# American Samoa's Forest Resources, 2001

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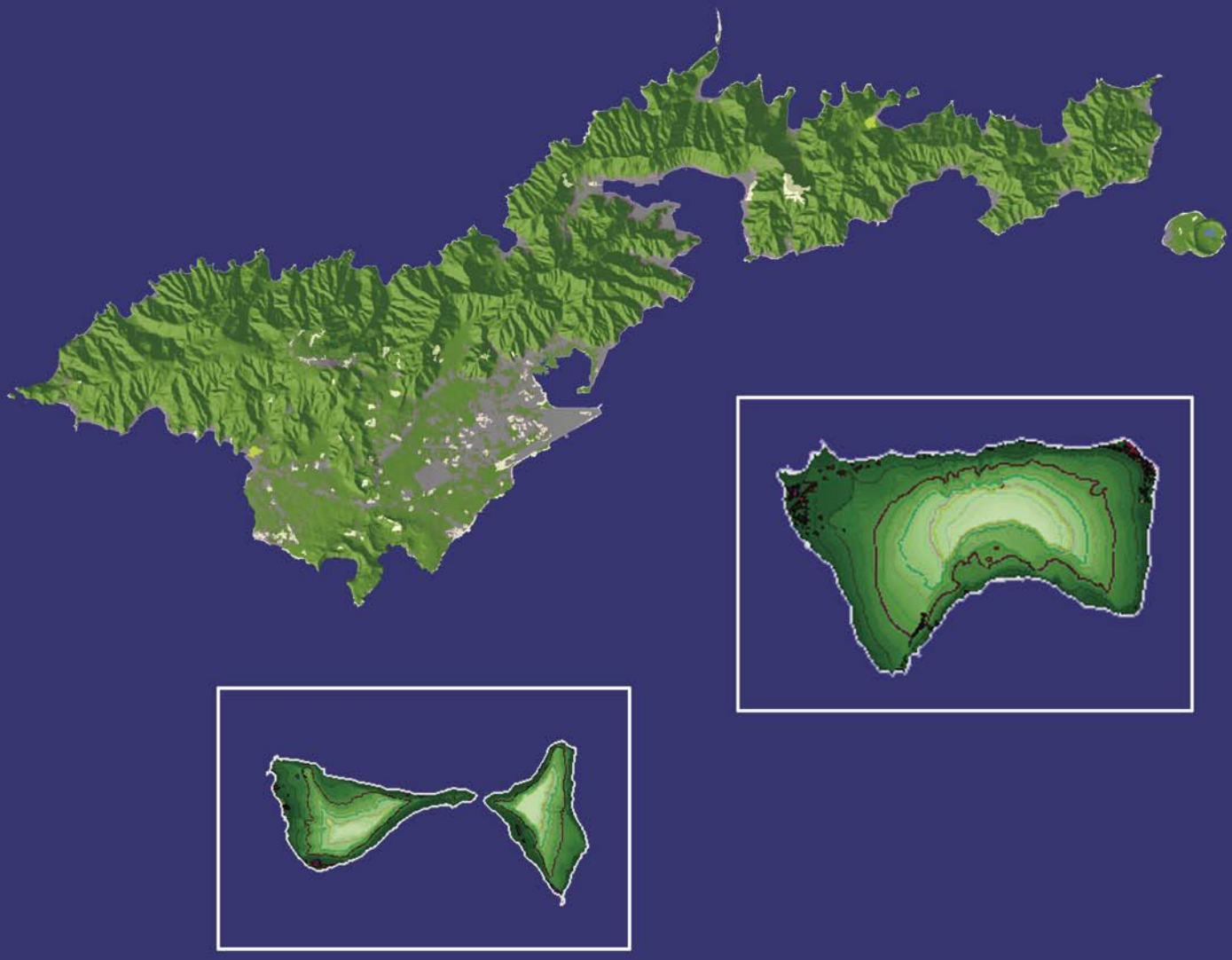

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## Abstract

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The Forest Inventory and Analysis Program of the Pacific Northwest Research Station collected, analyzed, and summarized data from field plots, and mapped land cover on four islands in American Samoa. This statistical sample provides estimates of forest area, stem volume, biomass, numbers of trees, damages to trees, and tree size distribution. The summary provides detailed tables and graphical highlights to help inform resource managers and policymakers, as well as educating the public regarding the status and trends in their natural resources.

Keywords: American Samoa, biomass, damage, FIA, forest inventory, timber volume.

## Summary

The Pacific Northwest Research Station Forest Inventory and Analysis (FIA) Program conducted a forest inventory on American Samoa to assess forest area, stem volume and biomass, tree damages, and associated understory vegetation. Twenty-one field plots were sampled by FIA and American Samoa foresters on the islands of Tutuila, Ta'u, Olosega, and Ofu. Land cover was mapped from high-resolution satellite imagery to stratify the field sample. Total forest area, including agroforest, was estimated to be 43,631 acres, or approximately 90.1 percent of the land area on these islands. Approximately 7 percent of the land cover is urban, the majority occurring on Tutuila. Gross stem volume was estimated as about 72 million cubic feet, inclusive of all size classes. The aboveground stem weight for trees at least 5 inches in diameter was estimated to be 1.1 million tons. Approximately 17 percent of the trees sampled had some form of damage, with the dominant damages being open wounds. Where the damaging agent could be identified, the primary causes were weather (25 percent) and insects (15 percent). In one-third of the cases of damage, a primary damaging agent could not be positively identified. Fifty tree species and 86 understory species were measured on 21 sixth-acre plots.

## Introduction

This summary of forest resources on the islands of American Samoa (fig. 1) is based on a pilot inventory, conducted in 2001, to test field data collection methods in the tropical Pacific. The USDA Forest Service, Pacific Northwest Research Station Forest Inventory and Analysis Program (FIA) in cooperation with Pacific Island foresters uses the inventory to help answer local and national questions about the status and trends in tropical forests. The fieldwork for this project was conducted primarily by American Samoa foresters with assistance from two mainland FIA foresters, which allowed the exchange of skills among cultures and agencies.

The FIA Program conducts a systematic, sample-based, field inventory across all ownerships in the Pacific Islands on a periodic basis. Prior inventory work in American Samoa (Cole et al. 1988) concentrated on developing a vegetation type map and assessing tree volumes for forest types. The current effort estimates the area of forest types, tree size distribution, volume, biomass, rooting and crown characteristics, and damages for living and dead trees. The inventory helps resource managers define the extent, size distribution, and species composition of their forested and nonforested lands, and after remeasurement, the change in their resources. Empirically based knowledge of the status and trends in forest vegetation can help managers plan sustainable supplies of wood, control invasive species, control erosion, and manage disturbances such as fire and animal damage.

## Objectives:

1. Test adapted FIA data collection and analysis methods in the tropical Pacific Islands.
2. Estimate the area of forest land by stand size class.
3. Estimate the volume, biomass, and carbon storage for trees by species and diameter class.
4. Estimate the numbers of trees that have died and those affected by insects and disease.
5. Share measurement and analysis techniques among groups involved in the inventory.

## Methods

### Site Description

American Samoa is a group of five volcanic islands, Tutuila, Aunu'u, Ta'u, Olosega and Ofu, and two coral atolls, Rose and Swains. The volcanic islands are topographically complex with steep rugged terrain. Slopes exceeding 70 percent occur

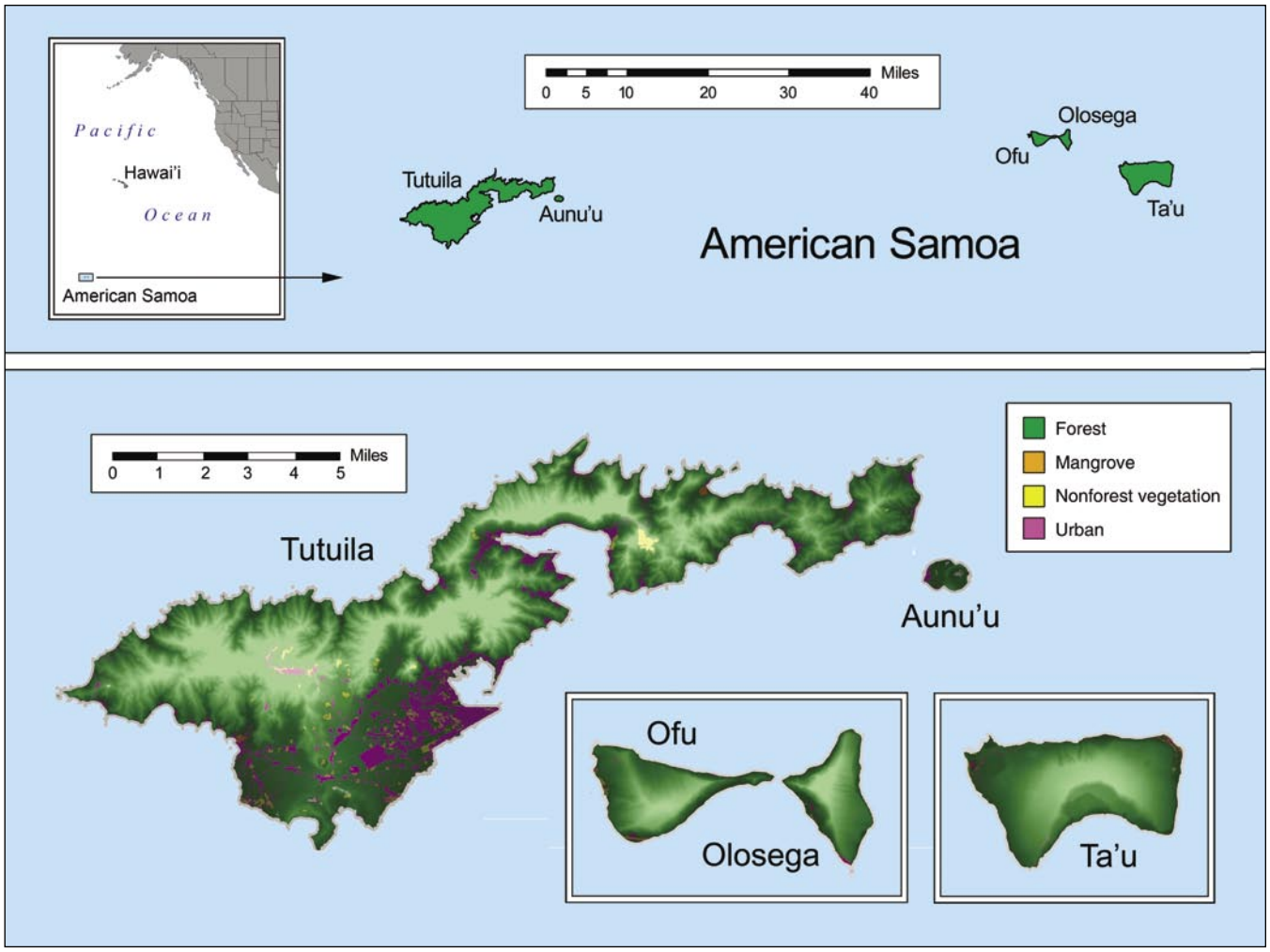


Figure 1—American Samoa is in the south-central Pacific Ocean, approximately 4,600 miles southwest of Los Angeles, California.

on about half of the volcanic landmass (Nakamura 1984). Mount Lata, on Ta'u, is the highest point in American Samoa reaching 3,166 feet in elevation. On the largest island in the group, Tutuila, Mount Matafao reaches a height of 2,142 feet. The climate is hot and humid with little variation in temperature annually and diurnally, but with a pronounced dry season lasting June through September (fig. 2).

Natural disturbances in American Samoa include hurricanes, past volcanic eruptions, and soil erosion. Hurricane frequency is moderate as American Samoa is east of the most active hurricane-producing storm tracks. Erosion is prevalent in deep volcanic soils on steep, cleared slopes. Humans have cleared forest, primarily on the lower, gentler slopes, and contributed to ecosystem disturbance by introducing nonnative plants, animals, insects, and diseases. The upland rain forest has also been logged on sites where soils permit agricultural use (Mueller-Dombois and Fosberg 1998).

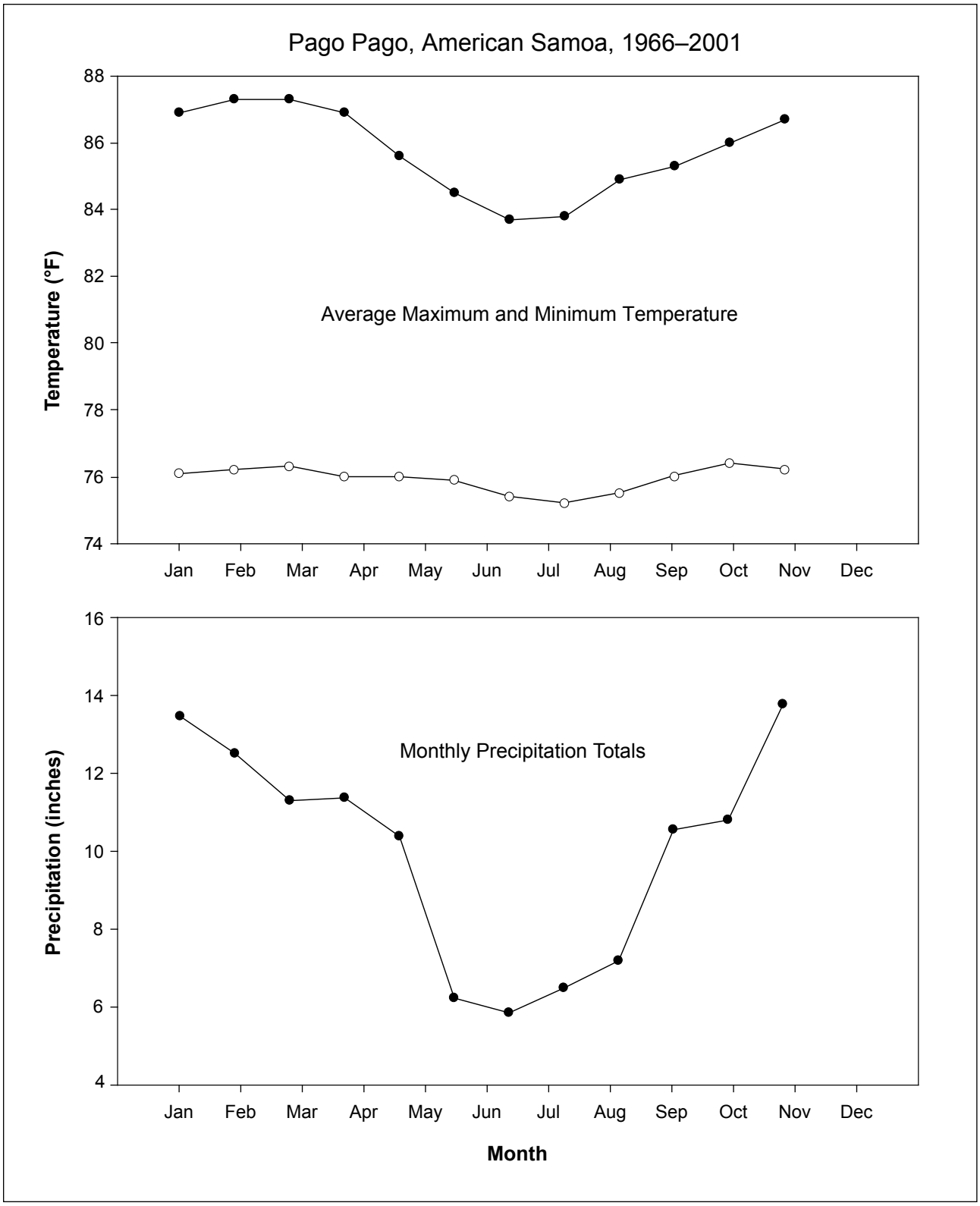


Figure 2—Average maximum and minimum temperature, and total monthly precipitation for Pago Pago, American Samoa. Note the pronounced seasonality in precipitation (Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?pipago).

