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American Samoa's Forest Resources: Forest Inventory and Analysis, 2012

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Cover: Pago Pago Harbor, Tutuila Island, American Samoa. Photo by National Park Service.

Abstract

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This report highlights key findings from 2012 data collected by the Forest Inventory and Analysis program across all forested land on four islands in American Samoa, updating previously published findings from data collected in 2001 (Donnegan et al. 2004). We summarize and interpret basic resource information such as estimates of forest area, stem volume, biomass, numbers of trees, damages to trees, and tree size distribution as well as overstory and understory vegetation cover and information on invasive plant species presence and cover. Detailed tables and graphical highlights are included to help inform resource managers and policymakers, as well as educate the public regarding the status and trends of their local natural resources. The appendices provide details on inventory methods and design and include summary tables of data, with statistical error, for the wide variety of forest characteristics inventoried.

Keywords: American Samoa, biomass, carbon, damage, forest land, inventory, vegetation, invasive plants.

Highlights

- Estimated total forest area: 39,156 acres
(Table 1, p. 8)
- Estimated total number of live trees: 28,278,000
(Table A2-1, p. 35)
- Total number of tree species recorded: 60
(Scientific and common names of plants found during inventory, p. 24)
- Estimated total net live tree volume: 61,829,000 cubic feet
(Table A2-4, p. 39)
- Estimated total live tree aboveground biomass: 2,349,000 dry tons
(Table A2-6, p. 42)
- Estimated total live tree aboveground carbon: 1,175,000 dry tons
(Table A2-6, p. 42)

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Guide to Forest Inventory and Analysis

Overview of the Purpose of This Report

This report presents a summary of American Samoa's forest resources from the most recent data collected by the Forest Inventory and Analysis (FIA) program in 2012 across all ownerships and forest types, updating previously published findings from data collected in 2001 (Donnegan et al. 2004). We summarize and interpret basic resource information, including forest area, ownership, land use change, biomass, biodiversity, standing dead wood, and forest health indicators. Pacific Northwest Research Station Forest Inventory and Analysis (PNW-FIA) implemented a sampling strategy in American Samoa that measures forest and nonforest vegetated plots, within a single year, on an intended 10-year cycle. PNW-FIA cooperates with Pacific Island foresters to use the inventory data to help answer local and national questions about the status and trends in tropical forests. These updated data are independent of those published in the earlier report; however, the values presented here cannot be compared to previous reports or datasets to assess changes in our forest resources over the past decade owing to a change in protocol between sampling years. Consistent sampling and field protocols standardized across different ownerships and forest management regimes will now allow for comparisons of change in future reports. This report covers all forested and vegetated nonforest lands in American Samoa, with estimates representing averaged values computed from all inventory plots visited by field crews in 2012.

Description of the Forest Inventory and Analysis Program

The FIA program was created within the U.S. Department of Agriculture Forest Service in 1928 to conduct unbiased assessments of all the nation's forested lands for use in economic and forest management planning. The FIA program was charged with collecting forest data on a series of permanent field plots, compiling and making data publicly available, and providing research and interpretations from those data. Four FIA units are responsible for inventories of all forested lands in the United States, including the territories and commonwealths of Puerto Rico, Guam, American Samoa, Northern Mariana Islands, and U.S. Virgin Islands, and three "freely associated states" (Pacific Island nations that forged a compact of free association with the United States); these include the Federated States of Micronesia, Republic of the Marshall Islands, and Republic of Palau. Historically, each of the four regional FIA units responsible for forest inventory in the United States implemented inventory methods to best fit their respective regional forest conditions and client needs, resulting in inconsistent national reporting (USDA FS 2006). After passage of the 1998 Farm Bill, the FIA program implemented an annualized inventory, which was designed to be

nationally consistent as well as spatially and temporally unbiased with respect to forest types and landownership groups (Bechtold and Patterson 2005). All FIA units use a common plot design, common set of measurement protocols, and standard database design for compilation and distribution of data. Under this unified approach, FIA is able to provide unbiased estimates of a wide variety of forest conditions over all forested lands in the United States in a consistent and timely manner.

Adaptations were made to the national design for the American Samoa inventory in order to include additional branching and rooting forms and additional tree crown measurements, as well as special-interest species ranging from invasive plants to pathogens to culturally or economically important plants of various life forms. With active assistance from American Samoa Community College, Community and Natural Resources, Forestry Division, plots were spaced uniformly at 1.9-mi intervals using a hexagonal grid, at a threefold intensification of the spacing used in the mainland U.S. inventory plot grid. Forest inventory plots included four 24-ft fixed-radius subplots, where a variety of information is collected at the plot, subplot, and tree levels (USDA FS 2012). Primary variables collected included plot location, slope, aspect, elevation, subplot slope position and slope shape, tree species, diameters, heights, damages, branching and rooting forms, decay, and epiphytic loadings (fig. 1). Additional information about annual inventories and methods is available in appendix 1 of this report and at <http://fia.fs.fed.us/>.



Figure 1—Forest Inventory and Analysis field crew using equipment to accurately measure diameter of a tree on plot.

Common FIA Terminology

What is a tree?—

The U.S. Forest Service defines a tree as a woody perennial plant, usually with a single well-defined stem carrying a crown, with a minimum height of 15 ft at maturity (USDA FS 2006).

What is a forest?—

Forests come in many shapes and sizes, varying from complex and species diverse to monoculture plantations. The FIA program defines forest land as an area currently or formerly (within 30 years) having at least 10-percent crown cover by trees of any size and not currently developed for nonforest use (USDA FS 2006). Forest land must be at least 1 ac in size with a minimum continuous width of 120 ft.

What is a forest type and forest type group?—

Most forests contain multiple tree species but are grouped into a single forest type; the functional characteristics of these tree species are then used to more broadly classify each forest type into a forest group. Forest type describes the species or species groups forming a plurality of all live trees (USDA FS 2006) (Example: mangrove forest type or lower montane wet rain forest type).

Forest Resources in American Samoa

American Samoa is an unincorporated and unorganized territory of the United States located in the South Pacific Ocean, about 2,500 mi south of Hawaii (fig. 2) and about 780 mi northeast of Fiji. It is the only U.S. territory south of the equator and therefore the only forest area inventoried by the FIA program in the Southern Hemisphere. The territory consists of seven islands: five inhabited high volcanic islands (Tutuila, Aunu'u, Ofu, Olosega, and Ta'u), one inhabited atoll (Swains), and one uninhabited atoll (Rose). Tutuila is the largest and main island of American Samoa, and the islands of Ta'u, Ofu, and Olosega make up the county of Manu'a, about 60 mi to the east. Tutuila has the most forest at 30,813 ac, compared to the smaller islands of Manu'a at 8,343 ac. The two coral atolls, Rose Atoll and Swains Atoll, are not included in the inventory owing to distance and logistical challenges. The climate of American Samoa is hot and humid, with little variation in temperature annually and diurnally, but with a pronounced dry season lasting June through September (fig. 3). This climate supports the diverse, largely intact forests of American Samoa, which contain examples of mixed paleotropical rainforest not found in other forested areas of the United States (USDI NPS 1997).

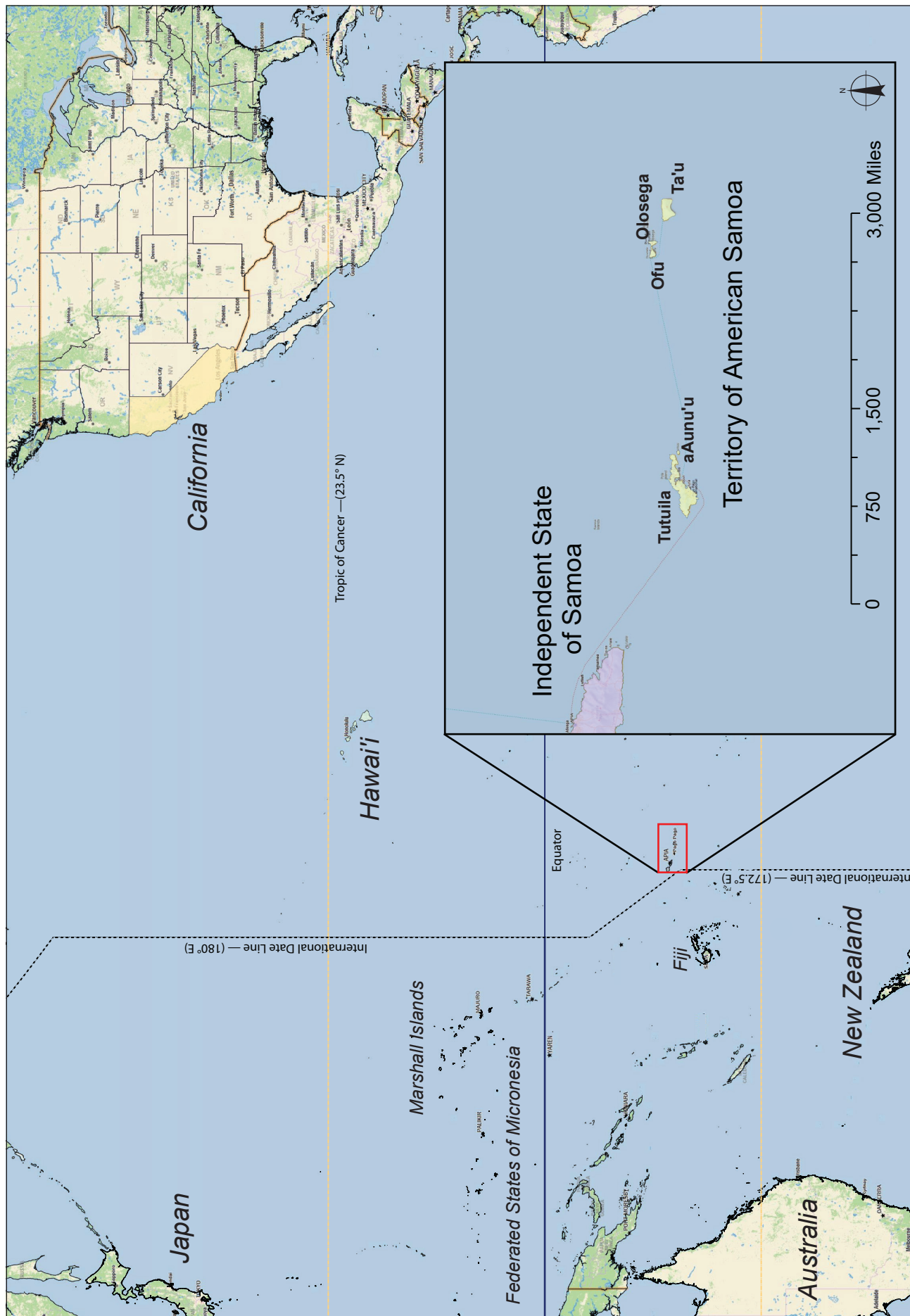


Figure 2—American Samoa is in the south-central Pacific Ocean, approximately 4,600 mi southwest of Los Angeles, California, and 2,500 mi south of Hawaii.

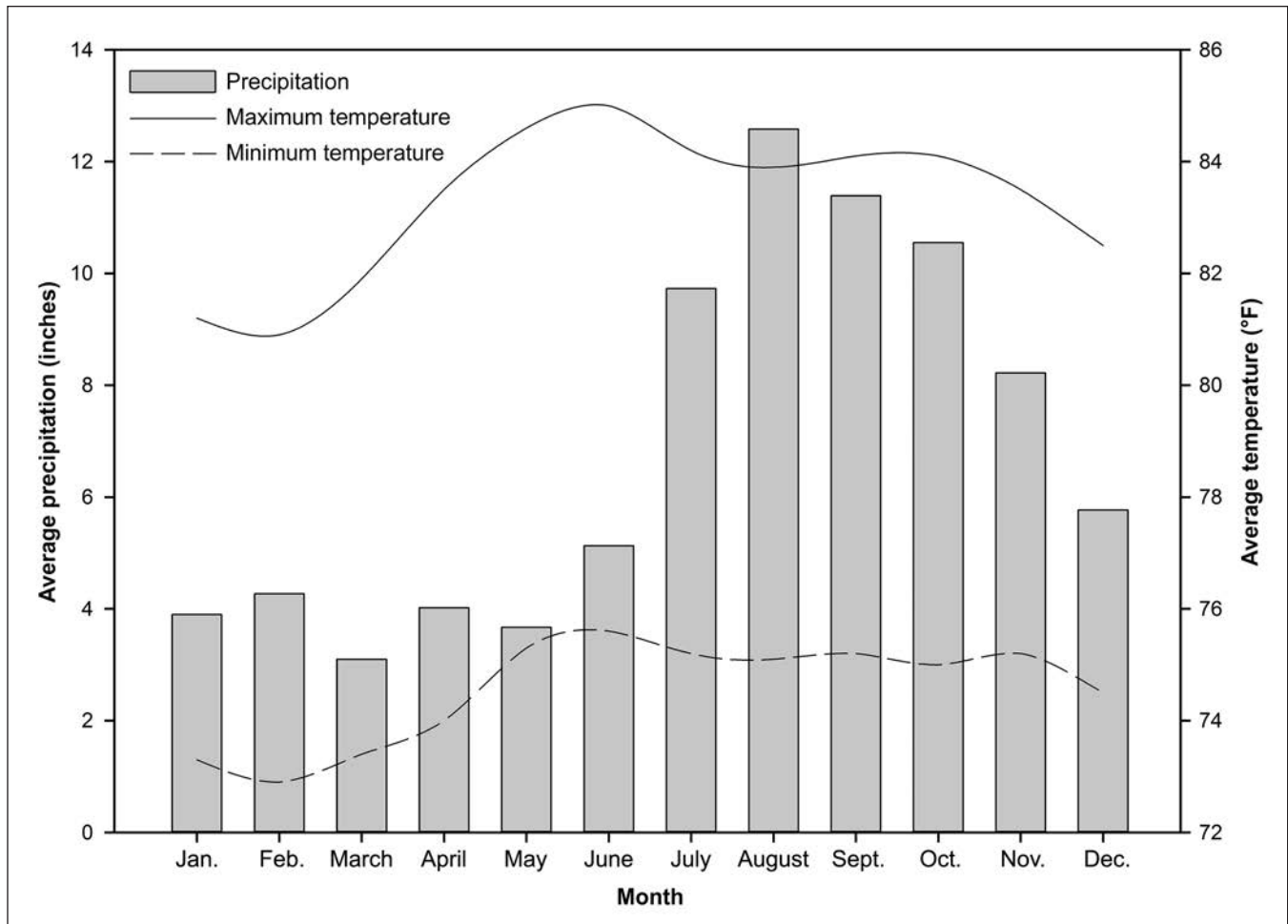


Figure 3—Average maximum and minimum temperature and total monthly precipitation for Pago Pago, American Samoa. Note the pronounced seasonality in precipitation (Western Regional Climate Center, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?pipago>).

The tropical forests of American Samoa offer many ecological benefits, including filtering runoff to streams, providing shade to help control water temperature, increasing water absorption, and contributing to the food web. Forested ecosystems also help with creation and retention of soils, complete nutrient cycling, and sequester large quantities of carbon. Tropical forests are among the most diverse ecosystems in the world and provide multiple benefits on the local and global scale through the provisions of goods and ecosystem services (Gardner et al. 2009). This high biodiversity provides a rich genetic diversity for species to be able to respond to external influences and maintain essential ecological processes that aid in recovery after disturbance. The forests of American Samoa also provide vital habitat for plants and animals, such as native fruit bats. *Pteropus tonganus*, called “pe’a fanua” in Samoan, and *Pteropus samoensis*, known as “pe’a vao,” play an important role as pollinators

and seed dispersers within the forest, are an important part of Samoa's culture, and are the source of many traditional stories, myths, and legends (USDI NPS 1997).

There are also social benefits derived from forest resources that are less tangible and more difficult to quantify. Forests are often the location for recreational, cultural, and spiritual activities. Agroforestry practices of Polynesian cultures in the South Pacific exemplify a long and unique history of close interaction between the people and the land. Traditional lifestyles for many local communities rely heavily on forest resources. Samoans retain close ties to the rain forest, as evidenced by communal ownership of forested lands and the status that ownership gives to the family and the village. The desire of Samoans to protect the integrity of their rain-forest and their traditional way of life is called fa'asamoa. Throughout the islands, forests provide subsistence foods, medicinal compounds, wood for local crafts and construction, and other materials important for cultural purposes and daily use.

