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Vegetation and Flora of the Aleipata Islands, Western Samoa[1]

W. ARTHUR WHISTLER[2]

ABSTRACT: The botany of four small, relatively undisturbed tuff cone islands off the east coast of Upolu, Western Samoa, is examined. During a series of visits to the islands, the vegetation was studied in nine sample plots, and a checklist of the 260 species comprising the flora was compiled. Six types of native vegetation are recognized, one of which (*Diospyros* coastal forest) appears to be unique to tuff cone islands. Casual observations were made on the avifauna and turtle species, and the ecological significance of the islands is discussed.

LYING JUST OFF THE EAST coast of the Aleipata district of the island of Upolu, Western Samoa (Figure 1), is a chain of four small islands (totaling about 1.7 km^2), which is known as the Aleipata Islands. Although the coastal and lowland area of the Aleipata coast adjacent to the islands is almost entirely covered with coconut plantations and villages, the islands are uninhabited and their plant communities are relatively undisturbed. Because of the extensive disturbance to the vegetation of the Aleipata coast, these islands serve as a refuge for native plant communities as well as native plant and animal species (Whistler 1981). In fact, some of the species occurring there are found nowhere else in Western Samoa.

METHODOLOGY

The data presented are based on a series of visits to the islands from 9 August 1973 to 12 January 1981 (Table 1). Nu'utele was visited most often because it is the largest of the islands and Nu'ulua the least often because it is relatively inaccessible. During the visits, all plant species were recorded. On the first few trips, this was casually done without thought of the comprehensive study that was to follow. On later visits more thorough investigations were made, often with certain species in mind. The results of these visits culminated in a checklist of the flora of the islands (Table 5). During the visits, voucher specimens were collected and vegetation surveys carried out. The voucher specimens are in the author's personal collection at the University of Hawaii, with duplicates at the Smithsonian (US), Bishop Museum (BISH), Kew (K), Berlin (B), and elsewhere.

To determine species composition of the forests, nine vegetation plots were sampled—six on Nu'utele, two on Nu'ulua, and one on Namu'a. No vegetation was sampled on Fanuatapu due to the limited extent of that island's forest. In the plots, which were selected because of their apparently representative vegetation, the basal stem diameters (dbh) of a number of trees were measured. Only trees with a dbh of 2.5 cm or greater were used. In some cases, a large number (e.g., 50–100) of trees was randomly selected (plots 2, 3, 4, 5, 7, and 9); in others (plots 1, 6, and 8) all trees in 20 × 25 m or 30 × 30 m plots were measured. For shrubby or herbaceous vegetation, estimates of cover were made for each of the component species.

The results of the tree sampling were combined into a differentiated table by the tabular comparison method (Mueller-Dombois and Ellenberg 1974), which involved the construction of a table of raw data for the relative dominance figures for all tree species in the nine forest plots. Relative dominance of a species is determined by dividing its total basal stem area by the sum of the basal stem areas of all of the trees in the plot or sample. By re-

[1] Manuscript accepted 1 April 1983.
[2] University of Hawaii, Department of Botany, 3190 Maile Way, Honolulu, Hawaii 96822.

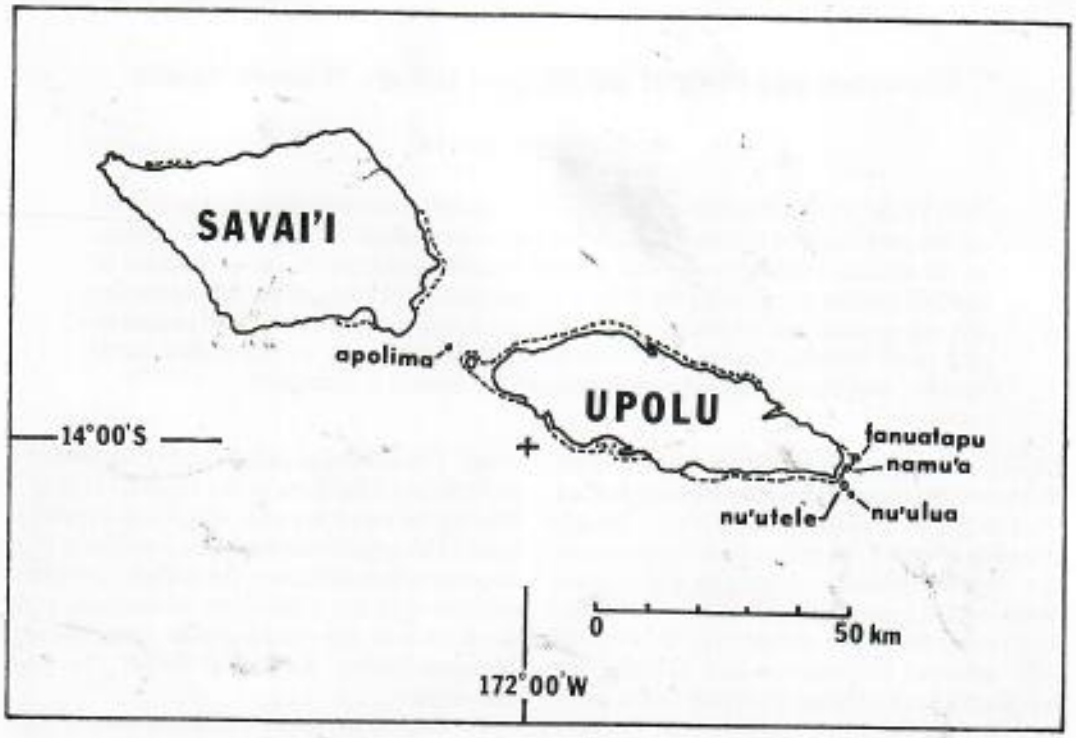

FIGURE 1. Map of Western Samoa.

TABLE 1

DATES ON WHICH THE ALEIPATA ISLANDS WERE VISITED

NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
9 Aug. 1973	13 Apr. 1974	27 Mar. 1974	25 Mar. 1974
29 Aug. 1973	28 Apr. 1979	27 Aug. 1978	26 Aug. 1978
18 June 1976	7 July 1980	26 Apr. 1979	6 July 1980
26 Sept. 1978		22 June 1980	5 Jan. 1981
9 Oct. 1978		31 July 1980	20 Dec. 1981
25 Apr. 1979		4 Jan. 1981	
6 Aug. 1979		20 Dec. 1981	
19 July 1980			
12 Jan. 1981			

arranging the species and their data, a final differentiated table was constructed with the species grouped into four categories—littoral forest species, coastal forest species, lowland forest species, and species with uncertain or variable distribution. Numbers were given to the plots after the rearrangements were completed, and indicate a general trend from littoral to lowland forest.

THE ISLANDS

The four islands, Nu'utele, Nu'ulua, Namu'a, and Fanuatapu, are the highly eroded remains of tuff cones formed by shallow submarine explosions sometime during the last Interglacial period (Kear and Wood 1959). All were originally circular in shape, but due to erosion, particularly from the force of the

TABLE 2

SIZE, ELEVATION, AND DISTANCE FROM SHORE OF THE ALEIPATA ISLANDS

	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Area (km²)	1.08	0.25	0.20	0.15
Elevation (m)	200	100	70	50
Distance from shore (km)	1.3	3.5	0.8	2.5

FIGURE 2. Scenic bay on the east side of Nu'utele Island.

waves on the east and southeast sides, various portions of the rims of all four cones are now gone. Some of the geographical characteristics of the islands are shown in Table 2.

The islands are made up of bedded and unbedded pyroclastic rock, known as "vini tuff", which is consolidated ash with fragments of coral and basalt mixed in. The only other places in Western Samoa where this type of rock occurs is at Cape Tapaga adjacent to Nu'utele Island, on Apolima Island in the strait between Upolu and Savai'i, and at Tafua on the southeast tip of Savai'i.

Nu'utele

With an area of just over 1 km², Nu'utele is the largest and least eroded of the four islands. It is bounded on its north and west sides by steep marine cliffs up to 180 m high. On its west side there is a sandy, palm-covered flat locally known as Vini, and this is often visited by Samoans who collect coconuts there. A clearing at Vini which was noted in 1979 was found in January 1981 to be planted in taro.

