



## Pacific Island Network Vital Signs Monitoring Plan

# Appendix M: Cultural Values of Indigenous and Other Culturally Associated Groups

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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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## Introduction

The PACN's sixth monitoring goal is to “*provide data to better understand, protect, and manage important resources that share cultural and natural value.*” Therefore, the first table in this appendix describes some of the natural resources which share cultural value for various cultural groups of the Pacific islands within the PACN. Cultural resources include objects of: (a) harvest, (b) medicinal, (c) utilitarian, (d) spiritual/religious, and (e) biological values. Biological values, in this case, apply to resources of both ecological and cultural significance. When applicable, we also address traditional values (e.g., reverence of places, people, and things; significance of stories and names) that provide context for the discussion about shared natural and cultural resources. The cultural resources and values presented in the table are limited to those values that share natural resource value and will be reflected in our monitoring objectives. The practices and beliefs of different cultural groups are as diverse as the individuals that comprise the cultures. For this reason, the values and resources discussed in this appendix should be viewed as examples, which are by no means exhaustive. Several NPS cultural resources division staff, other park staff, cultural representatives, community groups, and other experts have provided input to Table 1. Table 2 in this appendix is a summary of values, beliefs, and opinions about Vital Signs from focus group meetings. Additional discussion regarding cultural resource values and their importance to the selected Vital Signs is provided in Chapter 3.

**Table 1. Cultural Values and Other Considerations Associated with PACN Vital Signs.**

Vital Sign	Cultural Values and Other Considerations Associated with PACN Vital Signs
Climate	<p><b>I. Harvest value:</b> Not available (N/A)</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> In Samoa and Hawaii, observations, knowledge, and views of weather and climate forecasts serve as an indigenous calendar by which social and communal activities such as feasting, fishing, and hunting patterns are planned (Lefale 2003, M. Tolentino, pers. comm., 2006). In Hawaii, winds were important climatic features and given names and expressed in chants (e.g., strong mumuku winds in the vicinity of PUHE and Waihanau winds at KALA) (Pukui &amp; Elbert 1986, William Akau, pers. comm., 2006).</p> <p><b>IV. Spiritual/religious value:</b> Many aspects of nature were, and still are, revered by Pacific islanders. Perhaps no natural attribute receives as much attention as water, in its many forms. Water has been honored in chants and songs; the languages of Pacific islanders contain countless words for wind, rain, and clouds. Each manifestation has its own term describing variations in forms of clouds, mist, or winds and rains attributed to places, land divisions, and districts (Hart 2004, Valentine n.d., A. Arakaki, pers. comm., 2005). In Samoa, legend tells of two brothers that fled to earth during a war in the heavens and brought January storms with them. When they escaped to the heavens during a war on earth, they looked down upon hills that were formed from the heaps of the slain covered by earth dug up from the valleys. Their tears, wailing, and exasperation caused storms or hurricanes (Lefale 2003).</p> <p><b>V. Biological value:</b> N/A</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> Global warming is a phenomenon that could potentially raise sea-levels (USEPA 2000). In all Pacific Island parks, cultural sites, artifacts, and culturally important plant species in low-lying regions are particularly susceptible to inundation (Government of Samoa [GOS] n.d., Tutangata 2000). Submerged cultural resources at KAHO (e.g., remnant rock walls alignments) suggest that the coastline was once located farther offshore (NPS 2006). Global warming has also contributed to coral bleaching (Goreau 2002), killing culturally important corals, and the living things that depend on them.</p> <p><i>Justification: Collecting data on the weather and climate in select parks in the context of this value reflects PACN's recognition of their cultural importance to certain groups. Collecting information about global warming conditions/rising sea levels over time will increase our understanding of this devastating climatic condition on both natural and cultural resources.</i></p>
Groundwater dynamics	<p><b>I. Harvest value:</b> Surface water withdrawn from Waikolu Stream at KALA was a source of water for wetland taro; present-day diversion of surface and groundwater from the stream for use by the entire western half of the island impacts animal communities (NPS n.d.a).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> N/A</p> <p><b>IV. Spiritual/religious value:</b> To the Hawaiians, freshwater represented male procreative energy flowing above ground and as groundwater; it was called "water of life of Kane"; Kane means "male" or "husband" (Handy and Handy 1991).</p> <p><b>V. Biological value:</b> N/A</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> Changes in precipitation and surface and ground water affect vegetation, which has cultural value since it affects the sense of place or setting and traditional land use on a landscape (P. Hartzell, pers. comm., 2005). Changes in groundwater dynamics can result in direct impacts to cultural resources (i.e. increased surface runoff is more likely to cause erosion and thus damage to archaeological deposits). Past development upstream of parks have had a detrimental effect on stream flow or freshwater sources (e.g., rock wall above Waia`ula`ula stream at PUHE, destruction of freshwater springs at KALA) (M. Tolentino, pers. comm., 2006).</p> <p><i>Justification: Groundwater was and still is an important cultural resource for island groups. It is also a crucial source of freshwater for island economies. Monitoring short- and long-term response of an aquifer from baseline measurements will determine whether there are human-induced and non-anthropogenic stresses on groundwater reserves.</i></p>

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Water quality	<p><u>Cultural context:</u> The importance of water to many Pacific Island cultures is reflected in meanings of the term, which not only refers to the physical description, but is also a term used for concepts of wealth, life, emotions, and as a carrier of wisdom from one generation to the next (Valentine n.d.). Specific water-associated names were also applied to caves, springs, streams, other water sources, and places where fresh and salt water occur and mix. Location of water sources influenced settlement patterns and many natural habitats were modified for this purpose.</p> <p><u>I. Harvest value:</u> In Hawaii and elsewhere, water was an important resource used for drinking, cooking, agriculture, etc. (NPS n.d.b).</p> <p><u>II. Medicinal value:</u> N/A</p> <p><u>III. Utilitarian value:</u> Water in Pacific Island cultures was and still is important for bathing, and often the same sources are important habitat for harvested species including fish, invertebrates, and useful plants (e.g., makaloa, a sedge used for mats). In Hawaii, access to brackish ponds (possibly fresh water lenses) affected coastal settlement locations. At HALE, traditional Hawaiian agricultural farming is being practiced through a cooperative agreement with the park. This farm relies heavily on water from the park's freshwater streams (NPS 2005). In Hawaii parks, fishponds (e.g., Kaloko and Aimakapa fishponds) were dependent on water to raise fish for subsistence.</p> <p><u>IV. Spiritual/religious values:</u> "Samoans regard water as a gift from god and accordingly, they expect that it should be free." (GOS n.d.)</p> <p><u>V. Biological value:</u> In Hawaii parks, fresh or brackish water environments sustain native plant and animal populations used in past and present cultural practices.</p> <p><u>VI. Threats to cultural resources, sites, practices, values:</u> Oversiltation has resulted in the loss of limu (seaweed), important for seasoning, food vegetable, medicine, and taste enhancement (William &amp; Annie Akau, pers. comm., 2006). Land modification in and around freshwater sources at PUHE has resulted in elimination of tidal inflow and outflow of Pelekane Stream (W. Akau, pers. comm., 2006). Cesspools leach into coastal waters off KALA, resulting in reduced water quality and fish populations. Leptospirosis is a bacterial disease that affects humans and other animals and is found in streams. In American Samoa, leptospirosis has resulted in the death of four individuals (NPS 2006) and is an issue in all national parks within the PACN that have streams to which host animals have access. Piggeries, which are common in American Samoa, are one source of contamination for water sources (NPS 2006).</p> <p><i>Justification: In all of the PACN parks, water is an essential resource to any culture that lives off the land and an integral part of culture beyond its physical description. Monitoring the quality of water supports the NPS commitment to preserve, protect, and enhance resources of cultural value.</i></p>
Status and trends of established invasive plant species	<p><u>I. Harvest value:</u> N/A</p> <p><u>II. Medicinal value:</u> In American Samoa, mile-a-minute vine is used to stop bleeding after an injury and is used to shade taro crops from the sun (E. Suafoa, pers. comm., 2006).</p> <p><u>III. Utilitarian value:</u> N/A</p> <p><u>IV. Spiritual/religious value:</u> N/A</p> <p><u>V. Biological value:</u> N/A</p> <p><u>VI. Threats to cultural resources, sites, practices, values:</u> Polynesians, Micronesians, and Melanesians have had traditions of intentionally introducing culturally significant species to new-found lands. Although many of these species are not considered invasive, the extent of their impact on native ecosystems is not well documented. These species are no longer considered invasive but the substantial changes that have occurred as a result of the foreign introductions are unknown. In all PACN parks, there are important culturally useful native plant species at different ecological zones that are presently affected by invasive plants. Often the threat to culturally important plants occurs through habitat displacement or competition for resources (Cuddihy and Stone 1990). Established invasive plants in all PACN parks negatively impact culturally significant plant populations used in dance, food, medicines, fishing, lighting, decoration, etc. In Guam and Samoa, <i>Intsia bijuga</i> (ifit in Chamorro, the territorial tree of Guam; ifiele in Samoan), has attractive wood used for building and woodworking and is becoming an increasingly rare cultural resource due to over-harvesting and habitat displacement by invasive species (UNDP n.d., Wilkie et. al. 2002). Species such as chain of love (<i>Antigonon leptopus</i>) and scarlet ivy gourd (<i>Coccinia grandis</i>) have been identified as important invaders on Guam. On Saipan, scarlet ivy gourd is also considered a serious problem (Space &amp; Falanruw 1999). Buffelgrass (<i>Cenchrus ciliaris</i>) has replaced pili grasslands (<i>Heteropogon contortus</i>), a plant important for its historical use as house thatching (W. Akau, pers. comm., 2006). Archeological sites are being disrupted or covered by</p>

