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Botanical and ethnobotanical inventories of the National Park of American Samoa

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INTRODUCTION

The establishment of the National Park of American Samoa (NPSA) was authorized by an Act of Congress in 1988 to "preserve and protect the tropical forest and archaeological and cultural resources of American Samoa, and of associated coral reefs, to maintain the habitat of flying foxes, preserve the ecological balance of the Samoan tropical forest, and consistent with the preservation of these resources, to provide for the enjoyment of the unique resources of the tropical Samoa forest by visitors from around the world."

The National Park Service (NPS) was also directed to maintain traditional Samoan customs within the Park and to permit *traditional* subsistence uses in the Park, with certain conditions (NPS 1997). Agriculture, gathering, or fishing within the Park are restricted to native American Samoans and are limited in scope and location. They must be carried out in areas customarily used for these purposes, employing traditional tools and methods.

The concept of **fa'asamoa** is integral to managing the Park's natural and cultural resources. **Fa'asamoa** means the traditional Samoan way of life: respecting and adhering to the traditions and customs of the Samoan culture. The matai system of lawful, chiefly authority is one of the most important components of **fa'asamoa**.

The management plan (NPS 1997) further identified a critical need for information and understanding of the extent and nature of subsistence uses within the Park.

> "At present, NPS has only very limited knowledge of the nature and significance of traditional subsistence uses that are either going on now or have historically occurred in the Park.… The relationship of subsistence users to the land base and resources of the Park have not yet been identified or documented. NPS has not inventoried existing subsistence uses with the Park, knows very little about the attitudes and practices of present users, and has no way of monitoring future subsistence uses or develop mutually acceptable rules regarding these uses…"

The existing and proposed areas of the National Park of American Samoa (NPSA) integrate a unique combination of Samoan cultural components and biological resources, both marine and terrestrial. Effective management of any natural area depends upon a knowledge of the resources it contains, thus necessitating comprehensive botanical and ethnobotanical surveys. An assessment of the extent, diversity, and use of botanical resources will provide needed baseline data for developing appropriate management strategies to guide the successful integration of **fa'asamoa** and long-term sustainable use of these resources.

The vegetation of the islands of American Samoa has been extensively studied (Setchell 1924; Christophersen 1935, 1938; Amerson et al. 1982; Cole et al. 1988; Whistler 1980, 1992, 1994, 1995, 1998). Several of these studies (Whistler 1980, 1995;

Amerson et al. 1982) have included the collection of quantitative data in various vegetation communities, including some areas now within the boundaries of the Park. Whistler (1980) and Amerson et al. (1982) established linear survey routes and/or inventoried 41 study sites, including 20 on Tutuila, 10 on Ta'u, four on Olosega, and two on Ofu. Due to time limitations, 13 of the 41 sites were not sampled with plots; instead, diameter at breast height (dbh) was estimated for a random number of trees with no actual measurements taken. The major emphasis of the study was on trees, but information on ground covers and epiphytes was also recorded.

A vegetation survey and forest inventory of American Samoa was conducted in 1986 to evaluate vegetation types most useful to foresters and land-use planners (Cole et al. 1988). A total of 20 plots, on Tutuila (16) and Ta'u (4), were classified as timberland and sampled at five points within the plot. Selected trees with dbh between 12.5 cm to 90 cm, all trees >90 cm dbh within 17m of point center, and all trees < 12.5 cm within 7.7 m of point center, were tallied. Species, dbh, and total height were recorded.

Whistler (1994) selected 12 sites for vegetation sampling on Tutuila (11) and Ofu (1). Approximately 100 trees were picked at random and measured for dbh to determine relative dominance of the species. Permanent plots were subsequently established on Tutuila (5) and Ta'u (3) by Whistler (1995). Nine of the plots measured 50m x 20m, with one plot measuring 50m x 10 m. A total of 10 subplots were established and all trees with a dbh >5 cm were measured. Tags were nailed into the trees with dbh >10 cm. A checklist was made of all the species found in the plots, and the frequency of vines and lianas on the trees, as well as the presence of epiphytes, was noted. A preliminary study in an area along Mataala ridge above Olosega Village quantified the useful plants in four 2m x 50m transects (NPSA 1999).

Documentation of the cultural uses of plants in American Samoa ranges from brief descriptions of the uses and in some cases, cultivar names (Setchell 1924; Christophersen 1935), to an extensive, annotated list of Samoan plant names (Whistler 1984) including scientific and local names and a brief description of the plant and its uses. Whistler (2000) provides in depth information and numerous photographs and illustrations of the plants historically and currently used by Samoans. Wysong (2001) documented and quantified the subsistence usage of selected trees and coastal plants in the Manu'a Islands.

Disturbed areas (secondary forest, agroforests, and plantation and crop lands) are the main focus of subsistence activities by the Samoan people, providing a diverse array of culturally important plants that are harvested and cultivated. These areas are also important sources of food for flying foxes especially when primary forest resources are unavailable.

PROJECT METHODS

Botanical and ethnobotanical surveys were conducted over an 18-month period during 2001 and 2002, focusing on the Manu'a Group. Field work was carried out as follows:

(1) Ta'u — April 10-15, 2001 and May 29-June 6, 2002.
(2) Ofu and Olosega — April 16-28 and June 9-23, 2001.
(3) Tutuila — September 1-6, 2002.

The survey teams consisted of the authors, staff, and interns of the National Tropical Botanical Garden, graduate students, research associates, staff of the National Park of American Samoa, and island residents.

BOTANICAL SURVEY METHODS

Botanical surveys involved collecting voucher specimens of native and naturalized species and some cultivated plants located in the survey areas. Each specimen was geocoded using GPS. The vouchers were deposited at the National Tropical Botanical Garden herbarium and duplicates were given to NPSA (Appendix A). Duplicates were distributed to other herbaria such as the Bishop Museum and Smithsonian Institution, when available. In addition, plants were photographed, and digital images on CD media and 5x7 or 8x10 color photographs were provided to NPSA with this report (Appendix A).

Vegetation sampling was done along transects or in plots within the boundaries of the Park in the lowland coastal forest in the Saua area on Ta'u and along the Toaga coastline on Ofu. Transects were also done in the agroforest area behind Olosega Village, below Mataala Ridge, and on the Alei Plateau and Ridge on Olosega (Figures 1, 2, 3). The latter area was recently was authorized by Congress to be included in the Park. Permanent plots were not established at the request of the National Park of American Samoa. Botanical surveys were also done on Ta'u in the agroforest areas on the mountain above Fiti uta village and near Luatele (Judd's) Crater and along the Mataala Ridge trail on Olosega, but no plots were established.

Specifics on sampling methodology, transect and plot size, statistical analysis, etc., for these areas are given in the appropriate sections of the report. In general, standardized methods were used to facilitate the monitoring of changes in vegetation over time within the study sites and to compare sites in different areas. Location and size of plots, elevation, GPS coordinates, and in some areas, compass headings, were recorded for the study sites.

Measurements to calculate frequency, density, and dominance of plant species were collected. Frequency equals the number of plots in which a species occurs divided by the total number of plots sampled. Relative frequency (Rf) provides information on

patterns of distribution. Density equals the number of individuals in the area sampled. Relative density (Rd) is the number of trees of a species divided by the total number of trees recorded within the area sampled x 100%. Dominance is the total basal area for a species in the area sampled. The basal area of each tree is calculated $\{dbh/2)^2 \times 3.14\}$ and summed together for total basal area. Relative dominance (RD) is the total basal area of a species divided by the total basal area for all trees recorded in an area x 100%.

The numbers of individuals of each species were recorded, and all trees with a dbh $\geq$ 5 cm were inventoried and measured. For trees with multiple stems, all stems meeting this size parameter were measured. The dbh was measured at 1.3 m above the ground with the exception of buttressed trees; their diameter was measured above the buttress. Trees whose stems straddled the plot boundary were included in the inventory if $\geq$ 50% of the trunk fell within the plot. Trees that were rooted outside the boundaries were not counted, even if the trunk had fallen or was recumbent within the plot. In addition, the numbers of stems of bananas, breadfruit, and/or coconuts were counted, even if the latter two species had a dbh < 5 cm. Subplots were randomly selected and established within the study sites; seedlings, the number of stems of shrubs, and herbaceous plants were counted. For herbs and ferns with creeping rhizomes or multiple stems, only percent cover was estimated. Herbarium vouchers were collected for most of the species recorded in the study area.

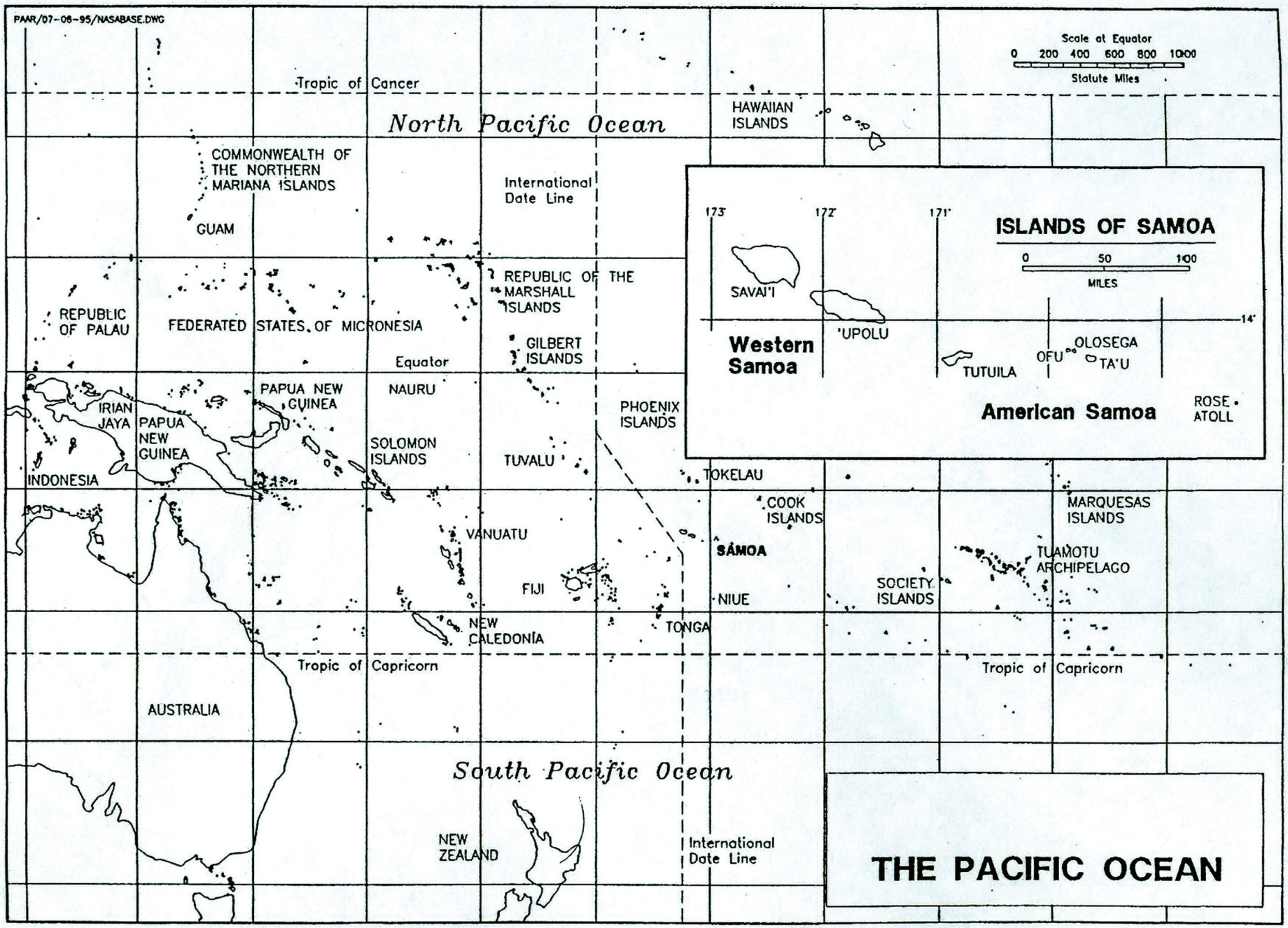

Figure 1. Map of American Samoa and Pacific Islands.

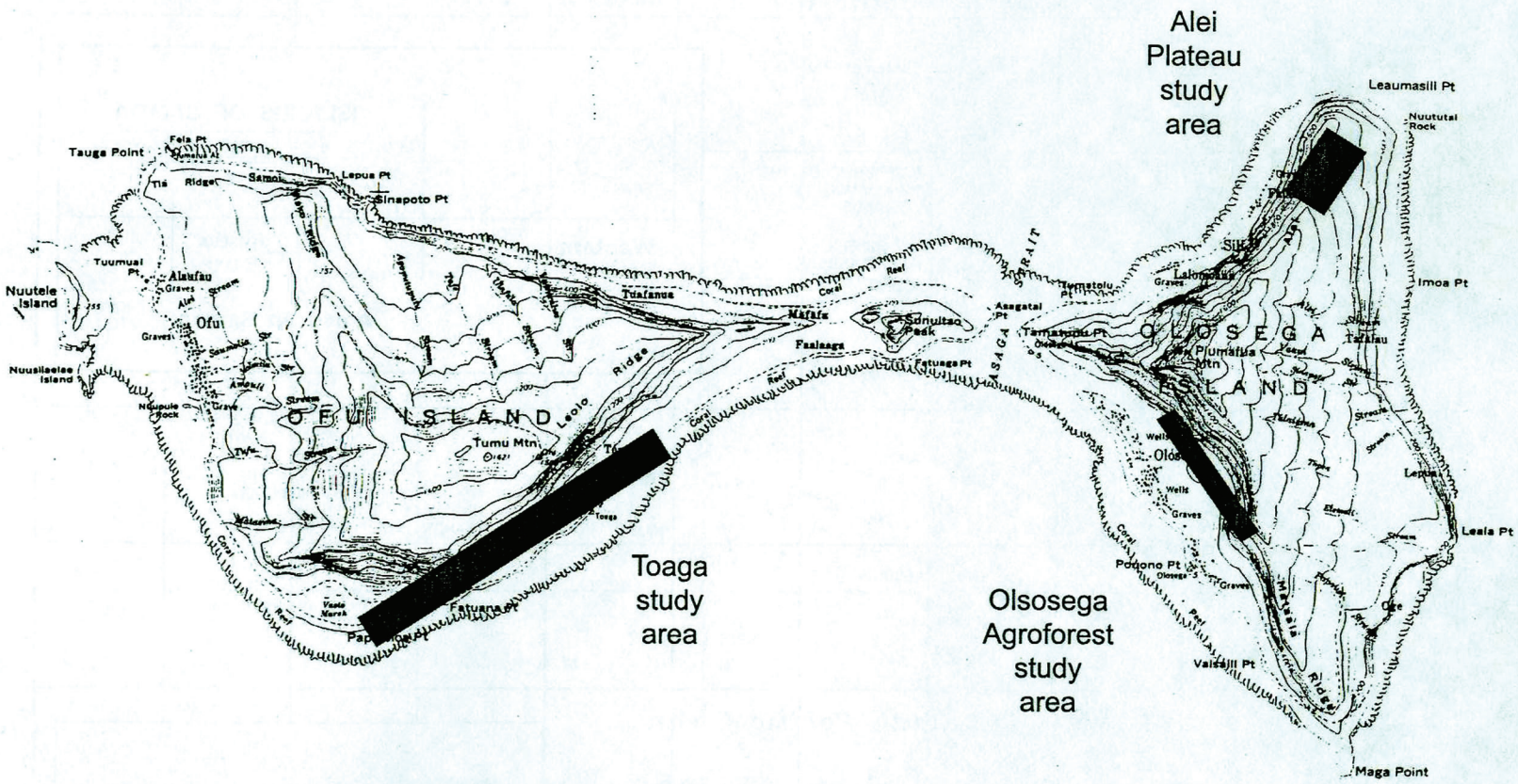

Figure 2. Location of study plots on Ofu and Olosega Islands.

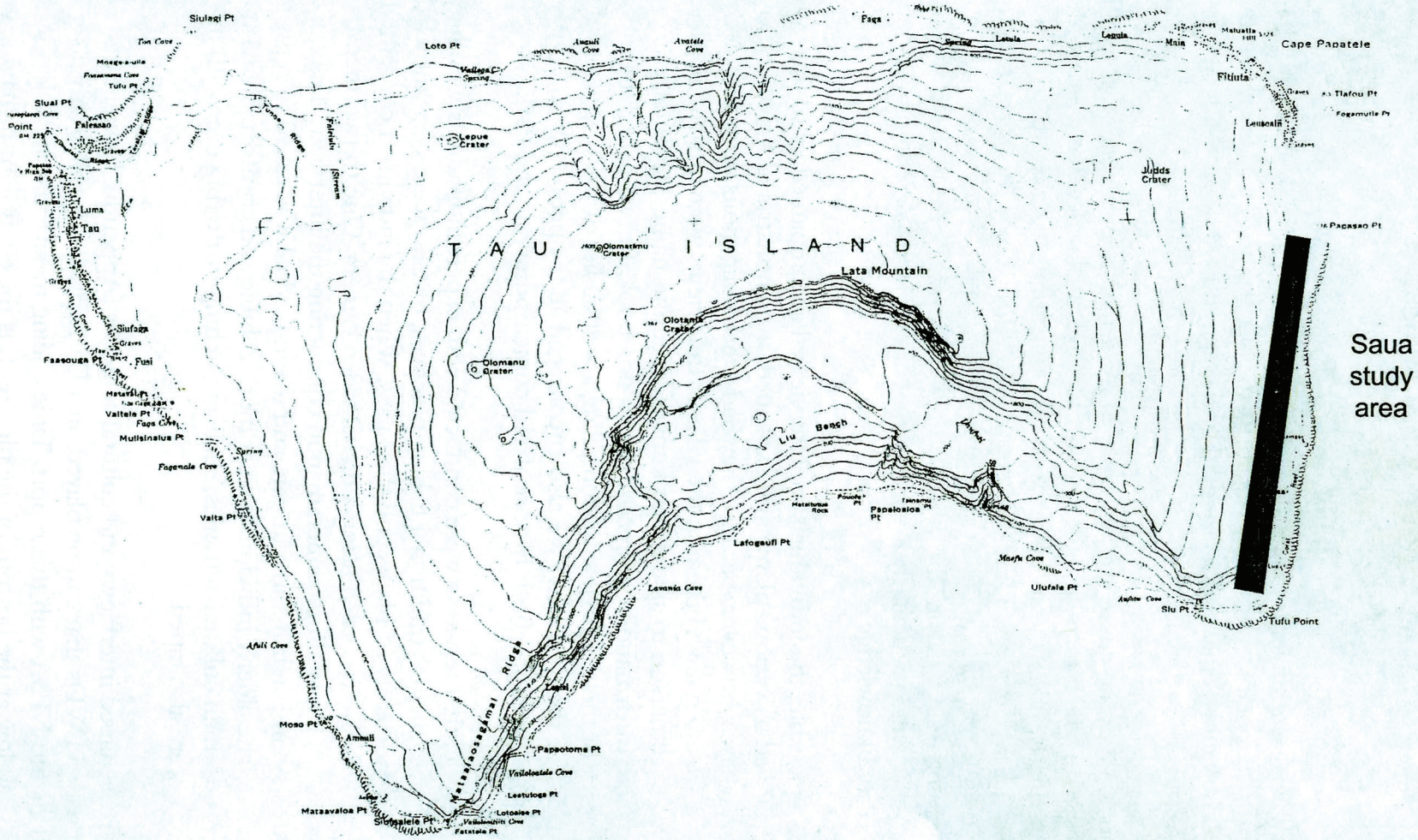

Figure 3. Location of study plots on Ta'u Island.

ETHNOBOTANICAL SURVEY METHODS

Our goal was to inventory and document three main groups of plants: 1) food crops that are cultivated or harvested from wild plants; 2) plants harvested for non-food uses; and 3) plants documented in the literature and/or verified by Samoans as food sources for flying foxes.

In any community there are two types of information about useful plants: generalist knowledge which many people know, and specialist knowledge which only a few, often elderly, people know. Because of the importance of the chiefly **matai** system in Samoa, we first attempted to meet with the **Pule Nu'u** (mayor) of each village to discuss our project and solicit their support and to seek their assistance in identifying individuals in the village who were knowledgeable about plants and their use(s). We were particularly interested in working with expert individuals who have specialized knowledge.

Where possible, the individuals we interviewed accompanied us to the study site and showed us various plants and explained or demonstrated how they were used. In most cases, however, because they had other obligations or were elderly or infirm, we interviewed them in the village. Interviews were unstructured, and we invited each person to share their knowledge about names, legends, etc. of plants they used. Information was recorded in a notebook. In two cases, the individuals prepared for their interview by compiling a written list of the plants and discussed these during the interview. We also encouraged all the people we interviewed to discuss resource use, both historical and contemporary, in the Park.

More in-depth interviews were conducted with expert individuals who had unique knowledge, such as traditional fishing practices, or who were very knowledgeable about a wide array of plants and their uses. When the individual consented, interviews were recorded using a digital video camera. One to two members of the survey team assisted the cameraman in conducting the interview. The questions were asked in English and Samoan, and the individual was asked to reply in Samoan. The elderly individuals were more voluble and comfortable with this format. Certain cultural activities, such as catching **atule** (big eye scad) in Ofu Village, were also taped.

All of the taped interviews and cultural activities (Appendix F) were transferred to timecoded DVDs that can be played on a DVD player. A full archival set was provided to NPSA with this report. Time coding means that a clock is included in a small window at the bottom of the picture. It is the equivalent to having an index to the information and makes these materials more useful for reference purposes because the viewer can refer to an exact place in the recording. This will be especially useful if the materials are translated from Samoan to English. The DVDs can be used to make VHS

tapes and the resulting copies will be of high quality, unlike duplicated videotapes made from VHS originals.

I. TOAGA, OFU ISLAND

OVERVIEW

The Ofu unit of the Park contains 70 acres (28.3 ha) of land along the southern shoreline from Fatuana Point west to Asaga Strait, including the narrow strip of beach south of the coastal road and the adjacent reef (Figure 4). This area encompasses one of best examples of healthy, intact coral reef in Samoa and is unique within the National Park system (NPS 1997). This management plan identified potential negative impacts to the reef such as subsistence overuse, future increased visitor pressure, and degradation due to terrestrial threats.

Figure 4. Aerial view of Toaga coastline.

Since the Park will attract increasing numbers of visitors, the level and easily accessible land across the road from the Park boundary would be very attractive for development to accommodate those visitors. Construction in this area would impair Park scenic resources and threaten reef health. Any attempt to expand the Park on Olosega should include consideration of this important strip of land (NPSA 1999). The coastal strip bisected by the road contains remnants of the littoral forest vegetation community (Figure 5) and includes native species as well as many cultivated plants and weeds (Amerson et al. 1982; Whistler 1992; Kirch 1993). The strip of land within the Park includes *Sophora tomentosa*, one of only three known localities in American Samoa (Amerson et al. 1982).

Figure 5. Toaga strand vegetation.

No previous transects or plots have been reported for the Ofu coastline with the exception of archaeological survey work. A total of 17 transects were oriented

perpendicular to the coastline and observations were made of soil variation and vegetation (Kirch and Hunt 1993). The horizontal distribution of dominant species was recorded along three transects (Kirch 1993).

TOAGA METHODS

The National Park Service sign at the east end of the Park was selected as the starting point of the survey. A control station, designated 0+0, was established on the beach, and the coastline was surveyed for a total distance of 1980 m. A map of the Toaga coastline was generated from the survey data by Peter N. Taylor (Appendix B). The survey or control line was used to determine the location of plots in the vegetation zone. It was not possible to continue shooting the survey line along the beach past 1980 m because the shoreline changed from sandy and gently sloping to rocky, with a large rock outcrop blocking sightlines. At 19+80, the control stations were moved to the road and placed at 50 m and 100 m intervals. The Park sign at the west end of the Park is located at 30+10.5 (a total distance of 3010.5 m from sign to sign). This latter area is not included on the Toaga map because the mapping program requires two points, one along the beach and one along the road.

Along the control line on the beach, wooden survey stakes, labeled with the station location, were placed at 50 m and 100 m intervals (e.g., 0+50=50 m, 1+00=100 m, 1+50=150 m, 19+50=1950 m). A station was established at 6+80 because of difficulties in sighting one at 7+00. At each station, a perpendicular line was run to the road and a hub and marked stake were placed at the edge of the road. The distance from the control line to the coastal edge of the vegetation and the distance to the roadside edge of vegetation were measured to determine the width of the coastal vegetation at each station. The area along the edge of the road (0.5-1.0 m in width) was not included. The American Samoa Power Authority (ASPA) cuts the vegetation under the power lines and utility poles that mark the Park boundary

The midpoint of the vegetation zone was marked with a tall wooden stake labeled with the station location (e.g., 2+50), and GPS readings were recorded. Two contiguous 10m x 10m plots were set up with the center line running from east to west along the middle of the vegetation zone. Fifty plots—totaling 5000m^2 (0.5 hectare)—were inventoried between 0+0 and 19+80. Of these, 38 were at the 100 m stations, beginning with 0+0 and 12 were at the 50 m stations. The vegetation between 17+00 to 18+40 was not inventoried because this area is privately owned land that is not part of the Park. All stakes, markers, and flagging tape were removed from the Park when the inventory was completed.

Trees with a dbh $\geq$ 5 cm were measured and inventoried in all 50 plots. Five subplots were randomly selected and the number of stems were counted for all plants >1 m tall. Within each subplot a 1m x 1m subplot was established: all seedlings, herbaceous plants, and stems of shrubs < 1 m tall were counted and percent cover estimated. The

dbh of standing dead trees was measured and noted to determine mortality, but not included in the data analyses. Cut stumps, especially of coconuts, were also inventoried and measured.

An additional 40 plots measuring 10m x 2m were inventoried at the 50 m and 100 m stations along the narrow, rocky coastline between 20+40 and 30+10 (near the NPS sign at the west end of the Park). All trees with a dbh ≥ 5 cm were measured and counted, except for *Hibiscus tiliaceus* which forms dense thickets with numerous tangled stems Information about the study plots is provided in Appendix B.

