INVENTORY AND MAPPING OF WETLAND VEGETATION IN THE TERRITORY OF AMERICAN SAMOA

by

W. ART WHISTLER

BOTANIST

prepared for

THE UNITED STATES ARMY CORPS OF ENGINEERS

PACIFIC OCEAN DIVISION, FORT SHAFTER

Contract # DACW84-76-C-0013

submitted

APRIL 1976

INTRODUCTION

The preservation of our environment is a vital and growing concern in the United States. As population pressure on the land grows, irreversible changes are wrought on the natural landscape. Of all these changes, none have been so drastic as those made upon our wetlands. The National Wildlife Federation estimates that today over one-half of the original wetlands has been destroyed.

In response to the growing concern about pollution and the irreversible loss of wetlands, Congress passed the Water Pollution Control Act of 1972, the purpose of which is "to insure that the chemical/biological integrity of water of the United States is protected from the irresponsible and unregulated discharges of dredged or fill material that could permanently destroy or alter the character of these valuable resources". Under Section 404 of this act the U.S. Army Corps of Engineers has been vested with the authority to regulate the discharge of dredged or fill material in the wetlands and waterways of the U.S.

Included in their area of jurisdiction is the Territory of American Samoa, which consists of seven islands with an area of approximately 76 square miles. Little was known about the size, extent, or ecology of the wetlands of American Samoa, or even what constituted a wetland in this island group. So to assist in the implementation of the regulation of these areas, the U.S.Army Corps of Engineers commissioned a survey and preparation of a report on the wetlands of American Samoa. There were three main objectives of this report: (1) the compilation of an inventory of wetlands in the Territory and delineation of their boundaries; (2) the preparation of a list of the characteristic plant species for each type of wetland; (3) the preparation of a field guide to wetland species and vegetation.

The opinions, findings, and conclusions expressed in this report are those of the investigator and are not necessarily those of the U.S.Army Corps of Engineers. The investigator wishes to thank all those individuals mentioned in the list of personal contacts, as well as Dr. James Maragos and Mr. Michael Lee of the Environmental Section of the U.S. Army Corps of Engineers in Honolulu for their great help in the preparation of this report. Special thanks go also to Lani Stemmermann for her able assistance in the preparation of the final report, and to Ismael Trono whose excellent illustrations of wetland plant species are included herein.

TABLE OF CONTENTS

METHODOLOGY

In January of 1976, a two week botanical field survey was made of the wetlands of American Samoa. Previous to this survey, the investigator had made a literature search for information pertaining to the vegetation and flora of American Samoa. Karl Rechinger (1908-11) made the most complete description of the types of vegetation in Samoa with the characteristic species associated with each type. This work, written in German, includes descriptions of mangrove forest and streamside vegetation, but not of the other important type of wetland--the coastal marsh.

William Setchell (1924) also wrote a description of the vegetation of Samoa--specifically of Tutuila. The mangrove forest was discussed, but no mention was made of the other wetland types. In Western Samoa, A.C.S. Wright (1963) discussed vegetation types in his work on soils, and in a report for the Western Samoan Government, Holloway (1975) listed sites of coastal marshes and mangrove forests for possible inclusion in a national park scheme.

References on the flora of Samoa were consulted in order to determine the distribution of known wetland species. The best sources for this are Christophersen (1935 and 1938), Setchell (1924), Yuncker (1945), and Reinecke (1898). Christophersen cited one species (Erythrina fusca) from Tutuila that was not found in the survey.

Wetland sites on Tutuila, Aunu'u, Ofu, Olosega, and Ta'ū were visited by the investigator who was usually accompanied by a local representative, graciously provided by the Public Works Department of the Government of American Samoa. Local informants were questioned at many of the sites about the plants and their Samoan names. Names that were known to be incorrect, based on the previous experience of the investigator, were scrutinized and questioned, so as to avoid misinformation. Correct Samoan names for plants have become harder to obtain as the Samoans have become less dependent upon the land due to the increasing Westernization. Incorrect guesses are often substituted for knowledge, or the informants may simply be mistaken. Some obviously incorrect names have been perpetuated in this way by unwary botanists who have published them.

All species at the sites investigated were listed, and their relative abundance was noted. Voucher specimens were collected for each species and photographs were taken (See Photograph Index). Rough maps were made in the field which were later compared with aerial photographs taken in 1971 in order to record the extent of the wetlands on maps in this report.

While in American Samoa, the investigator was given valuable assistance by Mr. Robert Page, Assistant Director of the Special Projects Division of the Public Works Department, who provided transportation and contacts on the outer islands, as well as information about many wetland sites. Don Graf, ecologist for the Government of American Samoa, was also contacted and provided useful information.

Few individuals in Samoa or elsewhere are knowledgeable about the Samoan vegetation. At the time of this report, however, there is a wildlife and vegetation survey in progress in American Samoa slated to be completed at the end of 1976. Mr. A. Binion Amerson, Jr., the ornithologist directing

the field work for Environment Consultants, Inc., provided great assistance and information, particularly concerning the birds associated with the wetlands. John Kuruc, the ecologist working for the same project was also most helpful in providing valuable information about the vegetation of the wetlands he had studied or visited.

TYPES OF WETLANDS

The natural wetlands of American Samoa can be divided into two main types--mangrove forest and coastal marsh. Wetlands, for the purposes of this report may be defined as "those areas having wet, marshy soil conditions frequently inundated by or covered with fresh, brackish, or saline water". Since the rainfall in Pago Pago and the surrounding area is over 200" a year, much of the rain forest which is the natural cover for most of the land surface has relatively saturated soil. However these are not really "wetlands" and are not included in this report.

The area of wetlands in American Samoa is relatively small--approximately 223 acres. This amounts to about 0.5% of the total land area. There are also several areas (e.g. Malaeimi Valley and Alao) where the removal of the natural forest cover has resulted in the creation of muddy or saturated soil conditions. These areas, along with the area of streamsides, which are nearly impossible to measure, are not included in the 223 acres.

MANGROVE FOREST

The mangrove forest is the major type of wetland vegetation found in American Samoa. The term "mangrove" refers to a tree that lives in loose, saturated salty soil, produces breathing roots, and reproduces viviparously by means of seeds that germinate while still on the tree. Mangrove forests are generally thought of as being strictly tropical, but they extend into temperate regions such as Bermuda (32°N) and Chatham Island (44°S).

The habitat that mangroves occupy is rather restricted--the site must be on a coast protected by coral reefs or offshore islands. They grow mostly on muddy shores of sheltered lagoons, mudflats, and along estuaries where sedimentation is occurring. Mangroves are obligatory halophytes in that they are found in brackish or salt water, but under experimental conditions they may do quite well in freshwater. In nature, however, they cannot compete with the more vigorously growing trees of the coastal and lowland forest except where brackish or saltwater conditions prevail. Only the mangroves can tolerate the salty soil conditions, hence they occupy and dominate this unique and restricted habitat. In Samoa they are found from slightly below the high tide mark up to an elevation of about 5 feet.

Two species of mangrove are found in Samoa. By far the most common one is Bruguiera gymnorhiza,"the Oriental mangrove". It is easily recognized by the numerous knobby breathing roots spreading out on the ground around the base of the tree. It reaches a height of 20 m or more and forms remarkable forests which exclude nearly all other trees.

The other mangrove species is Rhizophora mangle, the "red mangrove". It is more of a pioneer species than Bruguiera and forms a narrow strip on the seaward margins of the mangrove forest. The only large stand of Rhizophora in American Samoa occurs at Pala Lagoon where it forms a band of vegetation along the western edge of the Nu'uuli peninsula between the village and the lagoon. It is rarely more than 5 m high in American Samoa, and is easily recognized by the numerous stilt roots it produces.

Several other tree species, although not mangroves, are associated with the mangrove swamp. Hibiscus tiliaceus, the "beach hibiscus", is found there, but only in marginal or slightly elevated areas. It is a tree of coastal forests, secondary forests, and streamsides, so it shows a great deal of ecological flexibility. Less commonly found is Inocarpus fagifer, the "Tahitian chestnut", which is cultivated for its large edible nut. It is not characteristically a wetland species, but more commonly is found in cultivated areas and is naturalized in lowland forests. Another tree is Xylocarpus moluccensis, the "puzzlenut tree", which is relatively rare in Samoa. It is characteristic of rocky coasts and the margins of mangrove swamps; in American Samoa it is known only from Nu'uuli and Aunu'u. A fourth tree is Erythrina fusca which is found in coastal swampy areas and streamsides near the coast. It is very rare in American Samoa, having been collected only once--at Leone in 1929.

Acrostichum aureum, the "marsh fern", is commonly found forming thickets or large clumps on the margins of mangrove swamps as well as in other coastal wetlands. On the margins of the swamp and along estuaries the grass Paspalum vaginatum commonly forms large spreading clumps or mats.

Under the canopy of the mangrove forest most of the surface is mud or standing water with the grotesque breathing roots protruding everywhere. The only seedlings that are able to establish themselves in these shady and saline soil conditions are those of Bruguiera. The only other plants found in the swamp are epiphytes growing on the trunks and branches of Bruguiera trees. These are primarily orchids, ferns, and mosses.

To go along with the monotonous floral aspect of the swamp is the obvious absence of animal life. Crustaceans, molluscs, and fish are found there, but birds and other higher animals are few in number. The stillness of the forest, the pungent smelling mud, and the monotony of the vegetation combine to give one a gloomy and distinctive impression of the mangrove swamp.

There are eight locations in American Samoa where mangrove forests occur. Their total area is approximately 127 acres. Only five of these mangrove forests are significant, as the ones at Aua, Vatia, and Alofao have a combined area of less than 1 acre. No mangrove forests are found on Ofu, Olosega, or Ta'ū. The five major sites are described as follows.

Pala Lagoon: (Maps # 2-6)

By far the largest mangrove swamp in American Samoa is the one surrounding Pala Lagoon, between Tafuna and Nu'uuli. It has an area of approximately 85 acres, extending along the north and east shores of the lagoon. Most of the vegetation is a well-developed stand of large Bruguiera trees. These trees are up to 20 m high, widely spaced, but with interlocking crowns that allow little direct sunlight to penetrate to the ground. Along the Nu'uuli peninsula is a long strip of Rhizophora, as well as smaller stands along the seaward margin of the Bruguiera forest. Xylocarpus is also found at Pala Lagoon, along the seaward margin of the swamp and on the rocky western shore of the lagoon, but these trees are few in number.

Masefau: (Map # 7)

Behind the village of Masefau is a mangrove forest covering an area of approximately 15 acres. It is growing in a low-lying area below an elevation of 5 feet, and is drained by a small stream. The vegetation is similar to that of Pala Lagoon, with a mature forest of Bruguiera.

Aunu'u: (Map # 9)

This island off the southeast coast of Tutuila has two patches of mangrove forest, covering about 11 acres. A peculiar aspect of Aunu'u is Pala Lake (photograph #3)--an area of "quicksand" inland from the north coast of the island. It is slightly above sea level, and consists of reddish-brown mud covering an area of about 3 acres. The mud lake is totally devoid of vegetation, and is completely surrounded by a narrow strip of tall Bruguiera trees. The mangrove extends in a northwesterly direction, and is mixed with trees of the coastal and lowland forests. On the south coast next to the Aunu'u Elementary School is a patch of open mixed-mangrove forest on poor rocky soil. Here the Bruguiera is mixed with Xylocarpus and several coastal species. Much of the open aspect appears to be due to severe cutting by the villagers (photograph # 4).

Leone: (Map # 1)

At the village of Leone the estuary of a stream forms a wide area of mudflat inland from the shore. This mudflat is covered by a mangrove forest with an area of approximately 9 acres. This forest differs from those at Pala Lagoon and Masefau because there is a considerable amount of Rhizophora mixed with the Bruguiera, and the forest is dense and mostly less than 5 m high. This is due to effects of the villagers of Leone, such as cutting for firewood, or possibly to the environmental conditions favoring the Rhizophora. Behind the mangrove swamp the soil is wet but not saline, and grasses, Cassia alata ("candlebush"), and Hibiscus dominate. This is probably the same locality when the only specimen of Erythrina fusca was collected in American Samoa.

Aoa: (Map # 8)

Behind the elementary school at the village of Aoa is a mangrove forest with an area of about 4 acres (photograph # 1) that extends along several

branches of the stream that flows into Aoa Bay. The forest is mostly a mature stand of Bruguiera trees, like those at Pala Lagoon and Masefau, and there is also some Rhizophora along the margins.

COASTAL MARSH

The other type of wetland in American Samoa is the coastal marsh. In Western Samoa this type of vegetation has been called "lowland rush and reed swamp". The term "swamp", however, usually refers to wetlands with woody vegetation, but since the area in question is dominated by herbaceous vegetation, the term coastal marsh is more appropriate.

Coastal marshes are found in shallow depressions along the coast, protected from the sea by a slightly higher shore that serves as a barrier. This marsh land appears to have been formed by gradual sedimentation and filling in of a shallow lagoon, possibly related to long term changes in sea level. The marshes lie mostly at an elevation of 1-10 feet, and since there is no stream draining the marsh, there is no direct tidal effect. This lack of a direct connection to the sea is the main factor determining whether a low lying coastal area has marsh vegetation or a mangrove forest.

The soil in the marsh is usually saturated, and there may be areas of standing water, particularly in the rainy season. The water is fresh to slightly brackish. The vegetation consists of herbaceous plants 1-2 m high which are commonly ferns or species of the sedge family.

In American Samoa the coastal marshes cover an area of approximately 96 acres. On Tutuila there are two coastal marsh habitats--one at Vatia on the north coast and one at Alao at the eastern end of the island. There are two on Aunu'u, one of which occupies the center of the volcanic crater on the island and two on the western coast of Ta'ū--at Lumā and at Fusi. Ofu and Olosega have one each, making a total of eight in American Samoa.

Of all the types of vegetation in American Samoa, the coastal marshes have been the most affected by the action of man. They lie on the coast where nearly all Samoan villages are located. These wet areas in close proximity to villages are ideal for growing taro (Colocasia esculenta; see photographs # 9 and 10) and have been extensively cultivated for hundreds of years. Thus very little coastal marsh vegetation can be found today. The only site which appears to be relatively undisturbed is the marsh inside Aunu'u Crater.

The eight coastal marsh sites in American Samoa are described as follows:

Aunu'u Crater: (Map # 10)

The largest area of coastal marsh in American Samoa is to be found in

Aunu'u Crater (photographs # 5 and 6). The marsh has an area of approximately 34 acres and differs from typical coastal marshes in several respects, in that it is relatively undisturbed and hence the vegetation has a different character than that of the other sites. With an elevation of 20 feet, the marsh within the crater is higher than most coastal marshes. The marsh has several ponds in the center and is drained by a stream that flows out the eastern end of the crater. Due to its relatively higher elevation there are no tidal effects upon it and the water is fresh.

The marsh has two main zones of vegetation. The western half is composed almost entirely of two species, Eleocharis dulcis, the "water chestnut", and a fern, Cyclosorus gongylodes, which form a dense vegetation 1-1.5 m high. On the eastern side the vegetation is dominated by large clumps of Acrostichum. These three species make up almost the entire vegetation over the major portion of the marsh. Along the edges of the marsh there is a dense thicket of Hibiscus trees that is penetrated only with difficulty and which separates the marsh from the coconut groves and secondary forest on the inside slopes of the crater. On disturbed portions along the edge Ludwigia octovalvis, the "willow primrose", and Rhynchospora corymbosa are growing--plants typical of disturbed coastal marshes.

Aunu'u: (Map # 11)

Between the village of Aunu'u and the western slope of the crater is a large depression with an elevation of less than 5 feet. Most of this depression is marshy and covers an area of approximately 22 acres. Little of the natural vegetation remains, as the villagers have made extensive use of the land for the cultivation of wetland taro. Indeed, these are probably the best taro patches in Samoa, with extensive canals and even a paved walkway crossing the area (photograph # 9).

Wetland species found here are Acrostichum, Cyclosorus, Eleocharis, Rhynchospora, and Ludwigia--the same species found inside the crater. There are also a number of weeds that have invaded the area, and as such are facultative wetland species. These include Canna indica, Alternanthera sessilis, Paspalum conjugatum, Mikania micrantha, and Commelina diffusa. The latter three species are common weeds of taro patches on wet or dry land. Probably few weeds would persist in the area if the marsh were allowed to revert back to its natural vegetation. But on cultivated land these weeds proliferate on the bare soil in the bright light conditions between the spaced taro plants.

Lumā: (Map # 12)

On the island of Ta'ū there is a large area of disturbed coastal marsh behind the village of Lumā. It occupies a depression with an elevation of less than 6 feet and covering an area of approximately 18 acres. It lies behind the village and extends up to the high cliffs that surround the marsh on three sides.

This marsh, like the one behind the village of Aunu'u is so extensively cultivated that little of the natural vegetation remains (photograph # 10). The typical marsh plants such as Rhynchospora, Ludwigia, and Eleocharis occur

here, but there is little to distinguish them from the many species of weeds that grow in abundance. Another species found here is Coix lacryma-jobi, "Job's tears", which is abundant in some spots.

Fusi: (Map # 13)

South of the Lumā marsh is a much smaller marsh at Fusi. It occupies a narrow depression on the strip of land between the high coastal cliffs and the sea. It covers an area of approximately 2 acres and lies below 5 feet in elevation. The marsh was probably once heavily cultivated, but is not at the present time. It is separated from the main village and there are only one or two houses nearby. The area surrounding the marsh is neglected plantation land that has become mixed with secondary forest species. There are some small patches of mud and standing water at the center of the site.

The vegetation is dense and from 1.2-2 m high and appears to be reverting back to a more natural condition. The dominant species are Ludwigia, Rhynchospora, and Eleocharis, and several large clumps of Acrostichum. There are Hibiscus trees forming dense thickets on higher ground in some places on the edges of the marsh. Two other wetland species were found at the Fusi marsh, both of them rare in American Samoa. Limnophila fragrans, a low, creeping white-flowered herb was found here and growing as a weed in the Lumā taro patches, and a single plant of Cyperus odoratus was found mixed with the Ludwigia and Rhynchospora.

Olosega:

The west coast of Olosega consists of high steep cliffs, at the base of which is a narrow strip of land. The village of Olosega is on the higher part of this strip near the shore, and between it and the cliff is a long narrow depression which at one time was a coastal marsh.

Now, however, nearly the whole marsh area, approximately 6 acres in extent, is covered with taro. The same coastal marsh plants--Ludwigia, Rhynchospora, and Eleocharis, displaced from their normal dominance by cultivation, survive along with other "weeds" commonly associated with taro.

Ofu: (Map # 14)

On the southern-most tip of Ofu is a small flat area backed up against steep coastal cliffs. In this plain there are several depressions, one of which is covered by a coastal marsh called Vaoto. This marsh is more or less round in shape and has an area of approximately 4 acres, all of it below an elevation of 5 feet. The southern edge of the marsh is cut off by the small airfield that has been recently constructed there.

The vegetation is similar to that of the Fusi marsh, as its cultivation has been neglected and it is reverting back to a natural condition. The dominant species are the same as those at Fusi--Rhynchospora, Eleocharis, and Ludwigia. Another species found here is Paspalum orbiculare, a grass found in a variety of habitats ranging from wet crater meadows (e.g. on Upolu, Western Samoa) to dry scrubby ridge vegetation on Tutuila.

Vatia: (Map # 15)

Behind the village of Vatia is an area of marshy soil which was once a coastal marsh. It occupies an area of nearly 7 acres, all of which is below an elevation of 5 feet. Like the marshes at Lumā and Olosega, little is left of the natural vegetation due to the cultivation of taro. A very small patch of mangrove is found along a stream at the other end of the village.

Alao: (Map # 16)

Behind the village of Alao there is another area of marshy land. It covers an area of approximately 4 acres, and is below an elevation of 10 feet. Little of the natural vegetation of a coastal marsh is found here, as with most of the other marshes mentioned above, due to the extensive cultivation of taro.

OTHER WETLANDS

The mangrove forests and coastal marshes are the only two important types of wetlands found in American Samoa. In Western Samoa there also are wetlands associated with montane craters, basins, and crater lakes, but due to its geography and smaller size, American Samoa is lacking these types of wetlands. Of minor importance in American Samoa are the wetlands associated with the numerous streams. These wetlands are of very limited extent, being restricted to the margins of streams and to the channels of intermittent streams.

There are many streams on Tutuila, but they are almost totally absent from the Manu'a Islands (Ofu, Olosega, and Ta'ū). The vegetation of these streamside wetlands is dominated by Brachiaria mutica ("California grass"), Coix, and Canna, as well as many other weedy species found in wetland taro patches. Barringtonia samoensis, a medium-sized forest tree closely related to the dominant coastal forest tree Barringtonia asiatica, is commonly found along mountain streams.

Behind the village of Alao on the eastern end of Tutuila there is an area of several acres covered with wet soil. It lies between 25 and 45 feet in elevation and is surrounded on three sides by low hills. Three intermittent streams flowing into the area, possibly along with soil factors, contribute to the saturated soil and poor drainage (Map # 17).

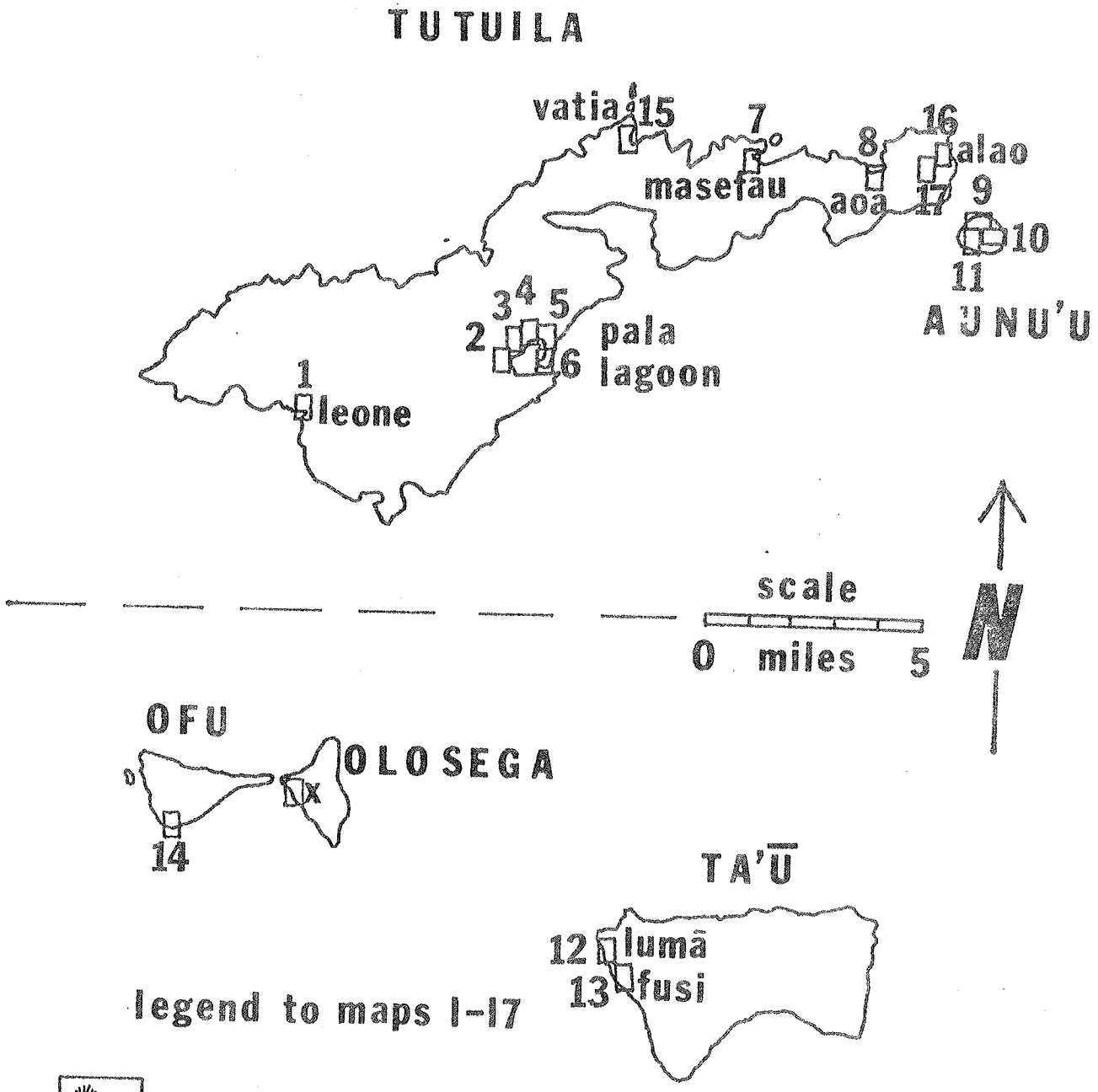
The vegetation at this site is dominated by Coix growing from 1-1.5 m high, and Cassia alata ("Candlebush"), a shrub growing in clumps up to 3-4 m high. There are also smaller amounts of Canna and Hibiscus. These plants are typical wetland species, but only the Hibiscus is native to Samoa. The original vegetation of the site probably was lowland forest, but this was cleared long ago. At the time of the survey, there was no cultivation over most of the site. There were scattered coconut trees, and a few banana trees were growing on the margin. Due to the disturbed character of this area, it is not considered to be a true wetland (photograph 8).

There is another site at Malaeimi Valley on Tutuila which has geographic features similar to that at Alao. It is a broad valley owned mostly by the Mormon Church and is currently used for pasture land. A number of intermittent streams flow into the valley from the mountains that surround it on three sides. The natural vegetation of the valley is undoubtedly lowland forest, but this has been cleared to make the pasture.

The soil in much of the pasture was water-saturated at the time of the survey. It was covered with herbaceous species, three of which were weedy wetland plants not observed elsewhere during the survey. These three are Ludwigia hyssopifolia, Cuphea carthagenensis, and Struchium sparganophorum. Two coastal marsh species were also seen--Ludwigia octovalvis and Rhynchospora--but neither was as common as the three weedy species. Based on the weedy nature of the vegetation, the geographic character of the site, and the present use of the land, Malaeimi Valley is not considered in this report to be a wetland.

There is one other site in American Samoa that should be mentioned. It is several acres in extent and lies along the road just past the village of Tula on the eastern end of Tutuila. It may have at one time been a coastal marsh, as it lies between 5 and 15 feet in elevation at a site that is geographically similar to the coastal marshes previously mentioned. At the north end of the site there is a thicket of Hibiscus trees which at the time of the survey were in standing water. The water appeared to be in channels, so it is likely that the area had previously been cultivated. Also there were open patches of weedy vegetation, some of it too in standing water. The dominant weeds are Cyperus javanicus (a typical coastal strand species), Eriochloa procera (a grass more often found in drier habitats), Alternanthera sessilis, Paspalum conjugatum, Commelina diffusa, and Ludwigia octovalvis. This is not typical wetland vegetation, particularly with the presence of the Cyperus and the Eriochloa. The standing water is probably due to poor drainage of rainwater falling previous to the time of the survey, and the site is not considered in this report to be a wetland (photograph 2).