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	<p>alien plants at several PACN parks (NPS 2006). Miconia and Japanese anemone, which are not yet at KALA, were cited as species that are cause for concern by community members (C. Nash, pers. comm., 2006) because of their potential negative impacts on the park's resources.</p> <p><i>Justification: Determining the status and trends of invasive species and monitoring invasive species along entry corridors will help to assess the threats to culturally important species that make up the natural habitats of PACN parks.</i></p>
<p><b>Early detection of invasive plants</b></p>	<p><b>I. Harvest value:</b> N/A  <b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> N/A  <b>IV. Spiritual/religious value:</b> N/A  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> In all PACN parks, newly established invasive plants have the potential to impact culturally significant plant populations used in dance, food, medicines, fishing, lighting, and decoration, among others. Often the threat to culturally important plants occurs through competition for resources and habitat displacement (Cuddihy and Stone 1990). In American Samoa, sisi aferika (giant African snails, <i>Achatina fulica</i>) has become major pests of taro and other crops and the predatory snail (<i>Euglandina rosea</i>) has driven native land snails to the edge of extinction (Trail 2002a). There, about 250 alien plant species have become established on American Samoa and some (e.g., fuisana or mile-a-minute vine, [<i>Mikania micrantha</i>]) threaten its native forest (Trail 2002a). At PUHE, invasive plants have become established after being introduced in soil used in ground maintenance (D. Kawaiaea, pers. comm., 2006).</p> <p><i>Justification: Early detection of invasive plant species, especially incipient populations, will help to perpetuate these culturally important species that make up the natural habitats of PACN parks.</i></p>
<p><b>Benthic marine community</b></p>	<p><b>I. Harvest value:</b> In American Samoa, large faisua (giant clams) and palolo (polychaete worms) are important for food. Traditionally, sea turtles were used for food but are now federally protected (Craig 2002). In all PACN parks, minerals such as salt and earth (e.g. alae [red earth in Hawaiian]), shell and bone also have cultural significance. In Hawaii and other Pacific Islands, uku (lobster), pearl oysters, opihi (limpets), various crabs, and wana (sea urchins), and kupee (nerites) were collected for food (NPS 2006, Peskadot n.d.). Sea salt (paakai) and seaweed collection is an ongoing cultural practice (Gutmanis 1976, NPS n.d.b).  <b>II. Medicinal value:</b> In Hawaii, certain seaweeds (e.g., limu kohu, limu eleele, limu kala, limu paipai) are important food items or used in medicines (Gutmanis 1976).  <b>III. Utilitarian value:</b> In Hawaii, corals, fish bones, shark teeth, sea urchins and invertebrate shells were historically used as tools or part of tools (e.g. coral sander, fish hooks and shell lures, shark teeth for weapons, sea urchin kii [statuettes] or files) (Bishop Museum 2003, NPS 2006). In Hawaii, certain seaweeds were used as fertilizer (NPS 2006). In Hawaii, kupee were harvested for jewelry (NPS 2006). In American Samoa, coral rubble is traditionally spread outside their houses (Craig 2002). Turtle shells are made into bracelets, combs, fishing hooks, and used in headpieces worn by a princess during dance ceremonies (Craig 2002).  <b>IV. Spiritual/religious value:</b> In Hawaii, all corals are culturally important; corals are the first organisms (of many) mentioned in "He Kumulipo," the 2000+ line long Hawaiian creation chant (Beckwith 1951). In Samoan folklore, sea turtles were believed to have the power to save fisherman lost at sea and are called l'a sa (literally, "sacred fish"), presumably because of this ability. Turtles are incorporated into Samoan song, art, and petroglyphs. Turtles and sharks appear at sea at Vaitogi when villagers sing a special song (Craig 2002).  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> N/A</p> <p><i>Justification: Many of the resources listed above are depleted or are threatened. Monitoring benthic marine communities, diseases, coral bleaching, and their impacts on marine ecosystems will provide data on these important resources and form a basis by which important</i></p>

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Marine fish	<p><i>management decisions can be made.</i></p> <p><b>I. Harvest value:</b> In the Pacific islands, which are surrounded by vast ocean, fishing is an important and vital cultural practice that continues to support or supplement many people for food and/or sport. (Titcomb 1972). In Samoa, alogo (Blue-lined surgeonfish, <i>Acanthurus lineatus</i>) is considered the single-most important species of reef fish harvested (Craig 2002). Other important harvested species include manini (<i>A. triostegus</i>) and pone (<i>Ctenochaetus striatus</i>). Overfishing older, reproducing reef fish is cited as a major threat to their populations (Craig 2002).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> Sharks teeth were also used in Pacific Islander weaponry and necklaces. Historically, fish and other vertebrate bones were used for fish hooks (Bishop Museum 2003).</p> <p><b>IV. Spiritual/religious value:</b> Sharks, for example, are sometimes associated with aumakua (family gods/guardians) for some Hawaiian families and were often considered guardians of the sea. Sharks (viewed by some as embodiments of Gods) are often prominent figures in Pacific Island mythology (Kamakau 1987). A symbiotic relationship existed with aumakua. Mortals did not harm or eat aumakua and even fed shark aumakua. Aumakua warned and reprimanded mortals in dreams, visions, and calls (Pukui &amp; Elbert 1986). In old days in Hawaii, the first solid food given to a child was thought to influence its afterlife. The red-eyed kole fish would give the child a rosy tinge and the hilu fish would insure good looks. A discreet form of compliment in praising a pretty infant, since open admiration was not only in bad taste but might bring bad luck, was to call him a hilu fish (Beckwith 1951). Chamorro legend tells of a giant fish that ate parts of Guam, giving it its characteristic shape. A woman, known as the Virgin Mary, captures the giant fish and protects the people of Guam (Government of Guam [GOG] n.d.).</p> <p><b>V. Biological value:</b> N/A</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> Development of the harbor at Kawaihae (e.g., dynamiting the reef) and diversion of stream flow in surrounding areas, have negatively impacted the spawning areas of culturally important fish species that are no longer found there (W. Akau, pers. comm., 2006). <i>Ciguatera</i> (from red tide) has affected fish populations in Hawaii such that many are no longer edible (A. Akau, pers. comm., 2006).</p> <p><i>Justification: The health of marine fish populations has direct impacts on people that depend on them. Monitoring the trends and populations of these resources provides much-needed information so mitigation actions can be taken to sustain marine fish populations for future generations.</i></p>
Freshwater animal communities	<p><b>I. Harvest value:</b> In Hawaii, various freshwater stream animals (e.g., nerites, shrimp, fish, crabs) were, and to a limited extent, are still important food items (PSRC n.d., D. Kawaiaea, pers. comm., 2006). In Hawaii opae ula (red shrimp) was collected for human consumption, and sold as aquarium novelties and live food for aquarium fish (NPS 2005, S. Stephens, pers. comm., 2005). Native damselflies (<i>Megalagrion</i> spp.) were used by the ancient Hawaiians practicing aquaculture (Dunbar 1997).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> In Hawaii, opae ula in anchialine ponds play a very important role in fishing practices as fish bait when mixed with soil (NPS 2006).</p> <p><b>IV. Spiritual/religious value:</b> Damselflies and dragonflies are important to some cultural groups as aumakua and dragonfly nymphs in freshwater environs were used in indigenous rituals in Hawaii (Howarth et al. 1998). Freshwater goby were fed to babies as their first meal because the "sticking" goby fish would cause good luck to "stick" to him (Beckwith 1951).</p> <p><b>V. Biological value:</b> Anadromous fish larvae that hatch in freshwater streams and washed out to sea serve as important food sources for benthic marine fish upon which Hawaiians depend (J. Yoshioka, pers. comm., 2005).</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> Freshwater sources are threatened by various anthropogenic causes. For example, current pig-rearing practices in Samoa create run-off contaminants that threaten water resources such as freshwater eel and shrimp which are important food items for Samoans (E. Suafoa-Taua'i, pers. comm., 2005). In addition, unresolved human sewage contamination reduced the natural environment values of freshwater habitats (GOS n.d.). Waikolu Stream at KALA is experiencing water diversion and periodic dewatering; research shows that compared to free-flowing streams, Waikolu has less goby fish density, a narrower range of habitats that may lead to</p>