The crater rim has been breached only on the east side of the island where there is a small bay (Figure 2) with a straight 300–400-m-long beach protected from waves by a fringing reef. The ends of the bay are formed by ridges of the old crater rim which abruptly terminate in low marine cliffs. Inland of the beach is a broad, flat area which was once the site of a leprosarium, only the ruins of which remain today. The stately littoral forest in this area is now in the late stages of replacing what

appears to have been a coconut grove. Except for Vini, nearly the whole island is covered with native or only partially disturbed vegetation. The feral pigs present on the island do not appear to do much damage to the vegetation.

Nu'ulua

Nu'ulua is similar in shape to Nu'utele, but is only one-quarter its area and half its elevation. It is bounded on the north, south, and west sides by steep slopes, but these are not as precipitous as the cliffs of the larger island. The west side extends as a small peninsula, through which is a sea tunnel. The east half of the island has been eroded away, leaving a bay facing southeast. Landing on the island is attempted only during calm seas. The straight, sandy beach is similar in size to the one on Nu'utele, and is marked at its ends by low ridges which terminate as small, low, rocky peninsulas. The northern ridge has been breached by the sea and forms separate islets, while the southern one extends 200–300 m to a rocky point partially covered with wind-swept vegetation (Figure 3). The wind- and waveswept lower margins of the island are nearly bare, but inland there is a cover of native vegetation, including a majestic *Pisonia*-dominated littoral forest behind the beach. The only signs of human disturbance are a few coconut palms near the shore. Many seabirds, particularly red-footed boobies and brown noddies, nest on the island, especially on the nearly barren peninsula. Prior to a 1982 government financial crisis which forced the closing of the turtle hatchery, eggs of sea turtles were regularly collected on the beach to be taken away and reburied at the hatchery.

FIGURE 3. Peninsula on the southeast tip of Nu'ulua Island.

Namu'a

Namu'a is situated on the reef directly across from the Aleipata turtle hatchery (Figure 4). It is similar to Nu'ulua in size (0.2 km^2) and elevation (70 m), but is semicircular and bounded by a steep cliff on its east side. At the base of this cliff is a flat, narrow marine ramp (Figure 5) which is awash at high tide, but at low tide the island can be circumnavigated on foot. On the west side there is a sandy, palm-covered flat similar to, but smaller than, the one on Nu'utele.

Although the island is now uninhabited, several concrete foundations covered with secondary vegetation testify to previous occupation. Because of its proximity to Aleipata, the island is easily accessible and often visited by villagers, fishermen, and even picnickers. These activities account for the disturbed vegetation, but most of the disturbance is limited now to the sandy flat area. A small herd of feral goats (possibly only five individuals) lives on the island, but the only apparent signs of damage are the chewed leaves of sprouting coconuts. Nearly the whole island, exclusive of the palm-covered flat, is covered with native coastal forest. This forest is mostly secondary with old coconut palms extending above the canopy. The palms do not seem to

FIGURE 4. Namu'a Island lying adjacent to the turtle hatchery.

FIGURE 5. Narrow marine ramp on the east side of Namu'a Island.

be successfully reproducing and probably will be eliminated eventually.

Fanuatapu

Fanuatapu is the smallest, lowest, and northernmost of the four islands (Figure 6). This crescent-shaped island is located on the reef with the open side of the crescent facing eastward. Its entire perimeter is steep sided, and landing can only be effected on a small sandy beach on its west side. The northern arm of the crescent is covered with coastal forest and a patch of coconut palms, but the longer, southern arm extends into a wind-swept peninsula with shrubby and herbaceous vegetation only partially covering the eroded tuff rock (Figure 7).

Although the island is uninhabited and probably always has been, it is currently used as a site for a signal beacon for ships approaching the east Upolu coast. The beacon, at the top of the island, is reached by means of a concrete stairway leading from the landing site on the west side. Near the beacon are the remains of an older beacon and cable tower. In addition to the small coconut plantation on the northern tip of the island, at the time of the most recent visit (December 1981), there was a

FIGURE 6. Fanuatapu Island, the northernmost of the Aleipata Islands.

FIGURE 7. The bay on the east side of Fanuatapu Island. Nu'ulua (left) and Nu'utele (right) can be seen in the background.

small patch of *ta'amu (Alocasia macrorrhiza)* near the signal beacon. No goats or pigs are present on the island. Seabirds nest there, particularly on the peninsula, but they are not as common as they are on Nu'ulua.

THE VEGETATION

Based upon physiognomy and floristic composition, the vegetation of the four islands can be divided into six native plant communities. The differences in these communities are largely determined by variation in elevation, exposure, and soil characteristics. The six communities are *Lepturus* rock strand, *Ipomoea* sand strand, littoral shrubland, littoral forest, *Diospyros* coastal forest, and *Dysoxylum* lowland forest. The disturbed areas on the islands are covered with secondary vegetation, most of which is either coconut plantation or early secondary forest dominated by coconut palms.

The first four of the native communities are littoral—those occurring on or near the seashore and dominated by species usually restricted to this habitat. These plants are usually dispersed by saltwater-resistant seeds, or less commonly, by fruits that adhere to seabird feathers. Three of these communities are herbaceous or shrubby, the fourth is forest. The other two, nonlittoral communities are both inland forests. All six communities or their equivalents were discussed by Whistler (1980) in a vegetation study of eastern Samoa. A map of the distribution of the plant communities on the four islands is shown in Figure 8.

Lepturus Rock Strand

This community is composed of the low herbaceous vegetation growing in open places—mostly areas with shallow soil or a bare rock surface. It predominates on cliffs and exposed ridges, which apparently are unable to support shrubby or woody vegetation due to the paucity of soil or to the exposure to salt spray. It is particularly characteristic of the low windswept peninsulas of Nu'ulua and Fanuatapu (Figure 9). Except for an occasional patch of *Pandanus*, these peninsulas are entirely devoid of trees. On Fanuatapu, the herbaceous vegetation alternates with patches of shrubs, but occupies the most exposed or steepest sites. The species found in this habitat are salt-tolerant, and because they require bright sunlight, they are rarely found in the shade of littoral trees or shrubs.

The most characteristic life form of this community is that of clump-forming grasses and sedges. The most typical species is the widespread littoral grass *Lepturus repens*. Other common grasses are *Brachiaria subquadripara* (particularly on the tip of Nu'ulua peninsula shown in Figure 3) and the knotgrass *Paspalum distichum*. The most common sedge is *Fimbristylis cymosa*, but *Cyperus stoloniferous* is sometimes locally abundant. Although not as common as the aforementioned monocots, dicots such as *Portulaca oleracea*, *P. lutea*, *P. australis*, and *Hedyotis biflora* are characteristic of this community. At the end of the Fanuatapu peninsula there is a small population of *Sesuvium portulacastrum*, and this is the only record for this species in Western Samoa. In addition to the flowering plants, *Acrostichum aureum*, the marsh fern, is frequently found growing in rock cracks in this habitat.

Ipomoea Sand Strand

This community is composed of low herbaceous vegetation growing on open areas of sandy beaches and flats, most typically as a narrow seaward fringe at the edge of littoral forest. Like the rock strand, the species that compose it are heliophytes which do not usually extend into the shady littoral forest, although they may persist in the brighter light conditions under coconut palms. The extent of this community is limited on the Aleipata Islands. It is mostly restricted to the sandy flats on the west-facing shores of Nu'utele, Namu'a, and Fanuatapu, and to a fringe along the sandy beach of Nu'ulua and Nu'utele bays.