DISTRIBUTION OF WETLANDS



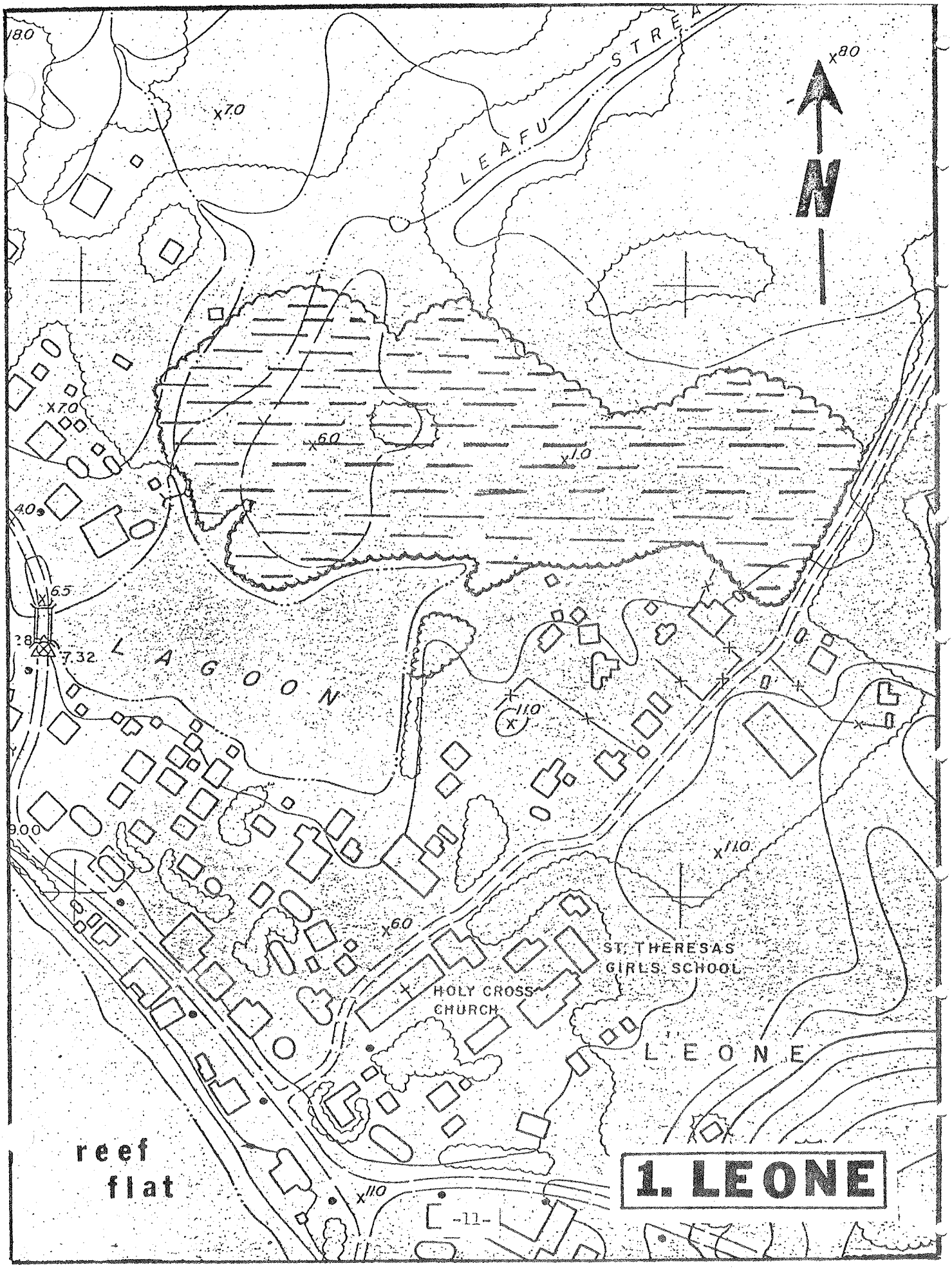
legend to maps 1-17

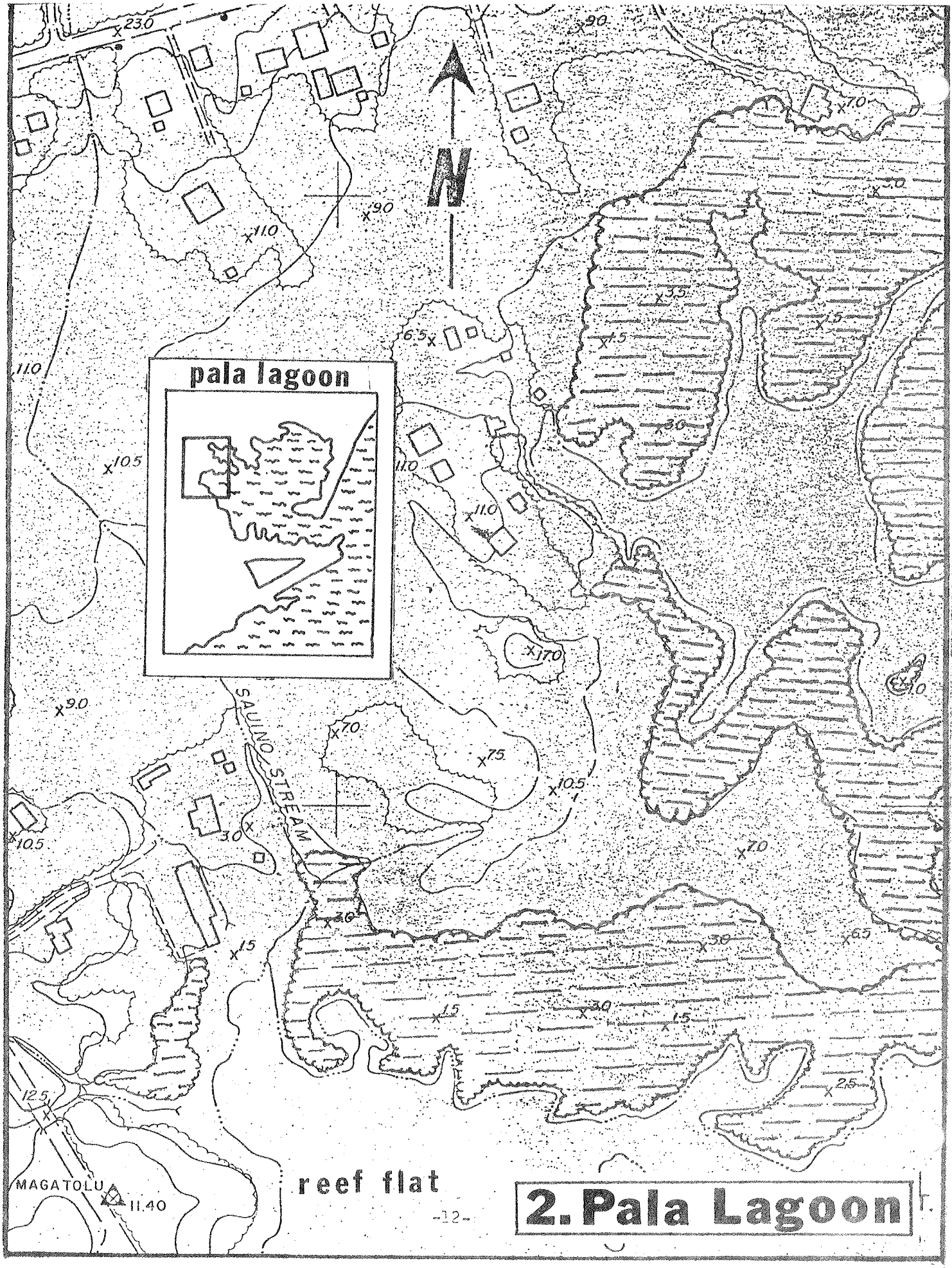
coastal marsh

mangrove (Bruguiera)

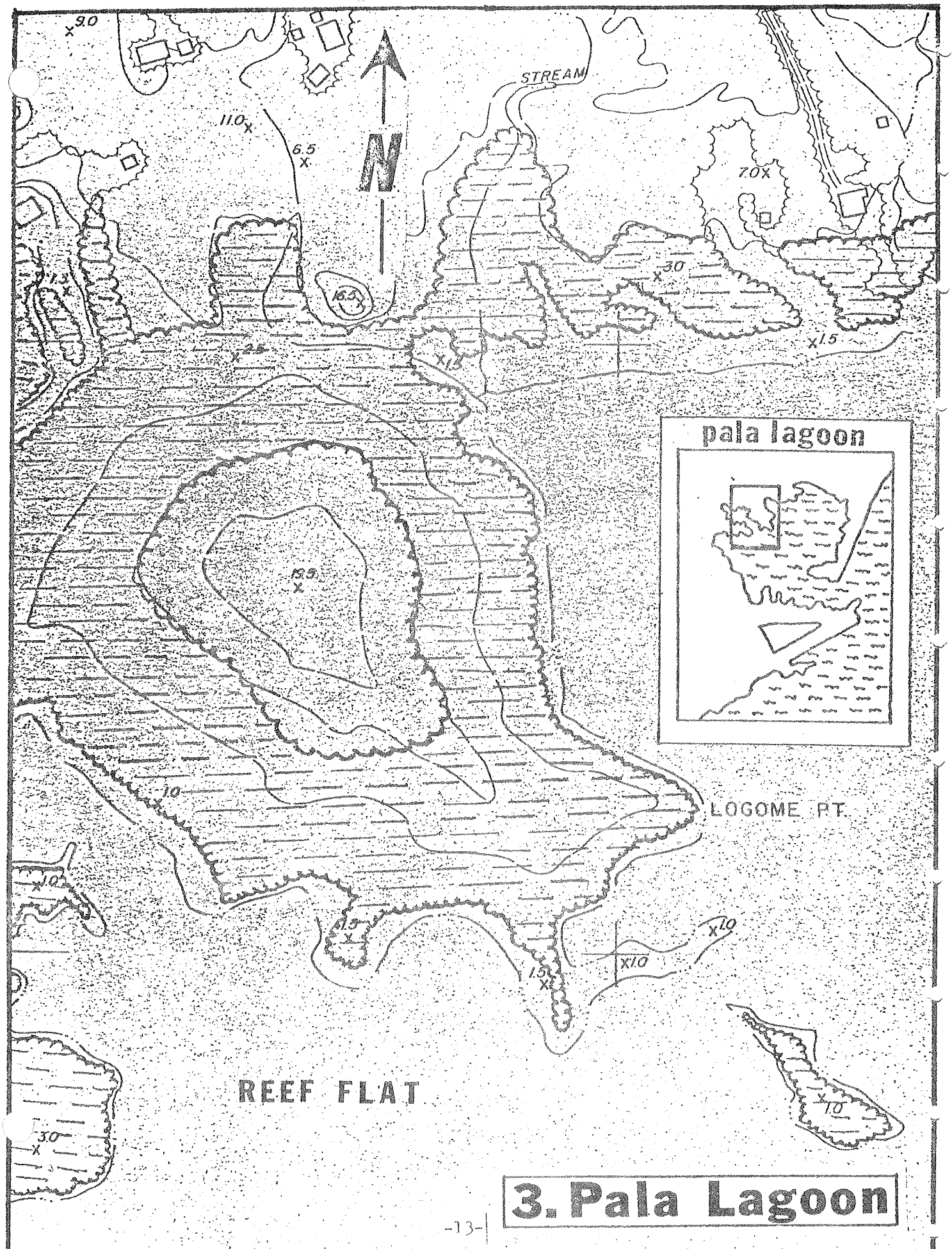
mangrove (Rhizophora)

X- map not available

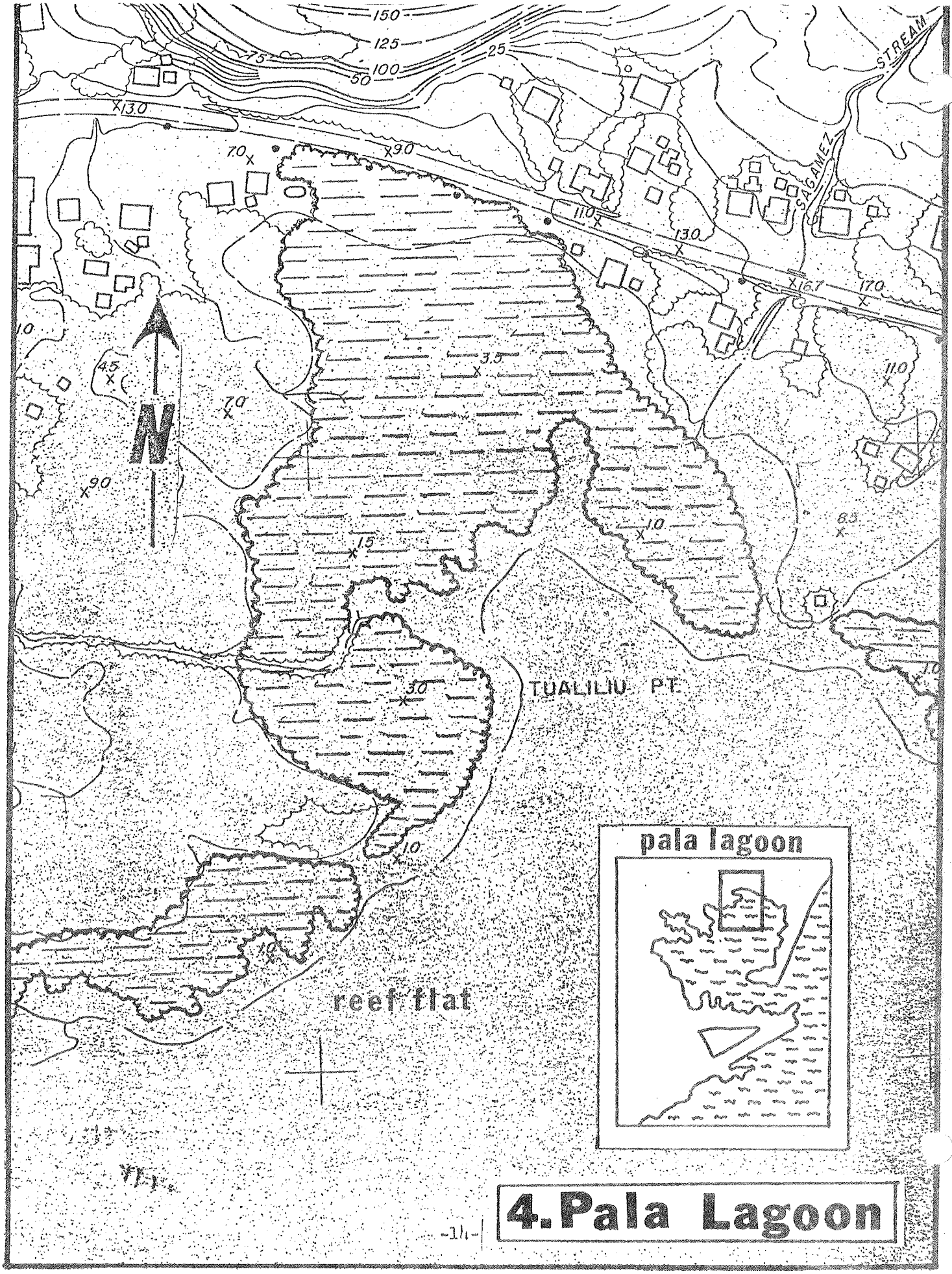

LEAFU STREA
N
LAGOON
ST. THERESAS GIRLS SCHOOL
HOLY CROSS CHURCH
LEONE
reef flat
1. LEONE



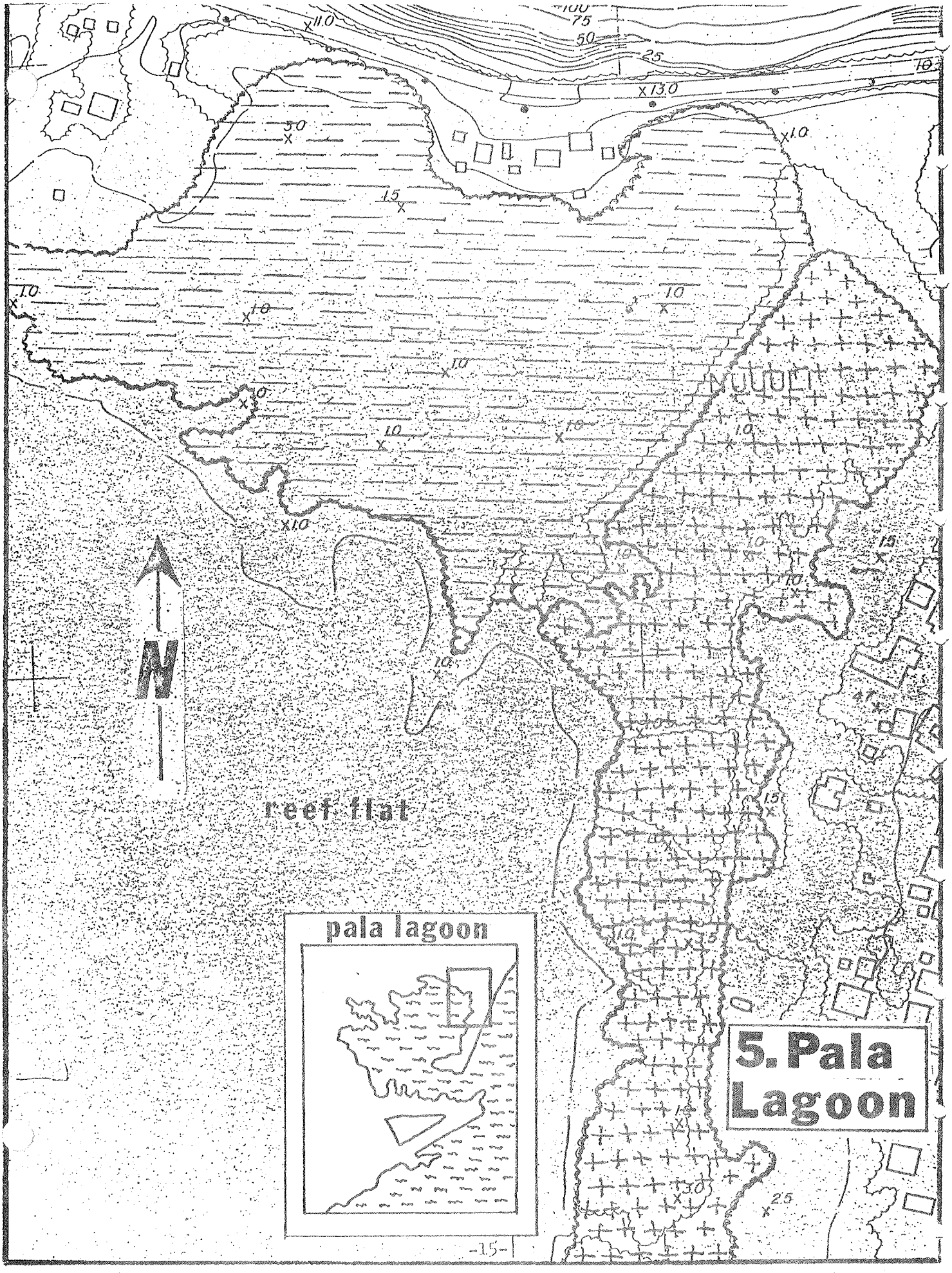
2. Pala Lagoon

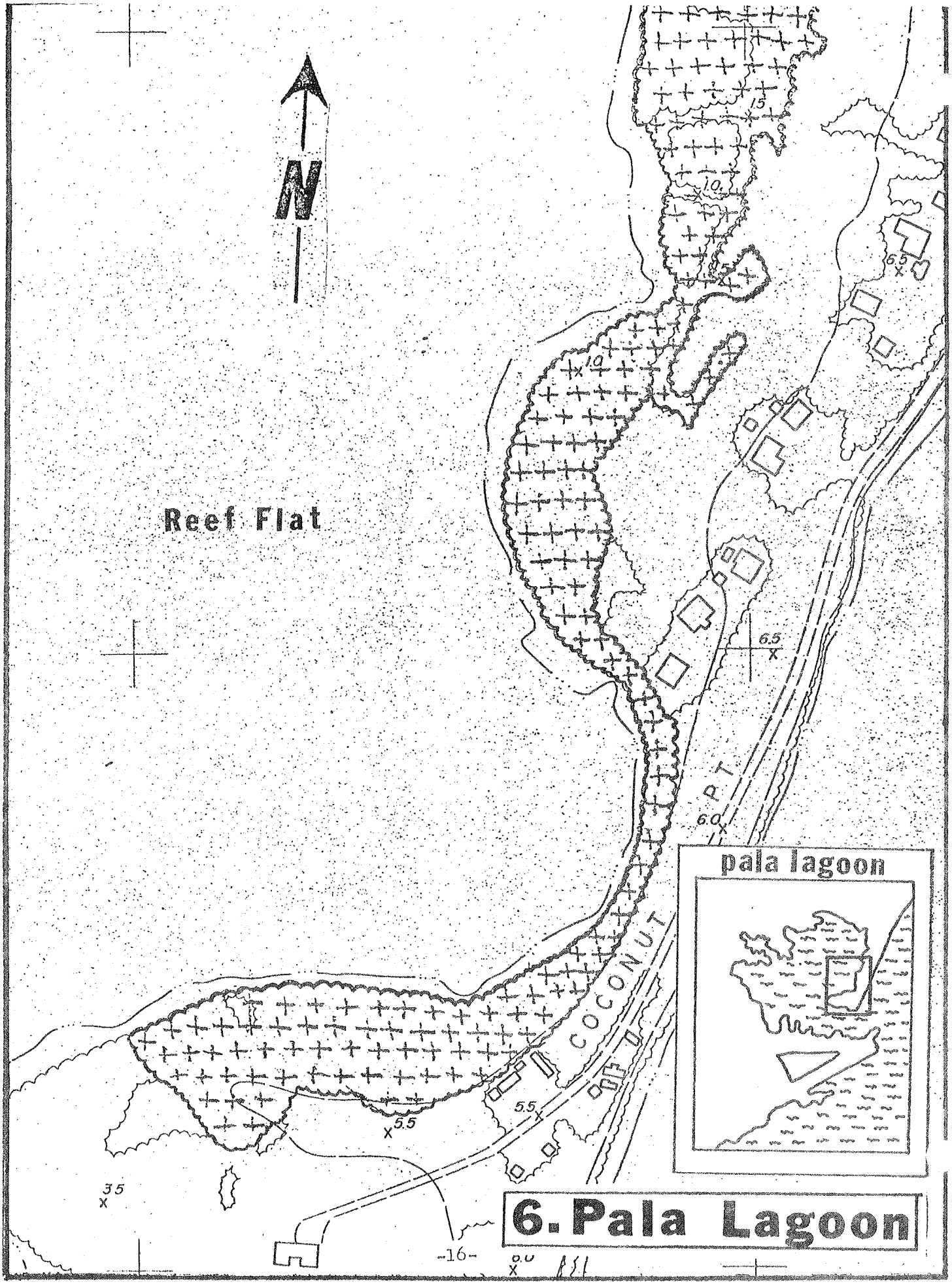


3. Pala Lagoon

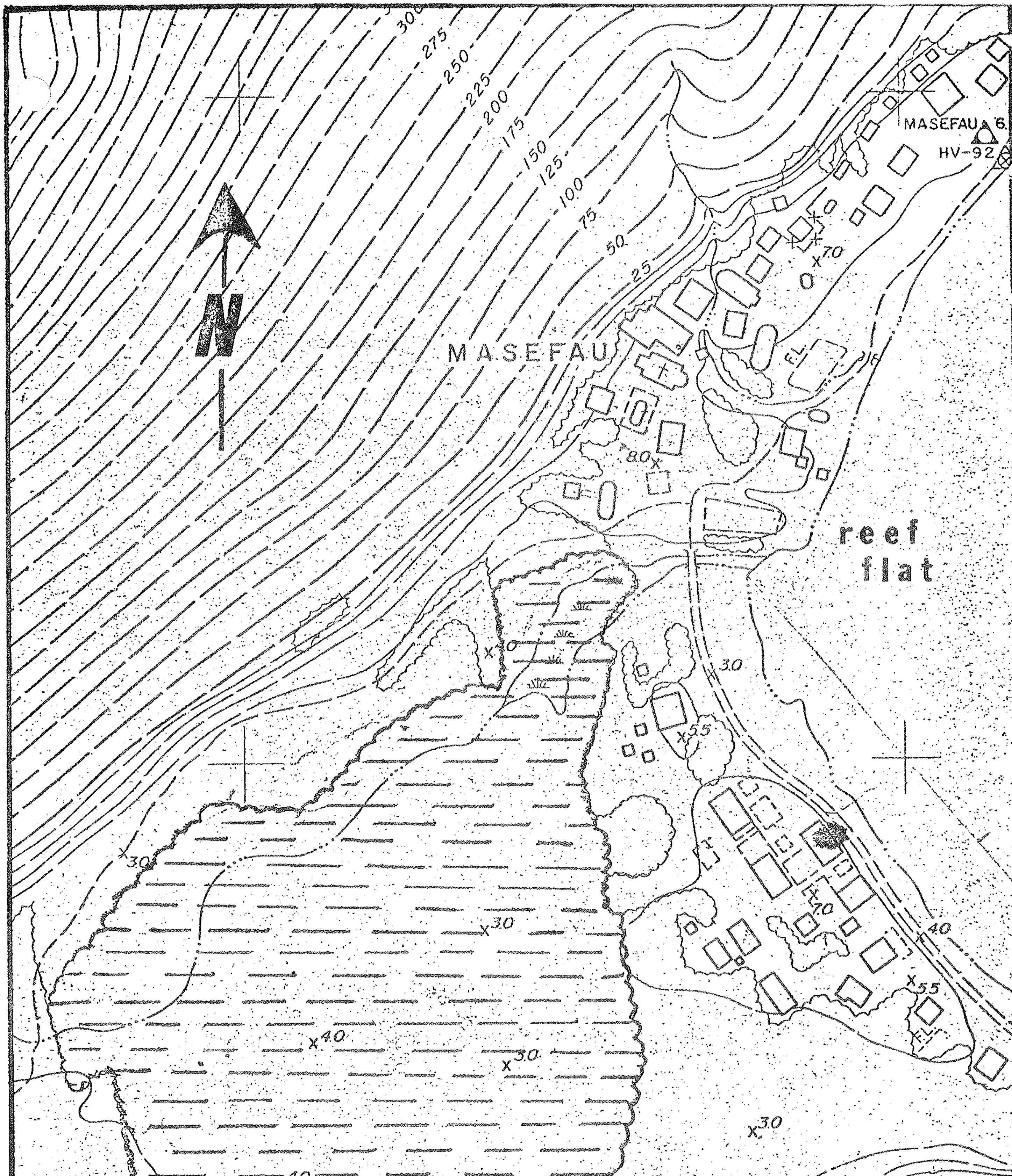


4. Pala Lagoon

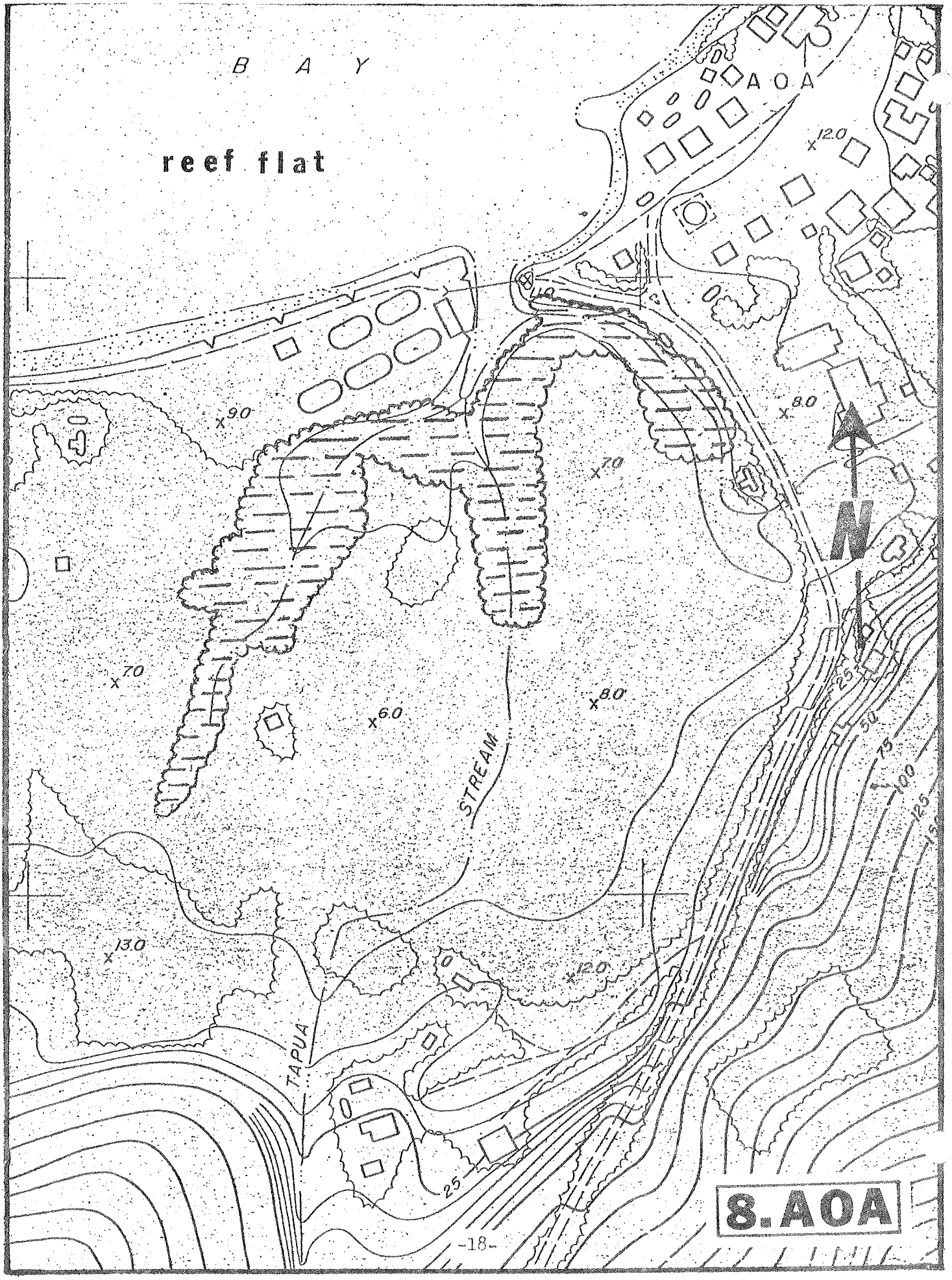

reef flat
pala lagoon
5. Pala Lagoon

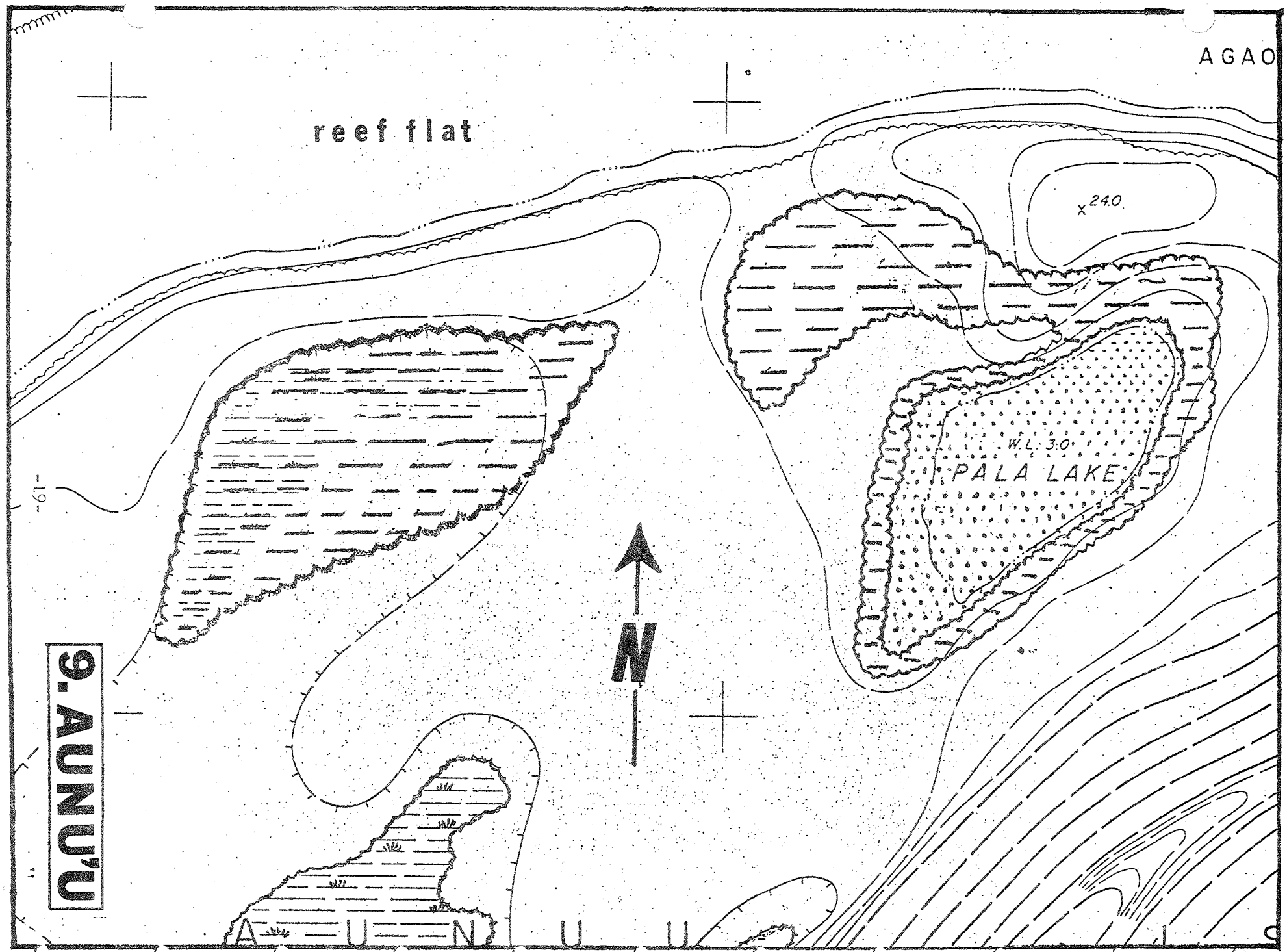


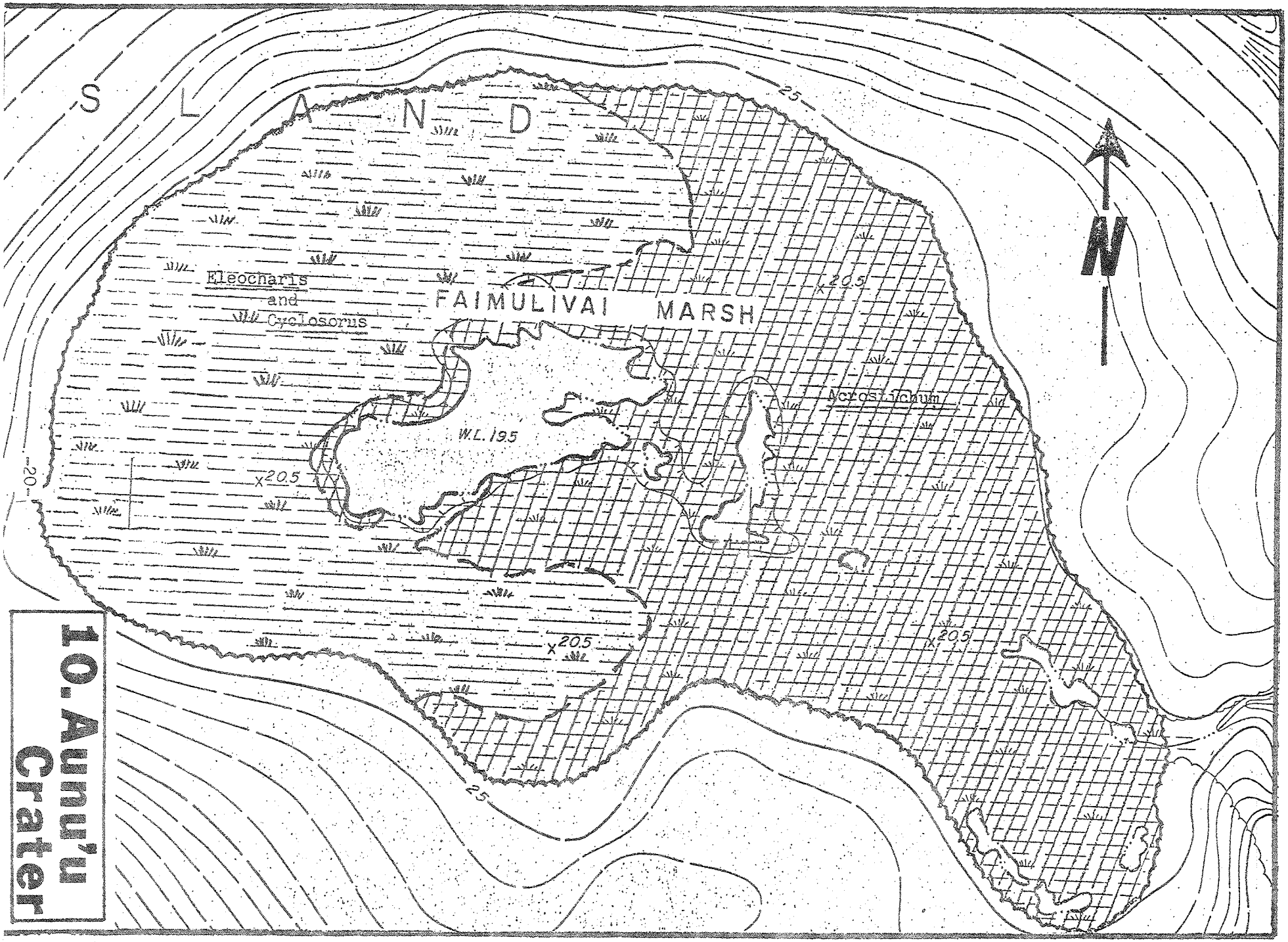
6. Pala Lagoon


MASEFAU
reef flat
MASEFAU 6
HV-92
300
275
250
225
200
175
150
125
100
75
50
25
7.0
8.0
3.0
5.5
4.0
FL

