Pacific Island Network
Vital Signs Monitoring Plan:
Phase III Report

Appendix A: National Park of American Samoa Resource Overview

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Pacific Island Network (PACN)

Territory of Guam
War in the Pacific National Historical Park (WAPA)

Commonwealth of the Northern Mariana Islands
American Memorial Park, Saipan (AMME)

Territory of American Samoa
National Park of American Samoa (NPSA)

State of Hawaii
USS Arizona Memorial, Oahu (USAR)
Kalaupapa National Historical Park, Molokai (KALA)
Haleakala National Park, Maui (HALE)
Ala Kahakai National Historic Trail, Hawaii (ALKA)
Puukohola Heiau National Historic Site, Hawaii (PUHE)
Kaloko-Honokohau National Historical Park, Hawaii (KAHO)
Puuhonua o Honaunau National Historical Park, Hawaii (PUHO)
Hawaii Volcanoes National Park, Hawaii (HAVO)

http://science.nature.nps.gov/im/units/pacn/monitoring/plan/

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EXECUTIVE SUMMARY AND INTRODUCTION

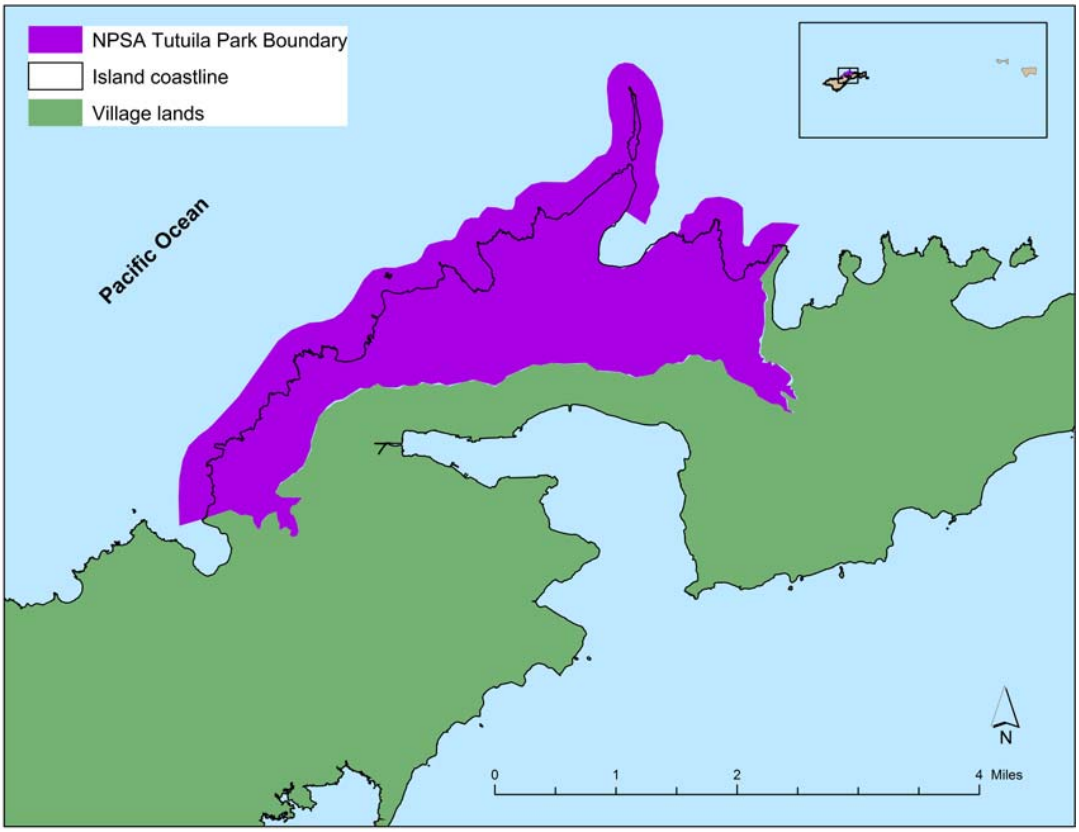
Enabling Legislation

The National Park of American Samoa was established in 1988 by PL 100-571 with park units on the islands of Tutuila, Ofu and Tau in the Territory of American Samoa. The park's purpose is to "preserve and protect the tropical forest and archeological and cultural resources of American Samoa, and of associated reefs, to maintain the habitat of flying foxes, preserve the ecological balance of the Samoan tropical forest, and, consistent with the preservation of these resources, to provide for the enjoyment of the unique resources of the Samoan tropical forest by visitors from around the world." Because the Park could not purchase land outright due to the traditional communal land system, it was not until 1993 that the park became legally established with a 50-year lease agreement. This agreement, involving lands within eight villages, enabled National Park Service (NPS) to begin managing lands and waters within the leased premises for National Park purposes. The park consists of 7,970 acres of land and 2,550 marine acres (NPSA's boundary extends 0.25 miles offshore where water depths are about 100 ft). In 2002, Congress approved a 30% expansion on Olosega and Ofu islands.

