ECOSYSTEM ASSESSMENT

New Survey to Collect Global News You Can Use

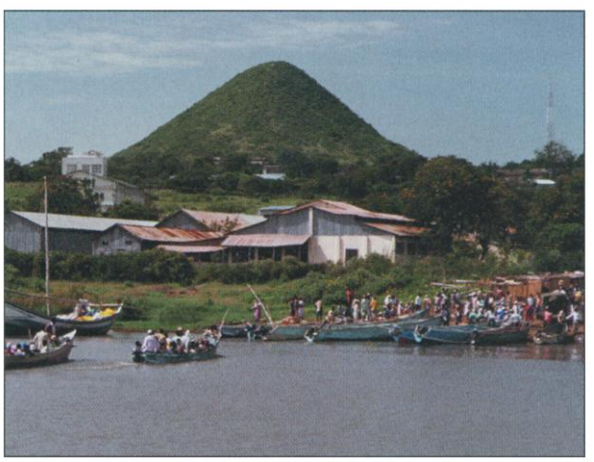
A new 4-year, $20 million project hopes to synthesize what's known about the world's ecosystems and help policy-makers deal with those under siege

The clear waters of Lake Victoria in eastern Africa once supported more than 350 species of cichlids, a small, bony fish that was a dietary staple of local villagers. Then fishery managers, in an attempt to bolster exports, introduced the larger, tastier Nile perch and Nile tilapia. The newcomers thrived in the lake's cool, deep waters and began gobbling up the cichlids. As the perch took over, fertilizer runoff from local plantations combined with sewage and industrial wastes to trigger vast algal blooms that sucked oxygen from the water. Today, up to half the cichlid species have vanished, residents who can't afford perch show signs of protein deficiency, and the once-healthy lake may soon become a dead zone.

Scientists say the tragedy that unfolded at Lake Victoria over the past 30 years might have been prevented, or at least mitigated, had local authorities known more about how changes to one part of the environment affect the entire system—and what to do about them. Even today, they add, there is a role for experts in assessing the lake's woes and proposing remedies. Generating that type of information—both global and local—is the aim of the Millennium Ecosystem Assessment, a 4-year, $20 million effort that will get under way early next year.

The assessment will turn loose ecologists and social scientists to gather and analyze data on the state of the world's ecosystems, assess nature's ability to provide essential "services" such as food and clean water, and project environmental trends such as deforestation, loss of species, and pollution (*Science*, 22 October 1999, p. 685). "It's simply a way of taking stock of what we know, what we need to know, and what are the consequences," says ecologist Jane Lubchenco of Oregon State University in Corvallis. The project will also carry out regional assessments to help policy-makers cope with pressing problems and avert future disasters.

Proponents say the assessment, funded mostly by the United Nations, the World Bank, and foundations, will transcend past efforts that viewed problems such as water scarcity and global warming in isolation (www.ma-secretariat.org). It's a "more holistic approach" than previous assessments, says Walter Reid, former vice president of programs at the World Resources Institute (WRI) in Washington, D.C. He's acting science director of the assessment, which will be highlighted next week at a meeting of world environment ministers in Bergen, Norway. Supporters have already won commitments for about two-thirds of the total funds and hope to have the rest by early next year.



Hard lesson. New assessment will attempt to head off environmental fiascoes such as Lake Victoria, where nonnative fish and pollution dramatically altered the ecosystem.

But some say that the assessment could end up a victim of its own lofty goals—to evaluate ecosystem health, supply data to implement treaties, and sell the message that ecosystems have economic value. "The challenge the [assessment] faces right now is that it's trying to do several extremely difficult things all at the same time," says Harvard environmental policy expert William Clark. Still, if the assessment manages to focus attention and resources on environmental sore spots like Lake Victoria and add substance to fuzzy buzzwords like sustainable development, it will be a success, Lubchenco says. "It's tremendously exciting, because it's what the world needs right now," she says.