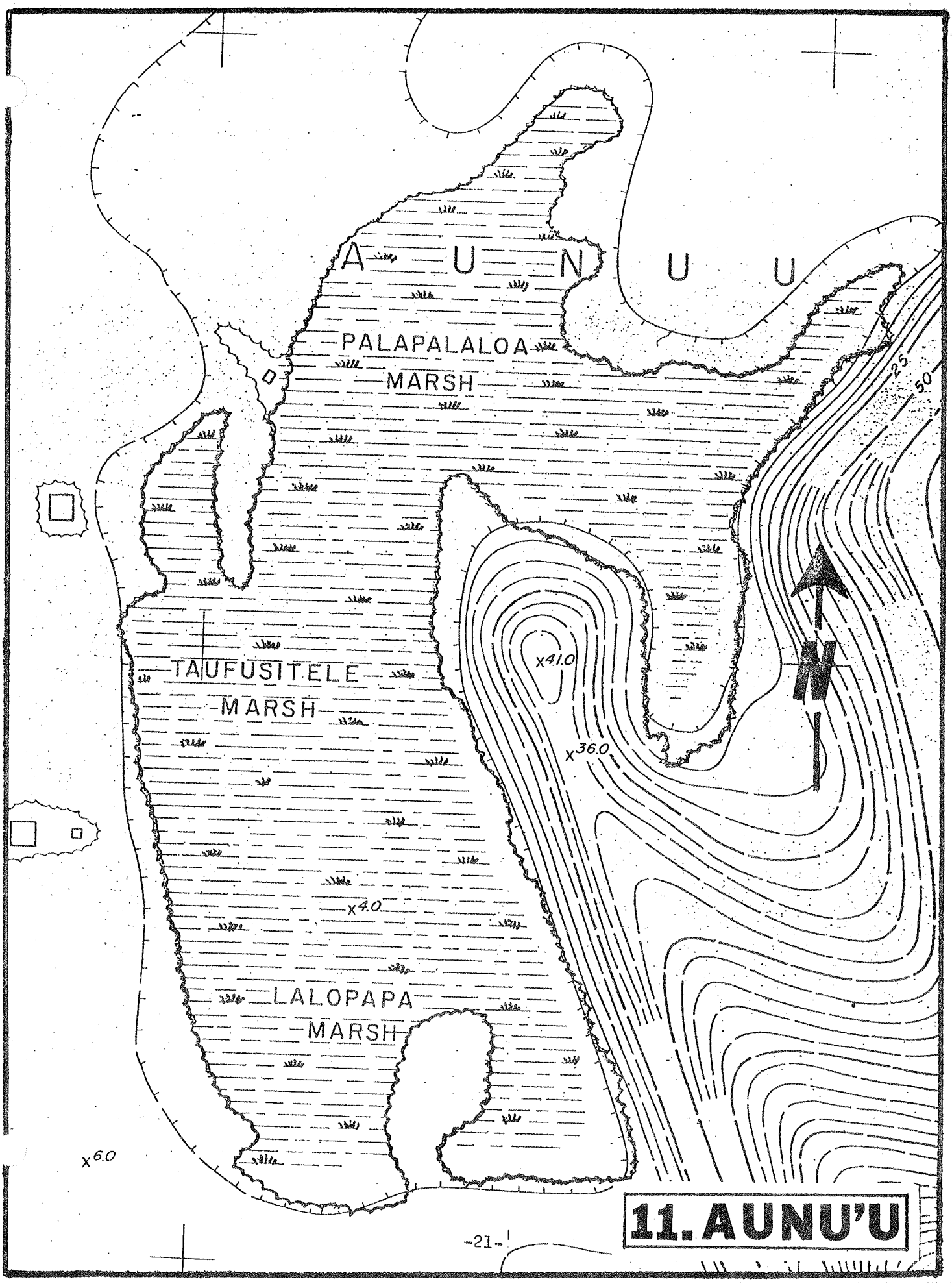
7. MASEFAU

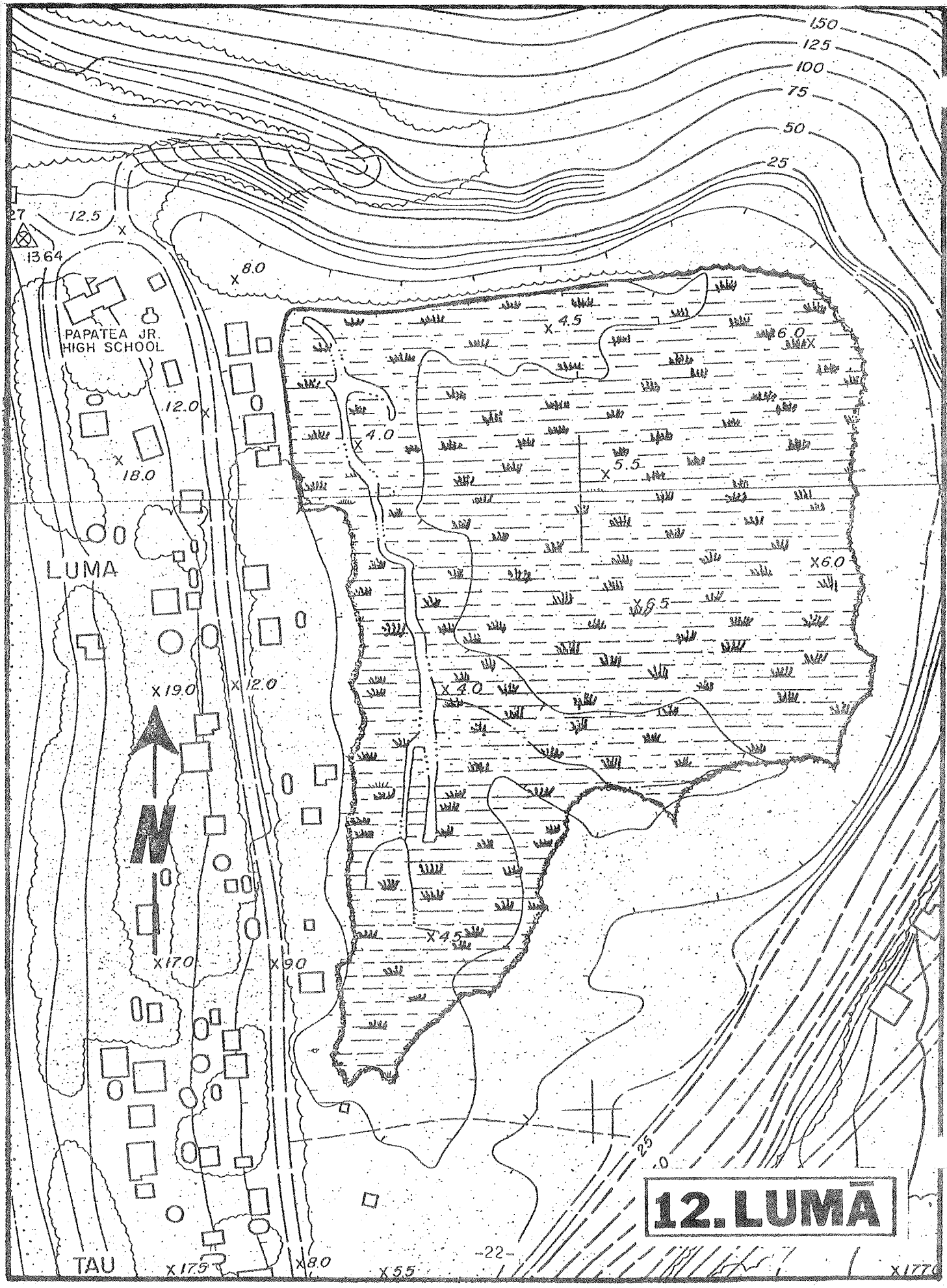

B A Y
reef flat
A O A
x12.0
x8.0
x9.0
x7.0
x7.0
x6.0
x8.0
x13.0
x12.0
STREAM
TAPUA
N
25
50
75
100
125
150
25
8. AOA

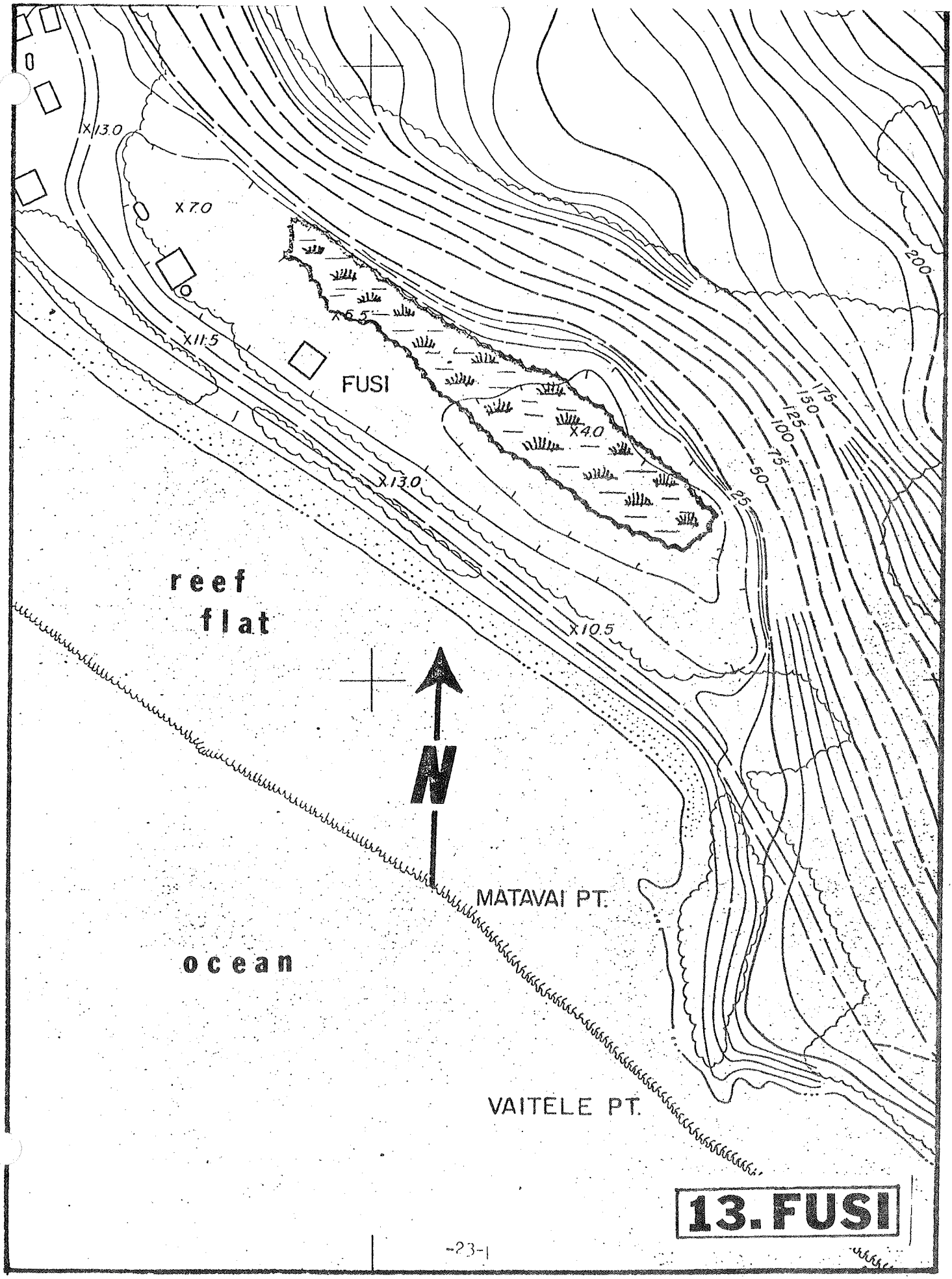

AGAO
reef flat
x 24.0
W.L. 3.0
PALA LAKE
N
9. AUNU'U
A U N U U
-19-



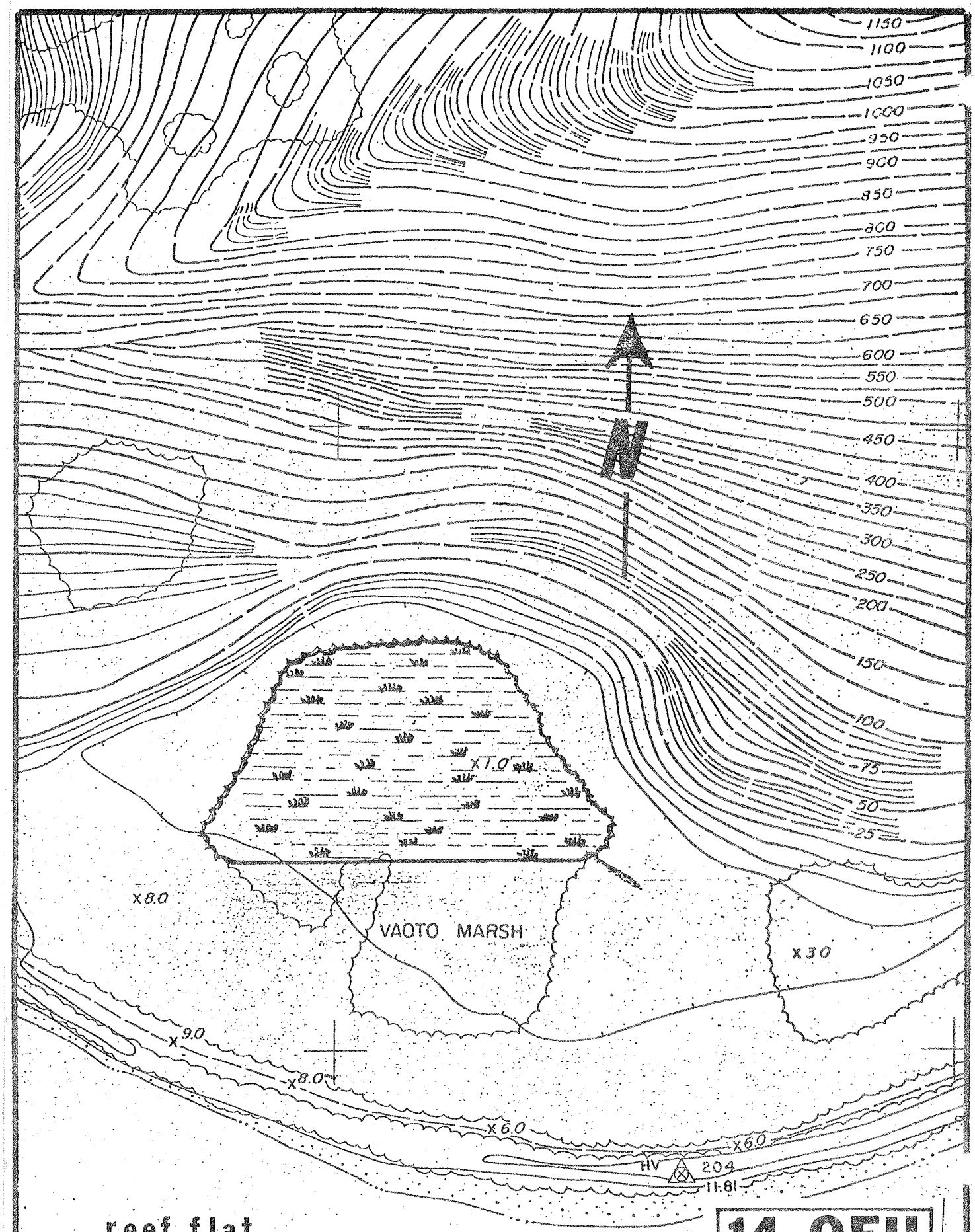
10. Aumu'u Crater


A U N U U
PALAPALALOA
MARSH
TAUFUSITELE
MARSH
LALOPAPA
MARSH
x41.0
x36.0
x4.0
x6.0
25
50
11. AUNU'U

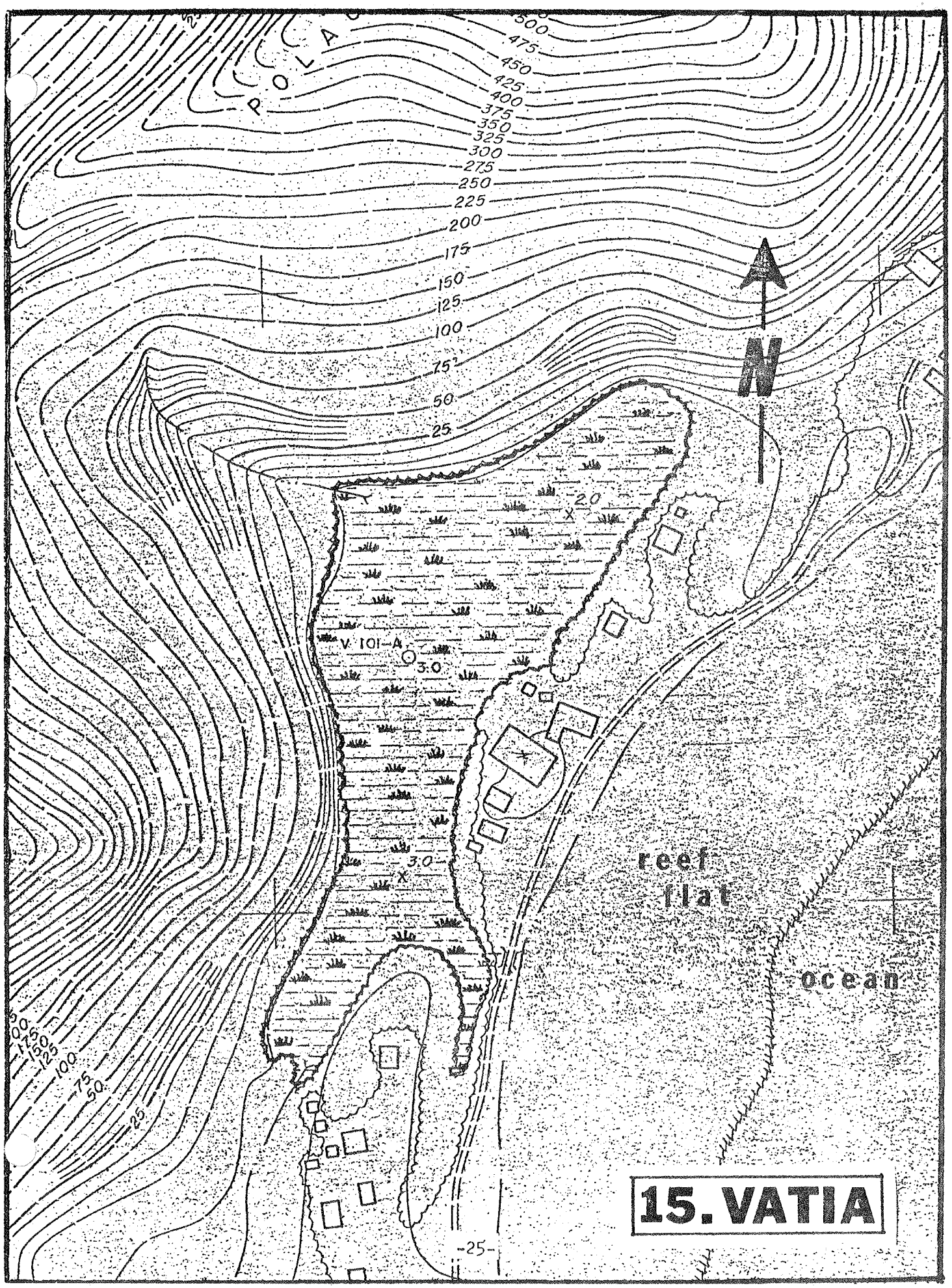

150
125
100
75
50
25
12.5
13.64
8.0
PAPATEA JR.
HIGH SCHOOL
4.5
6.0
12.0
4.0
18.0
5.5
LUMA
X6.0
X6.5
X19.0
X12.0
X4.0
N
X4.5
X17.0
X19.0
25
0
TAU
X17.5
X8.0
X5.5
X17.0
12. LUMA


X13.0
X7.0
X6.5
X11.5
FUSI
X4.0
X13.0
X10.5
200
175
150
125
100
75
50
25
reef
flat
N
MATAVAI PT.
ocean
VAITELE PT.

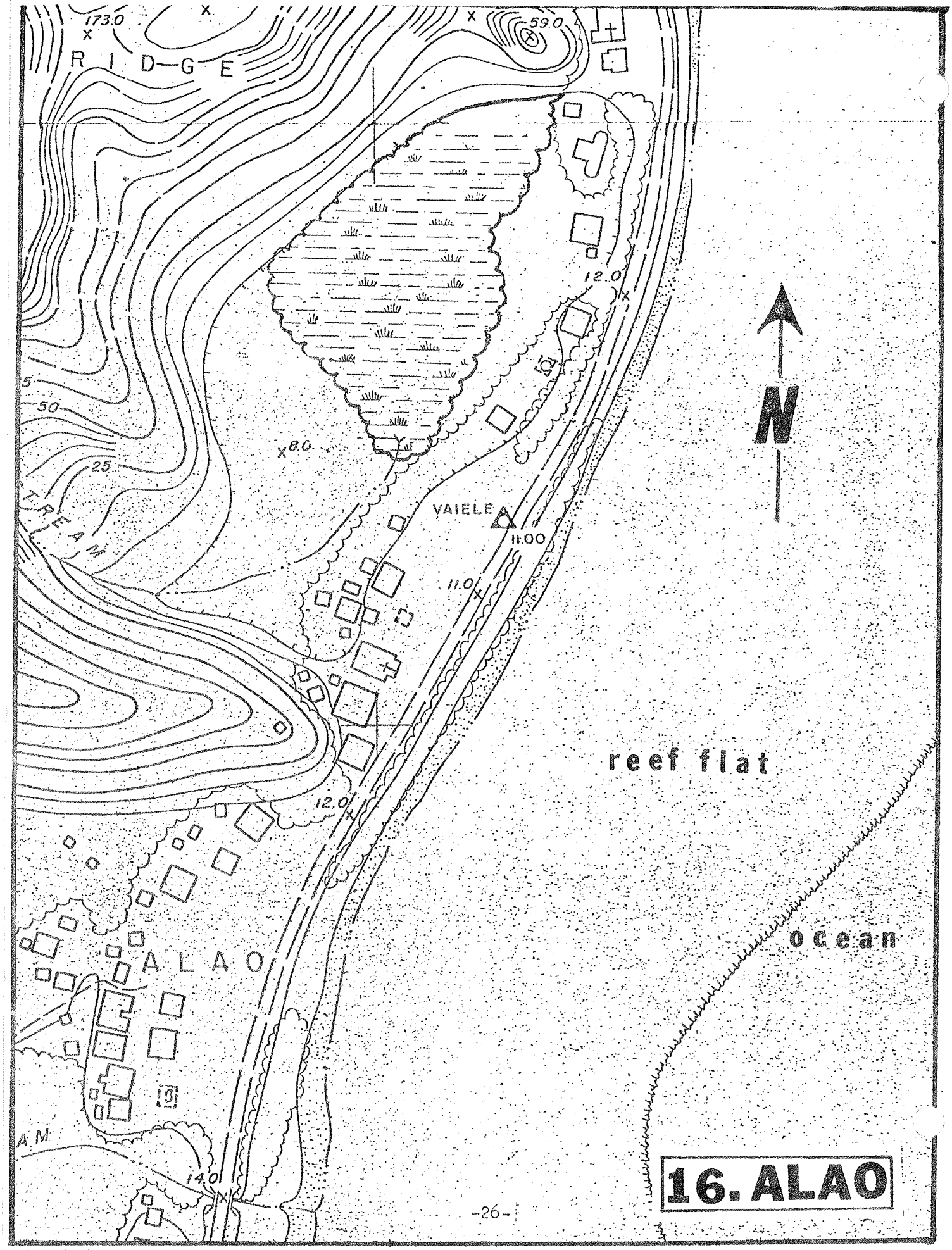
13. FUSI



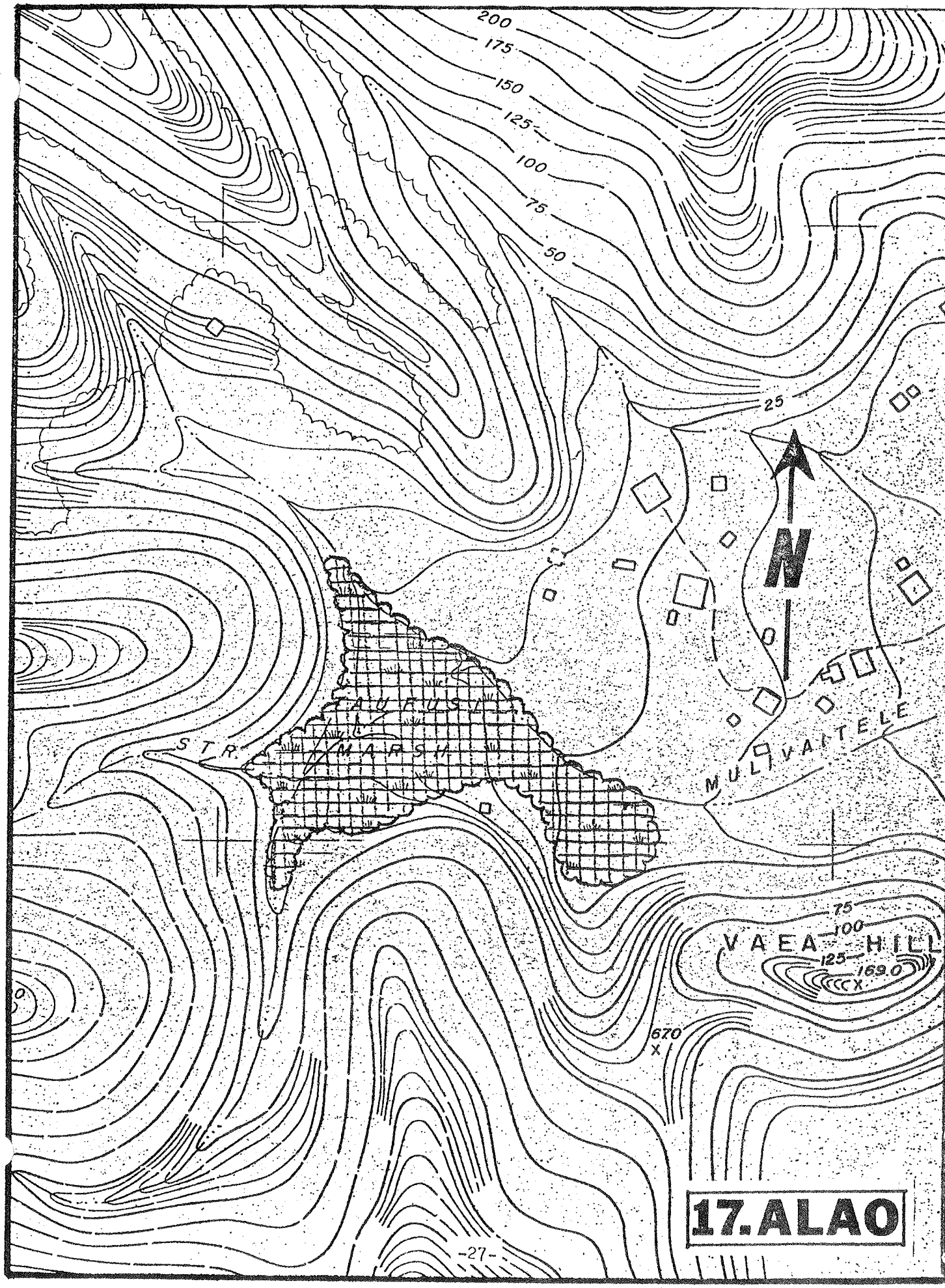
PAPALOLOA PT


500
475
450
425
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
N
2.0
V. 101-A
3.0
3.0
reef
flat
ocean
-25-

15. VATIA


173.0
RIDGE
59.0
12.0
N
50
25
8.0
VAIELE
11.00
11.0
STREAM
reef flat
12.0
ALAO
ocean
AM
14.0

16. ALAO


200
175
150
125
100
75
50
25
N
0
TAUFUSI
MARSH
STR.
MULIVAITELE
75
100
VAEA HILL
125
159.0
670
0

17. ALAO

ENUMERATION OF WETLAND SPECIES

The plants included in the following list are all those species found during the wetland survey, as well as one species (Erythrina fusca) that had been collected before in American Samoa, but was not found during the survey.

OBLIGATE HYDROPHYTES

Those plant species requiring standing water or saturated soil conditions. Only Bruguiera and Rhizophora grow in salt water (i.e. they are halophytes) while Xylocarpus, Erythrina, Acrostichum, Paspalum vaginatum, and sometimes Inocarpus are often found in brackish water. The rest are mostly freshwater requiring plants.

	Native species	Introduced species
Trees:		
	* Bruguiera gymnorhiza (I)	
	* Rhizophora mangle (I)	
	(R) Erythrina fusca (I)	
	(R) Xylocarpus moluccensis (I)	
Herbs and shrubs:		
	* Paspalum vaginatum (I)	* Coix lacryma-jobi (I)
	(R) Cyperus odoratus	* Rhynchospora corymbosa (I)
	* Eleocharis dulcis (I)	* Ludwigia octovalvis (I)
	(R) Limnophila fragrans (I)	Ludwigia hyssopifolia
		Struchium sparganophorum
		Cassia alata (I)
Ferns:		
	Acrostichum aureum (I)	
	Cyclosorus gongylodes (I)	

FACULTATIVE HYDROPHYTES

Those plants that are found in, but are not restricted to wetlands.