The government of American Samoa leases 9,000 acres on three islands (8,000 terrestrial, 1,000 aquatic) to the U.S. Department of the Interior, National Park Service. This park was established in 1988 with the lease extending for 50 years.

## Vegetation Types

Mueller-Dombois and Fosberg (1998) recognize seven distinct categories of vegetation in American Samoa: littoral vegetation, wetland vegetation, lowland rain forest, montane rain forest, cloud forest and scrub, vegetation on recent volcanic surfaces, and modified vegetation. Each category is briefly described below including forest and community types found within them, following Whistler (1992). The FIA inventory does not provide sufficient plot density to reliably classify vegetation types in these highly diverse tropical forests, but provides plot-level data to help refine remotely sensed estimates of forest type acreage and developmental stage. Some of the species named in the vegetation descriptions did not occur on the sample of FIA field plots.

**Littoral vegetation—**
Littoral vegetation is coastal vegetation growing on well-drained substrates and lava rock, excluding mangrove and coastal lowland vegetation. Community types include herbaceous strand, littoral scrub, *Pandanus* scrub, and littoral forest. Plant communities have adapted to the harsh environment of salt spray and the coarse, low-nutrient soils. *Thespesia populnea* (L.) Soland. ex Correa is commonly found in the littoral zone. Littoral vegetation helps stabilize coastal areas and helps protect soils from erosion as well as filtering runoff back to the ocean.

**Wetland vegetation—**
Wetland vegetation is vegetation growing in saturated lowland flats and mangroves. Community types include mangrove scrub and forest, swamp forest, coastal marsh, and montane marsh and bog. *Barringtonia samoensis* is a common species found in the freshwater marshes and was once prized for boat masts (see table 1 for common names of trees and species authorities). *Hibiscus tiliaceus* often surrounds marshlands. Mangroves in American Samoa are dominated by three tree species, *Rhizophora mangle, Bruguiera gymnorrhiza* (L.) Lam., and *Xylocarpus moluccensis* (Imk.) Roem. Ferns are common here as well. The wetland vegetation, like the littoral, acts to protect soils from erosion and acts as a sediment trap for runoff.

**Lowland rain forest—**
Lowland rain forest is low-elevation forest characterized by several distinct species assemblages (see Mueller-Dombois and Fosberg 1998). Community types are based on dominant species and include *Diospyros* forest, *Dysoxylum* forest, *Pometia*

**Table 1—Scientific and common names, and estimated specific gravities [a] of species measured as trees in American Samoa**

| Scientific name | Common name | Specific gravity | Number measured |
|---|---|---|---|
| *Adenanthera pavonina* L. | lopa | 0.50 | 3 |
| *Aglaia samoensis* A. Gray | — | .50 | 3 |
| *Alphitonia zizyphoides* A. Gray | toi | .50 | 14 |
| *Artocarpus altilis* (Park.) Fosb. | — | .50 | 10 |
| *Barringtonia samoensis* A. Gray | futu | .50 | 8 |
| *Bischofia javanica* Bl. | 'o'a | .54 | 7 |
| *Buchanania merrillii* Christorph. | — | .50 | 3 |
| *Calophyllum neo-ebudicum* Guillaum. | tamanu | .50 | 2 |
| *Cananga odorata* Hook. f. | moso'oi | .29 | 23 |
| *Canarium ovatum* Engler | pili nut | .50 | 1 |
| *Canarium vitiense* A. Gray | ma'ali | .54 | 4 |
| *Cassia fistula* L. | golden shower | .71 | 3 |
| *Castilla elastica* Sessé | pulu mamoe | .50 | 5 |
| *Cocos nucifera* L. | niu | .50 | 38 |
| *Cyathea lunulata* (Forst. f.) Copel. | olioli | .50 | 48 |
| *Cyathea* spp. Sm. | treefern | .50 | 4 |
| *Diospyros samoensis* A. Gray | auli | .50 | 4 |
| *Dysoxylum maota* Reinecke | maota | .50 | 34 |
| *Dysoxylum samoense* A. Gray | mamala | .50 | 2 |
| *Elaeocarpus ulianus* Christoph. | — | .50 | 25 |
| *Elattostachys falcata* (A. Gray) Radlk. | taputo'i | .50 | 1 |
| *Erythrina fusca* Lour. | lalapa | .25 | 2 |
| *Erythrina variegata* L. | gatae | .50 | 1 |
| *Ficus obliqua* Forst. f. | aoa | .50 | 1 |
| *Ficus scabra* Forst. f. | — | .50 | 2 |
| *Flacourtia rukam* var. *micronesica* Fosb. & Sachet | filimoto | .50 | 6 |
| *Garcinia myrtifolia* A.C. Smith | — | .65 | 1 |
| *Hernandia nymphaeifolia* (Presl.) Kub. | pu'a, Chinese lantern | .50 | 7 |
| *Hibiscus tiliaceus* L. | fau | .57 | 85 |
| *Inocarpus fagifer* (Park.) Fosb. | ifi | .50 | 9 |
| *Kleinhovia hospita* L. | fu'afu'a | .36 | 5 |
| *Macaranga grayana* Muell. Arg. | — | .50 | 2 |
| *Macaranga harveyana* (Muell. Arg.) Muell. Arg. | lau pata | .50 | 10 |
| *Mangifera indica* L. | — | .52 | 1 |
| *Morinda citrifolia* L. | nonu | .50 | 6 |
| *Myristica fatua* Houtt. | 'atone | .50 | 61 |
| *Neisosperma oppositifolia* (Lam.) Fosb. & Sachet | fao | .50 | 5 |
| *Neonauclea forsteri* Merr. | afa | .50 | 8 |
| *Omalanthus nutans* (J.G. Forst.) Guill. | fanuamamala | .50 | 1 |
| *Pipturus argenteus* (Forst.) Wedd. | soga | .50 | 8 |
| *Pisonia grandis* R. Br. | pu'avai | .50 | 1 |
| *Planchonella garberi* Christoph. | 'ala'a | .50 | 4 |
| *Planchonella torricellensis* (K. Schum.) Lam. | — | .50 | 2 |
| *Psychotria insularum* A. Gray | matalafi | .50 | 2 |

**Table 1—Scientific and common names, and estimated specific gravities [a] of species measured as trees in American Samoa (continued)**

| Scientific name | Common name | Specific gravity | Number measured |
|---|---|---|---|
| *Rhizophora mangle* L. | togo | .50 | 12 |
| *Rhus taitensis* Guillem. | tavai | .50 | 32 |
| *Scaevola taccada* (Gaertn.) Roxb. | to'ito'i | .50 | 3 |
| *Sterculia fanaiho* Setchell | fana'io | .50 | 1 |
| *Syzygium inophylloides* C. Muell. | asi | .50 | 6 |
| *Syzygium samarangense* (Bl.) Merr. & Perry | nonu vao | .50 | 1 |
| *Syzygium samoense* (Burk.) Whistler | fena vao | .50 | 1 |

[a] Specific gravity was used to calculate biomass and carbon mass.

forest, *Syzygium* forest, and *Planchonella (Pouteria)* forest. Tree species that are highly valued for their wood are found here and include *Pometia pinnata* J.R. & J.G. Forst., *Syzygium inophylloides*, and *Calophyllum neo-ebudicum*. Lowland rain forests occur on ridges, slopes, in valleys, and on lowland lava flows. Drier forest types are found on ridges and slopes. Extensive lowland lava flow forest once existed on the Tafuna plains of Tutuila, but except for 40 acres, it has been replaced largely by urban development and coconut plantations. As the market for coconut has dropped off, the plantations have been abandoned and are slowly converting to secondary vegetation with mixed agroforest.

**Montane rain forest—**

Montane rain forest is high-elevation, often steeply sloped forest (>1,640 feet) characterized by high precipitation. The dominant canopy species is the native *Dysoxylum huntii* Merr. ex Setchell. No community types are differentiated by Whistler (1992) for this category. The higher elevation forests tend to be less impacted by severe weather. The steep slopes inhibit cultivation.

**Cloud forest and scrub—**

Limited to the highest elevations on Ta'u and Olosega in American Samoa, this forest type is cooler and wetter than montane rain forest and dominated by tree ferns given sufficient recovery time following hurricanes. No community types are defined by Whistler (1992). The endemic *Reynoldsia plesosperma* A. Gray is the dominant tree form in these forests. Cloud forest is generally blanketed by clouds and mist, enabling a thick layer of mosses and epiphytes to grow on most surfaces.

**Vegetation on recent volcanic surfaces—**

Pioneer rain forest vegetation occurring on recent lava flows includes lowland volcanic scrub and upland volcanic scrub community types.

**Modified vegetation—**
Vegetation types that arise from human-caused changes in growing conditions, disturbance regimes, or other manipulations. Community types include secondary scrub, secondary forest, fernland, and managed land.

## Field Methods

This inventory is based on the national FIA inventory (USDA Forest Service 2003) conducted on the mainland United States across all ownerships and forest types. Adaptations were made to the national design to include additional branching and rooting forms, a topographically based index of site productivity, additional tree crown measurements, and the inclusion of special interest species ranging from invasive plants, to pathogens, to culturally or economically important species of various life forms. In the mainland FIA program, plots are spaced within forest land on a 3.3-mile grid. With the active assistance of the American Samoa Community College, Community and Natural Resources, Forestry Division, plots were spaced across all vegetation types at 1.9-mile intervals, yielding a triple intensification of the mainland inventory plot grid.

The FIA plot cluster is composed of four 24-foot-radius subplots. Three of those subplots are equally spaced, as if on spokes of a wheel, around the central subplot (fig. 3). The distance from the middle of the central subplot to the middle of each subplot on the three spokes is 120 feet.

A variety of information is collected at the plot, subplot, and tree levels (USDA Forest Service 2002). Differences in forest-type conditions are also mapped. For example, roads that intersect subplots are mapped, as are clear boundaries in forest size classes. The primary variables collected include plot location, slope, aspect, elevation, subplot slope position and slope shape, tree species, diameters, heights, damages, branching and rooting forms, decay, epiphytic loadings, crown characteristics, tree locations, and regeneration information. The field data for this inventory was collected over a 7-month period, starting May 2001.

## Analysis Methods

The FIA program defines different land categories (strata) across a landscape by using aerial photography or satellite imagery. The simplest stratification is separating land into forest and nonforest. However, stratifications can be assisted or refined by using ancillary data, such as topography, soils information, life zone or climate information, and prior inventories of vegetation groups.

The American Samoa land-cover stratification was conducted via a classification of IKONOS satellite data. Cloud cover on the interior of the islands was masked out and replaced with pieces of a vegetation map produced in 1988 from

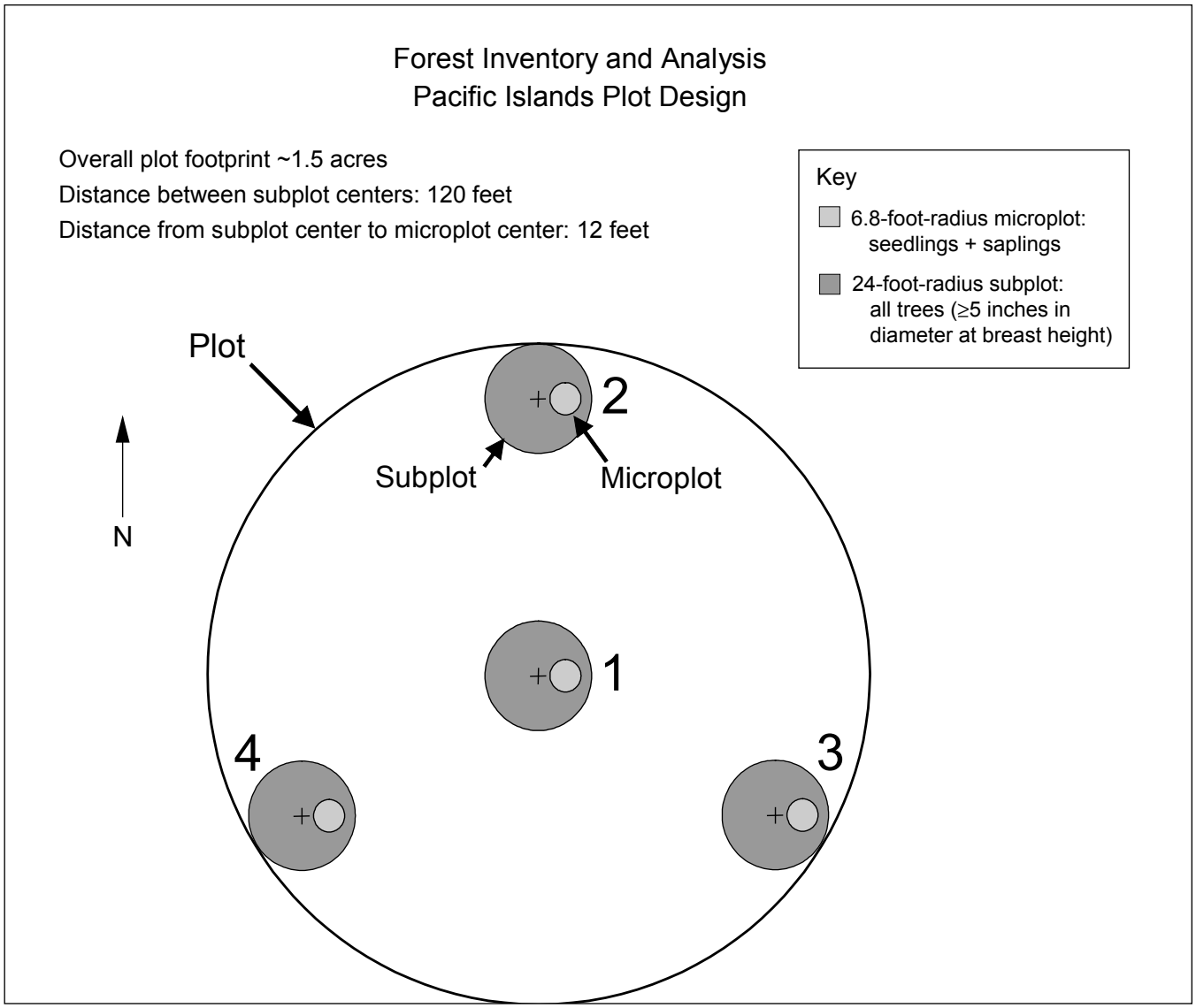


Figure 3—Forest Inventory and Analysis Pacific Islands plot design.

aerial photography. The initial classification divided the landscape into forest, urban, nonforest vegetation, barren, and water land types. Ten percent cover of trees was used as the basis for the forest land classification and includes both agroforests and mangrove forests. Nonforest vegetation includes other vegetation types with less than 10 percent cover of trees. The acreage each field plot represents was derived by dividing the total acreage of forest by the number of field plots falling within the geographic bounds of that specific land cover. Mean stand size is expanded to the landscape level by using the same expansion factors.

Wood volume was estimated for individual trees by using tree height and two stem diameter measurements. These measurements are expanded to volume

estimates by using equations for sections of a cone. Biomass for individual tree stems is estimated by using the specific gravity for known species (11 out of 51 species measured on American Samoa have known specific gravities). For species where specific gravity is not known, an average specific gravity, according to island group, is used. Figures for aboveground tree biomass are estimated by using bole volume and do not include branch, foliage, or root biomass.

An additive combination of relative density and relative basal area (importance value) is used to classify forest types and assess species dominance in a stand. Site productivity estimates traditionally require forest stand age, derived from the annual rings of forest trees. Because tropical trees do not produce consistent annual rings, a modified topographic relative moisture index (TRMI) (Parker 1982) was used as a proxy for site productivity. The TRMI used a weighted, additive combination of slope steepness, slope shape, and slope position to assess the potential moisture channeling to a forest stand. Although moisture is not likely to be the only factor limiting tree growth, here it serves as a proxy for productivity until we can obtain remeasurement data for forest productivity.

