



Pacific Island Network Quarterly

Quarterly Newsletter of the
Pacific Island Network
Inventory & Monitoring Program
July - Sept. 2008, Issue no. 13



National park **Signs** inform visitors about resources in parks



Notes from the Field page 4

Paul Brown offers up some perspective on marine fish monitoring in Pacific Island national park waters.

Featured Resources pages 6-7

This issue features the monitoring of two hugely important indicators of ecosystem health...seabirds and climate.

Critical Issue page 8

Strawberry guava has been altering and taking over landscapes in Hawaii since the 1800s. It has displaced native plant communities throughout the islands. A small insect may be the answer to controlling this highly invasive tree.

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Anchialine pool animals



Focal plant communities



Groundwater dynamics

Fish harvest

Freshwater stream animals



Established invasive plants

Landbirds

Climate

Water quality



Benthic marine

Focal plant species

Early detection of invasive plants

Landscape dynamics



Marine fish

Insectivorous bats

Seabirds

Frugivorous bats

National park **Vital Signs** inform park managers and scientists about the health of natural resources



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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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Inventory Update

Vegetation of Kahuku (HAVO) — not a mystery anymore!

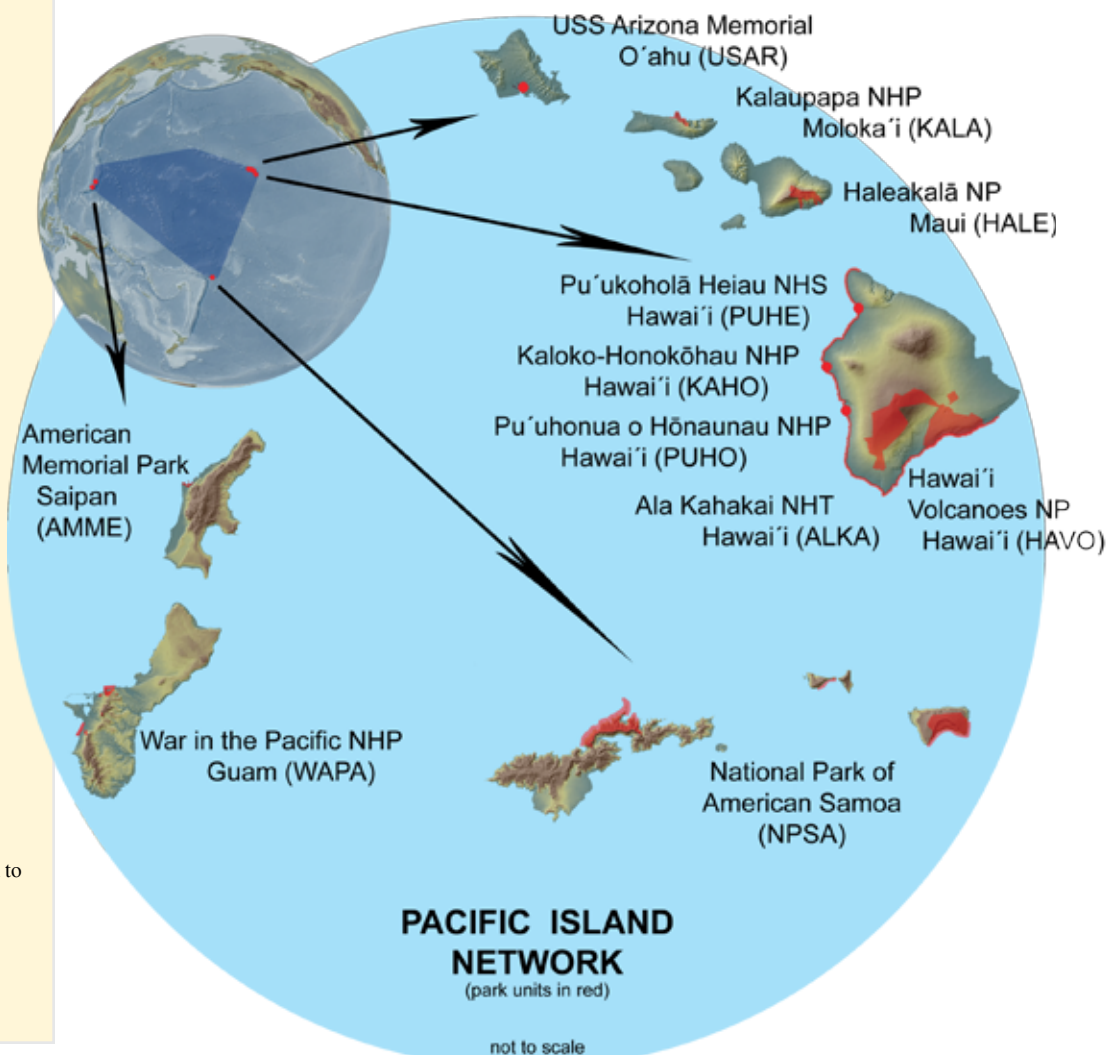
A recent addition to the PCSU technical report series is the much anticipated Inventory of Vascular Plants of the Kahuku Addition, Hawai'i Volcanoes National Park report. The Kahuku Ranch added about 116,100 acres to HAVO in 2003. Despite its size, the area had no recent surveys of its vegetation, leaving scientists to wonder about the botanical resources of this vast landscape. This inventory documented 455 plant species with 194 natives, including five endangered, one threatened, one candidate endangered, and seven species of concern. New records for native plants in the park included two ferns (*ka'upu* *Polystichum hillebrandii*; *pāmoho*, *Asplenium excisum*), an endemic panicgrass (*Panicum konaense*), a parasitic hulumoa (*Korthalsella remyana*), and an indigenous sedge (*Carex meyenii*). Except where topography restricted access, researchers found nonnative plants