To find enabling legislation documents on-line follow the “Policy & Legislation” link from the Pacific Island Network website:
www1.nrintra.nps.gov/im/units/pacn/parks/mgmt_docs.htm).

Geographic Setting

American Samoa (ranging from 11-14S, 168-171W) lies south of the equator in the central South Pacific Ocean. The main volcanic islands form a chain created as the ocean floor (Pacific Plate) glides over a stationary "hotspot" beneath the earth's crust. Secondary volcanism occurred as recently as 90 and 120 years ago in the archipelago. The islands are small and steep, ranging in size from the populated island of Tutuila (52 sq miles) to the smaller and sparsely populated islands in the Manua group (Ofu, Olosega, Tau; see map below). A maritime climate of tropical heat and rain prevails year-round. Cyclones hit periodically, the last six occurring in 1981, 1987, 1990, 1991, 2004, and 2005. The territory's population in 2004 is about 62,000 and growing rapidly (2.1% per year), with 96% of the population living on the southern side of Tutuila Island. Principal sources of revenue are federal grants and two of the world's largest tuna canneries (which process tuna mostly caught elsewhere in the Pacific). Together, the government and canneries employ two-thirds of the work force, over half of which was born outside of American Samoa, mostly from neighboring (western) Samoa. There are not many nearby islands except for Samoa which is approximately 112 km (73 miles) to the west of American Samoa and is 15 times larger in land mass.


NPSA Tutuila Park Boundary
Island coastline
Village lands
Pacific Ocean
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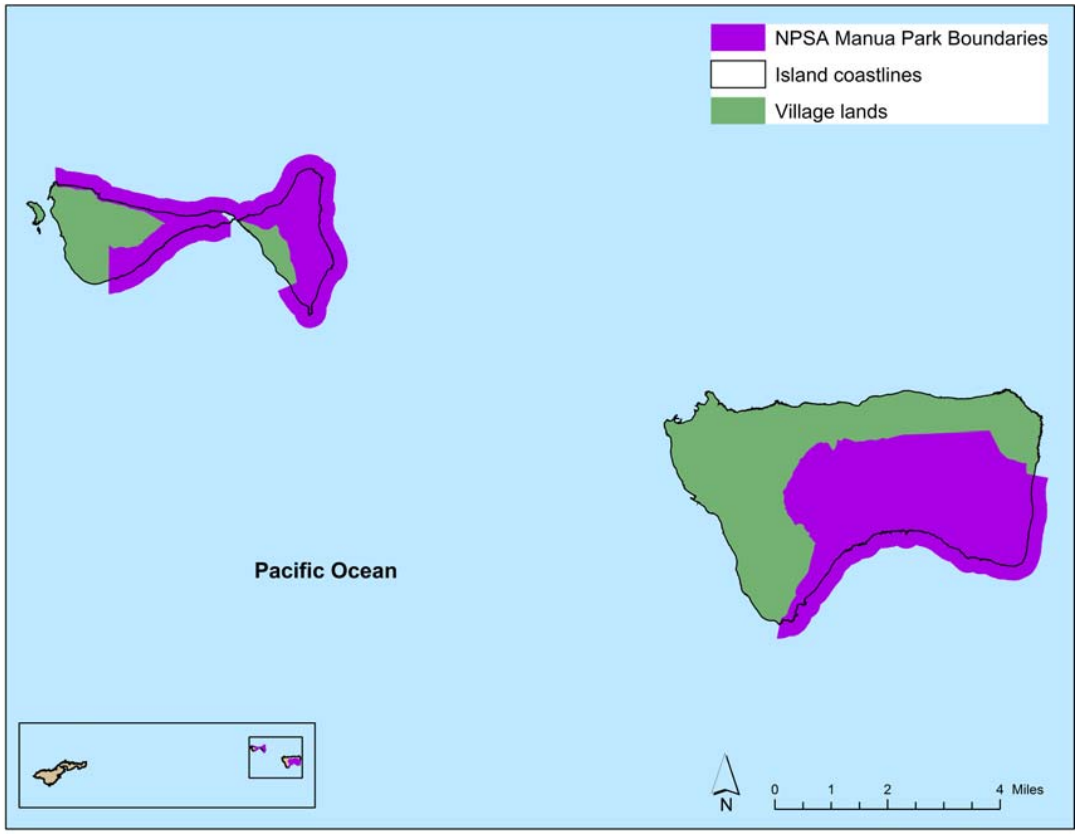
NPSA Manua Park Boundaries
Island coastlines
Village lands
Pacific Ocean
N
0
1
2
4 Miles

