand-[illegible]
[illegible] grass. Wide deep
pass [illegible]
[illegible] with small
[illegible]
An inlet with [illegible]
[illegible], some coconuts
connected by [illegible]

bar with another with
a [illegible] and
[illegible] and [illegible]
lagoonward. There two
islets, almost the length of bar, with
[illegible] sandy [illegible]
[illegible] and [illegible] with
submerged reefs
[illegible] an irregular
[illegible] bar [illegible] by
a couple of large
[illegible] made with
[illegible] and [illegible] one enlarged
[illegible] with coconuts
a deep narrow pass
[illegible] an elongate islet
irregular width, planted
to coconuts on sandy
[illegible].
[illegible] a shallow pass
[illegible] a narrow elongate
islet on bar with
some coconuts a little sand
[illegible] small bare bar. Then
a shallow pass
a reef with an elongate
narrow bar, widening
eastward into an islet
with a west pointing hooked
bar on west end in lagoon
narrows to bar on east.
Shallow pass.
Elongate islet, west part
partly bare, [illegible] pond.

Partly in Pandanus
Eastern and western
reef flats, separated
by a wet marsh. Pandanus
surrounded pits
some coconuts

Low elongate islet
partly in coconuts
somewhat beaten up,
eastern end wooded
Typical raised reef flat.
Pits in eastern end
with more & larger
pools nearer ocean
than internal flat
ones.

Small scattered Pandanus
open, scattered Pandanus
& Tree, mostly
Clusters of Wedelia
& scattered coconut trees
& a shallow pool
to S.W. of islet

Small dry reef
West end mostly bare
Rock, a few rocks
& bushes, two trees relict
with scrub
Dense grove coconuts
in south part of village
and around W. of station
Trees on north half.
E. & S. low open beach
with few coconuts among

trees, low forest in
north for remainder
Small pools with
stagnant beach rock
around rest. Ten years
ago mangrove swamp
in E. & N. most
now cleared

Low (1m) rocky
coral rock middle two sections.
Low & large mostly
coconuts, inland
mostly, a few dense
forest

Flat & moderately
high grass. Two Bigger
Raised tanks & tall trees
with vegetation around
Few coconuts on W. side
Projecting
of limestone and algae
extending into lagoon
Reef islet in coconuts
Islet in pass Kwadalk
mostly planted, a few
coconuts
Limestone still dense Pandanus
forest with belt of bush
but E end towards pass
has a grove of coconuts
Dense rock on this forest
area.

Northward
we are some distance
outside reef
extending from main
reef north-eastward,
apparently a coral formation
of low sand cays

7/Jan - south to Lisk.
Reef is widest + most
broad in N. E. corner. N. E. corner
appears to be considerable
forest [illegible] with only
a few Coconuts
Fruit around [illegible] N. E. corner
Patches of Breadfruit in
N. E. corner
Tournefortia Calophyllum
Scaevola Tandanus
Artocarpus Bruguiera
Hibiscus tiliaceus
Wind a point N. E. to N.
diagonally to beach.
Large channels on
N. + E. sides, scarcely
any west.

The fruit around the
island is [illegible] - does
not look too much like
Pamplis, nor Bruguiera,
one patch may be Bruguiera,
Brighter green than rest.
Dull green, rather small
leaved, in mass at Boulder
corner.
The land is brown
rusty looking.
The sand is coral
[illegible] sand.

Beach to Kwajalein
[illegible] south along South reef
[illegible] Reef Pigs etc.
[illegible] Reef of Pigs etc
has very considerable Pemphis.

Extensive boulder tract
on reef north of Pigs
Boulders seem to be
degree truncated & roughly
accounting for some
striate appearance.
Most of sand patches
on this reef are true
boulder + rubble tracts.

North of Ivvadah -
a huge loosened
boulder - a fruit of 4
craters between any
channels. Appears ready
to be lifted on reef by
a storm.

Coarsely striate appearance
apparently due to
submerged surge channels

Rubble all along shows a remarkable tendency to transverse ~~alignment~~ but fine striation on paler parts of reef flat is apparently not due to this, perhaps to shallow growing ~~such~~ such as seen at Kwaj by Tarawa.

Most of forest seen on Tarawa is left earlier this morning in Pisonia.

The herbaceous vegetation on the old ramp at Bigej seems to be Wedelia on about the peripheral half or ~~so~~ and Ipomoea in center. Though hard to be sure.

A very few scattered patch reefs in lagoon. Lagoon is quite rough today, quite a few white caps.

Down south reef at low altitude
Rubble a no alignment of rubble on these reefs, Boas very numerous, though Arenita bars on lagoon reef flats opposite inlets are occasional

Pemphis abundant occasionally shows wind striation.

1960 Hawaiian Is.

Oct. 16 - Honolulu

4 $471 Cirsium brokeri Engl.
cultivated in garden

Oct. 25 - Honolulu

4 : 422 Cirsium asiaticum L.
cultivated
~~brought in~~ (J. M. Clevenger)

Nov. 4 - Trip by Boeing jet
Honolulu to San Francisco
10:30 a.m. - 6 p.m. 3400 mi.

At about 1:30 - 2 p.m. Honolulu time the sea, as such, was practically unseeable - a scattered layer of small clouds ~~was~~ lay far below, spotting what appeared to be a deep blue sky slightly duller and richer than the "Prodochroma blue" seen in high mountains, but neither surface ~~or~~ seen on horizon visible. The clouds did not differ in appearance from what they would have looked like in the air - they above, except that one looked down on them, & slightly different appeared where the horizon would have been, & colors

from seeds brought from Utrecht in 1956 (Fisher 7"1=)
Flowers picked by J. M. Clevenger, Jr. from same wild as collected by me.

out both upward and downward above the sky was almost a blackish blue - not a night sky, no stars, but simply a sky blue diluted with black, a rather opaque blue, not transparent, lightening to a normal sky blue toward where the horizon should be. Being on the north side of the plane the future of the sun in this color system was not evident. From time to time an invisible turbulence shook the plane, giving a rather eery effect.

(As near as I can see from the other side, an indirect view through the glass diagonally, the sun as just a brilliant white light scarcely influencing more than by immediately adjacent blue.)

1920 California

Nov. 5 - Miles Canyon
still in fairly undisturbed condition except for railroad and highway in bottom.
South wall mostly densely wooded with a low growth of live oak, aesculus, arbutus, etc. Other wall open, grassy with scattered live oak. Stream in bottom with abundant water plants.
Road to Isabel, more open, but scattered live oaks and Quercus lobata & grass heavily grazed.