As with the other types of littoral vegetation, the species composing the sand strand are widespread plants with seawater-dispersed seeds. The most characteristic life form is that of creeping vines, and the most typical species is the beach morning glory, *Ipomoea pes-caprae*. Two other species with this life form, *Vigna marina* and *Canavalia maritima*, are also found here. *Ipomoea* is a pantropic species and is a characteristic plant of shores throughout the tropics. In the literature, this *Ipomoea*-dominated community has often been referred to as the "*pes-caprae* formation." On the islands, *Lepturus repens* and *Paspalum distichum*, both more characteristic of rock strand, are also commonly found in this community, as well as *Triumfetta procumbens*, which is a scandent to prostrate shrub. Where *Ipomoea* extends into coconut plantation, other, nonlittoral species, more descriptively referred to as "weeds," often grow with the sand strand species.

Littoral Shrubland

This community is composed of the shrubby vegetation growing in sunny littoral areas, most commonly as a fringe seaward of littoral forest, and on windswept ridges and slopes.

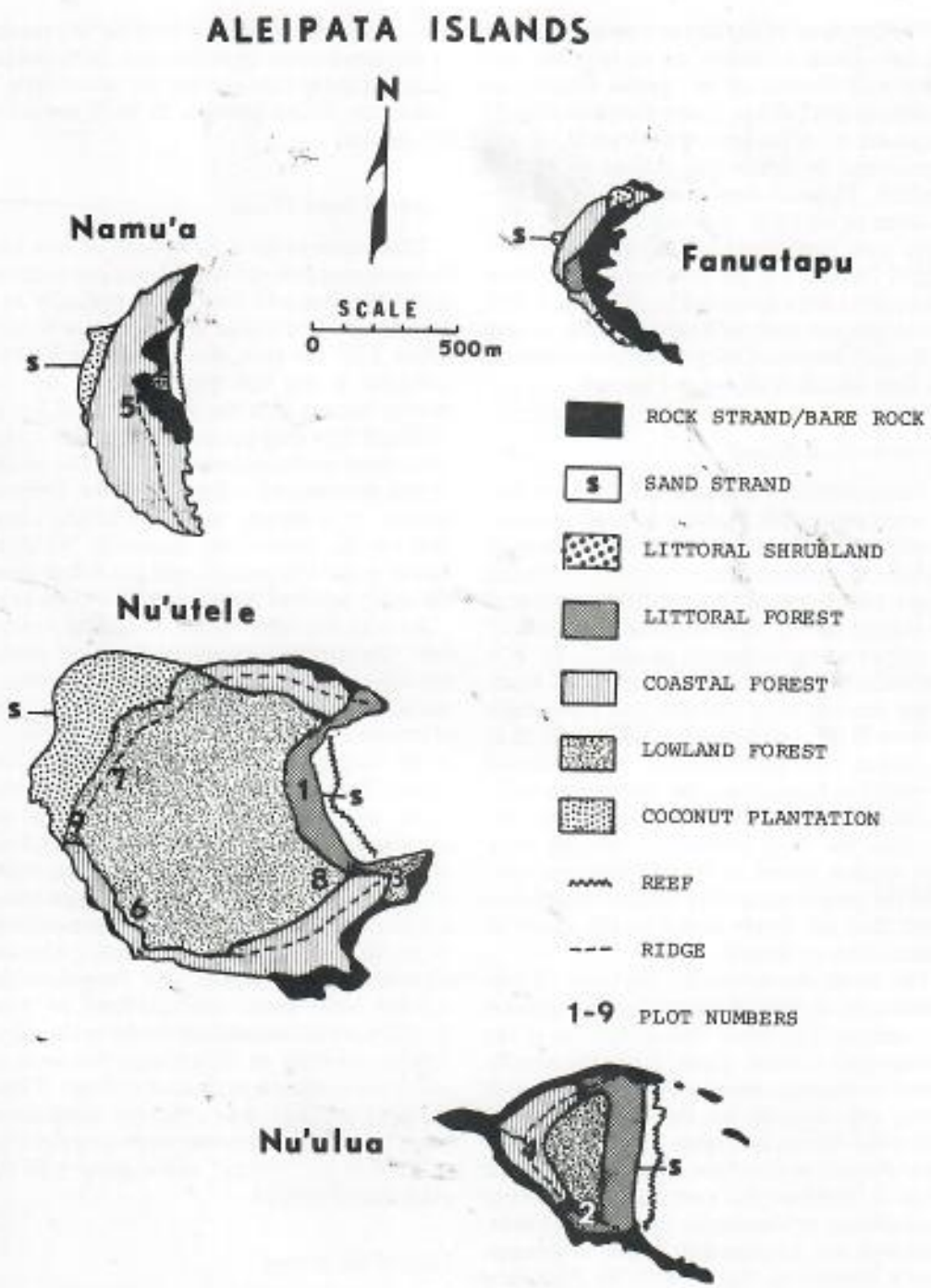

FIGURE 8. Vegetation map of the Aleipata Islands.

FIGURE 9. *Lepturus* rock strand community on Fanuatapu Island.

FIGURE 10. Samoan girl with baby red-footed booby in the dense vegetation of the littoral shrubland community on Fanuatapu Island.

The shrubs are mostly heliophytes and rarely (except for *Ficus scabra*) occur in the adjacent forest. On the Aleipata Islands, it is found on the rocky peninsulas of Nu'ulua and Fanuatapu, although not as far toward the tip as is the rock strand vegetation, and on the steep slopes of Fanuatapu, Namu'a, and to a lesser extent, Nu'utele.

The predominant life form of this community is shrubby, although some of the species are low, wind-pruned trees. The plants form a dense thicket mostly 1–2 m in height which is penetrated only with difficulty (Figure 10). In areas on the Fanuatapu peninsula with shallow soil or perhaps particularly windy conditions, rock strand vegetation prevails between the thickets. On the Aleipata Islands the most characteristic species is *Wedelia biflora*, a composite littoral shrub. Less common is *Scaevola taccada*, a littoral shrub, and *Ficus scabra*, a woody species that grows to be an understory tree in littoral forest. These three species often form nearly pure thickets by themselves for reasons that are not immediately apparent. Other less abundant species are *Clerodendrum inerme* which is a shrub, and *Phymatosorus scolopendria* which is a fern. Additionally, littoral vines such as *Ipomoea macrantha*, *I. littoralis*, and *Vigna marina* are occasional climbing over the shrubby vegetation in this community.

Littoral Forest

The littoral forest is the forest occurring on or near the seashore and which is dominated by tree species whose predominant mode of dispersal is by floating seeds or by sticky fruits that adhere to seabirds. Littoral forests are circumtropical, and throughout the tropical

Pacific they are similar in floristic composition. On the Aleipata Islands, they grow on the beach and on the lower portion of the ridges exposed to salt spray, although not on the most exposed places where rock strand and littoral shrubland instead prevail.

Several different littoral species may dominate in different situations on the Samoan coast—*Barringtonia asiatica*, *Calophyllum inophyllum*, *Hernandia nymphaeifolia*, *Pisonia grandis*, and perhaps *Terminalia catappa*. These species often form pure stands with a single species dominating the canopy. Some of these variations of littoral forest were treated as separate communities by Whistler (1980) in eastern Samoa, but because the distinction between the communities on the Aleipata Islands is less clear, the variations herein will merely be called subtypes of littoral forest.

Pisonia LITTORAL FOREST: The *Pisonia* littoral forest, which is dominated by *Pisonia grandis*, is the most common type of littoral forest on the islands. *Pisonia*, which is dispersed by sticky fruits which adhere to seabird feathers, develops a huge trunk and can form a tall, dense, nearly pure stand, as it does on Rose Atoll in eastern Samoa. On Nu'ulua, it forms a majestic forest in the bay area (Figure 11), from the shore inland for about 100 m where it is abruptly replaced by lowland forest trees. The only other canopy tree growing with the *Pisonia* is *Erythrina variegata*, but *Neisosperma oppositifolium* is common there as an understory tree. The forest floor is open, and the light ground cover comprises mostly *Neisosperma* seedlings (with perhaps only 5% cover) and to a lesser extent, those of *Pisonia*, most of which die in the dense shade of the canopy. This light ground cover contrasts markedly with the dense ground cover of the adjacent lowland forest.