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	<p>competition and an impact on fish populations, and an inhibition of these amphidromous animals from completing their life cycles (Brasher 1997 and 2003). Human alterations at the mouth of these streams also negatively impact the amphidromous life cycle of these species (Radtke, Kinzie &amp; Shafer 2001). In Hawaii, some coastal traditional fishing relied on spotting fishes from promontories, or when throw-netting, as fish migrated into clear coastal waters in bays or coves. If water quality is impacted these practices are threatened as well (L. Basch, pers. comm., 2005). In Hawaii, anchialine pools are threatened by siltation, groundwater withdrawal, and invasive species. In addition, the freshwater animals themselves are threatened by the introduction of non-native species (NPS 2006).</p> <p><i>Justification: Monitoring these freshwater biotic species not only supports the protection of them and their habitats, but also helps to protect their place in Pacific Island cultures.</i></p>
<p><b>Focal terrestrial plant communities</b></p>	<p><b>I. Harvest value:</b> Although Polynesians and Micronesians introduced many food plants from their places of origin, they also harvested native plants. For example, in Hawaii, kookoolau (<i>Bidens</i> spp.) and mamaki (<i>Pipturus albidus</i>) were common tea plants and ohelo (<i>Vaccinium</i> spp.) and fern shoots were food items. In Guam, coconut crabs found in focal plant communities are important food items for Chamorros.</p> <p><b>II. Medicinal value:</b> In Hawaii and Samoa, dozens of both native plants and introduced plants were sources of medicines from ancient times to present (GOS n.d., Krauss n.d., Suafoa, pers. comm., 2005).</p> <p><b>III. Utilitarian value:</b> In Hawaii, Guam, Samoa, and Saipan, native and Polynesian- or Micronesian-introduced species had a wide variety of historic uses and were of important value. These plants were used for staple and famine foods, mats, cordage, decoration, toys, clothing, ornaments, baskets, fishing gear and nets, sails, perfumes/scents, floats, hats, toilet paper, deodorants, soap/shampoo, toothbrushes, weapons, hunting tools, weed control, insect repellent, poisons, timber, traps, wrappers, canoes/boats, soil improvement, embalming material, aphrodisiacs, fertility control, seasonings, meat tenderizers, preservatives, drugs/medicines, artifacts, totems, magic-religious artifacts, musical instruments, fuels, containers, fire making, masticants, brushes, torches/lamps, boundary markers, dyes, adhesives, insulation, caulking, recreation, teas, cages/roosts, animal food, commercial products, abrasives, shade, brooms, and fans (American Samoa Historic Preservation Office (ASHPO) n.d., Bishop Museum 2003, GOG n.d., GOS n.d., NPS n.d.b, NPS 2006, Samoan Community Development Center n.d., Whistler 2000). Some of these may include rare, threatened, or endangered (RTE) species. In Guam, ifit (<i>Intsia bijuga</i>) is an important plant used in wood carving and other important cultural activities that exist today. Although not officially designated as Threatened or Endangered, it is becoming increasingly rare on Guam.</p> <p><b>IV. Spiritual/religious value:</b> Specific sites as well as entire ecosystems or regions were places of reverence for certain peoples (For example, wao akua, or “forest of the gods” [Hawaiian], is the upper elevation forests covered by mist [Handy and Handy 1991], a focal plant community). In Hawaii, maile (<i>Alyxia oliviformis</i>) and various native ferns continue to be used for hula and other cultural practices. Certain native plants are recognized by some cultural groups as kinolau (body form) of important Hawaiian gods. In Hawaii parks, there are flowers of several RTE species that could potentially be collected for ceremonial leis.</p> <p><b>V. Biological value:</b> Remnant dryland forests at PUHO were used historically for dry terrace cultivation of crops such as taro, sweet potato, sugar, and wauke (<i>Broussonetia</i> sp.) (NPS 2005).</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> N/A</p> <p><i>Justification: Monitoring terrestrial species and their communities provides information about the health of the ecosystem in which they live and directly and indirectly protects certain culturally significant species. Collections of rare, threatened, or endangered species directly impact remaining populations. Monitoring impacts of collections of these resources is vital to their survival.</i></p>
<p><b>Landbirds</b></p>	<p><b>I. Harvest value:</b> In many Pacific Island cultures, land birds had been important food sources (e.g., nene in Hawaii, rails in Guam, etc.). Some species are still harvested today. For example in Samoa, the lupe (Pacific pigeon), an important seed disperser, is still trapped for consumption despite its prohibition (NPS 2005, E. S. Tauai, pers. comm., 2005). In American Samoa, harvesting the lupe (Pacific pigeon) was part of an important ancient ritual and religious practice involving the creation of tia (star mounds) and its use in catching pigeons (Trail &amp; Seamon 2002).</p>

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	<p>Other birds, like the manu ali'i (Purple swamphen) are sometimes hunted as well (Trail 2002b).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> In historical Hawaii, the feathers of forest birds (oo, mamo, iiwi, apapane) were important for lei, kahili (feather standards), capes, and other clothing or ornaments worn or used by Pacific Islanders or their leaders. Although the collection of feathers from native birds is no longer an ongoing practice because many of the birds are extinct, rare, or uncommon, the cultural practice of creating feather leis using alternative bird feathers (often chickens) continues today. In historical times, feathers of Samoa's only parrot, the segavao (blue-crowned lorry) were collected to decorate fine mats (Seamon &amp; Trail 2002). In American Samoa, bird bones were used as needles to poke holes in pandanas (E. Suafoa, pers. comm., 2006).</p> <p><b>IV. Spiritual/religious value:</b> In Hawaii, pueo (Hawaiian short-eared owls) are considered by some cultural groups as aumakua. In Samoa, the lulu (Barn owl) is associated with ghosts or aitu and some people fear them (Grant 2002). Elepaio (a species of native Hawaiian flycatcher) is the traditional Hawaiian guardian spirit of canoe makers; these birds were thought by certain groups to indicate to canoe makers which trees were undesirable for use. In Hawaii, the kolea (golden plover) is associated by some Hawaiians with a god called Lono. This bird can be found in all PACN parks. Knowing the terrestrial and marine life forms that are associated with the akua and aumakua and understanding the links between terrestrial and marine life forms is culturally important. Understanding why certain species are associated with certain traditional gods or practices may tell us something vital about the species, the habitat, and management thereof (A. Arakaki, pers. comm., 2005). In Samoa before 1832, males (only matai) played a game of catching pigeons with nets made from a vine; the more they caught, the more elevated the status of the men (E. Suafoa, pers. comm., 2006).</p> <p><b>V. Biological value:</b> Many landbirds are also important pollinators of culturally significant plants used in dance, medicines, food, etc. The lupe (pacific pigeon) and the art of lupe-hunting are mentioned in many Samoan proverbs and is considered the most culturally important bird in Samoa. According to Samoan legend, hearing the wails and screams of the possibly extinct ma'oma'o (<i>Gymnomyza samoensis</i>), meant misfortune or death was imminent (Trail &amp; Seamon 2002).</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> In PACN parks, bird hunting and plant collecting for food or cultural/traditional practices/sport, and the environmental impacts of feral pigs may have directly affected forest passerine bird populations by disturbing/destroying critical bird habitat and spreading disease such as avian malaria. In PACN parks, the introduction of predatory alien animals (e.g. brown tree snakes on Guam; cats, rats, and mongoose in Hawaii) and plants have reduced forest bird populations significantly and have had a negative impact on cultural practices by depleting, extirpating, or causing the extinction of culturally important passerines.</p> <p><i>Justification: Collecting data about these culturally significant birds provides a basis by which NPS can make management decisions to protect the species in perpetuity.</i></p>
Seabirds	<p><b>I. Harvest value:</b> Various seabirds were important sources of protein for Pacific Island cultures (e.g., petrels, shearwaters, boobies). Historically, the eggs and chicks of seabirds were eaten by Hawaiians (Stone and Pratt 1994).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> Seabird bones were used for tools by Hawaiians and Samoans (USFWS 2005; J. Nakamura, pers. comm., 2005). In Hawaii's past, red-tailed tropicbird feathers and frigate birds were used in kahili (feather standards) (Rose et al. 1993). The breast feathers of tava'e (White-tailed tropicbird) are highly prized for fishing lures in Samoa. The behavior of tava'e and other seabirds also notify fishermen of the location of masimasi (mahimahi) and other fish, while at sea (Trail 2002d).</p> <p><b>IV. Spiritual/religious value:</b> Seabirds are prominent icons in Pacific Island mythology and identified in chants and dances. For example, the kaupu (Laysan albatross) was used by some cultural groups during specific ceremonies as a symbol of the god Kahoalii in Hawaii (Kamakau 1987). In Hawaii, hearing an "hāpai (pregnant) bird" (undetermined seabird) meant somebody's pregnant in the village (NPS 2006). Traditionally, the collection of the breast feathers for fishing lures off a live tava'e was considered a badge of honor for Samoan youth (Trail 2002d).</p> <p><b>V. Biological value:</b> N/A</p> <p><b>VI. Threats to cultural resources, sites, practices, values:</b> Populations of seabirds are now threatened by non-native predatory animals and by over fishing (e.g., black noddies rely on large fishes to drive their small prey fishes to the surface) (Stone and Cuddihy 1994).</p>

Vital Sign	Cultural Values and Other Considerations Associated with PACN Vital Signs
	<p><i>Justification: Monitoring the long-term trends of shearwaters, petrels, boobies, and other seabirds provides information to manage these culturally significant species for future generations. Also looking to modern uses of coastal areas may help determine the effects of present-day practices such as fishing strategies, etc.</i></p>
<p><b>Bats frugivorous and insectivorous</b></p>	<p><b>I. Harvest value:</b> Frugivorous bats have a significant cultural position in Samoan and Chamorro cultures as they are important food items in festivities; although harvesting is illegal (NPS 2001, Sheeline 1991).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> N/A</p> <p><b>IV. Spiritual/religious value:</b> These bats are prominent figures in Samoan folklore that represent fertility and survival, both important motifs of Samoan culture (Sinavaiana and Enright n.d.). In Samoa, men's tattoos have the sign of the pe'a (fruit bat, a stylized W), a symbol which can also be found on tapa cloth and on lapita pottery dated more than 3000 years old (E. Suafoa, pers. comm., 2006). Many Ancient Hawaiians called the hoary bat opeapea, as its wings reminded them of the half-leaf remaining on the taro stalk after the top half has been removed for cooking (Pukui and Elbert 1986).</p> <p><b>V. Biological value:</b> Hawaiian hoary bats are primary predators of night-flying insects, some of which are agricultural pests (Fullard 1989) or spread diseases and as such are valuable to commercial, agricultural, and natural ecosystems. Frugivorous bats are important seed dispersers, pollinators of strictly bat- or starling-pollinated plants (Cox et. al. 1991).</p> <p><b>IV. Threats to cultural resources, sites, practices, values:</b> Illegal hunting of these animals for food or export continues to have an impact on frugivorous bat populations, especially at NPSA and AMME (Craig et al. 1994, Sheeline 1991).</p> <p><i>Justification: Determining the presence, distribution, and activity levels of insectivorous and frugivorous bats provides data about the stability of these culturally significant animals.</i></p>
<p><b>Landscape dynamics</b></p>	<p><b>Cultural context:</b> Cultural uses of the land may have influenced how land is used today. Subsistence agricultural use in and around NPSA and WAPA actively continues today. Historically, the extensive ALKA trail has been associated with many population centers of the island of Hawaii, and its landscape has distinctive Hawaiian resources including heiau, royal centers, house sites, fishing settlements and shrines, fishponds, gardening terraces, petroglyphs, stone slides, and other sacred places (Dunbar 1997, NPS n.d.c). Salt pans and fish ponds were established in and around PUHE and KAHO but they were destroyed in a tsunami and are no longer functioning. In the past, sandalwood (<i>Santalum sp.</i>) was collected from the region of PUHE for the Southeast Asian trade. Now, no sandalwood is found in the area (M. Tolentino, pers. comm., 2006). According to Chamorro legend, human beings first ask for permission to enter strange districts so as not to incur the wrath of ancestral family spirits such as the Taotaomona (ghost, demons, monstrous, ogre-like figures) (Torres 2003). A similar practice of asking permission before entering certain areas is also a traditional protocol for sections of NPSA. The concept of inafa'maolek or interdependence reflects Chamorros' spirit of cooperation at the core of their culture. It is a powerful concern for mutuality rather than individualism and private property rights (GOG n.d.). In addition, the word Samoa, is believed to come from Tagaloa's (Supreme being's) son named Moa (center of the universe) and everything that lives upon Moa is Sa, or sacred, including animals, trees, and the land itself. All forms of violation are forbidden (UNDP n.d.).</p> <p><b>I. Harvest value:</b> The archeological remnants of many traditional farming plots such as circular plots for dryland taro and sweet potato are found in many Hawaii parks (NPS 2006).</p> <p><b>II. Medicinal value:</b> N/A</p> <p><b>III. Utilitarian value:</b> ALKA (Ala Kahakai National Historic Trail) is part of an extensive, predominantly coastal trail system that linked many historical Hawaiian routes and trails, including those that ran from the ocean to the mountains. This trail passes through KAHO, PUHO, PUHE, HAVO and across multiple landownership boundaries (NPS 2006). Sections of many other historic trails such as the Mamalahoa (carriage trail) and Hinalani trails run through parks on Hawaii Island (NPS 2006).</p> <p><b>IV. Spiritual/religious value:</b> N/A</p>