General Description of the Coastline and Vegetation

The composition and structure of the littoral vegetation varies along the 3 km stretch of coastline. The area is generally flat with a substrate of sand and mixed coral rubble that has washed in during high storm surges. The vegetation zone from the high tide mark to the road edge varies in width from 11.3 m at 12+50 to 45.5 m at 14+00.

At 18+40 the coastline becomes dominated by outcroppings of basaltic lava and large boulders that have fallen from the steep mountain ridge inland from the site. A few massive boulders are strewn along the sandy beach and out into the lagoon. This area is adjacent to the highest point (~4 m elevation) in the road.

At 20+50 the shoreline is only approximately 1 m wide with a 75-80% slope. The shoreline widens again between 20+90 to 23+50 and is relatively flat with areas of cleared vegetation under the power lines. There are three small dilapidated structures located here. From 23+50 to the west boundary of the Park at 30+10.5 the shoreline is boulder strewn and only 1-2 m wide in some places. This section of shoreline is dominated by a canopy of *Hibiscus tiliaceus, Hernandia nymphaeifolia,* and *Thespesia populnea,* with a few scattered trees of *Erythrina variegata, Macaranga harveyana, Morinda citrifolia, Pisonia grandis,* and a single *Terminalia catappa*.

Erosion is occurring in several locations in the Park caused by runoff from the road during heavy rains. Road fill and soil, sand, and small rocks are washing out onto the beach and into the lagoon. Erosion zones were observed at 23+50-23+60, 26+00-26+10, 20+85, 21+19, and 11+37.

The most serious erosion was seen at 11+35 to 11+40 where there is a 3 m wide cut that extends through the vegetation. There appears to be a natural drainage at 11+35, but the road grade and a berm of sand at the edge of the road are eroding a channel and draining water and road fill from the road onto the sandy beach. The road regularly washes out and road fill is trucked in to repair the pot holes. We recommend that NPSA work with the Public Works to pave the coastal road where it borders the Park. This

would prevent the erosion of fill into the marine Park, and would also benefit the residents of Ofu and Olosega villages who must traverse this stretch of rough road.

In general we observed little debris or rubbish in the Park with the exception of plastic bottles, floats, and other ocean-borne debris near the Ofu boundary sign. There was an accumulation of 50-gallon storage drums, the rusted remains of cars and boats, fishing nets, floats, and various plastic objects, washed up or abandoned along the rocky shoreline.

The native vegetation is relatively intact except along the roadside and around utility poles and beneath the power lines. The plants in these areas are cut back during routine maintenance by ASPA (Figure 6). Grasses, sedges, and broad-leaved weeds including *Cynodon dactylon, Cyperus spp., Desmodium spp., Digitaria spp.*, and *Bidens spp.*, are proliferating in these disturbed areas. Vines of *Canavalia cathartica* and *Vigna marina* are starting to clamber over and cover important species such as *Terminalia samoensis* and *Sophora tomentosa.*

Figure 6. Vegetation clearing under powerlines.

Cocos nucifera was the dominant cultivated species and occurred scattered throughout the Park. There were small groves at Plot 27 (12+90 to 13+00), and in and adjacent to Plots 30 to 32 (14+00 to 15+10), and 34 (16+00 to 16+10). None of these appear to have been tended recently as indicated by a small abandoned and collapsed **fale**, piles of fallen nuts around the trees, and small shrubs and trees that are growing under the coconut trees. These include *Colubrina asiatica, Hernandia nymphaeifolia, Senna alata, Cordyline fruticosa, Pandanus tectorius, Barringtonia asiatica, Ficus scabra, Ficus tinctoria,* and *Morinda citrifolia.*

While the plants in the privately owned land were not inventoried, we noted that the area had the greatest diversity of cultivated species along the Toaga coastline. *Artocarpus altilis* (breadfruit), *Musa* x *paradisiaca* (bananas), *Cocos nucifera* (coconuts), *Tacca leontopetaloides,* and numerous seedlings and juveniles of *Morinda citrifolia* and *Carica papaya* seedlings were found here. Several cultivated species (*Alpinia atropurpurea, Mangifera indica*, and *Persea americana*) that were not found anywhere else in the Park were recorded growing adjacent to Plot 35.

Other areas of disturbed vegetation are found adjacent to the abandoned structures near 21+00. The area around these had been cleared of trees and is mostly open, with only a few coconut trees and *Hernandia nymphaeifolia.* Ornamental plants include *Plumeria rubra* and *Hibiscus* x *archeri. Vigna marina*, a native vine, is covering large sections.

The roadside is dominated by a mix of invasive and ruderal weeds and grasses, including *Mikania micrantha, Ruellia prostrata, Stachytarpheta urticifolia, Digitaria ciliaris, Cenchrus echinatus, Desmodium incanum, D. triflorum, Chamaesyce hirta, C. hypericifolia, Bidens pilosa, Synedrella nodiflora, Sida acutifolia, Spermacoce assurgens,* and *S. ovalifolia.* This is the only location *Leucaena leucophylla* occurred at Toaga. These plants are reproductive, producing flowers and seeds, and regenerating and spreading. We recommend that NPAS eradicate this invasive species to prevent its spread into other areas of the Park.

TOAGA INVENTORY RESULTS

A total of 107 species were recorded in the Park during our surveys and a complete list is provided in Appendix B. We counted and measured 417 trees of 17 species (Table 1) in the 0.5 hectare (~1.2 acre) study area comprised of 50, 10m x 10m plots between 0+0 and 19+90 coordinates. Fourteen (82%) are native species.

Table 1. The number of species and individuals inventoried and measured in 50, 10m x 10m study plots at Toaga, Ofu, between 0+0 and 19+90 coordinates, and relative density (Rd), relative dominance (RD), and total basal area for each species.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Artocarpus altilis (P)	5	2	1.20	0.54	905.1
Barringtonia asiatica (N)	9	7	2.16	11.54	19480.1
Cocos nucifera (N)	108	34	25.96	41.62	70239.6
Cordia subcordata (P)	1	1	0.24	0.02	38.5
Geniostoma rupestre (N)	1	1	0.24	0.04	73.7
Guettarda speciosa (N)	25	13	6.01	2.39	4034.1
Hernandia nymphaeifolia (N)	53	23	12.74	18.67	31508.7
Hibiscus tiliaceus (N)	37	11	8.89	2.07	3486.1
Macaranga harveyana (N)	3	3	0.72	0.16	272.5
Morinda citrifolia (P)	1	1	0.24	0.02	30.2
Pandanus tectorius var. *tectorius* (N)	56	25	13.46	8.64	14583.1
Pisonia grandis (N)	1	1	0.24	0.33	564.9
Scaevola taccada (N)	2	2	0.48	0.03	45.0
Sophora tomentosa (N)	2	1	0.48	0.04	74.3
Terminalia samoensis (N)	102	28	24.52	12.14	20487.4
Thespesia populnea (N)	4	3	0.96	1.16	1956.7
Tournefortia argentea (N)	6	4	1.44	0.59	988.9
Total	416				168768.8

N = Native, P = Polynesian introduction, M = Modern introduction

Four species (*Cocos nucifera, Terminalia samoensis, Pandanus tectorius* var*. tectorius,* and *Hernandia nymphaeifolia*) dominated the coastal strand comprising 82 percent of the trees inventoried in the plots. Three dead, standing trees, one each of *Terminalia samoensis* (plot 49), *Hernandia nymphaeifolia* (plot 5), and *Artocarpus altilis* (plot 50), and five felled coconut trees (plots 27, 33, 34) were also inventoried.

Coconuts were the most common trees, with 108 trees in 34 plots. As noted earlier, these were scattered throughout the Park but were concentrated in groves in the middle section of the Park. Numerous juvenile coconuts are sprouting in these areas.

Terminalia samoensis, indigenous to the Samoan archipelago, was second in frequency with 102 trees in 28 plots (Figure 7). This species occurs primarily at the east end of the Park with the greatest concentration at 3+00 to 4+10 and 8+00 to 10+10. No trees were observed beyond 12+60**.** The distribution of *Terminalia samoensis* and coconuts indicates that *Terminalia samoensis* was once a dominant species in the Toaga coastal forest but was cut down when coconut groves were planted. The densest concentrations of *Terminalia samoensis* appear to be correlated with the absence of coconut trees.

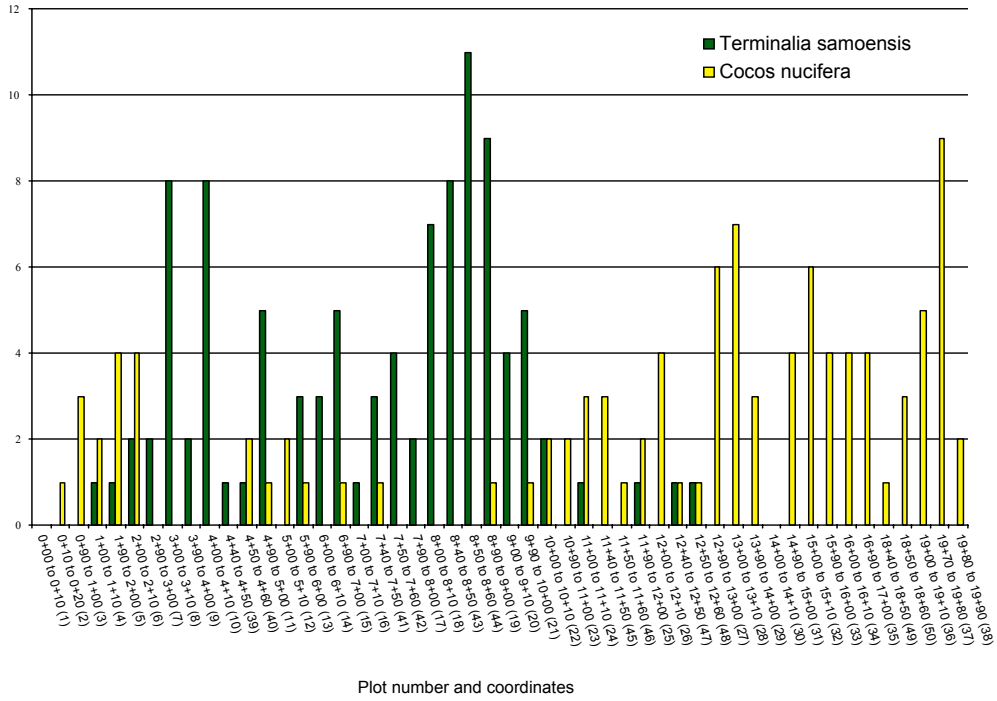

Figure. 7. Distribution of *Terminalia samoensis* and *Cocos nucifera* at Toaga, Ofu.

Pandanus tectorius var. *tectorius* (56 trees) and *Hernandia nymphaeifolia* (54 trees) were found in 25 and 24 plots respectively. In addition to the wild form of pandanus

with spiny, rough leaves that is used to weave thick, sturdy floor mats, called **papa**, there were scattered patches of cultivated pandanus. The leaves of this form (*P. tectorius* var. *laevis*) are smooth and were once used to weave sleeping mats and fine mats. The remaining 13 tree species in the plots ranged from as few as one individual for four species to 25 *Guettarda speciosa* and 37 *Hibiscus tiliaceus*. Six trees of *Tournefortia argentea* were recorded in the study plots.

In addition to the trees that were inventoried, 140 saplings and small trees (< 5 cm dbh), shrubs, vines, seedlings, and/or herbaceous plants of 23 species were counted in the five random 10m x 10m plots (Plots 7, 20, 29, 33, 45) (Appendix A). The majority (17) of these are native species indicating that the littoral forest is regenerating in these areas. However, *Morinda citrifolia,* a Polynesian introduction, was second in frequency with 26 seedlings and juveniles. It has been recorded that bats eat the fruits of this species but this is not a preferred food (Banack, personal communication). Two herbaceous species, *Oplismenus compositus* and *Stachytarpheta urticifolia*, were present in the plots.

The dominant shrub species was *Sophora tomentosa,* which has been reported in only three locations in American Samoa. A small but healthy population of more than 75 individuals with 22 adults, six juveniles, and 50 seedlings (Figure 8) was recorded within the plots (Figure 9). While only two plants with dbh ≥ 5 cm were inventoried, numerous mature plants, juveniles, and seedlings were found in 10 plots with the greatest concentration in plot 7 at 2+90 to 3+00 coordinates. Several large adult plants had been drastically cut back but were regenerating. Most of the undamaged adult plants were flowering and/or producing seeds.

Figure 8. *Sophora tomentosa*

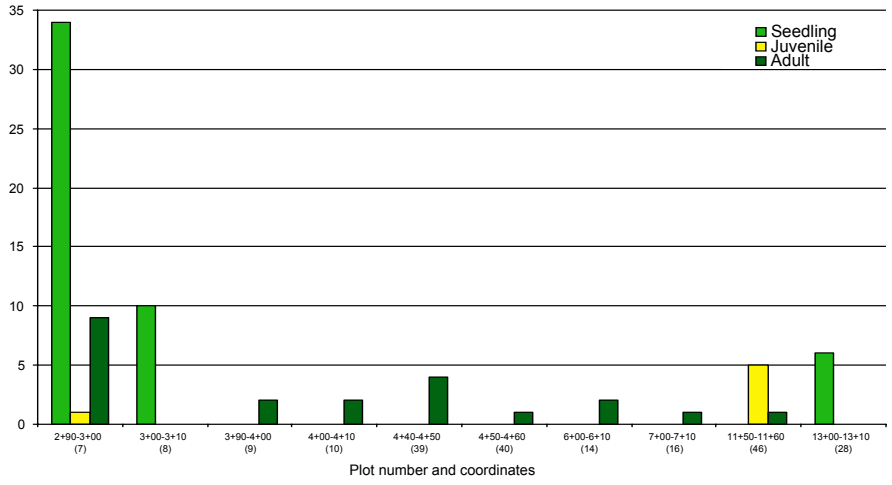

Figure 9. Distribution of *Sophora tomentosa* at Toaga, Ofu.

We recorded 65 species (of the total 107 species recorded in the Park) in the 800m^2 study area comprised of 40, 10m x 2m plots between 20+40 and 30+10 coordinates. In this section of the Park 109 trees of 11 species (Table 2) were counted and measured. Eight (73%) of these are native species. Three species (*Hernandia nymphaeifolia, Barringtonia asiatica,* and *Thespesia populnea*) dominated the coastal strand comprising 86 percent of the trees inventoried in the plots. *Hibiscus tiliaceus* was recorded in 25 of the plots and formed dense thickets throughout the area. There were five trees of *Erythrina variegata,* an important nectar source for the native **iao** or wattled honeyeater (*Foulehaio carunculata*), in this section of the strand. The only specimen of *Terminalia catappa* observed in the Park was located at 29+40 to 29+50 coordinates.

Table 2. The number of species and individuals inventoried and measured in 40, 10m x 2m study plots at Toaga, Ofu, between 20+40 and 30+10 coordinates, and relative density (Rd), relative dominance (RD), and total basal area for each species.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Artocarpus altilis (P)	2	1	1.83	0.23	293.2
Barringtonia asiatica (N)	33	13	30.28	17.39	21727.4
Cocos nucifera (N)	13	11	11.93	6.78	8467.7
Erythrina variegata (N)	5	3	4.59	0.74	928.4
Hernandia nymphaeifolia (N)	28	19	25.69	50.58	63198.5
Macaranga harveyana (N)	2	1	1.83	0.06	77.6
Morinda citrifolia (P)	5	5	4.59	0.31	387.4
Pisonia grandis (N)	2	2	1.83	4.00	4993.2
Terminalia catappa (N or P)	1	1	0.92	0.26	320.3
Thespesia populnea (N)	17	12	15.60	19.63	24530.6
Tournefortia argentea (N)	1	1	0.92	0.03	34.2
Total	109				124958.5

N = Native, P = Polynesian introduction, M = Modern introduction

LAND AND RESOURCE USE

Terminalia samoensis has been reported as an important source of food for flying foxes (Banack 1998) and the concentration of trees in the Park may be attracting the flying foxes that were observed in the area at dusk. Several trees that are growing adjacent to utility poles or under the power lines have been topping or severely pruned by ASPA. During discussions with Seufalemua Fa'asamala Puletasi, the head of public works, he indicated that he is aware of the important native trees, such as *Terminalia samoensis*, and tries to ensure that the work crews don't damage these. Since *Terminalia samoensis*

grows tall enough to interfere with the power lines, we recommend that NPSA ask ASPA to consider relocating the utility poles and lines to the other side of the road.

We interviewed three individuals about plants in the Park and their uses (see recorded interviews with Malaga Faga Lata Tau, Fa'agogo Mika Viliamu, and Seufalemua Fa'asamala Puletasi). We also extensively interviewed a member of one of the families that leases their property to the Park, Potasi Fagaese. Since his expertise is as a fisherman, these interviews focused on traditional fishing practices, and include footage of catching **atule** (big eye scad) at Ofu Village under his direction at a master fisherman (**tautai**) (see recorded interviews/activities).

Many of the plants along the Toaga coastline have uses for timber, firewood, medicine, etc. However, we did not observe or document current utilization of botanical resources in the Park, with the exception of occasional harvesting of leaves or green drinking nuts from coconut trees. Before the Park was created, people collected coral and sand from the beach and coconut leaves and nuts. This lack of use is due to several factors.

(1) The Park is comprised of land from only five families, and there appears to be little need for the Park resources, which consist primarily of native trees. These families cultivate and harvest breadfruit, bananas, coconuts, and taro on a limited basis from the agricultural area on the mountain side of the road that is not part of the Park.
(2) The landowners do not encourage other residents of Ofu and Olosega to harvest plants in the Toaga area.
(3) The plants that the villagers cultivate or harvest are obtained from their own property that is more conveniently located in or near the villages of Ofu and Olosega.

During conversations with villagers in Olosega and Ofu villages, several people expressed confusion about the Park and its purpose, and were not sure what activities were allowed, or not allowed. They believed that the Park was off-limits to everyone and that nothing could be harvested or gathered. The principal and some of the school teachers at the elementary school expressed their interest in knowing more about the Park. They suggested that informational materials, in English and Samoa, with photographs about the Park resources (marine life and plants) and their uses, would be very helpful to their students.

II. ALEI PLATEAU, OLOSEGA ISLAND

OVERVIEW

Portions of Olosega Island have been proposed for inclusion in the National Park of American Samoa, including the Alei Plateau and Ridge. The Samoans have used the forest resources on the upland plateaus for centuries. A preliminary survey of archaeological and cultural sites revealed star mounds, terraces, ditches, house platforms, a grave site, and numerous artifacts such as stone adzes and grinding stones (NPSA 1999). This area was known as Sili uta (Sili on the mountain) and it is believed that after the arrival of missionaries in the 19th century, the villagers moved to Sili tai (Sili by the sea), but continued to cultivate coconuts, taro, bananas, breadfruit, and other crops on the mountain.

Until the 1960s, copra was the main source of cash income for the Manuan islanders and coconut groves were widely planted. Remnant groves are evident on aerial photographs by their geometric planting patterns (Cole et al. 1988). As recently as 1981 the most of the plateau area was open and cultivated with taro, bananas, yams, coconuts, cassava, and even head cabbage, all of which thrived in the rich soil. There were 24 families in Sili village, and each family had their own plantation area and kept it tended and cleared.

Previous surveys of Olosega were done in five locations. The littoral scrub vegetation along the trail on the steep west-facing slope of Maga Point was surveyed in 25, 2m x 2m quadrats 10-20 m apart at 50-125 m elevation (Amerson et al. 1982). These authors also conducted a survey in montane forest along the trail up Mataala Ridge at 350 m elevation and estimated the dbh of 100 trees. The forest was dominated by *Syzygium samoense, Elaeocarpus tonganaus,* and *Trichospermum richii.* The cloud forest south of the summit of Piumafua Mountain was surveyed, and dbh was estimated for 71 trees along the trail at 530 m elevation. *Astronidium pickeringii, Fagraea berteroana,* and *Syzygium samoense* were the dominant species.

The coastal forest along the trail from Sili Village up to the beginning of plateau plantation land between 20-100 m elevation was surveyed as well. No plot was established and dbh was estimated for 100 randomly selected trees. The forest was dominated by *Barringtonia asiatica, Syzygium clusiifolium,* and *Diospyros samoensis.* More recently, a preliminary survey along Mataala Ridge above Olosega Village counted the plants in four 50m x 2m transects between 120 m and 600 m elevation (NPSA 1999).

ALEI PLATEAU METHODS

The study area is located on the Alei Plateau which is reached by passing through the village of Sili to Leaumasili Point, 2.4 km from the bridge at Asaga Strait. The trailhead near the point is overgrown with *Melanthera biflora* (formerly *Wollastonia biflora*) but quickly opens up and follows the coastline through the littoral forest. The trail is coral rubble through this section and begins to climb up the NNE slope of the ridge through the lowland forest in a series of switchbacks. There are two traditional resting places on the trail, **Fatu loa**, where the rock face is first exposed, and **Tumu**, where the trail is surrounded by large boulders. At 160 m (GPS 14º09.465S 169º36.692W) the trail reaches a formerly cultivated area with remnant *Cocos nucifera, Artocarpus altilis, Mangifera indica,* and *Pandanus tectorius* var*. laevis.* This area is directly above Nuututai Rock. The trail is not readily evident beyond this area and requires a guide. At this point the trail heads east and downhill to Tafalau on the coast, or southwest along Alei Ridge towards Mt. Piumafua.

Ten 100m x 2m plots for a total area of 0.2 ha (2000m^2) were established between 190 m and 340 m elevation along the Alei Ridge trail. The transects were laid 32 m apart and perpendicular to the trail following the contours of the slope in an easterly direction. Two 2m x 2m subplots were randomly selected and established within each plot. Information about the study plots is provided in Appendix C.

GENERAL SITE AND VEGETATION DESCRIPTION

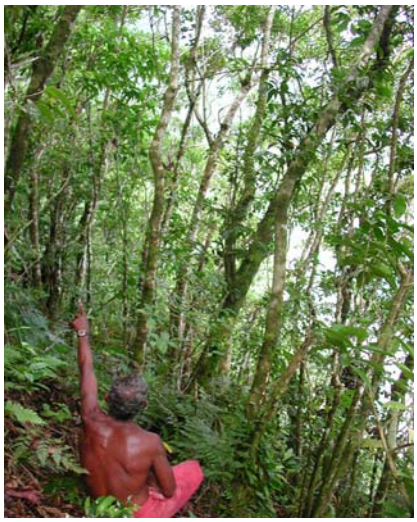

Figure 10. Regenerating native

The vegetation on the Alei Plateau is primarily secondary forest (Figure 10). The extensive agricultural use on the plateau for centuries, and the hurricanes in the early 1980s and 1990s have seriously damaged or destroyed the primary mixed lowland forest that formerly covered the island. A few large specimens of mature *Syzgium dealatum, S. clusiifolium, Calophyllum neo-ebudicum, Glochidion ramiflorum, Rhus taitensis, Planchonella garberi*, and *Tarenna sambucina* are scattered through the forest. These are important components of the secondary forest along with *Alphitonia zizyphoides, Syzygium inophylloides, Myristica inutilis* ssp*. inutilis, Diospyros samoensis, D. elliptica, Xylosma samoense, Elattostachys falcata, Geniostoma rupestre, Dysoxylum samoense,* and *Sterculia fanaiho*.

The understory consists of small trees of the above species, as well as *Ficus scabra, Morinda citrifolia, Bischofia javanica,* and *Premna serratifolia,* and shrubs of *Ixora*

samoensis and *Psychotria insularum.* Numerous vines and woody climbers occur, including *Alyxia bracteolosa, A. stellata, Dioscorea bulbifera, Hoya australis, Ipomoea macrantha, Jasminum didymum, Embelia vaupelii, Faradaya amicorum, Gynochthodes epiphytica, Piper graeffii,* and *Rourea minor*. The groundcover includes seedlings and juveniles of the tree species and ferns, including *Asplenium nidus, Davallia solida, Christella harveyi, Humata heterophylla, Nephrolepis biserrata, Phymatosorus grossus, Antrophyum plantagineum, Schizaea dichotoma,* and *S. robusta,* are the most common herbaceous plants.

In areas that were once cultivated, *Cocos nucifera, Artocarpus altilis,* especially **puou fatu**, a seeded form, *Mangifera indica, Inocarpus fagifer, Pandanus tectorius, Cordyline fruticosa, Zingiber zerumbet,* and an occasional stand of *Euodia hortensis* are found. These are typically found at the lower elevations of the plateau. *Hibiscus tiliaceus* is prevalent throughout the plateau and forms dense thickets in many places.

ALEI PLATEAU INVENTORY RESULTS

A total of 84 species were recorded during our survey and a complete list of species is provided in Appendix A. We counted and measured 496 trees of 30 species (Table 4) in the ten 100m x 2m plots. The majority (73%) of trees are native species (Table 3), and no one species dominated. Four native species [*Alphitonia zizyphoides* (7.3%), *Syzygium dealatum* (7.2%), *Calophyllum neo-ebudicum* (6.9%), and *Rhus taitensis* (5.6%)] comprised 27 percent of the total trees surveyed. *Inocarpus fagifer* (16.7%) and *Hibiscus tiliaceus* (13%) were the most dominant species in the study area.

Table 3. Native vs. cultivated/introduced species in plots at Alei Plateau, Olosega.

	Species	Individuals	Total basal area
Native	24	432	66416.4
Cultivated/introduced	6	64	30720.5
Total	30	496	97136.9

The largest native trees were *Syzygium dealatum* (82 cm), *S. clusiifolium* (52 cm), *Calophyllum neo-ebudicum* (78 cm), and three *Glochidion ramiflorum* (60 cm, 53 cm, 53 cm). The majority (294) of native trees were in the smallest size classes of 5 cm to 20 cm indicating the relatively young age of the secondary forest, because most of the trees have regenerated in the past decade since the hurricanes in 1990 and 1991 and the cessation of agricultural use over the past 20 years.