Pisonia littoral forest also predominates on the lower ridges of Nu'ulua and Nu'utele, but in these localities it is part of an ecotone between littoral and coastal forest. Mixed with the large *Pisonia* trees is a dense forest of small coastal forest trees, principally *Diospyros elliptica*, *D. samoensis*, and *Syzygium clusiifolium*. In plot 3 on the south Nu'utele ridge, the latter three species comprised about 63% of the individual trees, but only 31% of the relative dominance.

FIGURE 11. Majestic *Pisonia* littoral forest on Nu'ulua Island.

Pisonia is nearly absent from Namu'a and Fanuatapu. Its scarcity on these two easily accessible islands may be related to the smaller numbers of seabirds found there, since *Pisonia* may be dependent upon seabirds for dispersal and for soil high in nitrate and phosphate from the birds' excretions. Disturbance such as hunting pressure on birds may indirectly lead to the absence of *Pisonia*.

Barringtonia LITTORAL FOREST: The *Barringtonia* littoral forest is the most common type of littoral forest on high Pacific islands, where it often forms nearly pure stands on rocky shores. Sometimes it also dominates on inland slopes where coastal forest would normally be expected, and this is the case on Fanuatapu where *Barringtonia*-dominated

forest occurs on the south central part of the island. It was also the dominant species in the forest plot on top of Nu'ulua, although it had a relative dominance of only 22% there.

The only other plot where *Barringtonia* occurred was in plot 1 in Nu'utele Bay. In this area centered around the ruins of the leprosarium, the dominant species is *Terminalia catappa*. It is likely, however, that the *Terminalia* dominance is due to disturbance caused by the presence of the leprosarium; nowhere else in Samoa has it been reported to be the dominant species. In support of this idea, all seven of the *Terminalia* trees in the plot were over 34 cm dbh, while only four of the nine *Barringtonia* trees were this large, indicating that *Barringtonia* may eventually replace *Terminalia* in the plot. This bay is similar to that of Nu'ulua, and it is likely that its original vegetation was *Pisonia* littoral forest like that on Nu'ulua, but due to the disturbance by humans, either by clearing the forest for the leprosarium or by eliminating or reducing the number of seabirds, *Pisonia* was reduced to a secondary species. As in *Pisonia*-dominated forest, the Nu'utele Bay littoral forest has little ground cover, but the dominant species there is *Oplismenus hirtellus*, a low grass species.

FIGURE 12. *Diospyros* coastal forest on Namu'a Island.

Diospyros Coastal Forest

The *Diospyros* coastal forest is the low-stature forest found in coastal areas of Samoa and perhaps on some of the other nearby Polynesian islands as well. Unlike littoral forest species, coastal forest trees do not usually occur directly on the shore, and instead of having seeds dispersed by seawater, the seeds are dispersed by land birds who eat the fruits. In Samoa, this community is restricted mostly to tuff cone soil (mostly on the ridges and steeper slopes) and to steep rocky coastal slopes on the larger islands. In addition to occurring on all of the Aleipata Islands, this forest was also noted and described by Whistler (1980) in eastern Samoa on the tuff cones of Nu'utele (Ofu) and Aunu'u, and on rocky coastal slopes of Tutuila and Olosega. The author has also seen it on the island of Apolima in the Upolu-Savai'i strait, and since this community is characteristic of tuff cones, it is likely to occur as well at Tafua on the southeast tip of Savai'i.

Another characteristic of the forest is its unique species composition. It is dominated by *Diospyros samoensis*, *D. elliptica*, *Syzygium clusiifolium*, and to a lesser extent by *Planchonella linggensis* and *Garuga floribunda*. *Diospyros elliptica*, *Syzygium*, and *Garuga* are largely restricted to this habitat, but *D. samoensis* is an understory species in other communities; *Planchonella* is also common in inland ridge forests. Of the nine plots sampled, only plot 5 is "typical" coastal forest; in it 72% of the relative dominance is accounted for by coastal forest species. Most of Namu'a, in fact, is covered by coastal forest (Figure 12), although much of it is mixed with aging coconut palms. The coastal forest often occupies a zone between littoral and lowland forest, but sometimes is absent as a distinct entity. In such cases, it may form the understory extending into the other two communities. Such is the case with plot 4 where the coastal forest

species have a combined relative dominance of 39%, while the large littoral forest species have 41%. In plot 6, coastal forest species have 54% dominance while lowland forest species have 42%. As far as the number of trees is concerned, in the three aforementioned plots, 65% of the individuals were coastal forest species. In plot 6, there were 29 trees (over 2.5 cm dbh) per 100 m^2, with an average stem basal area of 0.43 m^2 per 100 m^2.

Since the coastal forest lacks a high canopy, the ground cover is much denser than that found in littoral forest. In plots 4–6, the average ground cover was roughly estimated to be 40–50%. Over two-thirds of this total comprised seedlings of *Syzygium*. Also common are the bird's-nest fern *Asplenium nidus* and the Polynesian arrowroot *Tacca leontopetaloides*. Less abundant are *Phymatosorus scolopendria*, *Oplismenus hirtellus*, *Derris trifoliata*, and *Zingiber zerumbet* (only on Namu'a).

Dysoxylum lowland forest

The *Dysoxylum* lowland forest is the high tropical forest occurring on nonbasaltic or alluvial soils of Samoa and possibly on other nearby Polynesian islands as well. The trees in this forest are not littoral, possibly because they cannot tolerate salt spray, and they have wind or bird-dispersed seeds rather than seeds dispersed by seawater. The forest occurs in protected places on Nu'utele and Nu'ulua Islands. On Nu'ulua it occupies the interior of the island below the ridges and summit and inland of the littoral forest—that is, within the "bowl" of the island (Figure 13). On Nu'utele it also occupies the "bowl" as well as the leeward slopes and the summit, which reaches 200 m in elevation. This same community (called "*mamala* lowland forest") was described by Whistler (1980) from eastern Samoa where it occurs in the lowlands, particularly in alluvial soil of coastal valleys.

The dominant species in this community are *Dysoxylum samoense* (*mamala*) and *D. maota* (*maota*). Although these two species are nearly indistinguishable, most of the trees sampled were probably *D. samoense*. The *Dysoxylum* species dominated lowland forest plots 8 and 9, in both cases with a relative dominance of 57%. These trees form a canopy up to 25 m in height, which they almost entirely dominate. Of the 25 sampled trees greater than 30 cm dbh in the two plots, 18 were *Dysoxylum*. The only other species with more than one tree this size were *Kleinhovia hospita* (three trees) in one plot and *Hibiscus tiliaceus* (two) in the other. Both of these are typical secondary forest trees. A *Dysoxylum* species was also the dominant canopy tree in plot 7, but the smaller coastal forest species *Syzygium clusiifolium* was the overall dominant due to its greater number of trees in the small sample (22 to 3).

FIGURE 13. *Dysoxylum* lowland forest on Nu'ulua Island.

Other common canopy trees in this forest are *Canarium samoense*, *Rhus taitensis*, *Calophyllum neo-ebudicum*, and *Sterculia fanaiho*. Although it did not show up in the three plots,

