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A Look at the Forests of American Samoa

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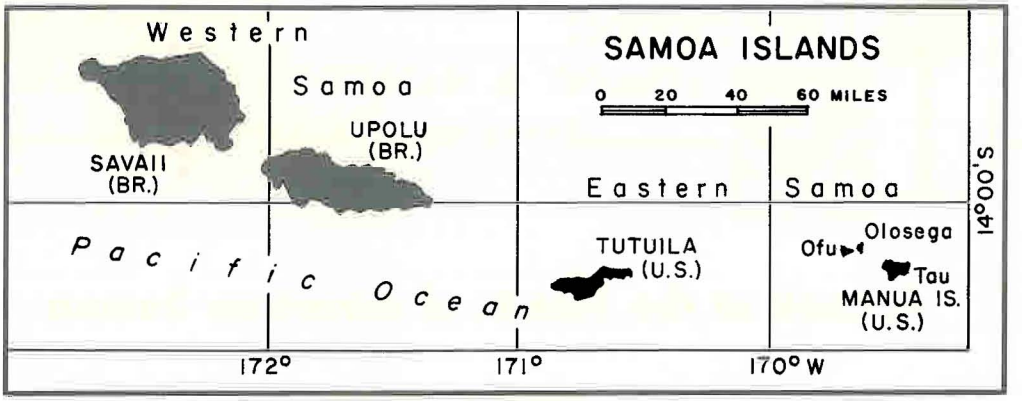
ABSTRACT: Management for timber crops is feasible on about 12,000 acres of forest land in American Samoa. Another 10,000 acres of forest land are on such steep topography that management for protection of watershed values should be paramount. Excluding such critical watersheds the forests hold 50 million board feet or more of sawtimber in a great variety of tree species. Some species have good growth form and wood quality. Little is known about the wood qualities of most.

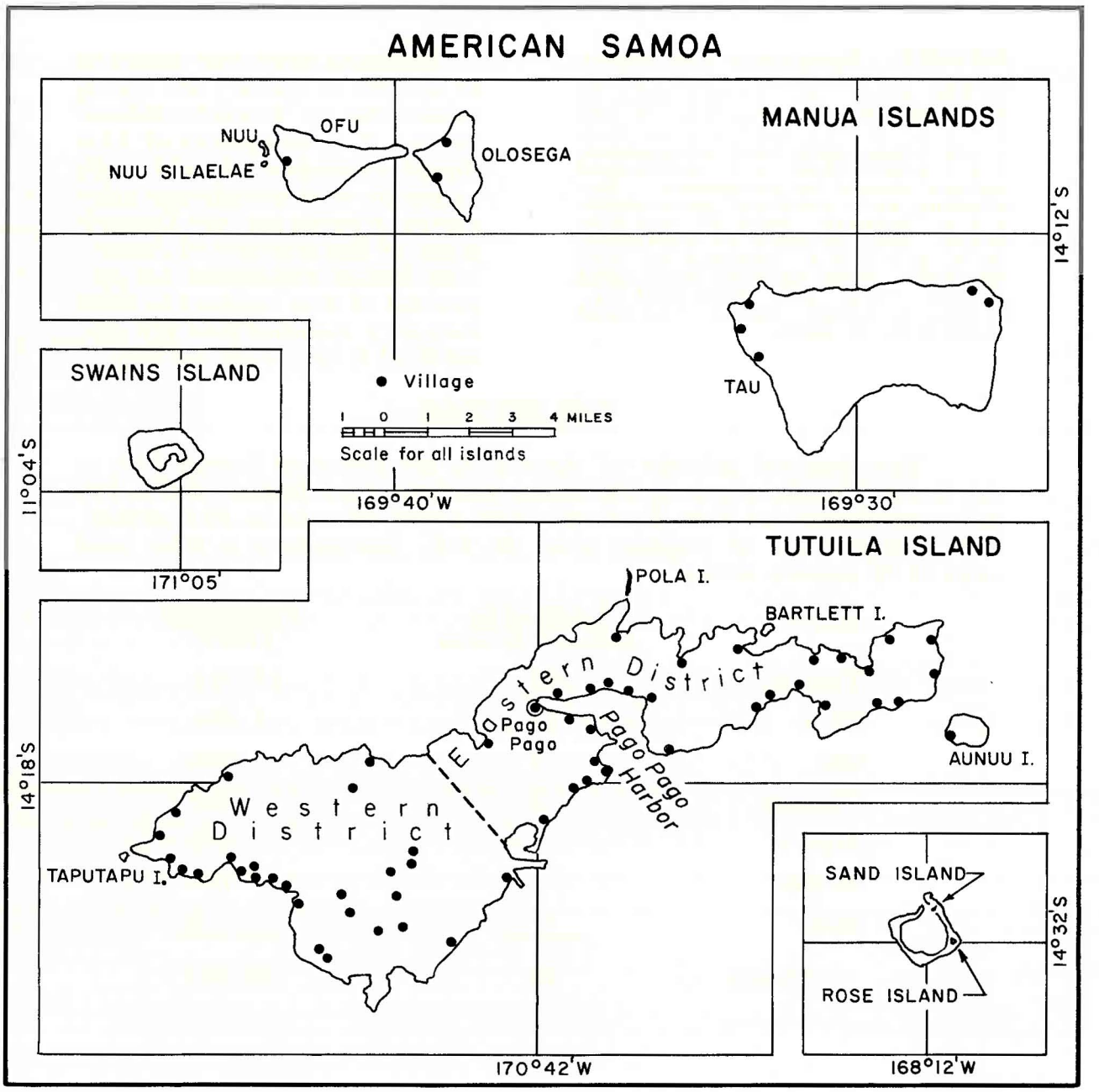
Samoans need new sources of income to satisfy the wants stimulated by "westernization." To see if development of the forest resource can add cash crops to the traditional subsistence economy, the Department of Agriculture of American Samoa requested an appraisal of this resource. This report summarizes the results of a one-week survey.

