



Pacific Island Network Quarterly

Quarterly Newsletter of the
Pacific Island Network
Inventory & Monitoring Program
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Seth Judge offers some perspective from high above the treeline on Mauna Loa where the endangered **Hawaiian petrels** make their burrows.

Notes from the Field
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Landscape and Groundwater Dynamics are two of the least tangible but most important resources for I&M to monitor.

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War in the Pacific National Historical Park is divided into seven separate units on the island of Guam and in surrounding coastal waters. Learn more about this unique NHP.

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The National Park Service has implemented natural resource inventory and monitoring on a servicewide basis to ensure all park units possess the resource information needed for effective, science-based management, decision-making, and resource protection.

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***NOTE:** Unless indicated all photos and articles are NPS.

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Inventory Update

War in the Pacific NHP Plant Checklist Now Available

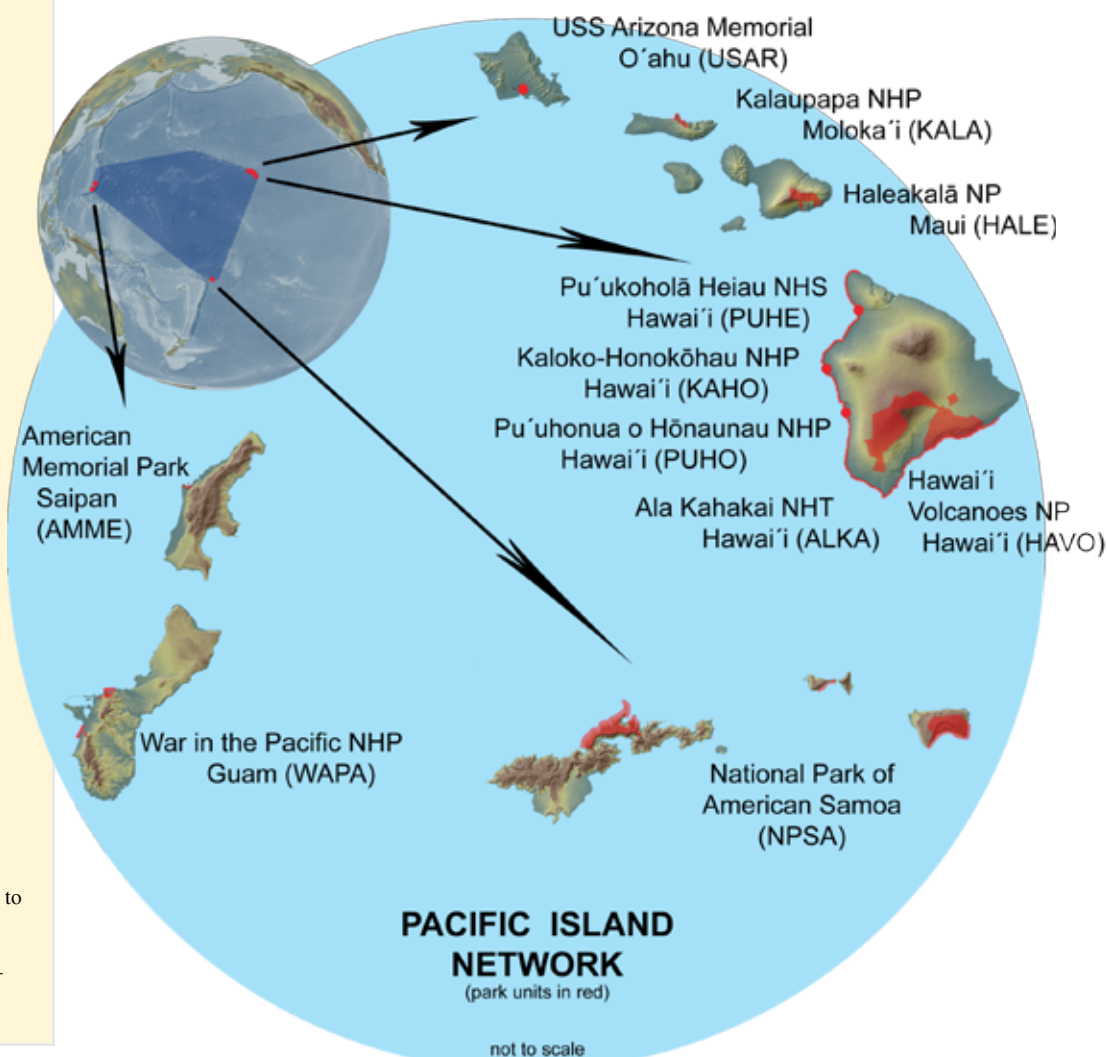
When inventory needs were assessed in 2003, a botanical survey for WAPA was one of the highest priorities because it was the only park in the PACN without a plant checklist. The inventory involved both literature searches and field surveys (2004/05) for plants that occur in the park. In addition, 755 plant specimens were collected as vouchers to create WAPA's herbarium, and 673 digital images of landscapes and individual plants were snapped. In summary, 392 plant taxa were identified within WAPA's seven park units. Of these, 44% (173) were found to be native to Guam and the Mariana Islands (15 endemic and 158 indigenous taxa). Uncommon endemic plants observed during the surveys included *chi'ute* (*Cerbera diltata*), *Maytenus thompsonii*, *Macaranga thompsonii*, *Phyllanthus saffordii*, *Xylosma nelsonii*, and *Tinospora homosepala*. The technical report for this inventory and