Vital Sign	Cultural Values and Other Considerations Associated with PACN Vital Signs
	<p><b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> N/A</p> <p><i>Justification: Land use outside of parks may threaten cultural resources such as water resources, cultural landscapes, viewscapes, soundscapes, etc. Monitoring land use patterns will provide data that does not currently exist. This information can be used to mitigate further impact on the parks' cultural and natural resources.</i></p>
Fish harvest	<p><b>I. Harvest value:</b> In the Pacific Islands, fishing is an important and vital cultural practice that continues to support indigenous cultures for food and/or sport (GOS n.d.). In American Samoa, regularly harvest species include apakoa (albacore), asiassi (yellowfin tuna), atu (skipjack) and tagi (dogtooth tuna). At present, these species are not abundant; over 99% of the tuna processed in American Samoa are not from waters off American Samoa (Craig 2002). Off Guam, pelagic fish such as tuna, barracuda, and wahoo are speared at 60 to 100 foot depths. This area is home to over 700 species of edible sea life; only mature animals are harvested (Peskadot n.d.)</p> <p><b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> N/A  <b>IV. Spiritual/religious value:</b> In Guam, Peskadot (literally "he who stalks the sacred resources of the Pacific Peoples") honor ancestral spirits or anihni with ceremonial rituals, prayers, and chants before harvesting fish resources (Peskadot n.d.). In American Samoa, during the time when mackerels come to shore (once a year), an untitled boy (Taule'ale'a) would go to the high point of island to look for mackerel. After the catch, the mackerel is cooked in an umu (traditional way of preparing Samoan food), and then the village people gather for a feast (NPS, 2006).  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> In Samoa, the majority of the rural population relies on fish for its subsistence; numerous edible inshore fisheries resources have been reduced due to over fishing, increasing population, natural disasters, increasing run-off, and destructive fishing methods (GOS n.d.).</p> <p><i>Justification: The health of marine fish populations has direct impacts on cultures that depend on them. Monitoring the trends and populations of these resources provides much-needed information so mitigation actions can be taken to sustain marine fish populations for future generations.</i></p>
Erosion and deposition	<p><b>I. Harvest value:</b> N/A  <b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> N/A  <b>IV. Spiritual/religious value:</b> N/A  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> At PUHE, sedimentation could result in the inundation or degradation of the offshore Pelekane Shark Heiau. At KAHO, deposition at Aimakapa Pond impacts water quality, changes in plant community (conversion to non-native species), impact to coot and stilt nesting areas, and have covered archeological sites and features (NPS 2006). At WAPA, sedimentation may have a significant impact on survival, reproduction, and recruitment of corals (Minton 2005), some of which are culturally important. In addition, sedimentation threatens submerged World War II artifacts at USAR and WAPA and AMME. Erosion and deposition of soil in the ocean impacts marine and near-shore cultural resources, including historical sites and biotic communities. At PUHE, harbor construction and ongoing activities that involved dredging, blasting, and stream diversion have impacted water quality, spawning activity of fishes, and reduced or eliminated the growth of culturally important harvested limu, fish, alowalo, and other species. Activities also support the growth of red tide and ciguatera that has eliminated most reef and predatory fishes for consumption (William &amp; Annie Akau &amp; Mabel Tolentino, pers. comm., 2006).</p> <p><i>Justification: Overall deposition of soil and its impact on marine ecosystems will provide data on important natural and cultural resources and</i></p>

Vital Sign	Cultural Values and Other Considerations Associated with PACN Vital Signs
	<p><i>form a basis by which important management decisions can be made. Monitoring the deposition of soil in the marine environment will help ensure the preservation of these important cultural sites and biotic communities by providing data that could alert resource managers of impending damage or destruction to the resources.</i></p>
<p><b>Cave community</b></p>	<p><b>I. Harvest value:</b> In Hawaii, caves were important for collection of drinking water. The Hawaiians carved water collection troughs from various native trees to harvest water from caves (Handy and Handy 1995).  <b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> In the Pacific, caves served as temporary shelters and refuges (Bryan 1915).  <b>IV. Spiritual/religious value:</b> In Hawaii, Guam and Saipan, caves have significance for a variety of cultural uses including burial sites (Bryan 1915, Torres 2003).  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> N/A</p> <p><i>Justification: In PACN parks that house natural and human-excavated caves, it is important to monitor human impacts to reduce, eliminate, or prevent degradation of these culturally important caves and the vulnerable natural and cultural resources within them. In PACN parks, drip caves and water seepage caves are important cultural sites because, as water sources, they suggest settlement patterns of indigenous communities and determine where trails are located. Caves also host biologically unique ecosystems in the Pacific, and are often considered sacred sites. For these reasons, caves warrant monitoring and protection.</i></p>
<p><b>Terrestrial invertebrate communities</b></p>	<p><b>I. Harvest value:</b> Native damselflies (<i>Megalagrion</i> spp.) were used by the ancient Hawaiians practicing aquaculture (Dunbar 1997).  <b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> N/A  <b>IV. Spiritual/religious value:</b> Damselflies and dragonflies are important to some Hawaiian peoples as aumakua (L. Basch, pers. comm., 2005). According to Chamorro legend, mosquitoes are the transformation of a betrayed young wife and are associated with Taotaomona, mischievous spirits or ghosts (Torres 2003).  <b>V. Biological value:</b> Invertebrates are important pollinators of culturally important plant species and are food sources for culturally important bird species (Cuddihy and Stone 1990).  <b>VI. Threats to cultural resources, sites, practices, values:</b> N/A</p> <p><i>Justification: Monitoring terrestrial invertebrates not only supports their protection, their habitats, and the plants and animals that depend on them, but also helps to protect their place in Pacific Island cultures.</i></p>
<p><b>Early detection of invasive invertebrates</b></p>	<p><b>I. Harvest value:</b> N/A  <b>II. Medicinal value:</b> N/A  <b>III. Utilitarian value:</b> N/A  <b>IV. Spiritual/religious value:</b> N/A  <b>V. Biological value:</b> N/A  <b>VI. Threats to cultural resources, sites, practices, values:</b> In all PACN parks, newly established invasive invertebrates have the potential to impact culturally significant plant populations used in dance, food, medicines, fishing, lighting, and decoration, among others.</p> <p><i>Justification: Early detection of invasive invertebrates, especially incipient populations, will help to perpetuate these culturally important species that make up the natural habitats of PACN parks.</i></p>

- Citations for cultural values information are from literature sources, park staff, experts, and pertinent websites.

## **Summary of values, beliefs, and opinions from focus group meetings relating the Vital Signs to park cultural resources**

Focus group meetings were conducted at 8 of the 11 PACN parks from March through July 2006. Park staff participating in these meetings varied from park to park, but included maintenance, interpretation, law enforcement, and cultural resources divisions, and in some cases superintendents. Additionally, some of the meetings included participants from natural history associations and cultural advisors associated with the national park, historical park, memorial park or historic trail (i.e., park units). These meetings were designed to discuss and record comments that link Vital Signs monitoring to cultural resources. The responses summarized in table 2 are the thoughts and opinions of those working in or with the park units\*, and do not necessarily represent scientifically verified information or the opinions of the National Park Service.

The focus group meeting participants were selected by the superintendent, park managers, or the cultural resources division with the park units. The meetings were conducted by an I&M facilitator and a recorder, lasted for 2-3 hours, and were attended by 4 to 15 participants. Two questions were posed to each of the focus groups and were repeated for each Vital Sign. The questions varied slightly by park, but in general terms were: (1) *What is the cultural significance of this Vital Sign, and how has it changed (or is changing) over time?*, and (2) *What specifically is important to monitor in the park?* The information was recorded on flipcharts and summarized in meeting notes which were reviewed by national park staff and participants who were at the meetings. The information presented in table 2 is an abridgment of the meeting notes. In summarizing the meeting notes, every effort was made to maintain the integrity of the original statements of the participants.

Table 2 is intended as a reference for superintendents, I&M principal investigators, national park staff, and other interested parties. The full meeting notes are available upon request.

PLEASE NOTE: The information contained in this table reflects the thoughts and opinions of the participants at the time the focus group meetings were conducted (Hawaiian spring and summer, 2006). Many items in the table have not been scientifically or historically verified to rigorous standards.

