

'Nonlinear' ecosystem response points to environmental solutions

17 January 2008

The preservation of coastal ecosystem services such as clean water, storm buffers or fisheries protection does not have to be an all-or-nothing approach, a new study indicates, and a better understanding of how ecosystems actually respond to protection efforts in a “nonlinear” fashion could help lead the way out of environmental-versus-economic gridlock.

There may be much better ways to provide the majority of environmental protection needed while still maintaining natural resource-based jobs and sustainable communities, scientists from 13 universities and research institutes will suggest Friday in a new article in the journal *Science*.

“The very concept of ecosystem-based management implies that humans are part of the equation, and their needs also have to be considered,” said Lori Cramer, an associate professor of sociology at Oregon State University.

“But ecosystem concerns have too often been viewed as an all-or-none choice, and it doesn’t have to be that way,” Cramer said. “What we are learning is that sometimes a little environmental protection can go a long way, and leave room for practical compromises.”

In their analysis, a diverse group of scientists from four nations analyzed the values and uses of mangrove forests in Thailand – a hot spot of concern about coastal ecosystems being degraded and losing their traditional value of storm protection, wood production and fish habitat. These saltwater forests are frequently being replaced with commercial shrimp farms.

In the past, the scientists said, it was often assumed that the environment responded to protection efforts in a “linear” fashion – in other words, protecting twice as much of a resource generated twice the amount of protection. But the new study, and others like it, are making it more

clear that ecosystems respond in a “nonlinear” fashion – protection of a small percentage of a resource might result in a large percentage of the maximum benefit that can be gained.

If the data are available to help quantify goods and services, researchers say, values can be attached to them and used to reach societal compromises. This might lead to most – but not all – of an environmental resource being protected, and some – but not all – of resources available for commercial use. The combined value of the ecosystem protection and commercial development may approach, or even exceed the value of a “hands-off” approach.

“Part of the problem now is that a lot of the data we need to make this type of assessment simply isn’t available,” said Sally Hacker, an OSU associate professor of zoology. “Biological, economic and sociological data could be enormously helpful to help us reach better management decisions, and this is something we need to improve.”

Fairly good data were available in the case of the Thailand mangrove forests, however, and researchers used it to make their case. On a given area of mangrove forest there, the assigned value of ecosystem services – storm protection, biological habitat, etc. – was determined to be about \$19 million with a “hands-off” approach and no commercial use whatsoever.

But with a full range of uses, which included leaving 80 percent of the area in mangrove forests and gaining almost all of their flood protection ability, the value was found to be \$17.5 million, Hacker said. And this allowed for a commercial shrimp fishery, gathering of wood products, fishing and other commercial uses.

“At some point we have to get beyond this ‘either-or’ mentality when it comes to land and ocean management,” Cramer said. “Insisting that our

ecosystems be either totally protected, or totally developed, just leads to polarization, entrenched positions and a loss of communication. We can do better than that, and a good scientific approach can help show the way.”

In the final analysis, the researchers said, everything should be on the table – the value of ecosystem services, the protection of species and the environment, jobs, tourism, protection of human life, even cultural and community values.

“Shrimp farming may be a person’s livelihood, and that cannot be ignored,” Cramer said. “At the same time these mangrove forests help protect human lives and healthy ecosystems, and you can’t ignore that either. The good news is that when we understand the nonlinear nature of ecosystem response, some of these compromises become possible.”

The concepts being developed, the researchers said, are directly relevant to the current debate over marine reserves in Oregon. The challenge there will be to balance an adequate amount of biological protection, and a careful analysis of the areas to be protected, with the needs and concerns of coastal communities, they said.

In like fashion, they said, such approaches may be relevant to many other societal debates – whether it’s health care or the preservation of protective marshes around New Orleans – in which values can be assigned to various services and compromises reached.

Source: Oregon State University

APA citation: 'Nonlinear' ecosystem response points to environmental solutions (2008, January 17) retrieved 18 September 2021 from <https://phys.org/news/2008-01-nonlinear-ecosystem-response-environmental-solutions.html>

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