checklist is available at: <http://www.botany.hawaii.edu/faculty/duffy/techrep.htm>

Hedyotis laciniata pictured at right is one of the uncommon endemic plants recorded at WAPA.



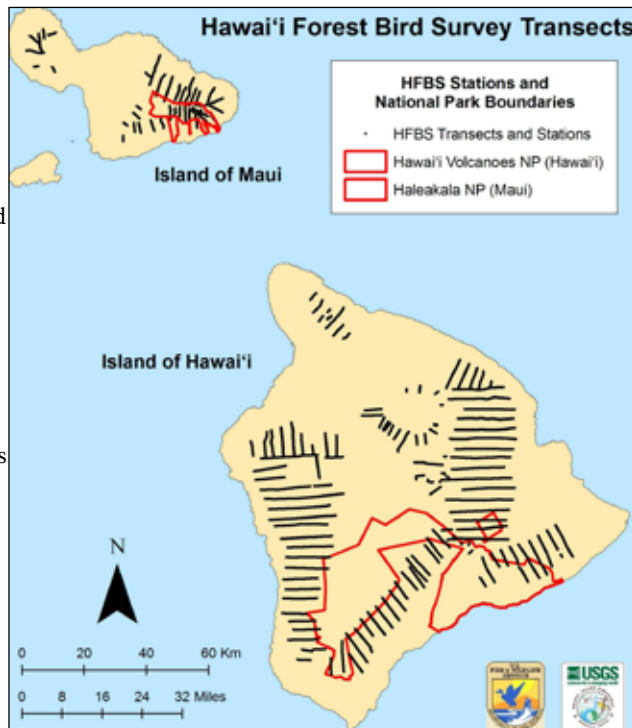
Botanist Joan Yoshioka prepares plant specimens for the WAPA herbarium.



Data Management

OLD DATA HAS NEW VALUE — Bird habitat data in HALE and HAVO provide insight into historic vegetation patterns

Although the Hawai'i Forest Bird Survey (HFBS) conducted from 1976–1981 was focused on birds, it also included some mapping of plant communities. The results of the forest bird surveys and several of the botanical components have been published, but much of the detailed information for the native and alien plant species surveys had not been retrieved from the field data sheets and analyzed. Recently, in a cooperative effort between the U.S. Geological Survey and the Pacific Island Network, a database was created to house all of the HFBS botanical data collected within and up to one kilometer outside of Hawai'i Volcanoes and Haleakalā National Parks. A total of 1,203 records were now in this database with information on the composition and structure of the plant communities, plant vouchers collected, and data on the impacts of feral ungulates recorded along each transect. Park staff and researchers can receive a copy of the database by contacting the PACN Data Manager, Kelly Kozar. A report describing the database is available at: http://science.nature.nps.gov/im/units/pacn/inventories/species_distribute.cfm



One-stop Shopping? Natural Resource Information Portal

If you have ever searched for data on NPS websites, then you know it can be an overwhelming task. The good news is... change is on the way! The newly created Natural Resource Information Portal (<http://nrinfo/Portal/Home.mvc/showWelcomePage>) aims to combine national data sets into one easily accessible location. Although the site is not fully up and running, NPS intranet users and contractors can access certified species lists, inventory status and products, climate data, links to the Vital Signs and protocol database, and other I&M and Natural Resource Program Center (http://www1.nrintra.nps.gov/nrpc_soa/) websites.