Table 4. The number of species and individuals inventoried and measured in 10, 100m x 2m study plots at the Alei Plateau, Olosega, and relative density (Rd), relative dominance (RD), and total basal area for each species.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Aglaia samoensis (N)	1	1	0.20	0.03	28.3
Alphitonia zizyphoides (N)	44	9	8.87	7.29	7079.7
Artocarpus altilis (P)	13	5	2.62	1.38	1338.0
Barringtonia asiatica (N)	6	2	1.21	2.26	2194.0
Bischofia javanica (N or P)	8	5	1.61	1.38	1338.0
Calophyllum neo-ebudicum (N)	10	4	2.02	6.85	6652.7
Cocos nucifera (N)	13	5	2.62	7.24	7035.2
Diospyros elliptica (N)	10	4	2.02	0.55	538.5
Diospyros samoensis (N)	22	6	4.44	1.41	1365.1
Dysoxylum samoense (N)	15	5	3.02	2.94	2852.8
Elattostachys falcata (N)	15	5	3.02	1.09	1061.0
Ficus scabra (N)	9	4	1.81	0.62	602.4
Flacourtia rukam (N)	23	7	4.64	1.26	1227.4
Garcinia myrticifolia (N)	1	1	0.20	0.02	19.6
Garuga floribunda (N)	5	4	1.01	0.92	897.5
Geniostoma rupestre (N)	12	5	2.42	0.74	719.8
Glochidion ramiflorum (N)	32	8	6.45	4.86	4719.2
Hibiscus tiliaceus (N)	80	9	16.13	13.01	12635.5
Inocarpus fagifer (P)	21	5	4.23	16.65	16172.0
Mangifera indica (M)	5	2	1.01	5.79	5622.8
Morinda citrifolia (P)	11	6	2.22	0.39	380.1
Myristica fatua (N)	24	8	4.84	2.96	2871.1
Planchonella garberi (N)	24	5	4.84	2.43	2362.9
Rhus taitensis (N)	21	7	4.23	5.60	5437.5
Sterculia fanaiho (N)	8	5	1.61	0.90	878.2
Syzygium clusiifolium (N)	4	2	0.81	1.50	1456.9
Syzygium dealatum (N)	34	7	6.85	7.19	6982.0
Syzygium inophylloides (N)	7	2	1.41	1.12	1085.7
Syzygium samarangense (M)	1	1	0.20	0.18	172.4
Tarenna sambucina (N)	17	5	3.43	1.45	1410.6
Total	496				97136.9

N = Native, P = Polynesian introduction, M = Modern introduction

The main cultivated and/or introduced species (*Inocarpus fagifer, Artocarpus altilis, Cocos nucifera, Morinda citrifolia,* and *Mangifera indica*) were clustered in the first

five plots (Figure 11). Only two trees were found in the plots at higher elevation, a single tree each of *Morinda citrifolia* (plot 7) and *Inocarpus* (plot 12). We saw little evidence of regeneration of these species with the exception of seedlings of *Inocarpus* in Plots 2 and 5 and *Morinda* in plots 2 and 3. The largest tree measured during our survey was an impressive *Inocarpus fagifer* in Plot 5 with a fluted trunk that was more than a meter wide above the buttress. Two mangoes had large trunks, 92 cm and 64 cm, respectively.

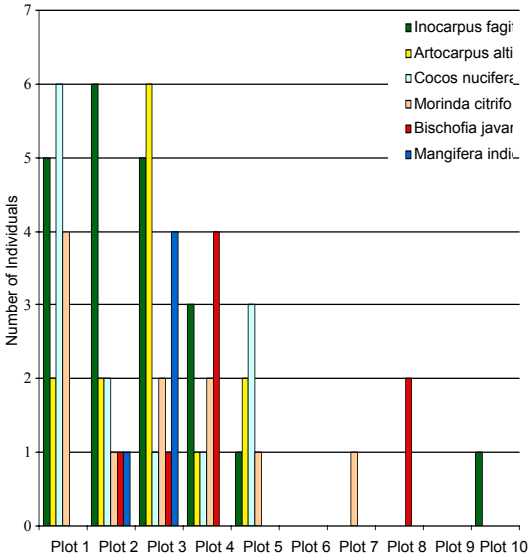

Figure 11. Distribution of five cultivated abundant and/or introduced species. in study plots on Alei Plateau.

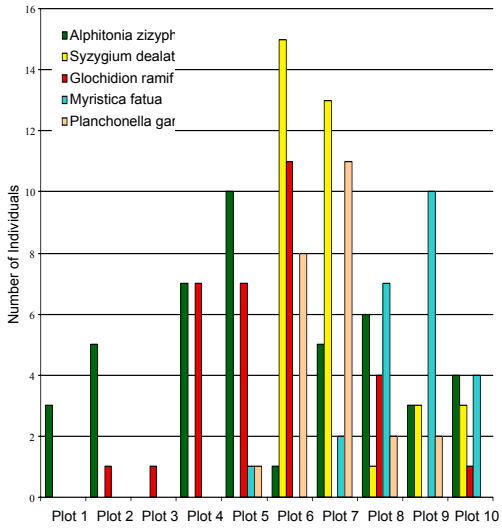

Figure 12. Distribution of five most common native tree species in study plots on Alei Plateau.

While not located within the plots, we noted the presence of several species that provide evidence that this area was once more widely used and cultivated. These include the smooth-leaved *Pandanus tectorius* var. *laevis*, the leaves of which are used to weave mats, and *Euodia hortensis*, which was often planted around or near home sites to ward off **aitu** (ancestral spirits or ghosts).

In comparison to the distribution of cultivated/introduced species, the most common native tree species were clustered in the upper plots (Figure 12), with only 10 individuals of two species (*Alphitonia zizyphoides* and *Glochidion ramiflorum*) found in the three lowest plots.

In addition to the trees that were inventoried, 489 plants of 52 species were counted in the 20 random 2m x 2m plots (Appendix A). Of these, 207 seedlings and saplings representing 23 native tree species were inventoried in the plots, including the first five plots where there was the greatest concentration of cultivated and introduced species. Two species, *Diospyros samoensis* and *Elatostachys falcata*, account for 58 percent of

the regeneration of the secondary forest with 67 and 52 individuals respectively. *Diospyros* was found in nine plots, with 22 plants concentrated in plot 5 at 270 m, and *Elattostachys* was found in five plots with 25 plants concentrated in plot 2.

LAND AND RESOURCE USE

In the past, native forest trees on the Alei Plateau were felled to make clearings for plantations. Taro and bananas were planted first because they produce harvestable crops in the shortest time, approximately six months for taro. Cassava (*Manihot esculenta*) also produces a fast crop, whereas bananas provide fruit year round. Tree crops such as breadfruit take longer to produce, but provide a long-term, albeit seasonal, supply of food. In addition to the staple crops, citrus, mangoes, and *Inocarpus fagifer* were planted. Breadfruit is a favorite food for flying foxes and they have helped distribute seeded breadfruit and mango trees. Smooth-leaved pandanus, **laufala**, was planted to weave mats. *Erythrina variegata* was often planted in the taro plantations because it is fast growing and would shade out weeds. *Hibiscus tiliaceus* provided poles and cordage for trellises for yam vines.

Coconuts supplied drinking water and coconut cream, the mature nuts were harvested for copra, and leaves provided shelter and were woven into baskets to carry produce down the mountain. The coconuts are gradually disappearing as the native forest regenerates. Although numerous sprouting coconuts are found beneath mature trees, few young trees are seen because coconuts do not like being shaded out by other trees, and regenerate only if the area around them is cleared.

Farmers hiked up to the plateau from the village in the morning to work their fields and harvest taro, bananas, and coconuts and other produce which were carried in baskets down the trail to the village. Farmers occasionally spent one or several nights on the mountain and built shelters thatched with coconut or banana leaves. Pigs were kept in rock enclosures and after the 1981 hurricane escaped and became feral. They now come down to Sili village, especially during dry periods when there is little food on the mountain, and dig up taro and other root crops. We saw minor evidence of pig damage during our surveys of the plateau area.

Forest resources were extracted in areas that were too steep to cultivate. Timber trees, mostly *Syzygium spp*. (**asi**) growing along the ridge above Sili Village were cut down and rolled down the sheer cliffs to the village below. Removal of the trees along the steep ridge often precipitated land and rock slides. **Asi** is a desirable timber for making traditional Samoa houses, and is now more abundant on the mountain because it is no longer harvested for this purpose. It is easy to cut, but hard and durable when dry. Along the ridge trail are many *Syzygium* trees with small diameter trunks, often multiple, surrounding the stump of a large central trunk that was cut down. The fruits of *Syzygium* are a source of food for flying foxes, doves, and other birds, and *Dysoxylum samoense* is thought to be the flying foxes' favorite food in the forest.

Flying foxes were once hunted by making a snare from *Caesalpinia major*, **anaoso**, a scrambling shrub with sharp, recurved thorns. The small leaflets were stripped from branches and petioles which were formed into a circle and attached to a handle of *Hibiscus tiliaceus* or bamboo (Figure 13)**.** The thorns would hook the bat's wings. The former practice of using **anaoso** to make bat snares was also verified on Ta'u.

Figure 13. Traditional bat

The Alei Plateau has not been in agricultural use for two decades for several reasons. Storm surge from a hurricane in 1981 destroyed most of Sili Village and the residents moved to Ofu or Olosega Villages or off island. The government road—a narrow, rough access road—from Sili Village around Leaumasili Point where it terminated, was damaged along the coast, and the steeper sections became impassable because of tree falls and rock slides. The road fell into disuse and because of lack of maintenance it was no longer passable, making it more difficult to reach the plateau. The hurricanes in 1990 and 1991 caused so much damage to the forest that access became even harder, and there are now so many feral pigs on the mountain they would destroy any taro plantings. Finally, only one family presently lives in the village of Sili.

Consequently, there is no longer a need to utilize the land on the mountain for agricultural purposes. Use of the forest has decreased to only the occasional harvesting of forest products for medicine, fiber, or wood by the sole family still resident in the village. The preponderance of regenerating native tree species along the Alei Plateau ensures that the area will gradually revert to primary forest, if undisturbed by hurricanes. Human activity is no longer impacting the forest.

While we did not establish plots on Mataala Ridge and Plateau, we did conduct a preliminary survey. The ridge trail commences at Maga Point where there is primarily *Vigna marina* and *Melanthera biflora* growing on the coral rubble. The trail reaches a relatively flat area 0.8 km from the trailhead where an abandoned water tank is located, surrounded by an abandoned agroforest area (GPS 14º11.366S 169º36.800W, 120 m elevation). There are scattered coconut and breadfruit trees, mainly **ma'afala**, *Zingiber zerumbet,* and *Cordyline fruticosa* around the tank. No bananas were seen. *Rhus taitensis, Tarenna sambucina, Hibiscus tiliaceus, Fagraea berteroana,* and *Flacourtia rukam* were also seen in the area. *Vigna marina* covered many of the plants in this area

Continuing along the ridge trail the vegetation changes from somewhat open with closed canopy to a dense canopy composed mainly of mango trees, with *Psidium guajava*, and *Inocarpus fagifer*. A large patch of *Euodia hortensis* was seen nearby. The trail to 420 m elevation goes through a diverse ridge forest with some large trees,

especially *Rhus taitensis*. Native trees included *Planchonella garberi, Diospyros samoensis, Alphitonia zizyphoides,* and *Syzygium dealatum*. The largest tree observed was a *Canarium sp.*, with a meter wide trunk. Numerous tree ferns grow on the sheer cliffs below the trail. Understory woody plants included *Alyxia bractiolosa, Ixora samoensis,* and *Psychotria insularum*. Very few weeds were observed with the exception of a large, tangled patch of *Derris malaccensis* and scattered plants of *Clidemia hirta* along and near the trail. This species could easily be eradicated while there are still few individuals.

The areas of Olosega Island proposed for inclusion in the National Park of American Samoa would protect significant natural and cultural resources. One of these resources, the mayor (**Pule Nu'u**), Malaga Faga Lata Tau, would be an excellent liaison with the Park to provide cultural and site knowledge to Park personnel and visitors. He has extensive information about the history and legends of the area, as well as an intimate knowledge about natural resources and cultural practices (see recorded interviews). He would be able to help identify appropriate locations for trails, so that a trail system could be created from Sili Village to the Alei Plateau connecting to the Olosega Plateau, the Mataala Ridge trail up to the summit area and down to Maga Point and Olosega Village. The history and use of the area, agroforestry systems, cultural sites, native forest, and natural resources could all be interpreted for residents and visitors to the Park.

III. Olosega Village Agroforest, Olosega Island

Overview

There are 40 households in Olosega village; 35 of these are on the mountain side of the road, five are on the coast. Six houses are no longer occupied and the residents have moved off island. There are three sections in the village. Most of the households in the Vaiapi and Satui sections have parallel strips of land that run from the seashore to the mountain, Mataala Ridge. These parcels include the coastal flat where the houses and backyard gardens are located, a natural wetland, the gradually sloping lower section of the mountainside, and the steep hillside (Figure 14). Most of the households in the Pouono section of the village have little flat land, and the area behind their homes quickly becomes steep.

Figure 14. Olosega Village

Taro is grown in the wetland, but extensive sections are not being used and are overgrown with *Ludwigia octovalvis*. The well-managed patches of taro are mulched

with coconut fronds, banana leaves, and banana stems. The area between the wetland and the steep slopes at the base of Mataala Ridge is used to cultivate crops, fruit trees, and other useful plants.

OLOSEGA AGROFOREST METHODS

The study area was located in the agroforest area behind the village. There is a foot path behind the houses along the edge of the wetland that turns inland at the south end of the taro plantings. The path parallels the wetland in a northwesterly direction through the lower section of the hillside. Five 100m x 2m plots for a total area of 0.1 ha (1000m^2) were established between 2 m and 12 m elevation, and two 2m x 2m subplots were randomly established within each plot. The transects were laid 10 m apart and parallel to the village in a northwesterly direction. The starting point (GPS 14º10.687S 169º37.333W) of the first transect was approximately 100 m beyond where the path entered the agroforest area, and 10 m past a small field of pineapples. Information about the study plots is provided in Appendix D.

GENERAL SITE AND VEGETATION DESCRIPTION

A narrow strip of land inland and adjacent to the wetland is relatively flat, but the terrain soon steepens to a slope of 20º to 45º or greater before becoming almost vertical. The steeper, rocky hillsides are devoted primarily to bananas and breadfruit, while taro and other roots crops, sugarcane, pineapples, and fruit trees are cultivated on the lower slopes.
Mature trees of native forest species, especially *Dysoxylum samoense, Diospyros samoensis, Sterculia fanaihio,* and *Tarenna sambucina*, are found on the upper slopes that are too steep to cultivate. Smaller specimens of these trees, and *Ficus scabra, Macaranga harveyana, Guettarda speciosa, Erythrina variegata, Omalanthus nutans,* and *Pipturus argenteus,* occur throughout the hillside.

As is typical for cultivated lands, introduced and weedy species thrive in disturbed, sunny areas. These include *Abelmochus moschatus, Ageratum conyzoides, Centella asiatica, Centotheca lappacea, Clidemia hirta, Cyperus cyperinus, Oplismenus compositus, Ruellia prostrata, Stenotaphrum micranthum,* and *Synedrella nodiflora. Mikania micrantha* is the predominant vine, especially in cleared areas where taro and bananas have been planted. Other vines include *Dioscorea bulbifera, Mucuna gigantea,* and *Vigna marina* in sunny areas, and *Derris malaccensis,* and *Epipremnum pinnatum* in shady places. *Freycinetia sp.* is occasionally found. The predominant ferns are *Asplenium nidus, Christella harveyi, Nephrolepis hirsutula,* and *Phymatosorus grossus. Clerodendrum buchananii* var. *fallax*, an attractive flowering shrub with an inflorescence that resembles a Samoan **fale**, is planted around many of the houses in the village and is naturalizing in the agroforest area.

OLOSEGA VILLAGE AGROFOREST INVENTORY RESULTS

A total of 62 species were recorded during our surveys and a complete list of species is provided in Appendix A. Most of these (42) are cultivated species such as breadfruit, bananas, citrus, *Theobroma cacao,* taro, cassava, *Ceiba petandra,* and ornamentals such as *Alpinia atropurpurea* and *Cananga odorata*, or introduced vines, herbaceous plants, and shrubs that have become weedy, including *Mikania micrantha, Ruellia prostrata, Ageratum conyzoides,* and *Clidemia hirta*.

We counted and measured 35 trees of eight species (Table 5) in the five 100m x 2m plots. Five (63%) of these are introduced, cultivated species. Also counted within the plots were 333 banana stems and 32 breadfruit trees that were ≤ 5 cm dbh (Figure 15, 16), but these were not included in the data analyses. Breadfruit was the dominant species comprising 75% of all the trees in the plots. The majority of the trees were the cultivar **Ma'afala** (17 trees), with **'Ulu manu'a** (3 trees), **Fefelo** (1 tree), and three unidentified trees also inventoried.

Table 5. The number of species and individuals inventoried and measured in 5, 100m x 2m study plots near Olosega Village, Olosega, and relative density (Rd), relative dominance (RD), and total basal area for each species.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Artocarpus altilis (P)	24	5	68.57	74.72	14781.6
Citrus aurantifolia (M)	1	1	2.86	0.50	98.5
Citrus sinensis (M)	2	1	5.71	1.35	266.1
Cocos nucifera (N)	3	2	8.57	8.96	1772.6
Dysoxylum samoense (N)	1	1	2.86	0.17	34.2
Hibiscus tiliaceus (N)	1	1	2.86	11.83	2339.7
Macaranga harveyana (N)	2	1	5.71	1.43	282.4
Omalanthus nutans (N)	1	1	2.86	1.05	208.6
Total	35				19783.6

N = Native, P = Polynesian introduction, M = Modern introduction

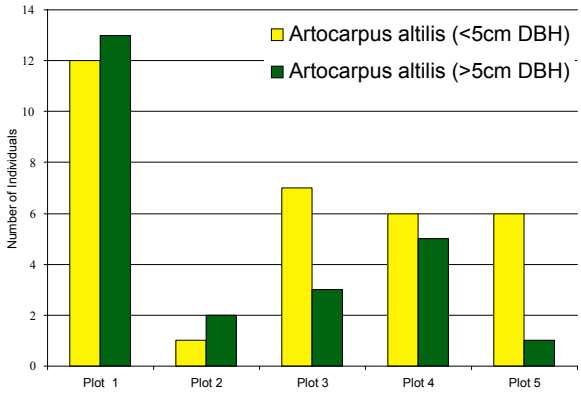

Figure 15. Distribution of breadfruit in the Olosega Village agroforest.

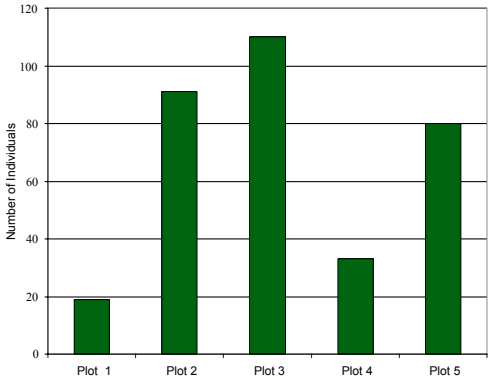

Figure 16. Distribution of bananas in the Olosega Village agroforest.

In addition to the trees that were inventoried, 78 saplings and small trees (< 5 cm dbh), shrubs, vines, seedlings, and/or herbaceous plants of 25 species were counted in the 10 random 2m x 2m plots (Appendix A). These were equally divided between native and non-native species, as is to be expected in an area under varying degrees of cultivation. Seedlings and juvenile trees of native species were primarily recorded in areas that have not been recently managed by the landowner by cutting down the vines and understory vegetation.

Macrothelypteris torresiana, previously reported for the islands of Ofu, Tutuila, and Ta'u (Whistler 1998), was documented in the agroforest area; it is a new island record.

LAND AND RESOURCE USE

Management practices in the agroforest area vary depending upon the needs of the landowner. Families that primarily depend upon subsistence agriculture tend to more intensively cultivate and manage their land. In many households the adults in their 30s to 50s are working in the wage economy on Tutuila, providing a home for their high-school-attending children, or caring for elderly parents in their 60s to 80s who have moved to Pago Pago for medical care and long-term convalescence. Since these households rely on earned income and family remittances rather than subsistence agriculture, their land is mostly in a fallow state (Figure 17), and in some areas is overgrown with introduced, weedy species and regenerating forest species. In 2001, only five households were reported to be actively and extensively using their land in the agroforest area.

Figure 17. Fallow agricultural area.

Breadfruit, bananas, and coconuts occurred throughout the entire area. Taro is found primarily in actively managed areas, often interplanted with bananas. After the taro is harvested, the land is left fallow for at least six months and quickly becomes covered with *Mikania*. The bananas are kept cleared of vines and the fruits harvested as needed. The *Mikania* provides cover, and when cut, mulch and nutrients for the next crop of taro. Cassava and *Alocasia macrorrhiza* tend to be found in unmanaged, overgrown plots. Pineapples and sugarcane are grown in one area near the south end of the wetland taro. The greatest concentration of cultivated and ornamental plants (citrus, mango, *Theobroma cacao, Ceiba pentandra,* which was formerly used to stuff pillows and bedding, *Cananga odorata,* used for flower garlands and perfume, and *Polyscias guilfoylei,* typically used for hedges), are all located near the north end of the village. These were all large and mature trees that had been planted many years ago.

Hibiscus tiliaceus, while not cultivated, is common and is harvested for poles, firewood, and cordage. *Macaranga harveyana* is a preferred tree for firewood because it burns fast and is also harvested from the area. The leaves of a banana relative, *Heliconia laufao*, are stripped for a stringy fiber that is used to strain coconut cream.

The resident population of Olosega village is declining, with only 216 people recorded for the entire island in the 2000 census (the total also includes Sili village). Only five families were reported to be actively farming and managing their hillside plantations, but most households still use the area to some degree, whether by harvesting already established plants, such as breadfruit or coconut, or by planting small crops of taro and bananas. Large sections of the hillside will revert to secondary forest as long as there is minimal pressure to use it to produce food. Since so little land is available for agricultural production on Olosega, this area will always remain important for that purpose. Changing population dynamics or using the land to grow crops for export to markets on Tutuila could intensify land use.

IV. SAUA, TA'U ISLAND

OVERVIEW

The Ta'u unit of the Park encompasses the southeastern portion of the island, including the sacred site of Saua, considered by many to be the birthplace of Polynesia. This area has been settled for close to 3,000 years and the numerous archaeological sites and features, such as wells, walls, and house platforms, at Saua attest to its long history of habitation and use.

The coastal area contains typical littoral forest as well as a unique vegetation community defined as a *Dysoxylum* lowland forest. It is considered to be the best remaining example of this type of forest in American Samoa (Whistler 1992, NPSA 1997). The forest is dominated by *Dysoxylum samoense* and contains some huge trees

(Figure 18), most of which are over a meter in diameter. It has been extensively altered due to its long period of habitation and disturbance from hurricanes in 1987, 1990, and 1991.

Figure 18. *Dysoxylum samoense* at Saua.

Consequently, species typical of disturbed lowland forests occur throughout the area. Whistler (1995) saw considerable evidence of subsistence agriculture plots in the old-growth forest during a visit in 1994. He expressed concern that continued cutting of trees could permanently jeopardize the forest, and recommended that the villagers of Fitiuta discontinue this practice and establish their agricultural plots elsewhere (NPSA 1997).

Sections of the forest at Saua have been previously surveyed. Five contiguous 10m x 10m plots (500m^2) were established in the "*Barringtonia* littoral forest" (Plot 9) and 10 contiguous 10m x 10m plots (1000m^2) were established in the "*Dysoxylum* lowland forest" (Plot 19) in 1976 (Amerson et al. 1982, Whistler 1980). A checklist was made of all species found in the plots, trees with dbh ≥ 2.5 cm were measured, and the percent cover, density, and/or frequency were determined for saplings, ground cover, and vines and climbers in the plots. Plot 9 contained 49 trees of six species and was dominated by *Barringtonia asiatica* (55%), and Plot 19 contained 88 trees of 11 species and was dominated by *Dysoxylum samoense* (86%).

The area was revisited during a botanical survey of Ta'u in late December 1990 and early January 1991, but because of recent hurricane damage, no plots were quantitatively sampled (Whistler 1992). Subsequently, a 50m x 20m (1000m^2) permanent plot was established in the Saua "*Dysoxylum* dryland forest". The same methodology as above was used except that trees with dbh ≥ 5 cm were measured and their diameters recorded. Trees with dbh ≥ 15 cm were marked with a numbered aluminum tag. A total of 97 trees of 13 species were inventoried in the plots and, as expected, *Dysoxylum* (89%) was dominant.

SAUA METHODS

A continuous plot 2,750 long x 2 m wide for a total area of 0.55 ha (5500m^2) was established. It was comprised of 11, 250m x 2m contiguous plots. A 2m x 2m subplot was randomly established within each 50 m section of the plot, for a total of 55 subplots. The plot was parallel to the road, and was placed at the approximate midpoint of the vegetation between the road and the cliff base. The starting point (GPS 14°14.012S 169°25.295W) was located 130 m past the stream that marks the northern

boundary of the Park (the Park sign is located about 350 m within the Park boundary). The plot headed south towards Tufu Point where it terminated at the wetland (GPS 14°15.403S 169°25.529W). Twelve lateral plots 40m x 2m heading 20 m east and 20 m west from the main north-south plot were established at 250 m intervals for a total area of 0.096 ha (960m^2). Information about the study plots is provided in Appendix E.

The main plot traversed the permanent forest plot established in 1993 (Whistler 1995). We were unable to locate these plots or any tagged trees, perhaps because the tags had fallen or become overgrown and were no longer visible.

General Site and Vegetation Description

The composition and structure of the littoral forest varies along this 3 km stretch of coastline. Within the Park, the coastline is predominantly a narrow coral rubble beach with a few herbaceous strand plants such as *Ipomoea pes-caprae* and *Vigna marina*. The vegetation along the shore is composed of shrubs such as *Scaevola taccada, Melanthera biflora, Pandanus tectorius* var. *tectorius, Tournefortia argentea*, and trees of *Barringtonia asiatica, Guettarda speciosa, Pisonia grandis,* and *Hibiscus tiliaceus,* the latter which forms dense thickets and arches over the coastal road in several sections of the Park.