Trees:		
	* Hibiscus tiliaceus (I)	Inocarpus fagifer
	Barringtonia samoensis	
Herbs:		
	Paspalum orbiculare	Canna indica
		Commelina diffusa
		Brachiaria mutica
		Cuphea carthagenensis
		Colocasia esculenta

NON-HYDROPHYTES

Those plant species which are occasionally, but not normally found in wetlands.

Herbs:		
	Cyperus javanicus	Paspalum conjugatum
		Eriochloa procera
		Mikania micrantha
		Alternanthera sessilis

* Denotes important wetland species.
(R) Denotes species rare in American Samoa.
(I) Denotes species that are illustrated.

Direct Benefits

The coastal marshes or at least the land formerly covered with this type of vegetation are of great direct benefit to the Samoans. It is the prime agricultural land for the cultivation of taro. The flat wet land in the easily accessible coastal areas is ideal for growing taro, and consequently only one area of coastal marsh in American Samoa has been left intact today. This one area is in Aunu'u Crater, and it was probably spared due to the abundance of other suitable wetlands for the needs of the villagers on the small island, coupled with the non-commercial character of the original Samoan economy. It may also be due to soil or water characteristics of that particular marsh, such as the standing water being too deep for growing taro.

The mangrove forest, on the other hand, is of very little direct benefit to the Samoans. The major use of the mangrove forest is for firewood. Mangrove wood makes excellent firewood, as it burns well even when green. On Aunu'u severe cutting damage was observed on a small patch of mangrove forest near the elementary school. However, the use of mangrove for firewood is probably declining today, due to the increasing urbanization and use of other fuel sources in American Samoa. Guest (1939) mentions that the mangrove wood is sometimes used for house posts, but the wood is generally considered to be of little value for construction.

A small amount of food is obtained from the mangrove forest in the form of animal life found there. Some fishing is done and large crabs are frequently trapped. However, both fishing and crabbing in the mangrove forest are of limited extent, as fishing in the lagoon and beyond the reef, as well as the purchasing of canned fish at the stores are much more important to the Samoan diet.

The land upon which the mangrove forest grows is probably its most valuable asset in the eyes of the Samoans. The land has no value for agriculture the way it is, as no crop plants can tolerate the brackish or salt water conditions, but in some areas the swamp has been filled in and the land reclaimed, as has been done at Utulei. In 1924 Setchell reported a mangrove forest at Utulei, but today not a trace of mangroves remains there. At the village of Masefau a villager told the investigator that some of the mangrove forest there was soon to be cut down and the land filled in to make space for a new church.

Since the land of the coastal marsh is so valuable for agriculture, it it not usually subject to filling in, and the coastal marsh land is retained, although its natural vegetation has long since been virtually destroyed.

Indirect Benefits

Probably the most important function of the mangrove forest is its land-building ability and the protection it provides against erosion. As

the coral reef grows outward from the shore, the mangroves follow and stablize the shoreline. Sediments eroded from the land are trapped, reducing the flow of stream and estuary water on the reef flat and increasing the sedimentation. As the land becomes higher and the water less salty, non-mangrove species become established and these species eventually dominate, replacing the mangroves.

Mangrove trees are very hurricane-resistant due to their extensive root system. When hurricanes occur, the presence of mangroves can greatly reduce the amount of storm damage to the land, and as a windbreak, they protect villages and other vegetation in the immediate vicinity. They also can help prevent excessive flood damage since they serve as storage areas for water during floods.

Wetlands, primarily mangroves, are important as nursery and breeding grounds for many species of fish. A high nutrient imput derived from upland sources is supplied to the wetlands by the streams flowing into them. These nutrients, along with those produced by the breakdown and decay of organic material, support a myriad of small intertidal organisms which serve as a food source for fish and other large organisms.

Fauna:

The mangrove forest has its own peculiar fauna. Many species of crustaceans and other invertebrates are found only in mangrove forests, and it is likely some of these species are endemic to Samoa. The bird life in the mangrove forest is not unique, as the few species living there are common in other habitats. The few species of trees in the mangrove forest causes the lack of diveristy of the bird fauna. Mammal life in the mangrove forest is practically non-existent. There are only 3 or 4 native species of mammal--3 bats and 1 rat--and none of these are generally associated with mangroves.

The Grey Duck or "toloa" (Anas superciliosa) is one species that is unique to Samoan wetlands. It is found in undisturbed coastal marshes, ponds, lakes, lagoons, and streams, and has been recorded on Aunu'u where it was formerly much more common that it is today. The decline of the Grey Duck is due to the over-hunting by the villagers, and the destruction of its natural habitat. This species, although found outside Samoa, should be considered an endangered species in Samoa.

Vegetation:

Very little is known about the ecology of the Samoan wetlands. Although mangrove forests have been studied elsewhere in the Pacific, the unique interaction of all the different species occurring in the Samoan mangrove forest with each other and with their physical environment makes mangrove studies from other areas applicable only in their general aspects. The coastal marshes are unique, and very little has been written about them, possibly because very few of them in the Pacific have been left undisturbed or intact.

In Western Samoa incipient efforts have begun in the creation of a national parks system. A report has been prepared (Holloway, 1975) which includes proposals for the conservation of unique types of plant associations.

In the report eight sites of mangrove forest and one of the coastal marsh (as well as montane wetland types not found in American Samoa) are proposed for nature reserves. Wetlands in American Samoa similar to those in Western Samoa should be preserved for future study as well as for their contribution as unique ecosystems that enhance the diversity of man's habitat and enrich man's activities.

Unique species:

There are four plant species found in the American Samoa wetlands that can be considered rare. Erythrina fusca is a tree that has been collected only once in American Samoa. It is an indigenous species collected several times in Western Samoa and is widespread in the western Pacific. Another rare tree is Xylocarpus moluccensis. In Samoa it is found in only one location on Tutuila, one on Aunu'u, and one on Savai'i in Western Samoa. Like the above mentioned species, it is also found elsewhere to the west, and Samoa is the eastern-most extent of its distribution.

Limnophila fragrans is a small white-flowered herb that grows in coastal marshes and wet inland areas. It has been collected only three times in American Samoa, but its distribution extends to Fiji and west of there. Cyperus odoratus has been collected only two times in American Samoa, but is widespread elsewhere in the Old World Tropics.

Thus while none of the four species is limited to Samoa, they should be considered as rare plants endangered in this American territory.

RECOMMENDATIONS

The coastal marsh inside Aunu'u Crater should be considered a unique type of wetland vegetation, and any proposal for nature reserves should give this site priority. The other coastal marsh sites are so disturbed by man that they have in their present status no value as nature reserves.

The mangrove forests should be left alone as much as possible, particularly the ones growing directly on the coast. The best and largest site is at Pala Lagoon. The mangroves are valuable for land-building, protection against erosion and storm damage, and as a breeding and nursery ground for many species of offshore and coastal fish.

The mud lake on Aunu'u is a unique type of wetland and should be protected and considered as a site for a nature reserve.

Effort should be made to prevent the native Grey Duck from becoming extinct in Samoa. The preservation of the mud lake and the coastal marsh in Aunu'u Crater would help, along with a prohibition against shooting the ducks.

Effort should be made to protect the rare Samoan tree species. This applies particularly to Xylocarpus, since its locations are known.

ANNOTATED BIBLIOGRAPHY

1. Ashmole, M. J., 1963. "Guide to the birds of Samoa". Pacific Science Information Center, B.P. Bishop Museum, Honolulu, Hawaii. 21 pp.
   * A list of birds found in the Samoan Islands, along with descriptions, breeding data, and habitats in which the birds are found.

2. Bryan, E.H., Jr., 1935. "Samoan and scientific names of plants found in Samoa". B.P. Bishop Museum (Mimeograph copy).
   * A list of Samoan plant names, based mosly on previously published information.

3. Christensen, C., 1943. A Revision of the Pteridophyta of Samoa. B.P. Bishop Museum Bull. No. 177. 138 pp.
   * The most up-to-date list of the fern flora of Samoa, including sites of collection of the species and other information.

4. Christophersen, E., 1935. Flowering Plants of Samoa- I. B.P. Bishop Museum Bull. No. 128. 221 pp.
   * The most up-to-date published list of the flowering plants of Samoa, including sites of collection of the species.

5. Christophersen, E., 1938. Flowering Plants of Samoa- II. B.P. Bishop Museum Bull. 177. 138 pp.
   * A continuation of Part I of the above.

6. Fox, J.W. and K.B. Cumberland, eds., 1962. Western Samoa; Land, Life, and Agriculture in Tropical Polynesia. Christchurch, N.Z. 337 pp.
   * Includes a description of types of vegetation, with brief mention of mangrove forests on p. 64.

7. Guest, P.L., 1939. "Samoan trees, Appendix E". Mimeograph portion of a survey made of the economic trees of American Samoa. B.P. Bishop Museum.
   * A list of the economic plants of American Samoa with the Samoan names and where the plants occur. 54 pp.

8. Holloway, C.W., and C.H. Floyd, 1975. "A national parks system for Western Samoa". U.N. Development Advisory Team for the South Pacific (Mimeograph). 77 pp.
   * A report and plan for a national parks system for Western Samoa. It includes proposals for the preservation of a lowland rush and reed swamp (coastal marsh) and several mangrove swamps.

9. Marshall, C. and T.S. Thompson, 1953. "Report on Forestry in American Samoa". SIM report. 11: 1-172 (mimeographs).
   * A report on forestry and its potential in American Samoa. Includes a list of plants and their Fijian and Samoan names.

10. Marshall, C., 1950. Sustained Yield Management of the Mangrove Salt Water Swamp Forest of Fiji. Suva, Government Press. 19 pp.
    * A small booklet giving descriptions of mangrove forests and their associated species, as well as methods of forest management.

11. Merrill, E.D., 1945. Plant Life of the Pacific World. MacMillan Co., New York. 295 pp.
* A description of a mangrove forest and the associated species is given in Cpt. 4.

12. Parham, B.E.V., 1972. Plants of Samoa. New Zealand Dept. of Science and Industrial Research, Information Series No. 85. 162 pp.
* Up-to-date list of those Samoan plants with previously recorded and published Samoan names, plus some recorded by the author. Includes brief descriptions of many plants.

13. Powell, T., 1868. "On various Samoan plants and their vernacular names". Jour. of Botany, 6: 278-285, 342-347, and 355-370.
* An early recorded list of Samoan plant names, along with some of their uses.

14. Rechinger, K., 1907-1914. "Botanische und Zoologische Ergebnisse einer Wissenschaftlichen Forschungsreise nach den Samoa-Inseln, dem Neuguinea-Archipel und de Salmons-Inseln von Marz bis Dezember 1905". Akad. Wiss. Wien, Denkschr., 85: 202-388, 89: 451-455.
* A good list of the flora of Samoa, but written in German. It also includes a long section on types of vegetation in Samoa, along with their associated species.

15. Reinecke, F., 1898. "Die Flora der Samoa Inseln, II". Bot Jahrb. 25: 578-708.
* A good list of the flora of Samoa, along with some Samoan names, but it is written in German.

16. Setchell, W.A., 1924. American Samoa: Part I. "Vegetation of Tutuila Island". Carnegie Inst. Washington.
* A good description of the types of vegetation found in American Samoa, with a not-so-good species list.

17. Vaupel, F., 1910. "Die Vegetation der Samoa-Inseln". Bot. Fb. 44. Beibl. 102: 47-58.
* Written in German, not located.

18. Whistler, A., 1973. "Botanical survey of the Ta'ū boat harbor site, 1973". U.S. Army Corps of Engineers, Honolulu, Hawaii.
* Report describing the vegetation of the site of a proposed boat harbor.

19. Wright, A.C.S., 1963. Soils and Land Use in Western Samoa. New Zealand Soil Bureau Bull. No. 22. 189 pp.
* Description of types of vegetation in Western Samoa is included.

20. Yuncker, T.G., 1945. Plants of the Manu'a Islands. B.P. Bishop Museum Bull. No. 189. 73 pp.
* Flora list of the Manu'a Islands, including sites of collection for the species.

LIST OF PERSONAL CONTACTS

The following persons were consulted by the investigator concerning the wetlands vegetation of American Samoa.

A. Binion Amerson, Jr:

Staff scientist and Samoa Project manager for Environment Consultants, Inc. of Dallas Texas, who are conducting a wildlife and vegetation survey in American Samoa for the Department of the Interior, Fish and Wildlife Service.

Don Graf:

Ecologist for the Government of American Samoa.

Dr. Alison Kay:

Professor of General Science at the University of Hawaii, who is working on an ecological and geological study in the Pacific Islands for the National Park Service.

John Kuruc:

Ecologist for Environment Consultants, Inc., working on the vegetation of American Samoa.

Dr. Charles Lamoureux:

Professor of Botany at the University of Hawaii who is working on an ecological and geological study in the Pacific Islands for the National Park Service with Dr. Kay.

Dr. Dieter Mueller-Dombois:

Professor of Botany at the University of Hawaii and co-director of the former Hawaiian International Biological Project (IBP).

KEY TO WETLAND SPECIES

A. Ferns
B. Grasses and sedges
C. Other herbaceous plants
D. Trees and shrubs

A. Ferns

1. Robust, clumped fern 1-3 m high, margin of leaf segments entire; spores densely covering bottom surface of upper leaf segments.....*Acrostichum aureum*
1. Medium-sized fern, margin of leaf segments deeply toothed; spores in round sori along margins of leaf segments.
.....*Cyclosorus gongylodes*

B. Grasses and sedges

1. Sedges; stems triangular (or if round, then leafless), leaf margins often sharp.
   2. Stems round and leafless.....*Eleocharis dulcis*
   2. Stems triangular, leaves present.
      3. Inflorescence a dense cluster; leaves stiff and sharp-edged; spikelets about 8-12 mm long (1/3-1/2").....*Cyperus javanicus*
      3. Inflorescence otherwise, leaves not very stiff; spikelets 6 mm long (1/4") or less.
         4. Flowers in cylindrical spikes of similar length, arising from a common point; rare.....*Cyperus odoratus*
         4. Flowers in a spreading cluster, variously branched on stalks of different lengths; common.....*Rhynchospora corymbosa*
1. Grasses; stems round, margins not sharp.
   5. Tall or robust grasses 1-2.5 m high.
      6. Grass usually sterile; leaf sheath hairy...*Brachiaria mutica*
      6. Grass usually fertile with white to black beadlike fruits; leaf sheath not hairy.....*Coix lacryma-jobi*
   5. Grasses smaller; fruits never beadlike and leaf sheath not hairy.
      7. Grass usually sterile, forming dense clumps along estuaries; flowering stalk 2-branched when fertile.....*Paspalum vaginatum*
      7. Grasses usually fertile, growing in freshwater wetlands and drier areas; flowering stalk various.
         8. Branches of flowering stalk filiform; spikelets with a purple ring around the base.....*Eriochloa procera*
         8. Branches of the flowering stalk flattened; spikelets without a purple ring around the base.
            9. Spikelets round in outline; flowering stalk with two terminal drooping branches..*Paspalum conjugatum*
            9. Spikelets elliptical in outline; flowering stalk with several spaced branches...*Paspalum orbiculare*

C. Other herbaceous plants

1. Flowers inconspicuous, in dense, unbranched axillary clusters.
   2. Erect plant with toothed leaf margins.....*Struchium sparganophorum*
   2. Creeping plant with untoothed leaf margins....*Alternanthera sessilis*
1. Flowers not in dense axillary clusters.
   3. Flowers yellow, petals and sepals four.
      4. Petals 3-6 mm long (1/8-1/4"), pointed.....*Ludwigia hyssopifolia*
      4. Petals 9-15 mm long (3/8-5/8 "), rounded and notched at the tip.....*Ludwigia octovalvis*
   3. Flowers not yellow, petals and sepals three or five.
      5. Flowers white; vines or creeping plants.
         6. Vine with many clusters of white flowers; leaves arrowhead-shaped.....*Mikania micrantha*
         6. Prostrate herb with solitary flowers; leaves elliptic or obovate.....*Limnophila fragrans*
      5. Flowers blue, purple, or red; plants never vines.
         7. Flowers red; tall herb with broad leaves; fruit bristly.....*Canna indica*
         7. Flowers blue or purple, herbs with small leaves less than 25 mm wide (1"); fruit not bristly.
            8. Flowers blue, petals three; leaves grasslike with parallel veins.....*Commelina diffusa*
            8. Flowers purple, petals five; leaves not grasslike. .....*Cuphea carthagenensis*

D. Trees and shrubs

1. Leaves compound, divided into three to many segments.
   2. Leaves palmate with three leaflets; stems thorny, flowers red.....*Erythrina fusca*
   2. Leaves even-pinnate with six to many leaflets in opposite pairs; stems not thorny, flowers white or orange to yellow.
      3. Tree; leaflet pairs mostly 3-4, tips pointed; flowers small, fruit large, round.....*Xylocarpus moluccensis*
      3. Shrub; leaflet pairs 8-24, tips rounded; flowers orange and showy; fruit a black pod.....*Cassia alata*
1. Leaves simple.
   4. Leaves opposite; fruits long and cylindrical.
      5. Calyx with about 12 long, linear lobes.....*Bruguiera gymnorhiza*
      5. Calyx with 4 short, triangular lobes.....*Rhizophora mangle*
   4. Leaves alternate; fruits not long and cylindrical
      6. Flowers yellow, large and showy; leaves heart-shaped.....*Hibiscus tiliaceus*
      6. Flowers white, not large and showy, leaves not heart-shaped.
         7. Flowers with many showy red stamens, hanging in long racemes.....*Barringtonia samoensis*
         7. Flowers with inconspicuous stamens, in short racemes 25-50 mm long (1-2").....*Inocarpus fagifer*

Acrostichum aureum L.

Chrysodium aureum (L.)Mett.

Technical:

Large coarse fern often growing in large clumps. Rhizome short, stout, erect. Frond stiff, erect to ascending, up to 3 m or more long. Rachis 2-10 mm thick, tough, longitudinally grooved, bearing 8 to many alternately arranged pinnae. Pinnae leathery, lanceolate, up to 35 cm or more long, 2.5-5 cm wide, tip and base acute, margins entire and slightly revolute, glabrous and finely, conspicuously reticulate-veined, on a stalk 1-4 cm long. Stipes clustered, base covered with scales. Sori found on the upper 1-10 or more pinnae, completely covering the lower surface of the pinnae except for the midvein.

General:

This fern may be recognized by the following characteristics:

(1) A large fern forming dense clumps.

(2) Tough leathery pinnae arranged pinnately on a frond up to 3 m long.

(3) The bottom surfaces of the upper pinnae covered with a dense layer of brown sporangia.

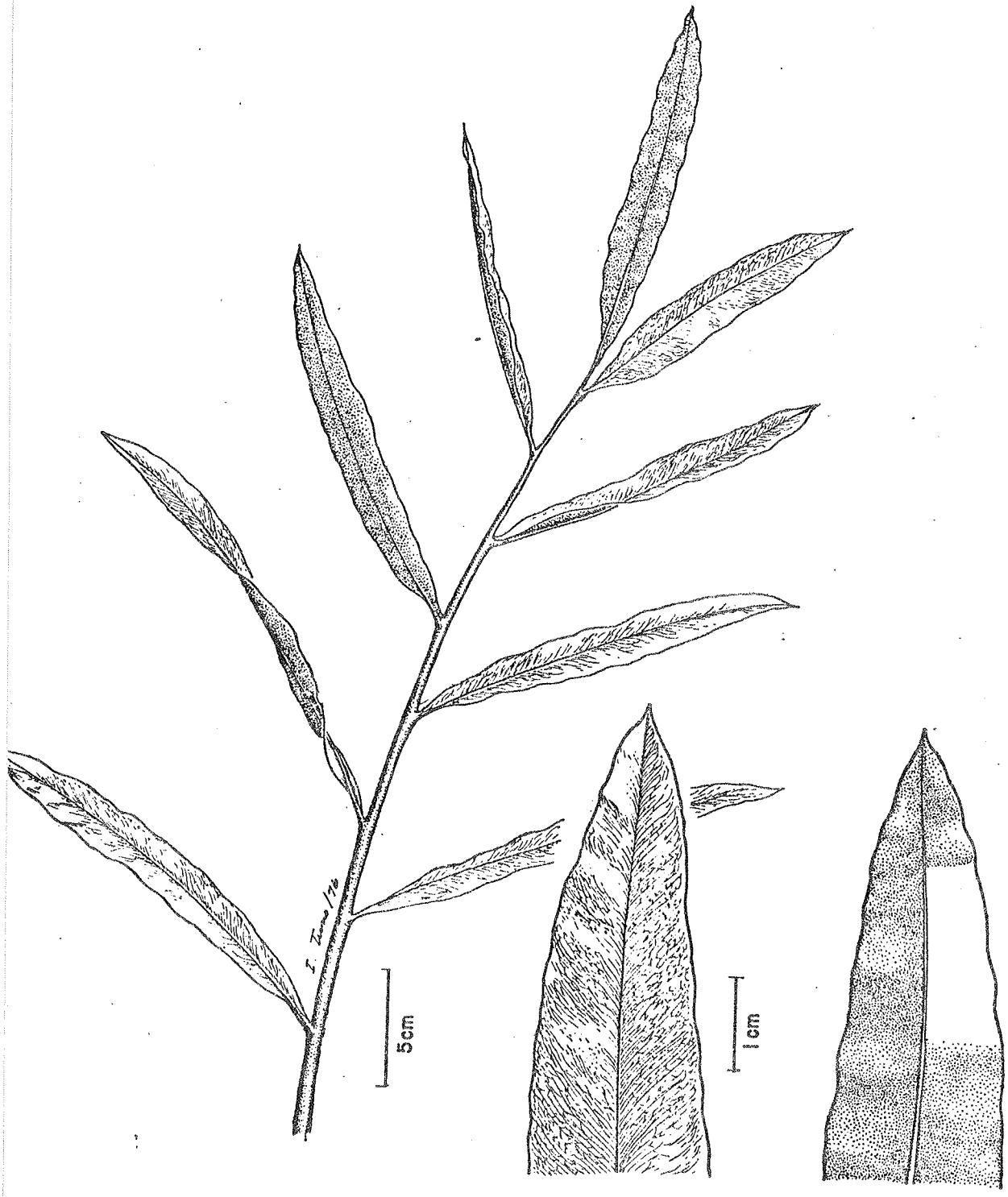
The marsh fern is common in wet coastal areas such as coastal marshes and along the edges of mangrove forests. A smaller form of the same species is occasionally found in drier areas on rocky coasts. The species is pantropical in distribution.

Samoan: Sa'ato or Ulu sa'ato

English: Marsh fern

Voucher Specimen # W 3292

Photograph # 21



ACROSTICHUM AUREUM L.

Bruguiera gymnorhiza (L.)Lmk.

Bruguiera sexangula sensu Degner non Lmk.
Bruguiera conjugata (L.)Merr.
Bruguiera rheedii Bl.

Technical:

A large tree up to 20 m high with rough grey bark, surrounded by kneed pneumatophores, and flowering even when quite small. Leaves opposite, blade elliptic, shiny, 6-15 cm long, tip and base acute, margins entire and slightly revolute, lower surface lighter than upper, both lacking brown dots; petiole 2-6 cm long; stipules large, caducous, leaving an annular scar. Flowers solitary, axillary, on a stout pedicel 1-2 cm long. Calyx waxy, red to white, 3.5-5 cm long, divided about half way into 10-12 tough linear lobes. Petals 10-12, caducous, slightly shorter than calxy lobes, hairy, orange-brown, tip two-lobed, with a filament between the lobes. Stamens 18-22. Ovary 3-4 celled, style ca. 2 cm long with a minutely lobed tip. Fruit green, germinating on the plant and producing a cylindrical, six-ribbed radicle up to 20 cm long.

General:

A medium to large mangrove tree recognized by the following characteristics:

(1) No prop roots, but with many knobby breathing roots coming to the surface all around the tree.

(2) Leathery leaves lacking brown dots on the lower surface.

(3) White to red, waxy calyx up to 5 cm long (2") with 10-12 tough linear lobes.

(4) Fruit cylindrical and 6-ribbed, up to 20 cm long (8").

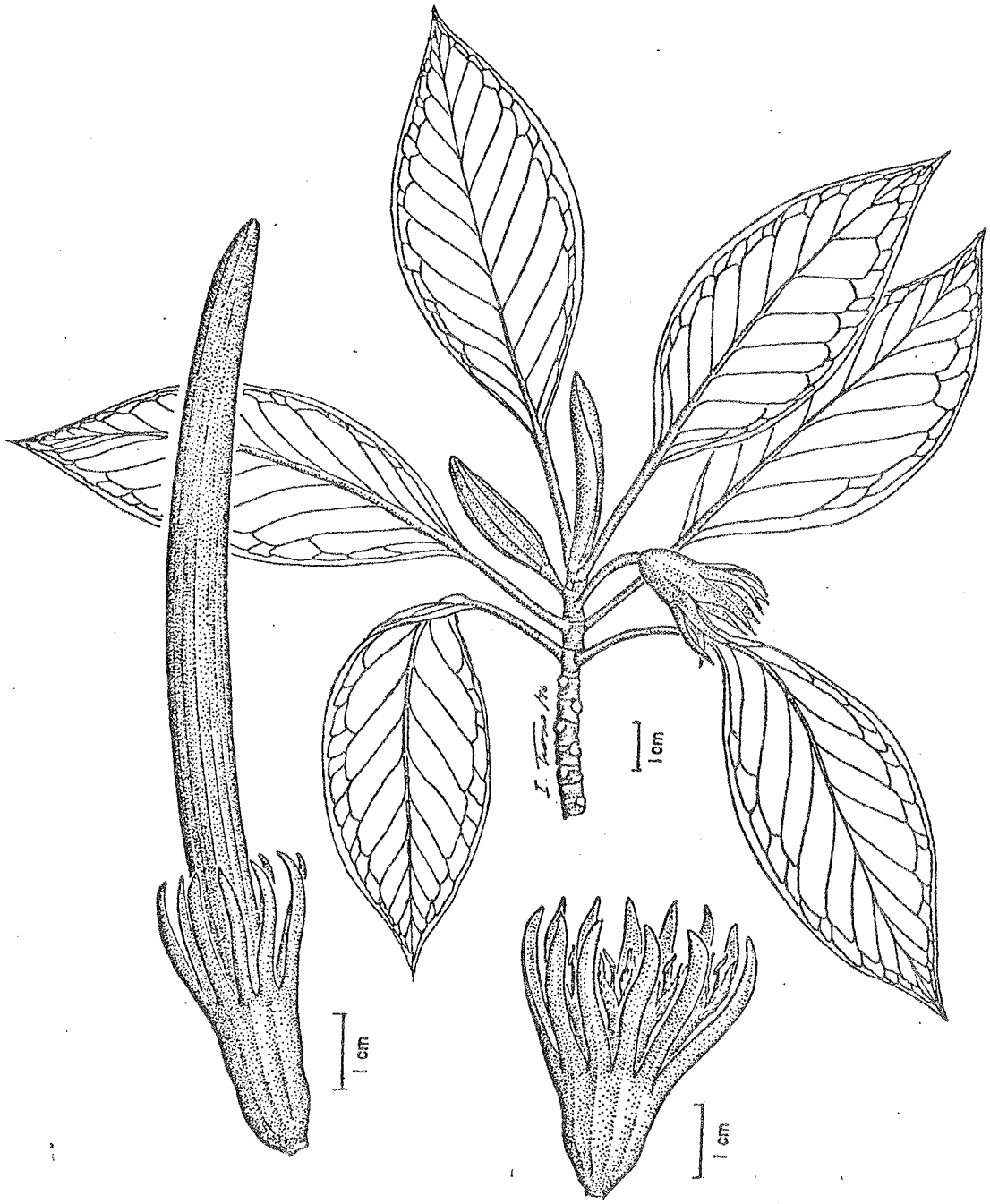
This tree is the dominant, and often the only tree in most of the mangrove forest. It is found on protected coasts, mostly in estuaries and shallow lagoons, not venturing far from salt or brackish water. This tropical Asian species is probably native to Samoa and owes its wide distribution to the salt-tolerant seedlings that drift long distances.

Samoan: Togo

English: Oriental mangrove

Voucher Specimen # W 3259

Photograph # 12



BRUGUIERA GYMNORHIZA (L.) Lmk.

Cassia alata L.

Technical:

A large shrub 2-4 m high. Leaves alternate, pinnately compound, 30-80 cm long; leaflets in 6-16 pairs, oblong to obovate, up to 15 cm long, tip obtuse to rounded-emarginate, base broadly rounded or truncate, margins entire, surfaces glabrous, the lowermost leaflet pair remote from the other pairs. Flowers showy in dense racemes 40-60 cm long including the 10-20 cm long stalk; each flower is subtended by a caducous bright orange bract 2-3 cm long. Sepals 5, elliptic, 12-18 mm long, yellowish, glabrous, tips rounded. Petals 5, obovate, ca. 2 cm long, bright yellow with obvious veins, tips rounded. Stamens 7, unequal in size, 2 large ones 7-10 mm long, the other five much smaller, filaments 2-8 mm long. Ovary narrow, curved, ca. 15 mm long with a style ca. 5 mm long. Pod black, straight, 50-70 seeded, 10-15 cm long, broadly winged, the two wings 15-20 mm wide, margins crenate.

General:

A large shrub recognized by the following characteristics:

(1) Long upright flowering stems bearing densely packed yellow flowers with orange bracts.

(2) Large pinnately compound leaves bearing 6-16 pairs of elliptic leaflets.

(3) Black many-seeded pods 10-15 cm long (4-6") having broad wings with wavy margins.