Nov. 7 - Sacramento Valley, from air. The area west of the lower Sacramento River is almost entirely under intensive rice cultivation. The land is in large blocks and the entire area is cut by a system of large sloughs lined by very narrow gallery woods, usually not much more than a single row of trees, or even only a strip of low scrub. Between these sloughs are a network of ditches. Along the river itself there is a narrow strip of

belt of orchard (peaches?), mostly on the east side, still green but showing some change of color toward red. At a junction of several sloughs is a patch of forest or swamp. Some small wooded islets in larger sloughs.
The soil, where the fields are ploughed, is almost black.

Nov. 28 - Chantilly airport
Large open field, thickly
grown with weeds.
Different weed communities
apparently representing
different times of withdrawal
from cultivation - borders
between them abrupt and
straight. One community
dominated by Helianthus.
A few scattered Rubus
and one Rhus in this.
Separated from a
grassy community
by a line of bunchgrass
1-2 m. tall, the latter
spread 1-3 m. beyond
this into grass. Asters
apparently annual.
In smaller number
on into the grass.
In the fields abundant
small burrows and
ground - as many as 7 in
one sq. m. seen.
In grass a maze of
interlacing runways,
some burrows. Heads
some larger burrows
with fresh dirt
around entrances
2 or 3 inches wide
up to 6 in. tall in grass
a few scattered small

Clumps of Andropogon.
Several rows of large
evergreens
At least 6 or 8 species
of trees just over the top
of the weeds and bushes.
Several meadow larks
& blackbirds
Remains of mice etc
occasional on grass.
Raccoon tracks in mud
near large puddle.
One large owl just at sunset.
also flying low over grass.
One row of oaks with
a small patch of saplings
nearby.

1961 Virginia
Taylor Runnels
Jan. 22, Lake Bancroft
1.5 mi. s. of Falls Church
edge of deciduous woods
shore of lake.

4 1 4 2 3 Betula nigra
occasional

2 24 Ligria ligustrina
occasional

25 Vaccinium
occasional

2 26 Alnus serrulata Willd.
common

27 Corylus
occasional

2 28 Hamamelis virginiana
occasional

After several days of weather ranging between 25° and 0° F the lake is frozen over with a firm sheet of ice, that bears a man's weight very well. There are several long irregular cracks that have frozen together again, after opening. On the surface are patches of ripple marks, also curious series of concentric irregular ring-like ridges, also patches of semi-consolidated snow.

The upper part of this arm of the lake, the drowned

small tree 6 m. tall.
— Shrub; winter condition.
shrub 1 m. tall; winter condition.
shrub 1.5 m. tall, winter condition.
many-stemmed shrub 2.5 m. tall, catkins present, not yet at anthesis.
shrub 1.5 m. tall,
— catkins present, not yet at anthesis
shrub 1.5 m. tall, winter condition.
mouth of Tributary #1, is largely filled with silt and covered by marsh. The lower parts of this are dominated by tussocks of Juncus effusus, the upper and greater parts by Typha, with clumps of Scirpus cyperinus (vel aff.).

These marshes do not seem nearly as firmly frozen as the open water. The ice here, as well as in muddy places around the edges seems unusually porous, there is a slight elevation in temperature from heat from decomposition of organic matter in the mud.

1961 Washington area.

Feb 22. A heavily overcast day, damp and locally very foggy.

In Washington, in the afternoon, areas where snow was still lying were observed to be apparently smoking - white vapor was drifting up from them in great quantities.

In the evening, during considerable driving around the area south of Falls Church and Arlington and southeast of Seven Corners, fog was locally so thick as to make driving almost impossible. The distribution of the fog was very irregular. It was observed to be much heavier in areas where there was still much snow on the ground. The snow was giving off "clouds of vapor, and where it was piled up the snow piles looked like smoking volcanoes. The temperature was generally warm.

probably at least in the 40's. Obviously the fog resulted from warm saturated air drifting over the snow and being cooled. Of course, clouds, and the irregularity of its distribution resulted from the irregularity of the persisting snow from storms a week or more earlier.

Feb. 26. Great Falls

The water is so high that only one small patch of rocks is showing. The water is a cafe au lait color and smells quite filthy.

Mar. 3 – Route from U of H to Wilson tunnel to Kaneohe & Kailua.

Delonix regia along Wilder Ave.
Foster Garden. Spathodea on corner.
Large banana in Palama
Mango trees Cycas at Kupaka St.
Kamehameha on mountain to right. Casuarina forest above it and on ridges to rt. + left of Kalihi St. on way to tunnel.
Center row of Jasminum multiflorum between highway
Below Casuarina on slope scrub largely of Schinus. more Psidium and Eugenia cumini up the valley.
Scattered Acacia koa, abundant abundant up the valley.
Patches of planted Eucalyptus Eugenia jambos, then forest of Melaleuca, Casuarina, etc. just below tunnel.
View of Kaneohe Bay.
Fluted cliffs with Pyrolandia forest at base of left. Leucaena patches Banana plantations. Large mango trees. Road lined with banana

plantations down to Kaneohe.
Large mango trees and Spondias ? on rt. before main intersection.
Kahekili-Kailua Rd.
Hills on right with Lantana, Leucaena, guava.
Lowlands on right mixed low forest of Hibiscus tiliaceus, Eugenia cumini, banana guava, Leucaena
Prosopis forest at base, low, flat-topped, apparently wind-sheared; undergrowth of Schinus, etc.

Mar. 4 – University to Makiki.
Wilder Ave. –
Punahou – Hybocerus hedge
Row of Roystonea
Kapiolani St. left ward
Victoria – Ficus microphylla (a beginning) on rt. in yard.
Vineyard at Queen Emma's
Fine groups of palms.
Vineyard: ~~Houghtailing~~ Palms on left a Phoenix, prob. hybrid of P. canariensis + dactyl.
2 large banana at Houghtailing to rt. on King, on left several more Phoenix.

1941 Haw. Is. Oahu

Large Fiesta bungalows
on King beyond Kalihi
Moanalua Gardens.
Salt Lake Hill - Kiawe
forest. Leucaena under lays
some Opuntia on left.
Red Hill - mostly Leucaena
scrub, scattered low Prosopis.
Aiea - Cassia ~~fo~~ fistula
and eucalyptus hedge on rt.
as road enters town
Several Cassia fistula in town
Sugar cane fields.
Leucaena with some Prosopis
in waste places around
P.H., but mostly cane.
Waipahu
10:44 Schofield Rd. Jct.
Sugar cane.
Waianae Mts. ahead to rt.
Lower slopes grassy and
eroded in places, mostly
thin kiawe forest, with
cactus + shrubs + grass.
10:48 Barbers Pt. Jct.
Sugar.
Thin good Prosopis forest, dense and
with acacia farnesiana and
interesting dry land plants
Sida fallax
Abutilon incanum
Chloris inflata very abundant
on very rocky ground.
Gossypium tomentosum to road
Nanakuli

3. bluffs on right with
thin Prosopis much cactus.
In Nanakuli large
Calotropis gigantea (white
berry)

Rt. Nanakuli & Waianae
steep bluffs showing
lamination of lava.
edge with grass, etc.
Waianae - tidal flats
with Batis.
Much denser Prosopis forest.
Cliffs with cactus.