TABLE 3

DIFFERENTIATED TABLE OF THE RELATIVE DOMINANCE (%) OF TREE SPECIES FOUND IN FOREST PLOTS ON THE ALEIPATA ISLANDS

SPECIES	PLOT NOS.* 1	2	3	4	5	6	7	8	9	SAMOAN NAME
Littoral forest species										
Terminalia catappa	57	11	—	—	8	—	—	—	—	*talie*
Hernandia nymphaeifolia	11	17	—	—	—	—	—	—	—	*pu'a*
Barringtonia asiatica	14	—	—	22	—	—	—	+	—	*futu*
Pisonia grandis	—	47	55	10	—	—	—	+	—	*pu'avai*
Guettarda speciosa	—	—	—	4	—	—	—	—	—	*puapua*
Erythrina variegata	—	3	9	—	4	—	—	+	—	*gatae*
Morinda citrifolia	—	+	+	2	—	—	—	+	—	*nonu*
Cocos nucifera	3	—	—	—	9	—	—	—	—	*niu*
Neisosperma oppositifolium	10	3	—	3	—	+	2	+	—	*fao*
Coastal forest species										
Diospyros elliptica	—	—	13	—	18	+	—	—	—	*amume*
Diospyros samoensis	—	7	13	6	27	+	6	+	2	*'au'auli*
Syzygium clusiifolium	—	7	5	4	9	37	23	+	5	*asivai?*
Planchonella linggensis	—	—	+	21	3	17	7	—	1	*'ala'a*
Garuga floribunda	—	—	2	7	15	—	—	3	—	*magaui*
Lowland forest species										
Dysoxylum spp.†	5	2	—	19	—	2	16	57	57	*mamala* and *maota*
Rhus taitensis	—	—	—	—	—	32	11	—	—	*tavai*
Inocarpus fagifer	—	—	—	+	—	—	1	3	15	*ifi*
Calophyllum neo-ebudicum	—	—	—	—	—	5	8	—	1	*tamanu*
Sterculia fanaiho	—	—	—	+	—	—	+	3	4	*fana'io*
Polyscias samoensis	—	—	—	—	—	3	2	+	—	*afia*
Kleinhovia hospita	—	—	—	—	—	—	—	28	—	*fu'afu'a*
Canarium samoense	—	—	—	—	—	—	15	—	—	*ma'ali*
Neonauclea forsteri	—	—	—	—	—	—	5	—	—	*afa*
Myristica fatua	—	—	—	—	—	+	—	—	3	*'atone*
Flacourtia rukam	—	—	—	—	—	—	—	+	+	*filimoto*
Species with uncertain or variable distribution‡										
Antirhea inconspicua	—	—	+	+	+	—	—	—	2	
Macaranga stipulosa	—	1	—	—	—	—	—	—	—	*pata*
Glochidion ramiflorum	—	—	+	—	—	—	—	—	1	*masame*
Hibiscus tiliaceus	—	—	+	—	7	—	6	—	10	*fau*
Randia cochinchinensis	—	—	+	—	—	+	—	+	—	*olamea*
Sapindus vitiensis	—	—	1	—	—	—	—	—	—	
Psychotria insularum	—	—	—	+	—	+	—	1	—	*matalafi*
Ficus scabra	—	—	—	+	—	+	—	2	—	*mati*
Phaleria disperma	—	—	—	+	—	+	—	—	—	*sumi*
Aleurites moluccana	—	—	—	1	—	—	—	—	—	*lama*
Canthium merrillii	—	—	—	—	—	1	—	—	—	*olasina*

NOTE: + indicates less than 1% relative dominance; — indicates absence.

* Plot 1: Nu'utele Bay, 3 m; Plot 2: Nu'ulua ridge, 60 m; Plot 3: Nu'utele ridge, 60 m; Plot 4: Nu'ulua summit, 75 m; Plot 5: Namu'a summit, 60 m; Plot 6: Nu'utele summit, 180 m; Plot 7: Nu'utele summit, 150 m; Plot 8: Nu'utele bay, 15 m; Plot 9: Nu'utele slope, 150 m.

† *Dysoxylum samoense* and *Dysoxylum maota* are nearly indistinguishable when sterile, so the data for these two species are lumped together to avoid possible errors.

‡ The following species were found in a single plot (number shown in parentheses) and had less than 1% dominance there: *Desmodium umbellatum* (5); *Elattostachys falcata* (5); *Manilkara dissecta* (6); *Linociera* sp. (6); *Syzygium malaccense* (8); *Allophylus timorensis* (8); *Securinega flexuosa* (8); and *Ficus tinctoria* (8).

TABLE 4

AREA, SIZE, AND DISTANCE FROM SHORE FOR THE ALEIPATA ISLANDS

ISLAND	(a) AREA (sq. root)	(b) ELEVATION	(c) RECIPROCAL OF DISTANCE FROM SHORE	(d) AVERAGE OF a TO c	FLORA SIZE*
Nu'utele†	1.0	1.0	1.0	1.0	1.0
Nu'ulua	0.48	0.50	0.37	0.45	0.52
Namu'a	0.42	0.35	1.62	0.80	0.84
Fanuatapu	0.37	0.25	0.52	0.38	0.37

* Includes only native and naturalized species (not weeds).
†Data for Nu'utele in each case were set at 1.0 and the data for the other islands are expressed as a ratio of that.

Aleurites moluccana, the candlenut, also appears to be common in the lowland forest. The most abundant subcanopy trees in plots 7–9 were *Syzygium clusiifolium* which is, as mentioned above, a coastal forest species, *Inocarpus fagifer* (Tahitian chestnut), and *Myristica fatua*. In addition, this forest has several small tree species like *Psychotria insularum*, *Ficus scabra*, *F. tinctoria*, *Flacourtia rukam*, *Antirhea inconspicua*, and *Polyscias samoensis*. These, although sometimes numerous, do not contribute much to the relative dominance of the sample due to their small size.

In plot 8 in the Nu'utele Bay area, the density of trees over 2.5 cm dbh was 13.4 per 100 m^2 and the average stem basal area 0.44 m^2 per 100 m^2. This latter figure is only about 70% of the figures Whistler (1980) obtained from similar forests on Tutuila, but the tree density is similar (averaging 12.2 in five plots in eastern Samoa).

The ground cover is composed mostly of species different from those of littoral and coastal forest. In the two bay area plots (7 and 8), the dominant ground cover species was *Piper graeffei* which at maturity is a high-climbing vine. Also common are *Oplismenus hirtellus*, a grass, and *Tectaria stearnsii*, a fern. No ground cover sample was made in plot 9.

Disturbed Vegetation

The main disturbance to the vegetation of the Aleipata Islands has been the planting of coconut palms. Two areas—the sandy flats of Nu'utele and Namu'a—are currently dominated by coconut and appear to be regularly tended or harvested. Three other places—a small patch on Fanuatapu, the west-facing slope of Namu'a, and the bay area of Nu'utele—also have palms, but overall, native species predominate in the vegetation. On Fanuatapu and Namu'a, although the crowns of the palms stand above the forest canopy, littoral and coastal forest trees predominate. Under disturbed conditions, coconut palms cannot successfully compete with coastal forest trees, and unless tended or replanted, they eventually die out. Little coconut regeneration was seen in these forests or in the bay area of Nu'utele where the palms are being replaced by littoral forest. On Nu'ulua, only a few coconut palms were seen, and there is no evidence that any plantation was ever established there.

The only other disturbed vegetation noted may have been caused by weather conditions—such as a hurricane. On the northern ridge of Nu'ulua, a small area of vegetation dominated by *Macaranga harveyana* (38% relative dominance) and *Hibiscus tiliaceus* (26%) was briefly sampled. These two species are typical secondary forest trees requiring sunny, open situations for establishment. Another secondary forest species, *Rhus taitensis*, had a relative dominance of 32% in plot 6 on top of Nu'utele. This relatively high amount of *Rhus* in the plot may indicate past weather-related disturbance there, or perhaps unusual environmental conditions at the site which favor that tree.

FLORA

A total of 260 species were collected on the four islands (Table 5). Of these, 178 (68%) are native or naturalized, mostly native. Weedy exotics, those introduced herbs or shrubs which are mostly or entirely restricted to sunny, disturbed habitats, account for another 54 species (21%). The remaining 28 (11%) are ornamental or cultivated plants whose presence on the islands can be attributed to purposeful introduction.

With its 153 native and naturalized species, Nu'utele has the largest flora of the four islands. This flora includes 86% of these species recorded on the islands. Although considerably smaller than Nu'utele, Namu'a has 129 species and 72% of the islands' native and naturalized species. Nu'ulua has only 79 species and 44%, and Fanuatapu 57 species and 32%. Namu'a has the highest number of weedy exotics (43 of the 54 attributed to the islands), which can be accounted for by the island's accessibility and frequency of use. If the percentage of the flora attributed to introduced species is any indication of disturbance, Namu'a is the most disturbed of the islands, since 32% of its flora consists of introduced species (the other three are below 23%).