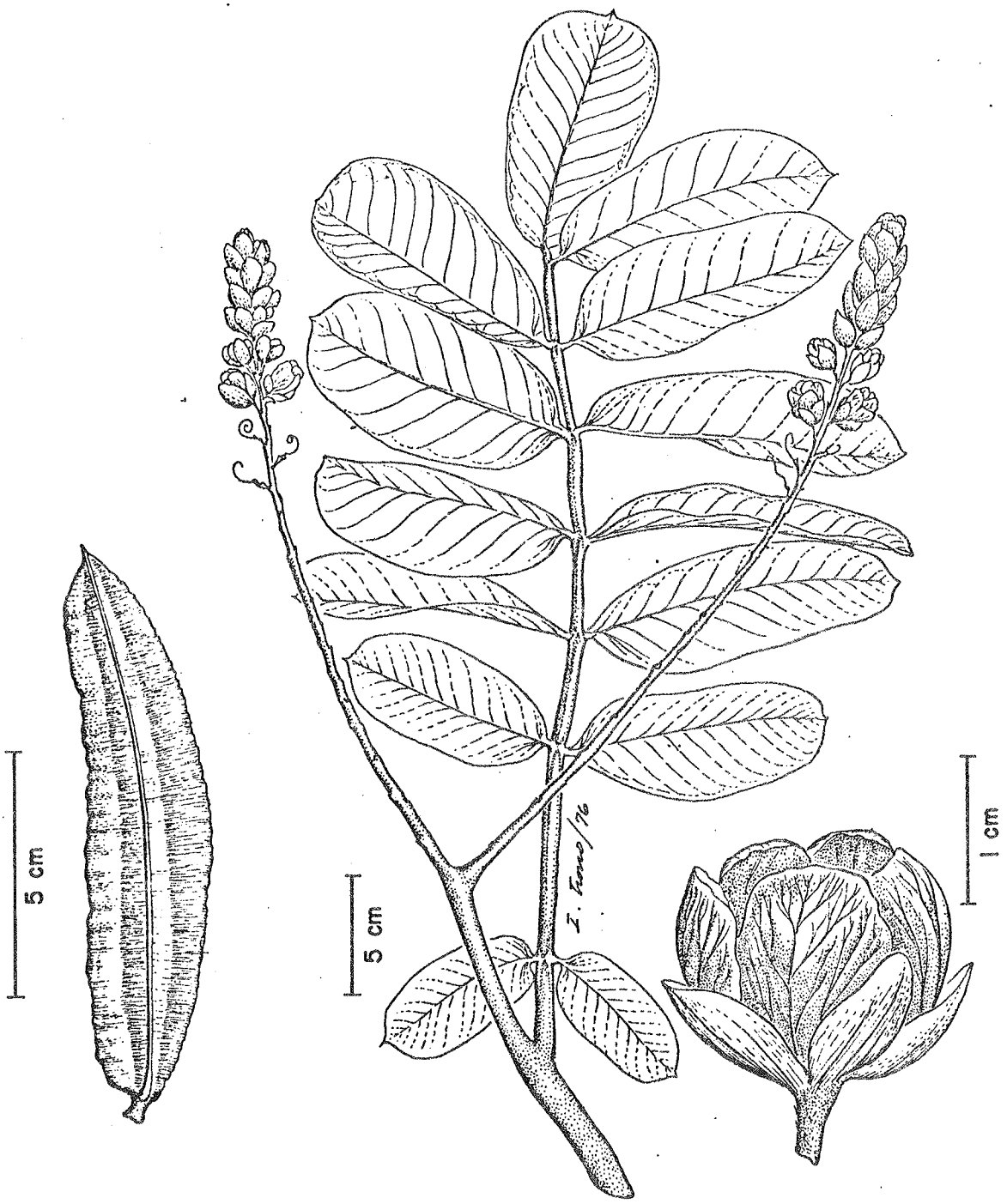
This colorful shrub is found in swampy, freshwater areas and and along streams and drainage canals. It is native to tropical America and was probably introduced to Samoa around the turn of the century. The Samoans use the leaves to prepare a medicine for ringworm, and it is sometimes cultivated for that purpose, as well as for its showy flowers.

Samoan: La'au fai lafa

English: Candlebush

Voucher Specimen # W 3286

Photograph # 16



CASSIA ALATA L.

Coix lacryma-jobi L.

Coix lacryma L.

Technical:

Robust annual grass. Culms 1-2 m high, erect, stout, filled with pith, strongly branched at base. Leaf sheath striate, rounded, glabrous. Ligule membraneous, fringed, ca. ½ mm long. Leaf blade 15-60 cm long, 2-4 cm wide, base rounded, upper surfaces and margins scabrous. Inflorescence of several branches in fascicles growing from leaf axils. Spikelets unisexual; the female spikelet on a pedicel 1-6 cm long, enclosed in a hard, shining, globose-ovoid to ovoid bead-like shell black to white in color, 8-12 mm long, bearing at its apex a 1-5 cm long raceme of male spikelets, each ca. 8 mm long, two-flowered, arranged in twos and threes.

General:

This grass may be recognized by the following characteristics:

(1) Large robust grass up to 2 m high with leaves 2-4 cm wide (.8-1.6").

(2) Separate male and female flowers.

(3) Seed enclosed in a hard white, grey, or black bead-like shell 8-12 mm long (.3-.5").

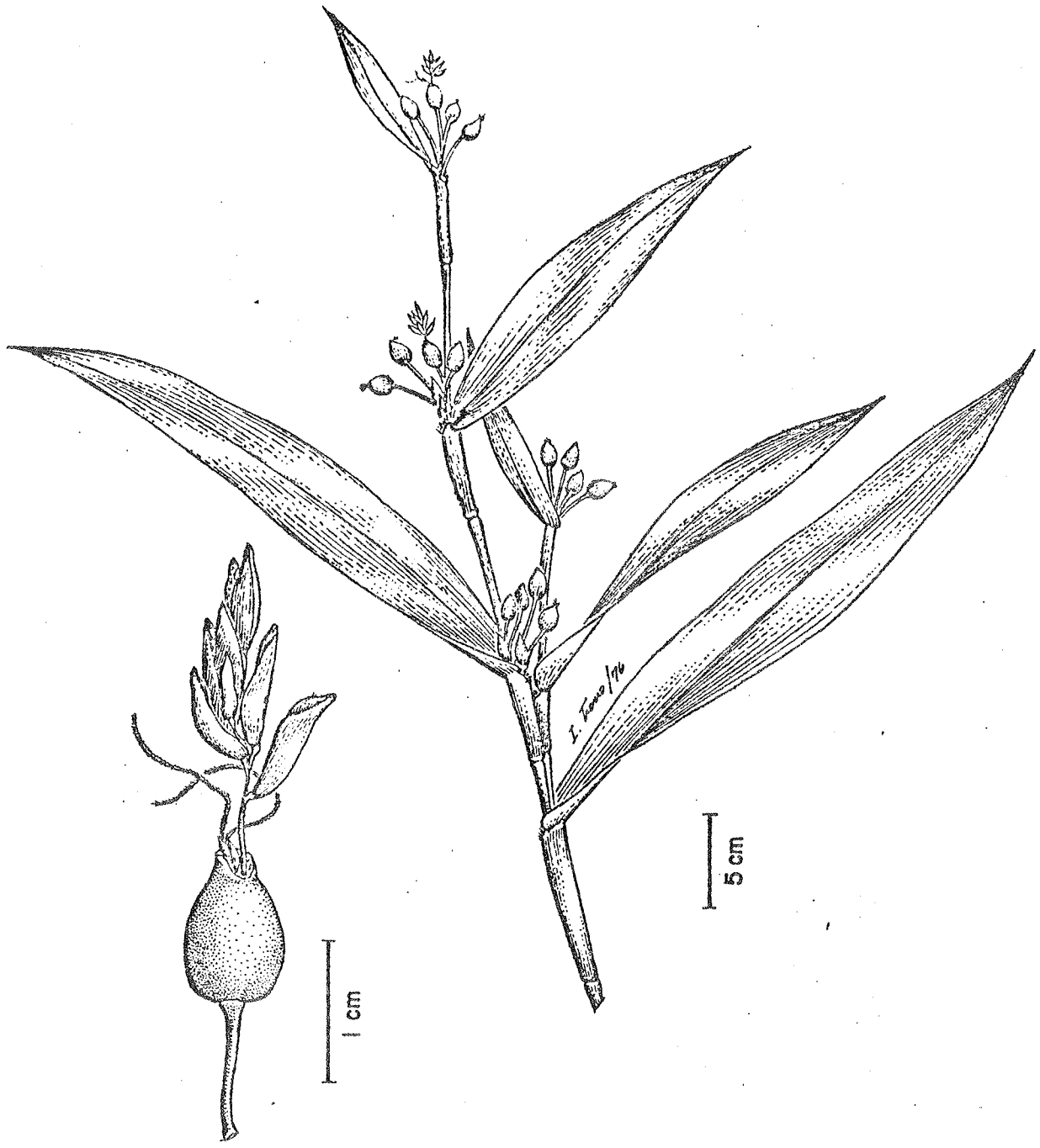
It is a common grass along disturbed streamsides, irrigation canals, and in some inland swampy or marshy areas. Although the fruit is edible, it is never used for food in Samoa. It is a weed in wet taro patches, but does not commonly occur in the coastal marshes. The seeds are often used as beads to make necklaces.

Samoan: Sagasaga

English: Job's tears

Voucher Specimen # W 3310

Photograph # 15



COIX LACRYMA-JOBI L.

Cyclosorus gongylodes (Schkuhr)Link

Dryopteris gongylodes (Schkuhr)O.K.
Nephrodium unitum R.Br.
Aspidium unitum (R.Br.)Mett.

Technical:

Coarse medium-sized fern spreading by rhizomes. Rhizome ca. 8 mm thick, obscurely scurfy, black, branching to form dense mats, and producing scattered black roots. Frond stiff, erect, up to 1.4 m high. Blade up to 80 cm long, pinnately divided into 30-60 pinnae in opposite pairs. Pinnae lanceolate to narrowly lanceolate, up to 12 cm long, 8-13 mm wide, tip acute to attenuate, base rounded and subsessile on rachis, set at right angles to the plane of the frond, upper surface glabrous, lower mostly with scattered appressed hairs, margins deeply serrate-dentate, teeth 2 per cm in the middle of pinna. Stipe 60-90 cm long, purplish black towards the base, 2-4 mm thick. Sori small, 4-6 per side of tooth, in two converging rows.

General:

This fern may be recognized by the following characteristics:

(1) Stiff, erect fronds up to 1.4 m high, divided into 15-30 pairs of pinnae.

(2) Pinnae set at right angles to the plane of the frond.

(3) Pinnae lanceolate, up to 12 cm long, deeply toothed.

(4) Sporangia on lower surface of pinnae, along the tooth margins.

(5) Stipe purplish-black at base.

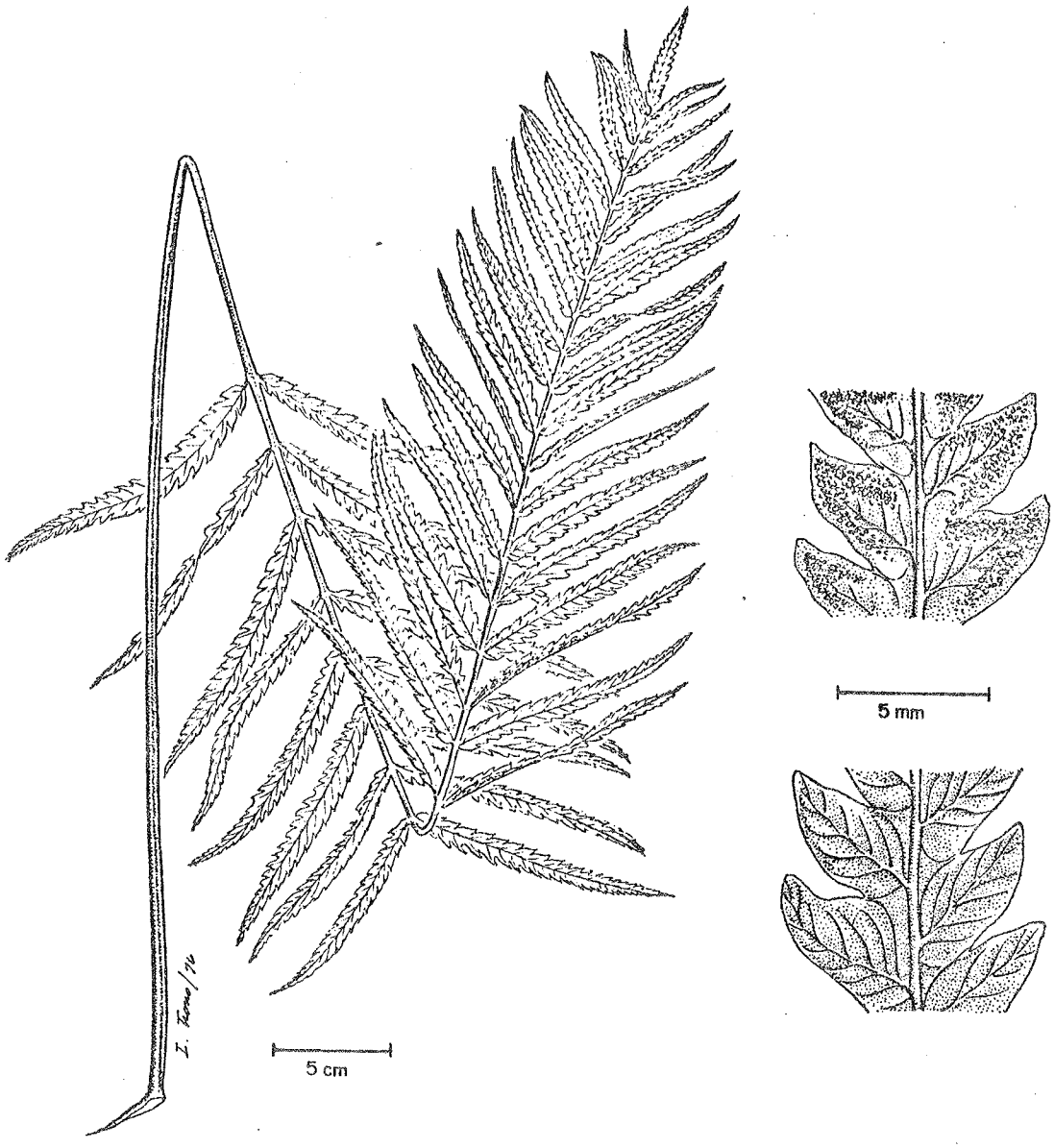
This species is characteristic of wet areas at low elevations. It is a dominant species of the Aunu'u Crater, where it is associated with Eleocharis, and is often sterile, but spreads by extensively creeping rhizomes. It has a pantropical distribution.

Samoan: Vao tuāniu

English: Swamp Cyclosorus

Voucher Specimen # W 3269

Photograph # ??



CYCLOSORUS GONGYLODES(SCHK.) LINK

Eleocharis dulcis (Burm.f.)Hens.

Eleocharis plantaginea R.& S.
Eleocharis sphacelata sensu Rech. non R.Br.

Technical:

Perennial leafless rush with elongate stolons sometimes bearing small tubers. Stems erect, tufted, 40-150 cm high, 3-10 mm wide, terete, glabrous, finely longitudinally striate and conspicuously transversely septate. Sheath membraneous, oblique at apex, purplish. Inflorescence a single, terminal, cylindrical, elongate, many-flowered spikelet 1.5-6 cm long, ca. as broad as the stem. Glumes oblong, 4-6 mm long, tip obtuse with a scarious margin, midvein distinct, imbricate and appressed to the spikelet. Bristles 6-8, as long to twice as long as nut. Stamens 3, anthers linear. Style 2-3 lobed, ca. 4 mm long, base triangular, dark brown. Nut biconvex, obovate, 1.5-2 mm long, shining brown.

General:

This rush may be recognized by the following characteristics:

(1) Leafless, round, green stems having transverse partitions.

(2) Inflorescence a terminal spikelet 1.5-6 cm long (.6-2.4") bearing many overlapping scales.

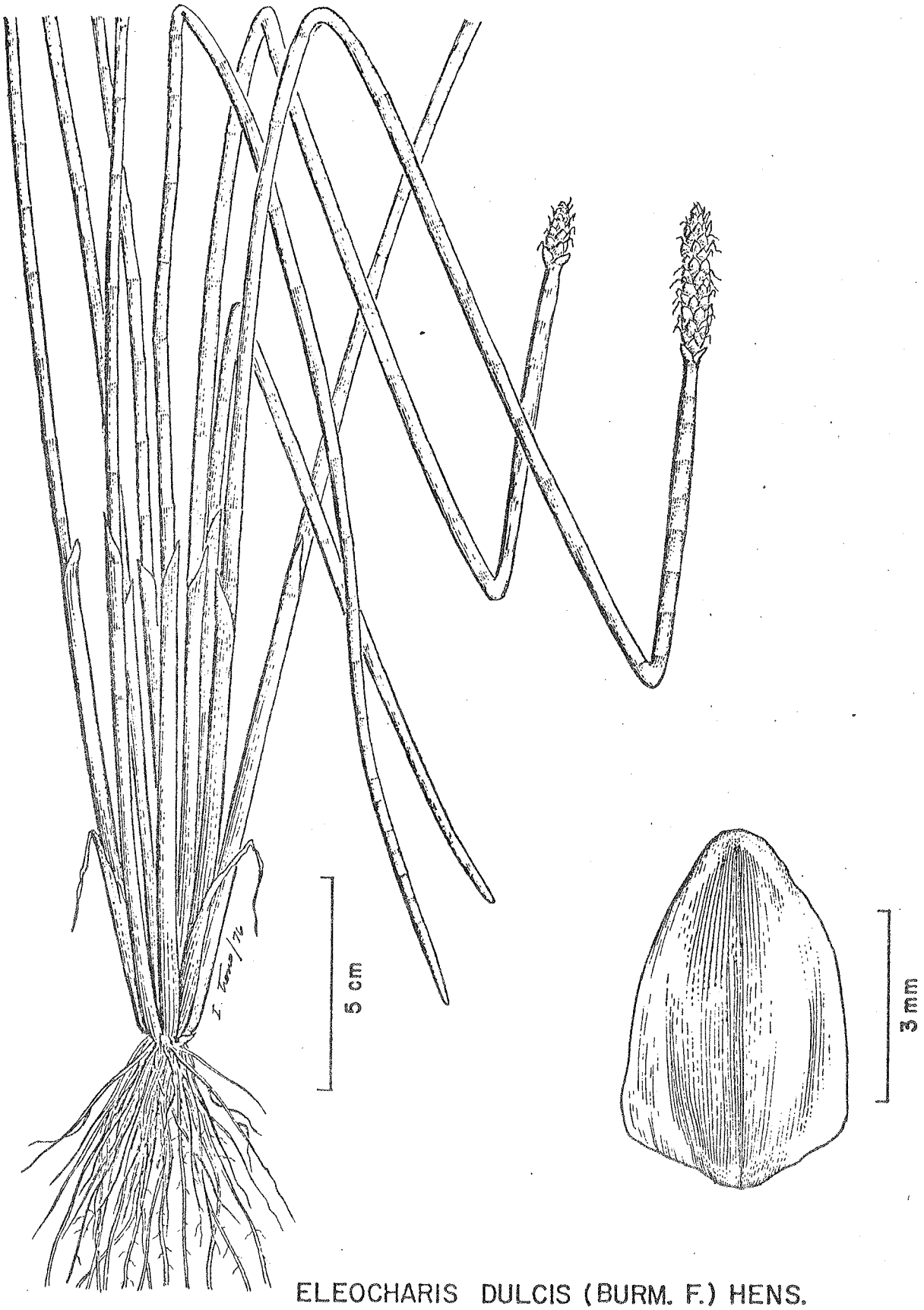
Eleocharis is commonly found in coastal freshwater marshes, often as a dominant species. The same species is found along the margins of crater lakes in Western Samoa, such as Lake Lanoto'o at 700 m, but crater lakes are not found in American Samoa. A widespread tropical species found from West Africa to the Pacific.

Samoan: 'Utu'utu

English: Water chestnut

Voucher Specimen # W 3266

Photograph # 20



ELEOCHARIS DULCIS (BURM. F.) HENS.

Erythrina fusca Lour.

Erythrina ovalifolia Roxb.

Technical:

Medium to large tree up to 25 m high. Stems spiny, trunk with corky ridges or tubercles. Leaves alternate, pinnately trifoliate, rachis 6-15 cm long, sometimes spiny; terminal leaflet oval, larger than the similar lateral pair, 8-15 cm long, tip obtuse, base round, surfaces glabrous, lower lighter than the upper, margins undulate; petiole of leaflets 3-7 mm long. Inflorescence an axillary, many-flowered raceme 20-30 cm long, bearing the flowers in groups of 3. Calyx irregularly splitting or bilabiate, 10-15 mm long, on a pedicel 5-15 mm long. Corolla papilionaceous, 3.5-5 cm long, bright red, keel and wings marked with white, standard long-clawed. Stamens 10, diadelphous, 3-4 cm long. Style purple distally, as long as the stamens. Pod 10-20 cm long, 12-18 mm wide, constricted and septate between the seeds. Seeds dark brown, ca. 15 mm long, 2-8 per pod.

General:

This tree can be recognized by the following characteristics:

(1) Leaves trifoliate with oval leaflets 8-15 cm long (3.2-6").

(2) Stems, branches, and sometimes the leaf rachis spiny.

(3) Flowers red, showy, 3.5-5 cm long (1.4-2").

(4) Long pods bearing 2-8 brown seeds ca. 15 mm long (.6")

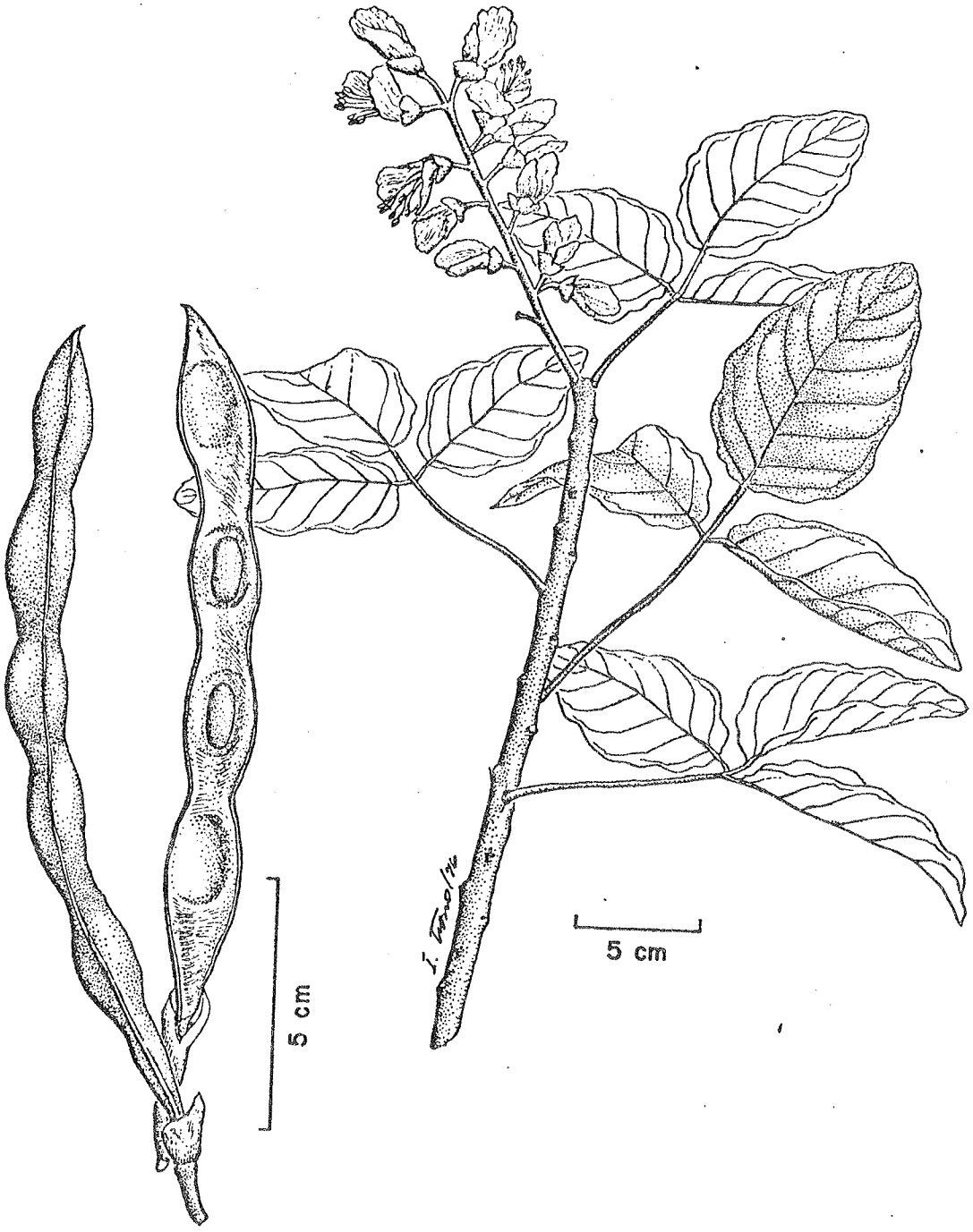
This Erythrina is very rare in Samoa, as it has been collected in only three localities (two places on Upolu, Western Samoa, and at Leone on Tutuila). It was collected only once at Leone, and that was over 40 years ago. It is a tree of swampy coastal areas, and is also found in Fiji, Java, and elsewhere in the Western Pacific.

Samoan: Lalapā

English: (none)

Voucher Specimen # (none)

Photograph # (none)



ERYTHRINA FUSCA LOUR.

Hibiscus tiliaceus L.

Pariti tiliaceum (L.) Britton

Technical:

A medium-sized, freely branching tree 4-15 m high. Leaves alternate, round to cordate, palmately 7-9 veined, 6-20 cm long, tip shortly acuminate, base cordate, margins entire to finely crenate-dentate, upper surface glabrous, lower densely short-pubescent with many stellate hairs; petiole 1.5-10 cm long; stipules ovate, 2-4 cm long, finely pubescent. Flowers solitary or in few-flowered racemes, showy, on stout, pubescent pedicels 1-4 cm long. Calyx 2-2.5 cm long, puberulent, deeply divided into 5 lanceolate lobes and subtended by a smaller epicalyx with 10-12 acute lobes. Petals 5, round and clawed, 5-8 cm long, yellow with a maroon base inside, turning red with age. Stamens monadelphous, anthers white. Ovary 5-celled, with a long, maroon 5-lobed style. Fruit a capsule 2-2.5 cm long, densely covered with fine, yellow pubescence, and splitting open by five valves; seeds reniform, ca. 5 mm long, several per cell.

General:

This widespread and variable tree may be recognized by the following characteristics:

(1) Heart-shaped leaves densely short-hairy on the lower surface.

(2) Showy yellow flowers (aging to red) maroon inside at the base.

(3) Stamen filaments united into a maroon tube around the style.

(4) Fruit ca. 2.5 cm long (1"), covered with fine yellow hairs, and splitting open from the top by five valves.

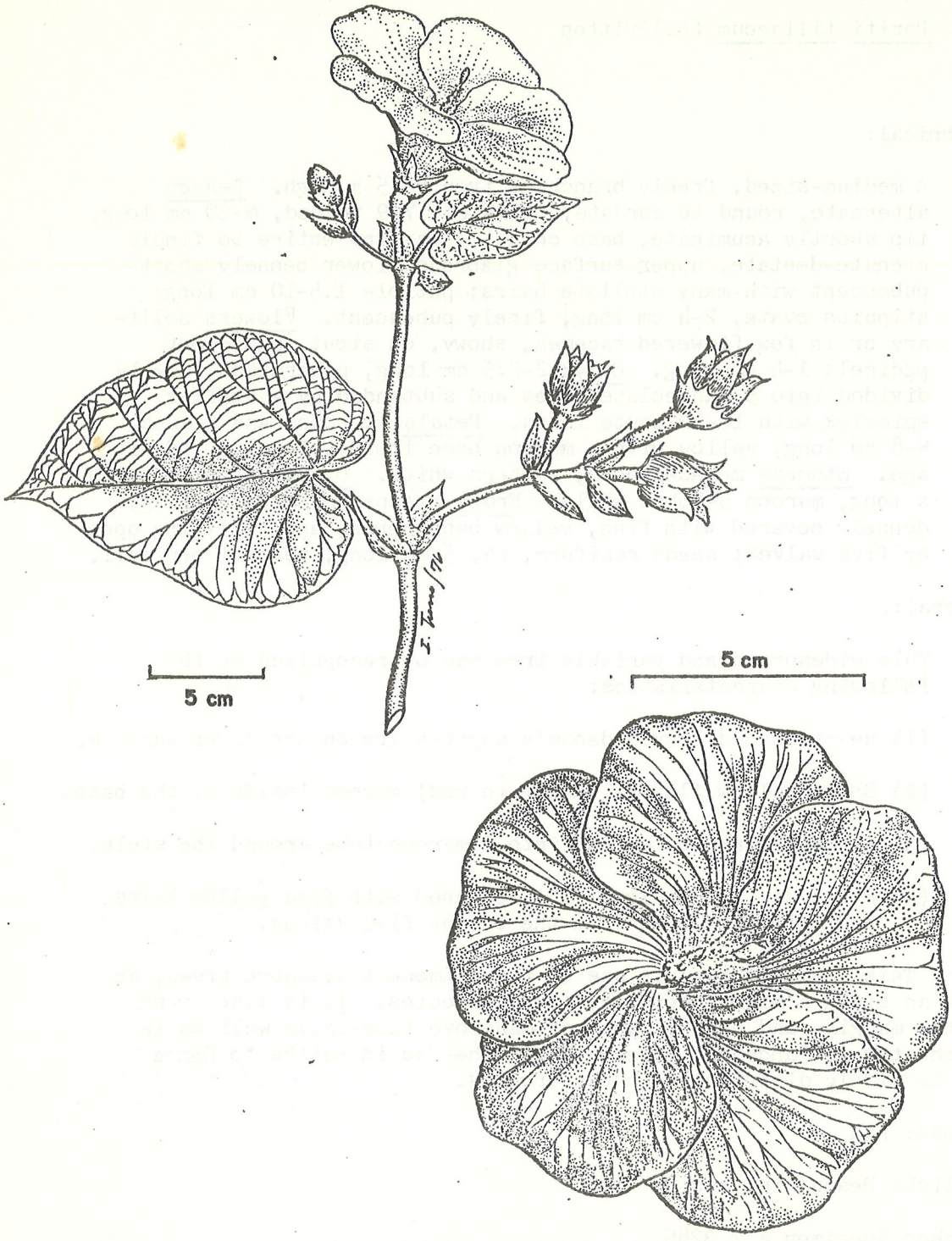
This Hibiscus tree is one of the commonest seashore trees, as well as being a major secondary forest species. It is also found on the margins and higher parts of mangrove forests, as well as in freshwater wetlands and streamsides. The fau is native to Samoa and is widely distributed in the Tropics.

Samoan: Fau

English: Beach hibiscus

Voucher Specimen # W 3285

Photograph # 23



HIBISCUS TILIACEUS L.

Limnophila fragrans (Forst.)Seem.

Ambulia serrata Wett.

Technical:

A low, creeping herb. Stems reddish, glabrous, aromatic when bruised. Leaves opposite, decussate, glabrous, elliptic to obovate, 10-25 mm long, gland dotted especially on the lower surface, tip mostly rounded, base sessile, margins serrate on upper half of leaf. Flowers solitary and sessile in the leaf axils, only one per pair of leaves. Calyx 3.5-5 mm long, divided about half way into 5 linear to subulate lobes, tips acute to acuminate. Corolla sympetalous with 5 short, rounded lobes, bilabiate, 6-8 mm long, white with dark longitudinal lines in the throat. Stamens 4, didynamous, included. Ovary with a filiform, bifid style. Capsule ovoid, about as long as calyx, 4-valved, many seeded.

General:

This aromatic herb can be recognized by the following characteristics:

(1) Low creeping plant with reddish stems.

(2) Leaves opposite, sessile, 10-25 mm long (.4-1"), with upper margins toothed.

(3) Small white sessile flowers solitary in the leaf axils, only one flower per node.