The area is generally flat with a substrate of sand and mixed coral rubble that has washed in during high storm surges, and small basaltic boulders that have fallen from the adjacent slopes. The littoral forest has been extensively altered from centuries of habitation and cultivation in this area. A few remnants of disturbed primary forest are dominated by scattered, magnificent specimens of *Pisonia grandis* (Figure 19), *Hernandia nymphaeifolia,* and *Dysoxylum samoense*, with extensive secondary regeneration of *Dysoxylum, Pisonia spp., Diospyros samoensis, Ficus scabra,* and *Psychotria insularum*. The ground cover typically contains *Asplenium nidus, Piper graeffei, Epipremnum pinnatum,* and *Ipomoea macrantha*.

Figure 19. *Pisonia grandis* at Saua.

The site includes large areas of regenerating secondary forest containing scattered mature individuals of *Dysoxylum samoense, Sterculia fanaiho, Myristica fatua, Psychotria insularum, Hernandia nymphaeifolia, Barringtonia asiatica, Diospyros samoensis, Macaranga harveyana,* and *Pisonia grandis,* among other species. The understory consists of small trees of these species as well as *Ficus scabra* and *F. tinctoria, Pipturus argenteus, Pisonia umbellifera,* and *Morinda citrifolia.* Vines clambering over the rocks and climbing up trees include *Mucuna gigantea,*

Epipremnum pinnatum, Derris trifoliata, Piper graeffei, and *Hoya pottsii.* The ground cover includes seedlings and juveniles of overstory trees and the ferns *Tectaria stearnsii, Asplenium marattioides, Arthropteris repens, Phymatosorus grossus,* and is often dominated by the birdnest fern, *Asplenium nidu*s.

The zone of agricultural use decreases with distance from the village of Fitiuta. At the north end of the Park, there are a few small sections of formerly open, cultivated land with *Artocarpus altilis, Cocos nucifera, Musa x paradisiaca, Carica papaya, Colocasia esculenta, Alocasia macrorrhiza,* and *Manihot esculenta,* that are now often overgrown with vines of *Mikania micrantha*. The trees in formerly cultivated areas that are transitioning into secondary forest include *Morinda citrifolia, Hibiscus tiliaceus, Ficus scabra, Macaranga harveyana,* and *Dysoxylum samoense*. The ground cover in these areas typically includes *Ruellia prostrata, Zehneria sp., Oplismenus hirtellus, Asplenium nidus, Epipremnum pinnatum, Nephrolepis hirsutula, Zingiber zerumbet,* infrequent *Clidemia hirta,* and seedlings and juveniles of native forest species such as *Dysoxylum samoense* and *Barringtonia asiatica*.

Several sections of mature, old agroforest have a closed canopy dominated by *Artocarpus altilis* and *Cocos nucifera*, with an understory of *Dysoxylum samoense, Morinda citrifolia, Macaranga harveyana, Ficus scabra,* and *Barringtonia asiatica*. With the exception of the formerly cleared areas now overgrown with *Mikania*, we saw no evidence for recent clearing of land in the Park for agricultural purposes. Secondary forest in various stages of growth is regenerating throughout the Park, especially in areas that had been damaged during the hurricanes of 1990 and 1991 and in long-abandoned agricultural sites. The vegetation ranges from dense stands dominated by *Dysoxylum samoense* to stands of mixed species with *Dysoxylum, Sterculia fanaiho, Ficus scabra,* and *Diospyros samoensis.*

The southern portion of the transect near the wetland comprises young secondary forest, dominated by *Macaranga harveyana* with a few *Pisonia grandis, Morinda citrifolia,* and *Dysoxylum samoense* trees, many of which are shrouded in *Mucuna gigantea* and *Ipomoea macrantha* vines. The ground cover in this area includes fallen, sprouting *Pisonia* trunks and branches, *Asplenium nidus, Epipremnum pinnatum, Derris trifoliata, Phymatosorus grossus*, and numerous seedlings of *Dysoxylum* in places where the vines do not predominate.

The wetland area was dry when we visited and is dominated by the large fern, *Acrostichum aureum*, many of which were dead. Whistler (1992) reported that the wetland was being used to grow taro in the early 1990s. We saw no evidence of taro plantings during our visit, and we were informed that this was no longer the practice since the establishment of the Park. The area is gradually becoming overgrown by *Macaranga harveyana* and *Morinda citrifolia.*

ARCHAEOLOGICAL SITES

One of the most significant archaeological features of the Park is adjacent to the road near the midpoint of the transect (1250m). There is a large rectangular paved courtyard (Figure 20) leading to an inner sunken courtyard surrounding a circular chief's well. The site is seriously impacted and being damaged by several large trees—one *Barringtonia asiatica* (Figure 21) has a diameter of 77.6 cm—that have become established on the site and are uplifting and displacing the stones. Scores of *Barringtonia* seedlings up to one meter tall cover the site, and there are several saplings up to 4m tall of *Barringtonia, Morinda citrifolia,* and *Pisonia grandis*. Around the perimeter of the well are eight large

Figure 20. Paved courtyard.

Figure 21. Vegetation growing on chief"s well

birdnest ferns, *Asplenium nidus*, each more than a meter in diameter. The walkway to the inner courtyard is in good condition with the rocks intact and covered with moss. There are some vines of *Ipomoea macrantha* and *Epipremnum pinnatum* growing on the site.

Vegetation removal is critical to preserving the integrity of this important cultural site. We recommend that all of the trees and saplings be cut down and painted with a herbicide to kill them. The vines, ferns, and seedlings need to be carefully removed to prevent the displacement of rocks attached to the root systems. The site should be regularly inspected and all new seedlings removed before they become established.

Several stone artifacts were discovered during our inventory (Figure 22). We found a rounded basaltic rock, approximately 15 cm in diameter, with a handle, lying on the ground beneath a *Hibiscus tiliaceus* thicket along the Park road. Three stone adzes were found in a streambed approximately 10 m on the mountain side of the road.

We surmise that they washed down from a site further inland during heavy rains in March 2002 that caused all of the streams in the area to flood, and made the first major stream crossing beyond Fiti uta impassable to vehicles. The adzes were lying on the surface of the ground, in a slight circular depression in the streambed that prevented them from washing downstream and into the ocean. The adzes vary in size and quality. The largest is relatively rough-hewn, 27 cm long with a 6.5 cm wide cutting edge. The second adze is smoother; 19.2 cm long with a 4.2 cm cutting edge. The smallest, and finest, adze is 13 cm long with a 4 cm cutting edge. The artifacts were all delivered to the NPSA office in Pago Pago.

It is likely that other stone adzes may wash down this stream after heavy rains and be carried out to sea and lost. We recommend that Park personnel routinely check the streambed after periods of flooding to locate and recover any artifacts. The discovery of three stone adzes in such close proximity indicates that this drainage area would be a good candidate for archaeological excavation. Location information on where these artifacts were found is provided in a separate document to the National Park of American Samoa.

Figure 22. Stone artifacts found during Saua survey.

SAUA INVENTORY RESULTS

A total of 86 species were recorded during our surveys and a complete list is provided in Appendix A. We counted and measured 531 trees of 20 species (Table 6) in the 0.55 ha (5500m^2) study area comprised of 11, 250m x 2m plots.

Table 6. The number of species and individuals inventoried and measured in 11, 250m x 2m study plots at Saua, Ta'u, and relative density (Rd), relative dominance (RD), and total basal area for each species.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Artocarpus altilis (P)	23	5	4.33	4.70	9653.6
Barringtonia asiatica (N)	12	2	2.26	8.93	18365.4
Carica papaya (M)	11	2	2.07	0.42	855.6
Cocos nucifera (N)	12	7	2.26	4.49	9234.9
Diospyros samoensis (N)	57	6	10.73	3.64	7478.6
Dysoxylum samoense (N)	121	11	22.79	17.69	36370.2
Ficus scabra (N)	66	10	12.43	5.74	11808.3
Glochidion ramiflorum (N)	1	1	0.19	0.08	160.7
Hernandia nymphaeifolia (N)	5	1	0.94	9.61	19748.8
Hibiscus tiliaceus (N)	27	7	5.08	1.55	3181.8
Macaranga harveyana (N)	49	8	9.23	3.43	7055.0
Morinda citrifolia (P)	36	8	6.78	1.59	3276.5
Mucuna gigantea (N)	3	1	0.56	0.03	62.9
Pandanus tectorius var. *laevis* (P)	2	2	0.38	0.30	624.6
Pipturus argenteus (N)	27	6	5.08	1.29	2647.1
Pisonia grandis (N)	73	9	13.75	35.14	72250.2
Pisonia umbellifera (N)	1	1	0.19	0.03	56.7
Sterculia fanaiho (N)	3	1	0.56	0.89	1833.9
Syzygium dealatum (N)	1	1	0.19	0.03	63.6
Terminalia catappa (N or P)	1	1	0.19	0.42	860.1
Total	531				205588.3

N = Native, P = Polynesian introduction, M = Modern introduction

An additional 100 trees of 16 species (Table 7) were counted and measured. in the 0.096 ha (960m^2) study area comprised of 12, 40m x 2m plots lateral to the main plots. Thirteen of these (81%) are native species with four introduced and/or cultivated species (*Artocarpus altilis, Carica papaya, Cocos nucifera,* and *Morinda citrifolia*). Also counted within the plots were 20 banana stems, 34 breadfruit seedling or root suckers, and a single coconut seedling, but these were not included in the data analyses.

Pisonia grandis, was by far, the most dominant tree (63.8%) in the lateral plots, with *Dysoxylum samoense* at 10%.

Table 7. The number of species and individuals inventoried and measured in 12, 40m x 2m study plots at Saua, Ta'u, and relative density (Rd), relative dominance (RD), and total basal area for each species in the 960m^2 (0.096 ha) study area.

Species	Number of individuals	Number of plots in which they occurred	Relative density (Rd)	Relative dominance (RD)	Total basal area
Artocarpus altilis (P)	6	1	6	3.01	1341.6
Barringtonia asiatica (N)	7	2	7	3.99	1780.7
Carica papaya (M)	1	1	1	0.11	47.8
Cocos nucifera (N)	1	1	1	0.70	314.0
Diospyros samoensis (N)	8	4	8	1.79	796.7
Dysoxylum samoense (N)	23	7	23	10.12	4511.7
Ficus scabra (N)	9	4	9	1.22	543.1
Ficus tinctoria (N)	1	1	1	0.06	26.4
Guettarda speciosa (N)	1	1	1	0.20	87.7
Hernandia nymphaeifolia (N)	1	1	1	6.38	2844.9
Hibiscus tiliaceus (N)	9	3	9	4.37	1948.5
Macaranga harveyana (N)	10	5	10	3.38	1505.9
Morinda citrifolia (P)	4	3	4	0.53	236.5
Pipturus argenteus (N)	1	1	1	0.07	29.2
Pisonia grandis (N)	17	6	17	63.76	28435.1
Tarenna sambucina (N)	1	1	1	0.34	149.5
Total	100				44599.2

N = Native, P = Polynesian introduction, M = Modern introduction

Native species comprised 84% of the plants in the entire study area (11, 250m x 2m plots and 12, 20m x 2m plots) with 534 individuals (Table 8).

Table 8. Native vs. cultivated/introduced species in plots at Saua, Ta'u.

	Species	Individuals	Total basal area
Native	18	534	223742.5
Cultivated/introduced	6	97	26445.0
Total	24	631	250187.5

Dysoxylum samoense had a total relative dominance of 16.3%. This figure is much lower than the 86% dominance reported by Whistler (1995). That 1000m^2 study plot was located to encompass the largest remnant of the old growth *Dysoxylum* forest at Saua, whereas our plots traversed the entire length of the coastal forest in the Park.

Dysoxylum was distributed throughout the Park (Figure 23), and ranged from 5 cm to 81.2 cm in dbh compared to the 15.8 cm to 113.5 cm trees measured in the permanent study plot. Five *Dysoxylum* were larger than 0.5 m in diameter (81.2, 78.5, 71.5, 64.6, and 58 cm): however, the majority (99 trees) were between 5 cm and 19 cm.

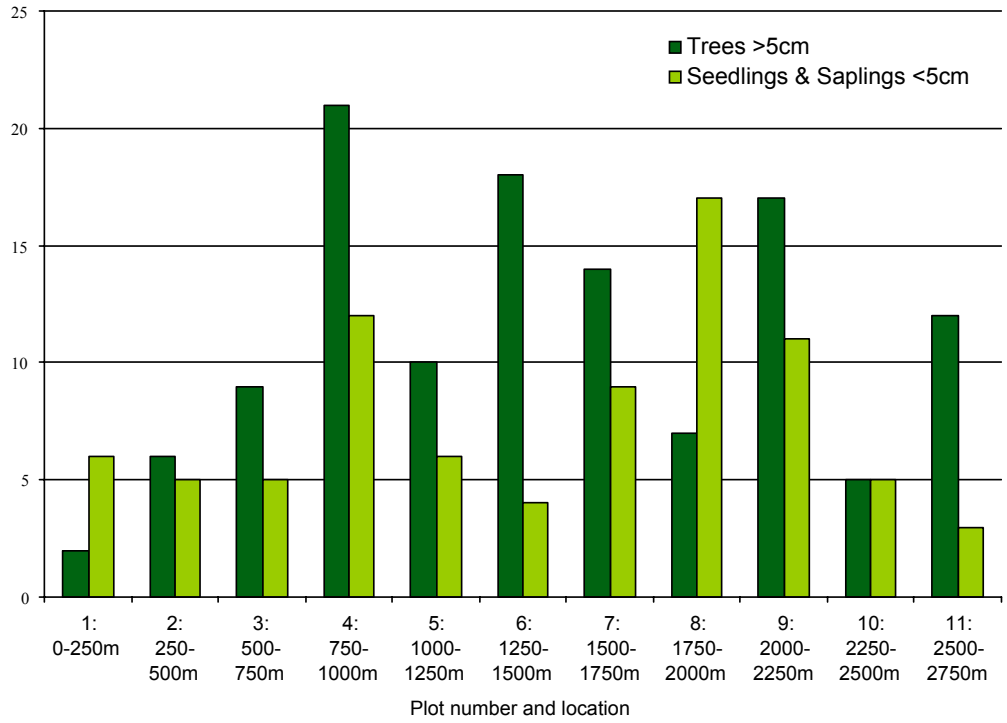

Figure 23. Distribution of *Dysoxylum samoense* at Saua.

In addition to the five large *Dysoxylum* trees, there were 22 native trees at 0.5 m or greater in diameter. The largest trees measured were more than a meter in diameter: four *Pisonia grandis* at 193.1, 183.6, 118.5, and 101.4 cm, a *Hernandia nymphaeifolia* at 139.9 cm, and a *Barringtonia asiatica* at 100.5 cm. Only six *Hernandia* were documented in the plots, but additional trees were observed along the seashore. The dominant understory trees were *Ficus scabra, Diospyros samoense,* and *Dysoxylum samoense* in closed canopies, and *Macaranga harveyana* in more open areas, especially in areas that had been in agricultural use and at the sourthern end of the Park.

The majority (421) of native trees were in the smallest size classes of 5 cm to 20 cm (Table 9) indicating the relatively young age of the secondary forest, because most of the trees have regenerated in the past decade since the hurricanes in 1990 and 1991 and the cessation of agricultural use since the land became part of the Park.

Table 9. Size class ranges of native trees at Saua, Ta'u.

Size class range of native trees	Number of trees
5-10	253
11-20	168
21-30	61
31-40	18
41-50	7
50-60	5
60-70	4
70-80	4
80-90	3
90-100	5
100.5-193.1	6

The largest introduced trees were two breadfruit at 68.2 cm and 55.3 cm. The combined diameters of the multiple trunks of a smooth-leaved pandanus totaled 62.9 cm. The majority (67) of the introduced trees were < 20 cm in diameter, especially the *Carica papaya* and *Morinda citrifolia*, the latter which is a main understory tree.

The dominant cultivated species in the plots are *Artocarpus altilis* and *Musa* x *paradisiaca* (Table 10). Most of the breadfruit plants are seedlings or small root suckers that are sprouting from mature trees. Only 13 mature coconut trees (all ≥ 20 cm in diameter) were documented in the plots, and the sprouting seeds are mainly localized under one tree in plot 7. As described in the section for the Alei Plateau, coconuts will not regenerate in shaded areas and seedlings will continue to grow only if the area is kept cleared. The regenerating native forest at Saua is now providing dense enough shade to prevent the growth and maturation of coconut trees.

Table 10 Introduced cultivated species in Saua, Tau study plots.

Plot	Bananas	Breadfruit		Coconuts	
		< 5 cm dbh	≥ 5 cm dbh	< 5 cm dbh	≥ 5 cm dbh
11, 250m x 2m	125	153	23	116	12
12, 20m x 2m	20	34	6	1	1
Total	145	187	29	117	13

A *Clinostigma samoense* palm tree was observed at the cliff base outside of the boundaries of plot 4 at 981m. This species is endemic to the Samoan archipelago and occurs wild on the islands of Upolu. Two trees were also seen growing along the abandoned access road above Fiti uta village that led to agricultural areas near Luatele Crater. Those trees were obviously planted because this species is not known to occur naturally in American Samoa. The tree at Saua may have been planted, but because of

its location in a rocky outcropping, it probably grew from a seed dispersed by a flying fox or native bird.

In addition to the trees that were inventoried, 527 saplings and small trees (< 5 cm dbh), shrubs, vines, seedlings, and/or herbaceous plants of 45 species were counted in the 55 random 2m x 2m plots (Appendix A). The majority are native species (Table 11) with *Dysoxylum* (83 plants), *Diospyros samoensis* (23), *Ficus scabra* (21), and *Pisonia grandis* (19) the most prevalent, along with numerous ferns, especially *Asplenium nidus*, and vines, primarily *Epipremnum pinnatum* and *Piper graeffei*. Four weedy, introduced species were present in small quantities, mainly *Mikania micrantha* in seven of the subplots, with a few *Justicia procumbens, Ruellia prostrata,* and *Oplismenus hirtellus* in sunny areas. The groundcover in closed canopy areas is dominated by native ferns, vines, and seedlings and saplings of native trees.

Table 11. Species of trees < 5cm dbh, herbs, and vines in 55 random plots at Saua.

Plant form	NUMBER OF SPECIES
Native trees	16
Ferns	6
Vines	9
Cultivated/introduced	8
Weedy species (includes 2 vines)	6
Total	45

LAND AND RESOURCE USE

The village of Fitiuta has 57 households and is divided into two sections: Maia, the west side and Leusoalii the east side—the boundary is the church. Each section has its own **Pule Nu'u** (mayor) and chiefs (**matai**); 40 (~15 in residence), and 30 (~9 in residence), respectively. Leusoalii is closest to and affiliated with the Park. The families in Maia now farm in Faga, west of the village along the coast towards Ta'u village. In ancient times, Maia was once located at Faga but moved to its current location because of warfare with Ta'u village and because its coastal location exposed it to strong waves and hurricane winds.

The Manua Islands are considered to be the most traditional in American Samoa, but, because of out-migration, little of this knowledge is being passed on. Many youngsters go to high school on Tutuila and stay there after graduation or move to Hawaii or the U.S. mainland where jobs area available. Children learn by doing, consequently the many Samoans who have lived off island for much of their teenage and young adult

years have had little contact with Samoan practices, even common ones like making a cooking oven (**umu)** or preparing traditional foods like **fa'ausi** (see recorded interviews). For example, no one makes bark cloth (**siapo**) any more, although one or two families have *Broussonetia papyrifera* (**u'a**) plants in their yards, in honor of their mothers or grandmothers, who were once siapo makers. Most of the tapa boards (**upeti**) used to pound **siapo** have been lost, but at least one ancient specimen has survived.

Although *Piper methysticum* (**'ava**) is still culturally important, only two **matai** still grow the plants in their home gardens. Since the homes are all modern style with sheet metal roofs, no one makes roofing thatch, which the old woman used to weave from sugarcane leaves, mainly the variety **tolo fualau**. This type of thatch would last for six to seven years, compared to coconut leaf thatch that only lasts for a year or so. Many of the women, especially mothers, still use a few plants for plant medicines, but there is not a master healer, or **taulasea**, in the village. The herbs are usually gathered from around the houses and in the home gardens.

There is still cultural expertise about plants and their uses, especially among the old **matai** in their 70s and 80s, including Ta'aga Faleali'i Tagaloa, Sega Apisai Atoe, Paopao Faresa, and Papu Tosi (see recorded interviews). Paopao Faresa, a skilled builder (**tafuga**), is one of the few people in the entire Samoan archipelago who can build a traditional Samoan house or **fale**. Several of the **matai**, including Paopao, still make rope (sennet or **afa**) from coconut husks. There is a preferred variety, now uncommon, known as **niu afa**, that has long, narrow nuts with long husk fibers. Most of the elderly men are unable to hike to the mountain to harvest plant materials or to work their farms and plantations. An elderly man in Ta'u Village was an expert at making fishing traps (**enu**), and taught several younger men, mostly in the 40s and 50s, to do so. He moved away a couple of years ago. The apprentices have a difficult time obtaining the roots of *Freycinetia reineckei* required because it typically grows on the native trees found high on the mountain where people no longer want to hike. A few of the younger men in their 30s are very knowledgeable about traditional practices. See recorded interviews with Fale Lauofo who demonstrated how to make a cooking fire (**umu**), food preparation, and making **fa'ausi**, a special dish made from taro.

At one time, all the families had farms on the mountain slopes above Fitiuta village and grew crops including taro, coconuts, cacao, cassava, yams (*Dioscorea alata*), and *Piper methysticum*. There were even agricultural plots on the floor of Luatele Crater at 365 m elevation. Crop growth on the mountain is different than along the coast. The soil is better because in the forest soil is enriched every year with nutrients from the leaves of the trees. In the lowlands the soil is rocky and hard to work. At one time the entire village kept their pigs communally in stone pens in the village area, all the way to Saua. When the airport was built, it was decided that each family would keep its own pigs, and many escaped. There have always been pigs on the mountain, but their numbers have greatly increased since the hurricanes.

Agricultural use of the area started declining in the 1960s and ceased in the early 1990s because many people left the island, all of the crops were destroyed, and fallen trees made the access road impassable. Feral pigs proliferated and will destroy any taro plantings and are dangerous, so now few, if any, people from the village go to the mountain. Pigs sometimes come down to the village and root up taro and other crop plants.

The trail up the mountain inconspicuously begins in a backyard garden in Maia, then climbs steeply via switchbacks through agroforest and native forest trees. The trail is still in fairly good condition, with stone walls along steep banks to prevent erosion, and stones put in as steps in steep areas. The trail reaches an access road that follows the contour of the mountain at 180 m elevation. The access road is now bordered by secondary forest with little evidence of cultivation except for a few scattered coconut and breadfruit trees and naturalized *Zingiber zerumbet*. There is heavy pig damage everywhere in the area, especially to the east of the stream that marks the Park boundary.

The plantation road gently sloped south then turned north through a cleared area and entered the main coastal road. In 2001 the hillside was completely smothered in vines

Figure 24. Vine-covered abandoned agricultural land.

Figure 25. Rock quarry on Ta'u mountain side.

of *Merremia peltata* and *Mikania scandens* with a few trees of *Macaranga harveyana*, bananas, and breadfruit (Figure 24). The area is now impassable because the construction company McConnel Dowell dynamited the mountainside (Figure 25) and is quarrying rock for the airport extension. The entrance to the former plantation access road now leads to the quarry.

Until the early 1990s, the coastal area that is now part of the Park was used for agricultural purposes (Figure 26), and forest trees were felled to plant taro and bananas. Cut trees were left in place and small branches were cut and burned. No trees of any kind were left because taro needs the sunshine and will die if shaded. Depending on soil conditions it can take up to one year before taro is ready to harvest. Actively managed and maintained farms were visited regularly and vines and weeds were cut or trimmed. If left unchecked, vines such as *Mikania* reduce productivity and yields of crops. Once the taro was harvested, the area would be left fallow. The bananas and breadfruit continue to grow, native trees regenerate, and the weeds are eventually shaded out. The area becomes rejuvenated and can be cleared again in a few years or decades to start the cycle over. If new land or the required labor force is not available to clear a new area, cultivated areas are replanted. After harvesting, grass and weeds are allowed to grow in the fields to keep the soil moist for six to seven months, before cutting these back and replanting. Farmers prefer to shift to new areas because they don't get the same growth and productivity in subsequent crops in the same area and the resulting corms are smaller.

Figure 26. Coconut grove.

The soil in a large extent of the Saua area is thin and sandy with an overlay of coral rubble, the areas of cultivation in the coastal forest were limited. There were agricultural plots all along the coast as far as Tufu Point, and even a few up on the Liu Bench. In the early 1990s, people began to abandon the area because of the hurricanes and subsequent feral pig disturbance. The 1993 taro blight forced many to abandon their farms. Since the introduction of the blight-resistent Palau taro varieties, people are starting to return to their farm lands, but not into the Park. Before the area became part of the Park, plants such as *Vigna marina, Macropiper puberulum*, and *Tarenna sambucina* would be harvested for medicine. Today, people only go to the Park to fish along the coast.

Overall, the island of Ta'u and the village of Fiti uta are experiencing the same cultural erosion seen in the rest of the Manu'a Islands, and American Samoa in general. The Park area is now only used by fisherman, and no agricultural activities have occurred within the Park boundaries since the late 1980s. The hurricanes in 1990 and 1991 greatly damaged the forest but also further diminished impacts on the forest because so many villagers moved off island. There were 358 residents counted in the 2000 census, compared to 454 in 1990. Another major factor in the reduction in agricultural and resource use within the Park has been the major public works projects on Ta'u during the past few years these have provided wage jobs for many of the young and middle-

aged men of the village who would have been actively farming. McConnell Dowell, the company improving the coastal road on Ta'u and extending the Fitiuta Airport, has hired most of the able-bodied men in the village and so very little work is being done in the plantations. What food is produced locally is now grown in backyard gardens or small agricultural plots near the village.