THE SETTING

The tropical islands of American (or Eastern) Samoa lie in the South Pacific about 2,300 miles southwest of Hawaii and 1,600 miles northeast of New Zealand. The seven islands in the group, with a population of slightly over 20,000, encompass a total land area of 76 square miles:

Island	Land area (Square miles)	Population (1960)
Tutuila	52	16,814
Ta'u	17	1,661
Ofu	3	605
Olosega	2	429
Aunu'u	1	436
Swains	1	106
Rose	--	0
Totals	76	20,051


Western
Samoa
SAMOA ISLANDS
0 20 40 60 MILES
UPOLU
(BR.)
SAVAII
(BR.)
Eastern
Samoa
14°00'S
Pacific Ocean
TUTUILA
(U.S.)
Ofu
Olosega
Tau
MANUA IS.
(U.S.)
172°
171°
170° W


AMERICAN SAMOA
MANUA ISLANDS
NUU
OFU
NUU SILAELAE
OLOSEGA
14°12'S
TAU
SWAINS ISLAND
Village
1 0 1 2 3 4 MILES
Scale for all islands
11°04'S
169°40'W
169°30'
171°05'
TUTUILA ISLAND
POLA I.
BARTLETT I.
Eastern District
Pago Pago
Pago Pago Harbor
AUNUU I.
14°18'S
Western District
TAPUTAPU I.
SAND ISLAND
ROSE ISLAND
14°32'S
170°42'W
168°12'W

Independent Western Samoa, less than 100 miles westward from Tutuila, consists mainly of Upolu Island (430 square miles) and Savai'i Island (700 square miles) and has a population of more than 100,000.

Except for Swains and Rose Islands, the islands of American Samoa are of relatively recent volcanic origin, mainly of basaltic rock. The topography is steep and mountainous in general, the large "plain" in the southwest part of Tutuila being the only exception. The highest peak on Tutuila is just over 2,100 feet. Soils are quite variable, but are thin and rocky on much of the mountain slopes.

