Pacific Island Network
Inventory & Monitoring Program

National Park Service
U.S. Department of the Interior

PACN QUARTERLY

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Plants & climate
Anticipating a changing climate for rare plants on three mountains
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At your fingertips
The inventory you seek may already exist - just look for it
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On the nudibranch
Sea slugs live interesting lives and help make the reefs vibrant
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Calling all scientists
The Hawai'i Volcanoes NP Bioblitz needs you
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... and much more

Sometimes mistaken for a nudibranch, the fuchsia flatworm (*Pseudoceros ferrugineaus*) is nearly as vibrant.

Building capacity to survive

Changing Habitats

Climate change projections in coming years indicate a 10-20% reduction in winter rains and a 5% increase in summer rainfall in Hawaii due to changes in the tradewind patterns. These changes are predicted to cause dramatic shifts in some habitats, making many currently suitable areas no longer hospitable for rare species. In response, rare plant populations need to be increased and expanded across their ecological ranges to increase their capacity to respond to habitat shifts/reductions and more frequent stochastic events (fire, hurricane, etc.) predicted by current climate change scenarios.

> ***"These rare plants are no longer safe in just one or a handful of places. But there is hope. We can increase their chances of survival by spreading their populations to new places where we believe they can survive despite a changing climate. It's a classic, don't-put-all-your-eggs-in-one-basket approach."***
>
> **–Sierra McDaniel, NPS Botanist**

The National Park Service at Haleakalā and Hawai'i Volcanoes have combined resources and know-how to give three dozen species a fighting chance to remain viable in the midst of climate change. Current models based on predicted changes in temperature and moisture regimes over the next decades forecast dramatic range shift and/or reduction for many native plant species. This creates a perilous situation for species with small population sizes within a limited geographic range. The purpose of this project is to establish satellite populations of 36 rare and endangered species within their modeled ecological ranges.

Previous Projects

Previously established propagation and planting projects were centered on stabilizing existing rare plant populations in localized areas. Still, many of the selected species number less than 50 individuals and remain geographically isolated. Park resource managers conducted planting efforts with 135 species to boost their numbers and restore biodiversity in both parks. Much of the effort has centered on locating individuals or populations, collecting planting material, and developing effective propagation techniques. Plant establishment focused primarily on fenced, ungulate-free areas nearby remnant populations or in adjacent areas containing similar habitats. Locations of past plantings are limited to sites near documented occurrences (current and historical) and do not necessarily reflect the actual ecological range that these plants could occupy now or in the future.

Bidens micrantha kalealaha

Geranium arboreum

Clermontia samuelii samuelii

The Building Capacity Project

This project builds upon earlier work by expanding rare plant populations across a wider ecological range thereby "building capacity" for these species to survive. Recent habitat modeling combines information on historical plant occurrences with habitat type (soil/substrate type, elevation/temperature and moisture conditions) to identify the most suitable ecological ranges for rare species. Establishing rare plant populations in favorable micro-site conditions across this broader ecological range will build greater capacity for these species to persist in the wake of climate change. This is a proactive effort to keep these species alive.

Efforts at both parks focus on expanding rare plant populations in subalpine, dry ʻōhiʻa woodlands, and mesic/wet montane zones where climate change is most likely to cause dramatic habitat shifts. The species selected for expanding populations were those for which successful propagation and planting techniques have already been developed, and plant survivorship has been found to be strong.

Seeds or cuttings have already been collected for all of the 36 target species, and thousands of seedlings are being propagated in park greenhouses. In 2014, both parks made significant progress by planting nearly 3000 seedlings of 32 species at multiple sites, and the project is on track to accomplish its goals by the autumn of 2015.

For more information, contact ***Sierra McDaniel at: sierra_mcdaniel@nps.gov***

The Fragile Future (Inventory & Monitoring Program's Role)

The ultimate success of this innovative project along with the effects of shifting climates on other rare plants can only be measured through long-term monitoring efforts. The Pacific Island Inventory & Monitoring program is developing methodology to detect and describe changes in the distribution and abundance of rare, threatened, and endangered plant species like the ones targeted in this project. Ideally, we will be able to aid the parks by repeated monitoring in which we verify existing populations, describe species stand structure, suggest limiting factors, and detect critical changes in abundance and distribution while management action is still a viable option.

For more information, contact ***Alison Ainsworth at: alison_ainsworth@nps.gov***

Would you move ?

Project Video

Trematolobelia wimmeri

Hibiscadelphus giffardianus

Haleakalā National Park

Hawai'i Volcanoes National Park

Already at your fingertips

For over a decade, the PACN Inventory & Monitoring Program has been surveying of all sorts of plants, animals, and physical resources. With the Bioblitz inventory project just around the corner at Hawai'i Volcanoes National Park, the time is right to remind you of some of the park inventory information you already have at your fingertips. And don't forget about quick access to your park species lists.