ETHNOBOTANICAL INTERVIEWS AND CULTURAL ACTIVITIES

In addition to the interviews detailed in the previous sections, other individuals and cultural activities were recorded. Ola Aloese (Ofu Village) and Lesa Lata Tau (Sili Village) demonstrated how to weave mats from coconut and pandanus leaves (Figure 27). Simeamativa Tautala of Olosega Village talked about weaving practices as well as life in the village over the past five decades. On Tutuila, Suafo'a Velio, a **matai** of Leone Village, spoke about traditional farming and other cultural practices and village life in the old days. Mr. Uelese Tuailevao, also a resident of Leone, but originally from Samoa, talked about farming and tattoos. Mrs. Unita Hall spoke about farming, and Mr. Joe Timu Alatogo Tagoilelagi in Vatia spoke about farming, life in the village and how it has changed. Also on Tutuila, Mrs. Adeline Pritchard Jones and Mrs. Marilyn Pritchard Walker demonstrated **siapo** making. Mr. Sven Ortquist a master wood carver discussed his art and his thoughts on the forest and the loss of Samoan traditional culture (see recorded interviews). Approximately 25 hours of interviews and cultural activities were recorded.

Figure 27. Videotaping cultural activities

SUMMARY

A total of 232 species were recorded during our surveys, and 104 species were counted and/or measured within plots that encompassed 15,260m^2 (3.8 acres) on the islands of Ta'u, Ofu, and Olosega in the Manu'a Group of American Samoa. The plots ranged in size from 800m^2 to 5500m^2. A total of 1688 trees representing 52 species with a $\geq$ 5 cm dbh were counted and measured. In addition, 1234 plants representing 102 species (trees < 5 cm dbh, seedlings, shrubs, vines, and herbs) were counted within random plots in the study areas.

Table 12. Summary table of all areas surveyed in this study, including number of trees > 5cm dbh in plots, shrubs, seedlings, vines, and trees < 5cm dbh in random plots, and number of species.

Location	Area (m^2)	AREA (HA)	Area (acres)	Number of trees ≥ 5 cm dbh	Species in tree plots	PLANTS IN RANDOM PLOTS	Species in random plots	SPECIES IN SURVEY AREA
Toaga 50, 10m x 10m	5000	0.500	1.24	417	17	140	23	104
Toaga 40, 10m x 2m	800	0.080	0.20	109	11	-	-	65
Toaga Total	5800	0.580	1.43	526	28	140	23	108
Alei Plateau	2000	0.200	0.49	496	30	489	52	84
Olosega Agroforest	1000	0.100	0.25	35	8	78	26	62
Saua 2750m x2m	5500	0.550	1.36	531	20	527	48	79
Saua 11, 40m x2m	960	0.096	0.24	100	16	-	-	-
Saua Total	6460	0.646	1.60	631	36	527	48	86
Mataala Ridge	-	-	-	-	-	-	-	22
Ta'u Ridge	-	-	-	-	-	-	-	5
Total	15260	1.526	3.77	1688	52	1234	104	232

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This project could not have been conducted without the support and participation of staff of the National Park of American Samoa. Mino Fualau worked with us on Ta'u Island, guiding us on a hike to Luatele Crater and doing reconnaissance work of the Saua area, as well as assisting with interviews and survey work. Tavita Togia assisted with interviews and survey work on Ofu and Olosega. Epi Suafoa organized and helped with interviews in Fitiuta Village and on Tutuila; Stassia Samuels provided assistance with trip logistics and botanical surveys in Saua, and Rory "Junior" West helped with survey work in Saua. We could not have accomplished our botanical survey work without the help of hard-working field guides: Mapu Tauanuu at Toaga and Alei, Malaga Faga Lata Tau, and his son Vaiuli Malaga, at Alei, Paulo Paulo on Ta'u, Lemasani Faafuaua in the Olosega agroforest, and Tui Liloi on the Mataala Ridge trail. We are indebted to all of the people who graciously shared their knowledge and expertise with us in interviews and recorded conversations. We are especially grateful to the families who provided us with lodging and a home base for our work in the Manu'a Islands. Aliilelei Phil Laolagi and Elizabeth (Bekka) Laolagi allowed us to convert the Asaga Inn into a field station during our stay on Ofu and Olosega, and helped us with logistics, transportation, and meetings with matai and village residents. Ola Aloese, Malaga Faga Lata Tau and his wife, Lesa Lata Tau, all helped make our stay there a pleasurable and very productive one. Sega Apisai Atoe and his wife Palagi kindly welcomed us into their home in Fitiuta, and we enjoyed the warm hospitality of their daughter Florita and her husband, Fale Laulii Lauofo.

This project is dedicated to Fale Laulii Lauofo who died unexpectedly in December 2002 at the age of 32. Fale was a friendly, down-to-earth man who took great pride in teaching his children traditional Samoan practices and in sharing his knowledge about plants, farming, food preparation, and fishing. His loss is a sad example of the need to document traditional knowledge and practices in American Samoa before they disappear.

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APPENDIX A. BOTANICAL INVENTORY OF SELECTED AREAS OF THE MANU'A ISLANDS, AMERICAN SAMOA. Plants were inventoried, measured, and documented in study plots at Toaga (TO), Ofu, Olosega Village agroforest (OL) and Alei Plateau (AP), Olosega, and Saua, Ta'u (SA). Plants were also documented along the Mataala Ridge Trail (M), Olosega, and the trail to Luatele Crater, Ta'u (T). A total of 232 taxa are listed. Status is defined as Endemic = confined to a particular geographic area and with a specific distribution; Indigenous = native in a particular locality; Polynesian = plants introduced by the Polynesian people; Modern = plants introduced after western contact; Ind/Pol = Indigenous or possibly a Polynesian introduction; Pol/Mod = Polynesian and/or modern introduction. X = plant present in study area, X [1] = tree measured in study plot, X [2] = shrub, herb, seedling, or vine inventoried in random plots, X [1,2] = plant found in both trees and random plots. V = herbarium specimens vouchered. P = color and digital photographs provided with report.

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Abelmoschus moschatus	Malvaceae		Modern			X				*	
Achyranthes aspera	Amaranthaceae	lau tamatama, tamatama	Ind/Pol					X		*	
Acrostichum aureum	Pteridaceae	sa'ato, pupu sa'ato, la'au sa'ato	Indigenous					X		*	
Ageratum conyzoides	Asteraceae	lau tae'oti, tae'oti	Modern			X [2]				*	
Aglaia samoensis	Meliaceae	laga'ali	Endemic		X [1]	X		X		*	*
Allophylus timoriensis	Sapindaceae		Indigenous	X						*	*
Alocasia macrorrhiza	Araceae	ta'amu	Polynesian			X [2]	X [2]			*	*
Alphitonia zizyphoides	Rhamnaceae	toi	Indigenous		X [1]					*	
Alpinia atropurpurea	Zingiberaceae	teiula, red ginger	Modern	X		X [2]					
Alysicarpus vaginalis	Fabaceae		Modern	X						*	
Alyxia bracteolosa	Apocynaceae	lau maile, lau mai'e	Indigenous		X [2]			X		*	
Alyxia sp.	Apocynaceae		Indigneous		X [2]						
Alyxia stellata	Apocynaceae	gau, lava, lau mai'e, lau maile	Indigenous		X [2]		X [2]			*	
Ananas comosus	Bromeliaceae	fala 'aina	Modern			X	X [2]				
Antrophyum alatum	Vittariaceae		Indigenous		X					*	
Antrophyum plantagineum	Vittariaceae		Indigenous		X [2]					*	
Arachniodes aristata	Dryopteridaceae		Indigenous		X					*	
Arthopteris repens	Oleandraceae		Indigenous				X [2]			*	
Artocarpus altilis	Moraceae	'ulu	Polynesian	X [1]	X [1]	X [1,2]	X [1,2]			*	
Asplenium marattiodes	Aspleniaceae		Indigenous				X [2]			*	
Asplenium nidus	Aspleniaceae	laugapapa, bird's nest fern	Indigenous	X	X [2]	X	X [2]			*	
Asplenium polyodon	Aspleniaceae		Indigenous		X					*	
Asplenium sp.	Aspleniaceae		Indigenous				X [2]				

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Barringtonia asiatica	Lecythidaceae	futu, fish-poison tree	Indigenous	X [1,2]	X [1]		X [1,2]			*	*
Barringtonia samoensis	Lecythidaceae	falaga	Indigenous					X		*	*
Bidens alba var. *radiata*	Asteraceae	beggar's tick	Modern	X						*	*
Bidens pilosa	Asteraceae	beggar's tick	Modern	X							
Bischofia javanica	Euphorbiaceae	‘o'a	Ind/Pol		X [1]	X	X			*	*
Bothriochloa bladhii	Poaceae		Modern	X						*	
Brachiaria subquadriparia	Poaceae	California grass	Modern	X						*	
Caesalpinia major	Fabaceae	‘anoso, ‘anoso vao, ‘anaoso	Indigenous		X					*	*
Calophyllum inophyllum	Clusiaceae	fetau	Indigenous	X							
Calophyllum neo-ebudicum	Clusiaceae	tamanu	Indigenous		X [1,2]					*	
Cananga odorata	Annonaceae	moso'oi, ilanglang	Polynesian				X			*	
Canarium harveyi	Burseraceae	mafoa	Ind/Pol					X		*	
Canavalia cathartica	Fabaceae		Indigenous	X				X		*	*
Capsicum frutescens	Solanaceae	polo, polo feu, polo vao, chili pepper	Modern				X [2]			*	
Carica papaya	Caricaceae	esi, papaya	Modern	X		X [2]	X [1]			*	
Cassytha filiformis	Lauraceae	fetai	Indigenous	X						*	*
Ceiba pentandra	Bombaceae	vavae, vavae samoa, kapok	Modern			X					
Cenchrus echinatus	Poaceae	tuitui, vao tuitui, sand bur	Modern	X						*	*
Centella asiatica	Apiaceae	togo, togotogo, moa	Polynesian	X		X [2]				*	*
Centotheca lappacea	Poaceae	sefa, lau ‘ofe’ofe	Ind/Pol		X [2]	X [2]				*	
Chamaesyce atoto	Euphorbiaceae	pulu tai	Indigenous	X						*	*
Chamaesyce hirta	Euphorbiaceae	vao ‘apulupulu, la'au fai moti, garden spurge	Modern	X						*	*
Chamaesyce hypericifolia	Euphorbiaceae		Modern	X						*	*
Chionanthus vitiensis	Oleaceae		Indigenous		X					*	
Chloris barbata	Poaceae	fingergrass	Modern	X						*	*
Christella harveyi	Thelypteridaceae		Indigenous	X	X [2]	X [2]				*	*
Citronella samoensis	Icacinaceae		Indigenous		v					*	
Citrus aurantifolia	Rutaceae	tipolo, tipolo lamolemole, tipolo samoa, lime	Modern			X [1]					

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Citrus sinensis	Rutaceae	moli ‘aina, sweet orange	Modern			X [1]				*	
Clerodendrum buchananii var. *fallax*	Verbenaceae		Modern			X [2]					
Clerodendrum chinensis	Verbenaceae	aloalo tai, alaalo sami	Modern						X		*
Clerodendrum inerme	Verbenaceae	aloalo tai, alaalo sami	Indigenous	X			X			*	*
Clidemia hirta	Melastomataceae	Koster's curse	Modern		X	X	X			*	*
Clinostigma samoense	Arecaceae		Pol/Mod				X		X		*
Cocos nucifera	Arecaceae	niu, coconut	Indigenous	X [1,2]	X [1]	X [1,2]	X [1,2]	X			
Colocasia esculenta	Araceae	talo	Polynesian			X [2]	X			*	
Colubrina asiatica	Rhamnaceae	fisoa	Indigenous	X [2]						*	*
Commelina diffusa	Commelinaceae	mau'u toga	Polynesian			X					
Cordia subcordata	Boraginaceae	tauanave	Indigenous	X [1]						*	*
Cordyline fruticosa	Agavaceae	ti, lauti, ti vao	Polynesian	X [2]	X [2]	X		X		*	
Crinum asiaticum	Amaryllidaceae	lau talotalo	Modern	X							
Cyanthillium cinereum	Asteraceae	ironweed	Modern	X						*	
Cyathea iunulata	Cyathaceae		Indigenous				X			*	
Cyperus cyperinus	Cyperaceae	mumuta, nut sedge	Ind/Pol	X		X[2]				*	
Cyperus rotundus	Cyperaceae	mumuta, nut sedge	Modern	X						*	
Cyrtandra pulchella	Gesneriaceae	momole’a	Endemic						X	*	*
Cyrtandra samoensis	Gesneriaceae	momole’a	Indigenous	X			X		X	*	*
Dactyloctenium aegyptium	Poaceae	beach wiregrass	Modern	X						*	
Davallia solida	Davalliaceae	laugasese	Indigenous		X [2]					*	*
Dendrolobium umbellatum	Fabaceae	lala, lau lala	Indigenous	X [2]						*	*
Dennstaedtia sp.	Dennstaedtiaceae		Indigenous				X				
Derris malaccensis	Fabaceae	‘ava niukini	Pol/Mod	X	X [2]	X				*	*
Derris trifoliata	Fabaceae	fue ‘o'ona	Indigenous	X			X [2]			*	
Desmodium heterocarpum	Fabaceae		Modern					X		*	
Desmodium incanum	Fabaceae	spanish clover	Modern	X						*	*
Desmodium triflorum	Fabaceae	three-flowered beggarweed	Modern	X						*	
Digitaria ciliaris	Poaceae	crab grass	Modern	X						*	
Dioscorea alata	Dioscoreaceae	ufi	Polynesian				X [2]				

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Dioscorea bulbifera	Dioscoreaceae	soi, bitter yam	Polynesian	X	X [2]	X [2]	X [2]			*	*
Diospyros elliptica	Ebenaceae	‘anume	Indigenous		X [1,2]					*	
Diospyros samoensis	Ebenaceae	‘au'auli	Indigenous	X	X [1,2]	X	X [1,2]	X		*	*
Doryopteris concolor	Pteridaceae		Indigenous		X					*	
Dysoxylum samoense	Meliaceae	tufaso, maota mamala, mamala	Endemic	X [2]	X [1,2]	X [1,2]	X [1,2]			*	*
Echinochloa colona	Poaceae	barnyard grass, jungle rice	Modern	X						*	
Elattostachys falcata	Sapindaceae	taputo'i, tapumatau	Indigenous		X [1,2]			X		*	*
Eleusine indica	Poaceae	ta'ata'a	Polynesian	X						*	
Embelia vaupelii	Myrsinaceae		Indigenous		X [2]						
Epipremnum pinnatum	Araceae	lau mai’a, fue laufao, tuafaga	Indigenous	X		X [2]	X [2]			*	*
Eragrostis amabilis	Poaceae	lovegrass	Modern	X						*	*
Erythrina variegata	Fabaceae	gatae, coral tree	Indigenous	X [1]		X				*	*
Euodia hortensis	Rutaceae	usi	Polynesian		X [2]					*	*
Fagraea berteroana	Loganiaceae	pualulu	Indigenous					X		*	
Faradaya amicorum	Verbenaceae	mamalupe, mamagi	Indigenous		X [2]		X [2]			*	*
Ficus godeffroyi	Moraceae	mati vao	Endemic					X		*	*
Ficus obliqua	Moraceae	aoa, banyan	Indigenous		X					*	
Ficus prolixa	Moraceae	aoa, banyan	Indigenous				X			*	
Ficus scabra	Moraceae	mati, mati vao	Indigenous	X [2]	X [1,2]	X [2]	X [1,2]			*	*
Ficus tinctoria	Moraceae	mati, mati’ata, dyer's fig	Indigenous	X			X [1,2]			*	*
Fimbristylis cymosa	Cyperaceae	mutia	Indigenous	X			X			*	*
Flacourtia rukam	Flacourtiaceae	filimoto	Indigenous		X [1,2]					*	*
Flueggea flexuosa	Euphorbiaceae	poumuli	Modern				X			*	
Freycinetia storckii	Pandanaceae	‘ie'ie	Indigenous			X					*
Garcinia myrticifolia	Clusiaceae		Indigenous		X [1]					*	
Garuga floribunda	Burseraceae	vi vao	Indigenous		X [1]					*	
Geniostoma rupestre	Loganiaceae	lau mafatifati, taipoipo, fua pipilo, mafatifati	Indigenous	X [1]	X [1]					*	
Geophila repens	Rubiaceae	togo, togo vao	Indigenous				X			*	
Glochidion cuspidatum	Euphorbiaceae	masame vao	Indigenous		X [2]						
Glochidion ramiflorum	Euphorbiaceae	masame	Indigenous	X	X [1,2]		X [1,2]			*	*

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Graptophyllum pictum	Acanthaceae	caricature plant	Modern	X							
Guettarda speciosa	Rubiaceae	puapua	Indigenous	X [1,2]		X	X [1]			*	*
Gynochthodes epiphytica	Rubiaceae		Indigenous		X [2]					*	
Hedyotis foetida	Rubiaceae		Indigenous					X		*	
Heliconia laufao	Heliconiaceae	laufao	Endemic			X					
Hernandia nymphaeifolia	Hernandiaceae	pu'a, chinese lantern tree	Indigenous	X [1]			X [1,2]			*	*
Hibiscus tiliaceus	Malvaceae	fau, fau tu, beach hibiscus	Indigenous	X [1,2]	X [1]	X [1]	X [1,2]			*	*
Hibiscus x archeri	Malvaceae		Modern	X							
Hoya australis	Asclepiadaceae	fue selela, lau magamaga, suni vao, lau 'olive	Indigenous	X	X [2]		X [2]			*	*
Hoya pottsii	Asclepiadaceae	fue selela	Indigenous				X [2]			*	
Humata heterophylla	Davalliaceae		Indigenous		X [2]						
Inocarpus fagifer	Fabaceae	ifi, Tahitian chestnut	Polynesian		X [1,2]					*	*
Ipomoea littoralis	Convolvulaceae	palulu, tagamimi	Indigenous	X						*	*
Ipomoea macrantha	Convolvulaceae		Indigenous	X	X [2]		X [2]			*	*
Ipomoea pes-caprae ssp. *brasiliensis*	Convolvulaceae	fue moa, fue tai, beach morning-glory	Indigenous	X [2]						*	*
Ischaemum murinum	Poaceae		Indigenous					X		*	
Ixora samoensis	Rubiaceae	filofiloa	Endemic		X [2]			X		*	*
Jasminum didymum	Oleaceae		Indigenous		X [2]			X		*	*
Justicia procumbens	Acanthaceae		Modern	X			X [2]			*	*
Lepturus repens	Poaceae		Indigenous	X						*	*
Leucaena leucocephala	Fabaceae	fuapepe, lusina, wild tamarind	Modern	X						*	*
Macaranga harveyana	Euphorbiaceae	lau pata, pata, lau patapata, papata	Indigenous	X [1,2]		X [1]	X [1,2]			*	*
Macropiper puberulum	Piperaceae	'ava'ava aitu	Indigenous			X				*	
Macroptilium sp.	Fabaceae		Indigenous				X			*	
Macrothelypteris torresiana	Thelypteridaceae		Indigenous			X				*	
Mangifera indica	Anacardiaceae	mago, mango	Modern		X [1]	X				*	
Manihot esculenta	Euphorbiaceae	manioka, tapioka, cassava	Modern			X	X			*	
Melanthera biflora	Asteraceae	ateate, beach sunflower	Indigenous	X [2]			X			*	*

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Meryta macrophylla	Araliaceae	ma'ulu'ulu, lau ma'ulu'ulu, fagufagu, lau fagufagu	Indigenous				X				
Microsorium sylvaticum	Polypodiaceae		Indigenous		X					*	
Mikania micrantha	Asteraceae	fue saina, mile-a-minute vine	Modern	X	X [2]	X [2]	X [2]			*	*
Morinda citrifolia	Rubiaceae	nonu, nonu togi, nonu vao, Indian mulberry	Polynesian	X [1,2]	X [1,2]	X [2]	X [1,2]			*	*
Mucuna gigantea	Fabaceae	fue inu, fue vai	Indigenous	X		X	X [1,2]			*	*
Musa x paradisiaca	Musaceae	fa'i	Introduced	X		X [2]	X			*	*
Myristica inutilis ssp. *inutilis*	Myristicaceae	'atone, Samoan nutmeg	Indigenous		X [1,2]		X [2]			*	
Neonauclea forsteri	Rubiaceae	afa	Indigenous				X			*	*
Nephrolepis biserrata	Nephrolepidaceae		Indigenous		X [2]		X			*	
Nephrolepis hirsutula	Nephrolepidaceae	vao tuaniu	Indigenous	X [2]	X	X [2]	X [2]			*	*
Omalanthus nutans	Euphorbiaceae	fanua mamala, foga mamala, mamala	Indigenous			X [1]				*	
Operculina turpethum	Convolvulaceae		Indigenous				X			*	
Ophioglossum pendulum	Ophioglossaceae		Indigenous		X					*	
Oplismenus compositus	Poaceae	fali, vao fali	Polynesian	X [2]		X [2]				*	
Oplismenus hirtellus	Poaceae	basket grass	Polynesian				X [2]			*	
Oxalis barrelieri	Oxalidaceae	vine	Modern	X						*	
Pandanus tectorius var. *laevis*	Pandanaceae	lau fala, lau'ie	Polynesian	X			X [1]			*	
Pandanus tectorius var. *tectorius*	Pandanaceae	fasa, lautolotolo, tolotolo, screwpine	Indigenous	X [1,2]	X	X [2]	X			*	*
Paspalum cartilagineum	Poaceae		Modern	X						*	*
Passiflora cf. *pulchella*	Passifloraceae	pasio	Modern	X						*	
Pennisetum purpureum	Poaceae	vao povi, elephant grass	Modern	X						*	*
Peperomia blanda var. *floribunda*	Piperaceae		Indigenous				X			*	
Peperomia pellucida	Piperaceae	vao vai	Modern				X [2]			*	
Phyllanthus amarus	Euphorbiaceae		Modern	X						*	*

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Phymatosorus grossus	Polypodiaceae	lau magamaga, lau auta	Indigenous	X [2]	X [2]	X	X [2]			*	*
Phymatosorus nigrescens	Polypodiaceae		Indigenous		X					*	*
Piper graeffei	Piperaceae	fue manogi, 'ava'ava aitu, 'ava'ava aitu sosolo	Indigenous		X [2]		X [2]			*	
Pipturus argenteus	Urticaceae	fau soga, soga	Indigenous	X		X	X [1,2]			*	*
Pisonia grandis	Nyctaginaceae	pu'avai	Indigenous	X [1]			X [1,2]			*	*
Pisonia umbellifera	Nyctaginaceae		Indigenous				X [1]			*	
Planchonella garberi	Sapotaceae	ala'a	Indigenous		X [1,2]			X		*	
Plumbago zeylanica	Plumbaginaceae		Indigenous		X					*	
Plumeria rubra	Apocynaceae	pua, pua samoa	Modern	X							
Pneumatopteris cf. *magnifica*	Thelypteridaceae		Indigenous				X			*	
Polygala paniculata	Polygalaceae	pulunamulole	Modern	X						*	*
Polyscias guilfoylei	Araliaceae	tagitagi, panax	Pol/Mod	X		X					*
Pometia pinnata	Sapindaceae	tava	Indigenous				X			*	
Premna serratifolia	Verbenaceae	aloalo, aloalo fanua	Indigenous	X	X [2]					*	*
Procris pedunculata	Urticaceae	fua lole	Indigenous		X					*	
Pseuderanthemum carruthersii	Acanthaceae	lau samasama, la'au samasama	Modern	X						*	
Psychotria garberiana	Rubiaceae		Endemic						X	*	*
Psychotria insularum	Rubiaceae	matalafi, olapito	Indigenous	X	X [2]		X [2]	X		*	*
Pteris ensiformis	Pteridaceae		Indigenous		X					*	
Pteris tripartita	Pteridaceae		Indigenous				X			*	
Pueraria montana var. *lobata*	Fabaceae	a'a, kudzu	Polynesian				X			*	
Pycreus polystachyos	Cyperaceae		Modern				X			*	
Pyrrosia adnascens	Polypodiaceae		Indigenous	X						*	
Rhus taitensis	Anacardiaceae	tavai	Indigenous		X [1,2]					*	*
Rourea minor	Connaraceae	fue uli	Indigenous		X [2]					*	
Ruellia prostrata	Acanthaceae	vao uli	Modern	X		X [2]	X [2]			*	*
Ruellia tuberosa	Acanthaceae		Modern	X		X				*	*
Saccharum officinarum	Poaceae	tolo	Polynesian			X					
Scaevola taccada	Goodeniaceae	to'ito'i	Indigenous	X [1,2]			X			*	*

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Schizaea dichotoma	Schizaeaceae		Indigenous		X [2]					*	
Schizostachyum glaucifolium	Poaceae	‘ofe, ‘ofe samoa, bamboo	Polynesian		X						
Scleria lithosperma	Cyperaceae		Indigenous		X [2]					*	
Scleria polycarpa	Cyperaceae	tafatolu	Indigenous		X					*	
Selaginella whitmeei	Selaginellaceae		Endemic					X		*	
Senna alata	Fabaceae	la’au fai lafa, candle bush	Modern	X						*	
Sida rhombifolia	Malvaceae	mautofu, Cuba jute	Polynesian	X						*	*
Sophora tomentosa	Fabaceae	lalatai	Indigenous	X [1,2]						*	*
Spermacoce assurgens	Rubiaceae		Modern	X						*	*
Spermacoce ovalifolia	Rubiaceae		Modern	X						*	*
Sphaerostephanos sp.	Thelypteridaceae		Indigenous				X [2]			*	
Stachytarpheta urticifolia	Verbenaceae	mautofu	Modern	X [2]						*	*
Stenotaphrum micranthum	Poaceae		Indigenous	X		X [2]				*	*
Sterculia fanaiho	Sterculiaceae	fana'io	Indigenous		X [1,2]	X	X [1,2]			*	*
Synedrella nodiflora	Asteraceae	tae'oti, lao’oti’oti	Modern	X		X [2]				*	*
Syzygium clusiifolium	Myrtaceae	asi vai	Indigenous		X [1,2]					*	
Syzygium dealatum	Myrtaceae	asi vai	Indigenous		X [1,2]		X [1,2]			*	
Syzygium inophylloides	Myrtaceae	asi toa, asi	Indigenous		X [1,2]					*	
Syzygium samarangense	Myrtaceae	nonu vao	Modern		X [1]					*	
Syzygium samoense	Myrtaceae	fena vao	Endemic		X [2]					*	
Tacca leontopetaloides	Taccaceae	masoa, Polynesian arrowroot	Ind/Pol	X [2]		X				*	*
Tarenna sambucina	Rubiaceae	manunu, ma’anunu	Indigenous		X [1,2]	X	X [1]	X		*	*
Tectaria stearnsii	Dryopteridaceae		Endemic		X		X			*	
Terminalia catappa	Combretaceae	talie	Ind/Pol	X [1]		X	X [1]			*	*
Terminalia samoensis	Combretaceae	talie	Indigenous	X [1,2]						*	*
Theobroma cacao	Sterculiaceae	koko, cacao	Modern			X					*
Thespesia populnea	Malvaceae	milo, Pacific rosewood	Indigenous	X [1]						*	*
Thuaea involuta	Poaceae		Indigenous	X							*
Tournefortia argentea	Boraginaceae	tausuni, moega pepe, beach heliotrope	Indigenous	X [1]			X			*	*
Trema cannabina	Ulmaceae	magele	Indigenous				X			*	

APPENDIX A. (CONTINUED)

Scientific Name	Family	Common name(s)	Status	TO	AP	OL	SA	M	T	V	P
Trichomanes bipunctatum	Hymenophyllaceae		Indigenous		X					*	
Triumfetta procumbens	Tiliaceae	mautofu tai, mautofu	Indigenous	X						*	*
Vaginularia angustissima	Vittariaceae		Indigenous		X					*	
Vigna adenantha	Fabaceae		Indigenous		X [2]					*	
Vigna marina	Fabaceae	fue sina, beach pea	Indigenous	X [2]		X [2]				*	*
Xanthosoma nigrum	Araceae		Introduced				X			*	
Zehneria samoensis	Cucurbitaceae		Indigenous				X [2]			*	
Zephyranthes rosea	Amaryllidaceae	zephyr lily	Modern			X				*	
Zingiber zerumbet	Zingiberaceae	‘avapui, faua povi, shampoo ginger	Polynesian		X [2]		X [2]			*	
Zoysia matrella var. *pacifica*	Poaceae	temple grass	Modern	X			X			*	*

APPENDIX B-1. Toaga, Ofu: Vegetation width, coordinates, and GPS for 50, 10m x10m plots.