Forest Area

American Samoa is primarily forested (81 percent) (fig. 4). The total land area is about 48,434 ac, with 39,156 forested ac (table 1). Forest land is defined as land that has at least 10-percent crown cover by live trees of any size, or has had at least 10-percent canopy cover in the past, based on the presence of stumps, snags, land use history or other available evidence. Nonforest land includes areas for homes, livestock enclosures, community areas, and small farms that have been cleared

Table 1—Estimated land area by land status, 2012

Land status	Manu'a	Tutuila East	Tutuila West	Total
----- Acres -----				
Forest land area:				
Unreserved forest land	4,212	14,493	13,688	32,393
Protected forest land (National Park Service lease and reserves)	4,131	2,106	—	6,237
Mangroves	—	526	—	526
All accessible forest land	8,343	17,125	13,688	39,156
Nonforest and other areas:				
Nonforest urban	—	2,290	6,317	8,607
Nonforest vegetation	80	590	—	670
Barren lands	—	—	—	—
Water	—	—	—	—
All nonforest and other	80	2,880	6,317	9,277
Total area	8,423	20,005	20,005	48,433

— = none.

QuickBird satellite imagery from Digital Globe, Inc. (Longmont, Colorado) was used to develop the vegetation mapping layers (Liu et al. 2011).

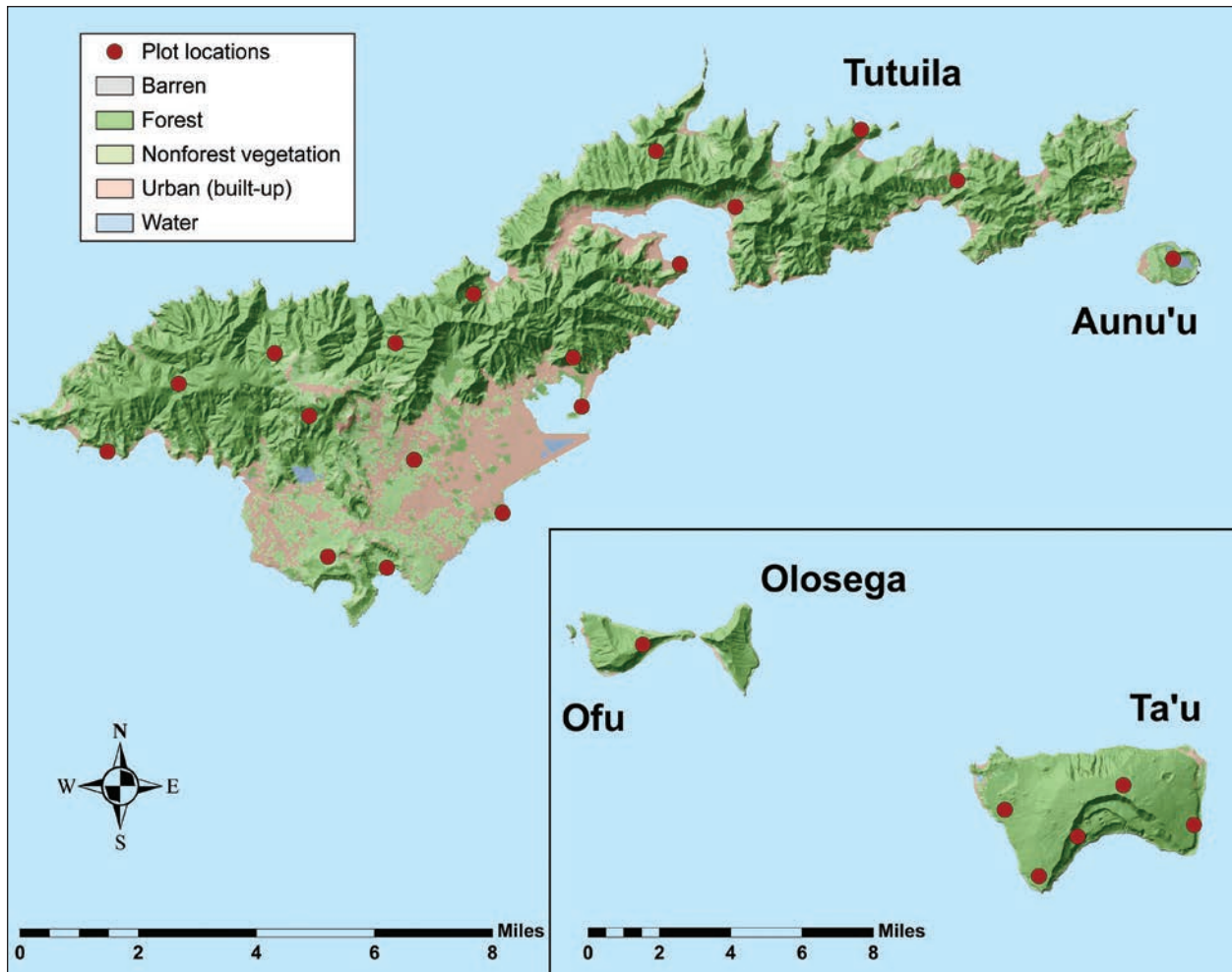


Figure 4—Forested plots measured in 2012 used to provide the data published in this report. Locations are approximate (forest/nonforest geographic information system layer: Liu et al. 2011).

within villages (found mainly along the coastal plain, valley floors, and on other flat areas on the islands), as well as urbanized areas consisting of low buildings and paved roads, located primarily near airports and harbors (Izuka et al. 2005).

Forest Composition

The natural vegetation of American Samoa is tropical rainforest (fig. 5), owing to its warm climate and year-round rainfall. The combination of climate, elevation, and soil types create a unique mix of ecoregions and forest types. American Samoa vegetation (as mapped by Liu et al. 2011) is primarily intact, continuous canopy forest, but is dominated by post-disturbance vegetation types. The majority of the land area (36.9 percent) was classified as a mixed *Rhus* secondary forest, dominated by tavai (*Rhus taitensis*), toi (*Alphitonia zizyphoides*), maota (*Dysoxylum maota*), lopā (*Adenanthera pavonina*), and moso'oi (*Cananga odorata*). This type of forest is

Ashley Lehman



Figure 5—The majority of American Samoa is composed of forested areas.

characterized by abandoned fields that, when left undisturbed, eventually revert to a high forest dominated by tall secondary species. The second largest class covering 14.2 percent of the total land area was classified as secondary scrub, an intermediate stage of vegetation that occurs when cultivated land is abandoned and allowed to revert to natural forest. Over time, this class of vegetation will be replaced by larger trees, developing into a mixed *Rhus* secondary-scrub forest type.

FIA crews identified 60 tree species in American Samoa (see “Scientific and Common Plant Names of Plants Found During Inventory”). The most common tree species present were *Hibiscus tiliaceus* (fau), *Myristica inutilis* (‘atone), *Cocos nucifera* (niu), *Dysoxylum maota* (maota), *Pandanus tectorius* (fasa), and *Musa* spp. (fa’i) (table 2).

The average FIA plot in American Samoa contained 11 different tree species (fig. 6). Forest stands tend to be dominated by smaller size trees that are less than 5 inches in diameter (fig. 7). Diameter distribution for trees follows a reverse-J pattern in American Samoa, indicating that regeneration is abundant (fig. 8). 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.

Table 2—Estimated number of trees in American Samoa, by species

Scientific name	Total	Sampling error	Scientific name	Total	Sampling error
<i>Number of trees (thousands)</i>			<i>Number of trees (thousands)</i>		
<i>Hibiscus tiliaceus</i>	1,140.8	360.4	<i>Ficus scabra</i>	50.1	39.1
<i>Myristica inutilis</i>	840.0	271.0	<i>Kleinhovia hospita</i>	50.1	39.1
<i>Dysoxylum maota</i>	438.8	128.0	<i>Myristica hypargyrea</i>	50.1	50.1
<i>Pandanus tectorius</i>	426.2	388.0	<i>Canarium mafoa</i>	37.6	37.6
<i>Cocos nucifera</i>	376.1	173.0	<i>Diospyros samoensis</i>	37.6	27.5
<i>Musa spp.</i>	313.4	220.7	<i>Morinda citrifolia</i>	37.6	20.7
<i>Cananga odorata</i>	188.1	74.3	<i>Sterculia fanaiho</i>	37.6	27.5
<i>Neonauclea forsteri</i>	175.5	88.6	<i>Aglaia samoensis</i>	25.1	25.1
<i>Inocarpus fagifer</i>	163.0	137.9	<i>Cyathea lunulata</i>	25.1	25.1
<i>Rhus taitensis</i>	163.0	67.7	<i>Ficus tinctoria</i>	25.1	25.1
<i>Macaranga harveyana</i>	150.4	86.9	<i>Ficus uniauriculata</i>	25.1	25.1
<i>Palaquium stehlinii</i>	112.8	112.8	<i>Terminalia richii</i>	25.1	17.3
<i>Alphitonia zizyphoides</i>	100.3	39.1	<i>Astronidium pickeringii</i>	12.5	12.5
<i>Barringtonia samoensis</i>	100.3	64.5	<i>Calophyllum neo-ebudicum</i>	12.5	12.5
<i>Bischofia javanica</i>	100.3	53.3	<i>Carica papaya</i>	12.5	12.5
<i>Buchanania merrillii</i>	100.3	100.3	<i>Elaeocarpus floridanus</i>	12.5	12.5
<i>Rhizophora mangle</i>	100.3	100.3	<i>Fagraea berteriana</i>	12.5	12.5
<i>Elaeocarpus ulianus</i>	87.8	66.5	<i>Flacourtia rukam</i>	12.5	12.5
<i>Planchonella samoensis</i>	87.8	55.8	<i>Garuga floribunda</i>	12.5	12.5
<i>Planchonella garberi</i>	75.2	55.1	<i>Hernandia moerenhoutiana</i>	12.5	12.5
<i>Syzygium inophylloides</i>	75.2	45.3	<i>Intsia bijuga</i>	12.5	12.5
<i>Canarium vitiense</i>	62.7	44.3	<i>Mangifera indica</i>	12.5	12.5
<i>Cyathea spp.</i>	62.7	62.7	<i>Spondias dulcis</i>	12.5	12.5
<i>Hernandia nymphaeifolia</i>	62.7	62.7	<i>Syzygium dealatum</i>	12.5	12.5
<i>Adenanthera pavonina</i>	50.1	50.1	<i>Syzygium samarangense</i>	12.5	12.5
<i>Artocarpus altilis</i>	50.1	23.4	<i>Tarennia sambucina</i>	12.5	12.5

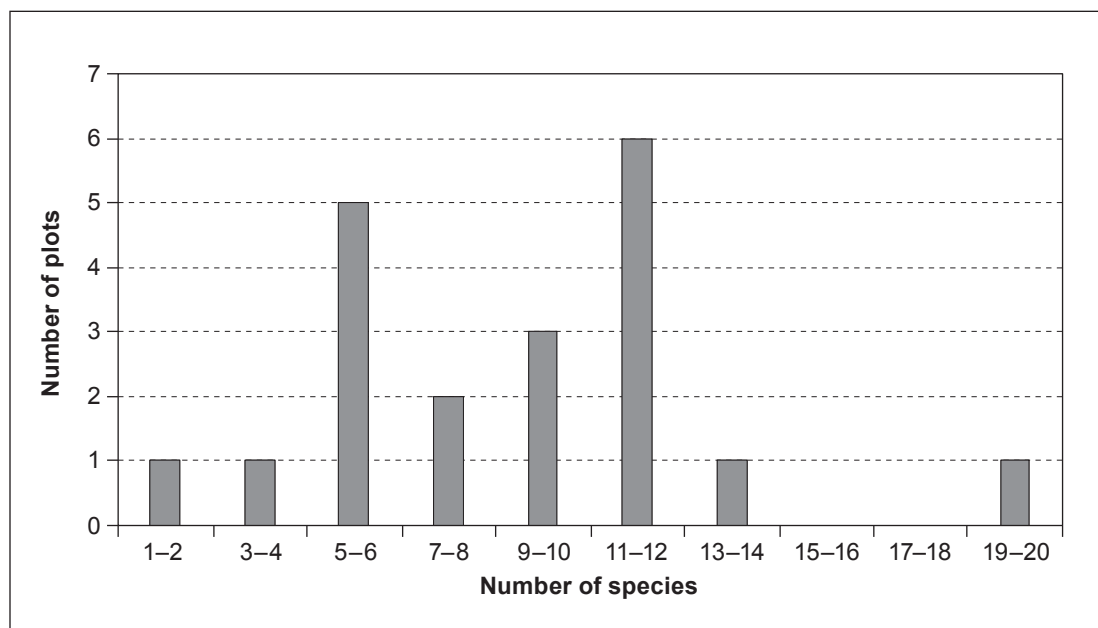


Figure 6—Number of tree species found on plots sampled by Forest Inventory and Analysis (FIA). The average number of tree species per field visited FIA plot was 11, and ranged from 1 to 20 species per plot based on the 20 plots inventoried.

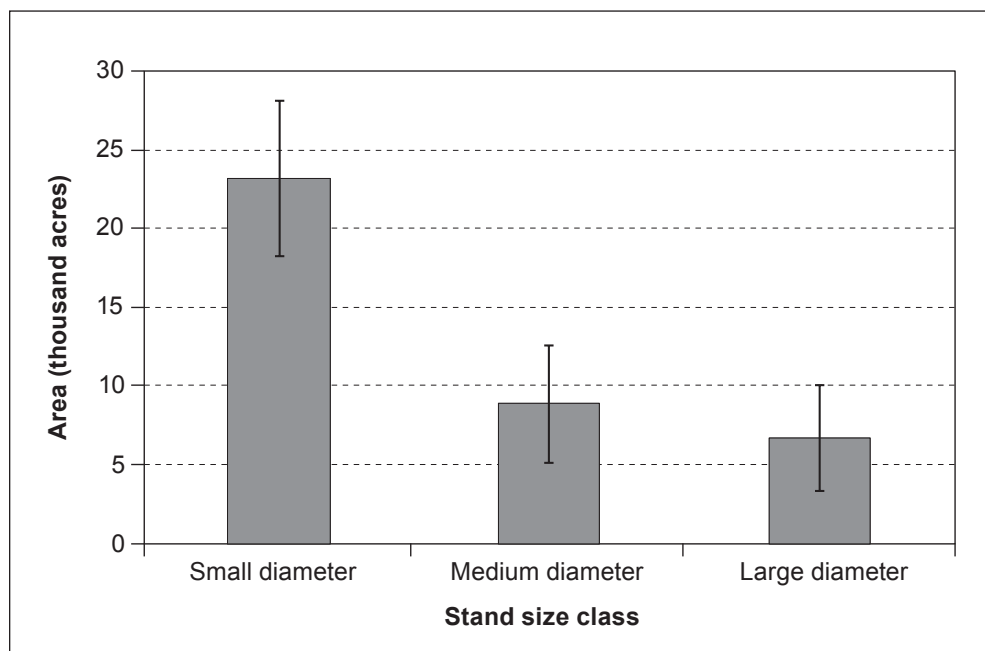


Figure 7—Forest area by stand size class. Large diameter stand-size-class forests are defined as having the majority trees ≥ 11.0 inches in diameter at breast height (d.b.h.). Medium diameter stand-size-class forests are defined as having the majority of trees between 5.0 inches and 11.0 inches d.b.h. Small diameter stand-size-class forests have the majority of trees with d.b.h. < 5.0 inches. Forests in the small diameter stand size class were more abundant than forests in medium and large diameter stand size classes.