Significant Natural and Cultural Resources

NPSA's paleotropical rainforests and Indo-Pacific coral reefs are unique to the NPS system, along with War in the Pacific National Historical Park (WAPA) located in Guam. The diversity of terrestrial species is low due to the isolation of the Samoan islands. Approximately 30% of the plant and one bird species are endemic to the archipelago. The only native mammal species are the large pteropid fruit bats (flying foxes) that play an important role in forest pollination. Other important biota resources are birds, reptiles, and stream ecosystems. The marine system, in contrast, is highly diverse with about 890 fish and 200 coral species, as well as rare and endangered sea turtles and humpback whales. Over a hundred nearshore species are harvested for food (fish, giant clams, octopus, palolo, and other invertebrates).

The Samoan culture (Fa asamoa) is of major significance. The environment intertwines with the Fa asamoa; many Samoan proverbs, names, chief titles originated from the Samoan names for plants, birds, fish, air, and clouds. The archeological and historical context of NPSA is composed of fale (house) foundations, masi pits (fermented breadfruit/banana), circular depressions, star mounds, grinding stones, adze quarries, oral history including myths/legends, traditional medicines, and the Samoan culture itself.

Resource Management Priorities

A major terrestrial priority is the control and/or eradication of invasive species, particularly alien plants (over 200 species) and feral pigs, but also introduced snails, slugs, and rats. It is essential to deal with this problem while it is still feasible, rather than wait for invasion to escalate as it has done in Hawaii.

Protection and preservation of the park's tropical forests is of great importance since tropical forests are declining worldwide. Success depends greatly on working with local villages on resource-related matters such as agriculture practices within the park. Problems include illegal expansion or creation of plantations, impacts on rare species (e.g., sheath-tailed bat, Pacific boa, spotless crake) and the use of detrimental agricultural practices (e.g. farming practices that facilitate erosion).

In the marine environment, a major issue is addressing impacts of climate change on coral reefs. The park is experiencing an increased incidence of coral bleaching and disease that is associated with rising water temperatures. Identification of temperature-tolerant corals (such as those in Ofu lagoon), and research on why such corals are temperature-tolerant is needed. Other major marine issues include overfishing, crown-of-thorns starfish damage to corals, and the demise of sea turtle populations in the region. A high priority for both terrestrial and marine programs is to develop a vital signs monitoring program to track changes over time.

NATURAL RESOURCES

Focal Ecosystems and Processes

- Mixed Paleotropical Rainforest
- Forest Pollinators (flying foxes and land birds)
- Seabirds (20 species)
- Focal Invertebrates (coconut crabs and land snails)
- Indo-Pacific Coral Reef Ecosystem
- Relatively Pristine Waters
- Coral Reef Fishes
- Threatened, Endangered Species and Rare Species

Vegetation: A distinctive feature of NPSA is that it incorporates the only mixed species paleotropical rainforest in the National Park Service system. NPSA's flora encompasses 487 native flowering plants and ferns and over 100 endemic plant species. (Whistler 2003). Notable forest resources include a nearly undisturbed cloud forest in the Tau unit and the largest remnant of intact lowland ridge forest in the Samoan Archipelago in the Tutuila unit.

Terrestrial Invertebrates: The territory contains 47 native land snail species. One of the species found within the park boundaries on Tutuila is extremely rare *Samoana abbreviata* (Cowie and Cook 1999). There are coconut crabs living in the territory; however not much is known about them and they are usually harvested when seen. The insect fauna is not well known.

Terrestrial Vertebrates: Important wildlife species include nectarivorous and frugivorous bird and bat species which fulfill an essential role in the ecosystem as forest pollinators and assist in maintaining the structure and diversity of the rainforest. There are 25 native species of land birds and two species of fruit bats (*Pteropus samoensis, P. tonganus*). There are 20 species of seabirds nesting in American Samoa. The Tahiti Petrels, estimated to be in the thousands, live on the Tau Island unit of the National Park.

Marine Communities: Marine resources are highly diversified with corals (200 species) and fish (890 species). The reefs are primarily fringing in nature with narrow reef flats and drop quickly into very deep water (thousands of meters). Most fore-reef areas have well developed spur and groove formations. At Tau Island, large coral bommies (*Porites* sp.) are among the largest living coral colonies in the world. The Aua transect in Pago Pago Harbor is the longest (at 83 years) monitored of any in the world (Abraham et al. 2004). Endangered humpback whales (M*egaptera novaeangliae*), locally known as (tafola) have been sighted in the park. Spinner dolphins (*Stenella longirostris*) transit through the park and may be day resting. A pod of dolphins (species currently unidentified) day rests just outside of the park. Little is known about other marine mammals in the territory.