Follow park hyperlinks (green) to their I&M pages and select the Inventory Reports drop-down menu to access these reports directly

American Memorial Park

Vegetation Inventory (2013), Bird Inventory (2010), Soil Survey (2009), Vegetation Classification Survey (2009)

Haleakalā National Park

Soil Survey (2009), Seabirds Inventory (2009), Ka'āpahu Plant Inventory (2008), Hawii Forest Bird Survey - Plants (2008), Shoreline Bird Inventory (2007), Bat Inventory (2007), Digital Geologic Map (2007), Ka'āpahu Forest Bird and Mammal Inventory (2007), Arthropods Inventory (2007), Reptiles and Amphibians Survey (2005)

Hawai'i Volcanoes National Park

Soil Survey (2009), Hawii Forest Bird Survey - Plants (2009), Shoreline Bird Inventory (2007), Bat Inventory (2007), Digital Geologic Map (2007), Kahuku Forest Bird Inventory (2007), Mosses Survey (2007), 'Ōla'a Plant Inventory (2007), Lowland Bird Inventory (2006), Seabirds Survey (2005), Three Incipient Invasives Survey (2005), Reptiles and Amphibians Survey (2005)

Kalaupapa National Historical Park

Vegetation Inventory (2014), Geologic Resources Inventory (2010), Marine Vertebrates and Fish Habitat Survey (2010), Small Mammal Inventory (2008), Vascular Plant Inventory (2008), Forest Bird Inventory (2008), Shoreline Bird Inventory (2007), Bat Inventory (2007), Reptiles and Amphibians Survey (2005), Petrel and Shearwater Survey (2002), Baseline Water Quality Inventory (1996)

Kaloko-Honokōhau National Historical Park

Vegetation Inventory (2011), Marine Vertebrates and Fish Habitat Survey (2010), Digital Geologic Map (2007), Reptiles and Amphibians Survey (2007), Bat Inventory (2007), Soil Survey (2005)

National Park of American Samoa

Sheath-tailed Bat Survey (2009), Vegetation Classification (2009), Soil Survey (2009), Digital Geologic Map (2007), Botanical and Ethnobotanical Inventories (2003), Seabirds Survey (2002)

Pu'uhonua o Hōnaunau National Historical Park

Vegetation Inventory (2011), Marine Vertebrates and Fish Habitat Survey (2010), Digital Geologic Map (2007), Reptiles and Amphibians Survey (2007), Bat Inventory (2007), Soil Survey (2005), Shorebirds, Waterbirds, and Seabirds Inventory (2004)

Pu'ukoholā Heiau National Historic Site

Vegetation Inventory (2011), Marine Vertebrates and Fish Habitat Survey (2010), Digital Geologic Map (2007), Reptiles and Amphibians Survey (2007), Bat Inventory (2007), Soil Survey (2005), Shorebirds, Waterbirds, and Seabirds Inventory (2005)

War in the Pacific National Historical Park

Vegetation Inventory (2014), Geologic Resources Inventory (2009), Soil Survey (2009), Vegetation Classification Survey (2009), Botanical Survey (2008)

On the nudibranch

Mention reefs and images of corals and fish usually pop up in your mind. This is understandable given that corals are the building blocks of the reefs while fish are the most conspicuous residents. With more than 800 hard coral species and more than 4,000 species of fish, no wonder humans think mainly of fish and coral. Apart from fish and corals, do you know what else resides in your marine community?

The benthic marine community is monitored by the Pacific Island Network in four national parks. So throughout 2015 the PACN Quarterly will profile lesser known invertebrates that make up the marine benthic community in a segment called *Creatures from the Reef*. Although, we will barely scratch the surface. Coral reefs have 32 of the 34 recognized animal phyla. For comparison, tropical rainforests typically only have nine animal phyla. Think back to your high school biology days... a phylum is a principal taxonomic category that ranks below kingdom and above class. Moreover, scientists estimate there may even be another one to nine million undiscovered species of organisms living in and around coral reefs.

This quarter we are featuring nudibranchs or "sea slugs." Along with snails, octopuses, squid, and bivalves such as clams, nudibranchs belong in the Phylum Mollusca. Having shed their shell during the larval phase of development, nudibranchs come in a variety of shapes and sizes ranging from a small speck to 12 inches long. The name nudibranchs is derived from the Latin word for naked, *nudus* and the Greek word for gills, *brankia* in reference to the gill-like appendages sticking out on the backs of many species. Nudibranchs are usually divided into two main groups, dorids and aeolids. Dorids have a bronchial (gill) plume for respiration that is found in clusters on their back, around the anus. Aeolids have cerata (lateral outgrowths) for respiration that are spread across their back.