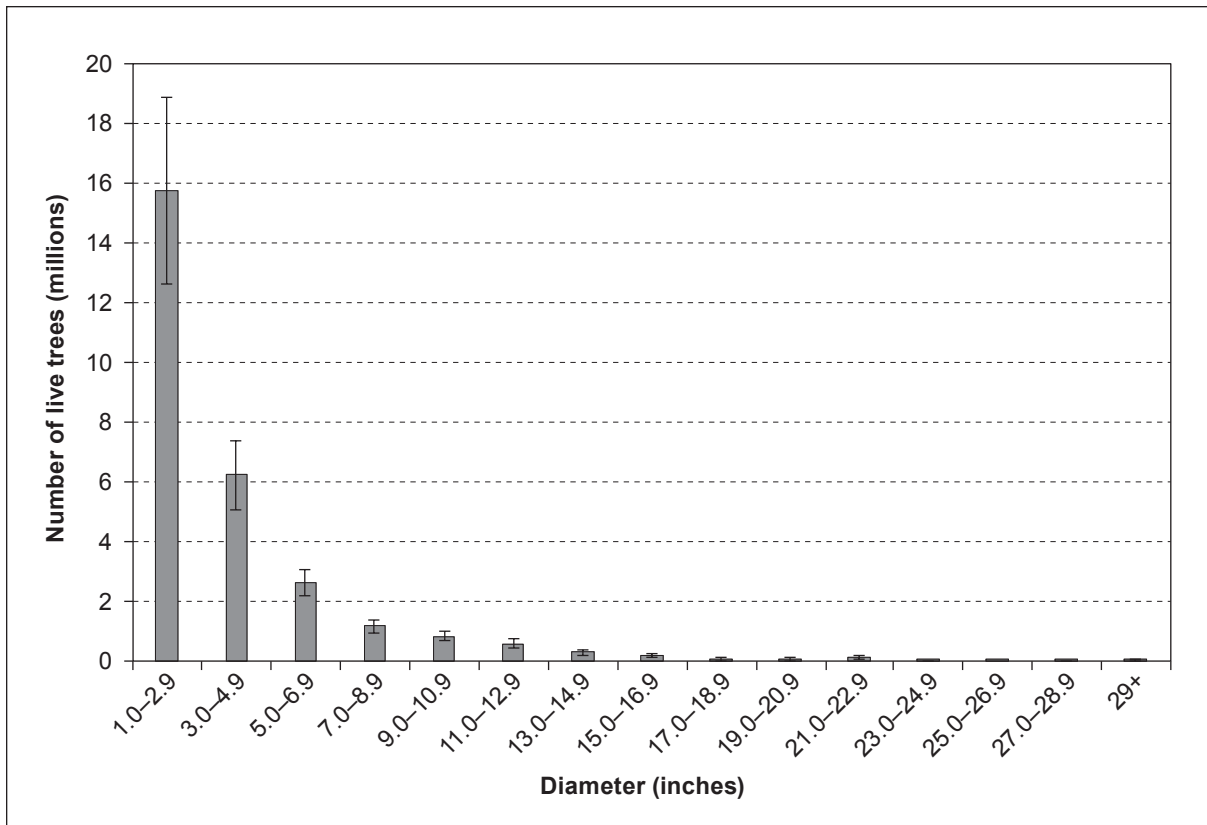


Figure 8—Estimated number of live trees by diameter class. Smaller trees are the most numerous across all size classes, indicating that regeneration is abundant.

Volume, Biomass, and Carbon

Volume is a metric by which forest productivity, vigor, and structure can be assessed and modeled to examine current forest conditions and project future forest status. Field-derived total tree lengths of the bole and diameter measurements are used to produce single-tree volume estimates, which are then expanded to assess the volume of entire forested stands. Volume estimates can then be used in additional models to study forest biomass and carbon dynamics. Biomass and carbon distribution by diameter class closely follows the pattern seen in volume by diameter class distribution, in which the majority of volume is concentrated in the small to medium stand size classes (fig. 9).

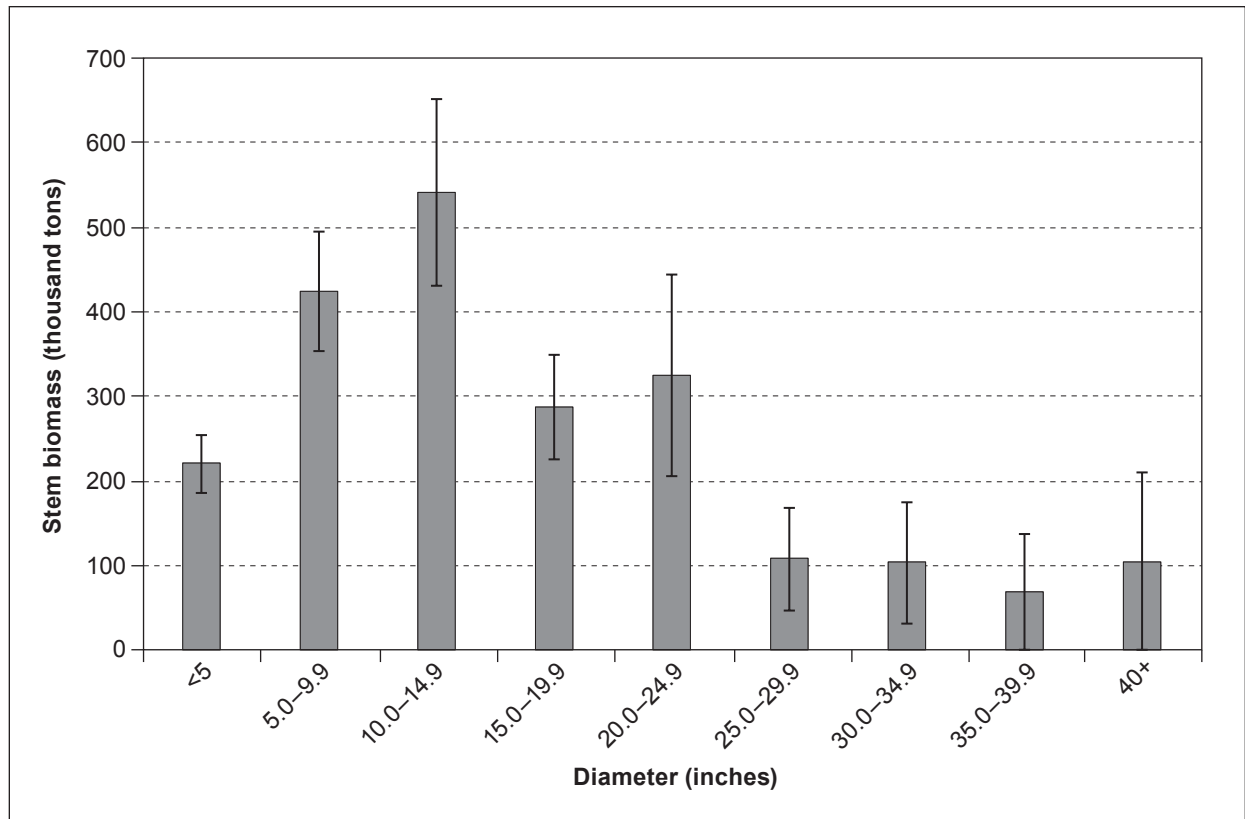


Figure 9—Live stem biomass (thousand tons) and stem biomass percentage of total by diameter class. In American Samoa, stem biomass is concentrated in trees of the diameter classes between 5.0 to 9.9 and 10.0 to 14.9 inches.

Understory Vegetation

Understory vegetation is an important structural component in all forest ecosystems. The life-form type and density of cover could affect forest structure and function, as well as influence wildlife habitat, spread of disease, soil stability, and competition between native and nonnative plants. FIA field crews sample understory vegetation in plots on forest and vegetated nonforest land (fig. 10). To reflect forest structure, the percentage of canopy cover by four layers and percentage of total canopy cover to 1 percent are estimated for tree seedlings (trees <1.0 inches diameter at breast height [d.b.h.]) and saplings (trees 1.0 to 4.9 inches d.b.h.); shrubs (woody, multiple-stemmed plants of any size including woody vines); forbs (herbaceous, broad-leaved plants, including nonwoody vines and ferns); and graminoids (grasses and grasslike plants, including rushes and sedges). To reflect species composition, percentage of total canopy cover and main canopy layer are estimated for the four most abundant (≥ 3 -percent canopy cover) seedling and sapling, shrub, forb, and graminoid species. Estimates of cover were made for several less common species that are considered to be of special importance by local foresters.



Ashley Lehman

Figure 10—Field crews identify the most common understory vegetation that occupies the highest percentage of cover within the subplot.

The most common understory species found on FIA plots were *Cordyline fruticosa* (ti plant), *Diospyros samoensis* (auauli), *Dysoxylum maota* (maota), *Ficus scabra* (mati vao), *Morinda citrifolia* (nonu), *Myristica inutilis* ('atone), and *Psychotria insularum* (matalafi). Understory vegetation canopy cover in American Samoa was greatest on Tutuila East (fig. 11).

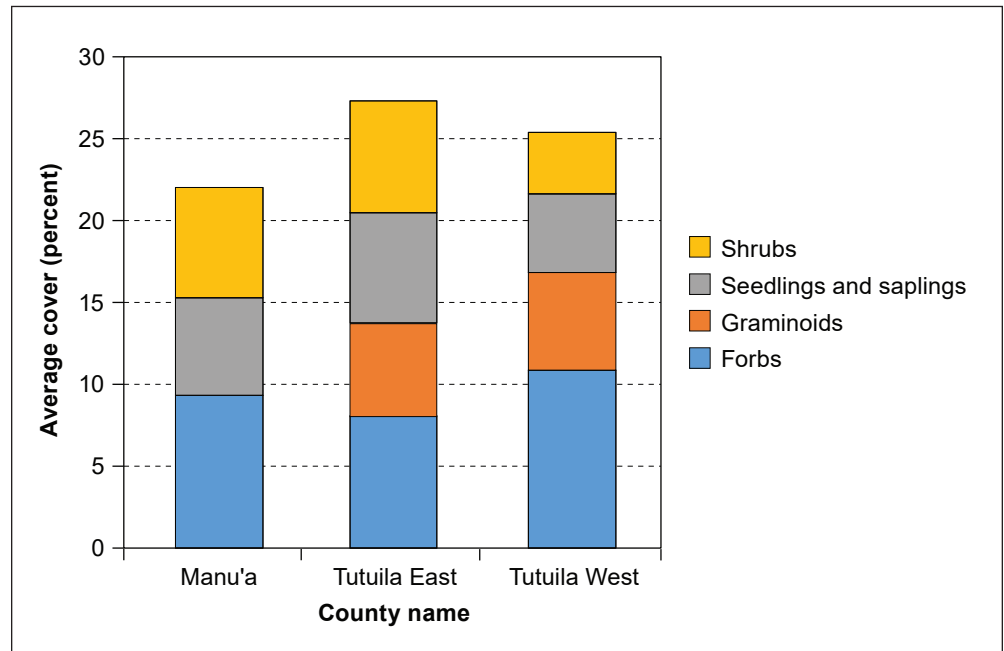


Figure 11—Average understory vegetation canopy cover percentage by county and life form in forests of American Samoa.

Extent of Standing Dead Wood

Standing dead trees (snags) represent an important component of forest structure and wildlife habitat. FIA plot measurements are well suited to estimate dead wood throughout all forest types and ownerships across the island. Dead trees fill many ecologically important roles in forests. Dead wood in a forest provides habitat for wildlife and fungi, improves soil fertility through nutrient cycling and moisture retention, adds to fuel loads, and is a key structural element in mature forests. Large-scale disturbances from weather-related events and insects can have a profound effect on the total dead wood stores present, which is an important parameter for forest managers. Dead wood resources are complex, and FIA provides estimates of the amount of standing dead trees. There are approximately 73,603 tons of dry dead wood in American Samoa: 39,798 tons in Tutuila East, 22,294 tons in Tutuila West, and 11,511 tons in Manu'a (fig. 12).

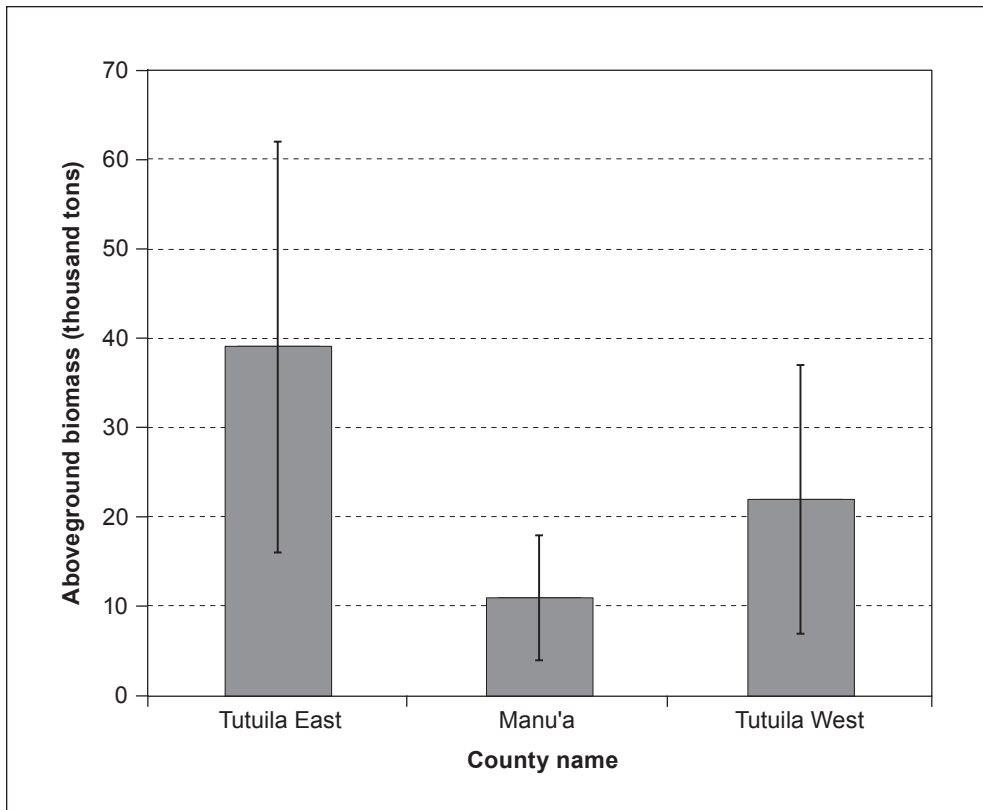


Figure 12—Aboveground standing dead tree biomass for trees with diameters greater than 5 inches. Manu'a has the least amount of standing dead wood, followed by Tutuila West, then Tutuila East.

Forest Ownership

Ownership has a strong influence on how forests are managed and used. About 90 percent of the territory's resident population are Samoan, and most land is held and managed within traditional family communal systems (Busche et al. 2011). In American Samoa, local families lease 9,000 ac on three islands (8,000 ac terrestrial, 1,000 ac aquatic) to the U.S. Department of the Interior, National Park Service. (Webb et al. 2014). The National Park of American Samoa was established in 1988 with a lease extending for 50 years.

Nontimber Forest Products

Nontimber forest products (NTFP) are forest products not traditionally sawn as timber, contributing to a diversified economy, including subsistence use. Nontimber forest products contribute in important ways to the livelihoods and welfare of the population living in and adjacent to forests by providing construction materials, fencing, furniture, foods, medicines, fibers, floral products, plant oils, dyes, food wrapping, fuels and livestock feed, and representing other important cultural values

(Dawson et al. 2014). Selected examples of important NTFP and agricultural crops on Pacific Islands include food crops such as banana (*Musa* spp.), breadfruit (*Artocarpus altilis*), fasa (*Pandanus tectorius*) (fig. 13), coconut (*Cocos nucifera*), and nonu (*Morinda citrifolia*), as well as handicrafts made from coconut and fasa, and floral products such as moso'oi (*Cananga odorata*) (Wilkinson and Elevitch 2000). In American Samoa's forests, *Pandanus tectorius*, *Cocos nucifera*, and *Musa* spp. were the selected NTFPs with the largest number of trees (fig. 14).



Figure 13—The pandanus tree (fasa, *Pandanus tectorius*) is harvested and utilized in a variety of ways; the trunk can be used as building material and the leaves are used for weaving material.