and extensive ungulate damage throughout the study site. For example, a pit crater surrounded by introduced grasses contained a unique, ungulate-free habitat of native species that spans all vegetation layers. This inventory serves as a baseline from which to document landscape changes in Kahuku and aid managers in the recovery of rare plants and control of introduced plants and animals.



Native parasitic hulumoa (*Korthalsella* sp.) on an 'ōhi'a branch (*Metrosideros polymorpha*), held in the hands of former HAVO Resources Management Chief, Tim Tunison.

For this and other inventories: <http://www.botany.hawaii.edu/faculty/duffy/techrep.htm>



Data Management

NPS Data Store — Managing and sharing natural resources data

Whether you are a National Park Service employee, researcher, or just interested in learning more about your favorite park, NPS Data Store is the tool for you. In response to the growing need for data management and documentation, the National Park Service has created a web-based system designed to integrate data dissemination while allowing for metadata (data about data) maintenance.

NPS Data Store has been organized and structured with the primary goals of:

- Consolidating duplicate metadata and dataset postings
- Integrating metadata records with data files
- Providing robust search interfaces to facilitate data discovery

- Facilitating data stewardship by data producers
- Integrating as seamlessly as possible with other NPS applications like the NPSFocus Digital Library and Research Station (NPS-wide), NatureBib, NPSpecies, and the NPS metadata system

NPS Data Store also functions as a storehouse and search engine, allowing users to look up natural resource, GIS, and other program datasets, digital documents, and digital photos produced nationwide. These citations can be queried by NPS unit, type of data, category, or keyword search.