Water Quality: The overall marine waters are generally of good quality due to tidal flushing; however some beach areas have been subject to intermittent closures due to contaminated stream runoffs.

Threatened, Endangered and Rare Species:

The rare sheath-tailed bat (*Emballonura semicaudata*) was virtually eliminated by Cyclone Val in 1991 (Grant et at. 1994) and is listed as species of concern on the Federal Threatened and Endangered Species.

Humpback whales *(Megaptera novaeangliae*) migrate northward from the waters of Antarctica, located 3,200 miles south from here to mate and to birth their young. They are currently listed as an endangered species because of world-wide population declines.

Two endangered species of sea turtle, the threatened green (*Chelonia mydas*) and the endangered hawksbill (*Eretmochelys imbricata*), are found in the territorial waters of American Samoa. Both species are described as critically endangered by the US Recovery Team.

Eight snail species (*Eua zebrina, Diastole matafaoi, D. schmeltziana, Ostodes strigatus, Samoana abbreviata, S. conica, S. thurstoni,* and *Trochomorpha apia*) are listed as candidates or species of concern on the Federal Threatened and Endangered Species (Cowie 2001).

The spotless crake (*Porzana tabuensis*), is a rare forest bird not seen on Tau since 1986. It was recently found on Mt. Lata (O'Connor and Rauzon 2004) and is listed as species of concern on the Federal Threatened and Endangered Species.

The many-colored fruit dove (*Ptilinopus perousii*), is one of the rarest birds in Tutuila and can be occasionally sighted at different areas on the island. (Trail and Seamon 2002). It is listed as a species of concern.

There is only one species of snake in the territory, the rare Pacific boa (*Candoia bibroni*), which is found on Tau Island (Amerson et al. 1982*a*).

<u>Threats & Stressors</u>

- The Spread of Invasive Species (terrestrial)
- Global Climate Change (causing coral bleaching and changes in species distribution and abundances)
- Cyclone Damage
- Overfishing
- Rapid Population Growth
- Expansion of Agricultural Plantations
- Sea Level Rise

Invasive Species: Invasive species pose the largest threat to the persistence of native species and biodiversity throughout the South Pacific. There are several invasive species in the territory: toads, giant African snails, rosy wolf snails, mile-a-minute vine, lopa trees, tamalini palagi trees, myna birds, feral pigs, and rats. NPSA's emphasis on managing terrestrial invasive plants and animals is a high priority. The focus will initially be on reducing the feral pig population, monitoring rat abundance, and removing tamalini palagi.

Global Climate Change: Tracking of sea surface temperature and climate changes (causing coral bleaching) is very important to management of NPSA coral reefs. Warmer temperatures are already causing coral bleaching and mortality, with associated increases in coral diseases.

Cyclone Damage: An area of concern for NPSA is cyclone destruction causing environmental changes. Though cyclones are a natural feature and can have an impact on species populations (e.g. sheath-tailed bat), over time most species will likely recover, unless there are other factors contributing to the decline such as overhunting.

Overfishing: The decrease in the fish size and numbers due to overfishing is a serious problem in NPSA and throughout the territory. Overfishing is a primary stressor to coral reefs throughout the territory, including NPSA. Few large fish (greater than 40 cm) remain on coral reefs. In NPSA, fishing is primarily for subsistence, and the catch is modest. However, a recent study suggested that as much as nine percent of the local commercial (artisanal) catch of reef fishes were illegally taken from park waters. American Samoa has fishing regulations that ban such activities as scuba fishing and destructive fishing techniques, but enforcement is not strong. A recent study documents the subsistence fishery occurring in the Ofu and Olosega park units.

Rapid Population Growth: Human population growth is a serious problem (e.g., loss of habitat buffer or reservoirs, potential degradation of air quality, water quality).

Expansion of Agricultural Plantations: The illegal expansion or creation of new plantations in the NPSA's forests causes losses of primary forest habitats. Working with local villages on resource-related matters such as agriculture practices within the park and plantation management would be beneficial in preserving the park's tropical forests.

Sea Level Rise: The rise in sea level could result in shoreline erosion, saltwater intrusion into groundwater aquifers, flooding of wetlands, and is a potential threat to cultural resources in the park and territory.