Makaha - native forest
and kukui in ravine at
head of valley.
Kiawe forest in debris at foot
slopes
cactus, pili grass on ledge.
Flats beyond - kiawe
forest, pastured.
Lualualei - quarry rock slope.

Water in sand at top
of beach.
Cane.
Kiawe forest
Makua V.
~~Kiawe~~ Kiawe forest.
Kaena Pt. road at base
of cliffs. Kiawe scrub
+ pili

10/1 Hawaiian Is.

Strand flat, with
Sporobolus.
Lower tuff slopes
with Atriplex semibaccata
Lipochaeta, Trisachne
Jacquemontia, Chloris inflata
Heterpogon (Kaena)
~~small trees with~~
Euphorbia
Santalum Wollastonia
Chenopodium
Boerhavia
Low Reseda shrub
also Acacia & Prosopis

On sand dune
Scaevola
Ipomoea
Heliotropium
Euphorbia degeneri
Boerhavia diffusa
Atriplex semibaccata
Dactyloctenium
Sporobolus virginicus
Vitex ~~sample~~ trees
Jacquemontia
Lipochaeta fallax
Ipomoea pes-caprae
Reseda

sea stand. Probably exhumed
a consolidated dune. These
remnants occur at various
elevations, up to base of present dune
(samples)

Oahu

Toward Mokuleia
Leucaena scrub
Some fields and
Casuarina wind breaks
Prosopis - open stands
with Leucaena scrub

The slopes around
Kaena Point are mostly
covered by a leucaena
scrub that in dead in
its upper parts possibly
killed by salt spray
but with prostrate
branches at the bases
of the dead bushes
that are living and
green. The whole vegetation
seems to be in poor
condition (because of
dry season & salt?)

On the windward side of
the point is a great
mass of lava boulders
piled out over a rough
terrace just above high
tide. On this are remnant
patches of what appear
to be beach-rock - bedded
limy sand and gravel quite
case hardened. If beach rock
it is from a previous high

Big Hawaiian Is

Mar. 6 - Univ. To Koko Head.
Leucaena scrub on hills to left of road below Univ. farm
Beyond Kaimuki - Kapahulu Valley - lower part the valley is filled with coral plain - lower slopes covered by scrubby open Prosopis forest. Coral plain built up, golf course + residence area. Formerly cane field. Double highway with Jasminum multiflorum and Lantana sellowiana in middle. Hibiscus hedges. also Nerium hedges.
Wailupe Valley - some native forest and Kukui at head. Slopes Prosopis with considerable pili grass. Some Opuntia.
Beyond - a row of Delonix on left. Bougainvillea on bluff at right.
Niu Valley - Kukui very noticeable at head, slopes or side of scrub (Schinus? + Leucaena?) with scattered Prosopis. Lower slopes Prosopis. Some grass on higher slopes
Hibiscus tiliaceus on right.
Kuliouou V. same as Wailupe, Niu. Ridges badly eroded. Goats?

Kuapa Pond - extensive margin of Batis maritima, but being destroyed.
Maunalua Bay shallow reef.
Koko Head - badly eroded Prosopis and Leucaena.
Koko Crater - Prosopis on base, Grass, some ~~Sida~~ of Schinus near
Hanauma - Prosopis on slopes with loose understory of Leucaena.
Prosopis on flat valley dense, no undergrowth. Cleared for pasture and steep slopes around bay with patches of wind-stunted Prosopis interspersed with patches of grass and eroded areas. Reddish

Walk down path from parking lot*
Weedy veg. of Schinus, Sapium, Alysicarpus, Passiflora foetida, Waltheria, Leucaena, Eragrostis, Trichloris, Bluffs of bedded tuff
Boerhavia repens
Sida
at base Leucaena thicket

Planted Casuarina Cocos,
Ficus microphylla, Malvaviscus
Polyscias guil. + Plumeria
Canna edulis + pavillion.
Cynodon dactylon.
Weeds - Chenopodium murale,
cenchrus, Eragrostis, Eleusine indica
sp?sata.
Prosopis indica.
Argemone glauca
Reichardia
Lipochaeta sp. mentiens complex.
Portulaca oleracea
Setaria verticillata
Cenchrus
Dactyloctenium
Malva parviflora (on sand)
upright, low, pub. above.
Conif. tuft, seeds on it
Mesembria aegyptia
Kyllinga (on sand)
Tribulus (on sand)
Bates maritima (top of beach)
Mangrove plant on beach
Patch of Eragrostis at
base of slopes + end of
beach to right.
(all up through it
Lipochaeta integrifolia
Isola-Depressa)
Heliotropium (green bush)
above -
Prosopis cairica
Portulaca oleracea

Stachys arvensis
Cenchrus echinatus
Eragrostis
Cantaria
Eragrostis variabilis
Heteropogon contortus

Low sand of Prosopis, Acacia,
Cantaria, Trichloris, Leucaena
Pennisetum, Reichardia
Waltheria
good patch of Eragrostis
in eroded place
Gomphia javanica (dwarfed)
Lenses Eragrostis on top
scar with Eragrostis
Cynodon, Cenchrus, Lipochaeta
Heteropogon, Portulaca in cracks
of tuff.

Eroded trail with Prosopis
scrub of Acacia farnesiana

Cassia leschenaultiana
Aganatum conyzoides (dwarfed)

Top of ridge - bare, eroded
down to tuff layer surface -
(clear)
Panicum fauriei
Chloris, Dactyloctenium
Waltheria, Heteropogon, Lantana
Heteropogon, Atriplex,
Reichardia, Lipochaeta
Passiflora, Digitaria,
Fimbristylis cymosa,

1961
~~Cassmelta~~ Hawaiian Is.

wind sheared Prosopis on right

Walking along Kanaunu slope toward sea end - first a very smooth eroded Tuff, then a rubble tract then a grooved & gullied slope.