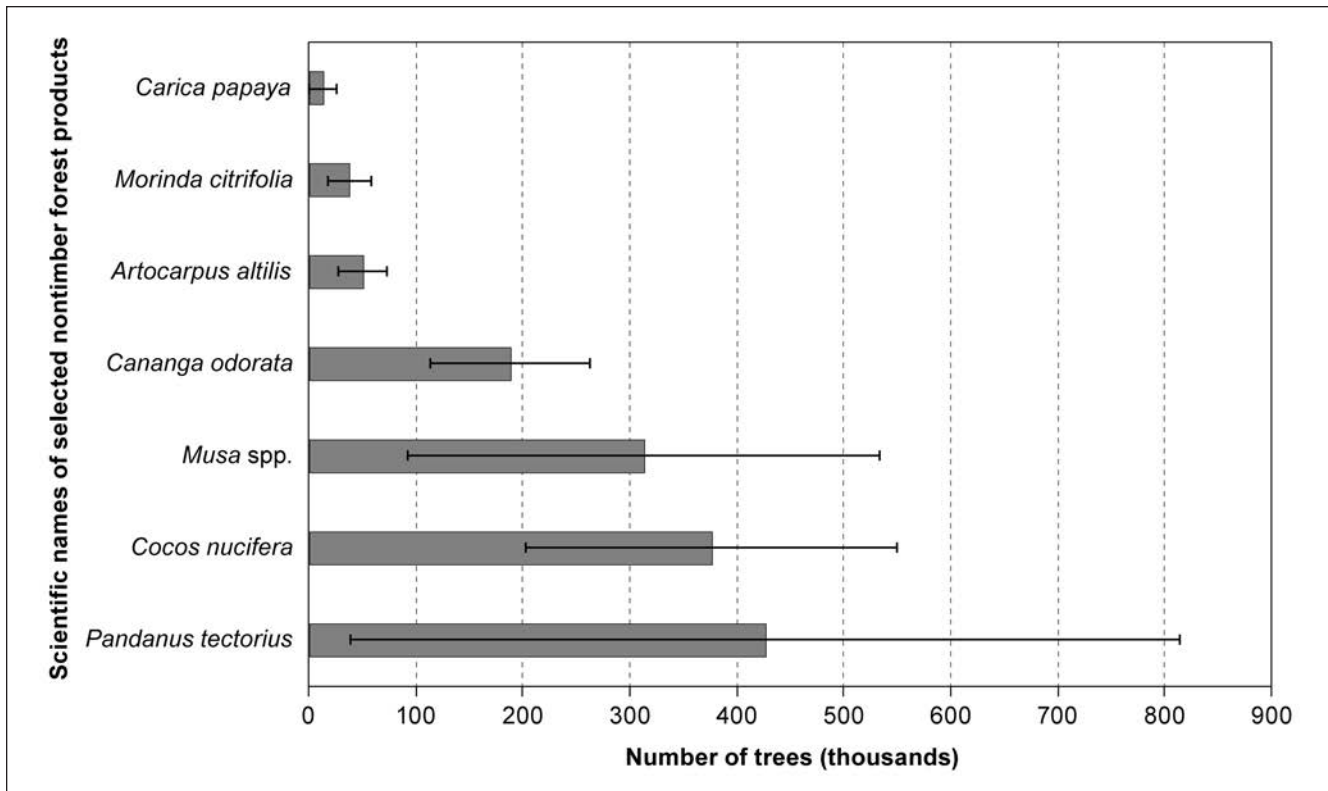


Figure 14—Number of trees of selected nontimber forest products (NTFP) species. *Pandanus tectorius*, *Cocos nucifera*, and *Musa* spp. had the highest number of trees of the NTFPs selected and sampled.

Forest Health

Forests are complex ecosystems, composed of plants, animals, and fungi that interact with each other and nonbiotic elements. Trees dominate forested landscapes, but less obvious components such as fungi and soil microbes are also important (Molina 1994), with each piece of the system playing a role in creating a balanced and healthy environment. Forests sequester carbon from the atmosphere and serve as long-term carbon storage (Harmon et al. 1990), and they protect soil from erosion as well as remove pollutants to improve air quality (Nowak et al. 2014). In American Samoa, forests comprise nearly 81 percent of the land area, and the health of these forests affects surrounding environments and their ability to maintain the unique species composition and function.

Forest Disturbances and Their Extent

Detecting damage to trees at the stand level is critical for assessing overall forest health in terms of resiliency, diversity, function, and resource sustainability. Healthy forests are important for protecting watersheds in island ecosystems. Forest disturbance and mortality resulting from damages inflicted by invasive vegetation,

insects, disease, or abiotic stressors such as weather events are all agents that can reinitiate a succession phase, thereby promoting new growth, regeneration, and shifts in species diversity and composition in American Samoa's forests. During surveys, to track the types of disturbances that are occurring in these forests, FIA crews assign a type and agent for each live tree with visible signs of damage, which can be used to indicate a presence of disturbance.

About 17 percent of the trees measured had some form of visible damage (fig. 15). Vines in the crown were the most prevalent damage recorded to saplings and trees, followed by conks/signs of decay and a loss of apical dominance (broken tops). FIA field crews assign a causal damage agent to the damages to help local forest managers assess forest pest problems. Field crews study the surrounding area looking for patterns such as branch breakage or blowdown, or signs of human or insect activity, and can often assign a causal agent. Sometimes, however, the cause of the damage cannot be reliably identified and is assigned a code signifying that the cause of damage is unknown. Weather, vegetation, and disease were the most commonly identified causes of damage (fig. 16).

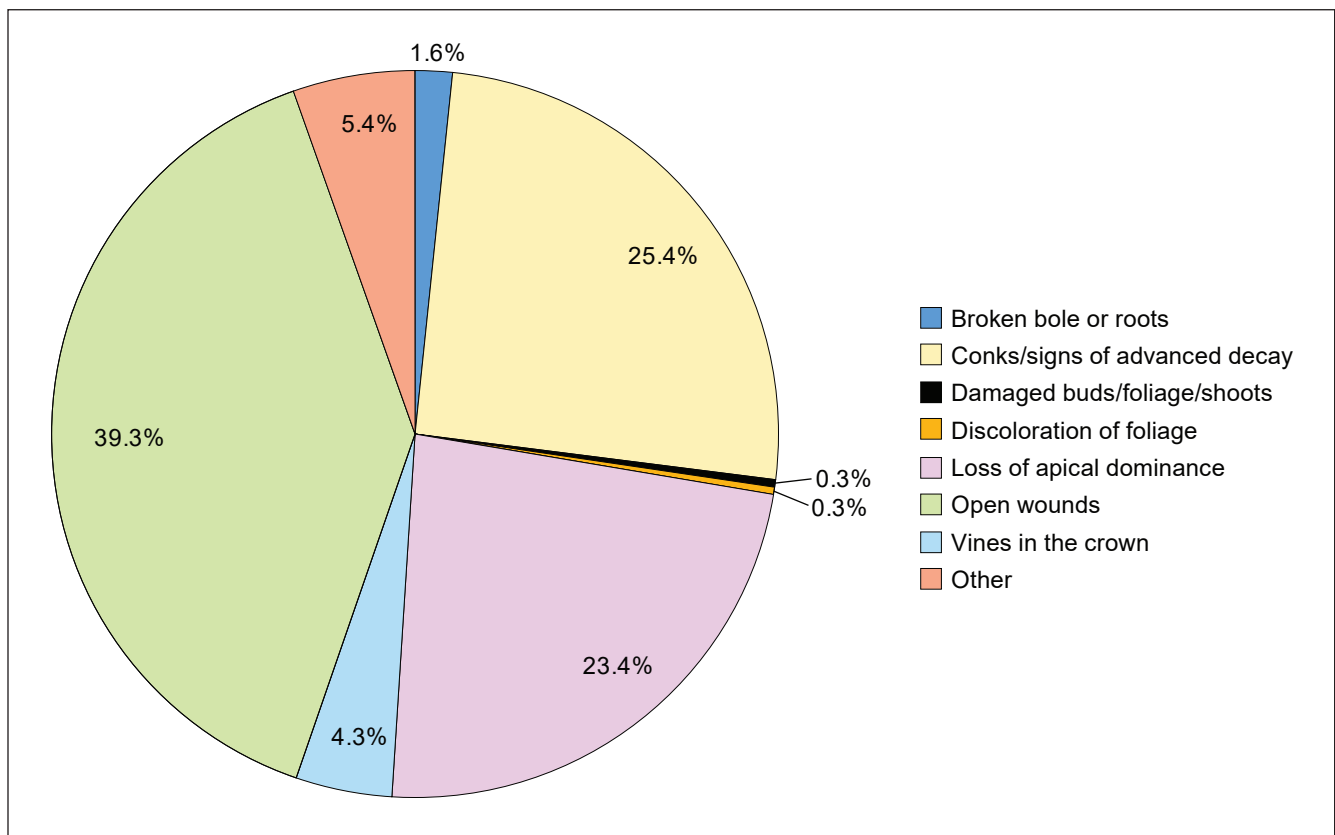


Figure 15—Tree damage types occurring on live trees in Forest Inventory and Analysis plots. The majority of damages to saplings and trees occurred as vines in the crown and conks and other signs of decay such as strangulations from other plants.

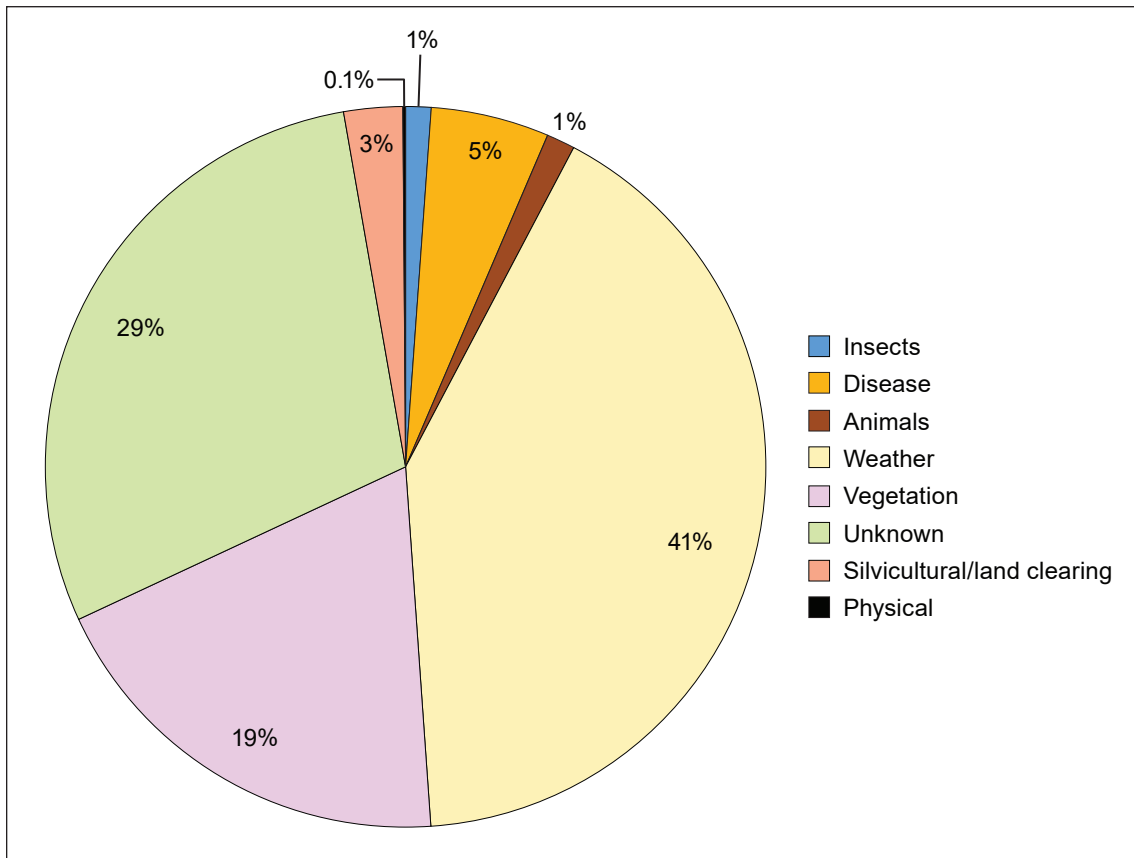


Figure 16—Sapling and tree damage agents. The majority of damages on these trees were caused by weather, vegetation (suppression, competition, or vines), and unknown damaging agents.

Weather Events

Tropical cyclones are a recurring natural disturbance that are relatively common in American Samoa between December and March (Busche et al. 2011), and weather was the most commonly identified damage agent on FIA plots in American Samoa. Six major storms hit American Samoa during the past 30 years, often inflicting significant damage to the landscape, especially to the forest and natural vegetation (Liu et al. 2011). Storms can affect the structure of the forest through severe damage such as stem breakage and uprooting, as well as through minor damage like defoliation and branch loss (Webb et al. 2014). Island regions are especially vulnerable to impacts related to climate change, such as increased storm frequency and intensity, which can decrease habitat suitability for forest regeneration (Donato et al. 2011) and can lead to sea level rise. Almost half of the weather-related damages were associated with 1 to 9 percent of the crown/stem or upper tree bole affected, whereas the other half was almost equally divided among four categories 10 to 19, 40 to 49, 50 to 59, and 60 to 69 percent of the crown/stem affected (fig. 17).

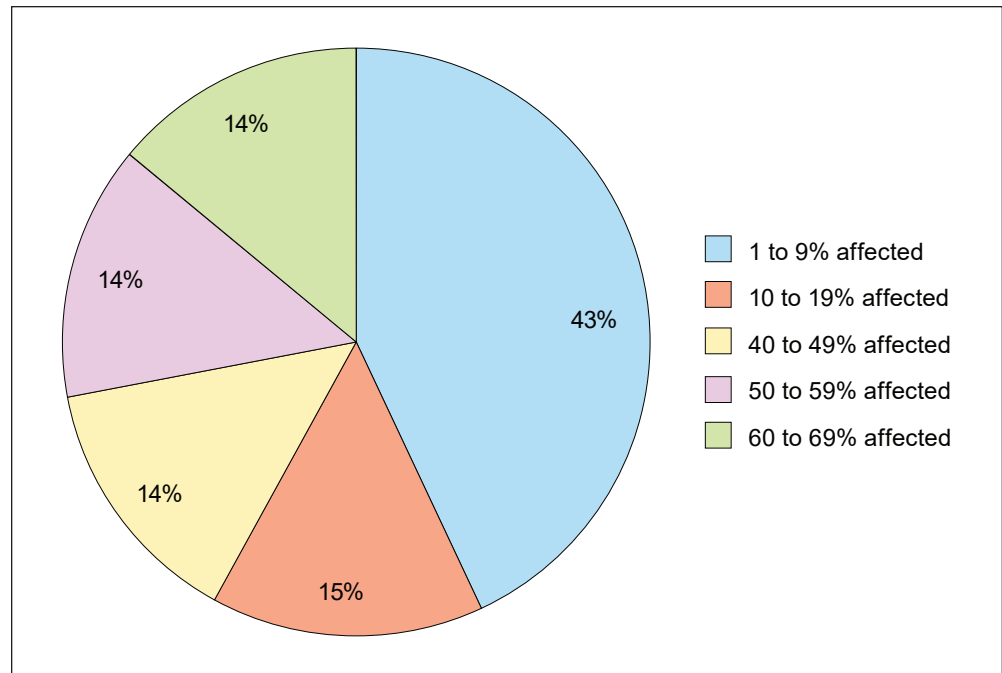


Figure 17—Damage severity to crownstem (stem within live crown) and upper tree bole (upper section of the tree bole between stump and live crown) from weather events.

Vegetation, Insects, Animals, and Disease

Introduced insects, animals, diseases, and vegetation affect the structure, function, and composition of American Samoa's forests both directly and indirectly. Direct effects of invasive organisms include damage and mortality to native flora from insects (such as the coconut rhinoceros beetle, *Oryctes rhinoceros*) and animals (feral pigs and other ungulates); mortality of native pollinators resulting from predation; and tree mortality resulting from disease (such as brown root rot, *Phellinus noxious*). A direct effect of introduced vegetation is associated with invasive vines that cover the crowns of native tree species. Trees that are heavily covered in vines will typically grow more slowly and face competition for light, water, and nutrients. In American Samoa, damage as a result of vegetation ranged from 0 to 99 percent severity of the amount of affected area, damages resulting from disease concentrated at 0 to 9 percent of the tree affected, and insects accounted for damages that occurred with a range of 0 to 9 or 60 to 69 percent severity (fig. 18).