Why a one-stop data shop? In 2007, the NPS Natural Resource Program Center recognized the need to simplify the process of finding, downloading, and sharing natural resource information by launching IRMA

(Integration of Resource Management Applications). As part of the IRMA project the Natural Resource Information Portal was developed. It is anticipated that by early 2009, more tools and links will be added and eventually all national data sets including NPSpecies, NatureBib, and NPS DataStore will be combined. For the time being this site is restricted to NPS intranet users and contractors; ultimately, the Natural Resource Information Portal will be available to the general public.

One of the highlights of the Natural Resource Information Portal is the certified species lists. Derived from NPSpecies (an NPS web-based application for documenting the occurrence and status of species in national parks), certified species lists provide information such as abundance, breeding status, nativity, and management concerns. Data presented in the certified species lists are verified by subject matter experts and

Featured Staff Asia Addlesberger

Asia joined the Pacific Island Network as Data Management Specialist in August 2008. Born and raised in Hawaii, she received a B.A. in Geography/Environmental Studies from UCLA and a M.S. in Geography with a concentration in GIS from San Diego State University. Although her thesis work focused primarily on the spatial analyses of disease transmission, her main interests remain in biogeography and conservation.



After graduate school, Asia worked as a GIS Specialist for an environmental consulting firm in San Diego before deciding to return home to the Big Island. After a long move, she is glad to be back in Hawaii and close to her family. Asia enjoys hiking, running, reading, and traveling.

represent our best knowledge of park natural resources.

To access certified species lists, click on the data tab from the Natural Resource Information Portal's homepage. From there, you can easily link to certified species lists, which offer you the opportunity to view, print, or download information. The user can define search criteria such as a unit (park name) as well as a category (mammal, bird, fish, reptile, amphibian, or vascular plant). A list is then returned with download options, the number of records, and the date that the data was certified. Although these data can be useful to a wide variety of audiences, they are especially important to NPS staff and collaborators.

Stay tuned for more data management information and updates.

Notes From the Field — Monitoring Endangered Petrels

Mauna Loa is a really big mountain.

I grew up in the Sierra Nevada Mountains where I would hike, backpack, and ski. I thought those were big mountains, but they pale in comparison to Mauna Loa. Mauna Loa is the most massive mountain in the world, when we include the huge chunk that escapes our eyes under the ocean's surface. The gradual slopes extend for dozens of miles to the summit at 13,679 feet (4,169 m). The endangered Hawaiian petrel (*Pterodroma sandwichensis*) nests on this volcano. My job is to spend my days hiking the enormous lava flows of Mauna Loa and monitoring the petrels' breeding activity. The nests are spread out across the gigantic lavascape in areas where few people venture. Often the most exciting thing I'll see at a nest site is white petrel feces, or "guano". Guano is like gold to a seabird biologist like me. It tells me the birds have arrived. By the freshness of the guano I can generally tell when the bird dropped its unwanted cargo. There is often bad news on the mountain as well, like a find of petrel carcasses from predation. Nest sites often feel like a crime scene, and recording and documenting evidence of petrels can help unravel mysteries regarding their behavior and breeding success.

The seabirds nest in small lava cavities, or burrows, in pāhoehoe flows from 1,500 to 5,000 years old. The adults first fly to the burrow in early April to prepare the nest and probably mate. The pair then heads out to sea to feed and store up enough energy to lay and incubate the egg in May. The egg laying event marks the beginning of a very long reproductive season during which the breeding pair, who mates for a life of up to 30 years, share in the duties. The male takes the first round of incubating while the female heads out to sea to feed. Theodore Simons investigated the breeding biology of Hawaiian petrels on Maui's Haleakalā in the early '80s. He found that the male may sit on the egg for three weeks before the female returns to take her shift. The egg will hatch over a month later, and then both parents work all breeding season feeding the chick. The adults leave the burrow late at night and typically spend 7-14 days feeding out at sea. Then, one of the parents will return to the burrow slightly after sundown to feed the chick a rich regurgitated load of squid, small fish, and other sea creatures. The chick is fed for several more months until it is big and strong enough to first take flight in November. It is believed that the bird will not return to land again for another 6 years, when it will be old enough to breed.

park; figuratively anyway. One would think that no other animals would use this habitat. Enter *Felis catus*, the domestic cat.