But with no shell for protection, how do they avoid being eaten? Their shocking array of bright colors serve to warn potential predators that they are toxic and it is best to stay away. Nudibranchs eat sponges, corals, hydroids, jellyfish, crustaceans, and even other nudibranchs. To find prey, nudibranchs use their highly sensitive tentacles called rhinophores found on top of their heads. The bright colors of nudibranchs come from the food they eat. Not only do some keep the colorful pigment of their food, some nudibranchs actually use other parts of their prey. After eating coral with algae, some nudibranchs can absorb the algae's chloroplasts (i.e. subcellular structure found in photosynthetic organisms) into their cerata where the nudibranch can then photosynthesize to make its own food. The nudibranchs that eat jellyfish will acquire their stinging cells (i.e. nematocysts), and actually place them in their cerata to be used for defense.

Nudibranchs are simultaneous hermaphrodites meaning each individual has a set of reproductive organs for both sexes. This evolved so that nudibranchs can maximize their reproductive output. Nudibranch eggs are embedded in a mucous matrix that both supports them and protects them. Dorids lay their eggs in flat ribbons usually attached to rocks, while aeolids lay their eggs in tangled masses attached to algae or other objects. The nudibranchs' lifespan ranges from less than a month to up to one year.

Hexabranchus aureomarginatus, a dorid nudibranch with its gill plume on the right.

There are over 3,000 species of nudibranchs in the ocean with an estimated 3,000 more yet to be discovered. So get out to your coral reef and look for some nudibranchs! Join us next newsletter for another equally compelling profile of an invertebrate marine benthic community member .

–S. A. McKenna, Ph.D.
NPS Marine Ecologist

2015 Bioblitz scientist and cultural practioner registration closes soon.

We need scientists from biological and other disciplines (committed UH student scientists can qualify as well). We have a unique opportunity to conduct a massive 24-hour inventory of Hawai'i Volcanoes NP resources. The event will take place May 15-16, and the focus is flexible depending on your interests.

The Bioblitz is a unique combination of taxonomic inventory, public outreach, science, and indigenous knowledge education. At its core, it is a 24-hour event in which trained scientists, Hawaiian cultural practitioners, families, students, teachers, and other community members will come together to explore the many organisms that make up the park. The event is a wonderful opportunity for scientists and traditional knowledge experts to involve the public in their hands-on field work and approaches to experiencing, observing, and understanding the natural world.

Please join us for this one-of-a-kind event by registering well before the end of January at:
http://www.formstack.com/forms/?834153-IIjFyNGPxI

Bringing the training to us

From treating for the signs of heatstroke to coding equations with the right keystroke, the Pacific Island Network brings in the experts to train us on the skills necessary to support a successful program. In early December, PACN staff joined an expert instructor from the National Outdoor Leadership School to hone our skills in wilderness first aid and CPR. The intensive 2 1/2 day class ensures that if an emergency in the back country does occur, our staff will be equipped with the skills to minimize the loss of life or limb.

Biotech Jake Gross was stuffed into a "rescue burrito" at a recent wilderness first aid training.

For most people, statistics is obscure and difficult. That's why we brought statistician Paul Geissler in from Lafayette, CO for a three day training in November. During the course, Paul shared his expertise in biological statistics and the open source statistical software package called *R*. A goal of PACN is to use *R* to automate repetitive statistical analyses and help ease the workload involved in generating annual reports. PACN staff plan to collaborate in future discussions to share *R* coding efforts among the different programs.

New faces in the PACN

Dr. Ryan Monello, Program Manager

Ryan sets out for a day on the river.

Ryan has been with the park service for over 15 years, spending time at Rocky Mountain National Park, National Park of American Samoa, and the NPS Biological Resource Division. Most recently, his work has focused on understanding the effects of disease and climate change on elk and desert bighorn sheep across 15 parks. He also provided disease and wildlife capture assistance to individual parks, and developed natural resource management plans for a variety of parks throughout the U.S. He is very excited to return to the Pacific and become fully immersed in the ecology and monitoring efforts taking place on the islands.

One of his first goals as Program Manager will be to get "out and about" to better understand park priorities and PACN. This will include meeting with park staff and cooperators and working with the monitoring programs in the office and field to better understand all facets of the network. Overall, he recognizes that the parks in this network are at the forefront of a number of critical natural resource issues, and looks forward to closely coordinating efforts to address the future challenges that the parks will face.

Ryan has been acting as the Program Manager on a part-time basis since late October and will start full-time in Hawaii in mid-January, 2015. His family will join him a little later in the year, and they are all looking forward to getting rid of everything winter-related and exploring the many amazing outdoor pursuits that the islands offer.