Invasive Vegetation

Invasive nonnative plant species pose a threat to native forests throughout American Samoa. The aggressive spread of introduced species to forested areas formerly occupied by native plants changes the composition, structure, and function of both natural and managed ecosystems. Alteration of native forests driven by the introduction of

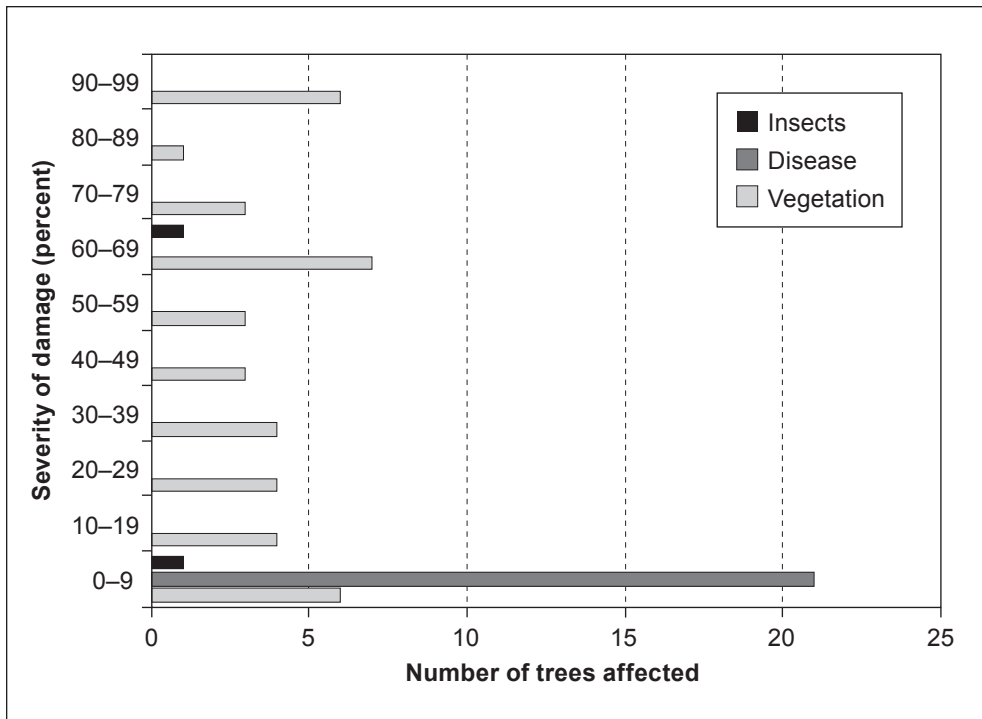


Figure 18—Severity of damages to seedlings and trees resulting from vegetation, disease, and insects.

nonnative vegetation can be particularly severe on oceanic islands, where increases in nonnative species have resulted in the decline and extinction of many endemic species (Cuddihy and Stone 1990, Steadman 1989).

Although local effects from nonnative species are easier to quantify, without an island-wide sampling effort such as the systematic and recurring FIA inventory, it would be very difficult to understand the extent of the spread of these species across all forested landscapes. To measure the overall impact of invasive species on American Samoa, FIA documents the presence, distribution, and abundance of identified invasive species. Six invasive plant species out of 26 species of concern identified by local foresters were present in inventory plots: *Adenanthera pavonina*, *Cinnamomum verum*, *Clerodendrum chinense*, *Clidemia hirta*, *Merremia peltata*, and *Mikania micrantha* (table 3).

Space and Flynn (2000) conducted an invasive plant survey in 1998 and described characteristics of these species. *Adenanthera pavonina* (red bead tree, lopā) is invasive in secondary forests. Many local residents roast and eat the seeds of this plant, and commonly refer to them as “Samoan peanuts” and do not see the trees’ presence as a problem. *Cinnamomum verum* (cinnamon, tinamoni) has the potential to become a major invasive species. *Clerodendrum chinense* (Honolulu Rose, losa Honolulu) is shade-tolerant and reproduces from root suckers. *Clidemia hirta* (Koster’s curse) is a

Table 3—Presence or absence in Forest Inventory and Analysis (FIA) plots of listed American Samoa invasive species identified by local foresters

Scientific name	Presence/absence
<i>Adenanthera pavonina</i>	✓
<i>Antigonon leptopus</i>	—
<i>Castilla elastica</i>	—
<i>Casuarina equisetifolia</i>	—
<i>Cinnamomum verum</i>	✓
<i>Clerodendrum chinense</i>	✓
<i>Clidemia hirta</i>	✓
<i>Coccinia grandis</i>	—
<i>Costus speciosus</i>	—
<i>Dieffenbachia maculata</i>	—
<i>Falcataria moluccana</i>	—
<i>Funtumia elastica</i>	—
<i>Imperata cylindrica</i>	—
<i>Kalanchoe pinnata</i>	—
<i>Lantana camara</i>	—
<i>Leucaena leucocephala</i>	—
<i>Ligustrum</i> spp.	—
<i>Lonicera japonica</i>	—
<i>Merremia peltata</i>	✓
<i>Miconia calvescens</i>	—
<i>Mikania micrantha</i>	✓
<i>Mimosa invisa</i>	—
<i>Piper auritum</i>	—
<i>Psidium cattleianum</i>	—
<i>Spathodea campanulata</i>	—
<i>Syngonium podophyllum</i>	—

✓ = species was found during FIA inventory; — = species was not found during FIA inventory.

Note: 26 species were searched for; 6 species were found on plot.

shrub that has been a serious problem in Hawaii, where biocontrol was implemented about 35 years ago. *Mikania micrantha* (mile-a-minute weed, fue saina) is a vine that has become well established as a major pest of disturbed areas in American Samoa. The presence of these species raises concern that invasive species could establish and outcompete native vegetation, creating a homogenous ecosystem less resistant and resilient to both natural and anthropogenic changes. Currently, *Mikania micrantha* is the most prevalent invasive species in American Samoa, and comprises 4.7 percent of total vegetation cover in forested areas (fig. 19).

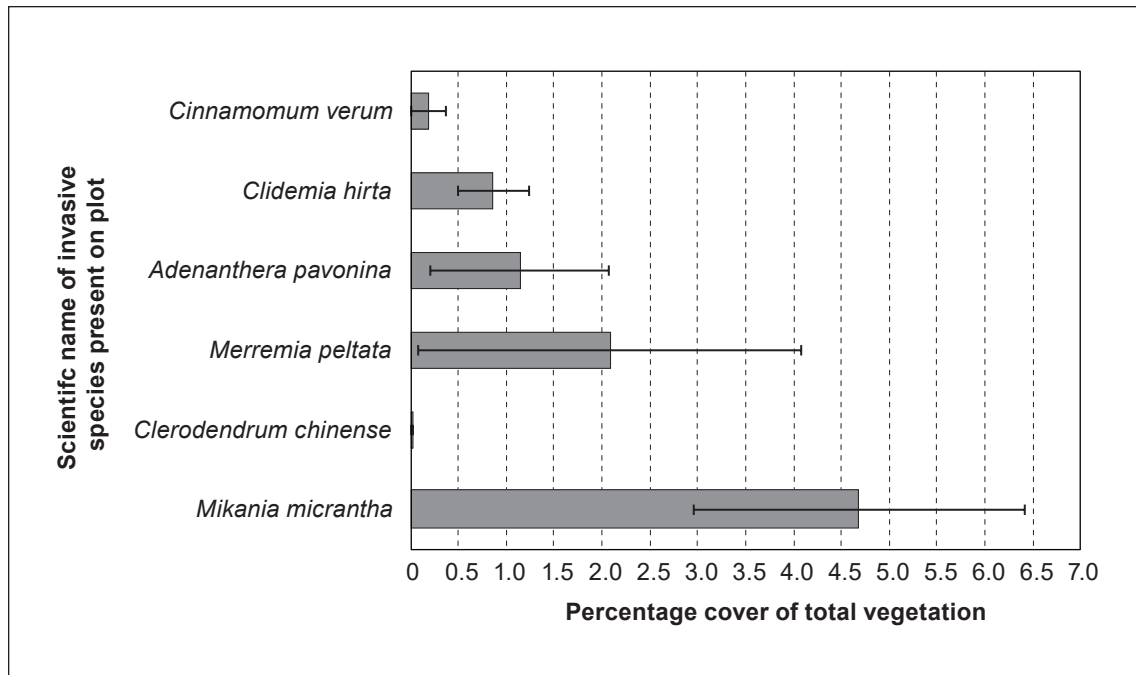


Figure 19—Total percentage of cover of invasive species present in the vegetation in forested lands in American Samoa.

Conclusions

This report presents an updated overview of American Samoa's forest resources, highlighting information that is new as well as confirming previously known information. We expect that some readers are eager to see more indepth research and analysis on selected topics to fully understand the current state and changes taking place in American Samoa forests. Additional tables summarizing the data can be found in appendix 2, and all the data are available for download in nonsummarized form at <http://www.fia.fs.fed.us>. Note that the results published in this report cannot be directly compared to those of the previous report (Donnegan et al. 2004) to assess changes in forest resources over the past decade owing to a change in sampling protocols between measurement periods. Use of the same sampling protocols and plot design will allow for assessments of change that occurred during the 10 years between visits in the future. Long-term forest monitoring in FIA plots is expected to provide information on the impacts of disturbances such as invasive species to tree growth and survival. Armed with these data, we can begin quantifying trends in American Samoa's forest, from assessing change in growth and survival of understory seedlings, to large, landscape-level changes facing forests from challenges like a growing population and a changing climate.

Scientific and common names of plants found during inventory

Life form	Scientific name	Samoan name	Common name
Trees:	<i>Adenanthera pavonina</i> L.	lopa	red beadtrees, coral bean tree, false wiliwili, red sandalwood
	<i>Aglaia samoensis</i> A. Gray	laga'ali	garland tree
	<i>Alphitonia zizyphoides</i> A. Gray	toi	toi
	<i>Artocarpus altilis</i> (Parkinson) Fosberg	ulu	breadfruit
	<i>Astronidium pickeringii</i> (A. Gray) Christoph.	matoi	
	<i>Barringtonia samoensis</i> A. Gray	falaga	
	<i>Bischofia javanica</i> Blume	o'a	Javanese bishopweed, bishopwood
	<i>Buchanania merrillii</i> Christoph.	gasu	gasu
	<i>Calophyllum neo-ebudicum</i> Guillaumin	tamanu	
	<i>Cananga odorata</i> (Lam.) Hook. f. & Thomson	moso'oi	
	<i>Canarium mafoa</i> Christoph.	mafoa	
	<i>Canarium vitiense</i> A. Gray	ma'ali	
	<i>Carica papaya</i> L.	esi	papaya
	<i>Cinnamomum verum</i> J. Presl	tinamoni	cinnamon
	<i>Cocos nucifera</i> L.	niu	coconut palm
	<i>Cordyline fruticosa</i> (L.) A. Chev	ti	ti plant
	<i>Cyathea lunulata</i> (G. Forst.) Copel.	saitamu	
	<i>Cyathea</i> spp.	olioli	tree fern
	<i>Diospyros samoensis</i> A. Gray	'au'auli	
	<i>Dysoxylum maota</i> Reinecke	maota	
	<i>Elaeocarpus floridanus</i> Hemsl.	'a'mati'e	
	<i>Elaeocarpus ulianus</i> Christoph.		Elaeocarpus
	<i>Fagraea berteriana</i> A. Gray ex Benth.	pualulu	
	<i>Ficus insipida</i> subsp. <i>scabra</i> C.C. Berg	mati vao	
	<i>Ficus tinctoria</i> G. Forst	mati	
	<i>Ficus uniauriculata</i> Warb.	mati	
	<i>Flacourtia rukam</i> Zoll. & Moritzi	filimoto	
	<i>Garcinia myrtifolia</i> A.C. Sm.		Garcinia
	<i>Garuga floribunda</i> Decne.	manuai vivao, magau'i, or vi vao	
	<i>Glochidion ramiflorum</i> J.R. Forst. & G. Forst.	masame vao	
	<i>Hernandia moerenhoutiana</i> Guill.	pipi	
	<i>Hernandia nymphaeifolia</i> (Presl) Kubitzki	pu'a	lantern tree
	<i>Hibiscus tiliaceus</i> L.	fau	sea hibiscus, beach hibiscus
	<i>Inocarpus fagifer</i> (Parkinson) F.R. Fosberg	ifi	
	<i>Intsia bijuga</i> (Colebr.) Kuntze	ifilele	
	<i>Kleinhovia hospita</i> L.	fu'afu'a	guest tree
	<i>Macaranga harveyana</i> (Müll.Arg.) Müll.Arg.	lau pata	
	<i>Mangifera indica</i> L.	mago	mango
	<i>Morinda citrifolia</i> L.	nonu	Indian mulberry

Scientific and common names of plants found during inventory (continued)

Life form	Scientific name	Samoan name	Common name
	<i>Musa ×paradisiaca</i> L. (pro sp.) [acuminata × balbisiana]		French plantain
	<i>Musa</i> spp.	fa'i	
	<i>Myristica hypargyrea</i> A. Gray	atoneulu	
	<i>Myristica inutilis</i> W. Rich ex A. Gray	'atone	
	<i>Neonauclea forsteri</i> Merrill	afa	
	<i>Palaquium stehlinii</i> Christoph.	gasu	
	<i>Pandanus tectorius</i> Parkinson ex Zucc.	fasa	Tahitian screwpine
	<i>Planchonella garberi</i> Christoph.	ala'a	
	<i>Planchonella samoensis</i> H.J. Lam	mamalava	
	<i>Polyscias samoensis</i> (A. Gray) Harms	tagitagi	
	<i>Pometia pinnata</i> J.R. Forst. & G. Forst.	tava	
	<i>Psychotria insularum</i> (A. Gray)	matalafi	
	<i>Rhizophora mangle</i> L.	togo	American mangrove
	<i>Rhus taitensis</i> Guill.	tavai	
	<i>Spondias dulcis</i> Parkinson	vi	Jewish plum, ambarella
	<i>Sterculia fanaiho</i> Setchell	fana'io	
	<i>Syzygium dealatum</i> (Burkill) A. C. Sm.	asi vai	
	<i>Syzygium inophylloides</i> (A.Gray) Müll.Stuttg.	asi	
	<i>Syzygium samarangense</i> (Blume) Merr. & L.M.Perry	nonu vao	
	<i>Tarenna sambucina</i> (G. Forst.) Durand	manunu	
	<i>Terminalia richii</i> A. Gray	malili	
	<i>Theobroma cacao</i> L.	koko	cacao
Shrubs:	<i>Alyxia bracteolosa</i> W. Rich ex A. Gray		bracteolate alyxia
	<i>Colubrina asiatica</i> (L.) Brongn.		Asian nakedwood
	<i>Faradaya amicorum</i> (Seem.) Seem.		
	<i>Freycinetia freycinetias</i>		
	<i>Gynochthodes epiphytica</i> (Rech.) A.C. Sm. & S.P. Darwin		
	<i>Hoya</i> spp.		
	<i>Hoya australis</i> R.Br. ex Traill		
	<i>Merremia peltata</i> (L.) Merr.		merremia
	<i>Oleandra neriiformis</i> Cav.		
	<i>Piper graeffei</i> Warb.		
	<i>Scaevola sericea</i> var. <i>taccada</i> (Gaertn.) Thieret & B. Lipscomb		beach naupaka
Forbs:	<i>Angiopteris evecta</i> (J.R. Forst.) Hoffm.		Oriental vessel fern
	<i>Asplenium nidus</i> L.		Hawai'i birdnest fern
	<i>Bidens pilosa</i> L.		hairy beggarticks
	<i>Christella harveyi</i> Holttum		
	<i>Clidemia hirta</i> (L.) D. Don		soapbush

Scientific and common names of plants found during inventory (continued)

Life form	Scientific name	Samoan name	Common name
	<i>Davallia solida</i> (J.R. Forst.) Sw.		luukbedoach (Palau)
	<i>Dioscorea bulbifera</i> L.		air yam
	<i>Dissotis rotundifolia</i> (Sm.) Triana		pinklady
	<i>Epipremnum pinnatum</i> (L.) Engl.		centipede tongavine
	<i>Heliconia paka</i> A.C. Sm.		
	<i>Lomagramma cordipinna</i> Holttum		
	<i>Mikania micrantha</i> Kunth		mile-a-minute
	<i>Nephrolepis hirsutula</i> (J.R. Forst.) C. Presl		scaly swordfern
	<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie		musk fern
	<i>Phymatosorus scolopendria</i> (Burm. f.) Pic. Serm.		monarch fern
	<i>Polygonum punctatum</i> Elliott		dotted smartweed
	<i>Ruellia prostrata</i> Poir.		prostrate wild petunia
	<i>Tectaria dissecta</i> (G. Forst.) Lellinger		cutleaf halberd fern
Graminoids:	<i>Oplismenus compositus</i> (L.) P. Beauv.		running mountaingrass
	<i>Paspalum conjugatum</i> P.J. Bergius		hilograss

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Metric Equivalents

When you know:	Multiply by:	To find:
Miles (mi)	1.609	Kilometers
Acres (ac)	0.405	Hectares
Tons	0.907	Metric tons (tonnes)

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Appendix 1: Inventory Design and Methods

Field Design and Sampling Method

The Forest Inventory and Analysis (FIA) program conducts a systematic, sample-based, field inventory across all ownerships on a periodic basis, remeasuring the same plots approximately every 10 years. All FIA units use a common plot design, common set of measurement protocols, and a standard database design for compilation and distribution of data. Adaptations were made to the national design for the American Samoa inventory in order to include additional branching and rooting forms and additional tree crown measurements, as well as special interest species ranging from invasive plants to pathogens to culturally or economically important plants of various life forms.