The climate of Samoa is warm and humid, with annual rainfall averaging about 200 inches. November to March is the wettest season, but April through October can only be classed as less wet. Southeast trade winds prevail much of the time. During October to March, however, winds are quite variable and frequently from the northwest.

American Samoa has what is described as a subsistence economy. Families grow much of their own taro, bananas, breadfruit, coconut, yams, pandanus, and other food and fiber crops. They raise some livestock, but depend a great deal on fish for protein. In recent years, however, there has been increasing reliance on imported food and other commodities and a trend away from subsistence agriculture. Copra production as an economic enterprise is said to be declining. Altogether, about 12,000 acres of land are farmed.

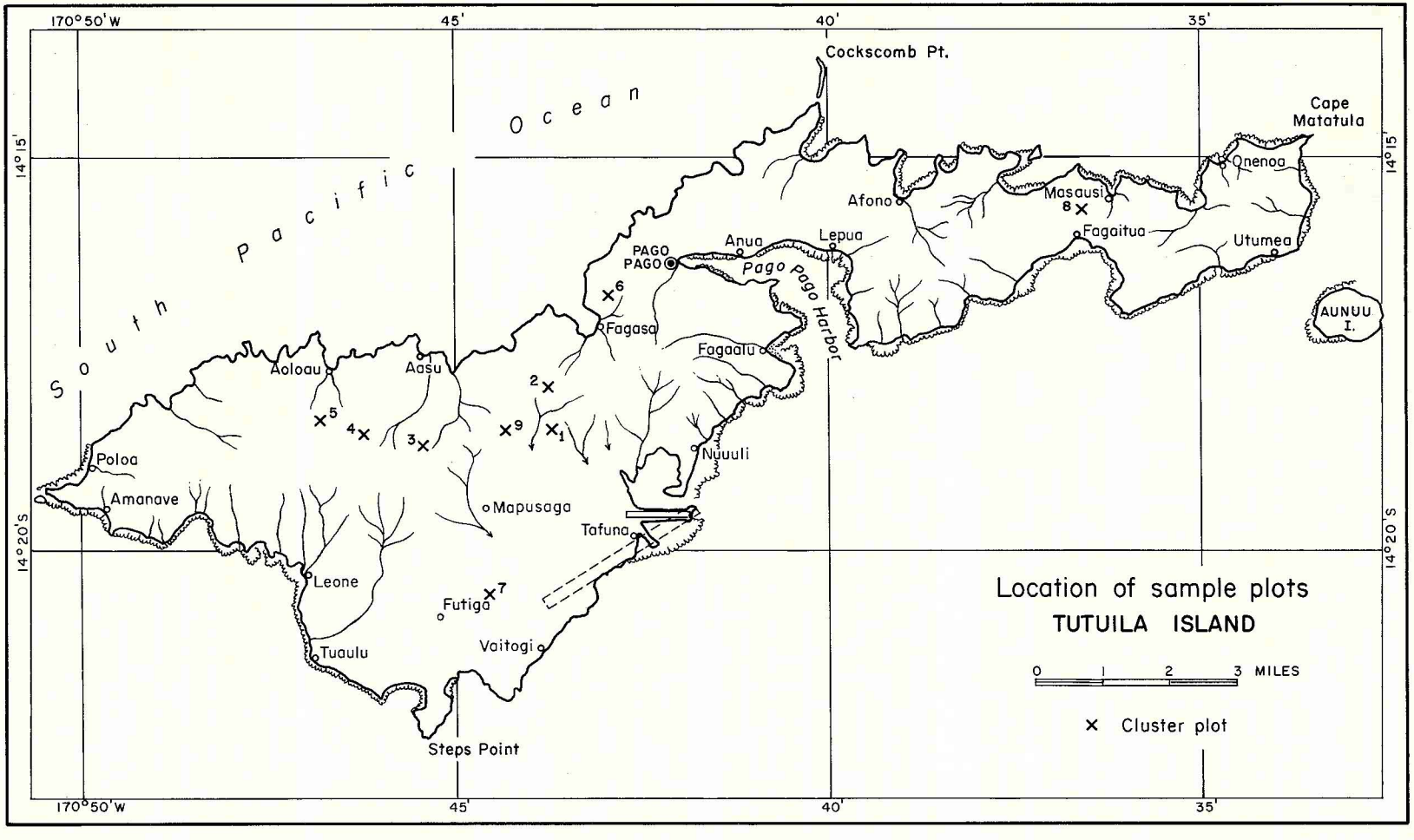
The largest single employer, by far, is the Government of American Samoa. The fish canning industry is also a significant employer, but other opportunities to work for pay are extremely limited. Consequently, interest is high in finding other sources of income, including forest products.