The number of species naturally occurring on an island is related to at least four major factors—the distance of the island from the source of its flora, the size of the island, its elevation, and its age. The first three of these factors are compared in Table 4. Because the age of the different islands is uncertain, it has not been included. However, age differences may not matter in this case since all four islands probably differ relatively little in this respect. In the table, Nu'utele has been set to 1.0 in each category, and the numbers for the other islands are expressed as a ratio of that. The numbers of native species on each of the islands correspond well with the square root of their island's area (at least in this small sample), except for Namu'a which has a larger flora than would be expected using this criterion. The numbers of native species on the islands also correspond well with the elevation of the island, except again for Namu'a which has a larger flora than would be expected. All other things being equal, the size of the flora on an island is inversely related to its distance from shore, and the short distance of Namu'a to the shore (0.8 km) accounts, then, for its relatively large flora.

By averaging the area, elevation, and distance data, we find a good correspondence with the actual number of species found on each of the islands. In fact, if this method is applied to Apolima (in the Upolu–Savai'i strait), the only other tuff cone island in Western Samoa, the same good correspondence is obtained (flora size equals 0.61, and 0.56 is predicted by the averaging method). These three factors (size, elevation, and distance from the main island) were arbitrarily given equal weight, and since this assumption is likely to be invalid, there is no implication here that this method applies to anything other than these Samoan tuff cone islands, nor is it the intent of this paper to delve into island biogeography. It only shows that the relatively large size of Namu'a's flora (as compared to that of the other three islands) is likely to have been caused by its proximity to shore.

The most common means of dispersal of the native plants found on the islands is by transport in the digestive tract of birds, which can be inferred from the colored, fleshy fruits of many of these species. Approximately 40% of the species fit into this category. Species with seawater-dispersed seeds comprise another 30%, and these plants are typical littoral species. Wind dispersed seeds and spores account for nearly 26%, and most of these are ferns. Dispersal of fruits by adhering to bird feathers appears the most likely means of transport for only 3% of the species. The number of littoral species on each of the islands is relatively similar, from a low of 33 to a high of 44. The number of bird-dispersed species (mostly inland species) is quite different, however, with nearly four times as many on Nu'utele as on Fanuatapu.

DISCUSSION

Botanically, the four islands are distinct from the main islands (Upolu and Savai'i) in both their flora and their vegetation. Eight

TABLE 5

CHECKLIST OF THE FLORA OF THE ALEIPATA ISLANDS

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Native and Naturalized Plants				
Pteridophyta				
Acrostichum aureum L.	(x)	X	(x)	(x)
Antrophyum plantagineum (Cav.) Kaulf.	X		X	
Asplenium falcatum Lmk.	X		X	
Asplenium nidus L.	X	(x)	(x)	(x)
Christella harveyi (Mett.) Holttum	X	X	X	
Cyathea lunulata (Forst. f.) Copel.			X	
Davallia epiphylla (Forst. f.) Copel.	X		X	
Davallia solida (Forst. f.) Spreng.	X			
Dryopteris dissecta (Forst. f.) O. K.	X	X	X	
Humata heterophylla (Smith) Desv.			X	
Lycopodium carinatum Desv.	X			
Lycopodium phlegmaria L.	(x)		X	
Nephrolepis biserrata (Sw.) Schott	(x)		X	
Nephrolepis hirsutula (Forst. f.) Presl	X	(x)	(x)	
Ophioglossum pendulum L.	X		X	
Phymatosoria scolopendria (Burm.) Pichi Serm.	(x)	(x)	X	X
Pteris ensiformis Burm.	X		X	
Pteris pacifica Hier.	X		X	
Pteris tripartita Sw.		X		
Pyrrosia adnascens (Sw.) Ching	X		X	
Schizaea dichotoma (L.) J. E. Smith	X		X	
Selaginella hochreutineri Hier.	X			
Selaginella laxa Spring	X		X	
Tectaria sternii Maxon	X		X	
Trichomanes humile Forst. f.	X		X	
Vittaria rigida Kaulf.			X	
Dicotyledonae				
Aizoaceae				
Sesuvium portulacastrum (L.) L.				X
Amaranthaceae				
Achyranthes aspera L.	X			X
Anacardiaceae				
Rhus taitensis Guillem.	X		X	
Annonaceae				
Cananga odorata (Lmk.) Hook. f. & Thoms.	(x)			
Apocynaceae				
Alyxia stellata (Forst. f.) R. & S.	X		X	
Cerbera manghas L.	X	X	(x)	
Neisosperma oppositifolium (Lmk.) Fosb. & Sachet	X	X	(x)	
Araliaceae				
Meryta macrophylla (Rich) Seem.	(x)			X
Polyscias samoensis (A. Gray) Seem.	X	X	X	
Asclepiadaceae				
Hoya australis R. Br.	(x)		X	(x)
Boraginaceae				
Argusia argentea (L. f.) Heine	X	X		
Cordia subcordata Lmk.		X	X	
Burseraceae				
Canarium harveyi Seem.	(x)?			
Canarium samoense Engl.	X			
Garuga floribunda Descne.	X	X	X	

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Celastraceae				
Gymnosporia vitiensis (A. Gray) Seem.	X			
Combretaceae				
Terminalia catappa L.	X	(x)	(x)	
Terminalia richii A. Gray	X			
Terminalia samoensis Rech.	X			
Compositae				
Wedelia biflora (L.) DC.	X	(x)	X	X
Connaraceae				
Rourea minor (Gaertn.) Leenh.	X			
Convolvulaceae				
Ipomoea littoralis Bl.	(x)		(x)	X
Ipomoea macrantha R. & S.	X	(x)	X	X
Ipomoea pes-caprae (L.) R. Br.	(x)	(x)	(x)	(x)
Cucurbitaceae				
Luffa cylindrica (L.) Roem.	X			
Zehneria grayana (Cogn.) Fosb. & Sachet	X	(x)	X	X
Ebenaceae				
Diospyros elliptica (Forst.) Green	X	X	X	(x)
Diospyros samoensis A. Gray	(x)	(x)	X	(x)
Elaeocarpaceae				
Elaeocarpus tonganus Burk.	X			
Euphorbiaceae				
Aleurites moluccana (L.) Willd.	(x)	X	(x)	
Antidesma sphaerocarpum M.-A.	X			
Euphorbia chamissonis (Klotch. & Garcke) Boiss.				X
Glochidion ramiflorum Forst.	(x)	(x)	X	
Macaranga harveyana (M.-A.) M. A.	X	X	(x)	X
Omalanthus nutans (Forst.) Guill.	X		X	
Securinega flexuosa (M.-A.) M.-A.	(x)		X	
Flacourtiaceae				
Flacourtia rukam Zoll. & Mor.	(x)		X	
Gesneriaceae				
Cyrtandra samoensis A. Gray			X	
Goodeniaceae				
Scaevola taccada (Gaertn.) Roxb.	X	(x)	X	(x)
Guttiferae				
Calophyllum inophyllum L.	(x)	(x)	(x)	
Calophyllum neo-ebudicum Guill.	X			
Hernandiaceae				
Hernandia nymphaeifolia (Presl) Kub.	X	(x)	(x)	
Lecythidaceae				
Barringtonia asiatica (L.) Kurz	(x)	(x)	X	X
Leguminosae				
Abrus precatorius L.	(x)		(x)	X
Adenanthera pavonina L.	X		(x)	
Caesalpinia bonduc (L.) Roxb.	(x)	X	(x)	
Canavalia cathartica Thou.	X	X	(x)	(x)
Canavalia maritima (Aubl.) Thou.			X	X
Derris trifoliata Lour.	X	X		X
Desmodium umbellatum (L.) DC.	X		(x)	
Erythrina variegata L.	X	(x)	(x)	(x)
Inocarpus fagifer (Park.) Fosb.	X	X	(x)	
Mucuna gigantea (Willd.) DC.	X	X	X	
Vigna marina (Burm.) Merr.	(x)	(x)	(x)	X
Loganiaceae				
Fagraea berteriana A. Gray	X		(x)	
Geniostoma samoense Rein.	(x)	X	X	X