The PACN utilizes NPS Data Store to distribute data for parks throughout the network. It is a tool which facilitates and promotes long-term Inventory and Monitoring program goals. As Vital Signs monitoring data become available, it can be easily uploaded to NPS Data Store. Most PACN data records contain current metadata,

Featured Staff - Marine Ecologist, Larry Basch

Larry has worked as a marine ecologist in the Pacific and elsewhere for 30+ years, focusing on ecology, fisheries, and oceanography related to marine conservation. He's in his second decade working for NPS, starting at the SE Alaska parks, now as marine ecologist for the Pacific islands parks. He earned a BS in Biology from Penn State working on land plant-animal interactions, wildlife, and streams, but discovering marine invertebrate animals set his path. He earned a master's in Biology at UCLA while living and working on projects throughout the California Channel Islands. This included documenting effects of El Nino on benthic populations and developing NPS prototype monitoring in kelp forests and the rocky intertidal zone at Channel Islands National Park. He later went to the University of California Santa Cruz for his Ph.D. where he compared the ecology, evolution, and oceanography of similar animals living in contrasting environments – California kelp forests and benthic communities in Antarctica. This was followed by a postdoctoral fellowship at UC San Diego, Scripps Institution

of Oceanography studying the ecology, reproduction, larvae and oceanography of kelp forest organisms that have been harvested to near extinction. Larry is basically a natural historian. Outside work he loves doing anything with family and friends, marine research, writing, teaching scuba diving, photography, swimming daily, surfing, kayaking, hiking, backpacking, reading, working on his house and land, and traveling.



associated databases, and GIS generated shapefiles. Depending on the project, data may also include field notes or images.

Park managers and researchers are encouraged to upload and share data using NPS Data Store. Increased citations will provide a better picture of data resources available nationwide.

Although anyone can search and download data, logins are required to upload data to the NPS Data Store. To request a login, contact the PACN Data Manager (see Kelly Kozar, page 2).

On the not-so-distant horizon, a new application is being developed to make uploading and viewing data in NPS Data Store even more user-friendly. To access NPS Data Store or for more information go to: <http://science.nature.nps.gov/nrdata>

Notes From the Field

Adventures in marine fish monitoring

On many tropical islands the flora and fauna are not very diverse since it is often a difficult journey for an organism to arrive and establish on an island. In the water virtually the opposite is true. Life abounds in the warm tropical waters of nearly every small island in the Pacific. Often there is so much life that many sessile organisms must compete for space. For example, few people realize that many hard coral species are actually quite aggressive and may attack their neighboring corals whenever they get too close. This kind of competition for space and resources is not limited to the benthic community. Many marine fish have similar daily struggles to maintain territories and access to vital resources. Damselfish are a good example. These small bright and colorful fish are often the icon for South Pacific coral reefs. Yet few realize that they are actually some of the most pugnacious animals on reefs. With names like south seas devil and humbug dascyllus, these aggressive little fish are usually only three inches long yet can chase off scuba divers and even five foot barracuda.

Not everything on the reef is quite so bold. Many marine fish are highly cryptic, either in coloration or behavior, and sometimes both. In a habitat with literally hundreds of predators, many smaller fish like blennies have adapted to hiding amidst cracks and crevices, and are able to dart quickly into a hole at the first sign of danger. Others, like the scorpionfish, are one of the dangers. These highly camouflaged ambush predators sit out in the open and wait for an unsuspecting meal to swim to them.



This damselfish, called the orangefin dascyllus (*Dascyllus auripinnis*), is a wee bully of the reef.

We watch these behaviors and interactions as we conduct the Marine fish monitoring protocol. This I & M protocol covers 30 dive sites within PACN waters each field season. Half of these are permanent transects which have already been established as part of the benthic marine community protocol. Our transects are 25m long from pin to pin (a pin is a large metal rod driven by sledgehammer into the steel-like basalt bedrock on the bottom of the ocean) and are in waters from 10-20m deep. The remaining 15 sites are randomly selected each year so that we can assess a wider area of our parks.