Feral cats have wreaked havoc on nesting petrels for decades. These cats are wild and adapt to the harsh and dry conditions of sub-alpine volcanoes across which they are known to travel several miles per day. I have found their scats at elevations near 10,000 feet. I collect and document the scats, and perform cat scat investigations to look for the characteristic black and white feathers of the Hawaiian petrel, which unfortunately I find frequently. I also find the soft grey down of chicks, as well as the beaks of squid which were presumably in the chicks' bellies before being depredated. The petrels are easy pickings for feral cats. Surviving birds today often have burrows with very narrow entrances that the cats cannot squeeze into. The chicks however, are vulnerable late in the breeding season when they walk outside the burrow to stretch and exercise. Feral cat trapping yields captures every year, but there always seem to be a few cats that are savvy enough not to fall for the bait. The most damaging depredation events occur early in the season when the adults are incubating the egg. During this time, a cat may kill the adult, and the egg will fail. The majority of depredated nests have remained inactive for over 20 years.

Although burrow monitoring and predator control efforts take an enormous amount of time, they are essential to protect the national park's rare and beautiful resources so that others may ponder these unique seabirds, and so the petrels can continue raising their young on the slopes of Mauna Loa.

—S. Judge, PCSU Petrel Researcher



From top left counterclockwise: Seth Judge on Mauna Loa in petrel territory; Seth at a burrow site; a Hawaiian petrel pokes its head out of a burrow; the tarsus bone of a depredated petrel



Outreach and Staffing Update

Outreach

In early November, I&M participated in a three day festival at Kaloko-Honokōhau NHP. Nearly 450 fourth and fifth graders from West Hawai'i schools participated in cultural and science based activities on the beach. I&M conducted a three part activity focusing on the water cycle and the importance of anchialine pools in West Hawai'i.

On November 19th, GIS day was celebrated at the Hawai'i Volcanoes NP visitor center. I&M's Viet Doan and a few other park-wide GIS practitioners led the charge with a booth and display for the public.

Staffing Update

NPS: A staff botanist position has been advertised and I&M hopes to hire for this position soon. Chris Rillahan, A biotech to be shared between WAPA/AMME and the PACN, has been hired and is stationed at WAPA. Chris will work for the PACN 50% of the time, helping to implement I&M monitoring protocols at WAPA and AMME.

CESU: There is a flurry of activity among the cooperator component of the I&M Program. Anne Farahi who has previously volunteered for the PACN aquatic program and worked as a temporary NPS administrative assistant, has now joined the CESU as a temporary aquatic technician until mid-March.

In addition, Mariska Weijerman who has been assisting with the development of the Anchialine Pools Protocol has switched duty stations from Kaloko-Honokōhau

NHP to NPS regional headquarters at the federal building in Honolulu. She will surely be missed by the KAHO marine and aquatic team, but I&M is happy to keep her aboard.

Kazuki Kageyama who has been instrumental in the development of several marine protocols has moved from his duty station of Kalaupapa NHP to Hawai'i Volcanoes NP to focus on benthic image analysis. (Both Mariska and Kazuki will report to their new duty stations in January.)

Finally, Rod Anderson from Mountain View has been hired on a short assignment to assist with formatting the Groundwater Dynamics Protocol.