THE FORESTS

Area. --Through study of aerial photographs of Tutuila Island and the Manua Islands, and on-the-ground reconnaissance of Tutuila, I determined that a large part of the land is forested. An even greater area appears forested until the areas of coconut tree plantations are excluded.

There is some turnover in forest areas because of shifting agriculture. Much of the family farming area (bananas, taro, etc.) is on steep slopes cleared of forest, and some crop land is allowed to revert to forest, presumably because of the low fertility after raising several crops. Usually, plantings are on the lower slopes, but some are in higher, relatively inaccessible spots.

In this appraisal, I have estimated that some 18,000 acres of Tutuila Island are forested--more than half of the total of 33,000 acres of land on the island. Further, I estimate that nearly half of the forested area is of such steep slope and thin soil that practical considerations and the need to protect watershed values should prohibit or limit


170°50'W
45'
40'
35'
14°15'
14°20'S
Cockscomb Pt.
Cape Matatula
South Pacific Ocean
Onenoa
Masausi
Afono
Fagaitua
Utumea
Lepua
Anua
PAGO PAGO
Pago Pago Harbor
AUNUU I.
Fagasa
Fagaalu
Aoloau
Aasu
Nuuuli
Poloa
Amanave
Mapusaga
Tafuna
Leone
Futiga
Tuaulu
Vaitogi
Steps Point
Location of sample plots
TUTUILA ISLAND
0 1 2 3 MILES
× Cluster plot

forest utilization or disturbance. Excluding such sensitive watersheds leaves about 10,000 acres of forest land as a primary timber-resource base on Tutuila Island.

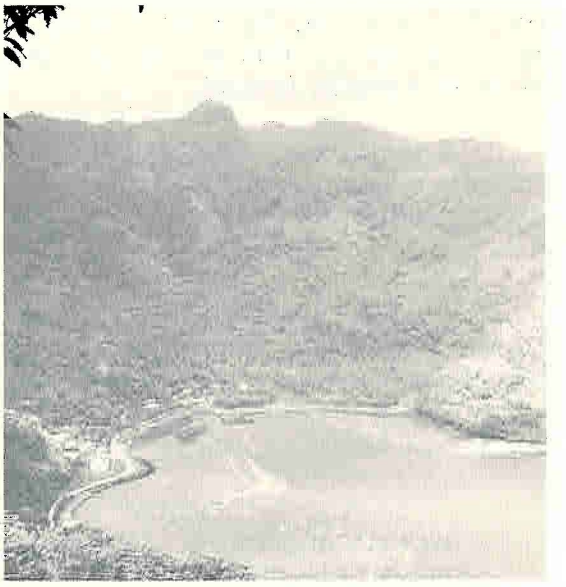
A large part of the forest is virgin or relatively undisturbed. Forests near the villages, however, have been tapped for timber and other products. I believe that the relatively undisturbed forest, exclusive of steep, sensitive watershed, amounts to some 7,000 acres.