The Marine fish protocol is co-located with the benthic marine community protocol. The marine fish protocol, however, is always started first. We do this for a few reasons. First and foremost, in many places lots of fish species see us as a threat and dive for cover or leave the area soon after we enter the water. In order to get accurate counts of the fish biomass and assessments of the fish assemblages we need to see what is there. We cannot do that if somebody scares away the fish before we have a chance to count and measure them. Secondly, humans are noisy and cumbersome underwater. Every time you exhale on scuba, a loud and very unnatural sound of bubbles escapes from your gear. While many fish acclimate quickly to this, some species never do.

Here at the National Park of American Samoa we typically see around 65 species of fish on a dive. These 65 can be very different between dives because different fish occur in different microhabitats and there are almost 1000 species

of coral reef fish in park waters. Now consider that most of these 1000 fish species have a completely different color phase for juveniles, males, and females (somewhere around 2,500 color patterns to identify). With this kind of diversity we see some spectacular things and no two dives are ever quite the same; even at the same dive site. From moray eels, clownfish, humphead wrasse, triggerfish, and sharks to endangered sea turtles and humpback whales, there is always a great diversity in PACN coral reef parks just waiting to be explored.

—Paul Brown, Marine ecologist (NPSA)



From top:
black-backed
butterflyfish
(*Chaetodon
melannotus*),
Picasso
triggerfish
(*Rhinecanthus
aculeatus*), and
zebra moray
(*Gymnomuraena
zebra*).

Right: Paul
records data
on the fish he
encounters along
a transect.



Outreach and Staffing Update

Outreach

The science communications team presented at the Hawaiian Conservation Conference in Honolulu on a web-based drill-down system for monitoring information delivery, and posters on fruit and insect bats monitoring, sea turtle nesting, and corals.

The PACN I&M program participated in this summer's PUHE cultural festival. The focus of this year's display was on native species and anichaline pools.

I&M also had a substantial presence at the HALE booth for the Maui County fair. I&M collaborated with HALE interpretation staff to integrate natural resources information and Vital Signs monitoring with the overall park goal of encouraging local visitation and resources education. The I&M Program had a general display at the Hawai'i County fair with in conjunction with HAVO as well.

In addition, I&M created park-specific informational posters describing I&M and the resources to be monitored at each park for park staff throughout the network. Many PACN parks now display these posters in their employee break rooms and other offices.

Staffing Update

NPS: Asia Addlesberger has begun working with the PACN as the Data Management Specialist. She is expertly settling into her role on the data management team. Learn more

about Asia in next quarter's featured staff column.

Anne Farahi also joined the I&M team as a temporary administrative assistant to aid in the smooth functioning of the program at the critical end of the fiscal year.

CESU: Sarah Nash has switched cooperator positions for the network. She has transitioned into her new position as Ecological Monitoring Database Application Specialist. The focus of this new position is dedicated to various data-related projects involving HALE and KALA.



Calendar • Upcoming events

- Oct. 2 = Internal deadline for first draft of 2007-2008 Annual Report and Workplan (AARWP)
- Oct. 3-5 = I&M participated in the Maui County Fair with HALE staff
- Oct. 7 = The PACN welcomes National I&M Leader, Steve Fancy back to the PACN for a short visit
- Oct. 23 = Steering committee conference call
- Nov. 3 = AARWP due to Washington office
- Nov. 6-8 = Annual cultural festival at KAHO, I&M will participate
- Dec. 18 = Board of Directors conference call

Games Corner

That's quite a feet!

The professor of Ornithology gave her class a pop quiz. During the quiz a student approached her and asked about all of the photos of birds' feet on the quiz. The professor explained that the student should be able to identify the bird simply by knowing what kind of feet it has.

Outraged by this absurd request the student headed for the door. The professor demanded that the student stop and tell her his name. The student paused for a moment, sat down, and promptly removed his shoes and socks. Then he looked at his professor and said, "Can't you tell?"

See if you can get an 'A' on the quiz!



a.



b.



c.



d.