**Table 2. Summary of Values, Beliefs, and Opinions from 8 PACN Park Units' Focus Group Meetings.**

NOTE: Information is opinion and may not be scientifically verifiable	Table 2. Summary of Values, Beliefs, and Opinions from 8 PACN Park Units' Focus Group Meetings.								USAR*	HAVO*	HALE*
	ALKA	KAHO	PUHE	PUHO	KALA	WAPA	NPSA	AMMIE			
<b>Ground-water dynamics</b>	<ul style="list-style-type: none"> <li>-Groundwater flow is depleted.</li> <li>-Anchialine pond conditions degraded due to groundwater withdrawal and the spread of invasives.</li> <li>-Toads and exotic fish deplete native life in the ponds.</li> <li>-The biomass in the ponds is dying and decomposing, and the ponds require biomass removal.</li> </ul>	<ul style="list-style-type: none"> <li>-Important to monitor wells because no surface water is available.</li> <li>-Freshwater feeds Kaloko pond.</li> <li>-Almost all anchialine pools were modified for cultural purposes. Some were used for drinking water.</li> <li>-Subsurface geology (and water movement) is not well understood.</li> </ul>	<ul style="list-style-type: none"> <li>-Because of plantations &amp; farms, little water going into streams.</li> <li>-Two streams, one near Spencer Beach, Waikui (“2 waters that bang together”), where fresh and salt waters join offshore. Need to monitor its currents/flow.</li> <li>-A second stream, Pelekane stream, is important for sea life, but is now dead.</li> </ul>	<ul style="list-style-type: none"> <li>-Ponds are not filling as fast as in the past.</li> <li>-The kupuna (elders) stories indicate freshwater gushed at ponds.</li> <li>-Groundwater near park (Kamehameha School) is not bubbling as in past.</li> <li>-The back country well is lower than normal.</li> <li>-After large storms, pools fill with sediment.</li> <li>-Studies the salinity of fish ponds show that water is more saline now than the 8% salinity recorded in past.</li> </ul>	<ul style="list-style-type: none"> <li>-Early settlements were placed in the back of the valleys.</li> <li>-Waikolu had Historical use due to steady water flow.</li> <li>-In Waialeia valley there is evidence of aqueduct structure.</li> <li>- KALA gets water from Waihanau pump house.</li> <li>-People knew where fresh water springs were. Do not know now.</li> <li>-The bay fills with mud due to heavy rains, streams and groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>-Stream channelization and erosion is also an issue.</li> <li>The surface water runs fast.</li> </ul>	<ul style="list-style-type: none"> <li>-Water is often contaminated in some smaller villages (stream water is used for drinking).</li> <li>-Less groundwater is available.</li> </ul>	<ul style="list-style-type: none"> <li>-The park is proposed to be a drainage area (Hydrology study just completed).</li> <li>-There have been recent fish kills, which are around heavy rainfall periods and not are bloom-related. Depleted oxygen has occurred when fish kill happens.</li> <li>- There are groundwater issues in the wetland itself.</li> <li>-Springs were a source of drinking water.</li> </ul>			
<b>Water quality</b>	<ul style="list-style-type: none"> <li>-Coastal subdivisions getting brackish water from taps.</li> <li>-Runoff hurting coastal water quality.</li> </ul>	<ul style="list-style-type: none"> <li>-Most important Vital Sign because without water, there are not plant communities.</li> </ul>			<ul style="list-style-type: none"> <li>-Cesspools leaching into coastal water in front of Bayview house; fish no longer abundant.</li> <li>-Oli oli can move from salt into freshwater</li> </ul>	<ul style="list-style-type: none"> <li>-Sewage seeped into ocean when treatment plant pipes broken during last typhoon.</li> <li>-Traditional collection of water was via</li> </ul>	<ul style="list-style-type: none"> <li>-Leptospirosis more prevalent, with 4 known cases of death.</li> <li>-Piggeries, common in villages, are one cause of contamination of</li> </ul>				

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	ALKA	KAHO	PUHE	PUHO	KALA	WAPA	NPSA	AMME			
					and visa versa. -Freshwater displaces squid along coastline. -Topside communities drying out Waikolu valley due to water use. -Topside cattle stir mud in valley streams.	rainwater, but the rain has changed. -Air and water cleaner during the War period. -Deforestation, construction, and land erosion all factor in to the problems with water quality.	water sources. -Several beaches not safe for swimming. -Leone village had mangroves that used to filter water, but they are now damaged or depleted.				
<b>Freshwater animal communities</b>		-Should monitor fishpond because both a cultural and natural resource. -Opae ula used for food and bait. -Hapawai used for food and jewelry; shells found at Kaloko. -Kupe'e used for food and jewelry (adornments); found in brackish waters. -Manini – found in Queen's bath, which are not supposed to be in pool. -Mosquito fish (guppies) are invasive. They eat opae ula and their larvae in anchialine pools.	-Hawaiian Calendar had kapu season for fishes. -Freshwater oopu [goby] not seen for a long time; was caught for food -Alowalo buries itself under the sand waiting for water, now no water so they die. -Opae shrimp used for food.	-Populations of freshwater and anchialine pool animals appear to be decreasing. -Less hīhīwai and water crickets are declining (used to feel them on leg in 1970's and 1980's when sitting by the pools). -Fewer opae ula, which are good for eating and are mixed with dirt for bait. -Fewer Damselies and dragonflies. -Exotic tilapia in the pond.	-Oopu is now and was harvested. -Introduced Tahitian prawns have been mixed into the opae ula habitat.	-People eat freshwater eels and shrimp. -Coconut crabs declining and seem smaller. -Tilapia introduced. -Changes occurred with land use, otherwise, not much in population changes. -For families with homes on stilts in wetland/swamp, freshwater fish very important food source. -Connections to the food source are needed to perpetuate traditions.	-There are now more eels in Vatia village streams.	- Tilapia an issue in wetland and swamps. Enters during heavy rains. -Nnot many dragonflies or damselflies, but lots of mosquitoes. -Seasonal butterflies, plus the Gardian butterfly (lays eggs on one plant sp), and Monarch butterfly. -Rain floods down low, including the park lands. -Shortly after war, freshwater shrimp were consumed for food.			

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	ALKA	KAHO	PUHE	PUHO	KALA	WAPA	NPSA	AMMIE			
<b>Marine fish</b>	<p>-Fish that were abundant but are now rare include: Manini, uouoa (mullet juveniles), akule, rockfish, aholehole, maiko, naena, api, and kala.</p> <p>-In the 1950's, by Makalawena, floating dark objects would wash ashore, which were about 2 inches thick. These were regurgitated mucous or vomit from whales that contained manini.</p> <p>-Today at Kukio there are no keiki fish.</p> <p>-Another fish that should be monitored is the Box fish.</p>	<p>-Fish are source of life; people live off of many species of fish.</p> <p>-Anchialine pools now filled with algae (previously supported opae ula, now mosquito fish)</p> <p>-Serious declines of fish (e.g., manini, opihi, wana ukiuki, opae ula).</p> <p>-Monitor humpback whales. Studies say whales staying in Alaska longer. How does this impact populations arriving later in Hawaii?</p> <p>-Historical change in opelu and moi populations because traditional methods of feeding (i.e., fish farms) are no longer practiced, so species are not staying in region.</p>	<p>-Don't see schools of awa, opelu, and akule anymore; no area to spawn.</p> <p>-Sharks are not important to monitor. What is important is the heiau. If we take care of the area as it used to be, the [Pelekane] heiau will pop up like before.</p> <p>-There is a lack of culturally important fish including: paauau, awa, opelu, akule, mullet, aku, ahi, halalu, moi, upapalu, uu and aweoweo, several kinds of alowalo, crab, sand crab, honu, mano [shark], and puhi [eel].</p> <p>-Mano is an amaukua.</p>	<p>-Fish populations decreased overtime.</p> <p>-Significant collection of aquarium fish.</p> <p>-Fishponds were nursery areas for fish such as puhi, ohua, and sea cucumber, but there are fewer native fish now due to exotic predators such as taape.</p> <p>-Specific fish groups mentioned to be decreasing include wrasse, goby, pakuikui, convict tang, puhi, manini, lauiपाला, and ohua.</p> <p>-Floating balls of whale regurgitation containing transparent ohua have been found.</p>	<p>-Perch (taape and toau) are eating the native fish keiki (fry) such as menpachi.</p> <p>Therefore the native fish are not as abundant.</p>	<p>-There were more fish before war than after war.</p> <p>-Turtle was not uncommon in the past. Still is occasionally taken for family festivals (harvest is illegal).</p>	<p>-Fish populations are decreasing.</p> <p>-Parrotfish, groupers, and surgeon fish populations are increasing.</p> <p>-2003 records indicate mackerel population of 10,000. In 2004 there were few mackerel, now almost none in some villages.</p> <p>-Palaia fish have drastically decreased.</p>	<p>-Some shellfish and invertebrates (e.g., octopus) are harvested.</p> <p>-Some harvesting is legal and some is illegal.</p> <p>-Sponulus were used for adornment and currency. Turtle shell plates were used similarly.</p>			

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	ALKA	KAHO	PUHE	PUHO	KALA	WAPA	NPSA				AMME
<b>Fish harvest</b>	<p>-The opae ula mixed with dirt were used as bait</p> <p>-Maybe moratoriums should be placed in certain seasons on harvest.</p> <p>-The pakuikui or Japanese red tail used to be considered a rubbish fish but is considered delicious now.</p>	<p>-Fish collections are made for the aquarium trade.</p> <p>-Monitor remaining fishponds as they are a source of awa, moi, amaama (tilapia), manini, puhi (predator), and shellfish.</p>	<p>-When the ocean is disturbed, it changes everything (e.g., introduction of ciguatera, from red tide). Must stop eating the reef fishes, and now eat only kole and paauau (food) from the reef.</p> <p>-Awa was traditionally farmed in fish ponds.</p> <p>-In the Harbor area, the people can't fish because of interrupted water flow, so need to make an opening to increase fishes.</p>		<p>-Fishing is not utilized as much as it was in the past.</p> <p>-According to one participant, 27% of the food on Molokai is hunted, gathered, or fished.</p> <p>-Sea urchins are eaten both currently and traditionally.</p> <p>-When the hala tree fruits turn yellow, it is time to harvest the sea urchins.</p>	<p>-There was no refrigeration so there was regular, small scale harvest of fish.</p> <p>-Chamorros used field weirs.</p> <p>-Chamorro used gigau, v-shaped nets to catch fish; this is now mostly prohibited.</p> <p>-Chamorro also used other kinds of nets to catch fish: gigau, chichinchulu, tekin, and gadi.</p> <p>-Fishing with these nets was common until the 1970s. Marine preserves have affected cultural practices.</p> <p>-Bleach, poison, and dynamite fishing is outlawed.</p> <p>-Decreases in fish populations and fish size are noted.</p> <p>-Juvenile rabbit fish are a delicacy.</p>	<p>-When mackerels come, a boy (Taulealea) goes to high point to look for them.</p> <p>Mackerel cooked in umu (traditional method), village feasts. Tradition stopped due to cultural changes &amp; fish decreases.</p> <p>-Fish sold for profit, more harvested.</p> <p>-Dolphins jumping in bays = schools of mackerel driven to shore.</p> <p>-Palolo (yearly spawning of marine "worms") increased, eaten.</p> <p>-Vaisua (giant clam) collected, decreased populations.</p> <p>-Changing fishing methods, now rod/reel instead of nets and spears.</p> <p>Negative impact on fish populations,</p>	<p>-Area used as fishing ground and important for turtle foraging.</p> <p>-People from different countries fish in Saipan.</p> <p>-Filipino-based (bamboo) and some local (tin can) traps used.</p> <p>-People use nets (talaza) from the shore.</p> <p>-Silverfish (atuli) fished a lot.</p> <p>-Pink goatfish (tiao) have decreased over time.</p> <p>-AMME and western Saipan lagoon area used for traditional cast net and spear fishing.</p>			