### Reliability of FIA Data

The area of land cover types mapped from the IKONOS classification is assumed to be accurate and is used as the basis for the expansion of the numbers of trees, tree volume, and tree biomass from the plot scale to the forest-type scale. Possible sources of error not accounted for in our estimates include errors in the land cover map owing to incorrect interpretation of the image, errors from rounding when working with pixel-based imagery, and measurement errors on field plots. Standard errors for the expansion of our estimates from field plots to the forested landscape were calculated according to the proportion of area occupied by forest. Forest area was treated as known rather than estimated, and variance was calculated by using methods in Cochran (1977). With one standard error as our basis for evaluation, there is a 68-percent chance that the true total gross stem volume (trees ≥5 inches diameter at breast height) on American Samoa lies between 59,798,356 and 73,600,504 cubic feet. There is a 68-percent chance that the true number of trees (≥1 inch diameter) on American Samoa lies within the range of 15,257,877 to 20,551,881.

## Resource Highlights

### Forest Area

The islands of American Samoa are primarily forested (90.1 percent; fig. 4, table 2) as interpreted from IKONOS satellite imagery. Agroforest and coconut plantations

**Urban lands expanded from 5 percent of the total land area to 7 percent in 15 years. Mangroves declined sharply in extent.**

have replaced the majority of the native lowland rain forest (Mueller-Dombois and Fosberg 1998); however, we have included these managed lands in our definition of forested acreage. About 7.3 percent of the island group is classified as urban, occupying the gentle terrain where lowland rain forest previously existed. The important mangrove forests act as a buffer to storms and as a sediment and nutrient filter for water moving from the land to the ocean. Mangroves were recently mapped (American Samoa Community College) and are estimated to cover approximately 120 acres on American Samoa. The National Park Service leases approximately 16 percent of the land on American Samoa for the National Park of American Samoa.

## Loss of Forest Land and Mangroves

The FIA group recently digitized the 1988 American Samoa land cover map (Cole et al. 1988) to compare with the recently produced IKONOS-based land cover map. We estimate that forest land area has declined by about 3 percent over the 15-year period (figs. 4 and 5, table 2). However, during this same period, the area occupied by mangroves has declined by approximately 18 percent as shown by the land cover

**Table 2—Estimated land area by land status, 1985 and 2001**

| | 1985 acres | | | | 2001 acres | | | |
|---|---|---|---|---|---|---|---|---|
| Land status | Ta'u | Ofu and Olosega | Tutuila and Aunu'u | Total | Ta'u | Ofu and Olosega | Tutuila and Aunu'u | Total |
| Accessible forest land: | | | | | | | | |
| Unreserved forest land | 10,837 | 2,978 | 30,976 | 44,791 | 7,108 | 1,450 | 27,368 | 35,928 |
| Protected forest land (National Park Service lease and reserves)[a] | — | — | — | — | 3,711 | 1,509 | 2,362 | 7,581 |
| Mangrove[b] | — | — | 148 | 148 | — | — | 122 | 122 |
| All accessible forest land | 10,837 | 2,978 | 31,124 | 44,939 | 10,819 | 2,959 | 29,852 | 43,631 |
| Nonforest and other areas: | | | | | | | | |
| Nonforest urban | 116 | 33 | 2,252 | 2,401 | 125 | 36 | 3,368 | 3,530 |
| Nonforest vegetation | 233 | 95 | 776 | 1,104 | 156 | 47 | 511 | 715 |
| Barren lands | — | — | 14 | 14 | 131 | 74 | 343 | 548 |
| Water | — | — | 64 | 64 | — | — | 10 | 10 |
| All nonforest and other | 349 | 128 | 3,106 | 3,583 | 412 | 157 | 4,232 | 4,803 |
| Total area (acres) | 11,186 | 3,106 | 34,230 | 48,522 | 11,231 | 3,116 | 34,084 | 48,434 |
| Nonsampled area: | | | | | | | | |
| Access denied | | | | | — | — | — | — |
| Hazardous conditions | | | | | 3,017 | — | 1,207 | 4,224 |

Notes: — = none.

Land area figures for 2001 acreage differ slightly from published survey area owing to boundary edges being constrained to square pixels on our satellite-image-derived vegetation map. Land area figures for 1986 acreage are computed from Cole et al. (1988) USDA Forest Service vegetation maps that were scanned and digitized for a geographic information system by FIA in 2002.

[a] Estimates of protected forest land acreage are from Graves 2003.

[b] Unpublished data from global positioning system survey by American Samoa Forestry Division and American Samoa Community College.

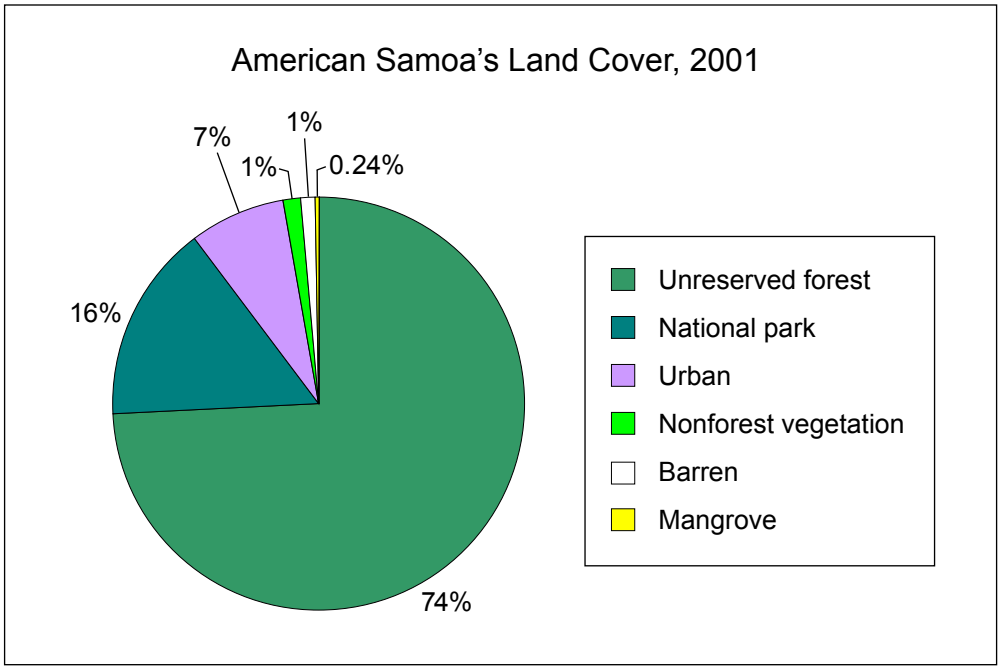


Figure 4—Land cover was mapped for American Samoa by using high-resolution satellite imagery. American Samoa is currently about 90 percent forested, including agroforest and plantations, and about 7 percent urban lands.

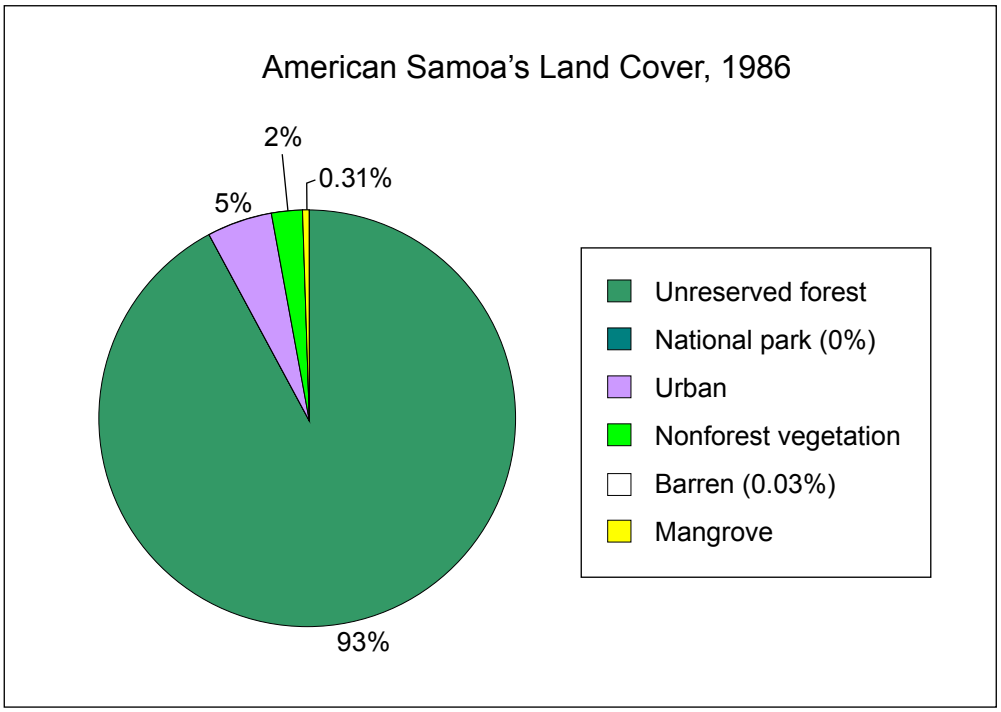


Figure 5—American Samoa was approximately 93 percent forested and 5 percent urban lands in 1986.

maps. Mangrove area has declined rapidly as increasing population and urbanization pressure has led to cutting and filling of mangroves (Whistler 1980). The 1988 map was produced via air photointerpretation aided by ground truthing, whereas the 2001 estimates were derived from mapping mangrove boundaries with global positioning systems. A more thorough inventory of the mangrove areas is currently being conducted by the Division of Forestry on American Samoa. Urban lands have increased by an estimated 47 percent. In contrast, the establishment of the National Park of American Samoa has increased protected lands from none in 1986 to 16 percent in 2001.

## Productivity

Potential productivity on forest land is relatively high where there are sufficient plains, plateaus, and local depressions to hold precipitation for plant growth (fig. 6). However, much of American Samoa is steeply sloped terrain (Nakamura 1984) where soil is retained primarily by vegetative cover (Mueller-Dombois and Fosberg 1998). In the first forestry survey of American Samoa, Nelson (1964) reports, "…approximately half of the forested area is of such steep slope and thin soil that practical considerations and the need to protect watershed values should prohibit or limit forest utilization of disturbances."

## Forest Structure

**The majority of forest acreage is dominated by trees averaging 5 to 11 inches in diameter.**

Forest stands tend to be dominated by moderate-sized trees that primarily range from about 5 to 20 inches in diameter (fig. 7). The majority of forest acreage is classified as stands with trees that average 5 to 10.9 inches in diameter. No stands were classified as larger diameter (20+ inches) stands; however, there are occasional large trees within the matrix of moderate-sized trees.

## Regeneration

Regeneration in American Samoa forests is plentiful. The diameter distribution for trees follows a reverse-J pattern, typical of all-aged forests (fig. 8, table 3). Through time, the numbers of trees growing into larger diameter size classes steadily decreases with increasing size class as competition and mortality take their toll. Hurricane, insects, disease, and human disturbance contribute to mortality as well.

## Wood Volume

Tree stem volume on **forest land** in American Samoa averaged approximately 1,530 cubic feet per acre. Reanalysis of the 1985 **timberland** data for American Samoa shows stem volume to have been approximately 1,700 cubic feet per acre at that time (Cole et al. 1988). However, the 1985 values do not include agroforest,

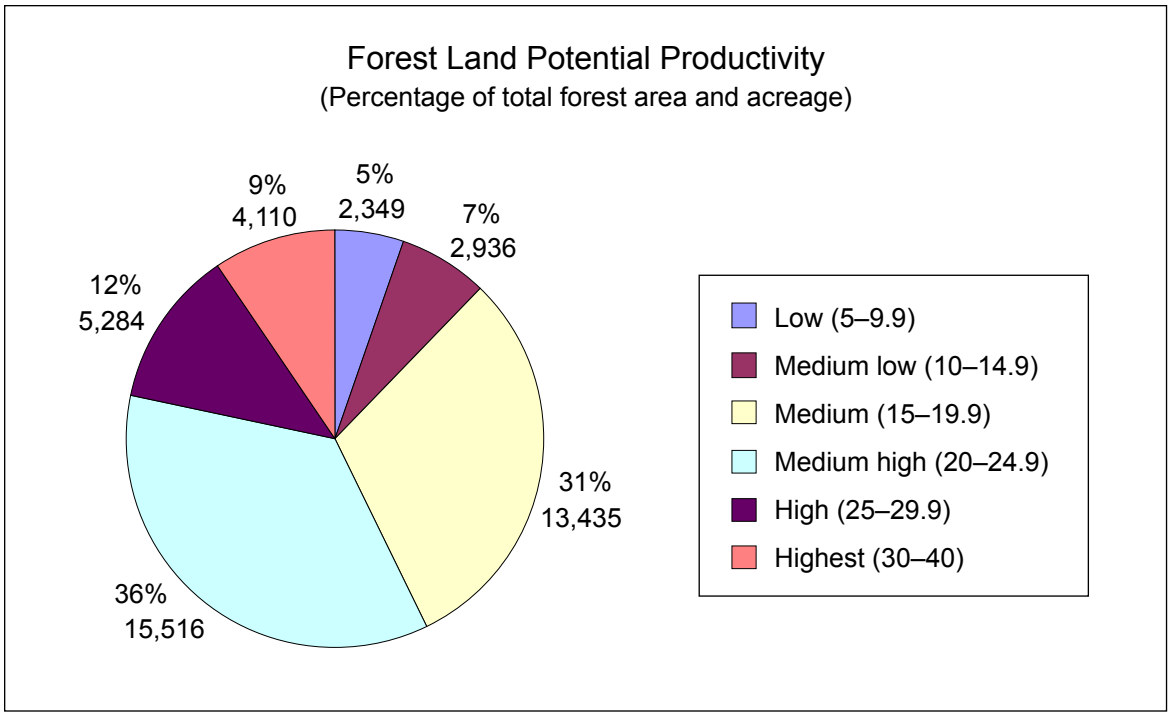


Figure 6—Based on a topographic relative moisture index (TRMI, i.e., moisture availability), much of the land on American Samoa is potentially medium to high productivity. Numbers in the legend represent scores on the TRMI.

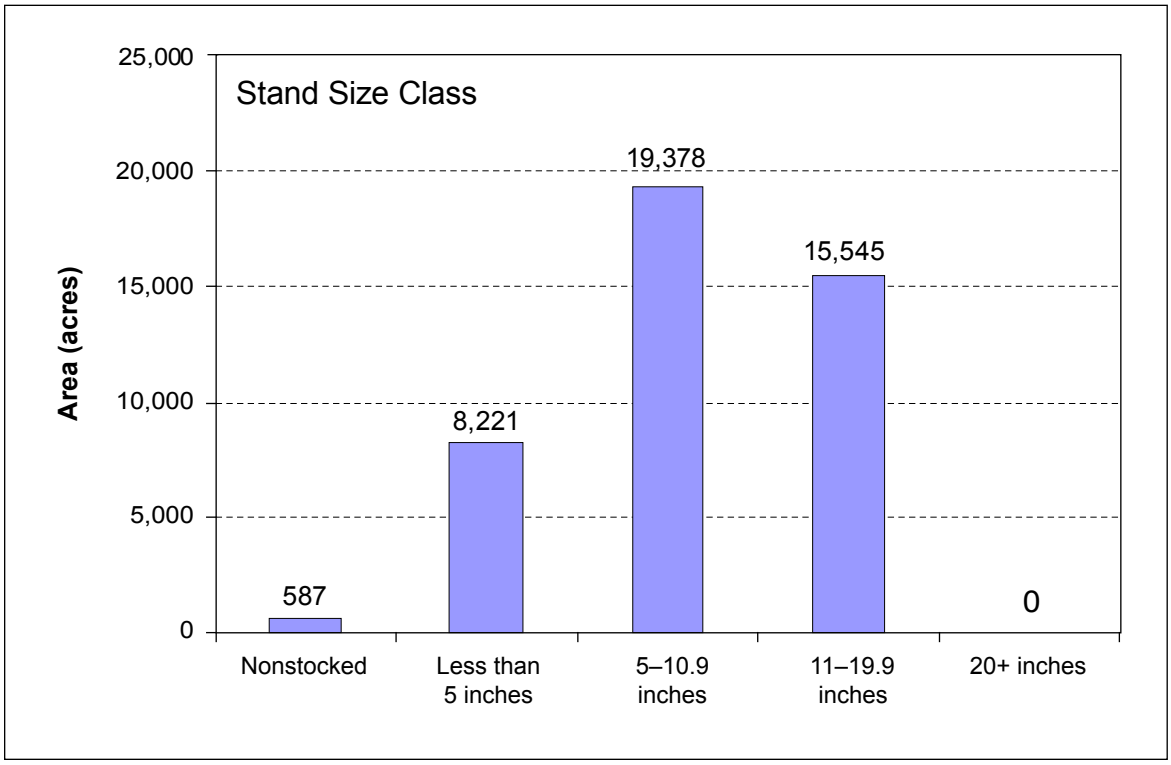


Figure 7—Although some large trees are present, stands are characterized primarily by small- to medium-diameter trees.