Control	Vegetation Width	Plot number	Plot Coordinates	Plot number	Plot Coordinates	Veg	Road	GPS
0+00	30.1	1	0+00 to 0+10	2	0+10 to 0+20	3.2	33.3	14°10.208S 169°38.425W
1+00	19.6	3	0+90 to 1+00	4	1+00 to 1+10	5.8	25.4	14°10.220S 169°38.486W
2+00	17.7	5	1+90 to 2+00	6	2+00 to 2+10	4.3	22	14°10.223S 169°38.532W
3+00	15.9	7	2+90 to 3+00	8	3+00 to 3+10	5.4	21.3	14°10.234S 169°38.591W
4+00	19.4	9	3+90 to 4+00	10	4+00 to 4+10	4.5	23.9	14°10.255S 169°38.642W
4+50	15.1	39	4+40 to 4+50	40	4+50 to 4+60	9.5	24.55	-
5+00	16.0	11	4+90 to 5+00	12	5+00 to 5+10	12	28	14°10.276S 169°38.699W
6+00	13.4	13	5+90 to 6+00	14	6+00 to 6+10	12	25.4	14°10.276S 169°38.745W
7+00	15.0	15	6+90 to 7+00	16	7+00 to 7+10	6.5	21.5	14°10.312S 169°38.804W
7+50	13.1	41	7+40 to 7+50	42	7+50 to 7+60	11	24.1	-
8+00	19.1	17	7+90 to 8+00	18	8+00 to 8+10	7.5	26.6	14°10.339S 169°38.850W
8+50	21.5	43	8+40 to 8+50	44	8+50 to 8+60	6	27.5	-
9+00	14.7	19	8+90 to 9+00	20	9+00 to 9+10	12.5	27.2	14°10.364S 169°38.894W
10+00	20.2	21	9+90 to 10+00	22	10+00 to 10+10	7.8	28	14°10.399S 169°38.942W
11+00	16.4	23	10+90 to 11+00	24	11+00 to 11+10	4.5	20.9	14°10.425S 169°38.986W
11+50	13.9	45	11+40 to 11+50	46	11+50 to 11+60	5.4	19.3	14°10.446S 169°39.007W
12+00	8.2	25	11+90 to 12+00	26	12+00 to 12+10	8.7	16.9	14°10.462S 169°39.032W
12+50	11.6	47	12+40 to 12+50	48	12+50 to 12+60	3	14.55	14°10.482S 169°39.051W
13+00	19.2	27	12+90 to 13+00	28	13+00 to 13+10	8	27.2	14°10.499S 169°39.074W
14+00	45.5	29	13+90 to 14+00	30	14+00 to 14+10	6.5	52	14°10.499S 169°39.108W
15+00	24.2	31	14+90 to 15+00	32	15+00 to 15+10	12	36.2	14°10.558S 169°39.153W
16+00	17.5	33	15+90 to 16+00	34	16+00 to 16+10	3.7	21.2	14°10.595S 169°39.195W
18+50	17.8	49	18+40 to 18+50	50	18+50 to 18+60	10	27.8	14°10.698S 169°39.305W
19+00	26.6	35	18+90 to 19+00	36	19+00 to 19+10	-	-	14°10.709S 169°39.324W
19+80	19.5	37	19+70 to 19+80	38	19+80 to 19+90	7.5	27	14°10.751S 169°39.344W

APPENDIX B-2. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 50, 10m x10m plots.

Plots	1	2	3	4	5	6	7	8	9	10	39	40	11	12
Species/Plot Coordiana	0+00 to 0+10	0+10 to 0+20	0+90 to 1+00	1+00 to 1+10	1+90 to 2+00	2+00 to 2+10	2+90 to 3+00	3+00 to 3+10	3+90 to 4+00	4+00 to 4+10	4+40 to 4+50	4+50 to 4+60	4+90 to 5+00	5+00 to 5+10
Artocarpus altilis														
Barringtonia asiatica														
Cocos nucifera		1	3	2	4	4						2	1	2
Cordia subcordata														
Geniostoma rupestre														
Guettarda speciosa		1	1		1	1					5			
Hernandia nymphaeifolia					1	1					7		1	3
Hibiscus tiliaceus						5		1	3	2	1			
Macaranga harveyana											1			
Morinda citrifolia									1					
Pandanus tectorius														
var. *tectorius*	1	1	3	3	2	5	4		3		1	3	3	
Pisonia grandis													1	
Scaevola taccada														
Sophora tomentosa									2					
Terminalia samoensis				1	1	2	2	8	2	8	1	1	5	
Thespesia populnea														
Tournefortia argentea				1		2								
Total	1	1	7	7	9	20	6	9	11	10	16	6	11	6

APPENDIX B-2. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 50, 10m x10m plots (Continued).

Plots	33	34	35	49	50	36	37	38		
Species/Plot	15+90 to 16+00	16+00 to 16+10	16+90 to 17+00	18+40 to 18+50	18+50 to 18+60	19+00 to 19+10	19+70 to 19+80	19+80 to 19+90	Total Number of Individuals	Total basal area
Artocarpus altilis				1				4	5	905.1
Barringtonia asiatica								1	9	19480.1
Cocos nucifera	4	4	4	1	3	5	9	2	108	70239.6
Cordia subcordata									1	38.5
Geniostoma rupestre									1	73.7
Guettarda speciosa									25	4034.1
Hernandia nyi	1			1	1				54	31508.7
Hibiscus tiliaceus									37	3486.1
Macaranga harveyana						1		1	3	272.5
Morinda citrifolia									1	30.2
Pandanus tectorius var. *tectorius*	1			1	1				56	14583.1
Pisonia grandis									1	564.9
Scaevola taccada									2	45.0
Sophora tomentosa									2	74.3
Terminalia samoensis									102	20487.4
Thespesia populnea			1		2		1		4	1956.7
Tournefortia argentea									6	988.9
Total	6	4	5	4	7	6	10	8	417	168768.8

APPENDIX B-2. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 50, 10m x10m plots (Continued).

Plots	13	14	15	16	41	42	17	18	43	44	19	20	21	22
Species/Plot Coordi	5+90 to 6+00	6+00 to 6+10	6+90 to 7+00	7+00 to 7+10	7+40 to 7+50	7+50 to 7+60	7+90 to 8+00	8+00 to 8+10	8+40 to 8+50	8+50 to 8+60	8+90 to 9+00	9+00 to 9+10	9+90 to 10+00	10+00 to 10+10
Artocarpus altilis														
Barringtonia asiatica		2												
Cocos nucifera	1		1		1						1		1	2
Cordia subcordata											1			
Geniostoma rupestre														
Guettarda speciosa	3		5	2	1	1	1		1					
Hernandia nymphaeifoli	2		3			4	3	6	2	3		2	1	3
Hibiscus tiliaceus	1													
Macaranga harveyana														
Morinda citrifolia														
Pandanus tectorius var. *tectorius*	3	3		3			2				3			
Pisonia grandis														
Scaevola taccada			1											
Sophora tomentosa														
Terminalia samoensis	3	3	5	1	3	4	2	7	8	11	9	4	5	2
Thespesia populnea														
Tournefortia argentea			1								2			
Total	13	8	16	6	5	9	8	13	11	14	16	6	7	7

APPENDIX B-2. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 50, 10m x10m plots (Continued).

Plots	23	24	45	46	25	26	47	48	27	28	29	30	31	32
Species/Plot Coordi	10+90 to 11+00	11+00 to 11+10	11+40 to 11+50	11+50 to 11+60	11+90 to 12+00	12+00 to 12+10	12+40 to 12+50	12+50 to 12+60	12+90 to 13+00	13+00 to 13+10	13+90 to 14+00	14+00 to 14+10	14+90 to 15+00	15+00 to 15+10
Artocarpus altilis														
Barringtonia asiatica		2			1			1	1	1				
Cocos nucifera	2	3	3	1	2	4	5	4	6	7	3		4	6
Cordia subcordata														
Geniostoma rupestre												1		
Guettarda speciosa									1	1				
Hernandia nymphaeifoli	1	3	1		1	2	1							
Hibiscus tiliaceus	1	1		4							11	7		
Macaranga harveyana														
Morinda citrifolia														
Pandanus tectorius														
var. *tectorius*		1	2	1		2		2	2					
Pisonia grandis														
Scaevola taccada							1							
Sophora tomentosa														
Terminalia samoensis		1			1		1	1						
Thespesia populnea														
Tournefortia argentea														
Total	4	11	6	6	5	8	8	8	10	9	14	8	4	6

APPENDIX B-3. Toaga, Ofu: Number of trees <5cm dbh, vines, herbs, and seedlings in five random 1m^2 plots.

PLOT	7	20	29	33	45	Total
Species	2+90 to 3+00	9+00 to 9+10	13+90 to 14+00	15+90 to 16+00	11+40 to 11+50	Number of Individuals
Barringtonia asiatica		1				1
Cocos nucifera			1		2	3
Colubrina asiatica		10				10
Cordyline fruticosa			1			1
Dendrolobium umbellatum	2					2
Dysoxylum samoensis			1			1
Ficus scabra				1	4	5
Guettarda speciosa					1	1
Hibiscus tiliaceus	2		1		6	9
Ipomoea pes-caprae ssp. *brasiliensis*				1		1
Macaranga harveyana				1		1
Morinda citrifolia			1	25		26
Nephrolepis hirsutula			1	1		2
Oplismenis compositus				1		1
Pandanus tectorius var. *tectorius* & var. *laevis*	3					3
Phymatosorus grossus		1	1	1	1	4
Scaevola taccada	6				1	7
Sophora tomentosa	43					43
Stachytarpheta urticifolia				1		1
Tacca leonotopetaloides				2		2
Terminalia samoensis	11				1	12
Vigna marina		1			1	2
Wollastonia biflora		1			1	2
TOTAL	67	14	7	34	18	140

APPENDIX B-4. Toaga, Ofu: Vegetation width, coordinates, GPS, and slope for 40, 10m x 2m plots.

Control	Vegetation Width	Plot number	Plot Coordinates	Plot number	Plot Coordinates	GPS		Slope
20+50	-	1	20+40 to 20+50	2	20+50 to 20+60	14º10.771S	169º39.367W	-
21+00	-	3	20+90 to 21+00	4	21+00 to 21+10	14º10.798S	169º39.390W	-
21+50	2.9	5	21+40 to 21+50	6	21+50 to 21+60	14º10.809S	169º39.414W	10º
22+00	2.3	7	21+90 to 22+00	8	22+00 to 22+10	14º10.819S	169º39.437W	10º
22+50	0.9	9	22+40 to 22+50	10	22+50 to 22+60	14º10.833S	169º39.461W	12º
23+00	1.7	11	22+90 to 23+00	12	23+00 to 23+10	14º10.844S	169º39.477W	-
23+50	2.2	13	23+40 to 23+50	14	23+50 to 23+60	14º10.865S	169º39.507W	25º
24+00	1.9	15	23+90 to 24+00	16	24+00 to 24+10	14º10.883S	169º39.528W	70º
24+50	1.2	17	24+40 to 24+50	18	24+50 to 24+60	14º10.902S	169º39.545W	68º
25+00	1.5	19	24+90 to 25+00	20	25+00 to 25+10	14º10.922S	169º39.572W	60º
25+50	-	21	25+40 to 25+50	22	25+50 to 25+60	14º10.932S	169º39.591W	-
26+00	-	23	25+90 to 26+00	24	26+00 to 26+10	14º10.946S	169º39.616W	-
26+50	-	25	26+40 to 26+50	26	26+50 to 26+60	14º10.955S	169º39.640W	-
27+00	-	27	26+90 to 27+00	28	27+00 to 27+10	14º10.962S	169º39.668W	-
27+50	-	29	27+40 to 27+50	30	27+50 to 27+60	14º10.979S	169º39.690W	-
28+00	-	31	27+90 to 28+00	32	28+00 to 28+10	14º10.990S	169º39.713W	-
28+50	-	33	28+40 to 28+50	34	28+50 to 28+60	14º10.998S	169º39.742W	-
29+00	-	35	28+90 to 29+00	36	29+00 to 29+10	14º11.008S	169º39.767W	-
29+50	-	37	29+40 to 29+50	38	29+50 to 29+60	14º11.025S	169º39.789W	-
30+00	-	39	29+90 to 30+00	40	30+00 to 30+10	14º11.034S	169º39.818W	-

APPENDIX B-5. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 40, 10m x 2m plots.

Plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Plot Coordinates	20+40-20+50	20+50-20+60	20+90-21+00	21+00-21+10	21+40-21+50	21+50-21+60	21+90-22+00	22+00-22+10	22+40-22+50	22+50-22+60	22+90-23+00	23+00-23+10	23+40-23+50	23+50-23+60
Artocarpus altilis														
Barringtonia asiatica	1									2				1
Cocos nucifera		3	1					1		1	1			
Erythrina variegata														
Hernandia nymphaeifolia	3	2	2	3	1	1		3						
Macaranga harveyana														
Morinda citrifolia														
Pisonia grandis														
Terminalia catappa														
Thespesia populnea				2					2	2		1		
Tournefortia argentea					1									
Total	4	5	3	5	2	1	0	4	2	5	1	1	0	1

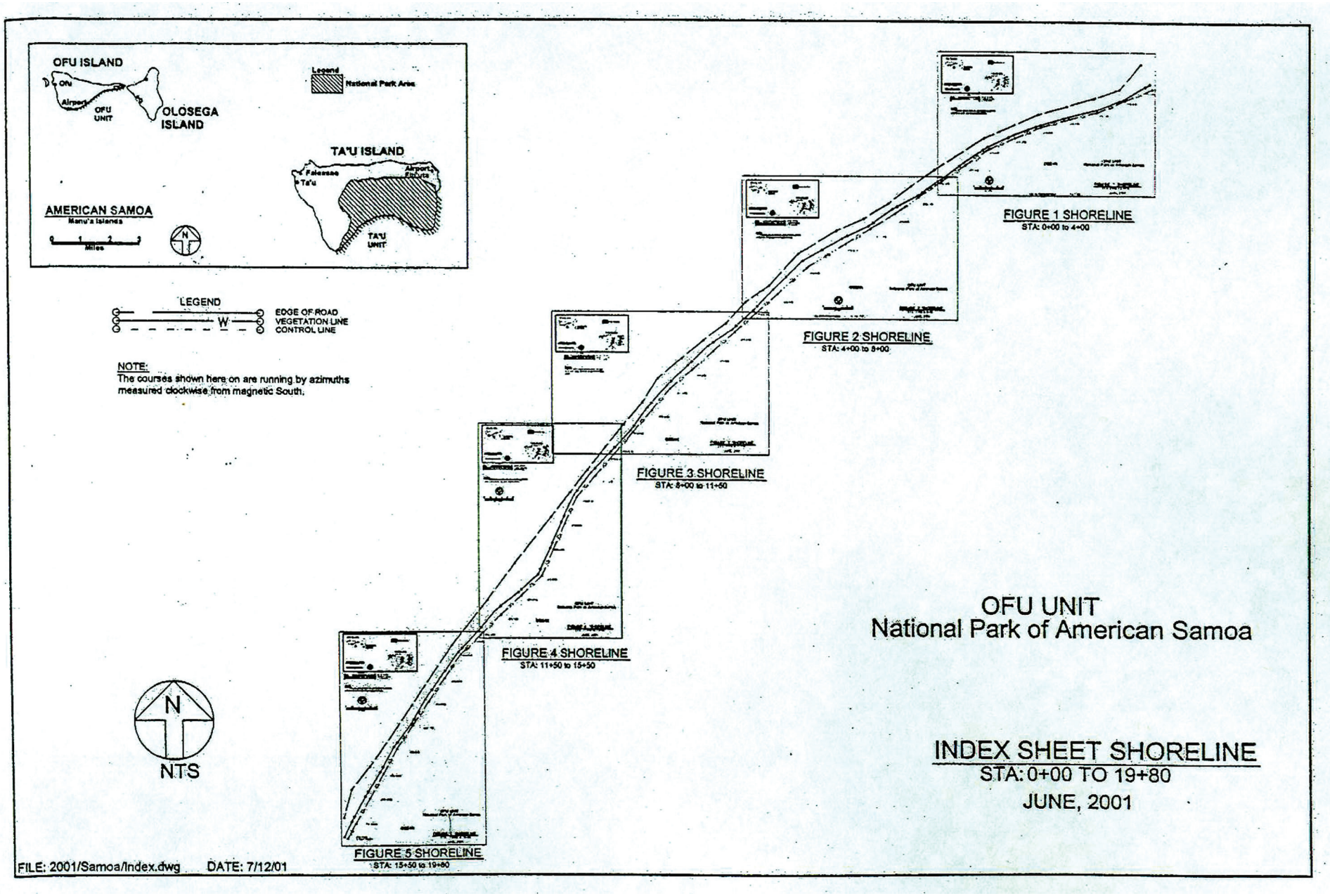
Plots	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Plot Coordinates	23+90-24+00	24+00-24+10	24+40-24+50	24+50-24+60	24+90-25+00	25+00-25+10	25+40-25+50	25+50-25+60	25+90-26+00	26+00-26+10	26+40-26+50	26+50-26+60	26+90-27+00	27+00-27+10
Artocarpus altilis													2	
Barringtonia asiatica		4	3	1				3	1		3	5	2	
Cocos nucifera			1				1	1						1
Erythrina variegata	2						1		2					
Hernandia nymphaeifolia		1	2			1	1		1	1	1	1		
Macaranga harveyana														
Morinda citrifolia		1	1						1					
Pisonia grandis														
Terminalia catappa														
Thespesia populnea				1	1					1	1			
Tournefortia argentea														
Total	2	6	7	2	1	1	3	4	5	2	5	6	4	1

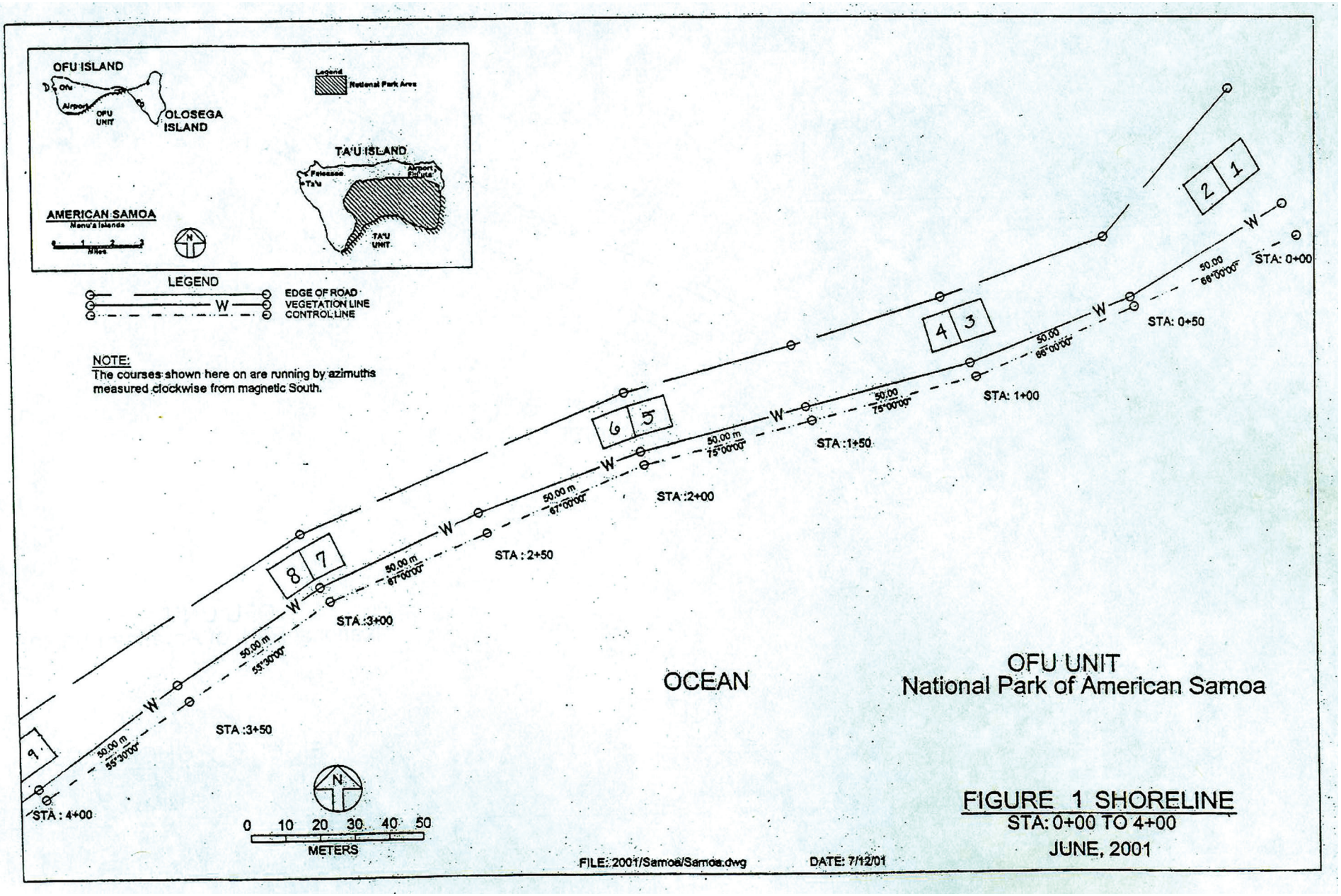
APPENDIX B-5. Toaga, Ofu: Number of trees with ≥ 5cm dbh in 40, 10m x 2m plots (Continued).