The Millennium Assessment is seen by many ecologists as the logical next step in taking stock of the global environment. An earlier scientific consensus that the ozone hole posed a serious environmental threat led to the 1987 Montreal Protocol, an agreement to phase out the use of ozone-destroying synthetic chemicals. Climate scientists have used a similar approach in the Intergovernmental Panel on Climate Change (IPCC), begun in 1988. The panel's 1995 report pointing to a human influence on global climate helped build support for the 1997 Kyoto treaty, with its plan to curb greenhouse gas emissions. Looking at ecosystems next is "a natural thing to do," says Reid. "These really are the big issues that confront development around the world."

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The complexity of most environmental problems demands looking at the big picture, Reid explains. Storing carbon in tree farms, for example, might seem like a good way to combat global warming, but it could also reduce biodiversity by replacing natural ecosystems with single-species plantations. "Part of what led the scientific community to this [point] was its frustration with things like the climate assessment, which is looking at only that one driving force," Reid says.

WRI has already laid the groundwork for the assessment, with Reid spearheading the project and WRI, the United Nations, and the World Bank providing the funding. For the past 2 years, WRI has conducted a Pilot Analysis of Global Ecosystems (PAGE), to be released next week as part of WRI's biannual World Resources 2000–01 report. Reid says PAGE was "a proof of concept that proved data and information are available at a global scale." WRI also intended it to be useful to policy-makers. For example, as part of the assessment, agricultural scientists at the International Food Policy Research Institute in Washington, D.C., gathered data on fertilizers and yields to produce high-resolution global maps showing which regions are degraded to the point that they may no longer be able to support crops.

Persuaded by the pilot project, environmental scientists are eager to proceed. The full assessment will "go into much more depth than we've ever done before," says Robert Watson, environment department director at the World Bank. Those details include filling data gaps in such areas as global forest cover and how much soils erode naturally, as well as weighing trade-offs, such as growing more crops by converting forests to farmland versus using more fertilizers and pesticides. And unlike the in-house WRI effort, the full assessment will tap a broader community. "It will be the world's best scientists trying to assess what we

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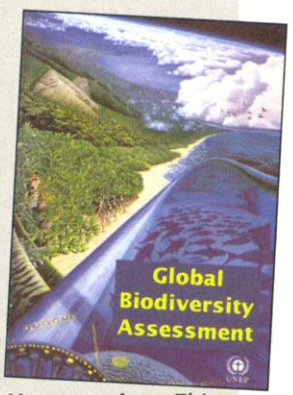
Ecologists Hope to Avoid the Mistakes Of Previous Assessment

For ecologists, an attempt to assess the world's ecosystems (see main text) has a familiar ring to it. A few years ago, many of the same scientists poured their energy into the Global Biodiversity Assessment (GBA). But that exercise sank without a trace after participants failed to find a receptive audience. "When you confront people with a 1000-page thing [containing] everything people think is important, that's not a way to move the political agenda," says emeritus ecologist Gordon Orians of the University of Washington, Seattle.

The United Nations Environment Program (UNEP) commissioned the GBA, which was conceived as a way to help countries carry out the 1992 Convention on Biological Diversity, and the Global Environment Facility kicked in $3 million to fund it. About 300 scientists from 50 countries helped write chapters on topics such as the magnitude and distribution of biodiversity, inventorying and monitoring, and species' economic value, and up to 1500 reviewed it. The report is "an excellent [scientific] document," says its organizer, Robert Watson of the World Bank. But as a policy tool, "it's not had the value many of us think it could have had."

The biggest mistake, say Watson and others, was a failure to determine ahead of time what policy-makers needed to know. "The scientific community just decided we needed this and did it," says Jane Lubchenco of Oregon State University in Corvallis. She says this was also a political error: Countries were "not particularly welcoming," because they feared being blamed for not adequately protecting species. Moreover, its sponsor put little effort into publicizing the study, Watson says.

Participants in the new ecosystem assessment hope to avoid those mistakes. The study will have input from the secretariats of the biodiversity treaty and other treaties, and organizers also have earmarked funds for public outreach. For all its faults, GBA had "a lot of hidden value," says Lubchenco, in stimulating research, framing questions, and linking experts around the world. **–J.K.**



Heavy going. This 1140-page tome was hard for policy-makers to digest.

know about a global issue and how it pertains to development in general," says Watson, who anticipates IPCC-sized teams—500 authors and 2000 reviewers—for chapters on ecosystem conditions, their future, and possible policy responses.