ANSWERS:

- a. Cardinal honeyeater (*Myzomela chermesina*)
- b. Purple swamphen (*Porphyrio porphyrio*)
- c. Nene (*Nesochen sandvicensis*)
- d. Shearwater chick (*Puffinus pacificus*)



Climate Monitoring

Network Parks Where Climate is Monitored

- All Pacific Island Network national park units

Importance: Driver of Ecosystem Processes

Climate is widely recognized as a major driver for terrestrial as well as marine ecosystems, affecting biotic as well as abiotic ecosystem characteristics and processes. Island ecosystems are particularly vulnerable to the effects of climate variability and change. Some examples of concerns in the PACN are: effects of increasing solar radiation and temperatures on coral reefs, the effects of prolonged El Nino-related droughts on groundwater supplies, and the spread of vector borne diseases due to changes in precipitation patterns.

Long-Term Monitoring

A number of different agencies and institutions have been operating weather stations in or near national park units and some have been collecting data for a long time. However, the data have not been available in a single location, and data analysis has not focused on the parks. This is where the PACN comes into the equation. I&M will add weather stations to some parks, as well as make use of existing weather stations belonging to a variety of climate monitoring organizations. The PACN will publish annual reports showing patterns of climate variables throughout the year. In addition, five year reports will include graphs and tables indicating long-term trends. Core weather parameters include: air temperature, precipitation, wind speed and direction, and relative humidity. Other variables measured may include solar radiation, soil moisture, soil temperature, and others.

Monitoring Objectives

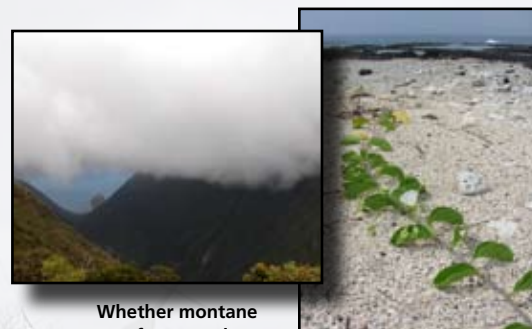
- Determine variability and long-term trends in climate for PACN parks through monthly and annual summaries of core weather parameters.
- Determine frequencies and patterns of extreme climatic conditions such as droughts, prolonged periods of unusual wind conditions, or tropical cyclones.

Management Applications

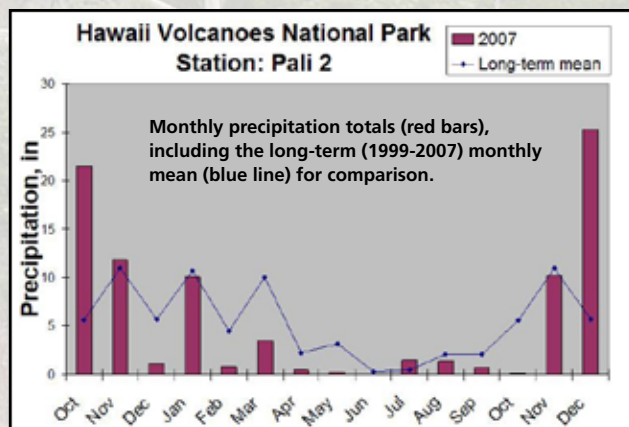
- Establishment of a climate monitoring network and database will enable the PACN to characterize an important physical component of park ecosystems. It will also provide valuable information on weather conditions for park managers.
- Long term monitoring will allow the PACN to generate reports on trends and patterns of climate parameters to aid in the analysis and interpretation of data from other natural resource monitoring efforts.



This map shows climate station locations in Kalaupapa National Historical Park. The stations belong to the National Weather Service Cooperative Observer Program (yellow) and the Remote Automated Weather Station network (green) that supports interagency fire management.



Whether montane wet forest or dry coastal habitat, climate profoundly influences species distribution and composition. Many special ecosystems which depend on vastly different climate conditions can be found in PACN parks. Long-term monitoring of climate is critically important to understanding changes in ecosystem characteristics.