Water Quality Designations

Similar to Hawaii, American Samoa designates areas based on usage, called "Special Management Areas," (SMA) although NPSA is not one of the designated areas, the SMA territory's open coastal waters include Pago Pago Harbor, Nuuuli Pala Lagoon and Leone wetlands. Marine waters in the territory are classified by their type (embayment, open

coastal, or ocean waters), for which a designated use is described. The American Samoa Environmental Protection Agency (ASEPA) water quality standards designate wetlands separately from surface waters which may be Class 1 or Class 2. Groundwaters are classified as 1G when potable and 2G if the natural salinity exceeds 10,000 mg/L. The ASEPA water quality standards are available at http://www.epa.gov/ost/standards/wqslibrary/territories/american_samoa_9_wqs.pdf.

CULTURAL ISSUES

- Oral history (myths and legends)
- Traditional medicines
- Samoan culture
- Archaeological sites (house foundations, masi pits, star mounds, grinding stones)

The main focus of the park is on its natural resources; however NPSA must exert care in preserving its limited cultural elements. NPSA continues to monitor the progress of the old Vatia trail work to ensure that archaeological artifacts and sites are not impacted. NPSA plans to install wayside exhibits on parts of the trail. This will be beneficial for visitors to understand the historical background behind each different feature, which includes fale (house) foundations, masi pits (fermented breadfruit/banana), circular depressions, star mounds, grinding stones, and adze quarries.

The Samoan culture could vanish if the current generation ceases communicating and sharing their experiences and traditions. NPSA acknowledges the importance of the Samoan culture and is documenting the history of the eight villages affiliated with the park. The data is being preserved by various methods (audio, digital, and hardcopy format) for future generations.

MANAGEMENT ISSUES

Park Management

NPSA's General Management Plan states, as mandated by Section 3(f) of Public Law 100-571, "shall contain specific measures for the protection and preservation of tropical forest resources, and archaeological and cultural resources of the park, including but not limited to, protection of flying foxes and measures to enhance visitation to the park from throughout the world, to the extent consistent with the protection and preservation of such resources." (National Park Service 1997). Park management documents (General Management Plan, etc.) are available on-line at the NPS intranet site (www1.nrintra.nps.gov/im/units/pacn/parks/mgmt_docs.htm). This website is available only from NPS computer networks. Inquiries about public access should be directed to the park.

The protection and preservation of tropical forest resources is being addressed by studies that are underway or have already been completed to accumulate baseline information and data on the park's botany, flying foxes, archeology, ethnography, coral reefs, etc.

Current major management issues include restoration of forest areas, changes in bird and bat populations, decline of seabird population, serious decline of the turtle population, the endangered and threatened land snails, overfishing, and coral bleaching and disease.

Restoration of Vegetation (Forest): Protection and preservation of the park's tropical forests is of great importance since tropical forests are declining worldwide. Contributing factors that influence the natural vegetation of the NPSA's forest are damage caused by invasive species, illegal expansion or new agriculture plantations within the park boundaries, and invasive weeds.

The success of restoring the forest depends greatly on working with local villages on resource-related matters such as agriculture practices within the park. Additionally, management and research on the effects of invasive species, in particular invasive trees, feral pigs, rats, and introduced snail and slug species is a priority. Data must be gathered on the incursion by new invasive species in areas adjacent to or external to the park.

The removal of weeds and restoration of forest areas that have not recovered due to past human activities (e.g., abandoned plantations with invasive weeds preventing establishment of a native forest canopy) is another important management issue that needs to be addressed**.**

Bird and Bat Populations: Monitoring of the forest to track trends over time in diversity, structure, and populations of bird and bat species will play an important role in ensuring forest health.

The worldwide population of seabirds is declining, thus it is essential to study the status and trends of nesting seabirds on Mt. Lata. Monitoring rare species such as the sheath-tailed bat and spotless crake to track any population changes is another important issue for NPSA.

Endangered and Threatened Land Snails: Trends of the endangered and threatened land snails should to be monitored as their predators – rats and especially predatory snails (*Euglandina rosea*) – could cause extinction of vulnerable species. If introduced to Samoa, the predatory flatworm (*Platydemus manokwari*) could have a potentially devastating effect on the have snail fauna.

Coral Bleaching and Disease: Coral reefs are an important habitat for reef fishes and marine fauna, consequently a major concern is decreasing the impacts of climate change on coral reefs. The park is experiencing increased incidences of coral bleaching and disease that is associated with rising water temperatures. Identification of temperature-tolerant corals (e.g. corals in Ofu lagoon) is needed along with research on factors contributing to the temperature-tolerance of corals. Another concern with coral reefs is crown-of-thorns starfish damage to corals.