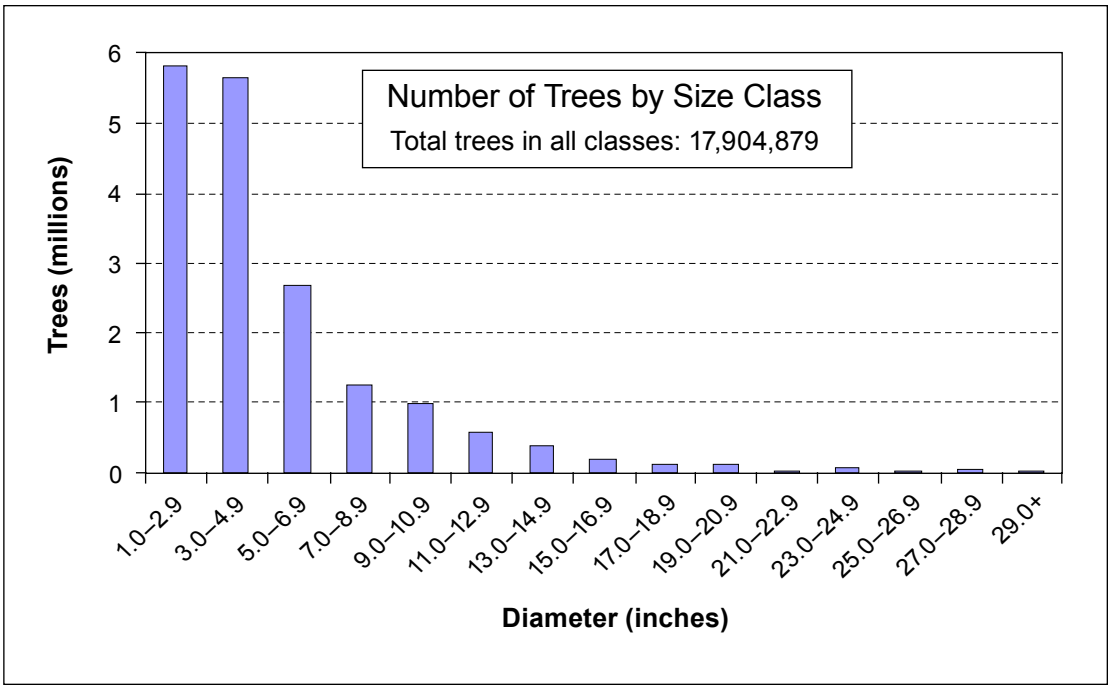


Figure 8—Smaller trees are the most numerous across all size classes. The number of these trees that grow into larger size classes gradually diminishes through time, typical of all-aged forests.

**Regeneration appears plentiful in American Samoa forests.**

steep forest, scrub, or moss forest, which would be expected to lower the overall average volume figure. Timberland is considered the most productive subset of forest land, where timberland is defined as being capable of producing at least 20 cubic feet of industrial wood per acre per year. A similar average volume on **timberland** of 1,668 cubic feet per acre was found on Palau (MacLean et al. 1988), whereas a lower average **forest land** volume of 940 cubic feet per acre was estimated for Guam where small-diameter trees are predominant (Donnegan et al. 2004). Nelson (1964) estimated an average of about 8,000 **board feet** per acre on forest land in American Samoa. To roughly convert board foot volume to cubic foot volume, we divided by five, estimating about 1,600 cubic feet per acre at the time of Nelson's (1964) survey. Although there are relatively few larger trees on American Samoa, their large diameters and heights contribute greatly to volume in the upper diameter size classes (fig. 9, tables 4 and 5).

## Biomass and Carbon

Biomass and carbon distribution by diameter class closely follows the pattern seen in volume by diameter class (fig. 10, tables 6 and 7). Approximately 22 percent of the individual tree species that were recorded on the FIA plots had known specific gravities for biomass calculations. The remainder of the species were assigned a specific gravity based on the average of known species.

## Table 3—Estimated number of live trees on forest land by species and diameter class

| Species | Diameter class (inches) | | | | | | | | | | | | | | | All classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.0–2.9 | 3.0–4.9 | 5.0–6.9 | 7.0–8.9 | 9.0–10.9 | 11.0–12.9 | 13.0–14.9 | 15.0–16.9 | 17.0–18.9 | 19.0–20.9 | 21.0–22.9 | 23.0–24.9 | 25.0–26.9 | 27.0–28.9 | 29.0+ | |
| | Number of trees | | | | | | | | | | | | | | | |
| *Adenanthera pavonina* | — | — | 14,135 | 28,270 | — | — | — | — | — | — | — | — | — | — | — | 42,406 |
| *Aglaia samoensis* | — | — | — | — | — | — | — | — | 14,135 | 14,135 | — | 14,135 | — | — | — | 42,406 |
| *Alphitonia zizyphoides* | — | 176,078 | 70,676 | 70,676 | 42,406 | — | — | — | — | — | — | — | — | — | — | 359,836 |
| *Artocarpus altilis* | 176,078 | — | 56,541 | 42,406 | 28,270 | — | — | — | — | — | — | — | — | — | — | 303,295 |
| *Barringtonia samoensis* | 704,314 | — | — | — | 14,135 | 14,135 | 14,135 | 14,135 | — | — | — | — | — | — | — | 760,855 |
| *Bischofia javanica* | — | — | 14,135 | 14,135 | — | 28,270 | 28,270 | — | — | — | — | — | — | 14,135 | — | 98,946 |
| *Buchanania merrillii* | — | — | 28,270 | — | — | — | — | — | — | 14,135 | — | — | — | — | — | 42,406 |
| *Calophyllum neo-ebudicum* | — | — | 14,135 | 14,135 | — | — | — | — | — | — | — | — | — | — | — | 28,270 |
| *Cananga odorata* | — | 352,157 | 56,541 | 70,676 | 70,676 | 42,406 | 28,270 | 28,270 | — | — | — | — | — | — | — | 648,996 |
| *Canarium ovatum* | — | — | — | — | — | — | — | 14,135 | — | — | — | — | — | — | — | 14,135 |
| *Canarium vitiense* | — | — | 14,135 | 14,135 | 14,135 | — | — | — | — | — | — | 14,135 | — | — | — | 56,541 |
| *Cassia fistula* | — | — | — | — | — | 14,135 | — | — | — | — | — | — | 14,135 | 14,135 | — | 42,406 |
| *Castilla elastica* | — | — | 42,406 | 28,270 | — | — | — | — | — | — | — | — | — | — | — | 70,676 |
| *Cocos nucifera* | — | — | 28,270 | 28,270 | 197,893 | 169,622 | 113,081 | 14,135 | — | — | — | — | — | — | — | 551,272 |
| *Cyathea lunulata* | 352,157 | 176,078 | 508,867 | 56,541 | — | 28,270 | 14,135 | — | — | — | — | — | — | — | — | 1,136,048 |
| *Cyathea* spp. | — | — | 28,270 | — | 28,270 | — | — | — | — | — | — | — | — | — | — | 56,541 |
| *Diospyros samoensis* | 352,157 | — | — | — | — | 14,135 | 14,135 | — | — | — | — | — | — | — | — | 380,427 |
| *Dysoxylum maota* | 176,078 | 176,078 | 98,946 | 84,811 | 98,946 | 56,541 | 14,135 | 14,135 | 14,135 | 28,270 | — | 14,135 | — | 14,135 | 14,135 | 804,483 |
| *Dysoxylum samoense* | 176,078 | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 190,214 |
| *Elaeocarpus ulianus* | 352,157 | 352,157 | 141,352 | 84,811 | 28,270 | — | 14,135 | — | — | — | 14,135 | — | — | — | — | 987,018 |
| *Elattostachys falcata* | — | 176,078 | — | — | — | — | — | — | — | — | — | — | — | — | — | 176,078 |
| *Erythrina fusca* | — | — | — | — | — | 14,135 | — | — | — | 14,135 | — | — | — | — | — | 28,270 |
| *Erythrina variegata* | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Ficus obliqua* | — | — | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Ficus scabra* | — | 176,078 | — | — | — | 14,135 | — | — | — | — | — | — | — | — | — | 190,214 |
| *Flacourtia rukam* | — | — | 70,676 | 14,135 | — | — | — | — | — | — | — | — | — | — | — | 84,811 |
| *Garcinia myrtifolia* | — | 176,078 | — | — | — | — | — | — | — | — | — | — | — | — | — | 176,078 |
| *Hernandia nymphaeifolia* | — | 176,078 | 42,406 | 14,135 | 14,135 | 14,135 | — | — | — | — | — | — | — | — | — | 260,890 |
| *Hibiscus tiliaceus* | 528,235 | 880,392 | 621,948 | 282,704 | 113,081 | 14,135 | 14,135 | — | — | — | — | — | — | — | — | 2,454,631 |
| *Inocarpus fagifer* | — | — | 28,270 | 42,406 | 28,270 | — | — | 14,135 | — | 14,135 | — | — | — | — | — | 127,217 |
| *Kleinhovia hospita* | — | 176,078 | 28,270 | — | — | 28,270 | — | — | — | — | — | — | — | — | — | 232,619 |
| *Macaranga grayana* | 176,078 | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 190,214 |
| *Macaranga harveyana* | — | — | 14,135 | 56,541 | 56,541 | — | 14,135 | — | — | — | — | — | — | — | — | 141,352 |
| *Mangifera indica* | — | — | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Morinda citrifolia* | 352,157 | 352,157 | 14,135 | — | 14,135 | — | — | — | — | — | — | — | — | — | — | 732,584 |
| *Myristica fatua* | 704,314 | 880,392 | 424,056 | 183,757 | 98,946 | 14,135 | — | 14,135 | — | — | — | — | — | — | — | 2,319,736 |
| *Neisosperma oppositifolia* | 352,157 | 352,157 | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 718,449 |
| *Neonauclea forsteri* | — | — | 42,406 | — | — | 14,135 | 14,135 | — | 14,135 | — | — | 28,270 | — | — | — | 113,081 |
| *Omalanthus nutans* | — | — | — | — | — | — | — | — | 14,135 | — | — | — | — | — | — | 14,135 |
| *Pipturus argenteus* | 528,235 | — | 42,406 | — | 14,135 | — | — | — | — | — | — | — | — | — | — | 584,776 |
| *Pisonia grandis* | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Planchonella garberi* | — | 176,078 | — | 14,135 | — | 14,135 | 14,135 | — | — | — | — | — | — | — | — | 218,484 |
| *Planchonella torricellensis* | — | — | — | — | 14,135 | — | — | 14,135 | — | — | — | — | — | — | — | 28,270 |
| *Psychotria insularum* | 176,078 | 176,078 | — | — | — | — | — | — | — | — | — | — | — | — | — | 352,157 |
| *Rhizophora mangle* | 176,078 | 528,235 | 42,406 | — | 14,135 | — | — | 14,135 | 28,270 | 14,135 | — | — | — | — | — | 817,395 |
| *Rhus taitensis* | — | 176,078 | 70,676 | 84,811 | 70,676 | 70,676 | 70,676 | 14,135 | 28,270 | — | — | 14,135 | — | — | 14,135 | 614,269 |
| *Scaevola taccada* | 352,157 | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 366,292 |
| *Sterculia fanaiho* | — | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Syzygium inophylloides* | — | — | 28,270 | 14,135 | — | — | — | 42,406 | — | — | — | — | — | — | — | 84,811 |
| *Syzygium samarangense* | — | — | 14,135 | — | — | — | — | — | — | — | — | — | — | — | — | 14,135 |
| *Syzygium samoense* | 176,078 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 176,078 |
| Total | 5,810,589 | 5,634,510 | 2,685,685 | 1,258,032 | 989,463 | 565,407 | 367,515 | 197,893 | 113,081 | 98,946 | 14,135 | 84,811 | 14,135 | 42,406 | 28,270 | 17,904,879 |

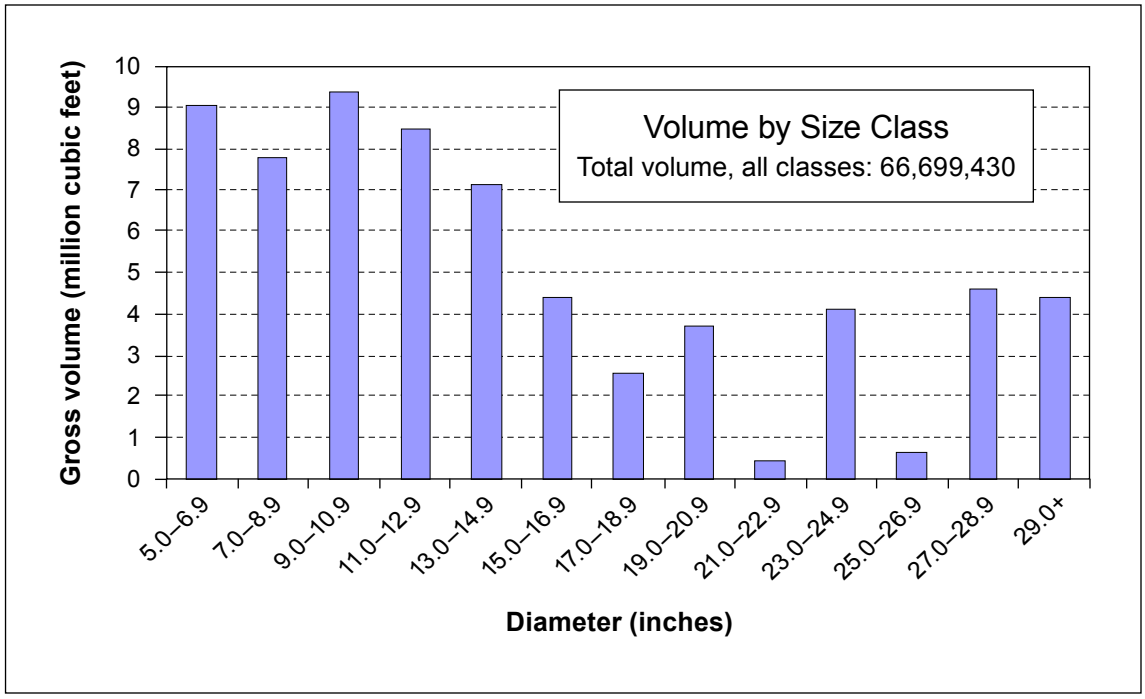


Figure 9—Larger trees contribute greatly to total volume of stem wood in American Samoa.