Seabird Monitoring

Network Parks Where Seabirds are Monitored

- 📍 Hawai'i Volcanoes National Park (HAVO)
- 📍 Haleakalā National Park (HALE)
- 📍 Kalaupapa National Historical Park (KALA)
- 📍 National Park of American Samoa (NPSA)



Importance: Ecological Indicators

Seabirds are a conspicuous component of both marine and oceanic island ecosystems and perform important functions within these ecosystems. As predators at the top of the food chain, they cycle nutrients derived from marine sources to terrestrial environments, primarily through the deposition of guano. Today, anthropogenic stressors threaten seabird populations with declines in abundance, density, and distribution. Prior to human colonization, seabirds nested widely in enormous numbers and great diversity on many Pacific islands. However, the group is now generally marked by precipitous declines and extirpations. Existing colonies are often remnants in dire need of protection, active monitoring, and management.

Long-Term Monitoring

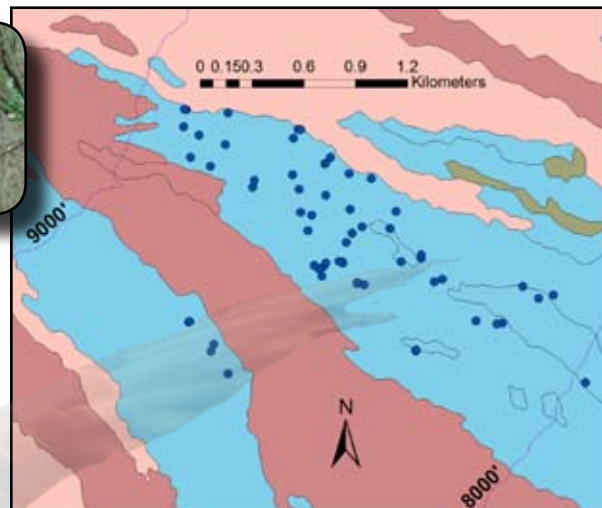
Rare, threatened, and endangered species are of primary concern to the PACN, and the only federally listed seabirds in the network are the endangered Hawaiian petrel, or 'ua'u, and the threatened Newell's shearwater, or 'a'o. Hawaii's largest breeding 'ua'u colony is at HALE, with a second smaller population at HAVO. Both the 'ua'u and 'a'o are suspected to breed in KALA. Seabird monitoring in Hawaii will focus on these two species. NPSA has the PACN's most diverse seabird assemblage--about 20 species. A disproportionate number of birds have been found along the coastline of the park's Tutuila unit, in contrast to coastline outside the park. Seabird monitoring at NPSA will focus on the coastline of this park unit. Due to the importance of these national parks to seabirds, periodic and consistent monitoring is recommended.

Monitoring Objective

- 📍 Determine current status and long-term trends in Hawaiian petrel colony distribution and density, recruitment and reproduction, and how these are affected by predator control at HAVO and HALE (priority objective).
- 📍 Determine whether Hawaiian petrel and Newell's shearwater are present in KALA.
- 📍 Determine long-term trends in relative abundance and distribution of common, low-elevation seabirds at NPSA.