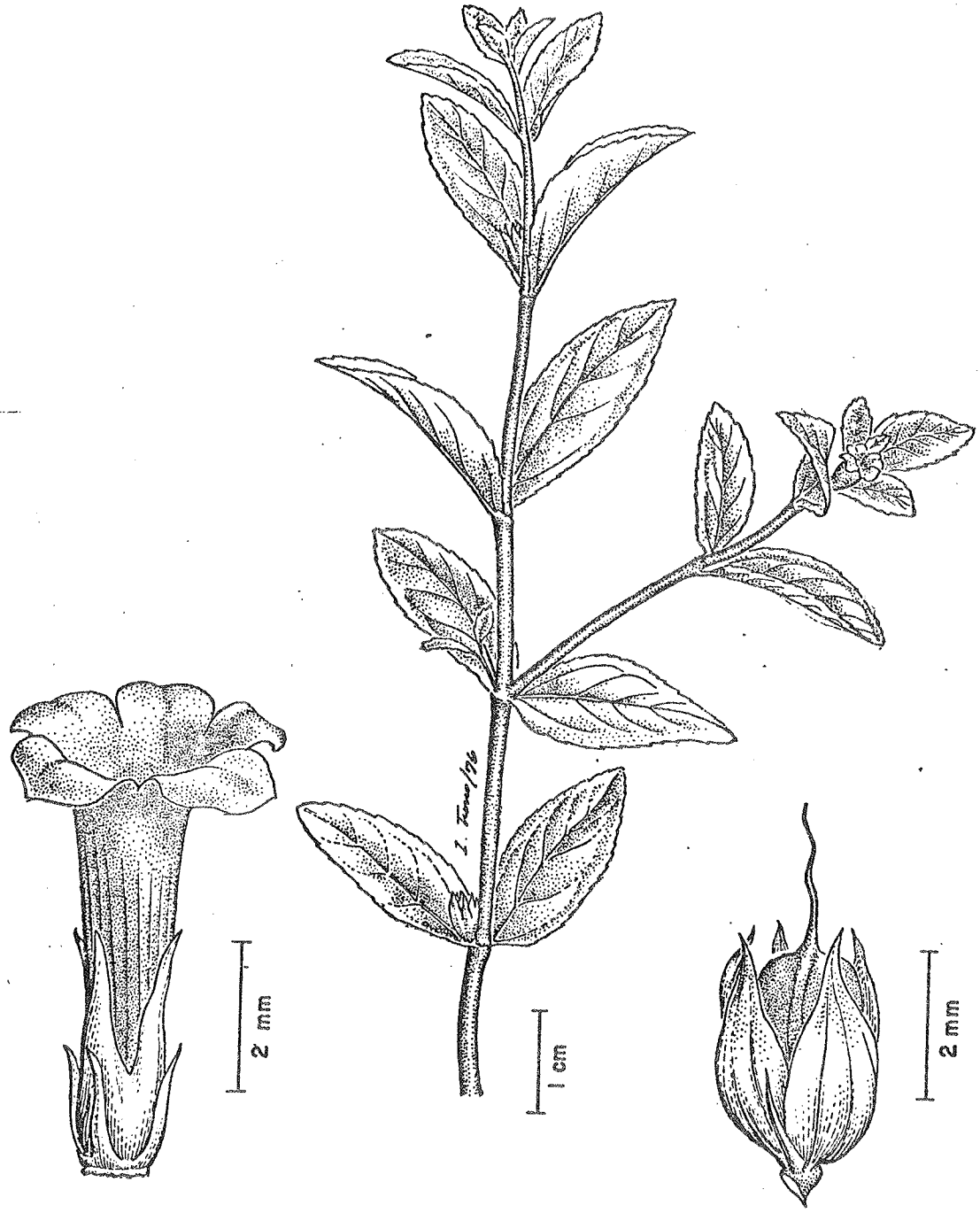
This herb is rare in Samoa, having been collected only a few times. It is found in marshy localities, and on Ta'ū it was found growing as a minor weed in a wet taro patch. Limnophila is native to Samoa and is found in Fiji and elsewhere, but is not very widespread.

Samoan: Tamole vai

English: (none)

Voucher Specimen # W 3305

Photograph # 18



LIMNOPHILA FRAGRANS (FORST. F.) SEEM.

Ludwigia octovalvis (Jacq.)Raven

Jussiaea suffruticosa L.
Jussiaea erecta auct. non L.
Jussiaea angustifolia Lmk.

Technical:

Erect, branched perennial herb becoming woody with age. Stems longitudinally ribbed, reddish. Leaves alternate, lanceolate to narrowly lanceolate, 4-13 cm long, tip and base acute, surfaces mostly glabrous, margins entire; petiole 1-4 mm long. Flowers solitary in upper leaf axils. Calyx divided to base into 4 ovate lobes 9-12 mm long, tips acute to acuminate, persistent, tube 8-grooved, with a pair of linear bracts above the base. Petals 4, caducous, obovate, 12-18 mm long, nearly as wide, yellow, tip rounded and notched. Stamens 8, ca. 3 mm long. Ovary inferior, enlarged in fruit, style ca. 1 mm long, stigma subglobose, ca. 2 mm across. Capsule subcylindric, longitudinally ribbed, 4-6.5 cm long, containing may flattened, round seeds ca. 1 mm across.

General:

This herb may be recognized by the following characteristics:

(1) Tall, coarse herb with reddish, longitudinally grooved stems.

(2) Yellow flowers with petals 12-18 mm long (.5-.75") with rounded and notched tips.

(3) Inferior ovary and nearly cylindrical fruit 4-6.5 cm long (1.6-2.6") crowned by 4 persistent calyx lobes.

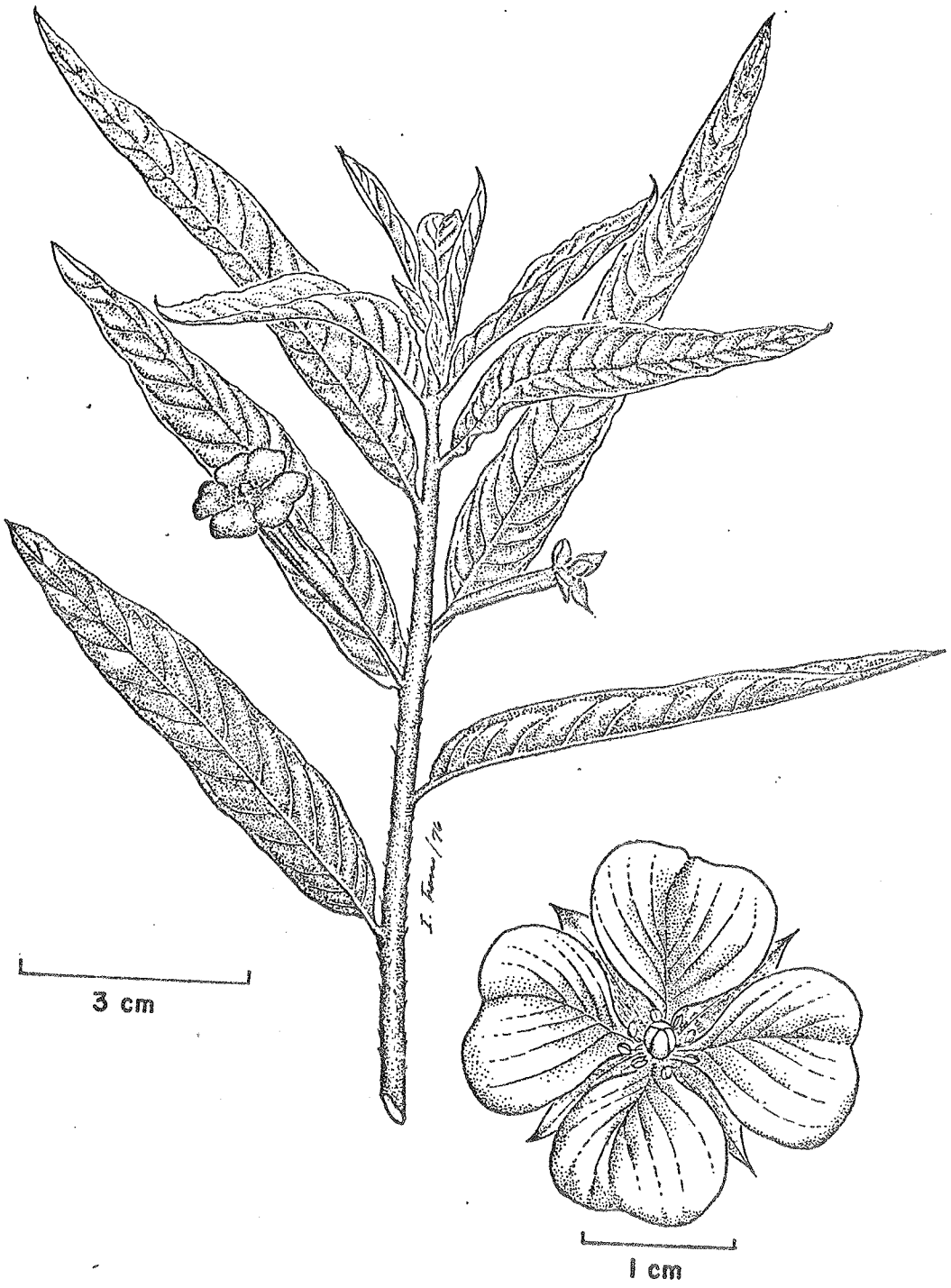
This herb is an aboriginal or early introduction to Samoa and is widespread in the Old World Tropics. It is a common weed of irrigation ditches, wet taro patches, and other wet places, as well as being a dominant species in the disturbed coastal marshes.

Samoan: Vao malō or La'avai (?)

English: Willow primrose

Voucher Specimen # W 3263

Photograph # 17



LUDWIGIA OCTOVALVIS (JACQ.) RAVEN

Paspalum vaginatum Swartz

Technical:

Creeping perennial grass often forming extensive colonies. Culms erect, 8-60 cm high, glabrous, spreading by creeping rhizomes and stolons. Leaf sheath longer than internodes, overlapping, mostly glabrous. Ligule less than 1 mm long, membranous. Leaf blade 2-16 cm long, 2-5 mm wide, glabrous, often with the edges rolled. Inflorescence of 2 (rarely 3) spreading racemes 2-5 cm long on a short axis; rachis 3-angled, 1-2 mm wide. Spikelets elliptic, acute, 3-4 mm long, pale green, solitary in two rows. Lower glume absent, upper glume and sterile lemma as long as spikelet, 3-5 nerved, glabrous.

General:

This maritime grass may be recognized by the following characteristics:

(1) Creeping grass forming dense colonies of erect culms.

(2) Inflorescence of two spreading branches on a short axis, but rarely flowering.

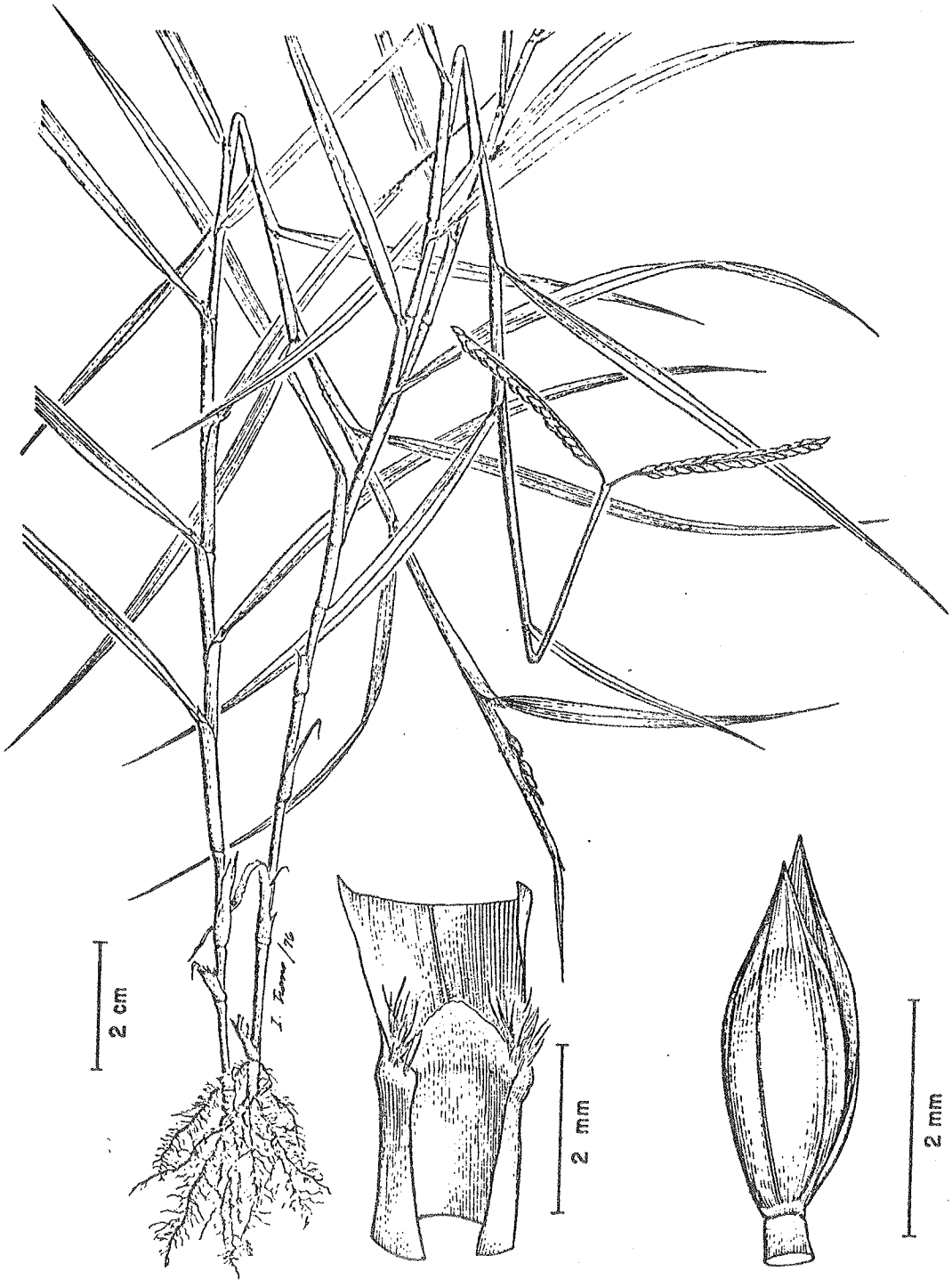
This grass forms dense patches along the edges of estuaries and mangrove swamps, and occasionally is a strand plant on the shore. Although it flowers infrequently, it can be easily distinguished from all other Samoan grasses by its habit and the habitat it occupies. It is a widespread species of the warmer parts of the world, and is probably native to Samoa.

Samoan: (none)

English: (None)

Voucher Specimen # W 3294

Photograph # 14



PASPALUM VAGINATUM SW.

Rhizophora mangle L.

Rhizophora mucronata Auct. non Lmk.
Rhizophora mangle L. var. samoensis Hochr.

Technical:

Small to medium-sized tree up to 5 m or more high with a round bushy crown and supported by numerous stilt roots. Leaves opposite, obovate to elliptic, leathery, 5-15 cm long, tip subacute to nearly acute-truncate, base nearly obtuse to somewhat cuneate, margins entire, mostly revolute, lower surface covered with many tiny brown dots; stipules large, caducous, leaving an annular scar. Flowers in 2-6-flowered cymes on a stout peduncle 1-3 cm long. Calyx waxy-yellow, deeply divided into 4 thick lanceolate lobes 10-15 mm long reflexed with age. Petals 4, hairy, narrowly lanceolate, 8-11 mm long, short-lived. Stamens 8, caducous. Ovary 2-celled, with a short 2-lobed style. Fruit greenish-brown, germinating on the plant and producing a long-cylindrical radicle up to 50 cm or more long, widest towards the acute tip.

General:

A small to medium-sized mangrove tree recognized by the following characteristics:

(1) Supported by numerous prop roots.

(2) Leathery leaves with lower surface covered with tiny brown dots.

(3) Waxy-yellow calyx with 4 sepals usually bent back.

(4) Fruit remaining on the plant for a long time, growing into a hanging long-cylindrical seedling widest near the tip.

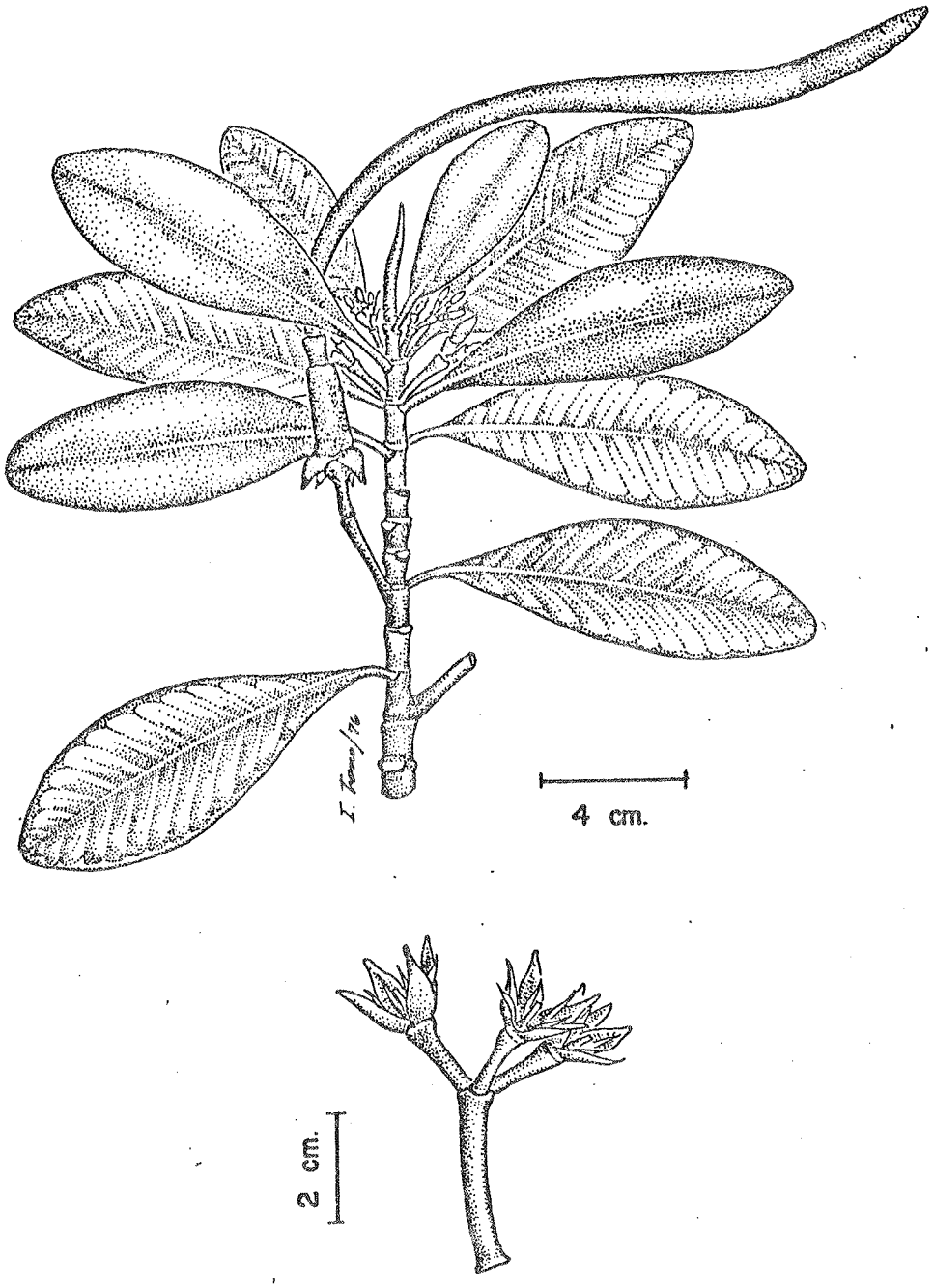
Rhizophora is found in mangrove forests along estuaries and in shallow lagoons. In Samoa few trees over 3 m high were seen. They are usually found on the seaward margin of the mangrove forest as a pioneer species, but are replaced inland by the much larger Bruguiera. The species is widespread in the American Tropics, and is apparently native to Samoa.

Samoan: Togo

English: Red mangrove

Voucher Specimen # W 3284

Photograph # 11



RHIZOPHORA MANGLE L.

Rhynchospora corymbosa (L.) Britt.

Rhynchospora aurea Vahl

Rhynchospora grandifolia Boeck. (?)

Technical:

A coarse perennial sedge up to 1.5 m high. Stems tufted, glabrous, erect to ascending, 3-angled, the angles smooth on the lower parts of the stem and scabrous on the upper. Leaves linear, up to 80 cm long or more, 8-16 mm wide, margins sharp and finely scabrous. Sheath short, membraneous, apex rounded to obtuse. Inflorescence a loose spreading panicle with the spikelets clustered at the ends of branches of varying lengths; the terminal portion 5-15 cm long, with lower solitary branches appearing to be axillary. Spikelets lanceolate, 6-9 mm long, 2-3 flowered, rusty-brown. Glumes ovate, apiculate, midvein distinct, 5-8 per spikelet. Bristles 4-5 mm long, filamentous, scabrous. Stamens 2-3. Style conical, up to 5 mm long, grooved longitudinally, articulated with the nut and persistent on it as a beak. Nut obovate to oblong-obovate, 2.5-3.5 mm long, rugose, light brown.

General:

This sedge may be recognized by the following characteristics:

(1) Tall unbranched plant with triangular stems.

(2) Leaves sharp-edged, 8-16 mm wide (.3-.7").

(3) A spreading, much-branched terminal inflorescence with smaller flowering branches appearing to be in the axils of the upper leaves.

(4) Spikelets rusty-brown, in clusters on the ends of inflorescence branches.

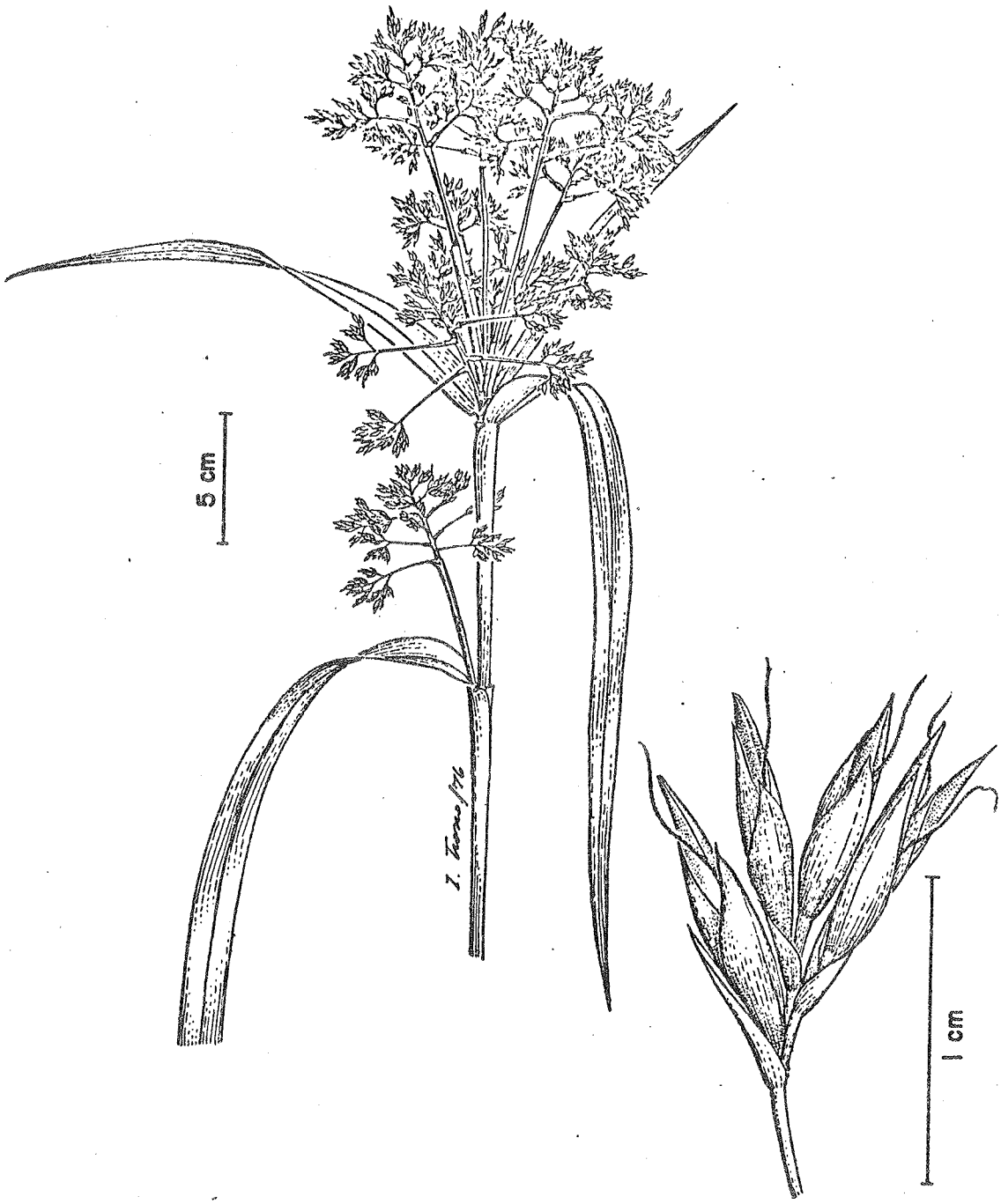
Rhynchospora is a dominant plant in the coastal marshes of Samoa and is a widespread species in the Tropics. In Western Samoa it is also found in mountain meadows in old craters. The sharp edges of the leaves can easily cut the unwary person.

Samoan: Selesele, Vao selesele, or Lau selesele

English: (none)

Voucher Specimen # W 3264

Photograph # 19



RHYNCHOSPORA CORYMBOSA (L.) BRITTON

Xylocarpus moluccensis (Lmk.)Roem.

Xylocarpus granatum sensu Laut. non Koen.

Technical:

Medium-sized tree up to 10 m or more high with conical-geniculate breathing roots. Leaves alternate, pinnately compound, rachis 8-25 cm long; leaflets 4-8 in opposite pairs, blade mostly ovate, 6-18 cm long, coriaceous, glabrous, tip acute to submucronate, base rounded to acute, somewhat oblique, margins entire. Flowers in drooping axillary panicles 8-20 cm long. Calyx tiny, 1-1.5 mm long, deeply divided into 4 lobes, pedicel 2-10 mm long. Petals 4, free, oblong-obovate, 4-6 mm long, white, reflexed. Stamens 8, fused into an urceolate tube 3-4 mm long. Style 2 mm long. Fruit subglobose, 5-10 cm in diameter, 3-4-valvate, brown, on a stout stalk. Seeds mostly 8-12, large, somewhat tetrahedral, pink, filling up the entire fruit and fitting together like a puzzle.

General:

This tree may be distinguished by the following characteristics:

(1) Alternate even-pinnate leaves with 2-4 pairs of oppositely arranged leaflets dark green in color.

(2) Flowers in a drooping inflorescence 8-20 cm long (3.2-8").

(3) Fruit round, 5-10 cm in diameter (2-4"), containing 8-12 large pink seeds fitting together like a puzzle.

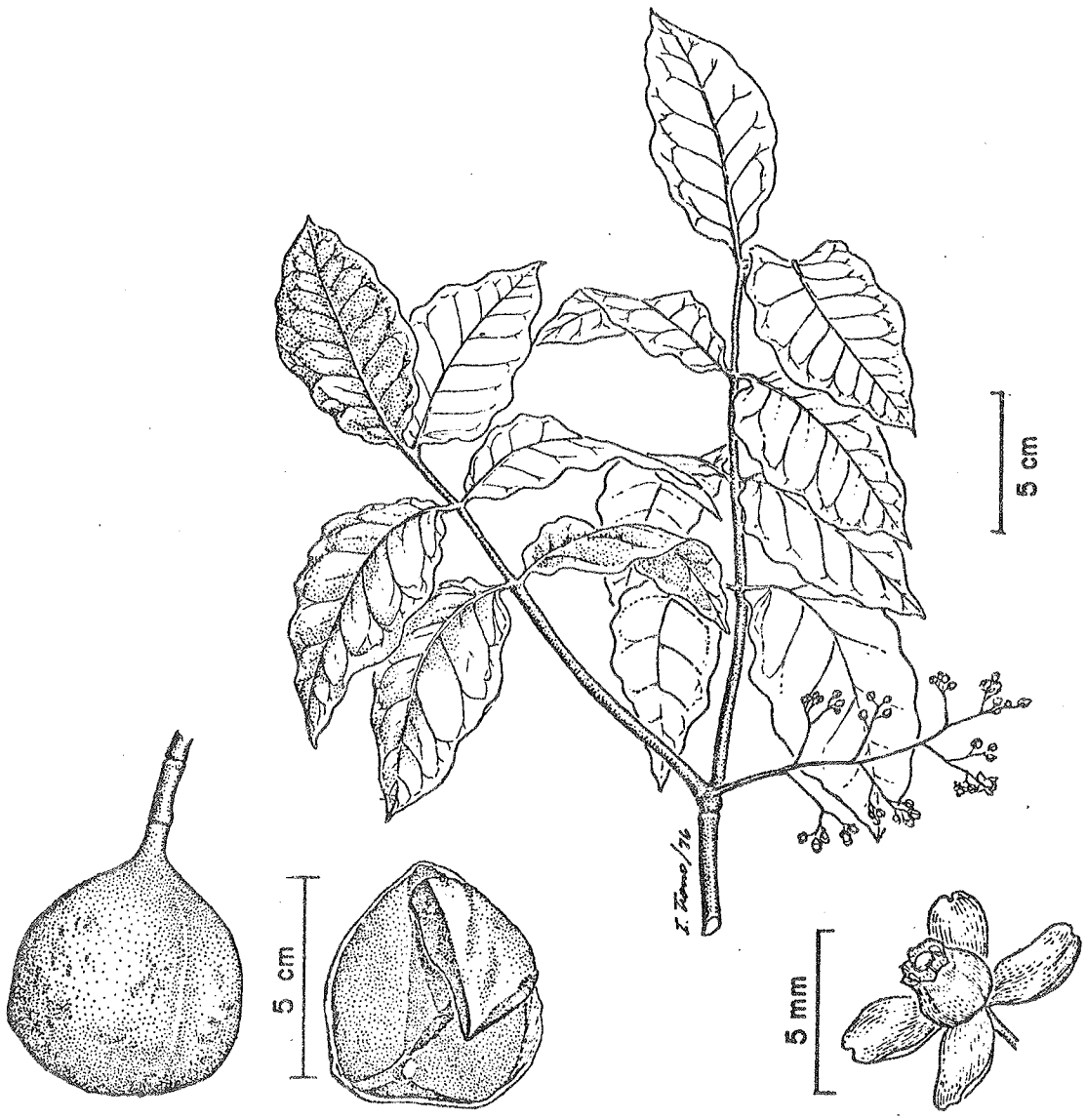
Xylocarpus is not common in Samoa, having been collected only on one part of Savai'i (Western Samoa), at Nu'uuli on Tutuila, and on Aunu'u. It is a widespread species in the tropical West Pacific on rocky shores and along the edges of mangrove swamps.

Samoan: Le'ile'i

English: Puzzle-nut tree

Voucher Specimen # W 3256

Photograph # 13



XYLOCARPUS MOLUCCENSIS (LMK.) ROEM.

SYNOPTIC DESCRIPTIONS

The following brief descriptions are for those species that are of lesser importance in the wetlands of American Samoa. The Samoan and English names, when they exist, are given. None of these species are illustrated in this report, but the voucher specimen number and photograph number are listed with the description. The species are in alphabetical order.

1. Alternanthera sessilis (L.)R.Br.

Samoan: None — English: None
Voucher specimen # W 3267 — Photograph # 34

A prostrate, creeping herb with flowers in dense, white axillary clusters; it is a widespread weed of wet or dry disturbed areas, recorded from all the islands of American Samoa.

2. Barringtonia samoensis A.Gray

Samoan: Falagā — English: None
Voucher specimen # W 3287 — Photograph # 24

A medium-sized forest tree with long, hanging racemes of white flowers bearing numerous red stamens; it is a species endemic to Samoa, found on all the islands, often along mountain streams.

3. Brachiaria mutica (Forsk.)Stapf

Samoan: None — English: California grass
Voucher specimen # W 3352 — Photograph # 27

A medium to tall, infrequently flowering grass with hairy leaf sheaths; it is a dominant species on Tutuila in wet areas such as streambeds and along streams, as well as in some drier areas.