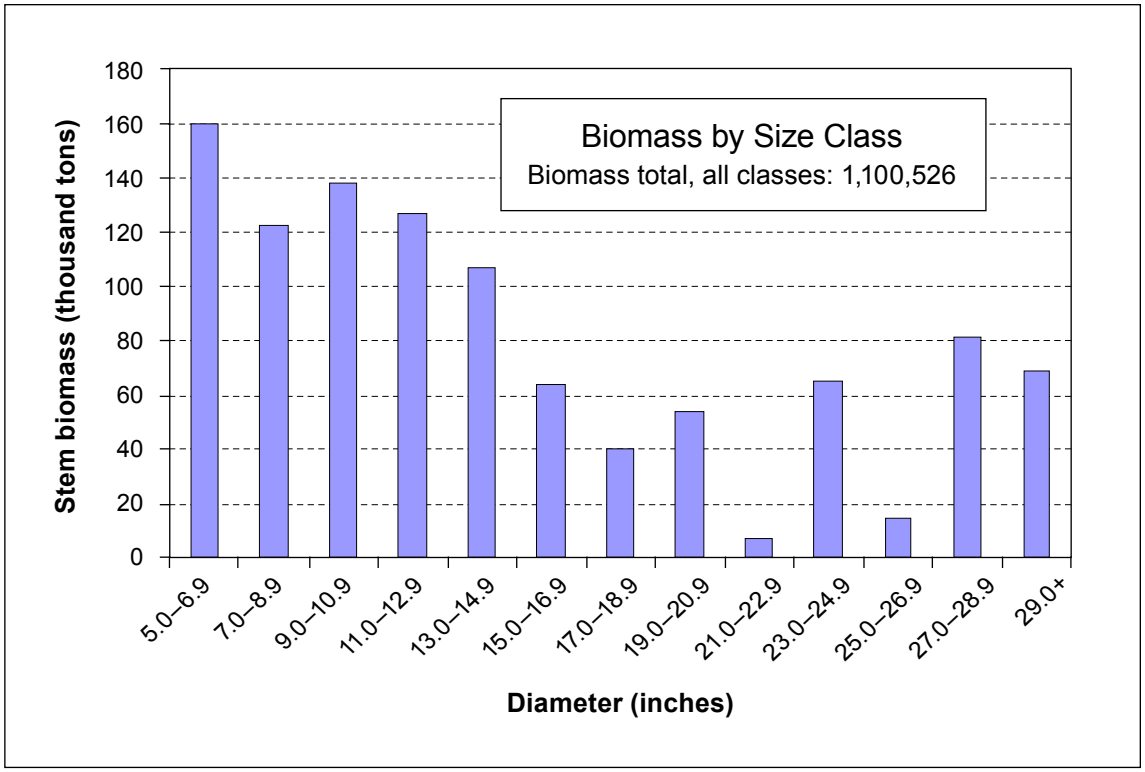


Figure 10—Stem biomass is concentrated in the smaller size classes for trees in American Samoa.

**Table 4—Estimated volume of all live trees on forest land by diameter class**

| | Diameter class (inches) | | | | |
|---|---|---|---|---|---|
| | <5 | 5–10.9 | 11–19.9 | 20+ | All sizes |
| | | | *Cubic feet* | | |
| Gross volume | 5,591,558 | 26,209,076 | 24,801,007 | 15,689,347 | 72,290,988 |
| Net volume | [a] | 26,131,770 | 24,494,828 | 15,553,000 | 66,179,597 |

[a] Net volume was not calculated for trees less than 5 inches in diameter.

## Numbers of Canopy and Understory Species

In addition to tree measurements, understory vegetation was identified and its cover was estimated when it occupied at least 3 percent of an FIA subplot. Special-interest species that were considered important by local foresters were estimated for cover even though their cover may have been less than 3 percent. The species estimates represent a rough approximation of cover and species numbers for the most common plants only. Fifty tree species and 86 understory plant species were identified on 20 FIA plots (tables 1, 8 and 9). To place our species numbers in context, Whistler (1980) suggests there are over 320 angiosperm species, and the National Park Service lists over 470 native species of flowering plants and ferns for American Samoa (Craig 2002). On a per-plot basis (approximately one-sixth of an acre: summing four subplots of 24-foot radius each = 7,238 square feet), there are fairly high numbers of tree species per plot, with an average of about seven species per plot (fig. 11).

## Tree Damage and Mortality

Approximately 17 percent of the trees measured had some form of visible damage (fig. 12, table 10). The primary damage types were evident as open wounds and conks (fungal growth on the trunk often indicates rot). Damaged shoots often result in lost apical dominance, meaning that a stem leader is damaged to the point that another branch assumes dominance as the primary stem.

**Seventeen percent of the trees measured in American Samoa exhibited visible damages.**

The FIA field crews attempt to assign a causal agent to tree damages that can help local forest managers detect forest pest problems before they become widespread. Often, the cause of damage cannot be reliably identified and is assigned as unknown. However, by studying the surrounding area looking for patterns of branch breakage and blowdown or signs of human or insect activity, a causal agent can be assigned to a damage type. Weather, insects, and humans tend to be identified as important primary and secondary disturbance agents in American Samoa forests (figs. 13 and 14).

## Table 5—Estimated gross volume of all live trees on forest land by species and diameter class

| Species | Diameter class (inches) | | | | | | | | | | | | | All classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.0–6.9 | 7.0–8.9 | 9.0–10.9 | 11.0–12.9 | 13.0–14.9 | 15.0–16.9 | 17.0–18.9 | 19.0–20.9 | 21.0–22.9 | 23.0–24.9 | 25.0–26.9 | 27.0–28.9 | 29.0+ | |
| | *Cubic feet* | | | | | | | | | | | | | |
| *Adenanthera pavonina* | 58,075 | 156,231 | — | — | — | — | — | — | — | — | — | — | — | 214,306 |
| *Aglaia samoensis* | — | — | — | — | — | — | 382,320 | 579,399 | — | 590,542 | — | — | — | 1,552,261 |
| *Alphitonia zizyphoides* | 269,184 | 497,981 | 336,685 | — | — | — | — | — | — | — | — | — | — | 1,103,850 |
| *Artocarpus altilis* | 160,877 | 231,808 | 277,599 | — | — | — | — | — | — | — | — | — | — | 670,283 |
| *Barringtonia samoensis* | — | — | 126,521 | 107,428 | 253,016 | 241,414 | — | — | — | — | — | — | — | 728,379 |
| *Bischofia javanica* | 41,136 | 77,345 | — | 244,268 | 452,859 | — | — | — | — | — | — | 1,636,210 | — | 2,451,817 |
| *Buchanania merrillii* | 100,989 | — | — | — | — | — | — | 546,323 | — | — | — | — | — | 647,312 |
| *Calophyllum neo-ebudicum* | 39,239 | 99,529 | — | — | — | — | — | — | — | — | — | — | — | 138,768 |
| *Cananga odorata* | 226,591 | 481,230 | 730,310 | 831,758 | 778,143 | 737,853 | — | — | — | — | — | — | — | 3,785,886 |
| *Canarium ovatum* | — | — | — | — | — | 311,981 | — | — | — | — | — | — | — | 311,981 |
| *Canarium vitiense* | 56,022 | 77,751 | 175,608 | — | — | — | — | — | — | 700,884 | — | — | — | 1,010,265 |
| *Cassia fistula* | — | — | — | 302,032 | — | — | — | — | — | — | 651,055 | 1,217,466 | — | 2,170,552 |
| *Castilla elastica* | 118,081 | 150,240 | — | — | — | — | — | — | — | — | — | — | — | 268,320 |
| *Cocos nucifera* | 85,950 | 274,842 | 2,265,070 | 2,980,564 | 1,956,314 | 246,546 | — | — | — | — | — | — | — | 7,809,286 |
| *Cyathea lunulata* | 1,113,553 | 272,218 | — | 349,977 | 247,596 | — | — | — | — | — | — | — | — | 1,983,343 |
| *Cyathea* spp. | 54,095 | — | 150,315 | — | — | — | — | — | — | — | — | — | — | 204,410 |
| *Diospyros samoensis* | — | — | — | 174,419 | 259,841 | — | — | — | — | — | — | — | — | 434,261 |
| *Dysoxylum maota* | 353,999 | 592,021 | 904,649 | 1,028,319 | 553,074 | 366,017 | 303,165 | 1,278,742 | — | 559,298 | — | 1,713,842 | 2,467,576 | 10,120,702 |
| *Dysoxylum samoense* | 39,925 | — | — | — | — | — | — | — | — | — | — | — | — | 39,925 |
| *Elaeocarpus ulianus* | 683,874 | 630,544 | 208,009 | — | 151,643 | — | — | — | 438,977 | — | — | — | — | 2,113,047 |
| *Erythrina fusca* | — | — | — | 178,448 | — | — | — | 477,220 | — | — | — | — | — | 655,668 |
| *Erythrina variegata* | 48,538 | — | — | — | — | — | — | — | — | — | — | — | — | 48,538 |
| *Ficus obliqua* | — | — | 130,280 | — | — | — | — | — | — | — | — | — | — | 130,280 |
| *Ficus scabra* | — | — | — | 180,070 | — | — | — | — | — | — | — | — | — | 180,070 |
| *Flacourtia rukam* | 208,538 | 55,584 | — | — | — | — | — | — | — | — | — | — | — | 264,123 |
| *Hernandia nymphaeifolia* | 193,242 | 162,856 | 198,914 | 188,745 | — | — | — | — | — | — | — | — | — | 743,757 |
| *Hibiscus tiliaceus* | 2,012,009 | 1,475,800 | 894,873 | 170,544 | 221,035 | — | — | — | — | — | — | — | — | 4,774,262 |
| *Inocarpus fagifer* | 70,820 | 242,499 | 206,203 | — | — | 370,467 | — | 393,419 | — | — | — | — | — | 1,283,409 |
| *Kleinhovia hospita* | 96,898 | — | — | 333,966 | — | — | — | — | — | — | — | — | — | 430,864 |
| *Macaranga grayana* | 40,388 | — | — | — | — | — | — | — | — | — | — | — | — | 40,388 |
| *Macaranga harveyana* | 41,640 | 346,466 | 485,194 | — | 361,717 | — | — | — | — | — | — | — | — | 1,235,017 |
| *Mangifera indica* | — | — | 77,300 | — | — | — | — | — | — | — | — | — | — | 77,300 |
| *Morinda citrifolia* | 30,452 | — | 107,167 | — | — | — | — | — | — | — | — | — | — | 137,619 |
| *Myristica fatua* | 2,093,677 | 1,282,281 | 1,208,118 | 268,509 | — | 363,906 | — | — | — | — | — | — | — | 5,216,492 |
| *Neisosperma oppositifolia* | 43,268 | — | — | — | — | — | — | — | — | — | — | — | — | 43,268 |
| *Neonauclea forsteri* | 109,858 | — | — | 163,166 | 181,906 | — | 233,821 | — | — | 1,503,431 | — | — | — | 2,192,181 |
| *Omalanthus nutans* | — | — | — | — | — | — | 269,468 | — | — | — | — | — | — | 269,468 |
| *Pipturus argenteus* | 122,790 | — | 79,893 | — | — | — | — | — | — | — | — | — | — | 202,683 |
| *Pisonia grandis* | 28,838 | — | — | — | — | — | — | — | — | — | — | — | — | 28,838 |
| *Planchonella garberi* | — | 60,441 | — | 121,898 | 230,857 | — | — | — | — | — | — | — | — | 413,197 |
| *Planchonella torricellensis* | — | — | 100,836 | — | — | 374,818 | — | — | — | — | — | — | — | 475,654 |
| *Rhizophora mangle* | 100,129 | — | 100,828 | — | — | 243,453 | 815,212 | 444,070 | — | — | — | — | — | 1,703,692 |
| *Rhus taitensis* | 213,293 | 542,143 | 594,714 | 877,199 | 1,458,700 | 350,428 | 572,444 | — | — | 773,880 | — | — | 1,935,498 | 7,318,298 |
| *Scaevola taccada* | 46,070 | — | — | — | — | — | — | — | — | — | — | — | — | 46,070 |
| *Sterculia fanaiho* | — | 44,372 | — | — | — | — | — | — | — | — | — | — | — | 44,372 |
| *Syzygium inophylloides* | 97,264 | 59,322 | — | — | — | 791,198 | — | — | — | — | — | — | — | 947,784 |
| *Syzygium samarangense* | 37,186 | — | — | — | — | — | — | — | — | — | — | — | — | 37,186 |
| Total | 9,036,486 | 7,813,504 | 9,359,086 | 8,501,312 | 7,106,700 | 4,398,080 | 2,576,430 | 3,719,173 | 438,977 | 4,128,035 | 651,055 | 4,567,518 | 4,403,073 | 66,699,430 |