Heliotropium curassavicum

Fimbristylis, Panicum, Richardia, Cyperus laevigatus, Lipochaeta ~~Tri~~ in spots

First small crater Kanaunu slope dense grass - Chloris, some Atriplex Cyperus. with ~~Ti~~ Sida, Reichardia Emilia - (Sida is prostrate)

Crater floor surrounded by low windsheared scrub of Prosopis

Inside this more grass with Commelina benghalensis

In lowest part of crater solid stand of Marsilea but with considerable invasion of Chloris, Setaria, Xanthium a little, Reichardia, Mariscus, Malva, Schinochloa common, ~~Cathayrus~~

Phaseolus lathyroides
Emilia sonchifolia
Jacquemontia (plant)
Waltheria, Sonchus
Tricachne, Cynodon
Pamplera, Portulaca
Ageratum, Solanum nigrum
Malvastrum

From crater west - striking silhouettes of wind sheared Prosopis on horizon.

4-5 ft of water, mud to edge of beach.

On out toward end of Kolis head, more bare eroded tuff.

Around edges of crater some remnants of ~~Sa~~ silty soil held by grass, and tangled roots of Kiawe - belt about ½ m. from beach intact. then ½ m. more eroding.

Schrebera glabosa, scattered in eroded slopes (appears rare) locally common - seedlings

1961 Hawaiian 9o

leeward slope very eroded. Patches of Prosopis mixed Heteropogon
Chloris in small ravines
Schinus less common
Waltheria, Desmodium, Acacia, Jacquemontia, Atriplex, Emilia, Portulaca oleracea, Euphorbia

Pu'u slope vegetation
Leucaena last struggling
plants are Chloris, Dactyloctenium
Portulaca, Lantana
Panicum or small terrace
Pet with spray on
Thursday up at Keahi
2:30 p.m.
Spectacular wind erosion
Parma sandwicensis
rare in crevices.

Euphorbia hirta, Eragrostis

Hanauma slope
Desmodium, crumbey.
Eragrostis, Schinus
Lipochaeta, Heliotropium
Panicum, Portulaca oleracea
Leucaena, Waltheria
Dactyloctenium
Euphorbia hirta, Eragrostis
pannarensis, Jacquemontia
Panicum torridum

Leeward slope
Vigna marina, Emilia
and much more of everything
else. Heteropogon abundant.
Bothriochloa rare (5 years ago
abundant acc. Lane)
Spectacular wind erosion
in depression running
down opposite crater.

Route back
Crater on left filled
with Prosopis forest.
Along ridge
Asystasia gangetica
Schinus terebinthifolius

slope —
Heteropogon (patchy)
with young shrubs
clumps of Prosopis.

Farm Trip - beautiful
view of coral reefs in
Hanauma Bay.
of Rocks Crater,
of serrate crest of
ridge end of Koolau
Maunalua Bay, fringing reef
Along road
Desmanthus virgatus
Euphorbia prostrata
Crotalaria mucronata

1961 Hawaiian Is.

Road from Hanauma cut through bedded tuffs
Prosopis forest. Scaevola.
Sand flats with
Ipomoea pes-caprae
Heliotropium anomalum

Where road turns in, one
solo Euphorbia left on
rt.
Sporobolus along fence
on right. Weedy flats
with sweet on slope
to left. Cliffs above the
head Hotel Iroquois.
Dryopteris decora on
high ledges.
Abutilon incanum
on left just before
Makapuu Pass.
Mixed pili grass
and more scrub.
Hipochaeta - Scaevola

Stop at base of cliffs
Cliffs with Lonchura.
Scaevola, sweeping from wide
beds, Hipochaeta
Panicum torridum
Dryopteris decipiens
Schedea sedoides
abundant in ledges and
talus.

Oahu

Boerhavia repens
Panicum torridum
Reynoldsia sandwicensis
Argemone glauca var latifolia (new form)
Many weeds
Sida
Cucumis dipsaceus
Solanum nigrum

Canavalia galeata on
with pubescent cvs.
acute small sepals, no
stipels maroon fls with
green keels and erect
radiating cvs from base
of standard.

On down at bulldozed area

Low scrub of Scaevola,
Santalum ellipticum,
Prosopis (very depressed)
Ipomoea indica
I. cairica
Sida
Jacquemontia
Reichardia
Panicum torridum
Dactyloctenium
Hipochaeta integrifolia
Fimbristylis cymosa
Heliotropium anomalum
Euphorbia degeneri
Lycium sandwicense
Cucumis sativus (new)

Atriplex
Lepidium [illegible]
Panicum [illegible]
Dactyloctenium [illegible]
Sporobolus virginicus
Tribulus cistoides
Boerhavia repens + albugo
Ipomoea pes-caprae ssp bras.
Coronopus didymus
Euphorbia prostrata
Anagallis arvensis
Emilia javanica
Stachys arvensis
Portulaca
Verbesina
Plumeria [illegible]
asptasia
on Mauka side top end of [illegible], some [illegible]
Coccinia
Sonchus
Canavalia
Digitaria [illegible]

Mar. 4, 1961 – Lanikai Point, Kailua
41409 Stachys arvensis
1 low cliff just above beach

Mar. 6, – Koko Head
on bare eroded Tuff
1 30 Panicum
common locally
1 31 Nama sandwicensis
very rare in crevices

2 m

weak herb, colorless.

60 m prostrate

70 m flowers purple

41432 Portulaca oleracea L. 40 orange stems and leaves fleshy.
occasional
1 33 Digitaria 60
rare
1 34 Emilia javanica 60 dwarfed by unfavorable habitat; flowers reddish.
common
23
in silty & bottom of crater
1 36 Marsilea villosa
abundant

1 37 Euphorbia 10 cm prostrate, purple.
common on roadside

March 6 - flats northwest 6 m.
of Makapuu Head, on
windward side
1 38 Cocculus
common among lava rocks
Twining, flowers greenish white.

March 7 - Manoa Cliff Trail 420 m.
1 39 (Ramos)
forming a dense brake
~~shoots~~ culms widely spaced, erect, 5-7 ~~cm~~ thick dark green, internodes rather long.

March 8 - Ridge north of 425 m.
Ofaeaia Gulch, Koolau Mt.
Open wet savanna-like flat.
1 40 Rhynchospora
occasional
1 41 Orthosteamma Eatofolium O. Ktze
very common
erect. petals 4, green, caducous, about 1 cm. across.
1 42 Lactuca exotica
common on bare cut banks
along trail.

1901 Hawaiian Is

Mon. 7 - Manoa Cliff Trail
entrance to trail
view of Lowland
on left Psidium cattleianum
and Eugenia jambos in
fencing of along trail.
Acacia and Acacia koa
overhead.

Thicket of Lantana
Forest of Psidium cattleianum
Occasional large koa
trees.

Large patch of Lantana
camara on gulch sides.
Lantana along road
borders & underbrushing
[illegible] and mass
of Eupatorium riparium
in banks.

Seems to be about
up border bet. koa and
Lehua zone. Bunches
of ferns frequent.
Much shade of forest.
Some Sleichenia.