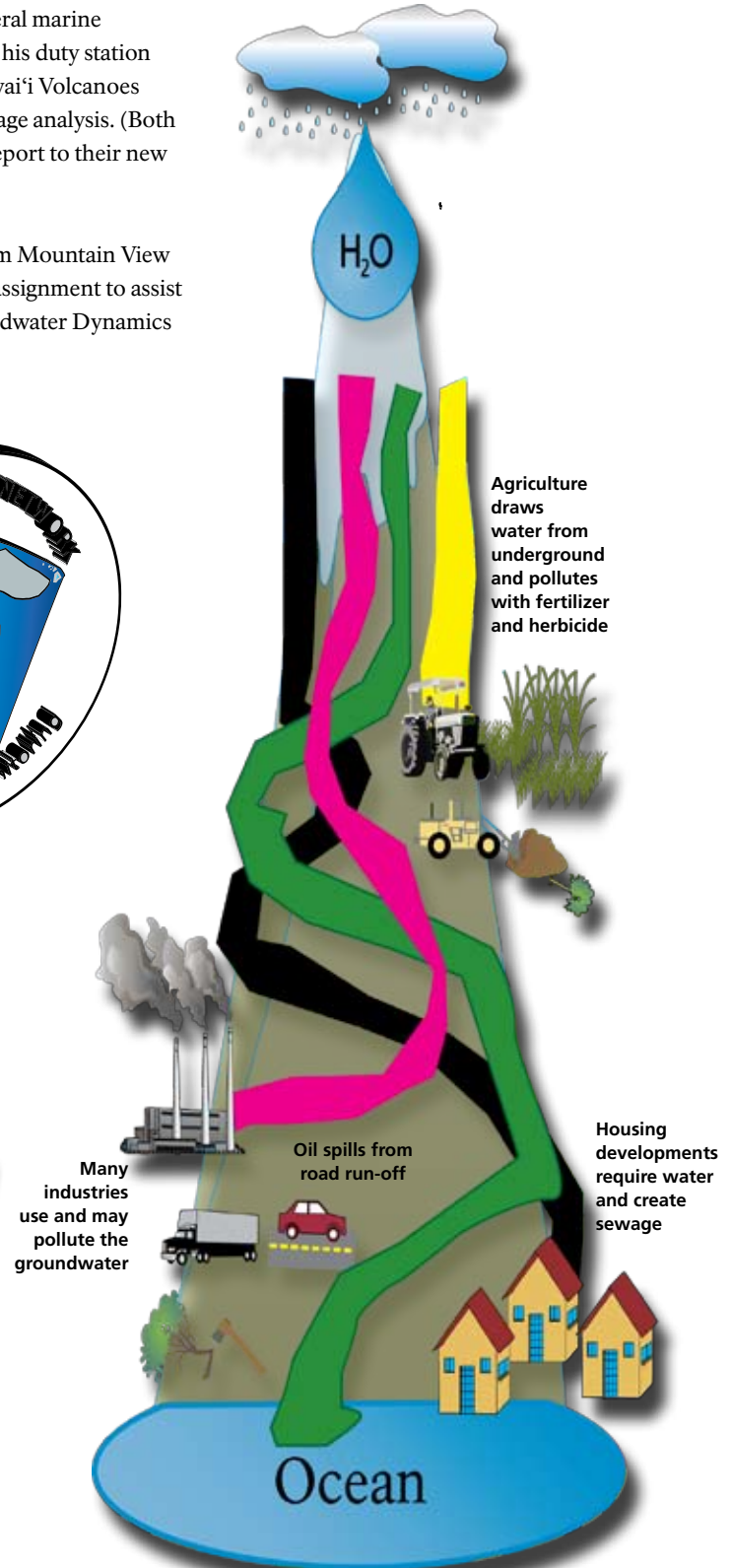
Calendar • Upcoming events

- Jan. 9 = Internal deadline for first draft of 2007-2008 Annual Report and Workplan (AARWP)
- Jan. 15 = Multi-agency meeting in Honolulu covering shared elements of anchialine pool monitoring
- Jan. 16 = Greg attends ATR training in Phoenix, AZ
- Jan. 22 = Microsoft Access training at HAVO
- Mar. 1-6 = Several I&M staff will attend George Wright Society biannual conference in Portland, OR
- Mar. 13-15 = Cory attends Video Software training on O'ahu

Games Corner

Good to the last droplet

Guide the water droplet safely from the mountain to the ocean. Start at the top of the diagram and choose a colored path, then follow your path down the mountain to see if you make it to the ocean safe and clean.





Landscape Dynamics Monitoring

Network Parks Where Landscape Dynamics is Monitored

▲ All Pacific Island Network national park units

Importance: Controlling Factor for Other Resources

The conversion of native habitat to developed land or to another vegetation type fundamentally affects habitat conditions and ecosystem processes. Fires, human-made development, ecosystem restoration, soil erosion, nutrient transport, and climate change are all examples of events or processes that can dynamically change a landscape. These changes impact native ecosystems in a variety of ways that alter species compositions and water quality as well as quantity. Land use and human or naturally caused land cover change must be considered a central component in developing strategies for managing natural resources and monitoring environmental change.