Jacob Gross, Biological Technician (vegetation)

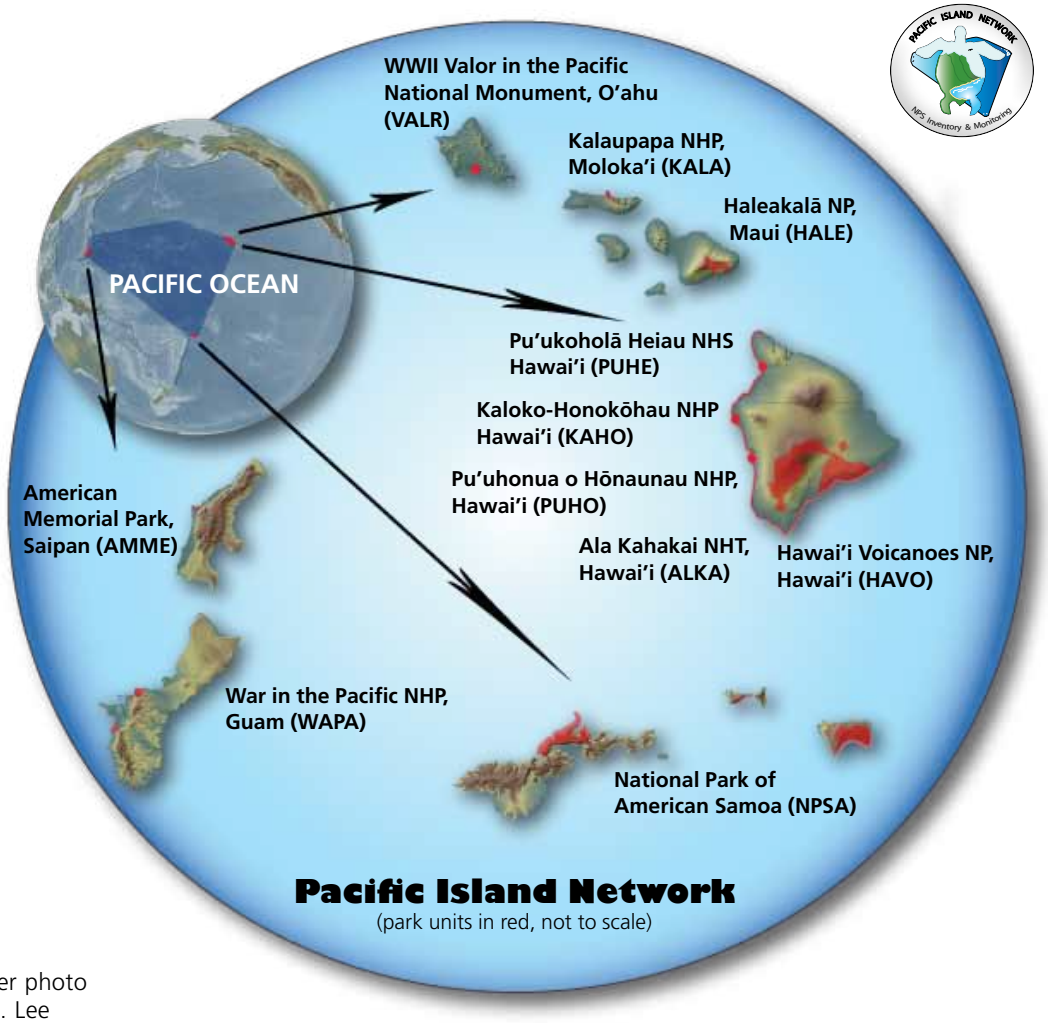
Jake conquers a mountain on O'ahu.

Jake's interest in natural resources management started during his first summer job with the Youth Conservation Corps at Sullys Hill National Game Preserve (ND). He also worked at Flint Hills & Marais des Cygnes National Wildlife Refuges (KS) as a Bio Tech and Wilson Lake (KS) as a Park Ranger.

After completing a B.S. in Biology at Emporia State University in 2006, he moved to Hawai'i Volcanoes National Park to intern with the USGS and the Hawksbill Sea Turtle Project where he fell in love with the Big Island and his wife, Danielle. In pursuance of jobs and graduate degrees, Jake and Danielle have since moved to Honolulu, Corvallis (OR), Davenport (FL), Volcano, Kona, Honolulu, Hilo, and Volcano (in that order). Jake recently completed a M.S. in Natural Resources Management at UH Mānoa during his last tour of Honolulu. When not moving furniture, Jake enjoys spending time with Danielle and their 5 month old son, Myles.

Field Schedule

	January	February	March
Anchialine monitoring			
Invasive plants		HAVO (training)	HAVO
Vegetation communities	HAVO (training)	HAVO (training)	HAVO
Water quality		W. Hawaii, KALA, NPSA, HALE	WAPA, AMME
Stream animals			WAPA
Ground water			AMME
Benthic marine			
Marine fish			
Climate (on-going)	All Parks----------	----------	----------



Cover photo by S. Lee

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The National Park Service (NPS) has implemented natural resource inventory and monitoring (I&M) 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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