Cuba

Pause 7 cats trail from
gulch
down hill part wood
Pinning trees, mtn flat
covered with planted
forest of several species
of Ficus, several Eucalyptus
Melaleuca and Lagerstroemia
species etc
Large patch of bamboo
Thick guava forest to
pass overlooking
Nuuanu Valley. Up
road to left
gradually terminals in
Araucaria, Pelea clusiaefolia
(Hbr.) several forms of
Metrosideros.
Down the draw towards
Pauoa road by a wash
with pressed formations
of tuff, & Pennisetum
purpurascens.
On slope of gulch
a very heterogeneous
population of Metrosideros
with Wikstroemia
sandwicensis, Acacia koa
gaudichaudiana, about
at acres 5 woodsia, and
fern sky at least
3 kinds between them.

mar. 8 - Honolulu to Pranohs
Cane fields. Some Eucalyptus plantings and Pineapple fields
Kipapa Gulch
Pineapple fields + Eucalyptus
Wahiawa. Araucaria
Gulch beyond pineapple stand - steep sides have some native plants -
Osteomeles, Dodonaea, Leucaena ~~fructa~~ sericea!, Metrosideros
Mainly guava and Leucaena.
Panicum purpurascens.
Aleurites.

Opaeula Gulch
lower part Metrosideros
ostearneler, etc.

1100' Heckt pasture is in an old planting of Eucalyptus and Cupressus macrocarpa.
Road above this through fields with scattered Koa. Panicum pratense
to sharp turn in rd. Then small road up ridge to end. Trail from here on ridge.
Eucalyptus on ridge.
Good Koa forest on sides of gulch, Kukui in bottom, some small Koa trees & starting from trail.
Psidium cattleianum

Osmanthus
Along trail -
some Eucalyptus planted
a Acacia koa
o Pteridium aquilinum
c Psidium cattleianum
c Trachytarpheta dichotoma?
subshrub, slender stalk, obtuse-acute lvs, not sharply serrate.
so. Melinis minutiflora
o Stylosanthes tamerameya
c Lantana camara
c-a Setaria geniculata
la Dalechampia linearis (Forbes)
o Cassia leschenaultiana
c Metrosideros collina
c Sphenomeris chinensis
c Andropogon virginicus
c Emilia sonchifolia
o Spathoglottis plicata
o Bidens pilosa
o Sida rhombifolia
lc Chrysopogon aciculatus
lc Axonopus compressus
lc Baccharis ~~indica~~ contracta
o Cuphea carthagenensis
c Santalum freycinetianum
o Osmanthus sandwicensis
o Passiflora edulis
o Aleurites moluccana
o Scaevola gaudichaudiana
△ (e) Nephrolepis exaltata
●o Pastalum orbiculare
o lc Dianella sandwicensis

c Freycinetia arborea
Gibbsiana
Paspalum conjugatum
2 Euphorbia multiformis
Erechtites hieracifolia (purple)
Erigeron terminalis
Rubus rosaefolius
Wikstroemia sp.

Camp 4.
flat ridge top with
Clerchenia, Cyrtandra
kauaiensis, scattered
Sapindus, Metrosideros, big
trees grassy areas
with much Andropogon
Rhynchospora Paspalum sp.
Wikstroemia (rare)
Grevillea robusta

flat erosion remnant

return
Pleomele aurea
Broussaisia arguta
Clermontia kakeana
side trail
Eupatorium riparium
Ageratum conyzoides
Conyza bonariensis

1200 rolate descent —
Path cut and
wood on upper side covered by Panicum purpurascens surrounded by large acacia koa trees with Metrosideros + Alengitas (try with pale leaves & opposite ear)
Walk along ridge through open acacia koa-woodland - some planted eucalyptus at first. Many weeds along trail + Andropogon Chrysopogon and Eleusine
On steep slopes dense koa is generally dominant but with scattered Dianthus, Psidium Cattleianum, Metrosideros and, on right, small clumps of Santalum.
Start up the trail Freycinetia a pipeans, towering in trees + some epiphytic Nephrolepis, but very few epiphytes here. Cocos a gaiola Araucaria, Pandanus appear. Great patches of Erigeron terminalis and Euphorbia [illegible] quite tall bottom at 1

on slopes & ridges of Waianae. Forest thru ~~up~~ pale against the general dull green of the koa and ohia. Bright green splashes are patches of Eucalyptus really small trees a bunch of 11 skatterers Thimbuff about 1 mile to small camp.

1400-1500' Here this is an open savanna of Ohia trees and grass, with abundant scattered Leucaena, some Metrosideros, koa, &.

Upper small road is thru open woodland of koa some ohia and Leucaena - many Lantana, Andropogon.

Before hairpin turn - cut with weathered hollow basalt.

View of Waianae Gulch with small Metrosideros wood on near slopes. Guava, Lantana and mango trees, also in bottom, koa on slopes, bushes in draws opposite with

900-1100' slope from reservoir has some ohia, many weeds. But also Crotalaria, Walsteinia, Leucaena, Leucaena grand. Verbesina, Stylosanthes, considerable Metrosideros, scattered Cupressus, Grevillea, Psidium cattley, some koa, ~~some~~ wooded - coffee, Osmanthus, Eucalyptus.

Turn mauka ~~at~~ Haleiwa ~~Haleiwa~~ super market & small church. & bet. 2 bridges W/ Haleiwa Theater

In Aiea - taro patches makai of old road.

March 9 - Poamoho Trail

Pineapple fields - these fields not cultivated, panicum and scattered acacia koa, many planted albizzia etc.

Then gulch with some native trees - i.e. Cibotium, tree ferns, Metrosideros.

Then a fine forest on both sides of road with much Cibotium, Dicranopteris, Metrosideros, Acacia koa, Cheirodendron, Clidemia hirta common along road, also Psychotria hawaiiensis, Pipturus, Broussaisia, Dubautia laxa, Machaerina angustifolia, Dicranopteris, Antidesma platyphyllum, Coprosma ochracea, Vaccinium calycinum, Cyrtandra, Hedyotis acuminata, Sadleria cyatheoides, Athyrium, Dryopteris, Lycopodium cernuum, Lycopodium clavatum, Adenophorus, Selaginella deflexa, Lycopodium venustulum, Lycopodium phlegmaria, Lycopodium serratum, Lycopodium cf. squarrosum, Lycopodium cf. carolinianum, Lycopodium cf. phyllanthum, Lycopodium cf. verticillatum, Lycopodium cf. gnidioides, Lycopodium cf. volubile, Lycopodium cf. dichotomum, Lycopodium cf. nutans, Lycopodium cf. cernuum, Clidemia, Andropogon, Dryopteris, Lobaria sedifolia.