Long-Term Monitoring

The Landscape Dynamics Protocol uses GIS and remote sensing technologies to map land use and land cover changes over time. A pilot study, testing the North Coast Cascades Network monitoring protocols using Landsat imagery for Hawai'i Volcanoes National Park, indicates that image differencing*, rather than change vector analysis**, provides results that are more accurate and easy to interpret and therefore better-suited for PACN resources management. A new pilot study will test the use of higher resolution imagery (Quickbird™) to detect land cover changes in more detail within Kaloko-Honokōhau National Historical Park. Moreover, GIS analysis of thematic layers of land cover, roads, and human population densities for the watershed of Kaloko-Honokōhau National Historical Park show an increasingly fragmented landscape due to urban development between 1980 and 2000.

Monitoring Objectives

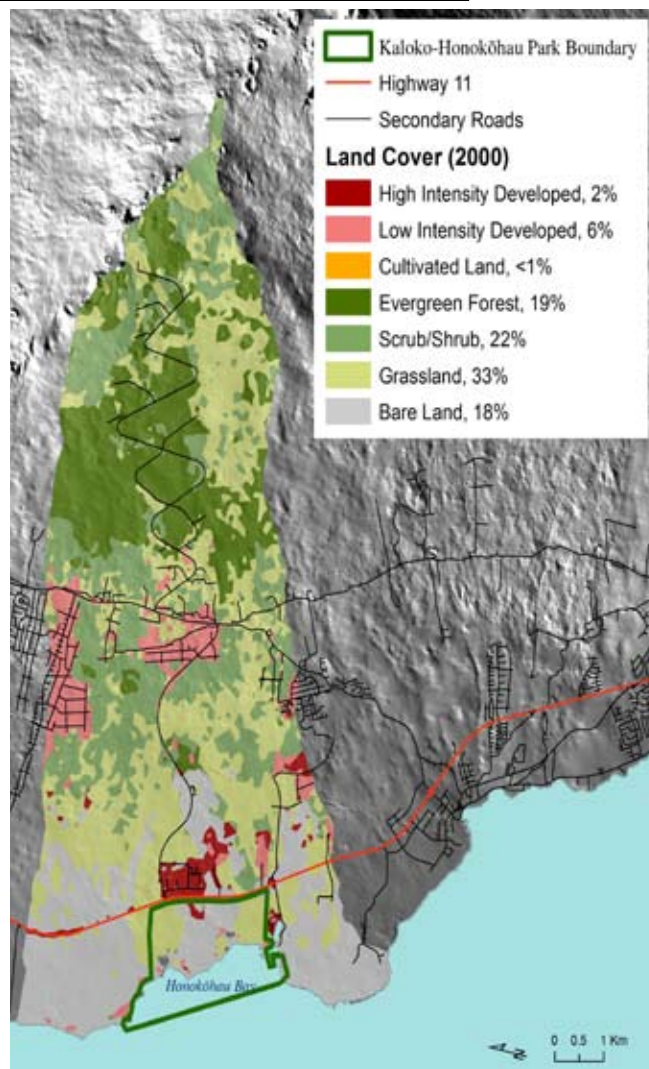
- ▲ Identify land cover changes (and trends) occurring within PACN parks
- ▲ Identify land use changes within the watersheds of PACN parks

Management Applications

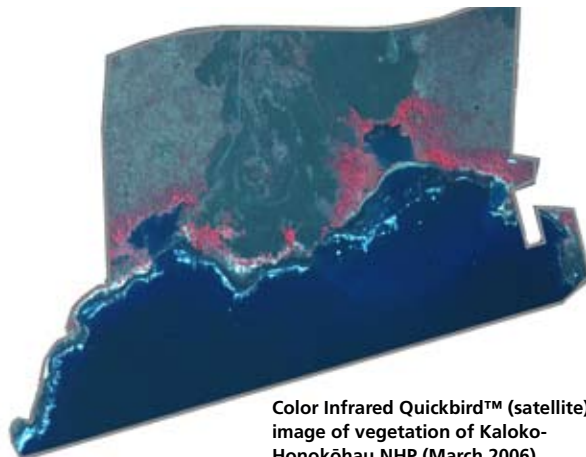
- ▲ Information from GIS land use analysis will provide park managers with comprehensive information (GIS files, databases, and reports) for evaluating the dynamic interaction between urban development, forest fragmentation, soil erosion, eutrophication, and the spread of invasive species
- ▲ Focus vegetation mapping efforts in areas that have changed, reducing time and effort required to maintain accurate up-to-date vegetation maps

* For more information on image differencing (image subtraction) go to: http://www.cast.uark.edu/local/brandon_thesis/Chapter_IV_change.htm

** Change vector analysis indicates the direction and magnitude of change. For more information see: <http://www.isprs.org/commission1/proceedings02/paper/00014.pdf>



The above GIS map depicts the vegetation classes of the watershed of Kaloko-Honokōhau NHP.