TABLE 5 (*Cont.*)

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Malvaceae				
Hibiscus tiliaceus L.	(x)	(x)	(x)	X
Thespesia populnea (L.) Sol.	X	(x)	(x)	X
Meliaceae				
Dysoxylum maota Rein.	X	X	X	
Dysoxylum samoense A. Gray	X	(x)	(x)	(x)?
Menispermaceae				
Stephania forsteri (DC.) A. Gray	X			
Moraceae				
Ficus obliqua Forst. f..	X	(x)	(x)	
Ficus prolixa Forst. f.	(x)		X	
Ficus scabra Forst. f.	(x)	X	X	X
Ficus tinctoria Forst. f.	X	X	(x)	
Myristicaceae				
Myristica fatua Houtt.	X			
Myrtaceae				
Syzygium clusiifolium (A. Gray) C. Muell.	X	(x)	X	X
Nyctaginaceae				
Boerhavia albiflora Fosb.		X		X
Pisonia grandis R. Br.	X	X	(x)	X
Oleaceae				
Jasminum betchei F.v.M.	(x)	(x)	X	
Jasminum didymum Forst. f.	(x)	(x)	X	
Linociera sp.	X			
Piperaceae				
Peperomia leptostachya H. & A.	X		X	
Piper graeffei Warb.	(x)	(x)	X	
Portulacaceae				
Portulaca australis Endl.	X	X	(x)	X
Portulaca lutea Forst. f.		X	(x)?	
Portulaca oleracea L.	X			X
Rhamnaceae				
Alphitonia zizyphoides (Spreng.) A. Gray	X		(x)	
Colubrina asiatica (L.) Brongn.	(x)	(x)	X	(x)
Rhizophoraceae				
Bruguiera gymnorhiza (L.) Lmk.			X	
Rhizophora mangle L.			X	
Rubiaceae				
Antirhea inconspicua (Seem.) Chr.	X	(x)	X	
Canthium merrillii (Setch.) Chr.	(x)		(x)?	
Gardenia taitensis DC.	X			X
Geophila repens (L.) I. M. Johnst.	X	(x)		
Guettarda speciosa L.	X	(x)	(x)	
Hedyotis biflora (L.) Lmk.		X	X	X
Ixora amplifolia A. Gray	X			
Morinda citrifolia L.	X	(x)	X	(x)
Morinda umbellata Seem.	X		X	
Neonauclea forsteri (Seem.) Merr.	(x)			
Psychotria insularum A. Gray	X	X	(x)	X
Randia cochinchinensis (Lour.) Merr.	X	X	X	X
Rutaceae				
Micromelum minutum (Forst. f.) Seem.	X			
Sapindaceae				
Allophyllus timorensis Bl.	X		X	X
Elattostachys falcata (A. Gray) Radlk.	X		(x)	
Pometia pinnata Forst.			X	
Sapindus vitiense A. Gray	X			
Sapotaceae				
Manilkara dissecta (L. f.) Dubard	X			
Planchonella linggensis (Burck) Pierre	X	X	X	

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Simaroubaceae				
Suriana maritima L.		X		
Solanaceae				
Solanum upoluense Wit.	X			
Sterculiaceae				
Kleinhovia hospita L.	X	(x)	(x)	
Melochia aristata A. Gray			X	
Sterculia fanaiho Setch.	X	X	(x)	
Thymelaeaceae				
Phaleria acuminata (Forst. f.) Gilg.	X			
Phaleria disperma (Forst. f.) Baill.	X	X	X	X
Wikstroemia foetida (L. f.) A. Gray	X			
Tiliaceae				
Triumfetta procumbens Forst. f.	X	(x)		
Ulmaceae				
Trema cannabina Lour.			X	
Urticaceae				
Leucosyke corymbulosa (Wedd.) Wedd.	X			
Pipturus argenteus (Forst. f.) Wedd.	(x)	X	(x)	X
Procris pedunculata (Forst.) Wedd.	(x)		X	
Verbenaceae				
Clerodendrum inerme (L.) Gaertn.	X	(x)	X	(x)
Faradaya powellii Seem.	(x)	X	X	
Premna obtusifolia R. Br.	(x)	(x)	X	X
Vitex trifolia L.	X		(x)	
Monocotyledonae				
Araceae				
Epipremnum pinnatum (L.) Engl.	(x)	X	(x)	
Cyperaceae				
Cyperus stoloniferous Retz.				X
Fimbristylis cymosa R. Br.	X	(x)		X
Mariscus javanicus (Houtt.) Merr. & Metcalfe	X	(x)	X	X
Mariscus seemannianus (Boeck.) Palla	X		X	X
Scleria lithosperma (L.) Sw.	X		X	
Scleria polycarpa Boeck.	X		(x)	
Gramineae				
Digitaria setigera Roth ex R. & S.	X	(x)	X	X
Ischaemum murinum Forst. f.			X	
Lepturus repens (Forst. f.) R. Br.	X	X	(x)	X
Miscanthus floridulus (Labill.) Warb.	(x)		X	
Oplismenus hirtellus (L.) Beauv.	X	X	X	X
Paspalum distichum L.		X		X
Stenotaphrum micranthum (Desv.) C. E. Hubb.	X			
Thuarea involuta (Forst. f.) R. & S.	X	(x)	(x)	
Hydrocharitaceae				
Halophila ovalis (R. Br.) Hook. f.			X	
Liliaceae				
Cordyline terminalis (L.) Kunth	X		(x)	X
Musaceae				
Heliconia paka A. C. Sm.	X	X		
Orchidaceae				
Dendrobium biflorum (Forst. f.) Sw.	(x)			
Dendrobium dactylodes Rchb. f.	(x)		X	
Dendrobium aff. *tokai* Rchb. f.	(x)		(x)	
Dendrobium triviale Krzl.			X	
Didymoplexis micradenia (Rchb. f.) Hems.	X			
Oberonia equitans (Forst. f.) Mutel	(x)		X	
Oberonia heliophila Rchb. f.	(x)		X	

TABLE 5 (*Cont.*)

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Phreatia micrantha A. Rich.			(x)?	
Phreatia stenostachya (Rchb. f.) Krzl.	X			
Taeniophyllum fasciola (Forst. f.) Rchb. f.	(x)		X	
Zeuxine plantaginea (Rchb. f.) B. & H.	X			
Palmae				
Cocos nucifera L.	(x)	(x)	(x)	(x)
Pandanaceae				
Freycinetia storckii Seem.	X			
Pandanus tectorius Park.	X	(x)	X	X
Potamogetonaceae				
Syringodium isoetifolium (Aschers.) Dandy			X	
Taccaceae				
Tacca leontopetaloides (L.) O. K.	X		X	(x)
Zingiberaceae				
Zingiber zerumbet (L.) Smith	(x)		X	
Weedy Exotics				
Dicotyledonae				
Acanthaceae				
Ruellia prostrata Poir.	(x)		(x)	X
Amaranthaceae				
Cyathula prostrata (L.) Bl.	X			
Compositae				
Ageratum conyzoides L.			X	
Emilia sonchifolia (L.) DC.	X	(x)	(x)?	
Mikania micrantha HBK.	(x)	(x)	X	(x)
Pseudelephantopus spicatus (Juss.) Baker			X	
Synedrella nodiflora (L.) Gaertn.	X	X	X	X
Vernonia cinerea (L.) Less.	X	X	X	(x)
Convolvulaceae				
Operculina turpethum (L.) Manso	(x)		(x)?	X
Stictocardia tiliifolia (Desv.) Hall. f.	X		(x)	
Cruciferae				
Rorippa sarmentosa (Forst. f.) MacBr.				X
Euphorbiaceae				
Euphorbia hirta L.	(x)		X	
Euphorbia prostrata Ait.			(x)	X
Phyllanthus amarus Sch. & Thon.	(x)		X	
Leguminosae				
Desmodium triflorum (L.) DC.			X	
Pueraria lobata (Willd.) Ohwi	(x)	(x)	X	
Malvaceae				
Hibiscus abelmoschus L.			X	
Sida acuta Burm. f.			X	
Sida parrifolia DC.	X			
Sida rhombifolia L.	(x)		X	
Urena lobata L.			X	
Passifloraceae				
Passiflora foetida L.	X	(x)	(x)	X
Passiflora laurifolia L.	(x)		(x)	
Passiflora maliformis L.	X			
Piperaceae				
Peperomia pellucida C. DC.			X	
Polygalaceae				
Polygala paniculata L.			X	
Rubiaceae				
Spermacoce assurgens R. & P.	X		X	