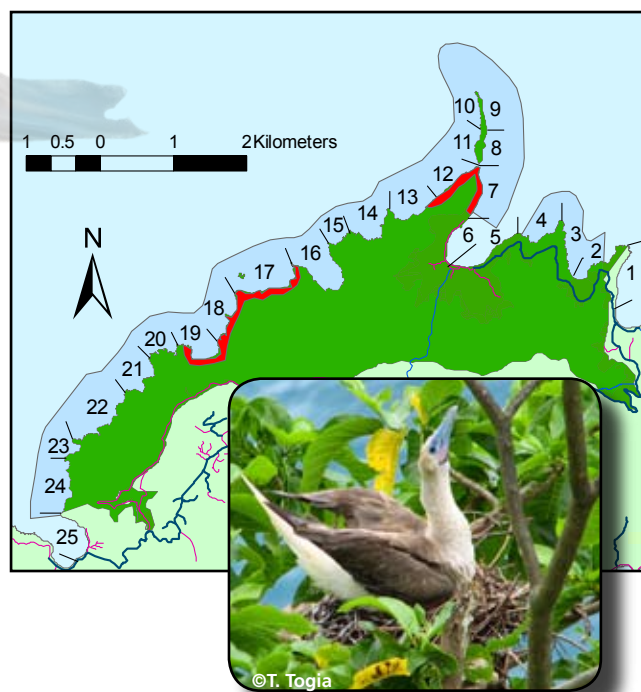
Management Applications

- 📍 Provide information for decision support to park management.
- 📍 Identify colonies with negative trends in reproduction and recruitment and assess needs for enhanced predator control.
- 📍 Improve understanding of park seabird ecology.



Top: A Hawaiian petrel (*Pterodroma sandwichensis*) outside its burrow. Above: At HAVO, the majority of petrels select burrows (blue dots) in pahoehoe lava flows ranging in age from 1500 to 5000 years. The pink and salmon colored flows are younger and less attractive as burrow locations. Approximately 50 active burrows have been located in this park.

Below: Sample units along NPSA (Tutuila Island) shoreline. Red polygons identify areas where red-footed booby (*Sula sula*) colonies have been found. Bottom: Red-footed booby on a nest.



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

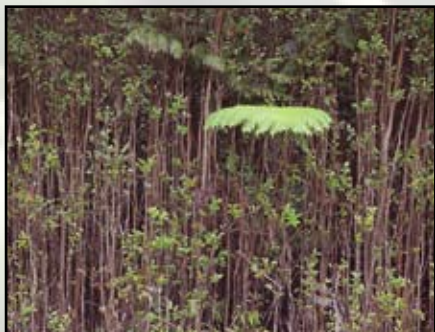
Resource website: http://science.nature.nps.gov/im/units/pacn/monitoring/vs_seabirds.cfm



Controlling Strawberry Guava's Invasion

Green mountains wrapped in clouds are a reassuring sight on islands across the Pacific. These forested highlands catch the water that humans depend on, and can preserve a rich diversity of life. Sadly, although green, many island forests are far from healthy. Among the greatest threats to native forests in Hawaii is the invasive tree, strawberry guava.

Native to Brazil, strawberry guava (*Psidium cattleianum*) was brought to Hawaii in 1825 for its tasty fruit, distinctive smooth bark, and evergreen leaves. Now widespread, this tree penetrates native wet forests statewide, its seeds scattered by non-native birds and pigs. Nearly 300,000 acres of conservation lands are affected by this plant on Hawai'i island alone. While roughly one tenth of this area has been lost to thick stands containing few other species, most Hawaiian rainforests invaded by guava remain in relatively good condition – for now. But with annual growth rates exceeding 10%, strawberry guava is rapidly taking over.



J. Jeffrey

Strawberry guava grows rapidly, creating dense thickets and squeezing out native vegetation.

Hawai'i Volcanoes National Park has been a leader in developing mechanical and herbicidal techniques for removing strawberry guava. But these costly methods have been focused on the park's most precious areas, small hotspots of endemic biodiversity, and it has not been possible to extend control over the vast landscape threatened by strawberry guava.

For many years, biological control has been recognized as the only hope for limiting the destructive spread of strawberry guava in Hawaii. Biocontrol is practiced worldwide and is based on the principle that specialized insects or diseases that keep a plant species in check in its

native range can be used to help restore balance where the plant has become invasive. Biocontrol is increasingly applied to manage wildland weeds in the US, with recent successes including the control of *Melaleuca* in the Everglades.