Overfishing: Overfishing is another major management concern for American Samoa. The fish population has decreased as well as the size of fish as indicated in a survey

conducted by Green (2002). Nighttime scuba fishery on Tutuila from 1995 to 2001 was a contributing factor in reducing the fish population; however the Governor's decision to ban scuba fishery has help to lessen the impact of overfishing. Further management plans to prevent overfishing are essential.

Sea Turtles: Another major marine issue is the demise of sea turtle population in our region due to human harvests of turtles and eggs, habitat loss of nesting beaches and incidental catches in fishing gear. In 2003, a sanctuary for sea turtles and marine mammals was established in all territorial waters.

Other Issues: A high priority for both terrestrial and marine programs is to develop a vital signs monitoring program to track changes in time.

INVENTORIES

Existing Inventories in Park

Vegetation: In 1975-1976, Amerson et al. (1982b) conducted an extensive inventory in the territory which included 42 study plots in 16 vegetation communities and habitat types. A plant list of 489 species was recorded as well as vertebrate observations.

Several plant inventories were conducted in NPSA and the territory of American Samoa by Whistler (1992, 1994, 1995, and 2003). These inventories include (1) a botanical inventory with detailed description of vegetation, rainforest, and disturbed vegetation in the park, includes voucher specimens which are kept at NPSA, and (2) a permanent forest plot which was established in NPSA in 1993, where 414 trees (49 species) were tagged. Additionally, botanical and ethnobotanical inventories were conducted between 2001 and 2002 in the park areas of Ofu, Olosega and Tau by Ragone and Lorence (2003). Voucher specimens of native and naturalized species and some cultivated plants were collected and kept at the Kaui Hawaii National Tropical Botanical Garden herbarium and duplicates stored at NPSA. The results of these inventories provided native flora species lists.

Terrestrial Vertebrates: A territory inventory of vertebrate wildlife and habitat of American Samoa including park boundaries in Tau was conducted by Amerson et al. during 1975 and 1976 (Amerson et al. 1982*b*). Fauna and flora species list were complied and potentially threatened and endangered species were identified.

An island-wide (Tutuila, Ofu, Olosega, and Tau) inventory, including NPSA, of seabird populations was conducted in 2002 by O'Connor and Rauzon (2004). This inventory will be used as a baseline for future comparisons of seabird populations.

The three native terrestrial mammals in America Samoa are the Samoan fruit bat (*Pteropus samoensis*), white-naped fruit bat (*Pteropus tonganus*), and sheath-tailed bat (*Emballonura semicaudata*). The first quantitative inventory in the territory was done in 1986 (Wilson & Engbring 1992). Data collected consists of non-replicated 30-min

counts at 21 sites. The data is used to track population trends with other inventories conducted by the American Samoa Department of Marine and Wildlife (DMWR) which indicates an overall decline in population after Cyclone Val in 1991 (Craig et al. 1993), but with some recovery thereafter.

A territory inventory of forest birds was conducted in 1989 by Engbring (1989) and has been continued by DMWR thereafter. The inventory includes calculated densities of forest birds on each major island; incidental information on seabirds, waterbirds, introduced species, and migratory birds and identification of threatened or endangered species.

Terrestrial Invertebrates: An inventory on the distribution and abundance of lands snails and slugs in the park was conducted in 1998 by Cowie and Cook (1999). The particular focus was on the family Partulidae. Besides the previous identified 42 indigenous species, several species were recorded for the first time, including five new species.

Freshwater Invertebrates*:* An inventory of aquatic macroinvertebrates and fish has recently been conducted in Laufuti Stream, on Tau (Cook 2004).

Marine Communities: A territorial inventory, with various sites within the park, of marine plants was conducted by Skelton (2003). The surveys included 26 sites and a total of 635 specimens were analyzed and 239 different species recorded.

A resurvey of stony corals and reefs was conducted in 1991-1992 (Maragos et al. 1994). There were 40 sites on Tutuila and Aunuu islands and 11 sites on Ofu and Olseaga (includes sites within the park boundaries) inventoried with the purpose of obtaining updated information on the status of coral reefs since the 1978 Coastal Resource Inventory (Aecos and Aquatic Farms, 1980). Results of the resurvey in 1991-1992 indicate that the abundance and coverage of live coral on Tutuila have declined; however the abundance and coverage of corals off Ofu and Olosega appear to not have changed significantly. Coral reef and reef resources were surveyed in the (then proposed) Ofu unit of NPSA in 1992 (Hunter et al. 1993) and corals, macro-invertebrates, macro-algae, and reef fishes were inventoried. An inventory of the coral reef community in Tutuila park unit was conducted by Green and Hunter (1998). Results of the inventory include recordings of 192 fish species and 85 coral taxa. Additional coral reef community inventories include (1) a territorial fish inventory done by Wass (1984) that includes a list of 991 fish species representing 113 families. Pictures of the local fish in American Samoa are available on the NPSA website: www.nps.gov/npsa/, (2) a fish list detailing species and distribution complied by Green (2002), and (3) a coral species list was compiled by Fisk and Birkeland (2002).