SPECIES	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Solanaceae				
Capsicum frutescens L.	X	X	X	
Physalis angulata L.			(x)	X
Solanum nigrum L.		X		X
Tiliaceae				
Triumfetta rhomboidea Jacq.			X	
Umbelliferae				
Centella asiatica (L.) Urb.	X		X	
Verbenaceae				
Lantana camara L.	(x)	(x)	(x)	X
Stachytarpheta urticifolia Sims	(x)		X	
Monocotyledonae				
Commelinaceae				
Commelina diffusa Burm. f.	X			
Cyperaceae				
Cyperus compressus L.		(x)?		
Cyperus rotundus L.			X	
Kyllinga nemoralis (Forst.) Dandy			X	
Mariscus cyperinus (Retz.) Vahl		(x)?	X	
Pycreus polystachyos (Rottb.) Beauv.			X	
Dioscoriaceae				
Dioscorea bulbifera L.	(x)	X	(x)	
Gramineae				
Axonopus compressus (Sw.) Beauv.	X		X	
Brachiaria subquadripara (Trin.) Hitch.	X	X		X
Centosteca lappacea (L.) Desv.	X		X	
Chrysopogon aciculatus (Retz.) Trin.			X	
Cyrtococcum oxyphyllum Stapf	X			
Cyrtococcum trigonum (Retz.) A. Camus			X	
Digitaria horizontalis Willd.	X		(x)	X
Echinochloa colona (L.) Link		X		
Eleusine indica (L.) Gaertn.				X
Eragrostis tenella (L.) Beauv.			(x)	
Oplismenus compositus (L.) Beauv.			X	
Paspalum conjugatum Berg.	X		(x)	
Sporobolus diander (Retz.) Beauv.			X	
Ornamentals and Cultigens				
Dicotyledonae				
Anacardiaceae				
Mangifera indica L.	X		(x)	
Apocynaceae				
Catharanthus roseus (L.) G. Don	(x)			
Araliaceae				
Polyscias guilfoylei (Bull.) Bailey	X			
Polyscias scutellaria (Burm. f.) Fosb.	X		X	
Bombacaceae				
Ceiba pentandra (L.) Gaertn.	(x)		(x)	
Caricaceae				
Carica papaya L.	(x)	(x)	(x)	X
Euphorbiaceae				
Acalypha grandis Benth.				(x)?
Breynia nivosa (Bull.) Small			(x)	
Codiaeum variegatum (L.) Bl.			(x)	

TABLE 5 (*Cont.*)

SPECIES	ALL ISLANDS	NU'UTELE	NU'ULUA	NAMU'A	FANUATAPU
Labiatae					
Coleus blumei Benth.				X	
Lauraceae					
Cinnamomum zeylanicum Bl.				X	
Leguminosae					
Samanea saman (Jacq.) Merr.		(x)		(x)	
Malvaceae					
Hibiscus rosa-sinensis L.		X			
Moraceae					
Artocarpus altilis (Park.) Fosb.		(x)		(x)	
Myrtaceae					
Eugenia uniflora L.				X	
Psidium guajava L.				(x)	
Syzygium malaccense (L.) Merr. & Perry		X			
Rutaceae					
Citrus aurantium L.?				(x)	
Solanaceae					
Cestrum diurnum L.		(x)			
Monocotyledonae					
Araceae					
Alocasia macrorrhiza (L.) G. Don		(x)		X	(x)
Amorphophallus campanulatus (Roxb.) Bl.		X			
Colocasia esculenta (L.) Schott		(x)		(x)	
Xanthosoma nigrum (Vell.) Mansf.					X
Cannaceae					
Canna indica L.		(x)?			
Commelinaceae					
Rhoeo spathacea (Sw.) Stearn		X			
Dioscoraceae					
Dioscorea alata L.				X	
Gramineae					
Schizostachyum glaucifolium (Rupr.) Munro		(x)	X		
Musaceae					
Musa paradisiaca L.		(x)		(x)	
Native and naturalized species	178	153	79	129	57
Weedy exotics	54	29	14	43	14
Ornamentals and cultigens	28	18	2	17	4
	260	200	95	189	75

NOTE: X indicates voucher specimens collected; (x) indicates no voucher specimens collected.

species of the flora in particular require comment. Four—*Neisosperma oppositifolium*, *Sesuvium portulacastrum*, *Boerhavia australis*, and *Ischaemum murinum*—are indigenous littoral species distributed elsewhere in the Pacific. Except for the population on the Aleipata Islands, *Neisosperma* is otherwise rare in Samoa. It is reported from one place on Savai'i and possibly only one as well on Upolu. *Sesuvium* is known from Western Samoa only from the small population on Fanuatapu. *Ischaemum* is a rare littoral grass which was reported once from Savai'i, twice from Tutuila, and a single time from Namu'a. It apparently also occurs on Niue (Sykes 1970) where it has been called *Ischaemum foliosum*. The *Boerhavia* on Nu'ulua is a new record for Samoa.

The other four species are inland plants—*Manilkara dissecta*, *Sapindus vitiensis*, *Linociera* sp., and *Solanum upoluense*. *Manilkara* (*pani*) is a widespread tree in the South Pacific, but outside of the Nu'utele population, it is

rare in Samoa. In the rest of the archipelago, it is known from a single collection on Tutuila (Christophersen 1935), and a small population on the Aleipata coast behind the turtle hatchery. *Sapindus* is a tree which also occurs in Fiji, but except for sterile specimens from the Aleipata Islands, it is known only from the Apia area (cultivated?) and a single specimen collected on Savai'i. *Linociera* is an unidentified species, but is possibly the same one occurring in Tonga—*Linociera pauciflora*. It is known from Samoa by a single sterile tree found by the author on Nu'utele. The fourth species, *Solanum upoluense*, is an herb collected and named in 1905 and not collected again until a few sterile individuals were seen on Nu'utele by the author in 1978. It may be an endemic species or perhaps a cultivar that was once cultivated by the Samoans, but which is long since forgotten.

The vegetation of the four islands is also distinctive. Two communities found on these islands—*Diospyros* coastal forest and *Dysoxylum* lowland forest—are otherwise uncommon in Samoa. Coastal forest is restricted mostly to tuff cones, only several of which are found in Samoa, and *Dysoxylum* lowland forest is rare on the main islands because it usually occupies areas now turned into villages and plantations.

The vegetation communities support a number of land birds. The author recorded the many-colored fruit dove (*manu mā*), barn owl (*lulu*), Pacific pigeon (*lupe*), white-rumped swiftlet (*pe'ape'a*), flatbilled kingfisher (*ti'otala*), wattled honey-eater (*iao*), Samoan starling (*fuia*), and possibly the blue-crowned lory (*sega*). Large numbers of seabirds also nest on the Aleipata Islands, including the red-footed booby (*fua'ō*), great frigate bird (*atafa*), blue-gray noddy (*laia*), brown noddy (*gogo*), and the white tern (*manu sina*). The islands also possess the only known remaining beaches used by breeding turtles in Western Samoa.

The relatively pristine condition of the Aleipata Islands may not last much longer. The population of Samoa is growing rapidly, land is becoming increasingly valuable, and proposals have been made to variously use these islands. The two smaller islands are claimed by the government, the two larger and least disturbed islands are communally owned by two families from the Aleipata district. In support of the unique nature of the islands, Holloway (1975) has recommended that the four islands be incorporated as a national park, a recommendation supported by Ollier, Whistler, and Amerson (1979).

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