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						-Elders report fish off Guam taste different than from other islands. -Certain families are considered fishing families and know when to set nets, look for crabs, and know the algae.	more fish caught with new methods. -Western Samoa uses traditional fishing methods, depend on fishing for food. Not in American Samoa -Gill netting in Ofu/Olosega.				
<b>Benthic marine community</b>	-Fewer resources in the ocean and nearshore areas. -Coral reefs are impacted by human use. -Increased human population leads to increased visitation. -The cultural advisors believe turtles are too numerous and need to be managed as they have adverse impacts on fish and consume too much limu. -Fish are being overharvested but turtles cannot be harvested. -Opihi are depleted from	-Important marine resource: limu -Marine communities change with development of the marina, and an increase in people. -Tidepools are losing their biotic diversity. -Monitor coral reefs because they have biological and cultural importance. -Monitor impacts of coral bleaching and harbor expansion. -Monitor turtles and their impacts on other species	-Crabs, limu, and alowalu are not abundant like before. -Loss of limu observed over time, due to over-siltation. -Limu ele ele is coming back, resulted in return of turtles. -Limu is used for seasoning, as a vegetable, medicine, taste enhancer, and to keep healthy. -Red coral now a problem in the general area of the island.	-Sea lettuce no longer in Keoneele cove. Lettuce gone before turtle population rose. Sea lettuce appeared seasonally & was raked up, used for fertilizer. -Branched seaweed (like ogo) was plentiful. Used to clean goggles & preserve fish. -Hinahina limu and ele ele decreased -Size and amount of kupee decreasing (due to food & jewelry harvest). -White snails	-Kala and limu not abundant like before -There used to be Condiun (limu) at Mormon pond. Not any more. -Change with limu. -There is still an acanthophera harvest. -Other concerns: invasive algae, ballast water issues, the effects on opihi (not a problem yet at KALA), and the sands and currents. -Discuss these issues with the patients about the long-term. -The crown of	-Commodos were set up over ocean via ramp/plank (no flush toilets). -Not much algae damage. -For some, octopus is a delicacy. -Some people harvest coral during low tide. Although illegal, there is large scale harvest (in Inarajan?). -Some burn coral to make lime for betel nut chewing. -Shellfish were introduced after the war for the button industry. -Dogus, a small limpet, used to	-Increase in algae from 2 streams in Leone negatively impacted coral reefs, which have been dying over the last 10-15 years. -Raw sewage is dumped into Pago Pago harbor. Serious enforcement issues -Natural cyclones damaged coral reefs. The substrate is less damaged, and reefs may grow back in 5-10 years. -Limu and sea cucumbers are less plentiful	-Seagrass abundance increasing with shift toward algae. -Aerial photos show shifts back to marine sand, followed by increase in seagrass. -Shorter species of seagrass more overgrown than longer spp. -Invertebrates that live in seagrass should be monitored. -Crab pit traps are set in the park. -Some ethnic groups eat white crabs, leading to decline. -Urchin numbers			

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	<p>overharvesting</p> <p>-Sea urchins and sea horses used to be common on limu.</p> <p>-Enforcement needed to ensure sustainable gathering.</p> <p>-Ballast water is a concern with its bringing in of invasive species.</p> <p>- "when the ulu is small, the hee is small" ("harvest appropriately to the season, and take only what you need").</p>	<p>and their ecosystem, due to the apparent population rebound. Historically, turtles were an important food source.</p>		<p>were more common, now black shell more common.</p> <p>-Limpets collected for money are rare. The interp. staff points them out on guided walks.</p> <p>-Fewer sea cucumbers and black sea urchins.</p> <p>-Collector sea urchin is overharvested.</p> <p>-Fewer slate pencil sea urchins (Uses: food, files, &amp; fish hooks, carved into kii).</p> <p>-Fewer aama &amp; 7/11 red crab.</p>	<p>thorns starfish which eat the corals are no longer seen as much historically. Tide events and rainfall may have changed this.</p>	<p>be found at Apra Harbor.</p> <p>-Clams (pagan, giant clams) used to be popular.</p> <p>-Fewer nice shells found on beach now.</p> <p>-Cowries more abundant live and on the beach.</p> <p>-Coral reef is dead or has little life in areas south of the Agat regions which may be due to reef degradation and water quality (sedimentation).</p> <p>-Sea cucumbers harvested and sent to Asia.</p>	<p>nowadays.</p>	<p>have decreased and became a delicacy as other cultures arrived.</p> <p>-Snails introduced to brackish and freshwater are taking over quickly.</p> <p>-Shifts of coral reef outside Saipan will cause impact on AMME.</p>			
<b>Bats</b>	<p>-Used the name "olepe" for bats. Bats used to frequent big caves, but these caves were destroyed by development.</p> <p>-There is a cave in back of the Kona Village Resort, but no bats for about 5</p>			<p>-Fewer bats present in park than before, were seen in front of admin. building, cove, over Honaunau Bay, by amphitheatre, and mauka.</p> <p>-Bats too small to eat, and so had different</p>	<p>-Bats rarely seen. Sightings while fishing near Waikolu Valley. Seen occasionally at the top of the Pali trail.</p>	<p>-Fruit bats are eaten.</p> <p>-Populations reduced likely due to brown tree snake and hunting.</p>	<p>-Increase in Tongan &amp; Samoan fruit bat populations on all islands since cyclones.</p> <p>-More bats in the park.</p> <p>-Sheath-tailed bats, none sighted on American Samoa according to</p>	<p>- No bat colonies in the park or island, but there have been sightings.</p> <p>-General AMME area was bat habitat.</p> <p>-Bat habitat still exists on Saipan.</p> <p>-Bats were and are a popular food item.</p>			

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	years. -Bats need cooler weather and would be more common on Hualalai mauka. -Bats never seen around Makalawena.			level of cultural significance. -Seen at dusk, early morning, over water & land. -Now usually by ramp, coming from mauka or the trees.			survey. -In caves near Faleasao, sheath-tail bats or/and swiftlets observed by locals, and sometimes people mistake swiftlet for bat.	-Bats are not legal to hunt but people do. -Bats were an economic activity and cash economy.		
<b>Landbirds</b>	-Alala (Hawaiian crow) used to be at Kaloko. -No more elepaio (Hawaiian flycatcher). -The iwi are dying, as evidenced by carcasses on the ground in the forest. -There are fewer io and pueo.	-Pueo is aumakua for some families. -Feathers are no longer collected legally, birds are still culturally important.	-Pueo important as aumakua -Historically, feathers of birds were taken for standards, or the birds were eaten. -Nene here historically.	-Golden plovers and io are seen. -Yellow billed cardinals and barn owls are frequently sighted. -The saffron finch is a problem. -Doves and mynas are numerous and increasing. -Other exotic birds present include kalij pheasants and erckels (Franklin).	-Should examine the relationship between how plant communities have changed and effects on birds. -Feathers have a cultural use. -Newer introductions of migrant birds noted over the past 4 years. -One owl and one hawk sighted.	-There are lots of Durango (crows) that attack people. -Coco bird (guam rail) is extinct on Guam; probably lost in 1970s. Snakes played a role. -Cats are a major bird predator on Guam. -Micronesian kingfisher is now missing from Guam. -Many native birds were harvested for food. -Introduced quails and other birds are now more common. -Migration of Golden plover presents a	-Mynah birds are drowning out native birds in recent years. The cardinal honeyeater now is found in mountains, driven to higher elevations by mynahs. -The wattled honeyeater is common due to large size and ability to live in most habitats. -The Samoan starling may be a keystone species, has a broad diet (eats almost anything); starlings disperse seeds. The starling is not disturbed by mynahs.	-Two endangered species: Nightingale reed warbler, and Moorhen. -AMME is only spot where Nightingale reed warblers remain. Little known of their behavior. -Native Micronesian kingfishers common at park. -Honeyeaters and Mariana fruit dove common at AMME. -Mariana swiftlet & Micronesian megapode not found. -Feral dog & cat problem in park & on island.		