Research on natural enemies of strawberry guava in Brazil over the last twenty years led to the selection of a leaf-galling scale insect, *Tectococcus ovatus*, as a promising and highly specific biocontrol agent. *Tectococcus* does not kill strawberry guava, but rather reduces plant vigor and fruit production, limiting the plant's ability to spread and overwhelm forest areas.



Galls form around *Tectococcus ovatus* as it feeds on the leaves of strawberry guava, sapping the plant's energy for growth and reproduction.

T. Johnson, USDA Forest Service

Testing by the US Forest Service has shown that *Tectococcus* can survive only on strawberry guava and does not pose a risk to related plants in Hawaii. Guava relatives in the Myrtle family, including the islands' dominant native 'ōhi'a lehua (*Metrosideros polymorpha*), and a broad selection of other test plants have been shown to be safe from attack by this insect. Strawberry guava's closest relative in Hawaii, common guava (*Psidium guajava*), is also left untouched by *Tectococcus* in lab tests and in Brazil, where the two guavas grow side by side. Such high specificity may seem surprising, but is not unusual among plant-feeding insects, particularly gall-formers which must live in intimate contact with their host plants.

In addition to protecting remaining native forests from invasion by strawberry guava, *Tectococcus* is expected to benefit agriculture by reducing numbers of pest fruit flies that emerge from wild strawberry guava to attack neighboring fruit crops.

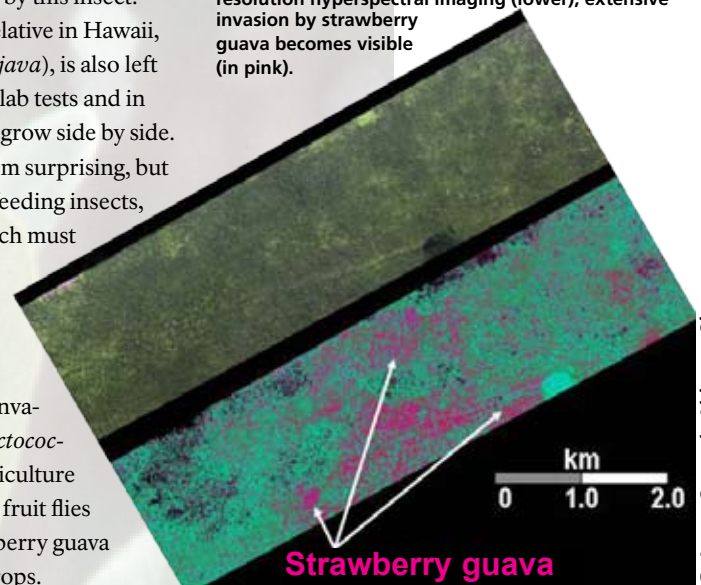
Biocontrol also is expected to increase the effectiveness of other weed control methods since the insect can reduce strawberry guava's ability to resprout and reseed after cutting and herbicide treatment.

Permits for release of *Tectococcus* were issued in April 2008 by the Hawaii Department of Agriculture and the USDA, following scientific and regulatory reviews begun in 2005. Initial field release is planned on Hawai'i island in 2009 following completion of a state Environmental Assessment. The insect is expected to be used for control of strawberry guava on Maui and other islands within a few years. Since the flightless *Tectococcus* must disperse from one strawberry guava to another by wind and crawling, natural spread of this biocontrol is expected to be gradual, moving outward from release sites over a period of decades.

Although this carefully chosen biocontrol agent is not a cure for all problems associated with strawberry guava, it is a critical tool for long term management on an island-wide scale, including remote areas of severely threatened Hawaiian rainforest.

—Dr. M. Tracy Johnson, USDA Forest Service
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Not all green is good: Forest cover appears healthy from an aerial view (upper) near Hawai'i Volcanoes National Park, but using high resolution hyperspectral imaging (lower), extensive invasion by strawberry guava becomes visible (in pink).



G. Asner, Carnegie Airborne Observatory