With active assistance from American Samoa Community College, Community and Natural Resources, Forestry Division, plots were spaced uniformly at 1.9-mi intervals using a hexagonal grid, at a threefold intensification of the spacing used in the mainland United States inventory plot grid. Forest inventory plots included four 24-ft fixed-radius subplots, where a variety of information is collected at the plot, subplot, and tree levels (USDA FS 2012). 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, and epiphytic loadings.

All plots classified by aerial photography as possibly being forested are established in the field without regard to land use or land cover. Field crews delineate areas within the plot that are comparatively less heterogeneous than the plot as a whole with regard to reserved status, owner group, forest type, stand size class, and tree density; these areas are described as condition classes. The process of delineating these condition classes on a fixed-radius plot is called mapping. All measured trees are assigned to the mapped condition class in which they are located.

On plots, crews assess physical characteristics such as slope, aspect, and elevation; stand characteristics such as age, size class, forest type, disturbance, site productivity, and regeneration status; and tree characteristics such as tree species, diameter, height, damages, decay, and vertical crown dimensions. They also collect general descriptive information such as proximity to water and roads, and the geographic position of the plot in the larger landscape.

The Pacific Northwest Research Station FIA (PNW-FIA) program sampled 21 forested plots in American Samoa on the standard national plot grid. Estimates of tree volume and other forest attributes were derived from tree measurements and

classifications made at each plot. A number of other variables are unique to PNW-FIA. These are “regional” variables and include such items as insect and disease damage, a record of previous disturbance on the plot. The Pacific Islands standardized plot installed at each forested location is a cluster of four subplots spaced 120 feet apart (fig. A1-1). Subplot 1 is in the center, with subplots 2 through 4 distributed radially around it. Each point serves as the center of a 1/24-ac circular subplot used to sample all trees at least 5.0 inches in diameter at breast height (d.b.h.). A 1/300-ac microplot, with its center located just east of each subplot center, is used to sample trees 1.0 to 4.9 inches d.b.h., as well as seedlings (trees less than 1.0 inch d.b.h.).

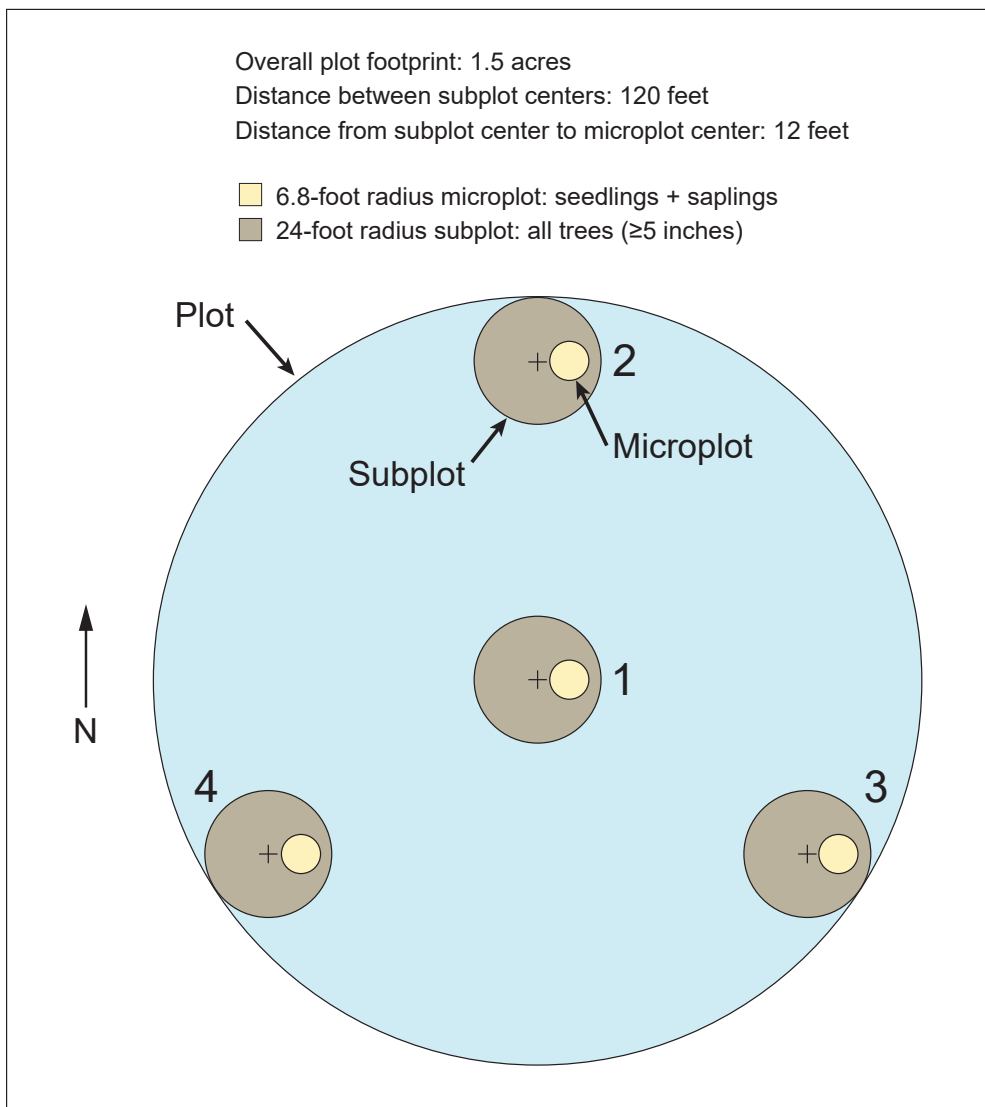


Figure A1-1—The Forest Inventory and Analysis plot design used in American Samoa.

Data Processing

The data used for this report are stored in the FIA National Information Management System (NIMS). The NIMS provides a means to input, edit, process, manage, and distribute FIA data. It includes a process for data loading, a national set of edit checks to ensure data consistency, an error-correction process, approved equations and algorithms, code to compile and calculate attributes, a table report generator, and routines to populate the presentation database. It applies numerous algorithms and equations to calculate, for example, stand size, volume, and biomass. The NIMS also generates estimates and associated statistics based on county areas and stratum weights developed outside of the NIMS. Additional FIA statistical design and estimation techniques are further reviewed in Bechtold and Patterson (2005).

Statistical Estimates

Throughout this report, we have published standard errors (SE) for most of our estimates. These SEs account for the fact that we measured only a small sample of the forest (thereby producing a sample-based estimate) and not the entire forest (which is the population parameter of interest). Because of small sample sizes or high variability within the population, some estimates can be very imprecise. The reader is encouraged to take the SE into account when drawing any inferences. One way to consider this type of uncertainty is to construct confidence intervals. Customarily, 66- or 95-percent confidence intervals are used. A 95-percent confidence interval means that one can be 95-percent confident that the interval contains the true population parameter of interest. For more details about confidence intervals, please consult Moore and McCabe (1989) or other statistical literature.

Access Denied, Hazardous, or Inaccessible Plots

Although every effort was made to visit all field plots that were entirely or partially forested, some were not sampled for a variety of reasons. Field crews may have been unable to obtain permission from the landowner to access the plot, and there were some plots that were impossible for crews to safely reach or access. Some private landowners deny access to their land, but privately owned plots usually are not as hazardous or inaccessible as plots on public lands. Although permission to visit public lands is almost always granted, some public land lies in higher elevation areas that can be very dangerous or impossible to reach.

This kind of missing data can introduce bias into the estimates if the nonsampled plots tend to be different from the entire population. Plots that are obviously non-forested (based on aerial photos) are rarely visited, and therefore the proportion of denied-access, hazardous, or inaccessible plots is significantly smaller than it is for forested plots. The post-stratification approach outlined in Bechtold and Patterson (2005) removes nonsampled plots from the sample. Estimates are adjusted for plots that are partially nonsampled by increasing the estimates by the nonsampled proportion within each stratum.

Appendix 2: Summary Data Tables

The following tables contain basic information about the forest resources of American Samoa as they relate to the discussion of current forest issues and basic forest resource information presented in this report. Data are also available for download in nonsummarized form at <http://www.fia.fs.fed.us>.

Number of Live Trees

Table A2-1—Number of live trees on forest land, by diameter class

Table A2-2—Percentage of live trees on forest land, by species

Table A2-3—Number of live trees on forest land, by species, and diameter class

Tree Volume

Table A2-4—Estimated net volume of live trees on forest land, by species and diameter class

Table A2-5—Estimated volume of all live trees on forest land by diameter class

Biomass and Carbon

Table A2-6—Aboveground biomass and carbon of live and dead trees on forest land

Table A2-7—Aboveground biomass of live trees on forest land, by species and diameter class

Understory Vegetation

Table A2-8—Average understory vegetation cover and number of FIA plots where the species occurred

Table A2-1—Number of live trees^a on forest land, by diameter class

Diameter class (inches)	Number of trees	
	Total	SE
<i>Thousand trees</i>		
1.0–2.9	15,773	3,126
3.0–4.9	6,247	1,143
5.0–6.9	2,633	437
7.0–8.9	1,204	217
9.0–10.9	865	173
11.0–12.9	602	145
13.0–14.9	313	88
15.0–16.9	201	56
17.0–18.9	88	38
19.0–20.9	88	38
21.0–22.9	138	54
23.0–24.9	38	21
25.0–26.9	13	13
27.0–28.9	25	17
29.0+	50	30

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = sampling error.

^a Includes all live trees ≥ 1 inches in diameter at breast height.

Table A2-2—Percentage of live trees^a on forest land by species

Scientific name	Samoan common name	Percentage of all trees	Scientific name	Samoan common name	Percentage of all trees
<i>Hibiscus tiliaceus</i>	fau	16.79	<i>Artocarpus altilis</i>	ulu	0.74
<i>Myristica inutilis</i>	'atone	14.71	<i>Cyathea lunulata</i>	saitamu	0.74
<i>Dysoxylum maota</i>	maota	6.09	<i>Polyscias samoensis</i>	tagitagi	0.74
<i>Pandanus tectorius</i>	fasa	5.05	<i>Sterculia fanaiho</i>	fana'io	0.74
<i>Cocos nucifera</i>	niu	4.46	<i>Adenanthura pavonina</i>	lopa	0.59
<i>Musa</i> spp.	meia	4.16	<i>Aglaia samoensis</i>	laga'ali	0.59
<i>Cananga odorata</i>	moso'oi	2.53	<i>Myristica hypargyrea</i>	atoneulu	0.59
<i>Macaranga harveyana</i>	lau pata	2.53	<i>Diospyros samoensis</i>	'au'auli	0.45
<i>Barringtonia samoensis</i>	falaga	2.38	<i>Terminalia richii</i>	malili	0.45
<i>Rhus taitensis</i>	tavai	2.38	<i>Carica papaya</i>	esi	0.3
<i>Neonauclea forsteri</i>	afa	2.08	<i>Fagraea berteriana</i>	pualulu	0.3
<i>Buchanania merrillii</i>	gasu	1.93	<i>Ficus tinctoria</i>	mati	0.3
<i>Inocarpus fagifer</i>	ifi	1.93	<i>Ficus uniauriculata</i>	mati	0.3
<i>Morinda citrifolia</i>	nonu	1.93	<i>Glochidion ramiflorum</i>	masame vao	0.3
<i>Rhizophora mangle</i>	togo	1.93	<i>Intsia bijuga</i>	ifilele	0.3
<i>Cordyline fruticosa</i>	ti	1.78	<i>Mangifera indica</i>	mago	0.3
<i>Ficus scabra</i>	mati vao	1.78	<i>Musa paradisiaca</i>		0.3
<i>Bischofia javanica</i>	o'a	1.34	<i>Psychotria insularum</i>	matalafi	0.3
<i>Palaquium stehlinii</i>	gasu	1.34	<i>Tarennia sambucina</i>	manunu	0.3
<i>Alphitonia zizyphoides</i>	toi	1.19	<i>Astronidium pickeringii</i>	matoi	0.15
<i>Cyathea</i> spp.	olioli	1.19	<i>Calophyllum neo-ebudicum</i>	tamanu	0.15
<i>Elaeocarpus ulianus</i>		1.19	<i>Cinnamomum verum</i>	tinamoni	0.15
<i>Theobroma cacao</i>	koko	1.19	<i>Elaeocarpus floridanus</i>	'a'mati'e	0.15
<i>Canarium vitiense</i>	ma'ali	1.04	<i>Flacourtia rukam</i>	filimoto	0.15
<i>Kleinhovia hospita</i>	fu'afu'a	1.04	<i>Garcinia myrtifolia</i>		0.15
<i>Planchonella samoensis</i>	mamalava	1.04	<i>Garuga floribunda</i>	manuai vivao, magau'i or vi vao	0.15
Tree unknown		1.04	<i>Hernandia moerenhoutiana</i>	pipi	0.15
<i>Canarium mafoa</i>	mafoa	0.89	<i>Pometia pinnata</i>	tava	0.15
<i>Hernandia nymphaeifolia</i>	pu'a,	0.89	<i>Spondias dulcis</i>	vi	0.15
<i>Planchonella garberi</i>	ala'a	0.89	<i>Syzygium dealatum</i>	asi vai	0.15
<i>Syzygium inophylloides</i>	asi	0.89	<i>Syzygium samarangense</i>	nonu vao	0.15

^a Includes all live trees ≥ 1 inch in diameter at breast height.

Table A2-3—Number of live trees^a on forest land, by species and diameter class

Scientific name	Diameter class (inches)									
	5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
----- Thousand trees -----										
<i>Adenanthera pavonina</i>	25.1	25.1	25.1	25.1	—	—	—	—	50.1	50.1
<i>Aglaia samoensis</i>	25.1	25.1	—	—	—	—	—	—	25.1	25.1
<i>Alphitonia zizyphoides</i>	50.1	29.6	25.1	17.3	25.1	17.3	—	—	100.3	39.1
<i>Artocarpus altilis</i>	50.1	23.4	—	—	—	—	—	—	50.1	23.4
<i>Astronidium pickeringii</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Barringtonia samoensis</i>	50.1	23.4	37.6	37.6	12.5	12.5	—	—	100.3	64.5
<i>Bischofia javanica</i>	62.7	36.1	25.1	17.3	12.5	12.5	—	—	100.3	53.3
<i>Buchanania merrillii</i>	75.2	75.2	12.5	12.5	12.5	12.5	—	—	100.3	100.3
<i>Calophyllum neo-ebudicum</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Cananga odorata</i>	100.3	46.8	62.7	44.3	25.1	25.1	—	—	188.1	74.3
<i>Canarium mafoa</i>	25.1	25.1	12.5	12.5	—	—	—	—	37.6	37.6
<i>Canarium vitiense</i>	—	—	—	—	12.5	12.5	50.1	34.7	62.7	44.3
<i>Carica papaya</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Cocos nucifera</i>	62.7	36.1	313.4	166.5	—	—	—	—	376.1	173.0
<i>Cyathea lunulata</i>	25.1	25.1	—	—	—	—	—	—	25.1	25.1
<i>Cyathea</i> spp.	62.7	62.7	—	—	—	—	—	—	62.7	62.7
<i>Diospyros samoensis</i>	12.5	12.5	25.1	25.1	—	—	—	—	37.6	27.5
<i>Dysoxylum maota</i>	213.1	93.2	112.8	43.7	37.6	27.5	75.2	45.3	438.8	128.0
<i>Elaeocarpus floridanus</i>	—	—	12.5	12.5	—	—	—	—	12.5	12.5
<i>Elaeocarpus ulianus</i>	12.5	12.5	75.2	55.1	—	—	—	—	87.8	66.5
<i>Fagraea berteriana</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Ficus scabra</i>	37.6	27.5	—	—	—	—	12.5	12.5	50.1	39.1
<i>Ficus tinctoria</i>	12.5	12.5	12.5	12.5	—	—	—	—	25.1	25.1
<i>Ficus uniauriculata</i>	25.1	25.1	—	—	—	—	—	—	25.1	25.1
<i>Flacourtia rukam</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Garuga floribunda</i>	—	—	—	—	—	—	12.5	12.5	12.5	12.5
<i>Hernandia moerenhoutiana</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Hernandia nymphaeifolia</i>	25.1	25.1	12.5	12.5	12.5	12.5	12.5	12.5	62.7	62.7
<i>Hibiscus tiliaceus</i>	965.3	299.2	175.5	76.7	—	—	—	—	1,140.8	360.4
<i>Inocarpus fagifer</i>	87.8	75.7	37.6	37.6	12.5	12.5	25.1	17.3	163.0	137.9
<i>Intsia bijuga</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Kleinhovia hospita</i>	37.6	27.5	12.5	12.5	—	—	—	—	50.1	39.1
<i>Macaranga harveyana</i>	125.4	78.8	25.1	17.3	—	—	—	—	150.4	86.9
<i>Mangifera indica</i>	—	—	—	—	—	—	12.5	12.5	12.5	12.5
<i>Morinda citrifolia</i>	37.6	20.7	—	—	—	—	—	—	37.6	20.7
<i>Musa</i> spp.	313.4	220.7	—	—	—	—	—	—	313.4	220.7