## Table 6—Estimated aboveground dry stem weight of all live trees on forest land by species and diameter class

| Species | Diameter class (inches) | | | | | | | | | | | | | All classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.0–6.9 | 7.0–8.9 | 9.0–10.9 | 11.0–12.9 | 13.0–14.9 | 15.0–16.9 | 17.0–18.9 | 19.0–20.9 | 21.0–22.9 | 23.0–24.9 | 25.0–26.9 | 27.0–28.9 | 29.0+ | |
| | *Tons* | | | | | | | | | | | | | |
| *Adenanthera pavonina* | 906 | 2,438 | — | — | — | — | — | — | — | — | — | — | — | 3,345 |
| *Aglaia samoensis* | — | — | — | — | — | — | 5,967 | 9,042 | — | 9,216 | — | — | — | 24,225 |
| *Alphitonia zizphoides* | 4,201 | 7,772 | 5,254 | — | — | — | — | — | — | — | — | — | — | 17,227 |
| *Artocarpus altilis* | 2,511 | 3,618 | 4,332 | — | — | — | — | — | — | — | — | — | — | 10,461 |
| *Barringtonia samoensis* | — | — | 1,975 | 1,677 | 3,949 | 3,768 | — | — | — | — | — | — | — | 11,367 |
| *Bischofia javanica* | 693 | 1,304 | — | 4,117 | 7,633 | — | — | — | — | — | — | 27,578 | — | 41,325 |
| *Buchanania merrillii* | 1,576 | — | — | — | — | — | — | 8,526 | — | — | — | — | — | 10,102 |
| *Calophyllum neo-ebudicum* | 612 | 1,553 | — | — | — | — | — | — | — | — | — | — | — | 2,166 |
| *Cananga odorata* | 2,051 | 4,356 | 6,610 | 7,529 | 7,043 | 6,679 | — | — | — | — | — | — | — | 35,232 |
| *Canarium ovatum* | — | — | — | — | — | 4,869 | — | — | — | — | — | — | — | 4,869 |
| *Canarium vitiense* | 944 | 1,310 | 2,960 | — | — | — | — | — | — | 11,813 | — | — | — | 17,028 |
| *Cassia fistula* | — | — | — | 6,693 | — | — | — | — | — | — | 14,428 | 26,981 | — | 48,103 |
| *Castilla elastica* | 1,843 | 2,345 | — | — | — | — | — | — | — | — | — | — | — | 4,188 |
| *Cocos nucifera* | 1,341 | 4,289 | 35,350 | 46,516 | 30,531 | 3,848 | — | — | — | — | — | — | — | 121,876 |
| *Cyathea lunulata* | 17,379 | 4,248 | — | 5,462 | 3,864 | — | — | — | — | — | — | — | — | 30,953 |
| *Cyathea* spp. | 844 | — | 2,346 | — | — | — | — | — | — | — | — | — | — | 3,190 |
| *Diospyros samoensis* | — | — | — | 2,722 | 4,055 | — | — | — | — | — | — | — | — | 6,777 |
| *Dysoxylum maota* | 5,525 | 9,239 | 14,118 | 16,048 | 8,632 | 5,712 | 4,731 | 19,957 | — | 8,729 | — | 26,747 | 38,510 | 162,229 |
| *Dysoxylum samoense* | 623 | — | — | — | — | — | — | — | — | — | — | — | — | 623 |
| *Elaeocarpus ulianus* | 10,673 | 9,841 | 3,246 | — | 2,367 | — | — | — | 6,851 | — | — | — | — | 32,977 |
| *Erythrina fusca* | — | — | — | 1,392 | — | — | — | 3,724 | — | — | — | — | — | 5,116 |
| *Erythrina variegata* | 758 | — | — | — | — | — | — | — | — | — | — | — | — | 758 |
| *Ficus obliqua* | — | — | 2,033 | — | — | — | — | — | — | — | — | — | — | 2,033 |
| *Ficus scabra* | — | — | — | 2,810 | — | — | — | — | — | — | — | — | — | 2,810 |
| *Flacourtia rukam* | 3,255 | 867 | — | — | — | — | — | — | — | — | — | — | — | 4,122 |
| *Hernandia nymphaeifolia* | 3,016 | 2,542 | 3,104 | 2,946 | — | — | — | — | — | — | — | — | — | 13,658 |
| *Hibiscus tiliaceus* | 35,797 | 26,257 | 15,921 | 3,034 | 3,933 | — | — | — | — | — | — | — | — | 102,452 |
| *Inocarpus fagifer* | 1,105 | 3,785 | 3,218 | — | — | 5,782 | — | 6,140 | — | — | — | — | — | 20,030 |
| *Kleinhovia hospita* | 1,089 | — | — | 3,753 | — | — | — | — | — | — | — | — | — | 6,743 |
| *Macaranga grayana* | 630 | — | — | — | — | — | — | — | — | — | — | — | — | 630 |
| *Macaranga harveyana* | 650 | 5,407 | 7,572 | — | 5,645 | — | — | — | — | — | — | — | — | 19,274 |
| *Mangifera indica* | — | — | 1,255 | — | — | — | — | — | — | — | — | — | — | 1,255 |
| *Morinda citrifolia* | 475 | — | 1,673 | — | — | — | — | — | — | — | — | — | — | 2,148 |
| *Myristica fatua* | 49,978 | 20,012 | 13,546 | 4,190 | — | 5,679 | — | — | — | — | — | — | — | 105,434 |
| *Neisosperma oppositifolia* | 675 | — | — | — | — | — | — | — | — | — | — | — | — | 675 |
| *Neonauclea forsteri* | 1,714 | — | — | 2,546 | 2,839 | — | 3,649 | — | — | 23,463 | — | — | — | 34,212 |
| *Omalanthus nutans* | — | — | — | — | — | — | 4,205 | — | — | — | — | — | — | 4,205 |
| *Pipturus argenteus* | 1,916 | — | 1,247 | — | — | — | — | — | — | — | — | — | — | 3,163 |
| *Pisonia grandis* | 450 | — | — | — | — | — | — | — | — | — | — | — | — | 450 |
| *Planchonella garberi* | — | 943 | — | 1,902 | 3,603 | — | — | — | — | — | — | — | — | 8,626 |
| *Planchonella torricellensis* | — | — | 1,574 | — | — | 5,850 | — | — | — | — | — | — | — | 7,423 |
| *Rhizophora mangle* | 1,563 | — | 1,574 | — | — | 3,799 | 12,723 | 6,930 | — | — | — | — | — | 33,059 |
| *Rhus taitensis* | 3,329 | 8,461 | 9,281 | 13,690 | 22,765 | 5,469 | 8,934 | — | — | 12,078 | — | — | 30,206 | 114,213 |
| *Sterculia fanaiho* | — | 692 | — | — | — | — | — | — | — | — | — | — | — | 692 |
| *Syzygium inophylloides* | 1,518 | 926 | — | — | — | 12,348 | — | — | — | — | — | — | — | 14,792 |
| *Syzygium samarangense* | 580 | — | — | — | — | — | — | — | — | — | — | — | — | 580 |
| Total | 160,221 | 122,205 | 138,190 | 127,029 | 106,858 | 63,802 | 40,209 | 54,319 | 6,851 | 65,299 | 14,428 | 81,306 | 68,717 | 1,100,526 |

## Table 7—Estimated aboveground weight of carbon for stems of all live trees on forest land by species and diameter class

| Species | Diameter class (inches) | | | | | | | | | | | | | All classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5.0–6.9 | 7.0–8.9 | 9.0–10.9 | 11.0–12.9 | 13.0–14.9 | 15.0–16.9 | 17.0–18.9 | 19.0–20.9 | 21.0–22.9 | 23.0–24.9 | 25.0–26.9 | 27.0–28.9 | 29.0+ | |
| | *Tons* | | | | | | | | | | | | | |
| *Adenanthera pavonina* | 444 | 1,195 | — | — | — | — | — | — | — | — | — | — | — | 1,639 |
| *Aglaia samoensis* | — | — | — | — | — | — | 2,924 | 4,431 | — | 4,516 | — | — | — | 11,870 |
| *Alphitonia zizyphoides* | 2,058 | 3,808 | 2,575 | — | — | — | — | — | — | — | — | — | — | 8,441 |
| *Artocarpus altilis* | 1,230 | 1,773 | 2,123 | — | — | — | — | — | — | — | — | — | — | 5,126 |
| *Barringtonia samoensis* | — | — | 968 | 822 | 1,935 | 1,846 | — | — | — | — | — | — | — | 5,570 |
| *Bischofia javanica* | 340 | 639 | — | 2,017 | 3,740 | — | — | — | — | — | — | 13,513 | — | 20,249 |
| *Buchanania merrillii* | 772 | — | — | — | — | — | — | 4,178 | — | — | — | — | — | 4,950 |
| *Calophyllum neo-ebudicum* | 300 | 761 | — | — | — | — | — | — | — | — | — | — | — | 1,061 |
| *Cananga odorata* | 1,005 | 2,134 | 3,239 | 3,689 | 3,451 | 3,273 | — | — | — | — | — | — | — | 17,263 |
| *Canarium ovatum* | — | — | — | — | — | 2,386 | — | — | — | — | — | — | — | 2,386 |
| *Canarium vitiense* | 463 | 642 | 1,450 | — | — | — | — | — | — | 5,789 | — | — | — | 8,344 |
| *Cassia fistula* | — | — | — | 3,280 | — | — | — | — | — | — | 7,070 | 13,221 | — | 23,570 |
| *Castilla elastica* | 903 | 1,149 | — | — | — | — | — | — | — | — | — | — | — | 2,052 |
| *Cocos nucifera* | 657 | 2,102 | 17,321 | 22,793 | 14,960 | 1,885 | — | — | — | — | — | — | — | 59,719 |
| *Cyathea lunulata* | 8,516 | 2,082 | — | 2,676 | 1,893 | — | — | — | — | — | — | — | — | 15,167 |
| *Cyathea* spp. | 414 | — | 1,149 | — | — | — | — | — | — | — | — | — | — | 1,563 |
| *Diospyros samoensis* | — | — | — | 1,334 | 1,987 | — | — | — | — | — | — | — | — | 3,321 |
| *Dysoxylum maota* | 2,707 | 4,527 | 6,918 | 7,864 | 4,229 | 2,799 | 2,318 | 9,779 | — | 4,277 | — | 13,106 | 18,870 | 79,492 |
| *Dysoxylum samoense* | 305 | — | — | — | — | — | — | — | — | — | — | — | — | 305 |
| *Elaeocarpus ulianus* | 5,230 | 4,822 | 1,591 | — | 1,160 | — | — | — | 3,357 | — | — | — | — | 16,159 |
| *Erythrina fusca* | — | — | — | 682 | — | — | — | 1,825 | — | — | — | — | — | 2,507 |
| *Erythrina variegata* | 371 | — | — | — | — | — | — | — | — | — | — | — | — | 371 |
| *Ficus obliqua* | — | — | 996 | — | — | — | — | — | — | — | — | — | — | 996 |
| *Ficus scabra* | — | — | — | 1,377 | — | — | — | — | — | — | — | — | — | 1,377 |
| *Flacourtia rukam* | 1,595 | 425 | — | — | — | — | — | — | — | — | — | — | — | 2,020 |
| *Hernandia nymphaeifolia* | 1,478 | 1,245 | 1,521 | 1,443 | — | — | — | — | — | — | — | — | — | 6,693 |
| *Hibiscus tiliaceus* | 17,540 | 12,866 | 7,801 | 1,487 | 1,927 | — | — | — | — | — | — | — | — | 50,201 |
| *Inocarpus fagifer* | 542 | 1,854 | 1,577 | — | — | 2,833 | — | 3,009 | — | — | — | — | — | 9,814 |
| *Kleinhovia hospita* | 534 | — | — | 1,839 | — | — | — | — | — | — | — | — | — | 3,304 |
| *Macaranga grayana* | 309 | — | — | — | — | — | — | — | — | — | — | — | — | 309 |
| *Macaranga harveyana* | 318 | 2,649 | 3,710 | — | 2,766 | — | — | — | — | — | — | — | — | 9,444 |
| *Mangifera indica* | — | — | 615 | — | — | — | — | — | — | — | — | — | — | 615 |
| *Morinda citrifolia* | 233 | — | 820 | — | — | — | — | — | — | — | — | — | — | 1,052 |
| *Myristica fatua* | 24,489 | 9,806 | 6,638 | 2,053 | — | 2,783 | — | — | — | — | — | — | — | 51,663 |
| *Neisosperma oppositifolia* | 331 | — | — | — | — | — | — | — | — | — | — | — | — | 331 |
| *Neonauclea forsteri* | 840 | — | — | 1,248 | 1,391 | — | 1,788 | — | — | 11,497 | — | — | — | 16,764 |
| *Omalanthus nutans* | — | — | — | — | — | — | 2,061 | — | — | — | — | — | — | 2,061 |
| *Pipturus argenteus* | 939 | — | 611 | — | — | — | — | — | — | — | — | — | — | 1,550 |
| *Pisonia grandis* | 221 | — | — | — | — | — | — | — | — | — | — | — | — | 221 |
| *Planchonella garberi* | — | 462 | — | 932 | 1,765 | — | — | — | — | — | — | — | — | 4,227 |
| *Planchonella torricellensis* | — | — | 771 | — | — | 2,866 | — | — | — | — | — | — | — | 3,637 |
| *Rhizophora mangle* | 766 | — | 771 | — | — | 1,862 | 6,234 | 3,396 | — | — | — | — | — | 16,199 |
| *Rhus taitensis* | 1,631 | 4,146 | 4,548 | 6,708 | 11,155 | 2,680 | 4,378 | — | — | 5,918 | — | — | 14,801 | 55,964 |
| *Sterculia fanaiho* | — | 339 | — | — | — | — | — | — | — | — | — | — | — | 339 |
| *Syzygium inophylloides* | 744 | 454 | — | — | — | 6,050 | — | — | — | — | — | — | — | 7,248 |
| *Syzygium samarangense* | 284 | — | — | — | — | — | — | — | — | — | — | — | — | 284 |
| Total | 78,508 | 59,881 | 67,713 | 62,244 | 52,361 | 31,263 | 19,702 | 26,616 | 3,357 | 31,997 | 7,070 | 39,840 | 33,671 | 539,257 |

**Table 8—Average nontree understory cover on FIA field subplots by species**

| Scientific name | Cover | Number of subplots | Standard deviation |
|---|---|---|---|
| | *Percent* | | |
| *Alocasia macrorrhizos* (L.) Schott | 1 | 4 | 0 |
| *Alpinia purpurata* (Vieill.) K. Schum. | 3.5 | 6 | 1.8 |
| *Alpinia samoensis* Rein. | 1 | 4 | 0 |
| *Alstonia reineckeana* Lauterb. | 60 | 1 | — |
| *Alyxia bracteolosa* Rich. ex A. Gray | 3.4 | 30 | 5 |
| *Alyxia* spp. Banks ex R. Br. | 2.3 | 4 | 0.5 |
| *Ananas comosus* (L.) Merr. | 3 | 1 | — |
| *Angiopteris evecta* (J.R. Forst.) Hoffmann | 2.8 | 24 | 1.9 |
| *Angiopteris* spp. Hoffm. | 2.8 | 5 | 1.8 |
| *Asplenium nidus* L. | 3 | 36 | 1.9 |
| *Brachiaria mutica* (Forsk.) T.Q. Nguyen | 30 | 1 | — |
| *Caesalpinia major* (Medik.) Dandy & Exell | 1.7 | 3 | 0.6 |
| *Calochlaena straminea* (Labill.) M.D. Turner & R.D. White | 18.3 | 3 | 12.6 |
| *Canavalia rosea* (Sw.) DC. | 4 | 1 | — |
| *Centotheca lappacea* (L.) Desv. | 2.9 | 16 | 5.9 |
| *Clidemia hirta* (L.) D. Don. | 2.4 | 29 | 2.3 |
| *Colubrina asiatica* (L.) Brongn. | 4 | 1 | — |
| *Commelina diffusa* Burm. | 1 | 1 | — |
| *Cordyline* spp. Comm. ex Juss. | 7 | 3 | 3.6 |
| *Cordyline fruticosa* (L.) Chev. | 5 | 42 | 8.4 |
| *Cyathea* spp. Sm. | 2 | 1 | — |
| *Cyathea lunulata* (Forst. f.) Copel. | 4 | 3 | 3.6 |
| *Cyclosorus interruptus* (Wild.) H. Ito | 6.5 | 38 | 7.5 |
| *Cyperus longus* L. | 1 | 1 | — |
| *Cyperus rotundus* L. | 7 | 1 | — |
| *Cyrtandra* spp. J.R. & G. Forst. | 1 | 2 | 0 |
| *Davallia solida* (Forst. f.) Sw. | 4 | 35 | 3.5 |
| *Davallia* spp. Sm. | 1.8 | 4 | 1 |
| *Derris malaccensis* Prain | 10.5 | 2 | 6.4 |
| *Derris trifoliata* (Lour.) | 11 | 3 | 16.5 |
| *Dioscorea alata* L. | 1 | 1 | — |
| *Dioscorea bulbifera* L. | 2.2 | 13 | 0.8 |
| *Diplazium proliferum* (Lam.) Thouars | 1 | 1 | — |
| *Epipremnum pinnatum* (L.) Engl. | 4.3 | 34 | 7.3 |
| *Epipremnum* spp. Schott | 2.3 | 12 | 1 |
| *Faradaya* spp. F. Muell. | 7 | 14 | 7.9 |
| *Faradaya amicorum* (Seem.) Seem. | 4 | 25 | 4.3 |
| *Faradaya powellii* Seem. ex Powell | 4.3 | 4 | 0.5 |
| *Freycinetia reineckii* Warb. | 5.1 | 25 | 5.4 |
| *Hedychium coronarium* Koenig | 1 | 1 | — |
| *Heliconia* spp. L. | 2.9 | 14 | 2.2 |
| *Hoya australis* R. Br. | 1 | 1 | — |
| *Hoya* spp. R. Br. | 2.5 | 2 | 2.1 |
| *Lomagramma* spp. J. Sm. | 65 | 2 | 7.1 |
| *Macropiper puberulum* (Benth.) Benth. | 1.8 | 5 | 0.4 |
| *Manihot esculenta* Crantz | 10.7 | 3 | 8.1 |
| *Mariscus javanicus* Houtt. | 17.9 | 9 | 32.5 |

