UC SANTA BARBARA

THE Current

August 26, 2008
George Foulsham

Study of Islands Reveals Surprising Extinction Results

It's no secret that humans are having a huge impact on the life cycles of plants and animals. UC Santa Barbara's Steven D. Gaines and fellow researcher Dov Sax decided to test that theory by studying the world's far-flung islands.

Their research, published this month in the Proceedings of the National Academy of Sciences, sheds surprising light on the subject of extinction rates of species on islands. The paper, "Species Invasions and Extinction: The Future of Native Biodiversity on Islands," is one in a series of reports by this team studying how humans have altered the ecosystems of the planet.

Gaines and Sax started the project with a question: What effect are humans really having on biological diversity? "The presumption at the time was that we are driving biodiversity to lower levels," said Gaines, who directs UCSB's Marine Science Institute. "Certainly, if you think about it at the global level, this is true because humans have done a lot of things that have driven species extinct."

However, when studied on the smaller scale of islands, the findings showed something completely different. Diversity is on the rise – markedly so in some instances. Diversity has gone up so dramatically that it might cause some to wonder if the health of the ecosystems might not be better because the number of species is twice as high as it used to be. But it's not that simple, Gaines said.

"What Dov and I worked on a few years ago is the fact that the vast majority of introductions (of species) don't have large negative effects," Gaines said. "Indeed, most

species that get introduced don't have much effect at all. It doesn't mean that they're not altering the ecosystem, but they're not driving things extinct like some of the big poster-child stories we've been hearing about."

Still, the study showed that human colonization has had a massive impact on ecosystems of islands, with the introduction of new, exotic plants and animals. In New Zealand, for example, there were about 2,000 native species of plants. Since colonization, about 2,000 new plant species have become naturalized. Over the same period, there have been few plant extinctions, so the net effect is that humans have transformed New Zealand's landscape by bringing in so many new species.

Sax, a former postdoctoral researcher at UCSB who is now assistant professor of ecology and evolutionary biology at Brown University, did much of the fact-finding for this report by painstakingly digging through data that had been collected over hundreds of years on islands around the world. "This is Dov's specialty," Gaines said. "Finding really old data sets that are very interesting."

"The dramatic increase in the number of species has changed how the system functions," Sax said. "Changing the abundance of natives versus exotics affects all of the other species that used to depend on the natives for food or shelter. So, it's not in any way to say that increasing biodiversity is a good thing."

With birds, it's a different story. The number of bird species on islands today is almost exactly the same as it was prior to human colonization, but the species of birds on the islands are very different. About 40 percent of the species of birds that you find on islands today are introduced species, Sax said, which means that a comparable number of birds has gone extinct. "In the case of birds," he said, "lots of extinctions, no change in total biodiversity."

All of this caused Gaines and Sax to ask new questions:

• Are the islands undersaturated? Can you still keep throwing species in there, with the result that nothing is going to happen?

• Are they now oversaturated? Are there limits in how many species an ecosystem can hold?

• Are we building an extinction debt? "Which means," Gaines said, "that by going in and mucking up the system, we may have already created the setting where too many species have been packed in, and we just haven't waited long enough to see these extinctions start to happen.

"The whole point of this study was to start looking down the path to see which of these wildly different scenarios might be right," Gaines added. "We haven't nailed the answer yet, but we've set the stage for answering whether islands are now saturated or not."

What made the research possible was that many of the explorers who colonized the islands included naturalists on their boats. From the time they landed on the islands, the naturalists were busy cataloging and documenting the plants and animals of each colony.

"It was very surprising to find such a strong correlation between the number of native and exotic plant species on islands around the world," Sax said. "In ecological research, a ‘strong' correlation often explains 50 percent of the variation. Here, the correlation

between native and exotics explains almost 100 percent of the variation. In other words, if you know how many native plants are on an oceanic island then you can predict almost perfectly how many exotic plants are there."

The study, which took a year and a half, included islands such as Lord Howe Island east of Australia and Tristan da Cunha, a group of remote volcanic islands in the south Atlantic Ocean, among others.

"These were all oceanic islands," Gaines said, "which means islands that are far enough away from a continent that they're not getting regular exchanges with the mainland."

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community

of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.