Color Infrared Quickbird™ (satellite) image of vegetation of Kaloko-Honokōhau NHP (March 2006).

Network: <http://science.nature.nps.gov/im/units/pacn/> Resource: http://science.nature.nps.gov/im/units/pacn/monitoring/vs_landscape.cfm



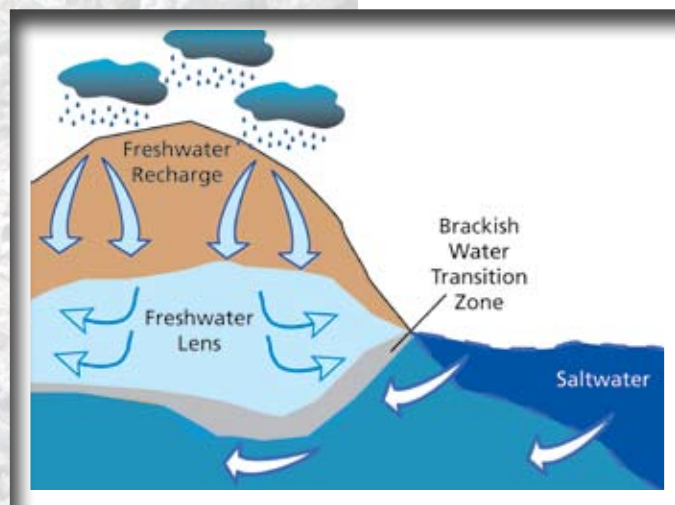
Groundwater Dynamics Monitoring

Network Parks Where Groundwater Dynamics is Monitored

- ▲ Kaloko-Honokōhau National Historical Park (KAHO)
- ▲ American Memorial Park (AMME)

Importance: Sustaining Life on Land

Groundwater characteristics reflect the interaction of fresh groundwater from the land and saltwater from the ocean. The source of fresh groundwater in tropical oceanic islands is precipitation. The fresh groundwater forms a lens-shaped body underlain by salty water from the ocean. Freshwater flows from inland areas where most recharge occurs and the lens is thicker, to coastal areas where the lens is thinner. Groundwater discharges into springs, streams, and the ocean. Depressions in the land surface at the coast expose the top of the freshwater lens and form surface-water bodies such as wetlands, lakes, ponds, anchialine pools, and springs. If the freshwater lens decreases, saltwater may encroach landward to fill the void. This can result in a reduction of the water table, the loss of wetland habitat, and an increase in salinity of coastal surface-water bodies. Because the biotic and ecological integrity of these coastal surface-water bodies and ecosystems (coastal strand flora, wetlands, fishponds, streams, and anchialine ponds) are intimately tied to water levels and water quality, they are also tied to the dynamics of groundwater. Consequently, the ecosystems that rely on coastal ground- and surface-water bodies are sensitive to changes in the groundwater system. Terrestrial plants with limited salinity adaptations, particularly coastal strand flora, can be adversely affected by salinity increases in groundwater as can the flora and fauna of wetlands, fishponds, streams, and anchialine ponds.



Oceanic island groundwater flows.

Long-Term Monitoring

The proposed groundwater monitoring program consists of periodic measurements of groundwater levels, temperature, and specific conductance (a measure of salinity) in selected wells in the parks. These wells penetrate below sea level and into the transition zone (between salt and freshwater) or through most of the thickness of the freshwater lens. This is the area where monitoring is more likely to show changes that may affect park resources. Of particular interest is a rise in the underlying saltwater. The groundwater will be measured by deploying automated electronic sensors and data loggers. Instruments will be calibrated and downloaded quarterly.

Monitoring Objectives

- ▲ Identify the present condition
- ▲ Determine trends and the rate of change
- ▲ Determine and document the periodicity and magnitude of long and short-term cyclical variations

Management Applications

- ▲ Early detection of groundwater trends before they affect other natural resources
- ▲ Develop mathematical models to understand groundwater trend cause and effect relationships
- ▲ Assist park resource management in understanding other park resources



Field crews taking groundwater measurements at wells.