4. Canna indica L.

Samoan: Fagamanu — English: Canna
Voucher specimen # W 3328 — Photograph # 26

A tall, erect, red-flowered herbaceous plant commonly found along stream-sides and in disturbed wet areas; it is a widespread tropical species recorded from Tutuila and Ta'ū.

5. Colocasia esculenta (L.)Schott

Samoan: Talo — English: Taro
Voucher specimen # (None) — Photograph # 10

Taro is the most important food crop in Samoa and a number of varieties of this species are grown on both wet and dry fields. It rarely flowers and is very rarely found in the wild state.

6. Commelina diffusa Burm.f.

Samoan: Mau'u toga
Voucher specimen # W 3270

English: Day flower
Photograph # 33

A creeping grasslike herb with blue flowers, found growing in wet to dry disturbed places; this widespread tropical species is one of the commonest weeds in taro on all the Samoan islands.

7. Cuphea carthagenensis (Jacq.)McBr.

Samoan: None
Voucher specimens # W 3234

English: None
Photograph # 31

A purple-flowered herb found in wet disturbed areas such as pastures and roadside ditches; it is a tropical weed relatively uncommon on Tutuila.

8. Cyperus javanicus Houtt.

Samoan: Selesele
Voucher specimen # W 3265

English: None
Photograph # 37

A coarse sedge with sharp-edged leaves and spikelets in a dense inflorescence; this indigenous species ranges from India to Polynesia where it normally grows on the coast, but occasionally is found as a weed in wet places.

9. Cyperus odoratus L.

Samoan: None
Voucher specimen # W 3314

English: None
Photograph # 29

A medium-sized to tall sedge found in wet areas such as streambanks and coastal marshes; it is a widespread species rare in American Samoa where it has been collected only twice--at Fusi, Ta'ū, and on Tutuila.

10. Eriochloa procera (Retz.)C.E.Hubb.

Samoan: None
Voucher specimen # 3290

English: None
Photograph # 38

A medium-sized grass with a purple ring around the base of the spikelet; this weed is a recent introduction to American Samoa, and is found on Ta'ū and Tutuila in dry or occasionally in wet, disturbed areas.

11. Inocarpus fagifer (Park.)Fosb.

Samoan: Ifi
Voucher specimen # W 3286

English: Tahitian chestnut
Photograph # 25

A tall tree with a large, edible nut, cultivated and escaping to become naturalized in forests and along the margins of mangrove forests; it is probably an aboriginal introduction to Samoa and is found on all the islands.

12. Ludwigia hyssopifolia (G.Don)Exell

Samoan: None — English: None
Voucher specimen # W 3233 — Photograph # 30

An erect, yellow flowered weed of wet disturbed places such as pastures and roadside ditches; it is a widespread tropical species, not common in American Samoa, recorded only from Tutuila.

13. Mikania micrantha H.B.K.

Samoan: Fue saina — English: Mile-a-minute weed
Voucher specimen # 2274 — Photograph # 35

A rapidly growing, white flowered vine found in all types of habitats; this widespread tropical species found on all the Samoan islands is the worst weed in Samoa due to its rapid growth which quickly overwhelms crop plants.

14. Paspalum conjugatum Berg.

Samoan: Vao lima — English: T-grass
Voucher specimen # W 3306 — Photograph # 36

A creeping grass with a two-branched inflorescence, found in all types of habitats; it is a troublesome weed and is very common on all the Samoan islands.

15. Paspalum orbiculare Forst.f.

Samoan: None — English: None
Voucher specimen # W 3307 — Photograph # 28

A medium-sized grass found in a vareity of habitats from the edges of crater lakes (Upolu, Western Samoa) to windswept mountain ridges; it is a native Polynesian species found on all the Samoan islands.

16. Struchium sparganophorum (L.)O.K.

Samoan: None — English: None
Voucher specimen # W 3229 — Photograph # 32

A weedy herb with white flowers in dense axillary clusters, found in wet areas such as pastures and streamsides; this species was first recorded from American Samoa during this survey, when it was found growing in Malaeimi Valley on Tutuila.

GLOSSARY OF WORDS USED IN KEYS OR DESCRIPTIONS

Acuminate- Leaf tip with a long tapering point set off abruptly from the main body of the leaf (fig. 4).
Acute- With a pointed end forming an acute angle (fig.4).
Alternate- Arrangement of leaves placed singly at different heights on the stem.
Annular- In a ring or arranged in a circle.
Anther- The pollen-bearing part of the stamen (fig. 6).
Apex- The tip or distal end.
Apiculate- Terminated by a short, sharp, flexible point.
Appressed- Closely and flatly pressed against a surface.
Ascending- Arising at an oblique angle or curved upwards.
Attenuate- Showing a long, gradual taper (fig. 4).
Axil- Upper angle that a petiole or peduncle makes with the stem that bears it.
Axillary- In an axil (fig. 1a)
Axis- The main or central line of development of any plant or organ.
Bifid- Two-cleft, as the tip of a style.
Bilabiate- Two-lipped, often applied to a corolla or calyx.
Blade- The expanded part of a leaf or petal (fig. 1a).
Bract- Small or scalelike leaves in a flower cluster.
Caducous- Falling off early or prematurely.
Calyx- The outer whorl of floral parts, composed of petals (fig. 6).
Capsule- A dry fruit from a compound ovary, splitting open at maturity.
Cell- A compartment inside the ovary.
Clawed- Having a long, narrow petiolelike base, said of some sepals and petals.
Coastal forest- The forest on the shore composed of species of plants that are tolerant to the sandy or rocky ground and the salt water and salt spray. The seeds of most of these species are salt tolerant and bouyant and are capable of being dispersed long distances, hence many coastal species have wide distributions.
Compound leaf- A leaf composed of two or more leaflets (figs. 1b,c,&d).
Cordate- Heart-shaped, with a sinus and rounded lobes at the base (fig. 3).
Coriaceus- Of leathery texture, said of leaves.
Corolla- The whorl of flower parts inside the calyx, composed of petals which are usually colored to attract insects (fig. 6).
Crenate- Shallowly round-toothed or scalloped, said of margins (fig. 2).
Culm- The stem of grasses, usually hollow except at the swollen nodes.
Cuneate- Wedge-shaped; triangular with the narrow end at the point of attachment, said of the bases of leaves or petals (fig. 4).
Cyme- A broad, more or less flat-topped flower cluster with the central flowers opening first.
Decussate- Opposite leaves in 4 rows alternating in pairs at right angles.
Dentate- With sharp, coarse teeth that are perpendicular to the leaf margin (fig. 2).
Diadelphous- Applied to flowers with stamens in 2 clusters (often 9+1).
Didynamous- Applied to flowers with 4 stamens in pairs of different length.
Distal- The end of an organ farthest from the point of attachment.
Elliptic- Oval in outline, narrowed to rounded ends, and widest near the middle (fig. 3).

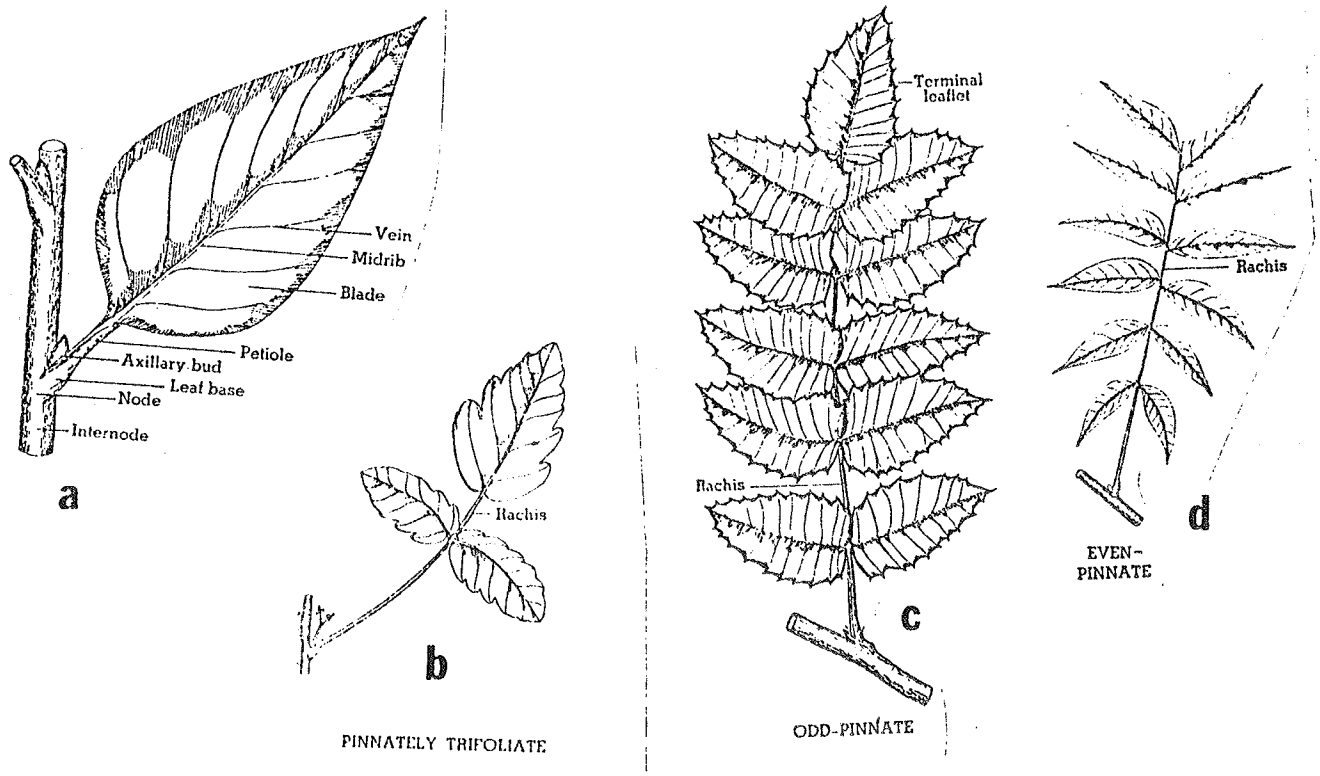
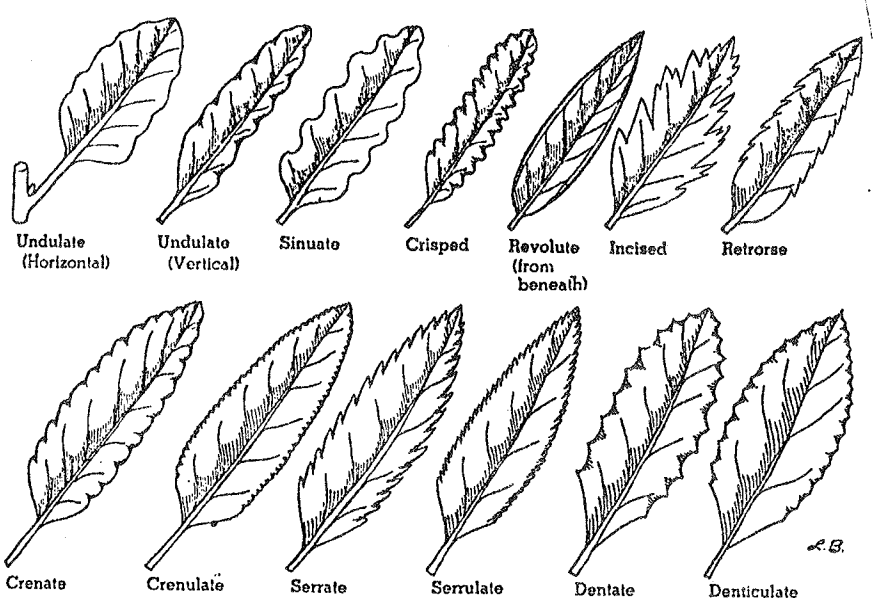


Fig. 1



Leaf margins.

Fig. 2

Emarginate- With a shallow notch at the apex (fig. 4).
Endemic- Native and confined to a particular region.
Entire- With a continuous or untoothed margin.
Epicalyx- A whorl of bracts below the calyx.
Even-pinnate- Compound leaf with no terminal leaflet and leaflets even in number (fig. 1c).
Facultative hydrophyte- A plant found in water or wet soil, but not restricted to these habitats.
Fascicle- A condensed or close cluster, said of flowers.
Filament- The stalk of the stamen (fig. 6).
Filiform- Threadlike, long and very slender.
Frond- The leaf of a fern
Geniculate- Bent, like a knee.
Glabrous- Not hairy.
Globose- In the shape of a sphere.
Glume- A small chafflike bract, one of the sterile bracts at the base of most grass flowers.
Halophyte- A plant that grows in saline soil, e.g. mangroves.
Herbaceous- Pertains to a plant with fleshy non-woody stems.
Hydrophyte- Plant growing in water or wet soil.
Imbricate- Overlapping, as shingles on a roof.
Included- Not protruding, as stamens not projecting from the corolla.
Indigenous- Native to an area, but not restricted to it.
Inferior- Said of an ovary that is seemingly below the calyx.
Inflorescence- Mode of flower bearing or the flower cluster (fig. 5).
Internode- The part of the stem between two nodes (fig. 1a).
Keel- The two front united petals of a papilionaceous flower, enclosing the cluster of stamens.
Lanceolate- Lance-shaped, much longer than broad (fig. 3).
Leaf sheath- The tubular structure below the leaf blade that surrounds the culm or stem of a grass.
Lemma- The lower of two bracts immediately enclosing a grass flower.
Ligule- A projection from the top of the sheath of grasses and sedges.
Linear- Long and narrow with the sides nearly parallel (fig. 3).
Longitudinally grooved- With grooves running parallel to the axis.
Lowland forest- The native forest behind the coastal forest which covers the lowlands and foothills.
Midrib- The main rib of a leaf, a continuation of the petiole (fig. 1a).
Monadelphous- Stamens united together into one group by their filaments, as in the Hibiscus flower.
Mucronate- Terminated abruptly by a distinct and obvious spiny tip (fig. 4).
Obligate hydrophyte- Plant growing in and restricted to water or wet soil.
Oblique- Slanting, unequally sided.
Oblong- Longer than broad, and with the sides nearly parallel most of their length (fig. 3).
Obovate- The reverse of ovate, with the terminal end broader than the basal end (fig. 3).
Obtuse- Blunt or rounded, as the tip of a leaf (fig. 4).
Opposite- Said of leaves situated two at a node on opposite sides of the stem.
Ovary- The seed- or ovule-bearing part of the flower which forms the fruit.

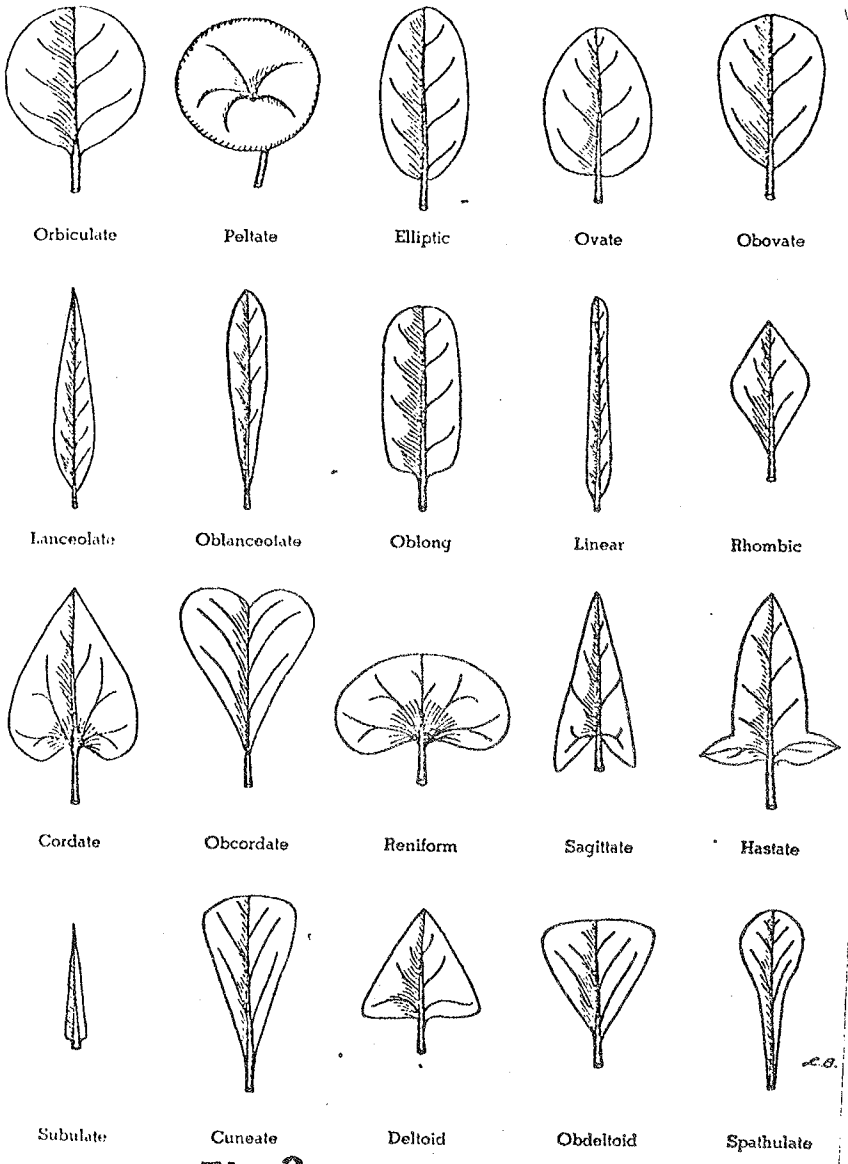


Fig. 3 Shapes of leaf blades.

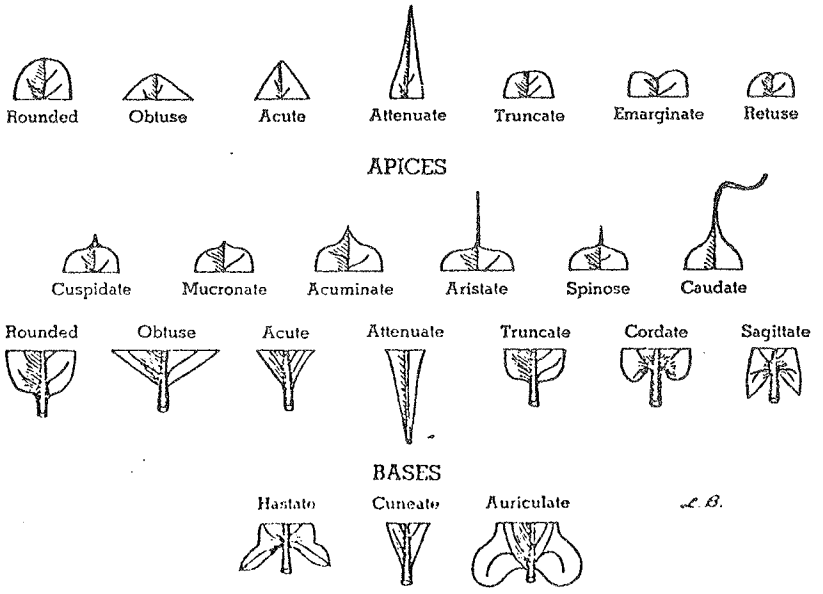


Fig. 4 Apices and bases of leaves: two upper rows, apices; two lower rows, bases.

Ovate- With an outline like that of a hen's egg, the broader end below the middle (fig. 3).
Ovoid- A solid that is oval in flat outline.
Palmate- A compound leaf with lobes radiating out in handlike fashion.
Panicle- A branching raceme (fig. 5).
Papilionaceous- Said of the corollas of pealike flowers, butterflylike.
Pedicel- The stalk of one flower in a cluster (fig. 6).
Peduncle- Stalk of a flower cluster (fig. 6).
Perennial- Said of plants that live three or more growing seasons.
Petal- One unit of the corolla, the whorl within the calyx (fig. 6).
Petiole- The leaf stalk (fig. 1a).
Pinna- A primary division or leaflet of a pinnate leaf.
Pinnate- Compound leaf with leaflets on either side of the rachis (fig. 1c & d).
Pith- The soft spongy material in the center of the stem.
Pneumatophore- A breathing root found on some plants living in wet soil.
Pod- A splitting, dry fruit.
Puberulent- Minutely pubescent with soft straight hairs barely visible to the unaided eye.
Pubescent- Covered with short, soft hairs.
Raceme- A simple elongated inflorescence bearing stalked flowers (fig. 5).
Rachis- The axis bearing the flowers or leaflets.
Radicle- The embryonic root of a germinating seed.
Reflexed- Abruptly recurved or bent downward or backward.
Reniform- Kidney-shaped.
Reticulate- Net-veined.
Revolute- Rolled backward, or said of a leaf with the margins rolled towards the lower side.
Rhizome- Underground stem bearing buds, nodes, or scalelike leaves.
Rugose- Wrinkled, covered with wrinkles.
Scabrous- Rough to the touch, covered with minute rough projections.
Scarious- Thin, dry, membranous, non-green, and translucent.
Scurfy- With scalelike particles on the surface, said of leaves and stems.
Sepal- One of the separate parts of a calyx, usually green and leaflike (fig. 6).
Septate- Partitioned, divided by partitions or cross walls.
Serrate- Said of a margin when it is saw-toothed with the angular teeth pointing foreward (fig. 2).
Sessile- Without a stalk, said of a leaf or flower.
Simple- Said of a leaf when not divided into leaflets (fig. 1a).
Solitary- Borne singly or alone, as of flowers.
Sori- Clusters of sporangia borne on the lower surface of fern fronds.
Spike- A type of simple, unbranched inflorescence with sessile flowers (fig. 5).
Spikelet- The ultimate cluster of a grass or sedge inflorescence composed of flowers and their subtending bracts.
Sporangia- The sacs or bodies bearing spores; the simple one-celled reproductive structures of ferns and lower plants.
Stamen- The pollen-bearing organ of a plant, composed of a filament and an anther (fig. 6).
Standard- The upper and broad, more or less erect petal of a papilionaceous flower.

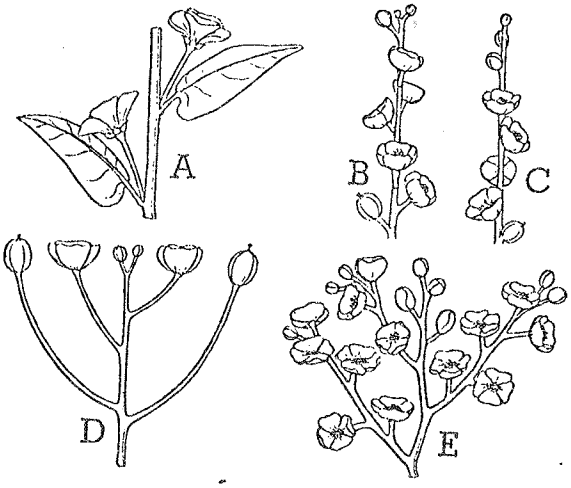


Fig. 5 Inflorescence types: A axillary flower; B raceme; C spike; D corymb (note buds on the inside [apical], fruits outside); E panicle (in this case of racemes but often of spikes or sometimes of corymbs). By Lucretia Breazeale Hamilton.

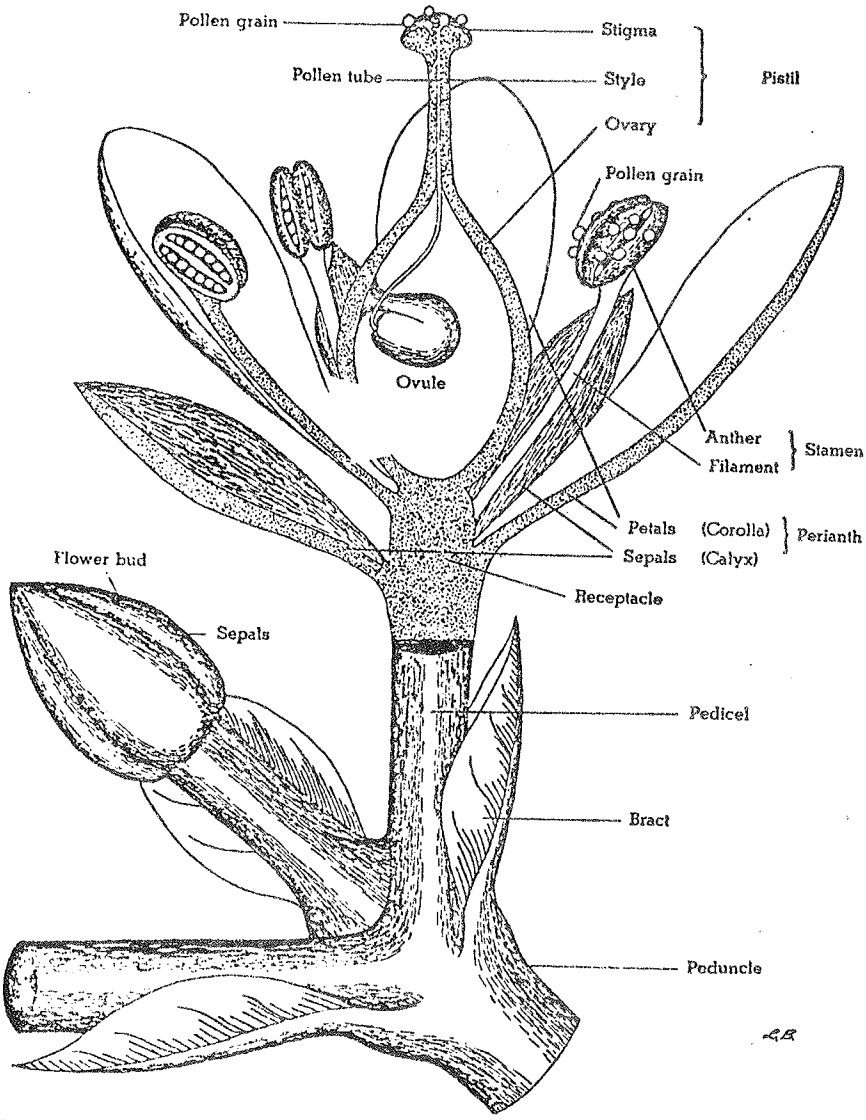


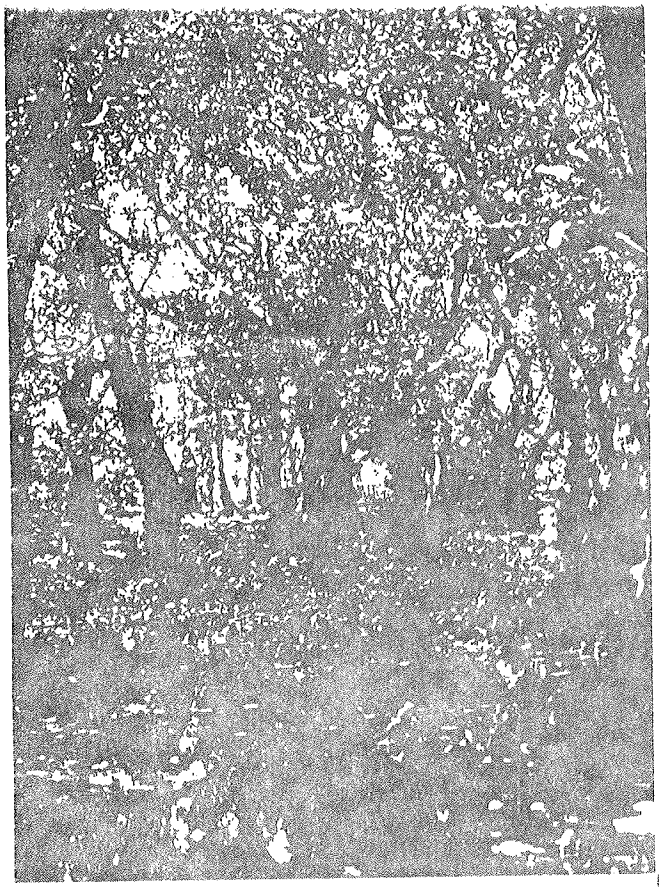
Fig. 6 A generalized flower (longitudinal section of one in a cluster [umbel] of three), showing the parts. Semidiagrammatic.

Stellate- Said of starlike hairs with radiating branches.
Stigma- The apical portion of the female part of the flower that receives the pollen (fig. 6).
Stipe- The petiole of a fern leaf.
Stipule- One of a pair of appendages at the base of the petiole or the leaf base at the point of attachment to the stem.
Stolon- A shoot that bends to the ground and takes root; a horizontal stem at or below the surface of the ground that gives rise to a new plant at its tip.
Striate- With fine longitudinal lines, channels, or ridges.
Style- The more or less elongated part between the stigma and the ovary (fig. 6).
Subulate- Awl-shaped, tapering from the base to the apex (fig. 3).
Sympetalous- Refers to corollas with the petals united, at least at the base.
Tetrahedral- Four-sided, as a 3-sided pyramid and its base.
Trifoliate- Refers to compound leaves with three leaflets (fig. 1b).
Truncate- Appearing as if cut off at the end, as of a leaf tip.
Tuber- A thickened, short, underground branch serving as a storage organ for food reserve (e.g. potato).
Undulate- Wavy, as of some leaf and petal margins (fig. 2).
Urceolate- Urn-shaped.
Valvate- Opening by valves, as in some types of fruits.
Valve- The unit or piece into which a capsule splits or divides when opening.
Venation- The arrangement or disposition of veins as in leaves.
Viviparous- Producing seeds that germinate before becoming detached from the parent plant.
Wing- A thin, dry, or membranous expansion or flat extention of an organ; also the lateral petals of a papilionaceous flower.

The figures included in this glossary were taken from Benson, Lyman, 1959, Plant Classification, D.C. Heath and Company, Lexington, Mass; 688 pp.

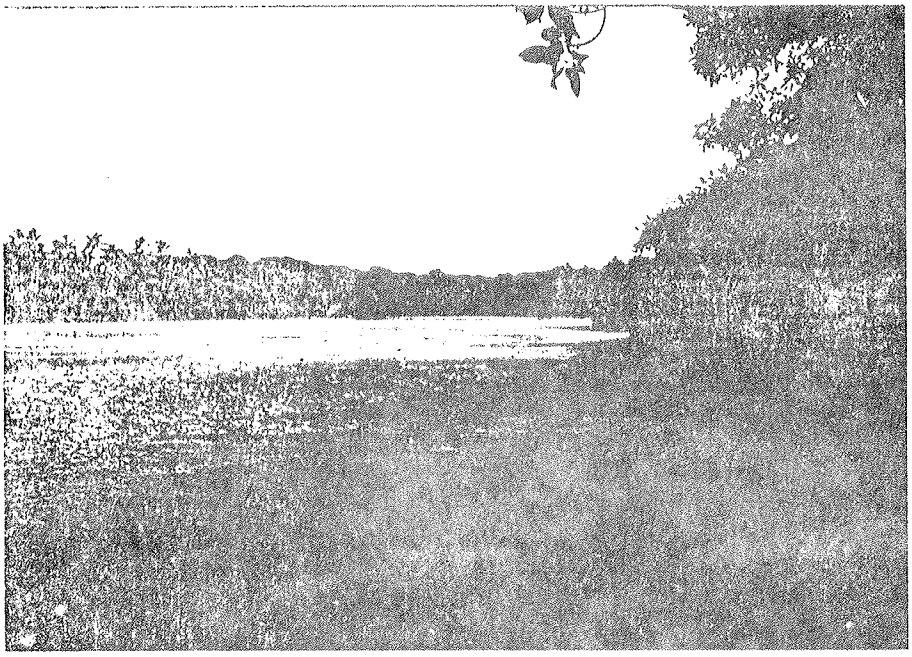
PHOTOGRAPH INDEX

1. Mangrove forest at Aoa.
2. Standing water in disturbed area at Tula, Tutuila.
3. Pala Lake on Aunu'u.
4. Damaged mangrove forest on Aunu'u.
5. Aunu'u Crater.
6. Vegetation in Aunu'u Crater.
7. Disturbed coastal marsh at Fusi, Ta'ū.
8. Disturbed wet area behind Alao, Tutuila.
9. Cultivation of taro (Colocasia esculenta) on Aunu'u.
10. Taro at Lumā, Ta'ū.
11. Rhizophora mangle.
12. Bruguiera gymnorhiza.
13. Xylocarpus moluccensis.
14. Paspalum vaginatum.
15. Coix lacryma-jobi.
16. Cassia alata.
17. Ludwigia octovalvis.
18. Limnophila fragrans.
19. Rhynchospora corymbosa.
20. Eleocharis dulcis.
21. Acrostichum aureum.
22. Cyclosorus gongylodes.
23. Hibiscus tiliaceus.
24. Barringtonia samoensis.
25. Inocarpus fagifer
26. Canna indica.
27. Brachiaria mutica.
28. Paspalum orbiculare.
29. Cyperus odoratus.
30. Ludwigia hyssopifolia.
31. Cuphea carthagenensis.
32. Struchium sparganophorum.
33. Commelina diffusa.
34. Alternanthera sessilis.
35. Mikania micrantha.
36. Paspalum conjugatum.
37. Cyperus javanicus.
38. Eriochloa procera.