Like the IPCC, the ecosystem assessment will be primarily a literature synthesis, although the authors hope to fold in new data such as high-resolution Landsat 7 images of global land cover. They also expect to develop two dozen indicators for ecosystem health, such as the crop maps that were developed as part of PAGE. Ecologists think such measures can help pin down environmental trends. Lubchenco says she's looking for the ecological equivalent of the 42-year record of soaring carbon dioxide levels from Mauna Loa in Hawaii that illustrates how humans are altering global climate. "What we don't have yet for ecosystems is a single compelling icon or set of measurements," she says.

The assessment will also extrapolate environmental trends, much as the IPCC has looked at changes in vegetation and farming conditions stemming from global warming. For example, Millennium Assessment experts might examine how an anticipated doubling in nitrogen from fertilizers over the next 40 years will impact water quality, fisheries, and even human disease. "This is a new area for ecologists," says ecologist Stephen Carpenter of the University of Wisconsin, Madison.

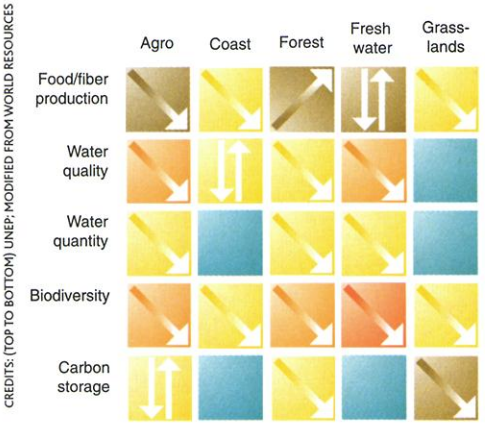
But the assessment is intended to be more than a scientific exercise. Organizers hope to tailor the information to the needs of those implementing international environmental agreements. In doing so, they want to avoid the fate of a similar effort that involved only scientists, whose tome "sank like a lead balloon" among policy-makers, says Stanford ecologist Gretchen Daily (see sidebar). Toward that end, Reid has gotten endorsements from leaders of the implementing bodies of three major environmental treaties—desertification, wetlands, and biodiversity—all of which will have representatives on the Millennium Assessment's 30- to 40-member board.

Another element designed to win over politicians is a series of 10 regional, national, and local-scale assessments that would, for example, examine solutions for places like Lake Victoria, or weigh plans to dam and divert the Mekong River in Southeast Asia, now the world's largest undammed river. Such assessments aren't new, Carpenter says, but "there are very few examples as integrated as what the Millennium Assessment envisions." Village-scale assessments will take an even finer scale approach. Madhav Gadgil of the Indian Institute of Science in Bangalore, India, has already done a pilot version that inventoried species and conditions such as erosion rates and water quality in a cluster of villages. Its findings, he says, have already affected what trees local people harvest and how they manage fish in streams. Recognizing that not all countries have the necessary expertise, these smaller scale studies will also train scientists in less developed countries so that, for example, they can analyze the Landsat 7 remote sensing data themselves.

Although the assessment will offer advice to policy-makers, it will be in the form of scenarios rather than recommendations. And if the assessment is done properly, say proponents, the result will be not only the most rigorous, accessible data set ever on world ecosystems, but also a document that will be hard for governments to ignore. "This report will tell the truth [and] embarrass people that ought to be embarrassed," says adviser Jose Goldemberg, an energy expert at the University of São Paolo.

Reid and other participants don't want to promise too much: "Even if it meets its scientific goals, there's no telling whether it will have much impact on policy," Daily says. But for the residents of Lake Victoria and other places around the world, the Millennium Assessment may offer communities the best chance to recover from an environment disaster—and perhaps avoid the next one.

–JOCELYN KAISER



Eco checkup. A pilot study of five global ecosystems found that many are hard-pressed to provide such "services" as crops and clean water.

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