**Table 8—Average nontree understory cover on FIA field subplots by species (continued)**

| Scientific name | Cover | Number of subplots | Standard deviation |
|---|---|---|---|
| | *Percent* | | |
| *Merremia peltata* (L.) Merr. | 32.7 | 3 | 54 |
| *Mikania micrantha* Kunth | 6.9 | 21 | 9.8 |
| *Mimosa pudica* L. | 3 | 1 | — |
| *Miscanthus floridulus* (Labill.) Warb. ex K. Schum. & Laut. | 3 | 2 | 2.8 |
| *Mucuna gigantea* (Willd.) DC. | 1 | 1 | — |
| *Musa balbisiana* Colla | 2 | 2 | 0 |
| *Musa* spp. L. | 3 | 1 | — |
| *Musa* x *paradisiaca* L. | 2 | 1 | — |
| *Nephrolepis hirsutula* (G. Forst.) C. Presl. | 5.3 | 3 | 3.1 |
| *Oplismenus compositus* (L.) Beauv. | 13 | 4 | 10.3 |
| *Paspalum conjugatum* Berg. | 15.5 | 4 | 14.2 |
| *Paspalum* spp. L. | 5 | 1 | — |
| *Passiflora samoensis* Exell | 1 | 1 | — |
| *Phaleria acuminata* (A. Gray) Gilg | 1.5 | 2 | 0.7 |
| *Phymatosaurus scolopendria* (L. Burm.) Pichi-Serm. | 5.4 | 17 | 8.6 |
| *Phymatosaurus* spp. Pichi-Serm. | 2.5 | 2 | 2.1 |
| *Piper graeffei* Warb. | 2.3 | 30 | 1.2 |
| *Piper latifolium* L. f. = *macropiper* | 2 | 1 | — |
| *Piper methysticum* G. Forst. | 30 | 1 | — |
| *Polyscias samoensis* (A. Gray.) Harms. | 1 | 1 | — |
| *Polyscias* spp. J.R. & G. Forst. | 3 | 11 | 2 |
| *Portulaca samoensis* v. Poelln. | 4 | 1 | — |
| *Procris pedunculata* (Forst.) Wedd. | 1 | 1 | — |
| *Psychotria insularum* A. Gray | 2 | 4 | 0 |
| *Pteris ensiformis* Burm. f. | 2 | 1 | — |
| *Pyrrosia lanceolata* (L.) Farw. | 2.5 | 2 | 2.1 |
| *Pyrrosia* spp. Mirbel | 3 | 2 | 1.4 |
| *Rhynchospora corymbosa* (L.) Britt. | 2.5 | 2 | 2.1 |
| *Saccharum officinarum* L. | 1 | 1 | — |
| *Sida samoensis* Rech. | 45 | 1 | — |
| *Tacca leontopetaloides* (L.) Kuntze | 1.8 | 6 | 1 |
| Unknown fern | 5 | 2 | 0 |
| Unknown orchid | 2 | 2 | 1.4 |
| Unknown vine | 12.5 | 4 | 21.7 |
| *Vigna marina* (Burm. f.) Merr. | 9.6 | 5 | 17 |
| *Wollastonia biflora* (L.) DC. | 2 | 2 | 0 |

Note: Percentage cover of "1" indicates cover less than or equal to 1 percent. Cover estimates are averaged among subplots where each species was found. A total of 72 subplots were surveyed for vegetation cover. The number of subplots where a species was found and the standard deviation for cover estimates provide an idea of spatial variability for each species across the island group.

**Table 9—Average understory tree cover and number of FIA subplots where a species occurs**

| Scientific name | Cover | Number of subplots |
|---|---|---|
| | *Percent* | |
| *Adenanthera pavonina* | 1.25 | 4 |
| *Aglaia samoensis* | 2.07 | 15 |
| *Alphitonia zizyphoides* | 1.8 | 5 |
| *Alstonia pacifica* (Seem.) A.C. Smith | 3 | 1 |
| *Antidesma sphaerocarpum* Muell. Arg. | 1 | 1 |
| *Antirhea* sp. Comm. ex Juss. | 2 | 1 |
| *Artocarpus altilis* | 2.05 | 13 |
| *Artocarpus odoratissimus* Blanco | 2 | 4 |
| *Barringtonia samoensis* | 1.25 | 4 |
| *Bischofia javanica* | 2.17 | 12 |
| *Calophyllum inophyllum* L. | 2 | 1 |
| *Calophyllum neo-ebudicum* | 2.14 | 7 |
| *Cananga odorata* | 5.53 | 15 |
| *Canarium harveyi* Seem. | 2 | 1 |
| *Canarium vitiense* | 2 | 3 |
| *Carica papaya* L. | 1 | 1 |
| *Cerbera manghas* L. | 1 | 3 |
| *Cinnamomum verum* J. Presl. | 1 | 1 |
| *Citrus sinensis* (L.) Osbeck | 1 | 1 |
| *Cocos nucifera* | 9.27 | 15 |
| *Cyathea decurrens* (Hook.) | 2 | 4 |
| *Cyathea lunulata* | 4 | 2 |
| *Cyathea* spp. | 4 | 10 |
| *Diospyros samoensis* | 2.41 | 33 |
| *Dysoxylum maota* | 2.64 | 38 |
| *Dysoxylum samoense* | 1.75 | 4 |
| *Elaeocarpus ulianus* | 2.5 | 9 |
| *Elattostachys falcata* | 1.25 | 8 |
| *Erythrina fusca* | 1 | 1 |
| *Erythrina variegata* | 6 | 1 |
| *Ficus godeffroyi* Warb. | 1.8 | 20 |
| *Ficus scabra* | 2.61 | 9 |
| *Ficus tinctoria* Forst. f. | 1.6 | 5 |
| *Flacourtia rukam* | 1.56 | 18 |
| *Geniostoma rupestre* J.R. & G. Forst. | 2.67 | 3 |
| *Glochidion cuspidatum* Pax | 1 | 1 |
| *Glochidion ramiflorum* Forst. f. | 1 | 2 |
| *Harpullia arborea* (Blanco) Radlk. | 1 | 1 |
| *Hernandia moerenhoutiana* Guill. | 1 | 1 |
| *Hibiscus tiliaceus* | 8.65 | 17 |
| *Inocarpus fagifer* | 1.78 | 9 |
| *Kleinhovia hospita* | 1.5 | 2 |
| *Macaranga harveyana* | 4.38 | 8 |
| *Macaranga stipulosa* Muell. Arg. | 1 | 1 |
| *Mangifera indica* | 1 | 1 |
| *Micromelum minutum* Wight & Arn. | 1 | 1 |
| *Morinda citrifolia* | 2.53 | 30 |
| *Myristica fatua* | 6.06 | 47 |

**Table 9—Average understory tree cover and number of FIA subplots where a species occurs (continued)**

| Scientific name | Cover | Number of subplots |
|---|---|---|
| | *Percent* | |
| *Myristica hypargyraea* A. Gray | 1 | 1 |
| *Neonauclea forsteri* | 1 | 1 |
| *Omalanthus acuminatus* Muell. Arg. | 2 | 4 |
| *Omalanthus nutans* | 2 | 1 |
| *Pandanus reineckii* Warb. | 6.75 | 4 |
| *Pipturus argenteus* | 12.2 | 5 |
| *Pisonia grandis* | 1 | 1 |
| *Planchonella garberi* | 1.33 | 3 |
| *Planchonella samoensis* Reinecke ex H.J. Lam | 3.67 | 15 |
| *Planchonella torricellensis* syn. *Pouteria torr.* | 2 | 3 |
| *Polyscias samoensis* | 2 | 4 |
| *Premna serratifolia* L. | 2 | 1 |
| *Psychotria insularum* | 2.94 | 31 |
| *Rhus taitensis* | 7.6 | 10 |
| *Scaevola taccada* (Gaertn.) Roxb. | 8 | 1 |
| *Sterculia fanaiho* | 1.7 | 9 |
| *Syzygium inophylloides* | 2.69 | 16 |
| *Syzygium samarangense* | 1.64 | 11 |
| *Tarenna sambucina* (Forst. f.) Dur. | 3 | 1 |
| *Terminalia catappa* (L.) | 1.33 | 3 |
| *Terminalia richii* A. Gray | 1.25 | 4 |
| *Theobroma cacao* L. | 1 | 2 |

Note: Percentage cover of "1" indicates cover less than or equal to 1 percent. A total of 72 subplots were surveyed for understory tree cover. Cover estimates are averaged among subplots where each species was found.

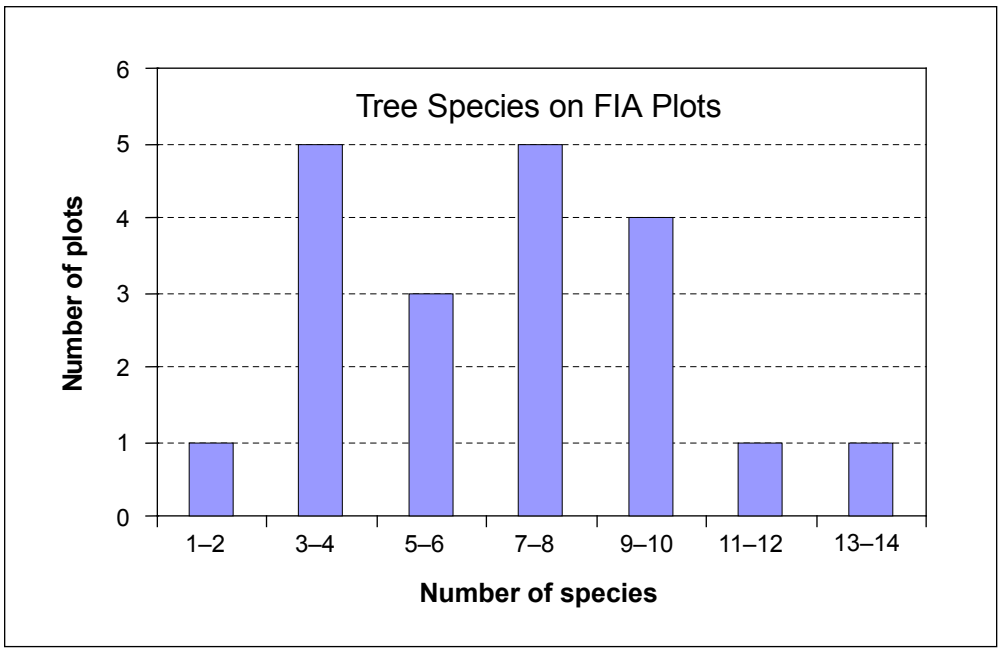


Figure 11—The average number of tree species per sixth-acre field plot was 7.

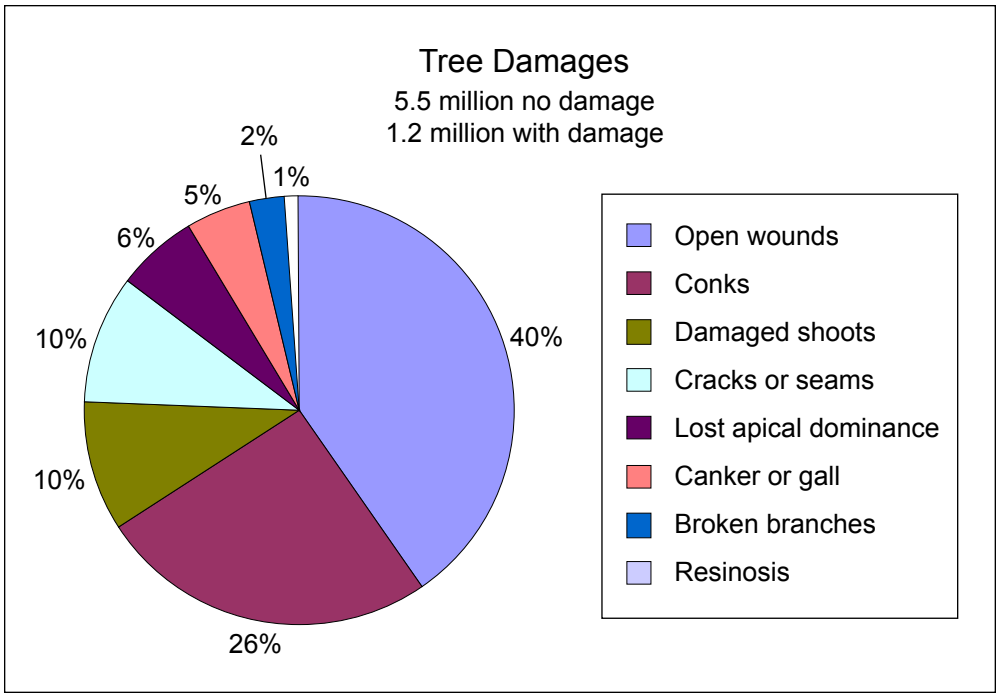


Figure 12—Tree damage types primarily occurred as open wounds or conks.

Very little evidence of mortality was encountered on our sample plots. *Hibiscus tiliaceus* was the only dead tree species that could be reliably identified on FIA plots. From these data we estimated that about 12 percent of this species was dead.

## Epiphytes

Plants that physically grow on trees by using space and moisture that might otherwise be available for the growth of the host tree are considered epiphytes in the FIA inventory. Depending on the amount and weight of plants growing in the branching network of a host tree, breakage of tree limbs can occur. Epiphytes also provide benefits including habitat, food supplies, and cooling effects in tropical forests. Field crews rated each tree sampled in the inventory according to epiphyte loading. We estimate that most trees on American Samoa support few or no epiphytes (table 11).

## Pilot Test Outcomes

The methods used for this inventory were adapted from the national FIA Program. Although consistency in measurement between regions is critically important, some adaptations were required to capture the differences found in these tropical forests. We have maintained the ability to compare this data set with data collected in other FIA regions and have standardized these methods for the inventory of the

**Table 10—Number of trees by primary damage type and species for all trees ≥5 inches diameter at breast height (includes dead trees)**

| Scientific name | No damage | Broken branches | Canker or gall | Conks | Cracks or seams | Damaged shoots | Lost apical dominance | Open wounds | Resinosis | All damages |
|---|---|---|---|---|---|---|---|---|---|---|
| *Adenanthera pavonina* | 42,406 | — | — | — | — | — | — | — | — | — |
| *Aglaia samoensis* | 42,406 | — | — | — | — | — | — | — | — | — |
| *Alphitonia zizyphoides* | 183,757 | — | — | — | — | — | — | — | — | — |
| *Artocarpus altilis* | 113,081 | — | — | — | — | — | — | 14,135 | — | 14,135 |
| *Barringtonia samoensis* | — | — | — | 42,406 | — | — | 14,135 | — | — | 56,541 |
| *Bischofia javanica* | 84,811 | — | — | — | 14,135 | — | — | — | — | 14,135 |
| *Buchanania merrillii* | 42,406 | — | — | — | — | — | — | — | — | — |
| *Calophyllum neo-ebudicum* | 14,135 | — | — | — | — | — | — | 14,135 | — | 14,135 |
| *Cananga odorata* | 240,298 | — | — | 28,270 | 14,135 | 14,135 | — | — | — | 56,541 |
| *Canarium ovatum* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Canarium vitiense* | 56,541 | — | — | — | — | — | — | — | — | — |
| *Cassia fistula* | 42,406 | — | — | — | — | — | — | — | — | — |
| *Castilla elastica* | 70,676 | — | — | — | — | — | — | — | — | — |
| *Cocos nucifera* | 155,487 | — | — | — | 28,270 | 98,946 | — | 254,433 | 14,135 | 395,785 |
| *Cyathea lunulata* | 593,678 | — | — | 14,135 | — | — | — | — | — | 14,135 |
| *Cyathea* spp. | 56,541 | — | — | — | — | — | — | — | — | — |
| *Diospyros samoensis* | 28,270 | — | — | — | — | — | — | — | — | — |
| *Dysoxylum maota* | 409,920 | — | — | 14,135 | — | — | — | 28,270 | — | 42,406 |
| *Dysoxylum samoense* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Elaeocarpus ulianus* | 296,839 | — | — | — | — | — | — | — | — | — |
| *Erythrina fusca* | 14,135 | — | — | 14,135 | — | — | — | — | — | 14,135 |
| *Erythrina variegata* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Ficus obliqua* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Ficus scabra* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Flacourtia rukam* | 84,811 | — | — | — | — | — | — | — | — | — |
| *Hernandia nymphaeifolia* | 84,811 | — | — | — | — | — | — | — | — | — |
| *Hibiscus tiliaceus* | 1,024,190 | — | 28,270 | 70,676 | 14,135 | — | 42,406 | 42,406 | — | 197,893 |
| *Inocarpus fagifer* | 127,217 | — | — | — | — | — | — | — | — | — |
| *Kleinhovia hospita* | 56,541 | — | — | — | — | — | — | — | — | — |
| *Macaranga grayana* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Macaranga harveyana* | 84,811 | — | 28,270 | — | — | — | — | 28,270 | — | 56,541 |
| *Mangifera indica* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Morinda citrifolia* | — | — | — | 14,135 | 14,135 | — | — | — | — | 28,270 |
| *Myristica fatua* | 678,489 | 14,135 | — | — | 14,135 | — | 14,135 | 14,135 | — | 56,541 |
| *Neisosperma oppositifolia* | — | 14,135 | — | — | — | — | — | — | — | 14,135 |
| *Neonauclea forsteri* | 98,946 | — | — | 14,135 | — | — | — | — | — | 14,135 |
| *Omalanthus nutans* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Pipturus argenteus* | 42,406 | — | — | — | — | — | — | 14,135 | — | 14,135 |
| *Pisonia grandis* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Planchonella garberi* | 42,406 | — | — | — | — | — | — | — | — | — |
| *Planchonella torricellensis* | 28,270 | — | — | — | — | — | — | — | — | — |
| *Rhizophora mangle* | 42,406 | — | — | 70,676 | — | — | — | — | — | 70,676 |
| *Rhus taitensis* | 395,785 | — | — | — | 14,135 | — | — | 28,270 | — | 42,406 |
| *Scaevola taccada* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Sterculia fanaiho* | 14,135 | — | — | — | — | — | — | — | — | — |
| *Syzygium inophylloides* | 56,541 | — | — | 14,135 | — | — | — | 14,135 | — | 28,270 |
| *Syzygium samarangense* | — | — | — | — | — | — | — | 14,135 | — | 14,135 |
| Total | 5,490,908 | 28,270 | 56,541 | 296,839 | 113,081 | 113,081 | 70,676 | 466,461 | 14,135 | 1,159,085 |