Timber stands. --To arrive at some objective measures of the timber resource, we measured 26 plots in forest types considered, on the basis of photo interpretation, to be representative of relatively undisturbed forest. Nine different locations were sampled. Several important findings are pointed up by the plot data:

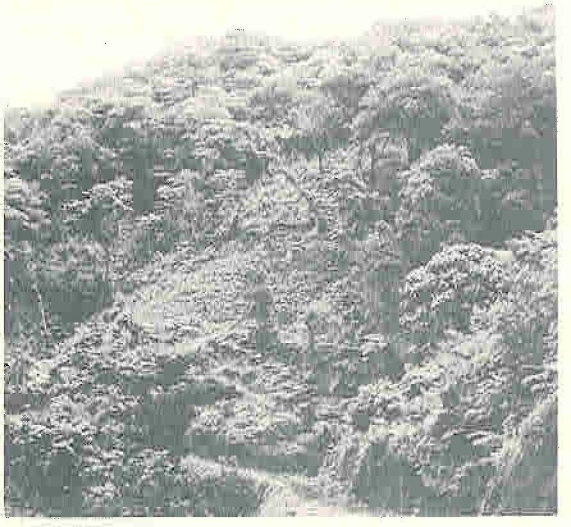
> A great number of different tree species grow in the forests of Samoa. We identified and tallied 25 different species on sample plots. Additionally, five individual trees tallied were not identified by name. We saw many other species while hiking through the forests. The literature shows many more species of trees in American Samoa than were noted on plots.
>
> Several of the species have good growth form and wood quality. Dysoxylum samoense (Meliaceae) is a notable example.
>
> In places, sawtimber yields are excellent. Forest stands vary widely in sawtimber volume, from less than 3,000 to more than 21,000 board feet per acre, based on individual plots sampled. It is not likely that the plots we measured covered the extremes. The overall average gross sawlog (merchantable) volume per acre, in the relatively undisturbed areas sampled, was near 8,000 board feet. Averages for the nine different locations ranged from about 3,000 to 16,000 board feet per acre.
>
> Dominant trees are generally 85 to 100 feet tall, with broad crowns. The tallest tree measured on a plot was 102 feet. The length of bole classed as sawtimber did not exceed 3 logs (48 ft.) in any trees measured on plots, although trees of greater merchantable length were seen in the forests. Even most trees of large diameter had fewer than 3 logs.
>
> Trees larger than 40 inches diameter breast height are not uncommon, but most by far were less than 30 inches d.b.h. The tallest tree measured also had the greatest diameter--73 inches. Stocking, as measured by basal area, ranged from 110 to 210 square feet, the average being 160. Cull trees comprised from 0 to 45 percent of the stocking, or 50 square feet of basal area on the average.

Although these observations lead to only rough estimates, it appears that there is a substantial timber resource on Tutuila Island. Depending on wood quality or merchantability of various species, the timber resource in the relatively undisturbed forests, exclusive of the steeper watershed

Looking southwest from ridge above Fagaitua. Much of the "forest" is coconut plantation.



Looking southwest across Fagasa Bay at forested upper slopes, coconut plantations on lower slopes, and patchwork of cultivated clearings.



Taro patch in a recent clearing on a 70 percent slope. The surrounding forest is relatively virgin.

Coconut and banana plantations on steep lands between Fagaitua and Masausi.

Relatively undisturbed forest surrounds cultivated patches on ridge north of Mapusaga.

Mamala (Dysoxylum samoense) appears to be one of the best species. This tree, 102 feet tall and 73 inches d.b.h., was growing in the forest shown to the left.

Maali (Canarium samoense) is a common species. This tree was 93 feet tall with a 47-inch diameter breast height.

areas, may amount to 50 million board feet or more of sawlogs. There is additional timber in the regenerating forests and as remnant trees in cultivated areas.

Tau Island, totaling only about 11,000 acres probably has a lesser proportion of forest land and a greater proportion of coconut plantations. Examination of aerial photos suggests that the forest area and timber resource of Tau amounts to about one-fourth that on Tutuila.

I made no estimates of the forest resource of the other very small islands of American Samoa.

FOREST USE

Greater values are now derived from the forests than are probably commonly recognized.

The forested watersheds help insure quantity and quality of water supplies. They moderate runoff, protect the soil from erosion, and reduce stream siltation. Excessive soil disturbance or cultivation on steep slopes would pose a threat to watershed values, but the type of cultivation practiced by Samoans (small patches of plantations, minimum soil working) and rapid regrowth of vegetation minimize watershed damage.