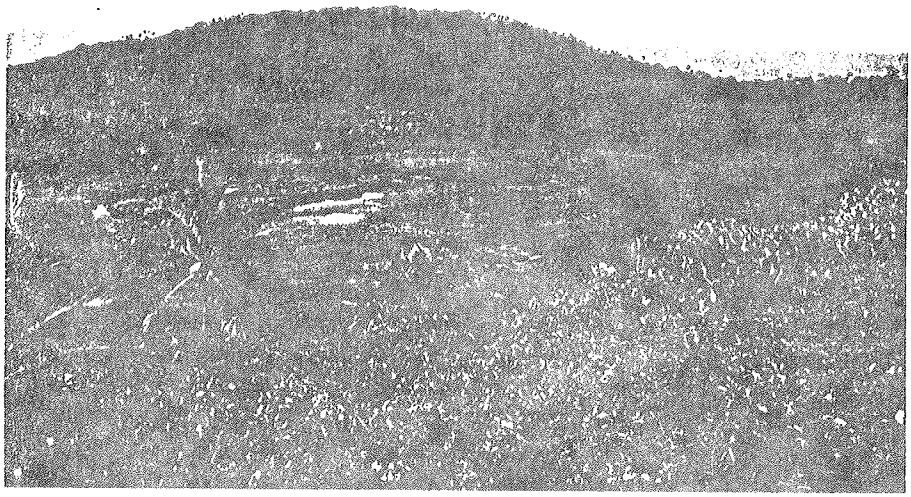
1. Mangrove forest behind the village of Aoa, Tutuila; the dominant tree is Bruguiera gymnorhiza.

2. Standing water in an area of poor drainage behind the village of Tula, Tutuila; the dominant tree is Hibiscus tiliaceus.



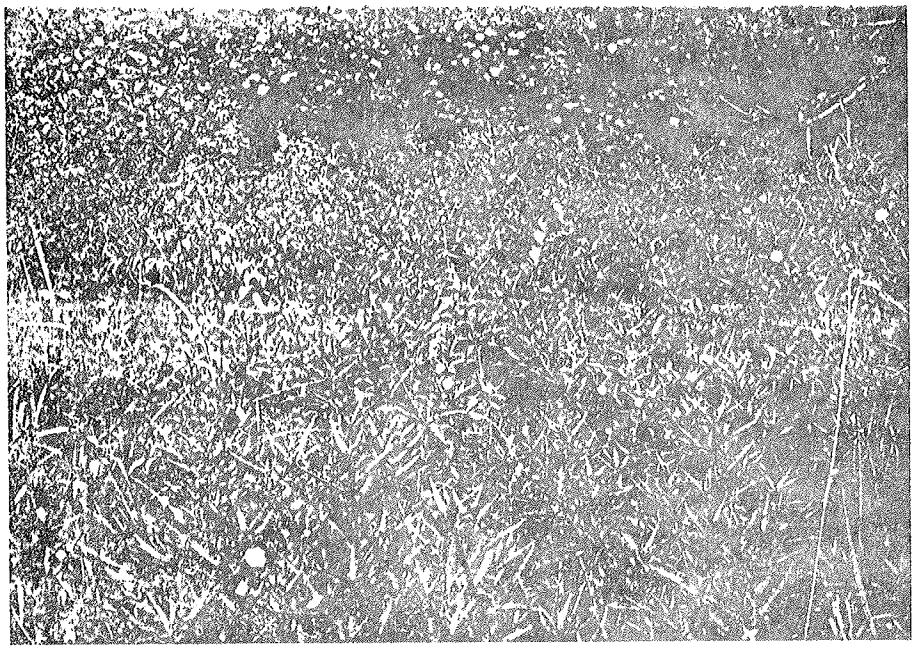
3. Pala Lake on the island of Aunu'u; a mudflat surrounded by Bruguiera gymnorhiza.

4. Remains of a mangrove forest on Aunu'u severely damaged by cutting for firewood.



5. Aunu'u Crater as viewed from the north rim; note the zonation of the coastal marsh vegetation.

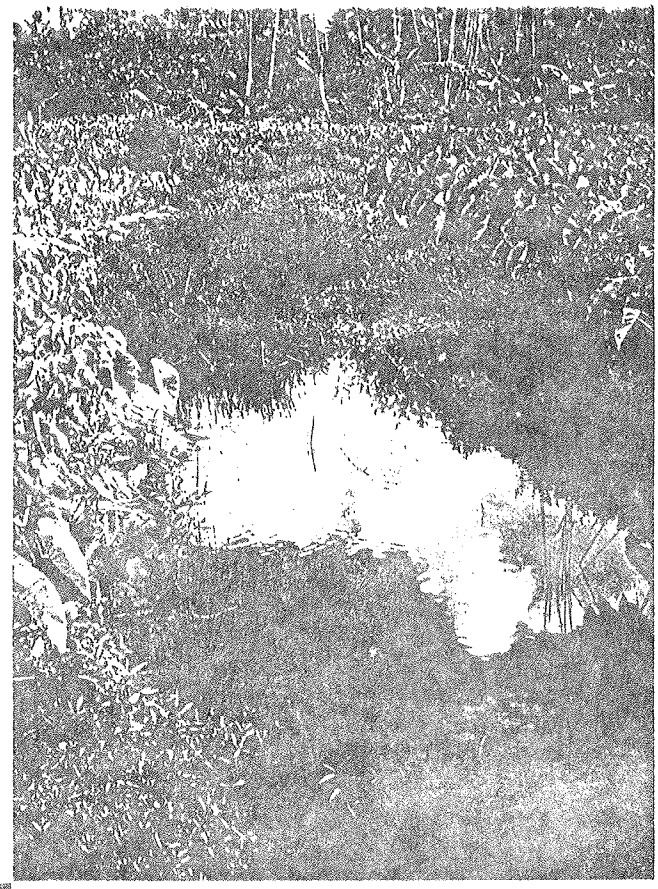
6. Coastal marsh vegetation in Aunu'u Crater, dominated by Eleocharis dulcis and Cyclosorus gongylodes.



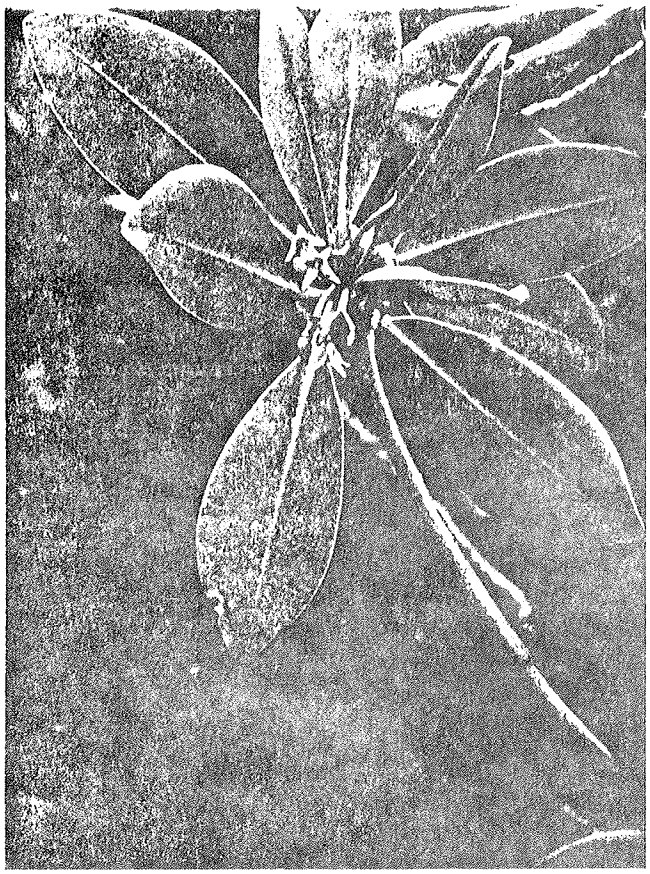
7. Disturbed coastal marsh at Fusi, Ta'ū, dominated by Ludwigia octovalvis and Rhynchospora corymbosa.

8. Disturbed wetland area behind the village of Alao, Tutuila, dominated by Coix lacryma-jobi and Cassia alata.

9. Taro cultivation in the coastal marsh behind the village of Aunu'u.



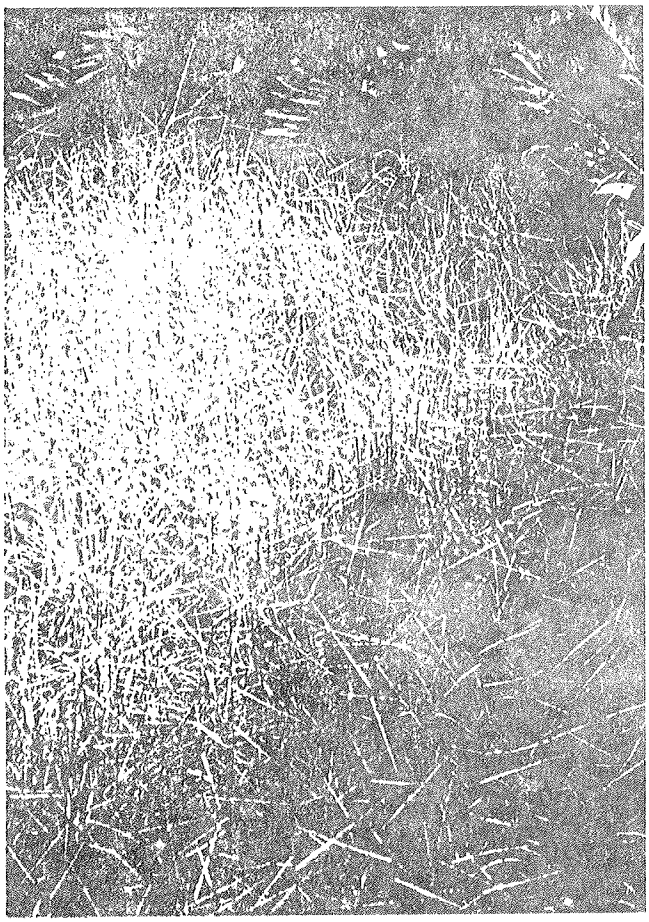
10. Taro growing in the coastal marsh at Lumã, Ta'ũ.



11. Rhizophora mangle growing in mangrove forest at Pala Lagoon, Tutuila.

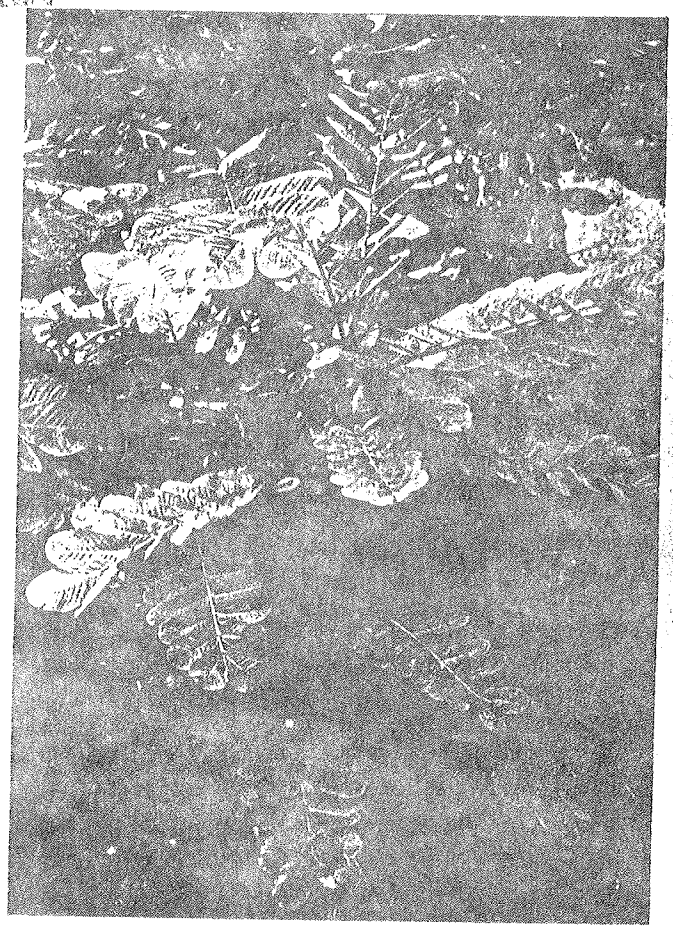
12. Bruguiera gymnorhiza growing in mangrove forest at Leone, Tutuila.

13. Xylocarpus moluccensis growing on the shore of Pala Lagoon, Tutuila.



14. Paspalum vaginatum growing on the margin of the mangrove forest at Leone, Tutuila.

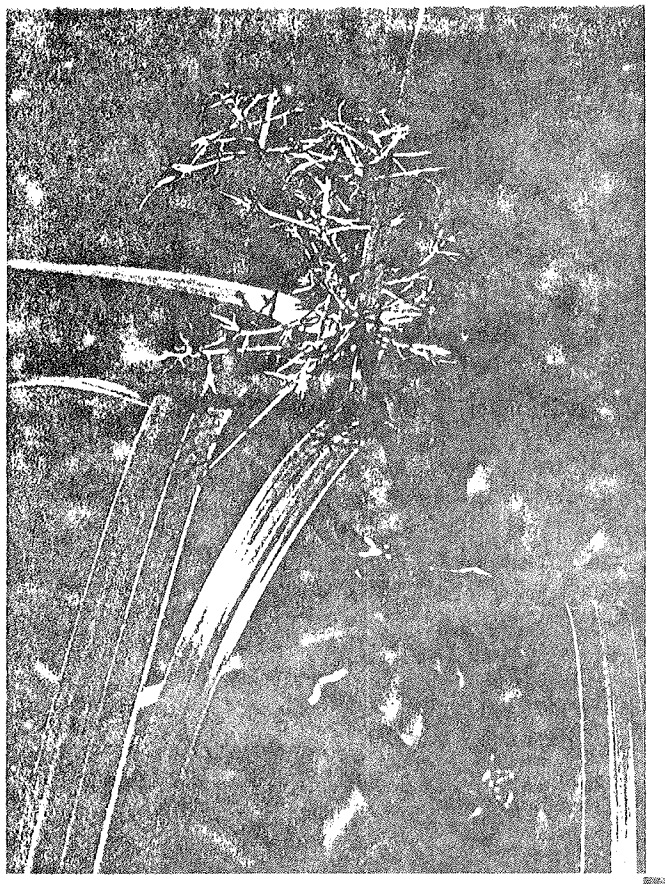
15. Coix lacryma-jobi growing in a taro field at Lumā, Ta'ū.



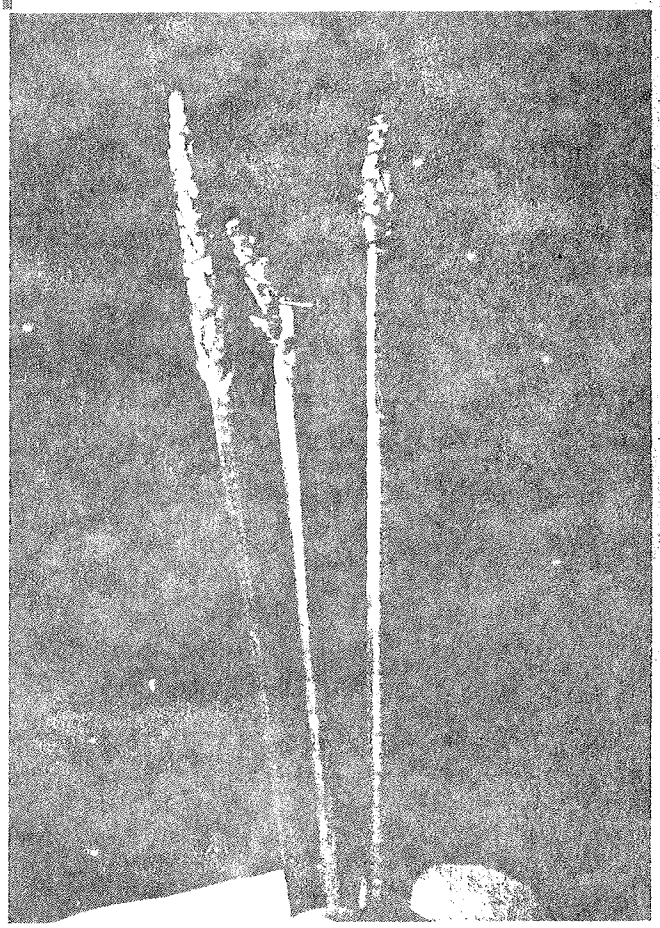
16. Cassia alata growing in wet disturbed area behind the village of Tula, Tutuila.

17. Ludwigia octovalvis growing in disturbed coastal marsh behind the village of Aumu'u.

18. Limnophila fragrans growing in disturbed coastal marsh at Lumā, Ta'ū.



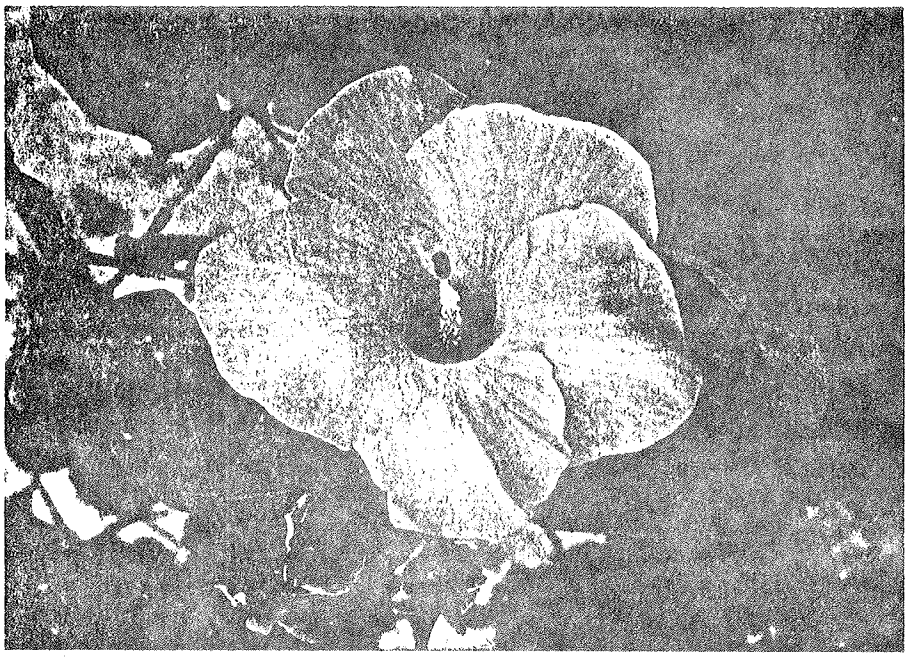
19. Rhynchospora corymbosa growing in disturbed coastal marsh at Fusi, Ta'ū.



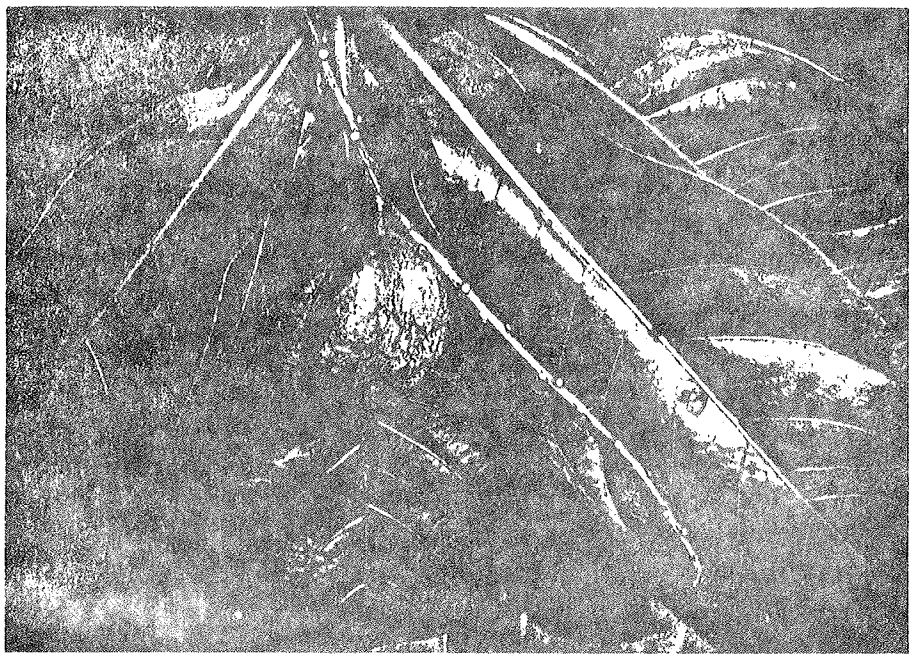
20. Eleocharis dulcis growing in disturbed coastal marsh behind the village of Aunu'u.

21. Acrostichum aureum growing at the edge of the mangrove forest at Leone, Tutuila.

22. Cyclosorus gongylodes growing in the disturbed coastal marsh behind the village of Aunu'u.



23. Hibiscus tiliaceus growing on the western coast of Ta'ū.

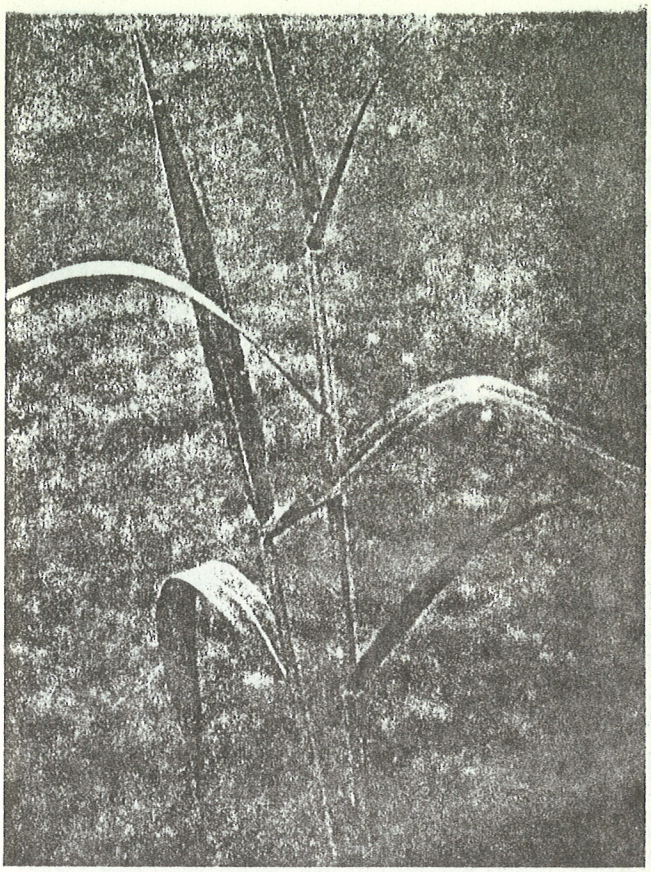


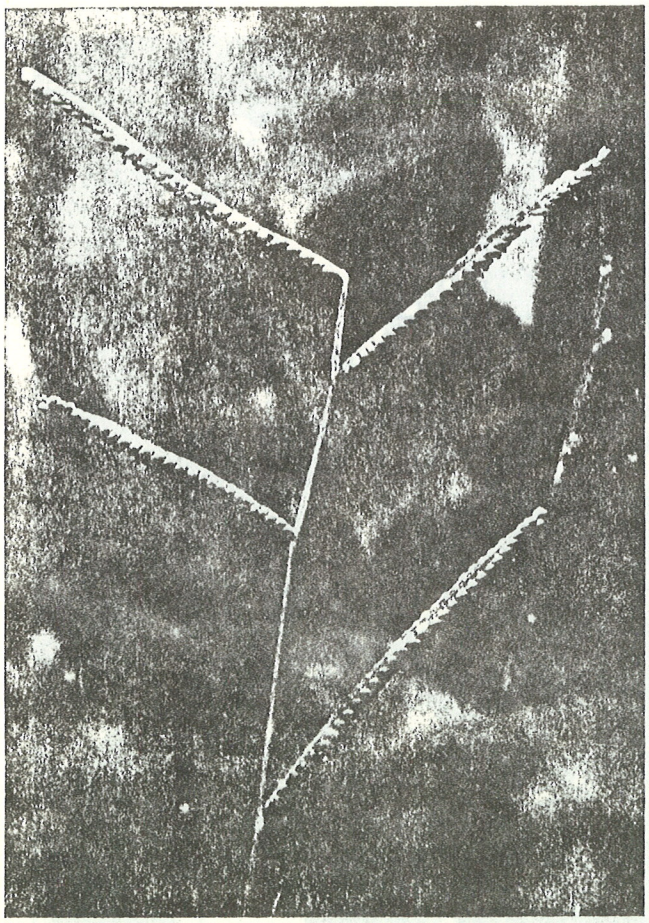
24. Barringtonia samoensis growing on the margin of the mangrove forest at Leone, Tutuila.

25. Inocarpus fagifer growing on the edge of the mangrove forest at Aoa, Tutuila.

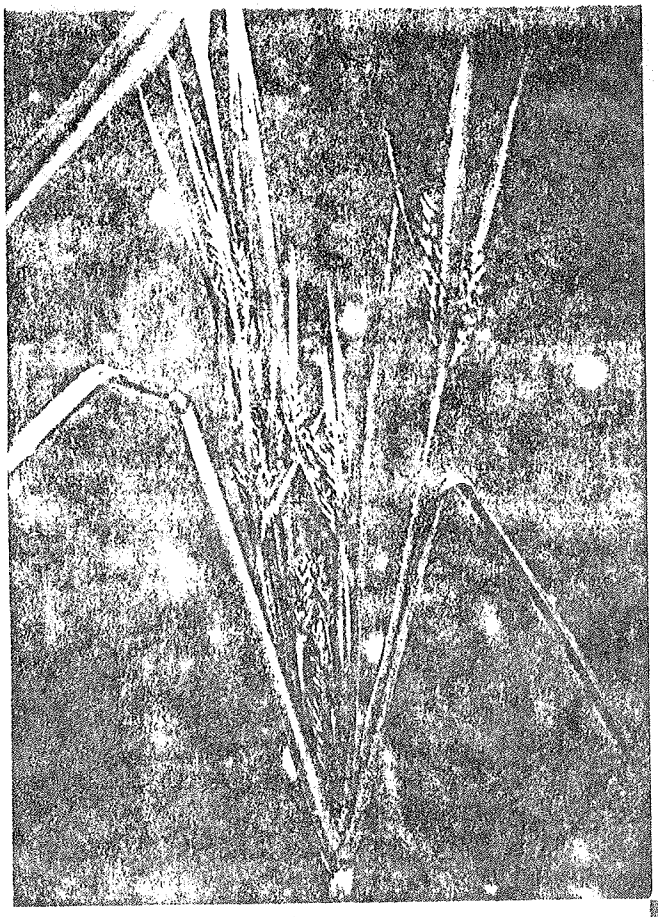
26. Canna indica growing in a taro patch at Aoa, Tutuila.

27. Brachiaria mutica growing in wet disturbed area at Tafuna, Tutuila.





28. Paspalum orbiculare, a weed growing in a taro field at Lumā, Ta'ū.



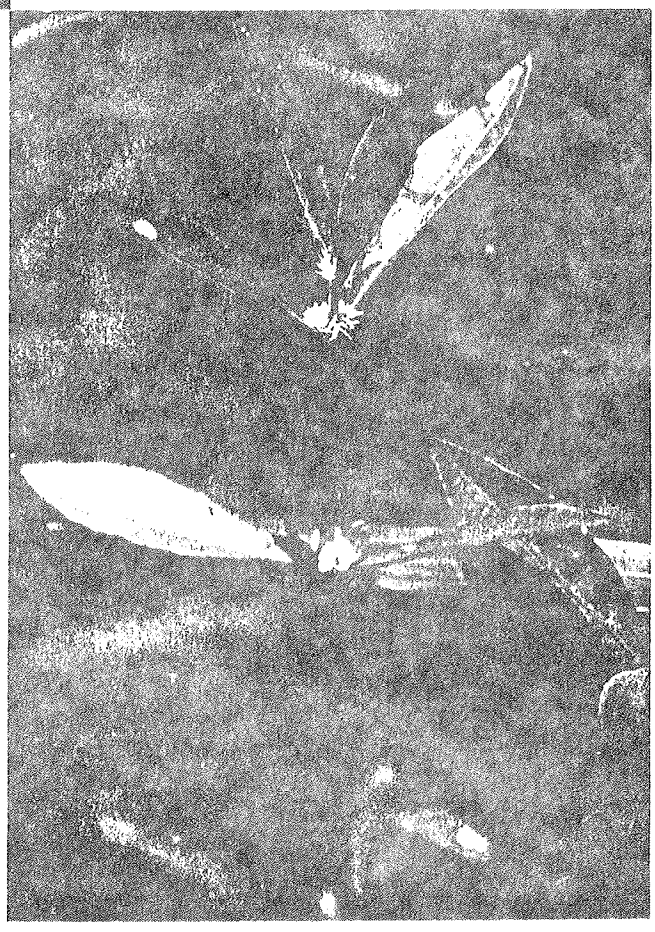
29. Cyperus odoratus growing in disturbed coastal marsh at Fusi, Ta'ū.

30. Ludwigia hyssopifolia, a weed growing in a wet pasture in Palacimi Valley, Tutuila.

31. Cuphea carthagenensis, a weed growing in a wet pasture in Malaeimi Valley, Tutuila.

32. Struchium sparganophorum, a weed growing in a wet pasture in Malaeimi Valley, Tutuila.

33. Commelina diffusa, a weed growing in a taro field behind the village of Aunu'u.



34. Alternanthera sessilis, a weed growing in wet disturbed area behind the village of Tula, Tutuila.

35. Mikania micrantha, a weed growing in a disturbed area on Upolu, Western Samoa.

36. Paspalum conjugatum, a weed growing in a taro field at Lumā, Ta'ū.

37. Cyperus javanicus, a coastal species found in wet disturbed area behind the village of Tula, Tutuila.

38. Eriochloa procera, a weed growing in wet disturbed area behind the village of Tula, Tutuila.