Identifying and updating lists of coral species in the park is an ongoing project. An inventory of species is listed on the Coral Inventory section on NPSA website: www.nps.gov/npsa/. The list, although not completed, contains information on park status, abundance, residency, and origin.

Invasive Species: An inventory of marine invasives at various sites on Tutuila including NPSA was conducted in 2002 by the Bishop Museum (Coles et al. 2003). The purpose was to detect past and recent introductions of marine species, and make recommendations for management and control. The findings show that there are relatively few introduced species in the waters of Tutuila. These species are not yet in the park and have not yet multiplied to the point of being considered invasive.

A plant species inventory was conducted by Space and Flynn (2000). A list of commonly found and potentially aggressive invasive alien plant species were documented as a result of this one-week survey.

Sea-level Rise: A coastal vulnerability assessment regarding future sea level rise within the NPSA was conducted in 2004 by Pendleton et al. An open-file report (to be finalized later) provides information of where physical changes are most likely to occur should the sea level rise continue.

Buffer Zone Inventories

Vegetation: As stated above, an extensive inventory of the vegetation communities and habitat types was conducted by Amerson et al. (1982*a*).

Plant diseases were collected and identified in the territory of American Samoa between October 1998 and July 2000 (Brooks 2000). The lists include pathogen fungi, bacteria, nematodes, a mycoparasite, and one virus.

Terrestrial Vertebrates: Previously mentioned territory inventories include: (1) an island-wide inventory of seabird populations conducted by O'Connor and Rauzon (2004), (2) quantitative inventories of bat populations in the territory were done by Wilson & Engbring (1992), (3) a territory wide inventory of the forest was completed by Engbring (1989), and (4) an inventory of terrestrial vertebrate wildlife and wildlife habitat of American Samoa was conducted by Amerson et al. (1982*a*).

Terrestrial Invertebrates: A checklist and bibliography of Samoan insects and related arthropods was compiled in 1997 by Kami and Miller (1998). The geographic coverage includes all the Samoan Islands (American and Western) and Swains Islands. Additional literature includes the *Insects of Samoa* series (9 volumes, 1927-1935) published by the British Museum (Natural History). As the territory is small, many of the approximately 2,523 insects are likely to be found in the park boundaries.

Marine Communities: A territorial coral inventory done by Lamberts (1983) includes a list of 177 species.

Invasive Species: As mentioned, a territorial inventory of marine invasives occurred in 2002 by Coles et al. (2003).

Soil: A soil survey was conducted in the territory (Nakamura 1984). As a result of the survey, detailed soil map were produced, as well as descriptions of the soil in each area surveyed. There are no other inventories or monitoring programs for soils.

Erosion/Mass Wasting: An open file report was written about landslides on Tutuila in 1979 (Buchanan-Banks 1981). White and Stearns conducted a landslide hazard mitigation study for Tutuila (1990).

Priorities for New Inventories in Park

Terrestrial and Marine Communities: Inventories of marine and terrestrial invertebrates are needed in all park units. Existing inventories of marine fishes and coral will be updated as new studies are conducted.

Invasive Species: An inventory of invasive plants in all park units is a priority.

MONITORING

Existing Monitoring in Park

Vegetation: Starting September 2004, a permanent forest plot was established in Tau by Edward Webb. Plants will be identified, tagged, and measured for diameter. Plots will be resurveyed in two years for growth, mortality, and recruitment.

Terrestrial Vertebrates: DMWR has monitored forest birds since 1991 and bats since 1986 at various sites throughout the territory. Four monitoring sites are located within NPSA.

Marine Communities: A monitoring program to assess the health of the coral reef environment is currently being developed. Other territorial or federal agencies are conducting ongoing monitoring programs that have at least one monitoring site within the park's boundaries include a quantitative inventory of fish, corals, and selected macro-invertebrates (Green 2002, Fisk et al. 2002) and baseline monitoring sites of corals (Mundy 1996, Green 1996). Species lists were compiled as a result of these monitoring projects. Monitoring harvests of fish and invertebrates in the Ofu and Olosega units of NPSA was initiated in 2002 and is expected to continue at 5-year intervals.

The World Wildlife Fund surveyed coral reefs to access the impact of climate change, especially due to SST and UV radiation. Two of their seven sites are located in NPSA (Vatia and Tafeu Cove). Quarterly sampling started in October 2002.