Good example of this at turning place at end of trail - starts through a grove of Acacia koa. Specimens - Dryopteris on steep bank on left.

Wild Sp. Rubus rosaefolius at base of banks, also Athyrium, Dryopteris, Juncaceae (French Alps)

small-landslide area Flueggea, Dryopteris, Metrosideros exsultata, Machaerina angustifolia and M. mergenii, Acacia koa, Cheirodendron and a

At the bottom of a small ravine a clump of bananas probably persisting from old hawaiian times. At upper edge of this a large Cyrtandra of viridifolia? and Cibotium chamissoi. Juncaceae along trail. Immediately on right Freycinetia, Antidesma and Pentatetra.

Then a large tree of Bobea elatior with epiphytic Asplenium, Peperomia, Astelia, Nice view from below.

All within 3/4 m. of bananas.

Then several saplings of Bobea sp. and a number of large Metrosideros with epiphytic Asplenium and Elaphoglossum

Acacia koa 1 mile

immediately above and Elaeocarpus bifidus about 100 m. Eugenia sandwicensis on right.

Clidemia 1 yd. at top

Then a small fresh
and wide, fine Excellent
example, I would say
on below Crazy, opposite
side of road. At crossing
a clump of Jasmin Cadup
several small Pelea. Then
a Magnif. small Metrosideros
& beyond, fine, on left
a small fine agoma tree and
a Pandanus (large
a mass at top.)
Left numerous in bunch of
right and Gleichenia
~~Flu~~ & Lanea
Immediately on left a
Doodia terminalis, appr.
var. crinacea, fine fronds.
Then, excellent Dicranopteris
and waterfalls and
right Davallia and Sphenom.
Across & left Colonies of
large fine commune only out
of Gulch, at (ranged at top
Psychotria (Straminea)
cf. mauiensis (white fl.)
& large less prom. beyond
to left.
on rt. Gardenia remyi
several m. off trail in Gleichenia
clear. Colony of Doodia
terminalis var. crinacea

when
dead
covers
bark
on it
red

1100 m.

Then a nice view of
Gulch on right at curve
in trail. Just above on
left a small clump
of Pelea cumingiana and
just beyond on rt Pelea of
fraxinifolia sent to Hawaii
200 m. on down on left some
large Calamus and a
clump of Psidium attleyanum
and Clidemia.
Just beyond, on left,
euphorbia & rock in
tangle of Gleichenia, etc.
Steep slope below with
Gleichenia with Doodia
term v. crinacea, Pelea rt.
~~Psychotria~~ Robea elatior, and
down 30 m Acacia mollis.
Beyond this a small
landslide scar with
Nephrolepis hirsutula
Andropogon along trail
then down to right Myrsine
& Pandanus
Robea elatior on right.
behind it a Cibotium with
Lycopodium phlegmarium
on brown trunk.
100 m down a large glaucous
Pouteria
Then on left Gleichenia glauca
down below mainly top
Psychotria & Hedyotis.

large koa, below on right an area of ohias and koa forest.
Just beyond, some Freycinetia and some Pandanus.
Low part of trail - muddy Pandanus etc. Sadleria etc.
Several hundred yards along just before another Hierochloa slope -
Pattosporum sp.
On left and then again on right Pittosporum
Syzygium sandwicensium
Wikstroemia sandwicensis?
Leaves 2-3 cm wide
Under a large mesophyll decurves the trail around a curve a Broussaisia with root-like shoots growing out into trail.
Trees have epiphytic Freycinetia. Etc. etc.
Well beyond this large curve another Cibotium glaucum and Dicranopteris
Epiphytes abundant Polypodium tamariscinum several kinds.

Great slopes of Hedychium with large Broussaisia and koa
Just before a man-made flat area a bit on right of Clermontia parviflora.
Hypolepis sp. Dicranopteris
Broussaisia Dicranopteris
under Cibotium etc.
Descend, curving around through mesophyll to left.
Then a brown cliff with Cladonia Sphaerophorus etc.
100 yds. beyond rest. a hybrid Deschampsia wolfii x gaud. like Gaud. people of Cr.
At a sharp left turn on right Argyrio Broussaisia in small Gleichenia patch.
Scattered along Trail Cyrtandra Pelagicum.
On rt. at turn Touchardia on left, Pittosporum rt.
Pleuroneurum accidentale on bark on left.
Native bananas in gulch below.
Well along on left a small seep with a Tuber with spectacular display of Elaphoglossum sp. & Polyspodium spectrum

Ridge on r. Hedyosmum and a tree with Psammisia and Polyhodium. Araceae. Rain forest.

Then ridge on r. Cyathea Weinlandii common and fairly common.

Apollias tenuis common. Also Palcua heleconioides. Platydesma appears.

Occasional bare rocky prominent escarpment even more common locally than the rainforest

Rain forest is by common Forest generally at this alt. - rather degraded. open and filled with Gleichenia Hymenophyllaceae on trees.

A great new landslide scar below Trail. Beyond this the forest is in better condition, but still not very good. Rare tree fern here. Probably Cyathea abundant.

Along Trail Sarcopalum conjugatum Centella. Psidium on cattle.

Forest of Eugenia, Metrosideros, Cyrtodeira, Acacia, Gouldia, Perrottetia

Cyathea Weinlandii common Leptopteris ? Hymenophyllum (?) on ridge

Cliff on r. along ridge

Cyathea abundant

Clermontia arborescens.

Cyrtandra cinnabarina ; a C. of Lanai(?) also Hypolepis on right.

Coprosma longifolia Campylopus extends down to Kapiolani Park.

Rare large Clermontia arborescens.

Across valley to Cyathea. Examples of Pritchardia. Large new landslide scar.

Then across to other side of ridge. Machaerina angustifolia common.

Elaeocarpus on cliff.

Leptospermum abundant planted and forming pure stand locally.

Trachyandra distichophylla on boulders. Cibotium glaucum on left.

Dubautia laxa overhead.

Trail goes up ridge. Veg. diverged and secondary. Sadleria, Psychotria, Pelea, Gouldia, Myrsine

1961 Hawaiian Is.

Metrosideros dominant

Lots Leptospermum in very abundant.

Rose-cranberry, Gaultheria,

Pass over to rt. side of ridge. Then on top again. Ph. Clotoxa Pandiflora. Dwarf in Bidens. Open to left side.