The scenic beauty and recreation potential of the forests are of great value; the forested mountains provide a scenic backdrop for the people in the villages on the flats and along the shore. Esthetic values will become more important with increased tourism. The topography and vegetation invite the recreationist who prefers an intimate association with the forest. An interesting bird life dwells in the forest habitat. The value of specific forest plants for scientific and other purposes is difficult to project.

Many useful products are now derived from the forests. For example: posts and other wood materials for building houses, logs for canoes, fine hardwoods for bowls and other implements, fuelwood, fruits and nuts, bark and other fiber material, and tree sap for glue. The Samoans continue to depend on the native forest for many such needs although imported substitutes play an increasing role.

Although more use of local timber seems a likely prospect, equipment used to harvest and manufacture wood products is not adequate. Introduction of simple modern milling and woodworking machinery may enable more efficient use of timber products for local needs and for export of specialized items.

Lack of roads into the mountainous interior of Tutuila limits use of the timber resource. There are no roads along the north coast, and the road from Pago Pago to Fagasa is the only road to the north coast. There are no motor vehicles on Tau Island.

FOREST OWNERSHIP AND MANAGEMENT

The forest belongs to the village or families, and products are harvested as needed. But there is no effort to reforest or improve the quality of the forest. The practice of harvesting the best trees and leaving poor trees and inferior species to regenerate the forest has probably been detrimental to timber values.

I did not see any planted forests of either introduced or native trees, but plantings of single trees and property line plantings are common. However, there seems an obvious opportunity and a need to start forest plantings--of the more desirable native species and carefully selected exotics--to develop better quality timber products on more accessible lands.

RECOMMENDATIONS

1. Watershed values in the forested mountains must be protected and enhanced. I saw few signs of real abuse of land, excessive runoff, or erosion. Nevertheless, the possible consequences of expanded cultivation should be carefully studied. An attempt should be made to define sensitive or critical watershed areas and establish limits for their use.

2. To stimulate use of local timber, some modern machinery and processing methods should be introduced. The Alaskan chain saw mill, a very light mill that can be hand-carried into the forest to mill rough lumber on site, is suggested for trial in Samoa. If found practicable, such mills could produce quantities of rough lumber or flitches for craft and other wood manufacture. Lumber drying and other problems would no doubt need attention but should not be critical. A centralized yard where logs and rough lumber could be sold, remanufactured, dried, or otherwise treated, or custom milled, might stimulate timber harvesting and wider utilization. Modern wood-working power tools and methods should be introduced to improve the small woodcraft industry.

If such pioneering efforts gain momentum, establishment of a small sawmill should be considered. Problems of logging and specific information on the volumes and quality of the timber resource would be more pertinent at such a time. Until the foreseeable production volume justifies the effort or expense, I hesitate to recommend fixing up the small mill owned by the Government. Unless it is set up properly, at considerable expense for modification and with qualified technical advice, many problems will be encountered.

The double-diffusion preservative treatment method may enhance the use of local material for posts and poles. This treatment should be tested on several species.

3. The wood qualities of several species in Samoa need to be examined. As a minimum, weight and shrinkage should be determined

for tree species held by local experts to be important in both quality and volume. Species showing greatest potential should be tested more extensively to determine strength, machining, gluing, and other properties.

4. Production of timber as a crop should be encouraged, just as any other crop which shows good promise for local use or for export products. The present timber supply, though small, and the potential to grow more timber, form an important part of American Samoa's limited resources. In addition to the present forested areas, there are many areas of accessible, once-cultivated land which are now idle. This land seems well suited for tree crops--for fuelwood, for house posts or other building timber, or for growth of sawtimber crops over a longer period of time. Desirable native species should be cultivated or encouraged in natural stands.

A few exotic timber species should be tested for adaptability. Agathis species, Eucalyptus deglupta, Swietenia species, and Toona species are examples. I was told that plantations of teak did well in Western Samoa.

Potential introductions should be carefully appraised to avoid introducing aggressive pests. For example, I noticed yard plantings of Casuarina species, but I suspect that other, better species could be found for the purposes that casuarinas serve.