Table A2-3—Number of live trees^a on forest land, by species and diameter class (continued)

Scientific name	Diameter class (inches)									
	5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
	----- Thousand trees -----									
<i>Myristica hypargyraea</i>	50.1	50.1	—	—	—	—	—	—	50.1	50.1
<i>Myristica inutilis</i>	777.3	240.2	62.7	44.3	—	—	—	—	840.0	271.0
<i>Neonauclea forsteri</i>	62.7	31.3	37.6	20.7	25.1	25.1	50.1	39.1	175.5	88.6
<i>Palaquium stehlinii</i>	62.7	62.7	50.1	50.1	—	—	—	—	112.8	112.8
<i>Pandanus tectorius</i>	426.2	388.0	—	—	—	—	—	—	426.2	388.0
<i>Planchonella garberi</i>	25.1	17.3	50.1	39.1	—	—	—	—	75.2	55.1
<i>Planchonella samoensis</i>	37.6	27.5	37.6	27.5	12.5	12.5	—	—	87.8	55.8
<i>Rhizophora mangle</i>	62.7	62.7	—	—	37.6	37.6	—	—	100.3	100.3
<i>Rhus taitensis</i>	25.1	17.3	37.6	20.7	62.7	31.3	37.6	27.5	163.0	67.7
<i>Spondias dulcis</i>	—	—	—	—	—	—	12.5	12.5	12.5	12.5
<i>Sterculia fanaiho</i>	37.6	27.5	—	—	—	—	—	—	37.6	27.5
<i>Syzygium dealatum</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Syzygium inophylloides</i>	25.1	17.3	25.1	25.1	25.1	17.3	—	—	75.2	45.3
<i>Syzygium samarangense</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Tarenna sambucina</i>	12.5	12.5	—	—	—	—	—	—	12.5	12.5
<i>Terminalia richii</i>	12.5	12.5	—	—	12.5	12.5	—	—	25.1	17.3
Tree unknown	50.1	50.1	—	—	—	—	—	—	50.1	50.1

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = sampling error.

^a Includes all live trees ≥5 inches in diameter at breast height.

Table A2-4—Estimated net volume of live trees^a on forest land, by species group and diameter class

Scientific name	Diameter class (inches)							
	5.0–9.9		10.0–14.9		15.0–19.9		20.0+	
	Total	SE	Total	SE	Total	SE	Total	SE
----- Cubic feet -----								
<i>Adenanthera pavonina</i>	86,626	86,626	221,687	221,687	—	—	308,314	308,314
<i>Aglaita samoensis</i>	24,068	24,068	—	—	—	—	24,068	24,068
<i>Alphitonia zizyphoides</i>	380,671	224,763	492,470	384,290	672,020	484,804	1,545,161	638,069
<i>Artocarpus altalis</i>	168,994	98,882	—	—	—	—	168,994	98,882
<i>Astronidium pickeringii</i>	27,953	27,953	—	—	—	—	27,953	27,953
<i>Barringtonia samoensis</i>	109,983	64,958	630,078	630,078	723,593	723,593	1,463,653	1,351,754
<i>Bischofia javanica</i>	119,521	76,646	326,656	237,718	328,092	328,092	774,269	456,854
<i>Buchanania merrillii</i>	300,321	300,321	192,920	192,920	581,732	581,732	1,074,974	1,074,974
<i>Calophyllum neo-ebudicum</i>	17,132	17,132	—	—	—	—	17,132	17,132
<i>Cananga odorata</i>	317,429	132,751	1,165,112	808,169	915,704	915,704	2,398,245	1,233,271
<i>Canarium mafoa</i>	43,533	43,533	190,179	190,179	—	—	233,712	233,712
<i>Canarium vitiense</i>	—	—	—	—	358,759	358,759	6,671,299	4,846,505
<i>Carica papaya</i>	20,284	20,284	—	—	—	—	20,284	20,284
<i>Cocos nucifera</i>	478,302	287,308	4,733,884	2,775,981	—	—	5,212,186	2,791,459
<i>Cyathea lunulata</i>	40,070	40,070	—	—	—	—	40,070	40,070
<i>Cyathea</i> spp.	102,066	102,066	—	—	—	—	102,066	102,066
<i>Diospyros samoensis</i>	10,864	10,864	419,990	419,990	—	—	430,854	419,658
<i>Dysoxylum maota</i>	779,699	468,428	1,310,377	535,145	975,983	772,597	9,868,821	4,843,429
<i>Elaeocarpus floridanus</i>	—	—	170,744	170,744	—	—	170,744	170,744
<i>Elaeocarpus ulianus</i>	208,557	208,557	1,802,138	1,443,961	—	—	2,010,695	1,645,519
<i>Fagraea berteriana</i>	89,374	89,374	—	—	—	—	89,374	89,374
<i>Ficus scabra</i>	109,468	94,423	—	—	—	—	212,992	197,262
<i>Ficus tinctoria</i>	30,612	30,612	175,574	175,574	—	—	206,187	206,187
<i>Ficus uniauriculata</i>	38,754	38,754	—	—	—	—	38,754	38,754
<i>Flacourtia rukam</i>	28,484	28,484	—	—	—	—	28,484	28,484
<i>Garuga floribunda</i>	—	—	—	—	—	—	583,965	583,965
<i>Hernandia moerenhoutiana</i>	128,967	128,967	—	—	—	—	128,967	128,967

Table A2-4—Estimated net volume of live trees^a on forest land, by species group and diameter class (continued)

Scientific name	Diameter class (inches)									
	5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
	-----Cubic feet-----									
<i>Hernandia nymphaeifolia</i>	176,277	176,277	86,565	86,565	248,527	248,527	239,266	239,266	750,635	750,635
<i>Hibiscus tiliaceus</i>	3,242,136	1,060,931	1,469,171	691,118	—	—	—	—	4,711,307	1,603,316
<i>Inocarpus fagifer</i>	289,158	256,919	296,092	296,092	177,577	177,577	739,041	547,238	1,501,869	1,067,173
<i>Intsia bijuga</i>	44,178	44,178	—	—	—	—	—	—	44,178	44,178
<i>Kleinhovia hospita</i>	296,308	207,643	137,441	137,441	—	—	—	—	433,748	307,083
<i>Macaranga harveyana</i>	489,494	322,306	195,533	146,705	—	—	—	—	685,027	419,127
<i>Mangifera indica</i>	—	—	—	—	—	—	144,017	144,017	144,017	144,017
<i>Morinda citrifolia</i>	65,786	39,320	—	—	—	—	—	—	65,786	39,320
<i>Musa</i> spp.	722,931	486,119	—	—	—	—	—	—	722,931	486,119
<i>Myristica hypargyrea</i>	171,145	171,145	—	—	—	—	—	—	171,145	171,145
<i>Myristica inutilis</i>	3,162,416	1,106,705	1,010,003	704,444	—	—	—	—	4,172,419	1,707,094
<i>Neonauclea forsteri</i>	310,787	202,046	249,851	137,986	521,789	521,789	1,009,502	763,023	2,091,929	1,332,175
<i>Palaquium stehlinii</i>	389,444	389,444	738,914	738,914	—	—	—	—	1,128,359	1,128,359
<i>Pandanus tectorius</i>	733,557	653,460	—	—	—	—	—	—	733,557	653,460
<i>Planchonella garberi</i>	39,189	27,101	517,319	358,109	—	—	—	—	556,507	385,186
<i>Planchonella samoensis</i>	520,155	503,210	807,026	649,149	726,814	726,814	—	—	2,053,995	1,418,384
<i>Rhizophora mangle</i>	125,859	125,859	—	—	283,979	283,979	—	—	409,838	409,838
<i>Rhus taitensis</i>	20,219	18,952	556,594	345,591	1,862,559	1,050,940	1,715,783	1,326,560	4,155,155	1,961,877
<i>Spondias dulcis</i>	—	—	—	—	—	—	437,675	437,675	437,675	437,675
<i>Sterculia fanaiho</i>	45,193	34,120	—	—	—	—	—	—	45,193	34,120
<i>Syzygium dealatum</i>	13,749	13,749	—	—	—	—	—	—	13,749	13,749
<i>Syzygium inophylloides</i>	380,531	309,481	382,982	382,982	1,178,631	816,881	—	—	1,942,144	1,108,979

Table A2-4—Estimated net volume of live trees^a on forest land, by species group and diameter class (continued)

Scientific name	Diameter class (inches)								All classes	
	5.0–9.9		10.0–14.9		15.0–19.9		20.0+		Total	SE
	Total	SE	Total	SE	Total	SE	Total	SE		
	-----Cubic feet-----									
<i>Syzygium samarangense</i>	38,922	38,922	—	—	—	—	—	—	38,922	38,922
<i>Tarennia sambucina</i>	57,282	57,282	—	—	—	—	—	—	57,282	57,282
<i>Terminalia richii</i>	27,581	27,581	—	—	782,951	782,951	—	—	810,532	782,237
Total hardwoods	604,160	333,692	4,733,884	2,775,981	283,979	283,979	144,017	144,017	5,766,040	2,954,352
Total other	14,419,865	2,572,804	13,545,418	3,169,145	10,054,730	2,412,109	17,944,060	6,874,380	55,964,073	11,523,572
Tree unknown	98,452	98,452	—	—	—	—	—	—	98,452	98,452
All species	15,122,477	2,697,053	18,279,302	4,128,979	10,338,709	2,407,886	18,088,076	6,859,528	61,828,565	11,546,330

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = standard error.

^a Includes all live trees ≥ 5 inches in diameter at breast height.

Table A2-5—Estimated volume of all live trees^a on forest land by diameter class

	Diameter class (inches)									
	<5		5.0–10.9		11.0–19.9		20.0+		All sizes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
----- <i>Thousand cubic feet</i> -----										
Gross volume	11,088	1,599	23,198	3,928	27,073	5,561	18,972	7,225	80,331	13,291
Net volume	—	—	18,539	3,213	25,201	5,242	18,088	6,860	61,829	11,546
Sound volume	—	—	19,054	3,369	25,643	5,285	18,347	7,011	63,044	11,686

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = standard error.

^a Includes all live trees ≥ 1 inches in diameter at breast height.

Table A2-6—Aboveground biomass and carbon of live^a and dead trees^b on forest land, by diameter class

	Diameter class (inches)											
	<5		5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
----- <i>Thousands of tons</i> -----												
Live tree biomass	228	37	448	77	581	120	304	66	789	305	2,349	425
Dead tree biomass	—	—	24	7	26	14	7	7	16	16	73	26
Live tree carbon	114	19	224	38	290	60	152	33	394	152	1,175	212
Dead tree carbon	—	—	12	4	13	7	3	3	8	8	36	13

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = standard error.

^a Includes all live trees ≥ 1 inch in diameter at breast height.

^b Includes all dead trees ≥ 5 inches in diameter at breast height; smaller dead trees were not measured in this inventory.

Table A2-7—Aboveground biomass of live trees^a on forest land, by species and diameter class

Scientific name	Diameter class (inches)											
	1.0–5.0		5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
	-----Tons-----											
<i>Adenanthera pavonina</i>	—	—	4,220	4,220	9,909	9,909	—	—	—	—	14,129	14,129
<i>Aglaiia samoensis</i>	1,183	1,183	1,970	1,970	—	—	—	—	—	—	3,154	2,254
<i>Alphitonia zizyphoides</i>	—	—	7,343	4,256	10,142	7,014	16,063	11,453	—	—	33,548	13,681
<i>Artocarpus altilis</i>	10,189	10,189	6,605	3,431	—	—	—	—	—	—	16,795	12,105
<i>Astronidium pickeringii</i>	—	—	734	734	—	—	—	—	—	—	734	734
<i>Barringtonia samoensis</i>	2,895	2,752	3,314	1,647	18,156	18,156	11,661	11,661	—	—	36,025	33,277
<i>Bischofia javanica</i>	530	530	9,430	6,516	13,579	9,407	12,939	12,939	—	—	36,478	21,694
<i>Buchanania merrillii</i>	3,820	3,820	10,929	9,378	5,829	5,829	9,609	9,609	16,232	16,232	46,419	44,756
<i>Calophyllum neo-ebudicum</i>	—	—	1,035	1,035	—	—	—	—	—	—	1,035	1,035
<i>Cananga odorata</i>	1,681	1,681	13,665	5,935	34,725	24,109	24,023	24,023	—	—	74,094	35,094
<i>Canarium mafa</i>	4,757	4,757	1,520	1,520	4,307	4,307	—	—	—	—	10,585	10,585
<i>Canarium ovatum</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Canarium vitiense</i>	763	763	—	—	—	—	17,684	17,684	175,564	125,606	194,011	135,000
<i>Carica papaya</i>	1,920	1,920	461	461	—	—	—	—	—	—	2,381	2,381
<i>Cassia fistula</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cinnamomum verum</i>	578	578	—	—	—	—	—	—	—	—	578	578
<i>Cocos nucifera</i>	—	—	13,912	8,632	134,516	73,918	—	—	—	—	148,428	74,456
<i>Cordyline fruticosa</i>	2,208	1,922	—	—	—	—	—	—	—	—	2,208	1,922
<i>Cyathea lunulata</i>	2,129	1,473	1,013	1,013	—	—	—	—	—	—	3,142	1,735
<i>Cyathea</i> spp.	3,864	3,864	3,913	2,728	—	—	—	—	—	—	7,776	6,227
<i>Diospyros samoensis</i>	—	—	597	597	16,720	16,720	—	—	—	—	17,317	16,705
<i>Dysoxylum maota</i>	5,404	3,654	35,509	16,723	61,584	24,959	38,767	30,583	318,188	242,842	459,453	247,511
<i>Dysoxylum samoense</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Elaeocarpus floridanus</i>	—	—	—	—	4,745	4,745	—	—	—	—	4,745	4,745
<i>Elaeocarpus ulianus</i>	—	—	3,217	3,217	38,829	24,497	—	—	—	—	42,047	27,390

Table A2-7—Aboveground biomass of live trees^a on forest land, by species and diameter class (continued)

Scientific name	Diameter class (inches)									
	1.0–5.0		5.0–9.9		10.0–14.9		15.0–19.9		20.0+	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
-----Tons-----										
<i>Fagraea berteriana</i>	—	—	4,468	3,411	—	—	—	—	—	—
<i>Ficus obliqua</i>	—	—	—	—	—	—	—	—	—	—
<i>Ficus scabra</i>	6,291	4,624	2,894	2,482	—	—	—	—	10,241	10,241
<i>Ficus tinctoria</i>	—	—	625	625	3,470	3,470	—	—	—	—
<i>Ficus uniauriculata</i>	—	—	803	803	—	—	—	—	—	—
<i>Flacourtia rukam</i>	—	—	1,021	1,021	—	—	—	—	—	—
<i>Garcinia myrtifolia</i>	8,546	8,546	—	—	—	—	—	—	—	—
<i>Garuga floribunda</i>	—	—	—	—	—	—	—	—	15,879	15,879
<i>Glochidion ramiflorum</i>	1,128	910	—	—	—	—	—	—	—	—
<i>Hernandia moerenhoutiana</i>	—	—	1,370	1,370	—	—	—	—	—	—
<i>Hernandia nymphaeifolia</i>	—	—	3,043	3,043	6,990	6,990	7,664	7,664	11,465	11,465
<i>Hibiscus tiliaceus</i>	38,219	16,001	120,213	40,818	78,089	36,473	—	—	—	—
<i>Inocarpus fagifer</i>	—	—	9,676	7,378	7,356	7,356	7,548	7,548	31,726	22,023
<i>Intsia bijuga</i>	3,663	3,663	1,978	1,978	—	—	—	—	—	—
<i>Kleinhovia hospita</i>	9,932	9,932	9,249	6,446	6,027	6,027	—	—	—	—
<i>Macaranga grayana</i>	—	—	—	—	—	—	—	—	—	—
<i>Macaranga harveyana</i>	1,650	1,650	13,399	7,571	4,912	3,455	—	—	—	—
<i>Mangifera indica</i>	—	—	1,150	1,150	—	—	—	—	11,195	11,195
<i>Morinda citrifolia</i>	7,541	5,394	3,006	1,770	—	—	—	—	—	—
<i>Musa paradisiaca</i>	4,725	4,725	—	—	—	—	—	—	—	—
<i>Musa</i> spp.	4,111	4,111	17,243	11,291	—	—	—	—	—	—
<i>Myristica hypargyrea</i>	—	—	3,732	3,732	—	—	—	—	—	—
<i>Myristica inutulis</i>	53,709	19,586	87,081	28,828	31,035	18,770	—	—	—	—
									171,826	57,875