Large tree with 2 sp. Hymenophyllum Polypod. torn. Thelypteris. a rosulate monocot. Lepto. Hymenophyllum. a rosulate Wilkesianum. Jamesia Metrosideros. Cheirodendron latifolium. Machaerina ang. Dubautia laxa. Vaccinium, Gaultheria cymbifolia, flesh. Perrya, Hedyosmum arbuscula, Pelea longifolia, Styphelia grand. Clotoxa Wilkesiana, Myrsine Degeneriana, Cyrtandra Hymenosporum, Freycinetia, Cheirodendron, Lysimachia all make up dense 2-3 m scrub on high slopes.

Ends rich. Clear up here.

Tetraplasandra on left

A ~~few~~ Tetramolopium alpinum trail

This area seems fairly good Closed Forest.

Many Leptospermum Tetramolopium

Pritchardia next to trail on left.

Cheirodendron with Wikstroemia Pritchardia over trail.

Hedyosmum arbuscula Ph. Gaultheria Hymenophyllum tunbridgense, Polypodium pellucidum, Thelypteris, Machaerina, Dubautia laxa, Vaccinium, Styphelia, Gaultheria, Broussaisia, Cyrtandra, Pelea, Myrsine.

Right over into a ravine with Closed scrub-forest containing Cheirodendron, Metrosideros, Gaultheria, Broussaisia, Cyrtandra, Pelea, Myrsine.

Bivouac spot.

Summit trail on other side of ravine.

Turn left. 210 m.

Boggy marsh in flat bottom of draw.

Ground very depressed. Lycopodium cernuum in boggy spot on left. Gaultheria, Vaccinium, Much Machaerina.

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Oahu

Gap at head of Kaau
Shaw is loading, bad ripples
and converted to grass.
Centella, Freckletia, etc.
On crest Vaccinium dentatum
Metrosideros, Broussaisia
Dicranopteris, Gleichenia
Paesia, Odontosoria,
Elaeocarpus, Pelea crenatifolia,
Tetraplasandra, Platydesma,
Labordia.

Low dense scrub
Dodonaea eglandulosa, Pittosporum
Myrsine, Nothocestrum,
Rhodomyrtus, Bidens,
Metrosideros (negra ?), Gouldia
Plenomeris, Phyllostegia
grand. ext. Trematolobelia,
Lagenella mannii
Labordia cyrtandroides,
Hillebrandia. Pisonia
Empetrum rigrum
Hedyotis centrostachys
Labordia, Gouldia st-johnii
Xanthoxylum.

Panicum, Nertera, Plantago
Peperomia, Bidens, Isodendrion
hillebr. on boggy ridge.

March 9 - Head of Punaluu Valley. 800 m.
just north of head of Pinnacle Trail
on wet windswept crest with
low scrubby vegetation

4 1443 Vittaria robusta — epi-7, caespitose
5 rare, in shelter of bushes,
terrestrial

2 44 Eugenia ~~[illegible]~~ Cordaucana Deg. — shrub 0.6 m. tall, fruit red.
occasional

1 45 Labordea — shrub 1 m. tall, flowers yellow.
rare

1 46 Cyanea — leafy stemmed shrub 0.7 m.
rare — tall, fruit yellow, fleshy.

3 47 Coprosma longifolia — shrub 2 m. tall, fruit
common — immature, fls pale green.

1 48 same 1.5 m tall.
flowers pale green with
red purple stigmas.

4 49 Broussaisia arguta [illegible] — weak shrub; flowers white.
shrub 1 m Tall

3 50 Dicranopteris pectinata — occasional along trail

3 51 Hicksia villosa (H. & A.) Gray — shrub 1.5 m tall; leaves
common — very rugose above, veins
red beneath, calyx green
white.

4 52 Vaccinium dentatum Sm. — shrub 0.3 m. high, much
occasional — branched; flowers red with
green tips; fruit red.

March 9. - Pinnacle Trail — 775 m.
near Waiau crest

1 53 Selaginella arbuscula
occasional on vertical mossy bank along trail

March 9 - Pinnacle Trail, Waiau-Manana — 601 m.

2 54 Lycopodium [illegible]
in Metrosideros forest

2 55 Cladonia
abundant on cut banks

March 1 - Manoa Cliff Trail
(from Nuuanu Pali Dr. end)
Row of cordyline terminalis
on left of entrance.
On trail proper - a strangling
fig (Ficus sp.?) on an
Acacia tree overhead.
Some large Acacia koa overhead
and Aleurites moluccana
on right. Trail grown up with
Setaria geniculata.
about 100 m. from entrance
Tricpiscia in ft., Persea
overhead. 2 introduced Elaeocarpus
above on left. Agapetes lowtoniana
on trail. Epiphyte on a Psidium
guajava. Passiflora edulis.
Stachytarpheta sp.
Koa and Sadleria overhead.
About 100 m. more or less dense
bamboo grove - beyond this
a Sadleria forest on rt. Lantana
on trail and Rubus rosaefolius.
Bananas on right
At first bend - some small
~~fern~~ Cibotium above on left.
Commelina diffusa on small
flat place. Then guava on rt
below. strawberry guava on left.
a Cibotium on rt. Psidium in
trail. strawberry guava
becomes abundant 100 m
beyond bend. Gleichenia
lin. on left just before second
bend.

take left fork at the end.
Then strawberry guava brush.
Stachytarpheta in ft. Lantana
Passiflora Piper - Psidium sp.
Sadleria, Metrosideros polymorpha
Casing Koa. Then guava
brush for considerable dist
with koa. Frequent
Thisis multiplex koa forest.
Coming out of extensive
guava one encounters a
patch of Cordyline,
with several large guavas
above trail and Metrosideros rt.
Then bare trail lined
with Eupatorium. Some
guava brush with Cordyline.
Then at a sharp left turn. First
small Sadleria forming
a sward below trail, also Lycop.
multiformis and Sphenomeris
chinensis Bidens.
Open mixed scrubby wood
of Sadleria & koa. Just beyond
a large koa hanging over
road Psidium station on right
and a thicket of Pteris (Pteridium)
sp. Sadleria. Around a small
bend, under an Aleurites tree
several Cyanea magnicalyx
mostly below trail. A little
farther, a slender Cyrtandra long.
Cheilanthes viridis
begins to appear on bank to left.

1961 Hawaii Trip

50 m. beyond bend keavola
gaudichaudiana above trail.
among clearing Metrosideros -
there showing variation
narrow lfs. forms here.
Just beyond this a large
rock on left, then Rubus
rosifolius below trail
several rods. Beyond this
clump, several branches of
Cyrtandra platyota - recent, compact,
rose-red leafed. Plagiochila many
common on rocks above trail,
Hedyscus common. Occ.
Lycopodium.

A little way on an open
lava stand with frequent
ground cover of Astelia pallida.
Psiadia scant below trail.
Several Bobea elatior below trail.
This lava stand continues
for some distance with scattered
Lobelia, Keavola, Psychotria,
Psiadia, strawberry guava etc.
Frosty trees below are Rubus.

