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## 1. CONSERVATION: Remote Pacific island a living laboratory for climate change (02/10/2011)

Laura Petersen, E&E reporter

The sign welcoming outsiders to a coral reef island 1,000 miles southwest of Hawaii reads: "Palmyra Atoll, Elevation: 6 feet, Population: 10."

The series of islands and islets, totaling 700 acres arranged in a horseshoe pattern around shallow lagoons and supported by a 16,000-acre coral reef, is more than a remote paradise, however. It is a living laboratory for how these unique tropical islands respond to climate change.



Sooty terns are one of the sea bird species that use Palmyra Atoll as a wintering ground or stopover on their long flights across the Pacific. Photo courtesy of the Nature Conservancy/Rob Shallenberger.

While atolls are found throughout the tropics, Palmyra is unique because except for the U.S. military during World War II and the small group of researchers that visit every summer, the atoll is uninhabited.

"It's hard to find anything pristine in the world today, but that's probably as close as you can get," said Jordan Jokiel, Palmyra program director for the Nature Conservancy, which is working alongside the Fish and Wildlife Service on an ongoing conservation, restoration and research project there.

"What we learn from a place like Palmyra can be applied to other places," Jokiel said. "It gives us a sense of how things should work and what we should be shooting for."

Located just north of the equator near the International Date Line in the Pacific Ocean, Palmyra is a U.S. incorporated territory that was used as a military fueling station from 1940 to 1945 and was once proposed as a nuclear dump site.

In 2000, the Nature Conservancy purchased the atoll's main island for \$37 million in order to preserve its astounding 125 species of coral, the world's largest terrestrial arthropod, the second-largest

population of red-footed boobies and one of the largest remaining stands of the towering *Pisonia grandis* tree.

The trees, found only on remote islands throughout the Indo-Pacific, can grow up to 100 feet tall and form large canopies.

"In the most mature state, you'd be walking through a forest that has big trunks widely spaced apart, but it would be like looking up in a cathedral with a green roof, all the leaves knit together," said Kathryn McEachern, an ecologist with the U.S. Geological Survey.

Recognizing the rich habitat and its vital role as a wintering ground and stopover for migratory sea birds, the Fish and Wildlife Service in 2001 designated Palmyra Atoll and its surroundings a national wildlife refuge. The Bush administration expanded protection for up to 50 miles from shore by declaring the atoll a national marine monument in 2009.

### **Altered state**

While never inhabited, the atoll was significantly altered by the military, which dredged the lagoons and connected several islands, cutting off water circulation between lagoons.

The island is also plagued by invasive species, including black rats and coconut palms. While some palms may have been native, several attempts to establish coconut tree plantations led to more than 2 million coconut palms growing on the atoll.

However, nature has managed to re-establish many processes in the past 65 years.

"When I went there, I was expecting to see a place that was really decimated," McEachern said. "It wasn't. The system does seem to have its own innate resilience. Therefore, the idea that you could move the atoll back to a native-dominated state is really not that far-fetched."

To help guide restoration efforts, USGS recently published a terrestrial [management plan](#) for Palmyra that calls for enhancing native species habitat, monitoring the abundance and health of natural resources, gathering new information through research, and coordinating conservation plans among relevant agencies. The USGS plan will aid in future management decisions, but limited funding means FWS and the Nature Conservancy will not be able to follow it step by step, Jokiell said.



Researchers working at Palmyra Atoll are studying coconut crabs, which are thought to be in decline throughout their range. Photo courtesy of FWS/Laura Beauregard.

"It's picking what we're able to do and what we think are the highest priorities from that plan," he said.

For example, project managers are currently focused on removing coconut palms from the most intact atoll forests through targeted herbicide application. Jokiell and others are also investigating ways to eradicate the highly destructive black rats, which devour tree seedlings and bird and turtle eggs.

## Research focus

Research is a key focus for the Nature Conservancy, which helped set up the Palmyra Atoll Research Consortium. The group of eight universities and institutions, including USGS, Scripps Institution of Oceanography, Stanford University, the University of Hawaii, and the American Museum of Natural History, send as many as 24 researchers at a time to work on Palmyra during the hot, humid summers.

Their work often has direct conservation implications, either by determining how different processes work to inform management actions, such as possibly reconnecting water flow between the lagoons, or collecting baseline data on species thought to be in decline, such as the coconut crab. One researcher describes the crabs, which can reach 7 pounds and have gigantic claws, as "charismatic."

"They are inquisitive," said Stacie Hathaway, a USGS ecologist who co-wrote the terrestrial management plan. "If you are sitting on the ground, they will come up to you and are interested in what's going on."

At only 6 feet above sea level, the ravages of climate change -- including rising oceans and increasing frequency and intensity of tropical storms -- mean Palmyra is more likely to be inundated and could one day be completely submerged.

Researchers are learning as much as possible while they still can, gaining insight into how the atoll's species have adapted to such a wet and destructive environment.

"We have an opportunity here to look at what happens in a situation where sea-level rise is very much a reality and to look and see how nature responds to that," McEachern said.

More than 50 scientific papers have been published based on Palmyra research. One of the most interesting identified how coconut palms act like an invasive species by disrupting nutrient cycling on the atoll.

The tall palms shade large areas, preventing *Pisonia grandis* from growing. This has two major effects: More nutrients are locked up for longer periods because when palms fall or die they do not decay as quickly as *Pisonia grandis*; and fewer nutrients are deposited on the atoll by seabirds via their guano because the birds only roost in *Pisonia grandis* canopies. With the atoll dominated by palms, seabirds are less likely to roost there, which also has potential negative implications on reproduction rates.

Jokiel said such interactions, and the lessons to be learned from them, provide the incentive for doing more landscape-scale conservation.

"If we want to protect places like Palmyra, it's very important to not just protect the land, but to get a sense of, 'What is the range of these seabirds that they are feeding?'" Jokiel said. "You need to protect those areas out at sea as well. You need to maintain a healthy fishery for these birds to catch fish and bring them back so the nutrients are available."

[Click here](#) to read the USGS management plan.