NPSA currently has long-term temperature loggers on the reef in Vatia and Ofu. Water temperatures have been recorded hourly since January 1999.

DMWR monitors territory-wide harvests of commercial fish and invertebrates to assess trends in resources. Monitoring for pelagic and bottomfish began in 1982, but monitoring of other artisanal and subsistence fisheries has been sporadic. Though the

inventories are not conducted within park boundaries, it is an informative summary for the territory.

Water Quality: ASEPA has been monitoring water quality at streams located in the park boundaries since May 2003. Monthly specimen collections are taken for field measurement and analysis for water quality. The data residues at ASEPA.

Climate: Monitoring of rainfall at Mount Alava in NPSA (along with eight additional sites outside NPSA) on Tutuila was conducted by the U.S. Geological Survey between 2000 and 2002. The data collected provides information about the availability of water resources of the island. For more information on this survey go to http://hi.water.usgs.gov/projects/project_samoa_gw.htm.

Invasive Species: Invasive tree and plant distribution monitoring of the territory, including park boundaries, is currently being initiated. Monitoring feral pig activity in NPSA, ongoing since 1997, provides an index of pig activity and ecological effects.

Buffer Zone Monitoring

Terrestrial Vertebrates: As previously mentioned, DMWR has monitored forest birds and bats throughout the territory.

Marine Communities: Long-term monitoring of the coral community in Fagatele Bay National Marine Sanctuary and other areas of Tutuila Island has been conducted by Birkeland et al. from 1985 to 2001. Coral abundance, colonies, species list were documented in addition to a fish species list. The surveys in 1998 and 2001 indicate an overall improvement in the condition of the reefs. In contrast to the coral community, the fish abundance has declined (Birkeland et al. 2004). Other coral reef monitoring sites located on Tutuila in Pago Pago Harbor is the Aua transect (Mayor 1924, Green 2002) and Utulei transect (Cary 1931, Cornish and DiDonato 2004).

A monitoring project beneficial to coral reef monitoring is the 'Hotspot Satellite Maps for Sea Surface Temperature (SST)' conducted by NOAA. The data provides a useful means of alerting coral reef managers to areas that may become bleached due to warming SST. Current data is available at NOAA Satellite and Information Service webpage (http://www.osdpd.noaa.gov/PSB/EPS/CB_indices/coral_bleaching_indices.html).

Monitoring of water temperature, currents, coral and fish surveys in the waters of American Samoa was conducted in 2002 and 2004 by NOAA. The monitoring project is scheduled to take place every two years. A report was published summarizing the surveys conducted in February 2004 (Brainard 2004). Also mentioned earlier, DMWR monitors annual harvests of fish and invertebrates to assess trends in resources.

Water Quality: Since 2001, ASEPA has been monitoring beach water quality in Tutuila to determine if the beach is safe for swimming. When bacterial levels are exceeded, a notice is published in the local newspaper.

Air Quality and Climate: Current data for National Water Service (NWS) stations on Tutuila and Tau can be obtained from the NWS website (http://weather.noaa.gov/weather/current/NSTU.html). The NWS station on Ofu was damaged in a Hurricane in 2002 and has not yet been replaced. Historic data for the NWS stations on Tutuila, Tau and Ofu are available from the NCDC website (http://www4.ncdc.noaa.gov/ol/climate/stationlocator.html). NOAA CMDL has conducted extensive measurements of aerosols, gases, solar radiation, and meteorological parameters at Cape Matatula, Tutuila for almost 30 years. Information is available at the NOAA CMDL website (http://www.cmdl.noaa.gov/obop/smo/).

Seismicity Monitoring: Since 1949, the Pacific Tsunami Warning Center (PTWC) in Ewa Beach, Hawaii, provides tsunami warnings guidance to most countries in the Pacific Basin, as well as to Hawaii and all other US interests in the Pacific outside of Alaska and the US West Coast.

CONCLUSION

NSPA's unique features are its paleotropical rainforests and Indo-Pacific coral reefs. Natural and important resources include forest pollinations (flying foxes), rare species (sheath-tailed bat, Pacific boa, spotless crake, many-colored fruit dove), coral reef community, sandy and rocky beaches, wetlands and streams, rainforests, and cloud forests. Primary threats to these resources include tropical cyclones, high fishing pressure, coral bleaching and mortality due to global climate change, rapid population growth, expansion of agriculture into primary rainforest, and invasive species.

Management priorities of this new National Park are to preserve rainforest and coral reefs while maintaining traditional land use (subsistence agriculture and fishing are permitted within the park.) In addition, NPSA will continue to protect its limited cultural elements.

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