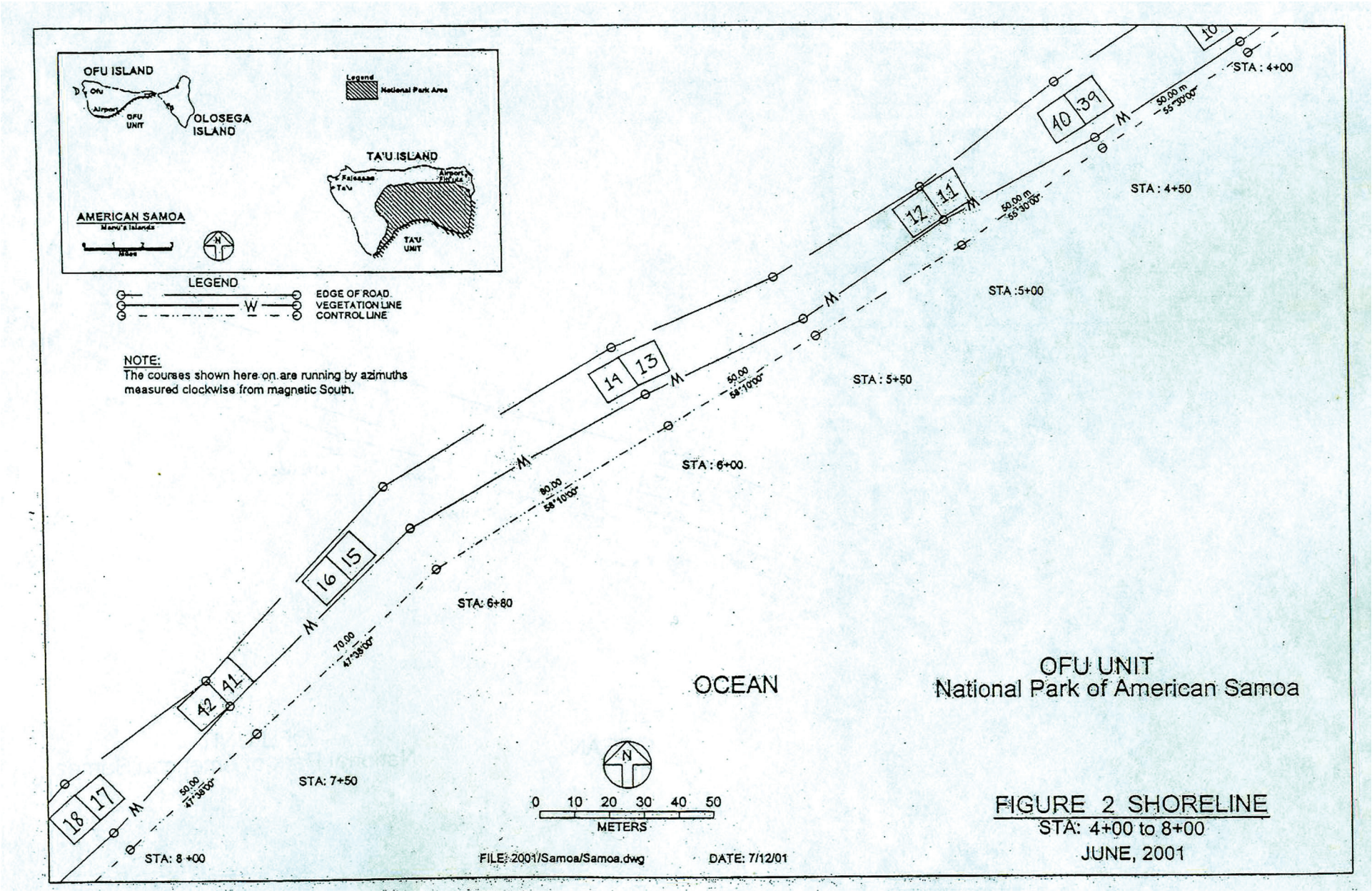
Plots	29	30	31	32	33	34	35	36	37	38	39	40	Total number of individuals	Total basal area
Plot Coordinates	27+40-27+50	27+50-27+60	27+90-28+00	28+00-28+10	28+40-28+50	28+50-28+60	28+90-29+00	29+00-29+10	29+40-29+50	29+50-29+60	29+90-30+00	30+00-30+10		
Artocarpus altilis													2	293.2
Barringtonia asiatica		1									5	1	33	21727.4
Cocos nucifera	1	1											13	8467.7
Erythrina variegata													5	928.4
Hernandia nymphaeifolia		1							1	1	1		28	63198.5
Macaranga harveyana			2										2	77.6
Morinda citrifolia			1						1				5	387.4
Pisonia grandis												2	2	4993.2
Terminalia catappa									1				1	320.3
Thespesia populnea	2		1	2					1				17	24530.6
Tournefortia argentea													1	34.2
Total	3	3	4	2	0	0	0	0	4	1	6	3	109	124958.5

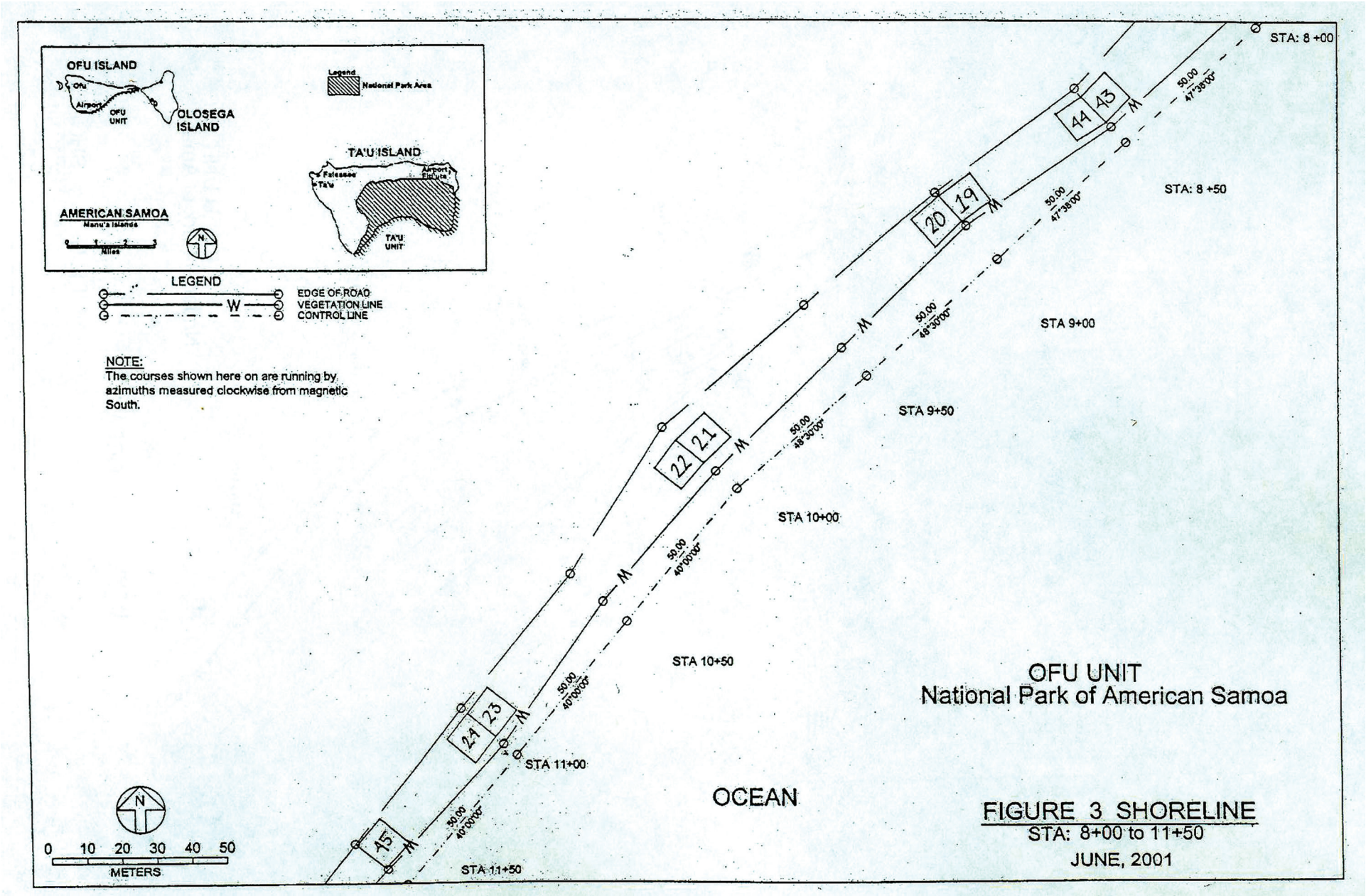
APPENDIX B-6. Toaga, Ofu: Total number of individuals and total dbh for 19 species inventoried in 50, 10m x 10m and 40, 10m x 2m plots.

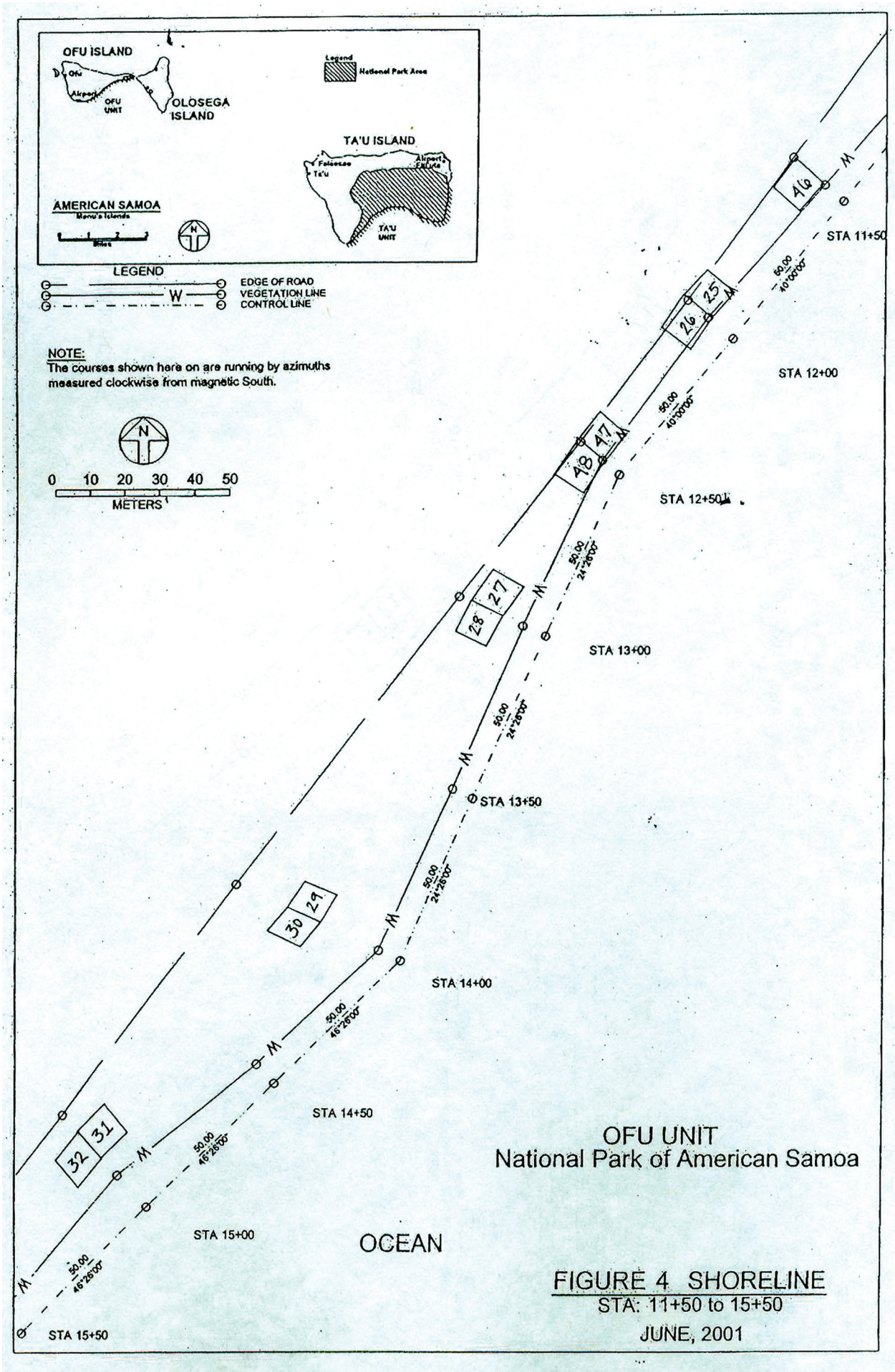
Species	Total number of individuals	Total basal area
Artocarpus altilis	7	1198.3
Barringtonia asiatica	42	41207.4
Cocos nucifera	120	78707.3
Cordia subcordata	1	38.5
Erythrina variegata	6	928.43
Geniostoma rupestre	1	73.7
Guettarda speciosa	25	4034.1
Hernandia nymphaeifolia	82	94707.3
Hibiscus tiliaceus	37	3486.1
Macaranga harveyana	5	350.0
Morinda citrifolia	6	417.6
Pandanus tectorius var. *tectorius*	56	14583.1
Pisonia grandis	3	5558.1
Scaevola taccada	2	45.0
Sophora tomentosa	2	74.3
Terminalia catappa	1	320.31
Terminalia samoensis	102	45017.9
Thespesia populnea	21	1956.7
Tournefortia argentea	7	1023.2
TOTAL	526	293727.3

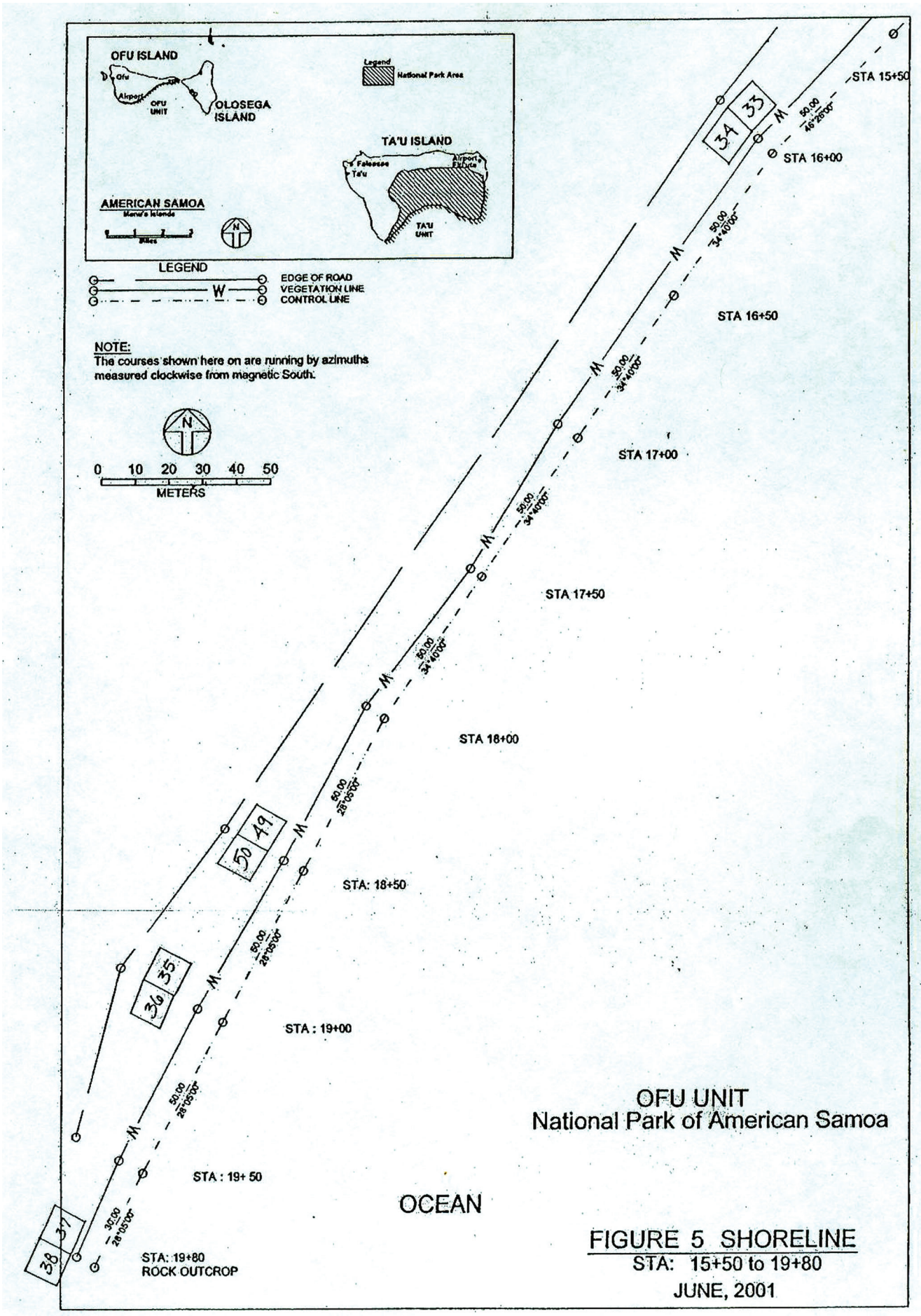

OFU ISLAND
OFU UNIT
OLOSEGA ISLAND
Legend
National Park Area
TA'U ISLAND
Airport
Faleasao
Ta'u
TA'U UNIT
AMERICAN SAMOA
Manu'a Islands
Miles
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
FIGURE 1 SHORELINE
STA: 0+00 to 4+00
FIGURE 2 SHORELINE
STA: 4+00 to 8+00
FIGURE 3 SHORELINE
STA: 8+00 to 11+50
FIGURE 4 SHORELINE
STA: 11+50 to 15+50
FIGURE 5 SHORELINE
STA: 15+50 to 19+80
N
NTS
OFU UNIT
National Park of American Samoa
INDEX SHEET SHORELINE
STA: 0+00 TO 19+80
JUNE, 2001
FILE: 2001/Samoa/Index.dwg
DATE: 7/12/01


OFU ISLAND
OLOSEGA ISLAND
OFU UNIT
TA'U ISLAND
TA'U UNIT
AMERICAN SAMOA
Manu'a Islands
Legend
National Park Area
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
STA: 0+00
STA: 0+50
STA: 1+00
STA :1+50
STA :2+00
STA : 2+50
STA :3+00
STA :3+50
STA : 4+00
50.00 m
66°00'00"
75°00'00"
67°00'00"
55°30'00"
OCEAN
OFU UNIT
National Park of American Samoa
0 10 20 30 40 50
METERS
FILE: 2001/Samoa/Samoa.dwg
DATE: 7/12/01
FIGURE 1 SHORELINE
STA: 0+00 TO 4+00
JUNE, 2001


OFU ISLAND
OLOSEGA ISLAND
OFU UNIT
Legend
National Park Area
TA'U ISLAND
TA'U UNIT
AMERICAN SAMOA
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
STA : 4+00
STA : 4+50
STA :5+00
STA : 5+50
STA : 6+00
STA: 6+80
STA: 7+50
STA: 8 +00
50.00 m 55°30'00"
50.00 58°10'00"
80.00 58°10'00"
70.00 47°30'00"
50.00 47°30'00"
OCEAN
OFU UNIT
National Park of American Samoa
0 10 20 30 40 50
METERS
FILE: 2001/Samoa/Samoa.dwg
DATE: 7/12/01
FIGURE 2 SHORELINE
STA: 4+00 to 8+00
JUNE, 2001


OFU ISLAND
Ofu
Airport
OFU UNIT
OLOSEGA ISLAND
Legend
National Park Area
TA'U ISLAND
Faleasao
Ta'u
Airport Ta'u
TA'U UNIT
AMERICAN SAMOA
Manu'a Islands
Miles
N
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
STA: 8 +00
STA: 8 +50
STA 9+00
STA 9+50
STA 10+00
STA 10+50
STA 11+00
STA 11+50
50.00
47°38'00"
48°30'00"
40°00'00"
M
44
43
20
19
22
21
24
23
A5
OCEAN
OFU UNIT
National Park of American Samoa
0 10 20 30 40 50
METERS
FIGURE 3 SHORELINE
STA: 8+00 to 11+50
JUNE, 2001


OFU ISLAND
OLOSEGA ISLAND
OFU UNIT
Legend
National Park Area
TA'U ISLAND
TA'U UNIT
AMERICAN SAMOA
Manu'a Islands
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
0 10 20 30 40 50
METERS
STA 11+50
STA 12+00
STA 12+50
STA 13+00
STA 13+50
STA 14+00
STA 14+50
STA 15+00
STA 15+50
OCEAN
OFU UNIT
National Park of American Samoa
FIGURE 4 SHORELINE
STA: 11+50 to 15+50
JUNE, 2001


OFU ISLAND
Ofu
Airport
OFU UNIT
OLOSEGA ISLAND
Legend
National Park Area
TA'U ISLAND
Faleasao
Ta'u
Airport
TA'U UNIT
AMERICAN SAMOA
Manu'a Islands
Miles
N
LEGEND
EDGE OF ROAD
VEGETATION LINE
CONTROL LINE
NOTE:
The courses shown here on are running by azimuths measured clockwise from magnetic South.
N
0 10 20 30 40 50
METERS
STA 15+50
STA 16+00
STA 16+50
STA 17+00
STA 17+50
STA 18+00
STA: 18+50
STA : 19+00
STA : 19+ 50
STA: 19+80
ROCK OUTCROP
OCEAN
OFU UNIT
National Park of American Samoa
FIGURE 5 SHORELINE
STA: 15+50 to 19+80
JUNE, 2001

APPENDIX C-1. Alei Plateau, Olosega: GPS, slope, elevation, and random plot locations for 10, 100m x 2m plots.

Transect number	GPS	Slope	Elevation (m)	Random Plots (distance in m from starting point of plot)	
1	S 14° 09.446 W 169° 36.756	-	190	41	97
2	S 14° 09.495 W 169° 36.788	25°	210	39	99
3	S 14° 09.449 W 169° 36.741	4°	190	28	72
4	S 14° 09.394 W 169° 36.957	22°	240	23	69
5	S 14° 09.489 W 169° 36.708	-	245	4	68
6	S 14° 09.518 W 169° 36.877	-	270	28	86
7	S 14° 09.588 W 169° 36.857	-	270	4	89
8	S 14° 09.650 W 169° 36.879	30°	290	38	87
9	S 14° 09.676 W 169° 36.897	30°	340	48	73
10	S 14° 09.676 W 169° 36.897	35°	340	25	71

APPENDIX C-2. Alei Plateau: Number of trees with ≥ 5cm dbh in 10, 100m x 2m plots.

Species/Plots	1	2	3	4	5	6	7	8	9	10	Total number of individuals	Total basal area
Aglaia samoensis										1	1	28.3
Alphitonia zizyphoides	3	5		7	10	1	5	6	3	4	44	7079.7
Artocarpus altilis	2	2	6	1	2						13	1338.0
Barringtonia asiatica								3		3	6	2194.0
Bischofia javanica		1	1	4				2			8	1338.0
Calophyllum neo-ebudicum						6	1	1		2	10	6652.7
Cocos nucifera	6	2	1	1	3						13	7035.2
Diospyros elliptica						6	2	2			10	538.5
Diospyros samoensis		4		2	2		3	5	3	3	22	1365.1
Dysoxylum samoense	5	3	4	2				1			15	2852.8
Elattostachys falcata	1	5	1	3	2	1		2			15	1061.0
Ficus scabra	1	1	4		2					1	9	602.4
Flacourtia rukam	1	1	1	7	6	3		3		1	23	1227.4
Garcinia myrtifolia						1					1	19.6
Garuga floribunda		5									5	897.5
Geniostoma rupestre	1	2	1	4	2			1		1	12	719.8
Glochidion ramiflorum		1	1	7	7	11		4		1	32	4719.2
Hibiscus tiliaceus	7	3		4	6	5	12	16	11	16	80	12635.5
Inocarpus fagifer	5	6	5	3	1					1	21	16172.0
Mangifera indica		1	4								5	5622.8
Morinda citrifolia	4	1	2	2	1		1				11	380.1
Myristica inutilis var. *inutilis*					1		2	7	10	4	24	2871.1
Planchonella garberi					1	8	11	2	2		24	2362.9
Rhus taitensis	2	1		2	2		7		5	2	21	5437.5
Sterculia fanaiho	1		2					1	2	2	8	878.2
Syzygium clusiifolium						1	2		1		4	1456.9
Syzygium dealatum						15	12	1	3	3	34	6982.0
Syzygium inophylloides						4	1		1	1	7	1085.7
Syzygium samarangense									1		1	172.4
Tarenna sambucina	4	2	6	1	2	1			1		17	1410.6
Total	43	46	39	50	50	63	59	57	43	46	496	97136.8

Appendix C-3. Alei Plateau, Olosega: Number of trees <5cm dbh, vines, herbs, and seedlings in 20 random 2m^2 supbplots (two per plot).

Species/Plots	1	2	3	4	5	6	7	8	9	10	Total number of individuals
Alyxia bracteolosa				5		1		1	3	15	25
Alyxia sp.						9	6			1	16
Alyxia stellata	1	1	9		5	1	1				18
Antrophyum plantagineum										12	12
Asplenium nidus										8	8
Calophyllum neo-ebudicum					1	5		1		6	13
Centotheca lappacea			8								8
Christella harveyi				1							1
Cordyline fruticosa			2	3	4	4		1	4		18
Davallia solida						8	25				33
Derris malaccensis	1										1
Dioscorea bulbifera							1	1			2
Diospyros elliptica						2	4				6
Diospyros samoensis	3	8	6	1	22		8	9	3	7	67
Dysoxylum samoense										1	1
Elattostachys falcata		25	5	14	2		5				51
Embelia vaupelii									4		4
Euodia hortensis					1						1
Faradaya amicorum	4		1					8	7	1	21
Ficus scabra				1				1		1	3
Flacourtia rukam								1			1
Glochidion cuspidatum				1							1
Glochidion ramiflorum			1			1	1				3
Gynochthodes epiphytica	1									4	5
Hoya australis						2					2
Humata heterophylla							1				1

Inocarpus fagifer		2			3						5

Appendix C-3. Alei Plateau, Olosega: Number of trees <5cm dbh, vines, herbs, and seedlings in 20 random

Species/Plots	1	2	3	4	5	6	7	8	9	10	Total number of individuals
Ipomoea macrantha				8							8
Ixora samoensis			2	3	1						6
Jasminum didymum	1				1	5	2				9
Mikania micrantha						1					1
Morinda citrifolia		2	1								3
Myristica inutilis var. *inutilis*									2	1	3
Nephrolepis biserrata			2			6	1				9
Phymatosorus grossus					5					1	6
Piper graeffii										4	4
Planchonella garberi					2	7	1			3	13
Premna serratifolia							1				1
Psychotria insularum	4			2		1	4				11
Rhus taitensis					1		1		4	1	7
Rourea minor							1			3	4
Schizaea dichotoma			1		5	2	1	12	1		22
Scleria lithosperma			1				2				3
Sterculia fanaiho	1									1	2
Syzygium clusiifolium							2				2
Syzygium dealatum	3				1		1				5
Syzygium inophylloides										1	1
Syzygium samoense				5							5
Tarenna sambucina			2	1				1		1	5
Vigna adenanthera			1								1
Zingiber zerumbet	15		6		8	2					31
Total	35	40	51	49	67	63	76	44	37	82	489

APPENDIX D-1. Olosega Agroforest, Olosega: GPS, slope, elevation, and random plot locations for 5, 100m x 2m plots.

Transect number	GPS	Slope	Elevation (m)	Random Plots distance in m from starting point of transect	
1	S14º10.687 W169º37.333	5º	2	24	94
2	S14º10.614 W169º37.367	10º-20º	4 to 6	5	67
3	S14º10.584 W169º37.370	25º	8 to 12	37	72
4	S14º10.528 W169º37.381	5º	5	40	70
5	S14º10.511 W169º37.392	20º	4	41	63

APPENDIX D-2. Olosega Agroforest, Olosega: Number of trees with ≥ 5cm dbh in 10, 100m x 2m plots.