Table A2-7—Aboveground biomass of live trees^a on forest land, by species and diameter class (continued)

Scientific name	Diameter class (inches)											
	1.0–5.0		5.0–9.9		10.0–14.9		15.0–19.9		20.0+		All classes	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
-----Tons-----												
<i>Neisosperma oppositifolia</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Neonauclea forsteri</i>	—	—	10,093	5,287	15,198	9,227	27,052	27,052	143,075	115,791	195,418	144,491
<i>Palaquium stehlinii</i>	—	—	8,480	8,480	14,804	14,804	—	—	—	—	23,284	23,284
<i>Pandanus tectorius</i>	—	—	14,821	13,492	—	—	—	—	—	—	14,821	13,492
<i>Pipturus argenteus</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Planchonella garberi</i>	—	—	1,943	1,382	29,619	23,327	—	—	—	—	31,562	24,369
<i>Planchonella samoensis</i>	—	—	9,756	9,086	27,411	19,650	19,116	19,116	—	—	56,283	38,483
<i>Polyscias samoensis</i>	6,427	4,513	—	—	—	—	—	—	—	—	6,427	4,513
<i>Pometia pinnata</i>	184	184	—	—	—	—	—	—	—	—	184	184
<i>Psychotria insularum</i>	340	340	—	—	—	—	—	—	—	—	340	340
<i>Rhizophora mangle</i>	15,729	15,729	3,849	3,849	—	—	24,483	24,483	—	—	44,062	44,062
<i>Rhus taitensis</i>	1,873	1,738	3,316	2,568	16,351	10,605	47,514	24,542	47,771	35,339	116,825	54,237
<i>Spondias dulcis</i>	—	—	—	—	—	—	—	—	23,529	23,529	23,529	23,529
<i>Sterculia fanaiho</i>	5,803	5,803	2,336	1,794	—	—	—	—	—	—	8,139	5,976
<i>Syzygium dealatum</i>	—	—	1,508	1,508	—	—	—	—	—	—	1,508	1,508
<i>Syzygium inophylloides</i>	—	—	8,784	6,435	12,923	12,923	30,316	20,978	—	—	52,023	29,183
<i>Syzygium samarangense</i>	—	—	977	977	—	—	—	—	—	—	977	977
<i>Syzygium samoense</i>	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tarennia sambucina</i>	4,973	4,973	1,340	1,340	—	—	—	—	—	—	6,313	5,094
<i>Terminalia richii</i>	5,304	5,304	998	998	—	—	16,452	16,452	—	—	22,753	17,039
<i>Theobroma cacao</i>	5,432	5,432	—	—	—	—	—	—	—	—	5,432	5,432
Tree unknown	506	506	2,666	2,666	—	—	—	—	—	—	3,172	2,692
All species	228,007	37,169	471,206	78,370	607,226	122,131	310,892	68,180	804,866	303,261	2,422,196	431,765

Note: Totals may be off because of rounding; estimates are subject to sampling error; SE = standard error.

^a Includes all live trees ≥1 inch in diameter at breast height.

Table A2-8—Average understory vegetation cover and number of Forest Inventory and Analysis plots where the species occurred

Scientific name	Common name	Average cover	Number of plots
		Percent	
<i>Rhizophora mangle</i>	American mangrove	15.7	1
<i>Astronidium pickeringii</i>		11.2	1
<i>Cyathea</i> spp.	tree fern	11.2	1
<i>Cyrtandra pulchella</i>	cyrtandra	11.2	1
<i>Procris pedunculata</i>	fua lolo	11.2	1
<i>Weinmannia affinis</i>		11.2	1
<i>Cananga odorata</i>	ilang-ilang, moso'oi	10.5	1
<i>Neonauclea forsteri</i>	afa	10.5	1
<i>Terminalia richii</i>	malili	10.5	1
Tree unknown	other or unknown live tree	10.2	2
<i>Carica papaya</i>	papaya	9.1	1
<i>Allophylus timorensis</i>	ebeludes, chebeludes	9	1
<i>Baccaurea taitensis</i>	saitamu	9	1
<i>Canarium mafoa</i>	mafoa	9	1
<i>Crossostylis biflora</i>	saitamu	9	1
<i>Dysoxylum huntii</i>	maota mea	9	1
<i>Elaeocarpus ulianus</i>	elaecarpus a'amatie	9	3
<i>Ficus obliqua</i>	aoa	9	1
<i>Ficus tinctoria</i>	mati	9	1
<i>Intsia bijuga</i>	ifilele	9	1
<i>Meryta macrophylla</i>	fagufagu	9	1
<i>Palaquium stehlinii</i>	gasu	9	1
<i>Securinega flexuosa</i>	poumuli	9	1
<i>Syzygium dealatum</i>	asi vai	9	1
<i>Syzygium samarangense</i>	nonu vao	9	1
<i>Musa paradisiaca</i>	fa'i French plantain	8.4	1
<i>Tarenna sambucina</i>	manunu	8.4	1
<i>Bischofia javanica</i>	Javanese bishopwood, koka	8.1	2
<i>Cocos nucifera</i>	coconut palm	8	4
<i>Cyathea lunulata</i>	olioli	7.9	4
<i>Elatostachys falcata</i>	taputoi	7.9	2
<i>Syzygium inophylloides</i>	asi	7.8	7
<i>Glochidion cuspidatum</i>	masame	7.4	2
<i>Myristica inutilis</i>		7.4	11
<i>Calophyllum inophyllum</i>	Alexandrian laurel, fetau	7.3	2
<i>Canarium vitiense</i>	maali	7.3	3
<i>Ficus godeffroyi</i>	mati	7.3	2

Table A2-8—Average understory vegetation cover and number of Forest Inventory and Analysis plots where the species occurred (continued)

Scientific name	Common name	Average cover	Number of plots
		Percent	
<i>Ficus uniauriculata</i>	mati	7.3	2
<i>Polyscias samoensis</i>	tagitagi	7.2	5
<i>Ficus scabra</i>	mati vao	7	9
<i>Psychotria insularum</i>	matalafi	7	8
<i>Barringtonia samoensis</i>	falaga	6.8	4
<i>Diospyros samoensis</i>	auauli	6.8	9
<i>Inocarpus fagifer</i>	ifi	6.8	4
<i>Samanea saman</i>	raintree	6.7	1
<i>Theobroma cacao</i>	cacao	6.7	1
<i>Cordyline fruticosa</i>	ti plant	6.6	11
<i>Aglaia samoensis</i>	laga ali	6.5	3
<i>Artocarpus altilis</i>	breadfruit, ulu	6.5	1
<i>Arytera brackenridgei</i>	taputoi	6.5	1
<i>Dysoxylum maota</i>	maota	6.5	10
<i>Elaeocarpus floridanus</i>	`a`mati`e	6.5	1
<i>Elaeocarpus grandis</i>	sapatua	6.5	1
<i>Macaranga harveyana</i>	lau pata	6.5	1
<i>Morinda citrifolia</i>	Indian mulberry, noni	6.5	8
<i>Musa</i> spp.	fa`i	6.5	1
<i>Pandanus tectorius</i>	Tahitian screwpine	6.5	1
<i>Syzygium samoense</i>	fena vao	6.5	1
<i>Barringtonia asiatica</i>	sea putat	6.4	1
<i>Dysoxylum samoense</i>	mamala	6.4	1
<i>Hernandia moerenhoutiana</i>	pipi	6.4	2
<i>Flacourtia rukam</i>	filimoto	6.2	3
<i>Planchonella samoensis</i>	mamalava	6.2	3
<i>Calophyllum neo-ebudicum</i>	tamanu	6	2
<i>Pometia pinnata</i>	tava	5.6	1
<i>Sterculia fanaiho</i>	fanaio	5.5	2
<i>Garuga floribunda</i>	manuai vivao	5.1	1
<i>Homalanthus nutans</i>	fanuamamala	5.1	1
<i>Cinnamomum verum</i>	cinnamon	4.9	1
<i>Dendrocide</i> spp.		4.9	1
<i>Manihot</i> spp.	manihot, cassava	4.9	1
<i>Cerbera manghas</i>	leva	4.8	3
<i>Buchanania merrillii</i>	gasu	4.3	1

Glossary

abiotic—Pertaining to nonliving factors such as temperature, moisture, and wind.

aerial photography—Imagery acquired from an aerial platform (typically aircraft or helicopter) by means of a specialized large-format camera with well-defined optical characteristics. The geometry of the aircraft orientation at the time of image acquisition is also recorded. The resultant photograph will be of known scale, positional accuracy, and precision. Aerial photography for natural resource use is usually either natural color or color-infrared, and is film-based or acquired using digital electronic sensors.

aspect—Compass direction that a slope faces.

biodiversity—Variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. <http://www.epa.gov/OCEPAt/terms/bterms.html>. (5 January 2015).

biomass—The aboveground weight of wood and bark in live trees 1.0 inch diameter at breast height (d.b.h.) and larger from the ground to the tip of the tree, excluding all foliage. The weight of wood and bark in lateral limbs, secondary limbs, and twigs under 0.5 inch in diameter at the point of occurrence on sapling-size trees is included in but is excluded on poletimber and sawtimber-sized trees. Biomass is typically expressed as green or oven-dry weight and the units are tons.

bole—Trunk or main stem of a tree.

damage—Damage to trees caused by biotic agents such as insects, diseases, and animals or abiotic agents such as weather, fire, or mechanical equipment.

diameter at breast height (d.b.h.)—The diameter of a tree stem, located at 4.5 feet above the ground (breast height) on the uphill side of a tree. The point of diameter measurement may vary on abnormally formed trees (USDA FS 2006).

disturbance—Any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment (Helms 1998).

ecosystem—A spatially explicit, relatively homogeneous unit of the Earth that includes all interacting organisms and components of the abiotic environment within its boundaries. An ecosystem can be of any size: a log, a pond, a field, a forest, or the Earth's biosphere (Helms 1998).

elevation—Height above a fixed reference point, often the mean sea level.

erosion—The wearing away of the land surface by running water, wind, ice, or other geological agents.

fixed-radius plot—A circular sampled area with a specified radius in which all trees of a given size, shrubs, and other items are tallied (USDA FS 2006).

forb—A broad-leaved herbaceous plant, as distinguished from grasses, shrubs, and trees (USDA FS 2006).

forest land—Land that is at least 10 percent stocked by forest trees of any size, or land formerly having such tree cover, and not currently developed for a nonforest use. (USDA FS 2006).

forest type—A classification of forest land based on and named for the tree species that forms the plurality of live-tree stocking (USDA FS 2006).

forest type group—A combination of forest types that share closely associated species or site requirements (USDA FS 2006).

graminoid—Grasses (family Gramineae or Poaceae) and grasslike plants such as sedges (family Cyperaceae) and rushes (family Juncaceae).

grassland—Land on which the vegetation is dominated by grasses, grasslike plants, or forbs.

invasive plant—A plant that is not native to the ecosystem under consideration and that causes or is likely to cause economic or environmental harm or harm to human, animal, or plant health. <http://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf>. (5 January 2015).

live trees—All living trees, including all size classes, all tree classes, and both commercial and noncommercial species listed in the FIA field manual (USDA FS 2006).

mortality—The death of trees from natural causes, or subsequent to incidents such as storms, wildfire, or insect and disease epidemics (Helms 1998).

native species—Plant species that were native to an American region prior to Euro-American settlement. For vascular plants, they are the species that are not present on the USDA Natural Resources Conservation Service (NRCS) (2000) list of nonnative species (see **nonnative species**) (USDA NRCS 2000).

nonforest land—Land that has never supported forests or formerly was forested and currently is developed for nonforest uses. Included are lands used for agricultural crops, residential areas, and constructed roads. The area must be at least 1.0 ac and 120.0 ft wide.

nonnative species—Plant species that were introduced to America subsequent to Euro-American settlement. Nonnative vascular plants are present on the USDA Natural Resources Conservation Service list of nonnative species (USDA NRCS 2000).

nontimber forest products (NTFP)—Species harvested from forests for reasons other than production of timber commodities.

ownership—A legal entity having an ownership interest in land, regardless of the number of people involved. An ownership may be an individual; a combination of persons; a legal entity such as corporation, partnership, club, or trust; or a public agency. An ownership has control of a parcel or group of parcels of land (USDA FS 2006).

pathogen—An organism or virus directly capable of causing disease.

regeneration—The established progeny from a parent plant, seedlings or saplings existing in a stand, or the act of renewing tree cover by establishing young trees naturally or artificially. May be artificial (direct seeding or planting) or natural (natural seeding, coppice, or root suckers) (adapted from Helms 1998).

remote sensing—Capture of information about the Earth from a distant vantage point. The term is often associated with satellite imagery but also applies to aerial photography, airborne digital sensors, ground-based detectors, and other devices.

reserved forest land—Land permanently reserved from wood products utilization through statute or administrative designation. Examples include national forest wilderness areas and national parks and monuments (USDA FS 2006).

sampling error—Difference between a population value and a sample estimate that is attributable to the sample, as distinct from errors due to bias in estimation, errors in observation, etc. Sampling error is measured as the standard error of the sample estimate (Helms 1998).

sapling—A live tree 1.0 to 4.9 inches in diameter (USDA FS 2006).

seedlings—Live trees <1.0 in diameter at breast height and at least 6 inches in height (softwoods) or 12 in in height (hardwoods) (USDA FS 2006).

shrub—Perennial, multistemmed woody plant, usually less than 13 to 16 ft in height, although under certain environmental conditions shrubs may be single-stemmed or taller than 16 ft. Includes succulents (e.g., cacti) (USDA FS 2006).

slope—Measure of change in surface value over distance, expressed in degrees or as a percentage (Helms 1998).

snag—Standing dead tree ≥ 5 in diameter at breast height and ≥ 4.5 ft in length, with a lean of < 45 degrees. Dead trees leaning more than 45 degrees are considered to be down woody material (DWM). Standing dead material shorter than 4.5 feet are considered stumps (USDA FS 2006).

species group—A collection of species used for reporting purposes (USDA FS 2006).

stand size class—A classification of stands based on tree size. Large diameter stands have the majority of trees at least 11.0 inches diameter at breast height (d.b.h.) for hardwoods and 9.0 inches d.b.h. for softwoods; medium diameter stands have the majority of trees at least 5.0 inches d.b.h. but not as large as large diameter trees; and small diameter stands have the majority of trees less than 5.0 inches d.b.h.

stratification—A statistical tool used to reduce the variance of the attributes of interest by partitioning the population into homogenous strata (Bechtold and Patterson 2005).

succession—The gradual supplanting of one community of plants by another (Helms 1998).

terrestrial—Of or relating to the Earth or its inhabitants; of or relating to land as distinct from air or water. <http://www.merriam-webster.com/dictionary/terrestrial>. (5 January 2015).

transect—A narrow sample strip or a measured line laid out through vegetation chosen for study (Helms 1998).

tree—A woody perennial plant, typically large, with a single well-defined stem carrying a more or less definite crown; sometimes defined as attaining a minimum diameter of 3 inches and a minimum height of 15 ft at maturity. For FIA, any plant on the tree list in the current field manual is measured as a tree (USDA FS 2006).

understory—All forest vegetation growing under an overstory (Helms 1998).

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