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						<p>concern for bird flu.</p> <p>-Generally, bird populations are increasing although they are not native species.</p>	<p>-Lots of purple swampthens.</p> <p>-Park staff noticed many rats on Mt. Lava (Tau), which could adversely affect bird populations.</p>	<p>-Brown tree snakes are an issue, sighted but none caught.</p> <p>-Prime and opportunistic snake habitat, a variety of food (bird, geckos, and skinks).</p>		
<b>Seabirds</b>	<p>-Ka iwa rare.</p> <p>-Two types of ulili (wandering tattler), big and small. Were frequent from Kona Village Resort to Kalaio. Whistle when they come in from ocean.</p> <p>-Aukuu (black-crowned night heron) seen along fish ponds during day &amp; shore at night.</p> <p>-The ponds provide important habitat for birds.</p> <p>-Hawaiian duck (koloa) is rare. There were lots of ducks around the resort area but the ponds are drier so there are</p>	<p>-Hawaiian stilt &amp; coot affected by avian botulism outbreak in 1994-1996, resulting in a population decline. Now numbers have increased.</p> <p>-Aukuu, koloa (golden plover), &amp; koloa are possible aumakua</p> <p>-Iwa (frigatebird) seen when storms imminent.</p> <p>-Migratory birds drawn to Kaloko Pond, including ruddy turnstones, shovelers, sanderlings, mallards, dunlins, yellow legs, scaup, and</p>	<p>-List of important birds: koloa, akekeke, aukuu, ulili, aeo, bristle-thighed curlew, koloa, iwa, koae, akekeke, noddy terns.</p> <p>-Iwa and noddy terns still used to detect fish in the ocean [for fishermen].</p>	<p>-The night heron is the only known native bird breeding in park.</p> <p>-High pitched crying sound is the hapai bird, (Uwe weke, may be a petrel).</p> <p>When you hear this bird it means somebody's pregnant.</p> <p>-Iwa comes in to shore before big storms.</p> <p>-The white-tailed tropic bird roosts on Hookena cliffs.</p> <p>-In flight over the ocean seabirds indicate an ahi school under them.</p>	<p>-Many seabirds used to nest on the ground near the lighthouse, but predator issues preventing them from doing so now.</p> <p>-In certain archeological sites there is evidence of seabird harvesting.</p>	<p>-Seabird populations on Pola Island increased.</p> <p>-More frigatebirds, white terns, and red-footed, brown, and masked boobies.</p> <p>-At Sauma Ridge, there is a noticeable increase of noddy populations.</p> <p>-At Afono Pass, shearwater calls decreased after last cyclone.</p> <p>-Petrels and shearwaters seen far off-shore.</p>	<p>-Migratory stop for sea birds like Golden Plovers.</p> <p>-Golden Plovers are low risk carriers of bird flu.</p> <p>-Wimbrels, Turnstones, Plover, Tattlers, Herons, Egrets, Tufted ducks, and Northern shovelers are found at AMME.</p> <p>-Occasionally, Blue-footed boobies, Seagulls, Sooty terns, and Black-headed terns are sighted when storms flow through.</p> <p>-Certain species of birds were used for open water boat</p>			

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	fewer ducks.	grebes.						navigation.			
<b>Climate</b>	<ul style="list-style-type: none"> <li>-Rainfall patterns are different, there is less rain, and it is harder to predict from clouds.</li> </ul>	<ul style="list-style-type: none"> <li>-Less rain than in years past. Has the vog had an impact on the climate?</li> <li>-Coastline changed due to rise in ocean. Less beach now. Old pictures show that one could gallop a horse along the coast in sand. Now, just rock.</li> <li>-Submerged cultural resources imply that the coastline was farther offshore (e.g., remnant of rock wall alignments).</li> <li>-Big surf negatively impacts the fishpond wall.</li> <li>-Overhead noise from the airport is an issue.</li> </ul>	<ul style="list-style-type: none"> <li>-If winds are named, they are significant.</li> <li>-Mumuku winds ("enhanced tradewinds") arrive during winter months; also called makai winds.</li> <li>-There was no mumuku winds for a long time but it did come in Feb 2005.</li> <li>-30-40 years ago, this area was cooler; weather is different now.</li> <li>-The south wind storms bring rain.</li> <li>-Hawaiians look to wind to determine what actions to take (e.g., sailing).</li> <li>-Used to rain a lot, providing water to lower areas.</li> </ul>	<ul style="list-style-type: none"> <li>-Warm season has lengthened, it is hotter, and starts earlier (March rather than June).</li> <li>-Hurricanes have become more of a threat in the region.</li> <li>-Frequent vog.</li> <li>-Recently more rain. It rains more in the summer, and the winter is dry.</li> </ul>	<ul style="list-style-type: none"> <li>-More rain over the last five years. Drought in 1990's, before that it rained every night.</li> <li>-Waihanau winds can destroy buildings (tore off roof). Occurred historically, lose plants and ornamentals from wind once per year.</li> <li>-Drought of the 1990's lowered animal numbers.</li> <li>-The four winds (one of which is the Waihanau) is a dance performed at the Merrie Monarch.</li> <li>-Settlement began on the Kalawao side of the island and then moved to the Kalaupapa side. Is this because of</li> </ul>	<ul style="list-style-type: none"> <li>-Chinese air pollution is a factor in Guam (yellow haze, air).</li> <li>-Forecasting has become more difficult due to changing and more variable conditions.</li> <li>-There have been few casualties in Guam with typhoons.</li> <li>-Red sunsets all across the sky preclude a bad storm, which are more difficult to see with Asian air pollution.</li> </ul>	<ul style="list-style-type: none"> <li>-Wind patterns changed last year [2005].</li> <li>-Tradewinds, which normally start in May, have not started yet [as of May 17, 2006].</li> <li>-On the north side of Tutuila, sea conditions are rougher, whereas the south side should be rougher this time of year [May, 2006].</li> <li>-Higher rainfall has resulted in more flooding.</li> <li>-Air temperature is hotter.</li> <li>-Increase in landslides; tamaligi (or tamalini) tree (<i>Albizia</i> spp.) could be a cause of increasing agricultural activity in forest.</li> </ul>	<ul style="list-style-type: none"> <li>-Beach erosion is being studied right now.</li> <li>-Mango tree blooming and fruiting used to be more predictable and varied slightly by locale, but now is less predictable.</li> </ul>			

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					climate?		-More lightening.				
<b>Landscape dynamics</b>	<ul style="list-style-type: none"> <li>-Remains of traditional Hawaiian circular plots. Environment for taro, gourds, &amp; sweet potato.</li> <li>-Shoreline used to dry fish. Wind blew flies away.</li> <li>-Shoreline was fished.</li> <li>-Trails include Mamalahoa (1870's carriage trail), Hinalani (mauka-to-makai trail), native plants &amp; mature trees along trail.</li> <li>-Restored Kaloko fishpond wall built on original foundation</li> <li>-Geology and topography influenced land use.</li> <li>-Certain sites had historic &amp; spiritual</li> </ul>	<ul style="list-style-type: none"> <li>-One site is famous for salt pans and fish pond, but is gone now (destroyed by tsunami?).</li> <li>-Fishponds: fish were transferred from pond to pond as they increased in size. Now no fishponds.</li> <li>-Farming: people farmed in the park area, areas traditionally irrigated. They grew taro, sweet potato, and watermelon.</li> <li>-Guava and mangoes used to grow along the rivers.</li> <li>-Heiau: the alii chose this site for the heiau and royal court because it was bountiful. Now it is not.</li> </ul>	<ul style="list-style-type: none"> <li>-Difference in water drainage due to bulldozing in the region of a cave mauka.</li> <li>-More housing and subdivisions in the area, more agriculture (coffee is a common crop; bigger farms are subdivided into smaller farms for "gentlemen farmers").</li> </ul>	<ul style="list-style-type: none"> <li>-Aerial photos show patterns of historic land use including terraces, rock walls, fish ponds, former pali trails, prehistoric agricultural uses, locations of goats and akia (native poisonous plant), and the location of former cattle areas.</li> <li>-KALA is well represented in the Mahele records.</li> <li>-Historic photos are available starting 1866.</li> </ul>	<ul style="list-style-type: none"> <li>-Demographic shift is obvious since the end of the war and even since the 1980s.</li> <li>-No zoning before the war, but now standard needs to be met.</li> <li>-After WWII, the population went from 22,000 to 200,000.</li> <li>-Guam went from agricultural to military and labor, increasing ¼ of land to 1/3.</li> <li>-Guam was very agricultural, grew yams, taro, bananas, corn, and surgarcane.</li> <li>-Past lack of zoning allowed industrial development in karst regions.</li> </ul>	<ul style="list-style-type: none"> <li>-Cyclones affected changes in land, including landslides.</li> <li>-In last 10 years a decrease in farming in park boundaries on Tau.</li> </ul>	<ul style="list-style-type: none"> <li>-Urbanization around park.</li> <li>- Development in the wetlands.</li> <li>- The wetlands were a heavily used dump before war. Plowed over and relatively undisturbed after war.</li> <li>-The threat is urbanization to the east (Puerto Rico Hill, Naval Hill area)</li> <li>-The old dump was potentially just capped &amp; could be leaching in park.</li> <li>-Tires and heavy metals are an issue.</li> <li>-Ordnance from WWII dump.</li> <li>-Upper class managed coastal areas and some inland areas (with latte sets) &amp; inland chiefs.</li> </ul>				

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		significance (e.g., child birth documented in petroglyph). -Cultural & historic sites significant for where they were placed, not random.						-Attitude was 'we belong to the land' rather than 'we own the land.' -During the Japanese period prior to WWII, 38% of Saipan was in sugar.			
<b>Established invasive plant species</b>		-Kiawe (threatens archeological sites such as petroglyphs). -Koa hale (Haole koa) –considered the second most significant threat at KAHO (after Kiawe). -Fountain grass -Mangrove (few now); adjacent lands have many trees. -Pickleweed -Christmas berry -Ivy gourd	-There is no pili (used to thatch houses) like before, due to the buffelgrass taking over the habitat. -List of invasive species: buffelgrass, fountain grass, Madagascar ragwort, Madagascar fireweed, puncture vine, wild spider flower, haole koa, panini, pickleweed, kiawe (used for charcoal; not compatible with foot traffic).	-List of invasive plants: ekoa, haole koa is everywhere, ivy gourd, opiuma, bitter melon, passion fruit, puncture vine, fountain grass, passion fruit (beach), guinea grass, fountain grass, red top grass (natal), sourbush, button aster in pili grass, kiawe, tobacco, lantana, Christmas berry, and the klu tree.	-Notable invasive species are Christmas berry and java plum. May have taken root when the dairy cattle removed in the 1950s. Historical photos may verify. -Christmas berry trees and lantana brought in for hedges. -New thorny grass ground cover near lighthouse. Need to manage this and others. -Strawberry guava, guava, and date palm present. Want to replace the date palm with native palm.	-Notable invasive species are: Indian vines, chain of love, scarlet gourd, passion fruit vine, bitter melon. -Postwar modern nursery is important: limes, mangoes, avocados, tobacco, and corn.	-Eradication of the tamaligi tree is important. -Clidemia hirta (Koster's curse) is a shrub that invades gaps in forests. Its spread has been linked to soil disturbances, especially by feral pigs. It is prevalent on Mt. Lata, Tau Island. -More invasive species in parks such as papaya, morning glory, mile-a-minute vine, and hibiscus, which takes over native terrain.	-Scarlet gourd is blanketing wetlands. -Mangroves are not shade tolerant and are affected by scarlet gourd. -Scarlet gourd is an island-wide issue. -Invasive tangentangen harbors endangered birds. It is used for barbecue wood, and adds nitrogen to soil which is good for agriculture. - Some areas covered by Scarlet gourd or Wild hydrangea, which die off when it becomes hot.			