Plots	1	2	3	4	5	Total number of individuals	Total basal area
Artocarpus altilis (<5cm DBH)	12	1	7	6	6	32	-
Musa x *paradisica*	19	91	110	33	80	333	-
Artocarpus altilis (>5cm DBH)	13	2	3	5	1	24	14781.6
Citrus aurantifolia	1					1	98.5
Citrus sinensis				2		2	266.1
Cocos nucifera	1		2			3	1772.6
Dysoxylum samoense	1					1	34.2
Hibiscus tiliaceus	1					1	2339.7
Macaranga harveyana	2					2	282.4
Omalanthus nutans					1	1	208.6
Total	19	2	5	7	2	35	19783.62

APPENDIX D-3. Olosega Agroforest, Olosega: Number of trees <5cm dbh, vines, herbs, and seedlings in 10 random 2m2 subplots ((2 subplots/100m plot).

Plots	1	2	3	4	5	Total number of individuals
Ageratum conizoides				1		1
Alocasia macrorrhiza				1	1	2
Alpinia atropurpurea					1	1
Artocarpus altilis					1	1
Carica papaya			1			1
Centella asiatica				1		1
Centotheca lappacea					1	1
Christella harveyi	1	3				4
Clerodendrum buchananii var. *fallax*		1				1
Cocos nucifera	1	1				2
Colocasia esculenta			2		1	3
Cyperus cyperinus		1				1
Dioscorea bulbifera					1	1
Dysoxylum samoense	2				2	4
Epipremnum pinnatum	3	2				5
Ficus scabra			1			1
Mikania micrantha	1	3	4	2	4	14
Morinda citrifolia	1		1	1		3
Musa x paradisica		1		1		2
Nephrolepis hirsutula	2	2		4	2	10
Oplismenus compositus	3	2	2		1	8
Pandanus tectorius var. *tectorius*		1				1
Ruellia prostrata			1			1
Stenotaphrum micranthum	1		1	2	2	6
Synedrella nodiflora			1			1
Vigna marina			2			2
Total	15	17	16	13	17	78

APPENDIX E-1. Saua, Ta'u: Coordinates, plots, GPS, compass headings, and random plot locations for 11, 250m x 2m plots.

Plot	Plot	Subplots	Plot Coordinates	GPS	Compass	Random Plots
1	0-250m	1	0-50	S14°14.012 W169°25.295	192°S	15
		2	50-100	S14°14.038 W169°25.303	170°S	8
		3	100-150	S14°14.058 W169°25.295	186°S	22
		4	150-200	S14°14.102 W169°25.296	186°S	25
		5	200-250	S14°14.126 W169°25.298	184°S	18
2	250-500m	6	250-300	S14°14.150 W169°25.305	184°S	6
		7	300-350	S14°14.179 W169°25.303	192°S	13
		8	350-400	S14°14.200W169°25.290	192°S	10
		9	400-450	S14°14.231W169°25.312	164°S	14
		10	450-500	S14°14.249 W169°25.292	164°S	4
3	500-750m	11	500-550	S14°14.277 W169°25.296	186°S	2
		12	550-600	S14°14.309 W169°25.297	186°S	1
		13	600-650	S14°14.330 W169°25.294	186°S	10
		14	650-700	S14°14.354 W169°25.300	176°S	25
		15	700-750	S14°14.396 W169°25.309	176°S	25
4	750-1000m	16	750-800	S14°14.414 W169°25.304	176°S	16
		17	800-850	S14°14.453 W169°25.315	176°S/157°S	7
		18	850-900	S14°14.478 W169°25.309	157°S	6
		19	900-950	S14°14.492 W169°25.295	157°S	16
		20	950-1000	S14°14.512 W169°25.302	157°S	14
5	1000-1250m	21	1000-1050	S14°14.549 W169°25.280	184°S	1
		22	1050-1100	S14°14.574 W169°25.285	170°S	6
		23	1100-1150	S14°14.604 W169°25.285	170°S	3
		24	1150-1200	S14°14.624 W169°25.281	170°S	15
		25	1200-1250	S14°14.666 W169°25.286	170°S	16

APPENDIX E-1. Saua, Ta'u: Coordinates, plots, GPS, compass headings, and random plot locations for 11, 250m x 2m plots (Cont).

Plot	Plot Coordinates	Subplots	Plot Coordinates	GPS	Compass	Random Plots
6	1250-1500m	26	1250-1300	S14º14.699 W169º25.292	200ºS	5
		27	1300-1350	S14º14.722 W169º25.269	200ºS	16
		28	1350-1400	S14º14.730 W169º25.303	200ºS	16
		29	1400-1450	S14º14.755 W169º25.306	200ºS	8
		30	1450-1500	S14º14.794 W169º25.317	186ºS	2
7	1500-1750m	31	1500-1550	S14º14.810 W169º25.320	164ºS	13
		32	1550-1600	S14º14.822 W169º25.309	198ºS	21
		33	1600-1650	S14º14.856 W169º25.318	198ºS	22
		34	1650-1700	S14º14.884 W169º25.340	194ºS	10
		35	1700-1750	S14º14.919 W169º25.349	194ºS	8
8	1750-2000m	36	1750-1800	S14º14.940 W169º25.345	174ºS	19
		37	1800-1850	S14º14.979 W169º25.346	174ºS	25
		38	1850-1900	S14º14.918 W169º25.344	174ºS	20
		39	1900-1950	S14º15.038 W169º25.349	144º/192ºS	12
		40	1950-2000	S14º14.968 W169º25.347	190ºS	16
9	2000-2250m	41	2000-2050	S14º15.076 W169º25.345	186ºS	4
		42	2050-2200	S14º15.111 W169º25.335	186ºS	9
		43	2200-2250	S14º15.126 W169º25.367	186ºS	21
		44	2250-2200	S14º15.143 W169º25.364	186ºS	23
		45	2200-2250	S14º15.191 W169º25.379	206ºS	12
10	2250-2500m	46	2250-2300	S14º15.202 W169º25.386	205ºS	16
		47	2300-2350	S14º15.210 W169º25.392	205ºS	2
		48	2350-2400	S14º15.246 W169º25.413	190ºS	16
		49	2400-2450	S14º15.279 W169º25.391	190ºS	20
		50	2450-2500	S14º15.302 W169º25.392	194ºS	24
11	2500-2750m	51	2500-2550	S14º15.332 W169º25.417	228ºS	9
		52	2550-2600	S14º15.357 W169º25.411	228ºS	18
		53	2600-2650	S14º15.375 W169º25.428	230ºS	11
		54	2650-2700	S14º15.400 W169º25.467	287ºW	10
		55	2700-2750	S14º15.392 W169º25.505	287ºW	4

APPENDIX E-2. Saua, Ta'u: Number of trees with ≥ 5cm dbh in a 2750m x 2m plot.

Plots	1	2	3	4	5	6	7	8	9	10	11	Total	
Transect Coordinates	0-250m	250-500m	500-750m	750-1000m	1000-1250m	1250-1500m	1500-1750m	1750-2000m	2000-2250m	2250-2500m	2500-2750m	number of individuals	Total basal area
Artocarpus altilis	2		3				1	2	15			23	9653.6
Barringtonia asiatica					3	9						12	18365.4
Carica papaya					3	8						11	855.6
Cocos nucifera	1	1	4	3		1		1	1			12	9234.9
Diospyros samoensis	3				5	10	15			23	1	57	7478.6
Dysoxylum samoense	2	6	9	21	10	18	14	7	17	5	12	121	36370.2
Ficus scabra	12	13	9	9		2	3	4	2	3	9	66	11808.3
Glochidion ramiflorum									1			1	160.7
Hernandia nymphaeifolia									5			5	19748.8
Hibiscus tiliaceus	4	2		1	7				2	5	6	27	3181.8
Macaranga harveyana	5		3	4	6		1	20		5	5	49	7055.0
Morinda citrifolia	1			3	1		4	12	9	5	1	36	3276.5
Mucuna gigantea										3		3	62.9
Pandanus tectorius var. *laevis*										1	1	2	624.6
Pipturus argenteus	2		14	1		1	2				7	27	2647.1
Pisonia grandis	1	3		1		4	14	11	4	19	16	73	72250.2
Pisonia umbellifera											1	1	56.7
Sterculia fanaiho											3	3	1833.9
Syzygium dealatum											1	1	63.6
Terminalia catappa											1	1	860.1
Total	33	25	42	43	35	53	54	57	56	69	64	531	205588.3

APPENDIX E-3. Saua, Ta'u: Number of trees <5cm dbh, vines, herbs, and seedlings in 22 random $2m^2$ plots.

Plots	1	2	3	4	5	6	7	8	9	10	11	
Transect Coordinates	0-250m	250-500m	500-750m	750-1000m	1000-1250m	1250-1500m	1500-1750m	1750-2000m	2000-2250m	2250-2500m	2500-2750m	Total number of individuals
Alocasia macrorrhiza	2	1	2	1		1						7
Alyxia stellata										1		1
Ananas comosus					1							1
Arthropteris repens		2		2								4
Artocarpus altilis	3								3			6
Asplenium marattioides		2		3	1							6
Asplenium nidus	1	6	1	4	6	6	5	4	7	8	5	53
Asplenium sp.		1										1
Barringtonia asiatica					3	2				1		6
Capsicum frutescens				1								1
Cocos nucifera	1						1					2
Derris trifoliata		1	1	2								4
Dioscorea alata			2		3							5
Dioscorea bulbifera		1										1
Diospyros samoensis						3		1	6	11	2	23
Dysoxylum samoense	6	5	5	12	6	4	9	17	11	5	3	83
Epipremnum pinnatum	3	6	3	6	5	7	9	8	8	8	5	68
Faradaya amicorum				2								2
Ficus scabra	5	2	1	6			2	2	3			21
Ficus tinctoria							2				1	3
Glochidion ramiflorum				1								1
Hernandia nymphaeifolia	1						1					2
Hibiscus tiliaceus	1		4									5
Hoya australis				1		4				2		7
Hoya pottsii				2								2
Ipomoea macrantha	1	2	4	2	2	6	3		1	3	8	32
Justicia procumbens				1								1
Macaranga harveyana					1			5				6

APPENDIX E-3. Saua, Ta'u: Number of trees <5cm dbh, vines, herbs, and seedlings in 22 random 2m^2 plots (Continued).

Plots	1	2	3	4	5	6	7	8	9	10	11	
Transect Coordinates	0-250m	250-500m	500-750m	750-1000m	1000-1250m	1250-1500m	1500-1750m	1750-2000m	2000-2250m	2250-2500m	2500-2750m	Total number of individuals
Mikania micrantha	4	2	6	2	4	2		1				21
Morinda citrifolia	1	1	1	3	1		2	3	5			17
Mucuna gigantea									4	1	4	9
Musa × paradisica	1	1					1					3
Myristica fatua				1								1
Nephrolepis hirsutula			5		2		1	2				10
Oplismenus hirtellus	3			1			1					5
Peperomia pellucida	1											1
Phymatosorus grossus					2	1	4	1	2	1		11
Piper graeffei	2	3	1	7	4	2	2		4	5		30
Pipturus argenteus	1		2					1				4
Pisonia grandis				2	2	1	3		2	4	5	19
Psychotria insularum				1	1							2
Ruellia prostrata		2		1				2				5
Sphaerostephanos sp.			1	1		1		2				5
Sterculia fanaiho										1		1
Syzygium dealatum				2		3				1	1	7
Tectaria stearnsii		3	2	4	2					1		12
Zehnaria samoensis	1		1		1			1	2		1	7
Zingiber zerumbet	3											3
Total	41	41	42	71	47	43	46	50	58	53	35	527

APPENDIX E-4. Saua, Ta'u: Coordinates, plots, GPS, and compass headings, and random plot locations

Plot number	Plot Coordinates (distance in m from starting point of plot)	GPS	Compass heading
1	0	S14º14.012 W169º25.295	102ºE 282º W
2	250	S14º14.150 W169º25.305	94ºE 264º W
3	500	S14º14.277 W169º25.296	15ºE 195º W
4	750	S14º14.277 W169º25.296	86ºE 266º W
5	1000	S14º14.549 W169º25.280	67ºE 246º W
6	1250	S14º14.699 W169º25.292	80ºE 260º W
7	1500	S14º14.810 W169º25.320	67ºE 320º W
8	1750	S14º14.940 W169º25.345	104ºE 345º W
9	2000	S14º15.076 W169º25.345	100ºE 280º W
10	2250	S14º15.202 W169º25.386	116ºE 296º W
11	2500	S14º15.332 W169º25.417	104ºE 284º W
12	2750	S14º15.403 W169º25.529	197ºE 277º W

APPENDIX E-5. Saua, Ta'u: Number of trees with ≥ 5cm dbh in 12 lateral 40m x 2m plots.

Transect Coordinates	1 0m	2 250m	3 500m	4 550m	5 1000m	6 1250m	7 1500m	8 1750m	9 2000m	10 2250m	11 2500m	12 2750m	Total number of individuals	Total basal area
Artocarpus altilis	6												6	1341.6
Barringtonia asiatica						3	4						7	1780.7
Carica papaya								1					1	47.8
Cocos nucifera	1												1	314.0
Diospyros samoensis						1	1			4	2		8	796.7
Dysoxylum samoense		1		5			7	5	1	3		1	23	4511.7
Ficus scabra				4				1		3		1	9	543.1
Ficus tinctoria												1	1	26.4
Guettarda speciosa									1				1	87.7
Hernandia nymphaeifolia										1			1	2844.9
Hibiscus tiliaceus		4	1									4	9	1948.5
Macaranga harveyana	4		1		1						1	3	10	1505.9
Morinda citrifolia							2		1			1	4	236.5
Pipturus argenteus				1									1	29.2
Pisonia grandis		1			2	1	3				5	5	17	28435.1
Tarenna sambucina				1									1	149.5
Total	11	6	2	11	3	5	17	7	3	11	8	16	100	44599.2

APPENDIX E-6. Saua, Ta'u: Total number of individuals and total dbh for 19 species inventoried in a 2750m x 2m and 12, lateral 40m x 2m plots.

Species	Total number of individuals	Total basal area
Artocarpus altilis	29	10995.2
Barringtonia asiatica	19	20146.1
Carica papaya	12	903.3
Cocos nucifera	13	9548.9
Diospyros samoensis	65	8275.3
Dysoxylum samoense	144	40881.9
Ficus scabra	75	12351.4
Ficus tinctoria	1	26.4
Glochidion ramiflorum	1	160.7
Guettarda speciosa	1	87.7
Hernandia nymphaeifolia	6	22593.6
Hibiscus tiliaceus	36	5130.3
Macaranga harveyana	59	8560.9
Morinda citrifolia	40	3513.0
Mucuna gigantea	3	62.9
Pandanus tectorius var. *laevis*	2	624.6
Pipturus argenteus	28	2676.3
Pisonia grandis	90	100685.3
Pisonia umbellifera	1	56.7
Sterculia fanaiho	3	1833.9
Syzygium dealatum	1	63.6
Tarenna sambucina	1	149.5
Terminalia catappa	1	860.1
TOTAL	631	250187.5

APPENDIX F. RECORDED ETHNOBOTANICAL INTERVIEWS AND CULTURAL ACTIVITIES.
For each DVD the activities documented and/or persons interviewed, place of residence, and date and location of interview/activity are provided. Tracks are listed in the main menu of each DVD and numbered sequentially. The length of each track is provided in minutes and seconds. Time code windows are inserted in the lower portion of the image with the clock set to hours, minutes, seconds, and frames. This gives a precise time location for each element of video providing an absolute reference to actual frame numbering on the original material. Because of this, each track of the DVD does not necessarily begin at 00:00. Segments are used to identify time code discontinuities in the original material. Also included is a summary of the contents of each DVD, names of interviewers, and the language(s) spoken, with the predominant language listed first. A total of 23 hours and 10 minutes of footage is included on 13 DVDs.

DVD 1
Timu (Joe) Alatogo Tagoilelagi, Vatia Village, Tutuila.
Location: Vatia Village, Tutuila.
September 4, 2002
Track 1. Length: 47:55
Track 2. Length: 1:24
Discussion of changes in the village, fishing, farming practices.
Interviewed by Diane Ragone, Jim Wiseman, Epi Suafo'a.
English.

Mrs. Unita Saleamua Hall, Vatia Village, Tutuila.
Location: Vatia Village, Tutuila.
September 4, 2002.
Track 3. Length: 52:43
Discussion of changes in the village, farming practices, food.
Interviewed by Diane Ragone, Jim Wiseman, Epi Suafo'a.
Samoan, English.

DVD 2
Potasi Fagaese, Ofu Village, Ofu.
Location: Toaga, Ofu.
June 14, 2001.
Track 1. Length: 41:14
Discussion of traditional fishing practices.
Interviewed by Tavita Togia, Jim Wiseman.
Samoan.

Location: Asaga, Olosega
June 20, 2001.
Track 2. Length: 43:00
Discussion of traditional fishing practices.

Interviewed by Jim Wiseman, Elizabeth Laolagi.
Samoan and English.

DVD 3
Location: Ofu Village, Ofu.
Track 1. Segment 1. Length: 53:34
Track 1. Segment 2. Length: 5:37
April 17, 2001.
Documentation of Potasi Fagaese and villagers using traditional methods to catch atule with tu'i and lau.Approximately 5,000 fish caught this day. Earlier in season, approximately 25,000 were caught in one day.
Samoan.

Location: Ofu Village, Ofu.
Track 2. Length: 4:43
Documentation of Potasi Fagaese and villagers; distributing atule catch.
Samoan.

Mrs. Ola Aloese, Ofu Village, Ofu.
Location: Asaga, Olosega.
June 13, 2001.
Track 3. Length: 49:56
Demonstration of making a traditional sleeping mat made of coconut frond, also used to construct fishing basket for catching atule.
Interviewed by Jim Wiseman.
Samoan and English.

DVD 4
Location: Ofu Village, Ofu.
April 18, 2001.
Track 1. Length: 11:04
Documentation of Ofu villagers using traditional methods to catch atule. No fish caught this day. Samoan.

Mrs. Simeamativa Tautala, Olosega Village, Olosega.
Location: Olosega Village, Olosega.
April 24, 2001.
Track 2. Length: 45:44
Track 3. Length: 14:35
Discussion and recollections of life in village, working on farms on Mataala, changes in the village and lifestyle. How to weave pandanus into mats.
Interviewed by Diane Ragone, Jim Wiseman, Tafue Tautala.
Samoan and English.

DVD 4 (continued)
Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Asaga, Olosega.
June 20, 2001.
Track 4. Length: 47:55
Discussion and demonstration of using anaoso (*Caesalpinia major*) to make a traditional snare to catch flying foxes.
Interviewed by Jim Wiseman, Sandra Banack.
English.

DVD 5
Fa'agogo Mika Viliamu, Ofu Village, Ofu.
Location: Ofu Village, Ofu.
June 11, 2001.
Track 1. Length: 39:46
Track 2. Length: 14:16
Discussion of plants of the Manu'a Islands: plant names, traditional uses.
Interviewed by Taviti Togia, Jim Wiseman.
Samoan.

Malaga Faga Lata Tau, Sili Village, Olosega.
Ola Aloese, Ofu Village
Location: Asaga, Olosega.
June 13, 2001.
Track 3: Segment 1: 6:39 – harvesting coconut leaves
Track 3: Segment 2: 11:07 – making items
Discussion and demonstration of various uses for coconut leaves: making baskets, whisk broom.
Interviewed by Jim Wiseman.
English and Samoan.

DVD 6
Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Toaga, Ofu.
June 13, 2001.
Track 1. Length: 50:14
Discussion of the names of plants in the strand vegetation at Toaga and how they are traditionally used.
Interviewed by Tavita Togia and Jim Wiseman.
Samoan.

Seufalemua Fa'asamala Puletasi, Olosega Village, Olosega.
Location: Asaga, Olosega.
June 15, 2001.

Track 2: Length: 63:08
Discussion of plants, fish, Olosega Village.
Interviewed by Tavita Togia and Jim Wiseman.
Samoan.
DVD 7
Sega Apisai Atoe, Fitiuta Village, Ta'u.
Location: Fitiuta Village, Ta'u.
April 15, 2001.
Track 1. Length: 48:42
Discussion of Fitiuta village, the National Park of American Samoa.
Interviewed by Gaugau Tavana, Diane Ragone, Jim Wiseman.
Samoan.

Paopao Faresa, Fitiuta Village, Ta'u
Location: Fitiuta Village, Ta'u.
June 6, 2002.
Track 2. Length: 62:26
Discussion of Fitiuta village, farming on the mountain, traditional house construction.
Interviewed by Epi Suafo'a, Mino Fualau, Diane Ragone, Jim Wiseman.
Samoan and English.

DVD 8
Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Sili Village, Olosega.
June 21, 2001.
Track 1. Length: 46:36
Demonstration of constructing a traditional fishing basket (enu) and the materials used.
Interviewed by Jim Wiseman.
Samoan and English.

Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Sili Village, Olosega.
June 22, 2001.
Track 2. Length: 8:22
Demonstration of soaking *Freycinetia* (ie ie) vines used to make the enu; placing an enu in the ocean.
Interviewed by Jim Wiseman.
Samoan and English.

Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Sili Village, Olosega.
August 18, 2002.
Track 3. Length: 28:25
Track 4: Length: 25:51

Demonstration and discussion of how enu construction evolved with examples of various enu; where to find materials to make an enu.
Interviewed by Jim Wiseman and Diane Ragone.
English and Samoan.

DVD 8 (continued)
Malaga Faga Lata Tau, Sili Village, Olosega.
Location: Sili Village, Olosega.
August 18, 2002.
Track 5. Length: 13:35
Discussion of cultural changes, importance of preserving and recording traditional practices and knowledge.
Interviewed by Jim Wiseman and Diane Ragone.
Samoan and English.

DVD 9
Fale Laulii Lauofo, Sega Apisai Atoe, Fitiuta Village, Ta'u.
Location: Fitiuta Village, Ta'u.
April 14, 2001.
Track 1. Length: 28:51
Demonstration of food preparation: Grating taro to make fa'ausi, husking coconuts, preparing an **umu**, cooking fire, splitting and grating coconuts.
Track 2. Segment 1: Length: 23:43.
Demonstration of food preparation: grating coconuts, wrapping taro paste in banana leaves, straining coconut cream, cleaning and peeling breadfruit, heating coconut milk with hot rocks to make sauce for fa'ausi. Scalding a pig on an umu.
Track 2. Segment 2: Length: 0:30
Cleaning a pig.
Track 3. Length: 27:59
Cleaning (continued) and stuffing the pig with leaves; placing pig, breadfruit, taro, and fa'ausi on umu to cook; opening umu and removing cooked food, and opening banana leaves to remove fa'ausi.
Track 4. Length: 7:01
Final preparation of fa'ausi; cutting and covering with browned coconut cream sauce.
Samoan and English.

Ta'aga Faleali'i Tagaloa, Fitiuta Village, Ta'u.
Location: Fitiuta Village, Ta'u.
May 29, 2002.
Track 5. Length: 23:21
Discussion of various plants and traditional uses, especially the names and importance of the different names for, and types of *Piper methysticum* ('ava).
Interviewed by Epi Suafo'a, Diane Ragone, Jim Wiseman.
Samoan and English.

Papu Tosi, Fitiuta Village, Ta'u.
Location: Fitiuta Village, Ta'u.
May 29, 2002.
Track 6. Length: 8:10
Discussion of uses of *Bischofia javanica* (oa) and *Erythrina variegata* (gatae) and how its flowering season is related to fishing seasons.
Interviewed by Epi Suafo'a, Diane Ragone, Jim Wiseman.
Samoan and English.
DVD 10
Lesa Lata Tau, Sili Village, Olosega
Location: Asaga, Olosega.
June 22, 2001.
Track 1. Length: 42:42
Demonstration of weaving a fine mat from pandanus.
Interviewed by Elizabeth Laolagi, Diane Ragone, Jim Wiseman
Samoan.

Malaga Faga Lata Tau, Sili Village, Olosega.
June 1, 2002.
Location: Toaga, Ofu
Track 2. 1:58
Demonstration of enu construction on beach; closeup and wide shots.
Track 3. 65:58
Demonstration of enu construction on beach.
Interviewed by Jim Wiseman.
English and Samoan.

DVD 11
Suafo'a Velio
Location: Leone Village, Tutuila.
September 2, 2002.
Track 1. Length: 54:19
Discussion of life in Leone, siapo designs, fishing, plant uses, cultural changes.
Interviewed by Epi Suafo'a, Diane Ragone, Jim Wiseman.
Samoan and English.

Uelese Tuailevao, Leone Village, Tutuila.
Location: Leone Village, Tutuila.
September 2, 2002.
Track 2. Segment 1. Length: 39:20
Track 3. Segment 2. Length: 22:20
Discussion of farming practices, cultural changes, traditional tattooing.
Track 4. Length: 10:20

Discussion of traditional tatooing continued.
Interviewed by Epi Suafo'a, Diane Ragone, Jim Wiseman.
Samoan and English.

DVD 12
Mrs. Adeline Pritchard Jones, Pago Pago, Tutuila.
Mrs. Marilyn Pritchard Walker, Vaitogi Village, Tutuila.
Location: Vaitogi Village, Tutuila.
September 5, 2002.
Track 1. Segment 1. Length: 50:17
Demonstration and discussion of traditional siapo making: bark cloth, plants and other materials use to prepare dyes, and implements, such as pounders and scrapers, that are used.
Track 1. Segment 2. Length: 6:38
Demonstration of rubbing technique using an upeti for the pattern; applying dyes and colors. Demonstration of the free-hand technique; applied to a board.
Track 2. Length: 37:51
Wide angle shots of dyes and rubbing techniques shown in Track 1. Discussion of artwork using designs derived from tatoo, comparing these to siapo designs, and origins of designs.
Track 3. Length: 25:55
Demonstration of free-hand technique continued. Examples of finished siapo and Closeups of natural dye materials, implements, plants and other natural materials that provide design symbols for the pounding boards (upeti).
English.

DVD 13
Sven Ordquist, Leone Village, Tutuila.
Location: Leone Village, Tutuila.
September 6, 2002.
Track 1. Length: 56:00
Track 2. Length: 19:00
Discussion of traditional Samoan wood carving, forest trees, conservation, education, his artistic training and wood carving practice.
Interviewed by Epi Suafo'a, Diane Ragone, Jim Wiseman.
English.