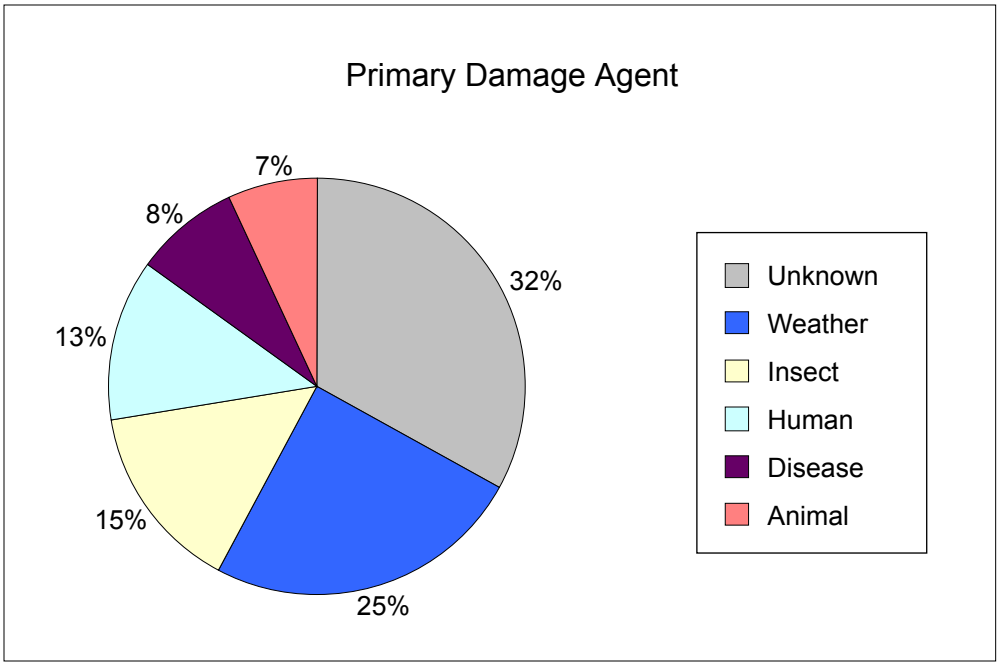


Figure 13—One-third of the most significant damages on trees were caused by unknown damaging agents. Weather, insects, and humans were the primary known damaging agents.

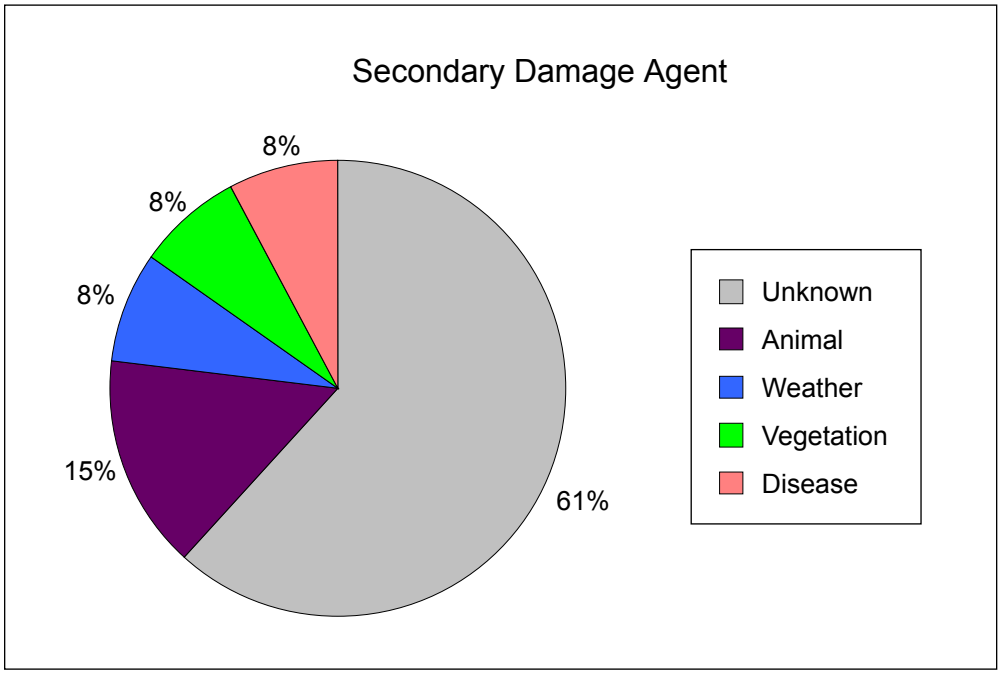


Figure 14—Over half of the secondary damaging agents were unknown, followed by animal damage.

**Table 11—Estimated number of trees on forest land by amount of epiphytes and species (includes dead trees)**

| Scientific name | Epiphyte loadings | | | | All loadings |
|---|---|---|---|---|---|
| | None | Low | Moderate | High | |
| *Adenanthera pavonina* | 14,135 | 14,135 | 14,135 | — | 42,406 |
| *Aglaia samoensis* | 28,270 | 14,135 | — | — | 42,406 |
| *Alphitonia zizyphoides* | 56,541 | 275,025 | 28,270 | — | 359,836 |
| *Artocarpus altilis* | 289,160 | — | 14,135 | — | 303,295 |
| *Barringtonia samoensis* | 704,314 | 56,541 | — | — | 760,855 |
| *Bischofia javanica* | — | 28,270 | 70,676 | — | 98,946 |
| *Buchanania merrillii* | — | 28,270 | 14,135 | — | 42,406 |
| *Calophyllum neo-ebudicum* | — | 28,270 | — | — | 28,270 |
| *Cananga odorata* | 451,103 | 141,352 | 56,541 | — | 648,996 |
| *Canarium ovatum* | — | — | 14,135 | — | 14,135 |
| *Canarium vitiense* | 14,135 | — | 42,406 | — | 56,541 |
| *Cassia fistula* | 14,135 | 14,135 | 14,135 | — | 42,406 |
| *Castilla elastica* | — | 14,135 | 56,541 | — | 70,676 |
| *Cocos nucifera* | 409,920 | 98,946 | 42,406 | — | 551,272 |
| *Cyathea lunulata* | 1,008,832 | 289,160 | 14,135 | — | 1,312,127 |
| *Cyathea spp.* | — | 42,406 | 14,135 | — | 56,541 |
| *Diospyros samoensis* | — | 176,078 | 204,349 | — | 380,427 |
| *Dysoxylum maota* | 260,890 | 317,430 | 226,163 | — | 804,483 |
| *Dysoxylum samoense* | 14,135 | 176,078 | — | — | 190,214 |
| *Elaeocarpus ulianus* | 42,406 | 845,666 | 98,946 | 14,135 | 1,001,153 |
| *Elattostachys falcata* | — | 176,078 | — | — | 176,078 |
| *Erythrina fusca* | 14,135 | 14,135 | — | — | 28,270 |
| *Erythrina variegata* | 14,135 | — | — | — | 14,135 |
| *Ficus obliqua* | — | — | 14,135 | — | 14,135 |
| *Ficus scabra* | — | 190,214 | — | — | 190,214 |
| *Flacourtia rukam* | 28,270 | 56,541 | — | — | 84,811 |
| *Garcinia myrtifolia* | — | 176,078 | — | — | 176,078 |
| *Hernandia nymphaeifolia* | 260,890 | — | — | — | 260,890 |
| *Hibiscus tiliaceus* | 740,263 | 1,389,259 | 487,053 | 14,135 | 2,630,710 |
| *Inocarpus fagifer* | 56,541 | 56,541 | 14,135 | — | 127,217 |
| *Kleinhovia hospita* | 204,349 | 28,270 | — | — | 232,619 |
| *Macaranga grayana* | 176,078 | 14,135 | — | — | 190,214 |
| *Macaranga harveyana* | 56,541 | 14,135 | 42,406 | 28,270 | 141,352 |
| *Mangifera indica* | — | — | 14,135 | — | 14,135 |
| *Morinda citrifolia* | 176,078 | 556,506 | — | — | 732,584 |
| *Myristica fatua* | 556,506 | 1,395,715 | 339,244 | 28,270 | 2,319,736 |
| *Neisosperma oppositifolia* | — | 718,449 | — | — | 718,449 |
| *Neonauclea forsteri* | — | 14,135 | 98,946 | — | 113,081 |
| *Omalanthus nutans* | — | 14,135 | — | — | 14,135 |
| *Pipturus argenteus* | — | 176,078 | 408,698 | — | 584,776 |
| *Pisonia grandis* | — | 14,135 | — | — | 14,135 |
| *Planchonella garberi* | 42,406 | 176,078 | — | — | 218,484 |
| *Planchonella torricellensis* | — | — | 28,270 | — | 28,270 |
| *Psychotria insularum* | 176,078 | 176,078 | — | — | 352,157 |
| *Rhizophora mangle* | 746,719 | 42,406 | 28,270 | — | 817,395 |
| *Rhus taitensis* | 84,811 | 317,430 | 212,028 | — | 614,269 |
| *Scaevola taccada* | 14,135 | 352,157 | — | — | 366,292 |
| *Sterculia fanaiho* | — | 14,135 | — | — | 14,135 |
| *Syzygium inophylloides* | — | 70,676 | 14,135 | — | 84,811 |
| *Syzygium samarangense* | — | 14,135 | — | — | 14,135 |
| *Syzygium samoense* | 176,078 | — | — | — | 176,078 |
| Total | 6,831,990 | 8,727,671 | 2,626,699 | 84,811 | 18,271,171 |

Pacific Islands. Comparing our acreage and volume estimates with those from prior surveys and surveys in similar tropical forests, we are confident that these methods provide statistically reliable estimates. These same methods will be used across the Pacific Islands to establish our base measurement. Remeasurement will occur every 10 years to provide data on status and change in Pacific Island forest resources.

In addition to providing results for change detection, the FIA inventory provided field training for local foresters. The ongoing inventory has been conducted on a different island group each year by a multinational crew that has included the American Samoa foresters trained during this pilot test.

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## Metric Equivalents

| When you know: | Multiply by: | To find: |
|---|---|---|
| Inches | 2.54 | Centimeters |
| Feet | .3048 | Meters |
| Miles | 1.609 | Kilometers |
| Acres | .405 | Hectares |
| Square feet | .0929 | Square meters |
| Cubic feet | .0283 | Cubic meters |
| Tons | 907 | Kilograms |
| Tons per acre | 2.24 | Tonnes or megagrams per hectare |
| Cubic feet per acre | .06997 | Cubic meters per hectare |
| Trees per acre | 2.471 | Trees per hectare |

**Table 12—Net timberland volume by tree component 1985 [a]**

| Tree component | Net timberland volume |
|---|---|
| | *Cubic feet* |
| Sawtimber: | |
| Sawlog | 13,827,495 |
| Upper stem | 3,024,293 |
| Craftwood bolts | 617,640 |
| Branch and crotch | 1,876,714 |
| Tip | 186,875 |
| Roughwood | 1,864,356 |
| Sawtimber total | 21,397,373 |
| Poletimber: | |
| Poletimber | 8,742,474 |
| Tip | 676,447 |
| Branch | 1,078,631 |
| Poletimber total | 10,497,552 |
| Total volume | 31,894,925 |

[a] Data recompiled from Cole et al. (1988) by using current methods.

**Table 13—Net timberland volume by species, American Samoa, 1985 [a]**

| Species | Common name | Net volume |
|---|---|---|
| | | *Cubic feet* |
| *Aglaia samoensis* | laga'ali | 440,400 |
| *Alphitonia zizyphoides* | toi | 195,993 |
| *Alstonia* spp. | — | 235,690 |
| *Arytera* spp. | lau'lili'i | 165,953 |
| *Barringtonia samoensis* | falaga | 249,787 |
| *Bischofia javanica* | 'o'a | 590,180 |
| *Calophyllum samoense* | tamanu | 3,493,340 |
| *Canaga odorata* | moso'oi | 146,573 |
| *Cerbera manghas* | leva | 446,289 |
| *Cinnamomum* spp. | ochod | 129,611 |
| *Cocos nucifiera* | niu | 409,406 |
| *Colubrina asiatica* (L.) Brongn. | fisoa | 235,441 |
| *Cordia subcordata* | tauanave | 271,251 |
| *Cyathea* spp. | olioli | 116,711 |
| *Diospyros samoensis* | 'au'auli | 1,400,345 |
| *Dysoxylum huntii* Merr. | maota mea | 706,540 |
| *Dysoxylum maota* | maota | 742,893 |
| *Dysoxylum samoense* | mamala | 316,362 |
| *Erythrina variegata* | gatae | 142,945 |
| *Eugenia* spp. | — | 201,584 |
| *Ficus* spp. | mati | 129,598 |
| *Flacourtia rukam* | filimoto | 1,006,583 |
| *Garuga floribunda* Decne. | — | 81,713 |

**Table 13—Net timberland volume by species, American Samoa, 1985 [a] (continued)**

| Species | Common name | Net volume |
|---|---|---|
| | | *Cubic feet* |
| *Gironniera celtidifolia* Gaudich. | lau'nini'i | 371,115 |
| *Glochidion ramiflorum* | mamase | 333,752 |
| *Guettarda speciosa* | belau | 146,966 |
| *Hibiscus tiliaceus* | fau | 1,084,986 |
| *Inocarpus fagifer* | ifi | 1,220,209 |
| *Kleinhovia hospita* | fu'afu'a | 245,938 |
| *Litsea samoensis* | papaono | 297,593 |
| *Mangifera indica* | mago | 688,846 |
| *Myristica* spp. | 'atone | 4,951,721 |
| *Neonauclea forsteri* | afa | 242,893 |
| *Pimelodeudron* spp. | — | 208,887 |
| *Planchonella* spp. | mamalava | 302,166 |
| *Planchonella torricellensis* | mamalava | 1,830,792 |
| *Psychotria* spp. | matalafi | 374,340 |
| *Rhus taitensis* | tavai | 5,306,192 |
| *Syzygium inophylloides* | asi | 769,298 |
| *Terminalia richii* | malili | 1,582,771 |
| *Trichospermum richii* (Gray) Seem. | elsau | 63,461 |
| Unknown | — | 17,813 |
| Total | | 31,894,925 |

[a] Data recompiled from Cole et al. (1988) by using current methods.

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