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<b>Early detection of invasive plants</b>	-Invasive plants are viewed as a problem. -House landscaping is a source of invasive species.		-Firebush is confined to higher elevations. -Invasive species coming in with soil.		-Miconia is a concern. -Change in plant species in hunting area. -Chinese banyan is established, but removing it unpopular as it is ingrained in community.		-Surveys conducted for invasive species (e.g., Strawberry guava priority). -The Panama rubber tree on Tutuila (outside park), may be dispersed by fruit bats & birds attracted to bright red seeds.	-Lantana is an island-wide invasive, not an issue at AMME yet.		
<b>Focal terrestrial plant communities</b>	-A list of depleted plants of concern include: pili grass, periwinkle plant, kaunaoa (used for bathing) at Makalawena, pua kala, red lau hala, poha, Kona loulou palm (Kukio has some, two at Kahalu), alahee (Kohainaiki is cultivating), lama (Hawaiian date tree, Kookoolau (for medicine and tea), beach hinahina, pohuehue vine (cleared from beach for	-Coastal sandalwood was an important agricultural product. -Naio (false sandalwood) population was monitored. -Other important species: ahulua ahuhu (a fish stunner), uhaloa makalaoa (the clearing of Kaloko increased number), wiliwili, akulikuli, beach lama, violet plant (development plans changed after plant	-Ohai ulaula was plentiful before, but is now endangered. -Pau o hiiaka population is holding but is impacted by being stepped on and competition with other plants. -Coconuts: young coconuts are taken off trees and are not allowed to pollinate and mature for safety reasons. No coconuts floating in the bay, so no regeneration. Coconuts used for scrub brushes, ropes,	-Focus on plants useful to human culture. Important plants: sweet potato, coconut, banana plant, pia (arrowroot), ulu, sugar cane, taro, gourd, laau (medicine plant), awa, noni (can eat young leaves; people come and harvest fruit from park), kukui, auhuhu (fish stunner), akia (also fish stunner), ulei (rose family; sticks used for traps, strong and flexible), lauhala, makalaoa (population is	-Some ornamental plants should be mapped/ documented because many of the individual plants tell a cultural or historic story.	-Coconut and betel nut trees are important. There is a danger of losing coconut trees due to disease. -Culturally important plants: flame tree (introduced), breadfruit, banyan tree (taotaomona or spirits inhabit the tree), lotigo (contains codeine or something similar), lada ( <i>Morinda</i> sp.). -Must ask taotaomona before entering the jungle; a formal request is	-Negative effects of cyclones on Tau (e.g., near Fitiuta village) when most trees lost leaves and coconuts were gone.	-Mangroves harbor endangered spp. -Were more wetlands. 60% filled or paved, affecting water quality & function. -Wetlands were used for agriculture. -During war, wetlands filled to service docks. -Part of forest filled during war. -Villages named for plants there. -Many plants grown or harvested for medicinal or traditional value. -In Carolinian		

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	ALKA	KAHO	PUHE	PUHO	KALA	WAPA	NPSA	AMME			
	<p>tourists), makaloa, and auhuhu, (once used for stunning fish, there is a little near KAHO but is very rare now). -Naupaka is pretty strong so there may be no problem with population. -People need to be taught how to gather plants in a sustainable way.</p>	<p>discovered), ulu, kookoolau, pili, Hawaiian pickleweed (used as food and insulation to cool fish), pau o hiiaka, hinahina, beach heliotrope (food), alahee, milo, hau, kou, naupaka, ilima (lei &amp; medicine), puakala (medicine), noni (medicine, food, dye), and kukui.</p>	<p>firestarters, torches, and implements. -Hawaiian calendar used to determine when to plant certain species.</p>	<p>dying back, shorter height), pohuehue (vine, used for fishing hukilau, jump rope, laxative, and to heal broken bones), pua pilo (used for medicine), there is less paper mulberry (wauke; used for cloth).</p>		<p>needed. -There is a decrease in coastal plants: nanasu (landscaping), naot, daog (landscaping), hibiscus tree, nigas (driftwood), ifit (beautiful wood used for houses).</p>		<p>society, information on herbs protected &amp; passed down. Some information lost. -ca 782, Chamorro cultivated rice. -Plants for medicine &amp; food. -Federico palms were cultivated. -Mangrove wood for oxcart staves. -Wild hibiscus for cordage, footwear, &amp; net fiber. -Wild yams from jungle.</p>			
<b>Terrestrial invertebrate communities and Early detection of invasive invertebrates**</b>	<p>-The coconut white fly is a problem as well as jasmine and honeysuckle, which grow wild. -Concerns with the pānini bug which kills cactus, flies which attack green mango, papaya rot, and aphids.</p>	<p>-Gall wasps have negative impact on wiliwili. -Damsselfly, very rare.</p>				<p>-Native snails almost gone. -Now African snails common. -Rosy snail introduced to affect African snails. -Parasitic flatworms (non-native) affected native partulids. -Ornamental land snails no longer common. -Purses, vests, games, &amp;</p>	<p>-Higher incident of wasps in the forest. Red-vented bulbuls were brought to the islands to eat wasps.</p>	<p>- Mosquitoes not an issue. -Native tree snails are very sensitive indicator species. -Japanese brought African snails to combat cane stalks. Others say Okinawans brought them in as a delicacy. They seem to be recovering population.</p>			

NOTE: Information is opinion and may not be scientifically verifiable	<i>Table 2. Summary of Values, Beliefs, and Opinions from 8 PACN Park Units' Focus Group Meetings.</i>								USAR*	HAVO*	HALE*
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						<ul style="list-style-type: none"> <li>cigarette cases from snails.</li> <li>-Most animals lost during war.</li> <li>-Coconut crabs common food but rare now.</li> <li>-Small crabs harvested, big crabs gone.</li> </ul>					
<b>Cave community</b>		<ul style="list-style-type: none"> <li>-Caves are an extremely sensitive resource issue. Focus group determined it is not appropriate for people to talk about caves. Some caves house human remains.</li> <li>-There are caves with contents that are unknown.</li> <li>-There are submerged caves near KAHO.</li> </ul>				<ul style="list-style-type: none"> <li>-Burial grounds and massacre sites in caves.</li> <li>-Caves used for refuges during war &amp; typhoons.</li> <li>-Pictographs &amp; hand prints in caves.</li> <li>-Caves used for ceremonies.</li> <li>-Many caves built by Japanese. Natural caves used by Chamorro.</li> <li>-Abundant herbal plants and mortar stones found near caves by settlements.</li> <li>-Caves not considered sacred, some artifacts in caves may be sacred.</li> </ul>		<ul style="list-style-type: none"> <li>-Caves appear to have been used for burials, art, and other items.</li> <li>-Post WWII caves were investigated and looted for artifacts.</li> <li>-During the Latte Period, burials occurred near latte stones on family-used sites to protect bones from raids by other chiefs/villages, and from being taken for tools (tools, weapons, and jewelry)</li> <li>-Families in Saipan hid in caves during the war.</li> </ul>			

NOTE: Information is opinion and may not be scientifically verifiable	<i>Table 2. Summary of Values, Beliefs, and Opinions from 8 PACN Park Units' Focus Group Meetings.</i>								USAR*	HAVO*	HALE*
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<b>Erosion and deposition</b>		<ul style="list-style-type: none"> <li>-Mountains are connected to ocean. What happens on land, impacts the ocean.</li> <li>-Monitor siltation, which may be related to development.</li> <li>-Deposition at Aimakapa has negative impacts on water quality, plant community, and bird nesting.</li> <li>-There is less shoreline due to siltation, and deposition has covered archeological sites.</li> </ul>	<ul style="list-style-type: none"> <li>-Not a pond at Pelekane; it is the silt from the stream. There is no freshwater filling it.</li> <li>-Sand from Kawaihae was sent to Mahukona (used to be plentiful) and is now being brought in to Spencer beach artificially because not being replenished like before.</li> </ul>	<ul style="list-style-type: none"> <li>-Concern about marine impacts of crushed coral sand placed along the shoreline of the cove to stabilize it and cover the roots of the coconuts. During high tides or storms the coral washes out into the cove and has to be replenished frequently.</li> <li>-Erosion from development has been noted.</li> <li>-Surf generated erosion is a problem along park shoreline.</li> <li>-Cultural features are getting exposed in Kilae from upslope land clearing. The top of the cave area is becoming exposed</li> </ul>		<ul style="list-style-type: none"> <li>-Erosion has increased over the last 20 years (some estimates claim it has doubled since the 1980s).</li> <li>-Builders often dig roads during the rainy season without setting up erosion or retaining fences.</li> <li>-From celebrations and other land practices such as development.</li> <li>-Fire has been used in Guam for about 3,500 years (for hunting or farming?).</li> </ul>	<ul style="list-style-type: none"> <li>-Water runoff from agriculture and erosion has damaged the coral reefs.</li> <li>-Increase in flooding after heavy rainfalls affects coral reefs, silt washed into ocean.</li> </ul>	<ul style="list-style-type: none"> <li>-Related to economic development and population growth.</li> <li>-Wetland filling appears to affect species in lagoons.</li> <li>-Erosion noted in many yam areas as they are being manipulated by modern development and/or agriculture. Introduced ornamentals are being found in these areas.</li> </ul>			

\* Focus group meetings have not yet occurred at HALE, HAVO, or USAR.

\*\* Two Vital Signs are combined in this row

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#### **Additional references:**

Appendix E: Working group reports

Appendix A: Park overview reports