Demonstration tree plantings should be established. These will pave the way toward expanded attention to forest crops. Such planting should be started right away and might include developing small plantations of a few of the best native species and a very limited number of exotics. In the long run, methods of forest management must be worked out to enhance the timber yields and other values of the forests.

5. Possibilities of exploiting the uniqueness of something Samoan should be investigated. Can the forest be tapped for products particularly marketable to the tourist? What, for example, is the marketability of a small "hand-hewn" Samoan outrigger canoe? Are there species of trees with particularly high quality wood for special products? Although the supplies are limited, lumber or flitches of species such as fau, milo, ifilele, and tamanu would demand a high price in the Honolulu craft industry.

6. The desirability of preserving natural areas should be investigated. Only a few areas remain of what apparently was once an extensive area of lowland forest westerly of Tafuna. Preservation of one or more significant-size parcels of this forest type and of upland forest types seems highly desirable for scientific and other purposes.

7. These recommendations make up a conservative forestry program for the present. To implement it will require more attention to forestry than is being given. Further, much of the work required should have on-going guidance of professional foresters or specialists in related fields. Forestry and forest utilization are dynamic; problems and

opportunities will change. The Government of American Samoa should provide for obtaining qualified professional forestry advice and leadership on a continuing basis. Officers of Samoa's Department of Agriculture have demonstrated an interest in forestry that is certainly justified by the available resources. Their initiative in investigating the possibilities for development is highly commendable. Similar enthusiasm has arisen in the past, but because a continuing program was not established, Samoa must still speak in terms of a "forestry potential" rather than of benefits for today's population. The next step is to capitalize on current enthusiasm. This means that forestry must be recognized as an important continuing government function and responsibility, and given sustained support.

ACKNOWLEDGMENTS

Mr. Thomas Annastas, Supervisor of Forestry Program, worked with me continuously during my 8-day stay in Samoa. He and Mr. Charles Shiraishi, Director of Agriculture, briefed me on agriculture and land use in general and obtained aerial photographs and maps for my study.

Mr. Taueu and Mr. Apineru, Assistants to Mr. Annastas, aided in the field work. They were particularly helpful in identifying trees by Samoan names.

SAMOA FOREST TREE NAMES

Samoan Name	Scientific Name	Family
A'a matie	Canarium sp.	Burseraceae
Afa	Neonauclea Forsteri	Rubiaceae
Aoa	Ficus spp.	Moraceae
Asi	Endiandra elaeocarpa	Lauraceae
Asi	Syzygium inophylloides	Myrtaceae
Asi	Syzygium tutuilense	Myrtaceae
Atone	Myristica inutilis and spp.	Myristicaceae
Au'auli	Diospyros samoensis	Ebenaceae
Fau	Hibiscus tiliaceus	Malvaceae
Fenga vao	(Not determined)	(Not determined)
Fetau	Calophyllum inophyllum	Guttiferae
Ifi	Inocarpus edulis	Leguminosae
Ifilele	Intsia bijuga	Leguminosae
Leva	Cerbera manghas	Apocynaceae
Ma'ali	Canarium samoense	Burseraceae
Malili	Terminalia Richii	Combretaceae
Mamala	Dysoxylum samoense	Meliaceae
Mamalava	Planchonella samoensis	Sapotaceae
Maota	Dysoxylum maota	Meliaceae
Masame	Glochidion spp.	Euphorbiaceae
Milo	Thespesia populnea	Malvaceae
Moso'oi	Canangium odoratum	Anonaceae
O'a	Bischofia javanica	Euphorbiaceae
Papaogo (?)	Litsea sp. (?)	Lauraceae
Pata	Macaranga spp.	Euphorbiaceae
Pulauvao	(Not determined)	(Not determined)
Tamanu	Calophyllum samoense	Guttiferae
Tavai	Rhus taitensis	Anacardiaceae
Toi	Alphitonia zizyphoides	Rhamnaceae
Vivao	Reynoldsia spp.	Araliaceae