Sharp bend to left - Cyrtandra
variabilis on rocks, Bidens, also.
Sphenomeris. Blechnum. Asplenium
Large lobelia with curled lvs.
below trail. Mixed scrub
on steep cliff-like slope.
Large Lycopodium common
in open grassy spots.
Around another bend is

an open lava stand with Lycopodium
on right. Then a few 2-formed
trees of Pouteria sandwicensis.
Then a broad open area with
grass and Psiadia. Frequent
Broad leaved Hawaiian
type slope. Keavola common.
Occasional white PCH. Santalum
below.

The trail bends to left &
straightens out across stone
with Rubus. Left a few
Keavola above.
Beyond this Pouteria and Bobea
more in opening of the Waipahu
Valley of Rubus forest below.

Along a curve to right & left
open lava ground with large trees
mixed. Frequent Psiadia Rubus
rosifolius. Lobelia from
ground cover.

After a couple of hundred m.
to right. The trail bends
sharply left. Just before
this a Lobelia tree leans
over trail with a clump
of epiphytic Peperomia and
wisps of Vittaria.

From here mostly
lava, open with Lobelia -
some grass and patch
of Rubus below. for 100 m.
Then bamboo grove above trail -
Then a patch of Lobelia, with
Keavola and Psychotria

Then boxa again, with below trail, several Pouteria (coppery young growth) also a small dutidezma plat.

A little way on an ext. melastom & Perotetia on left Athyrium proliferum.?

Then last guava trees & Cordyline. Beyond guavas Antidesma tree with Drosera burbifera & small bananas below trail. A few -yanthera Elaeocarpus bifidus below trail. Then curve to left with patch of Lobelia, boxa & Elaeocarpus. Perotetia hanging over trail, then guava forest.

Through this, a curve from which upper Manoa can be viewed, and Konahuanui if clear, is Psych. mariniana scrub on right. A bit beyond this a small gouldia Term. var. coriacea grows at edge of cliff. Then Diospyros ferrea v. sandw. also on cliff. Open cliff with Cordyline. Mixed scrub above with Dubrantia plantaginea. In a small clump of wood is Hibiscus, Perotetia, boxa, Piptrarus albidus. Then more Cordyline on cliff. Zingiber zerumbet in trail.

Next small clump of woods is Hibiscus & Lobelia, with Paederia foetida.

Then grassy clearing with some native plants - Gouldia, Hedyotis acuminata, Perotetia, Hibiscus. In first small opening, Charpentiera & one trail a few m. beyond next small opening, Osmanthus sandw. tree on it, mixed with Citharexylum which looks almost same as it.

Sharp turn to left. Then mixed boxa, Lobelia, Hibiscus, with much guava. Around a curve more Cyanea angustifolia above trail.

A bit farther, at a small bridge, in a guava thicket some small Wissadula sp.

Then boxa with Euphorbia, Hibiscus, Perotetia, Gouldia, Cordyline, Psychotria, Perrea, etc. beneath.

Open slope with Cordyline, Lobelia & other bushes, much Eupatorium. At other end a little Eupatorium adenophorum.

Then guava thicket, some native plants, much Cordyline. Considerable walk through this, then several small

19 200 1961 Hawaiian Is..

bromeliad plants and Touchardia, on left. Fern covered rocks above with Adenophorus, Selaginella + large Lobaria. Embelia hanging over trail.

Wide savanna with Touchardia, Dodonaea, cordyline, Coix, Colocasia, and Cyrtandra cf. cordifolia Prob. old Hawaiian cultivation.

Guava forest. Then ~~grassy~~ opening with Freycinetia, Pteridium alba and Clermontia Kakiana-this at least 7 large leaning koa on rt. Ilex anomala just above on left. Several more Clermontia on rt.

Much Freycinetia in this koa wood. Much Hibiscus. Large Pisonia on small wooded ridge top to left.

From here on more lobelioids than koa.

Open slope with views of Manoa + mts. Pteridium patches on spurs. Arboretum. planted forest in valley below. Brushy cliffs. Lobelioids + hapuus with both Cyrtandras

Patch of wood with koa, Hibiscus, Antidesma, lobelioids, Cordyline, Cibotium, around shoulder curve + down (Telephoto). Dead koa on rt. Small epiphytic Nephrolepis exaltata. At next small curve Psychotria hexandra bush to rt. Large membranous stipules.

Guava-lobelioids forest. Athyrium ~~Dryopteris~~ patch on left.

Guava-lobelioids forest. Down slope into ~~the~~ lobelioids-koa forest, mostly Ilex anomala, Clermontia, Pennantia + Zanthoxylum. Cibotium abundant. Antidesma + Psychotria (& Pisonia)

Main trail. (Rt. to Manoa down slope through koa-guava) Take left fork. then immediately another fork - left goes up Tantalus straight ahead around Tantalus. Take this. Through ~~guava~~ forest with ~~koa~~ guava, Pamakani esp. adenophorum. some lobelioids changing very soon to almost pure guava. with ground cover of Commelina diffusa. Occasional patches of Cyrtand. and Coix. Switchbacks. Blechnum occ. on banks. Nephrolepis cf. cordifolia or exaltata

abundant
Boulders + outcrops on left bank
Trichomanes saxifragoides, Adiantum cur.
Patches of Sadleria (cornutum
+ flavum). Thelypteris parasitica

Region Pauoa trail
Polypodium thunbergii + Pepromia
reflexa on large rock, also Trich. sax.
Adiantum on mossy rocks in left
sudden change - lava to black sand.
Selaginella abundant in black sand.
Kukui forest in spots
with Lecua, Elaeocarpus, Ilex
Psychotria, Antidesma, Aleurites
Freycinetia etc. on one straight
stretch of trail. Then more
guava forest. Persea, etc. planted
in it. Large kukui &
various planted trees. Then
thickets of coffee.
Stretch of guava forest. Then
kukui forest with planted Albizzia
falcata(?), then kukui in draws,
guava on ridges, occ. koa, lehua,
kukui in guava forest below to st.
Some areas have Psidium albidus.
Pogerstroemia planted, scattered
koa.
Eugenia jambos
Views of airport + Pearl Harbor, Barbers Pt.
and Pauoa V. Honolulu Harbor
Many exotic trees planted along
last part incl. Persea, Cryptomeria, Fiscus
Acacia, etc. Hibiscus tili. on road-

1 1/2 mi. bet.
entrance
much Hib. til. on upper
Round Top Dr.
+ great display of exotics.
Round top slopes covered
by Leucaena scrub.
Black sand quarry
on rt. on way up, fine
bedded black capilli
tuff or "black sand"