Network website: <http://science.nature.nps.gov/im/units/pacn/>

Resource website: http://science.nature.nps.gov/im/units/pacn/monitoring/vs_groundwater.cfm



War in the Pacific National Historical Park

History: The Pacific theater of World War II covered 1/3 of the Earth's entire surface, but only 1/145 of its total land mass. Thus, battles covered vast distances, required new strategies and equipment, and entangled many of the key Pacific islands. Although Guam is just one island of many involved in the struggles of WWII, War in the Pacific National Historical Park (WAPA) is the only national park devoted to honor all people from all nations who fought in the Pacific War, including those from the U.S., Japan, and the allied nations (Australia, Canada, China, France, Great Britain, New Zealand, the Netherlands, and the Soviet Union). The park was authorized on August 18, 1978 by the U.S. Congress to "commemorate the bravery and sacrifice of those participating in the campaigns of the Pacific Theater of World War II and to conserve and interpret outstanding natural, scenic and historic values and objects on the island of Guam for the benefit of present and future generations". It exists today as a tangible reminder of the immense suffering that occurred and of the many lives lost in WWII. It also serves to promote appreciation of the unique, diverse natural resources of both the land and the sea.



Cultural Resources: The seven separate units of WAPA, all facing the Philippine Sea, contain over 100 historical sites, monuments, and structures. A wide-ranging collection of WWII artifacts, mainly features of the 1944 American liberation, are haunting and very real.

The park includes WWII landing beaches at Asan and Agat, as well as coastal defense guns at Piti and hidden Japanese fortifications (e.g.,

caves, pillboxes, foxholes, and trenches), many of which were created by Chamorro slave labor. A Japanese naval communications center is at the Fonte Plateau unit, and the Memorial Wall at the Asan Bay Overlook displays the names of thousands of American and Chamorro casualties.

Culturally based subsistence food gathering still occurs at Asan and Agat beaches. In addition to the abundance of marine



life, visitors can observe sunken military amphibious tractors (amtracs) and other coral-encrusted weaponry underwater.

WAPA has one of the highest levels of species' diversity in the NPS within its coral reef systems. With more than half of WAPA's approximately 2000 acres underwater, Indo-Pacific coral reefs provide habitat for over 3,500 marine species including: the humphead wrasse (*Cheilinus undulatus*), hawksbill turtle (*Eretmochelys imbricata*), and green sea turtle (*Chelonia mydas*). The park also contains several forest types (i.e. limestone, riverine, ravine, and coastal), inland wetlands, an experimental mahogany forest, tropical savannah ecosystems, and six offshore islands that represent some of the last terrestrial areas in Guam unimpaired by the extremely invasive brown tree snake (*Boiga irregularis*).

Inventory and Monitoring

Highlights: A comprehensive inventory of WAPA's flora was conducted in 2004, as well as

an inventory of reptiles in 2008. The majority of monitoring and inventory, however, is directed towards WAPA's submerged resources. The largest threat to Guam's coral reefs,

sedimentation, has been monitored via underwater stations at the Agat and Asan units since 2003. The results have aided in the identification of spatial and temporal trends in sediment transport within WAPA. Studies of coral recruitment have been conducted



alongside sediment studies since 2004 and have alerted park scientists that recruitment rates are far lower than previously recorded on Guam. Comprehensive monitoring of marine fish and benthic organisms was launched in 2008.

Current Issues in Management: With an area of 212 square miles and 170,000 inhabitants, Guam faces numerous challenges associated with overcrowding and limited resources. There are pressing issues of arson, off-road vehicle use, overfishing, watershed degradation, illegal terrestrial and marine dumping, and poaching. Although the situation is already critical for Guam, over the course of the next 5-8 years, the island's population is projected to increase by 30,000 in association with a military buildup. WAPA is committed to maintaining and improving the cultural, historical, and natural resources of Guam through habitat restoration, resource protection and education. Experimental savannah restoration work is underway and large scale restoration is planned for the near future. Park staff members have introduced several exciting new outreach and education opportunities. The WAPA Reef Rangers Program (top photo) is the first stewardship program of its kind on the island. It brings Guam's scientists and managers together with local youth to share an appreciation of the island's beautiful coastal and marine resources.

— H. Moulton, WAPA Ranger