Table 1.--Average sawtimber volume per acre[1] at plot clusters, by species, American Samoa, 1964

Species	Plot cluster number									All plots	
	1	2	3	4	5	6	7	8	9	Total	Average
Mamala	1,120	(3/)	3,280	--	--	(3/)	4,280	5,910	1,550	16,140	1,790
Atone	(3/)	(3/)	(3/)	--	510	480	230	4,360	1,640	7,220	800
Masame	(3/)	--	--	--	--	--	--	--	--	(3/)	--
Toi	530	830	--	2,610	--	(3/)	340	--	1,200	5,510	610
Maota	(3/)	--	--	--	--	--	120	--	790	910	100
Afa	(3/)	(3/)	910	--	1,210	570	--	--	--	2,690	300
Tavai	5,130	270	--	2,340	--	560	2,220	--	--	10,520	1,170
Pata	110	440	--	(3/)	--	--	--	--	(3/)	550	60
A'a matie	(3/)	1,720	680	--	1,650	--	--	--	1,160	5,210	580
Maso'oi	--	(3/)	--	--	680	--	--	--	--	680	80
Ma'ali	--	2,430	--	--	(3/)	--	--	5,380	--	7,810	870
Mamalava	--	1,240	--	--	--	--	5,250	--	--	6,490	720
Ifi	--	(3/)	--	--	--	(3/)	(3/)	--	--	(3/)	--
O'a	--	640	830	--	--	--	--	760	--	2,230	250
Pulauvao	--	(3/)	--	--	--	220	--	--	--	220	20
Vi vao	--	600	--	--	--	--	--	--	--	600	70
Malili	--	--	1,950	--	--	--	--	--	830	2,780	310
Fenga vao	--	--	--	--	670	--	--	--	--	670	70
Asi	--	--	--	--	(3/)	430	--	--	--	430	50
Fau	--	--	--	--	(3/)	(3/)	--	--	(3/)	(3/)	--
Au'auli	--	--	--	--	--	500	--	--	--	500	60
Papaogo	--	--	--	--	--	(3/)	--	--	--	(3/)	--
Aoa	--	--	--	--	--	--	(3/)	--	--	(3/)	--
Leva	--	--	--	--	--	--	(3/)	--	--	(3/)	--
No identity	--	--	--	(3/)	500	530	--	--	--	1,030	110
Total	6,890	8,170	7,650	4,950	5,220	3,290	12,440	16,410	7,170	72,190	8,020
No. of plots in cluster	3	3	2	3	2	2	6	2	3	26	--
Average basal area[2]	60/110/170	70/100/170	30/90/120	50/60/110	40/90/130	90/120/210	50/150/200	0/160/160	40/90/130	--	--

1/ Estimated board-foot volume per acre averaged for all point samples (Basal Area Factor 20) at a location; based on Mesavage-Girard form class volume tables, International 1/4-inch rule, form class 77.

2/ Basal area of cull trees/merchantable trees/total.

3/ Tallied but no sawtimber.

REFERENCES

Bryan, E. H.
1935. Samoan and scientific names of plants found in Samoa. Bernice P. Bishop Museum. Mimeo. 38 pages.

Coulter, John W.
1941. Land utilization in American Samoa. Bulletin 170, Bernice P. Bishop Museum, Honolulu, Hawaii. 48 pp., illus.

Christopherson, Erling
1935. Flowering plants of Samoa. Bulletin 128, Bernice P. Bishop Museum, Honolulu, Hawaii. 221 pp., illus.

_____
1938. Flowering plants of Samoa--II. Bulletin 154, Bernice P. Bishop Museum, Honolulu, Hawaii. 77 pp., illus.

Koenig, Nathan
1961. The economic needs of American Samoa. Study made for the Committee on Interior and Insular Affairs, United States Senate, 87th Congress, 1st Session. GPO, Washington, D. C. 97 pp.

Marshall, Colin
1951. Report on forestry in American Samoa. Pacific Science Board, National Research Council, Washington, D. C. Mimeo. 172 pp.

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