GLOBAL ENVIRONMENT FACILITY

Science Moves up Ladder in Push for Sustainable Growth

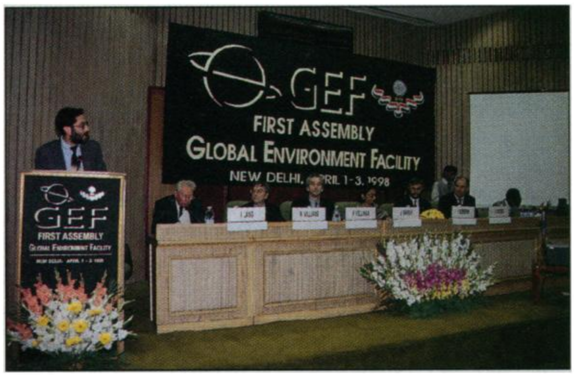
NEW DELHI, INDIA—In the past 4 years, three dozen industrial countries have put up $2 billion for an experiment to help developing nations cope with global environmental problems. The funds, channeled through a unique mechanism called the Global Environment Facility (GEF), are supporting some 440 projects in 110 countries, ranging from rural energy development in China to the preservation of a botanical collection in Indonesia. It's an ambitious effort—spurred by the conventions on biodiversity and climate change that grew out of the 1992 Earth Summit in Rio de Janeiro—to move sustainable development beyond political posturing into real-world projects.

Earlier this month, delegates from participating countries met here for the first GEF Assembly to assess how the experiment is going. They applauded the work done so far but agreed that there is plenty of room for improvement. An outside panel of experts, for example, recently gave GEF good marks for raising the profile of environmental issues in development projects but an incomplete for impact because so many projects are just getting off the ground. The report also urged GEF officials to lower the bar for participation by shortening the time needed to approve projects and clarifying what activities are eligible.

The delegates also approved the creation of a small research fund and the appointment of the first scientist from a developing country to head the facility's top scientific committee. And they welcomed a commitment for $2.7 billion more from the industrialized world to continue GEF's work over the next 4 years.

In spite of its size and potential influence, GEF has received little attention in the industrial world. It was established in 1991 to coordinate the environmental activities of the World Bank, the United Nations Environment Program (UNEP), and the U.N. Development Program. But it assumed greater importance in 1994 after becoming the implementing arm of the environmental treaties stemming from the Rio summit. Its projects focus on five areas: conserving biodiversity, reducing the risks of climate change, protecting the ozone layer, cleaning up international waters, and stopping land degradation. And although GEF seeks to have a global impact, everything it funds must include significant contributions from host countries.

"Take it or leave it, GEF is the only multilateral mechanism financing mainstream environment solutions, and everything needs to be done to strengthen this unique body," notes David Okali, an ecologist at the Department of Forest Resources Management of the University of Ibadan in Nigeria. "And the best part is, it is open to learning from its mistakes."



P. BAGLA

Talking science. Members of GEF's scientific advisory panel during a session of the assembly.

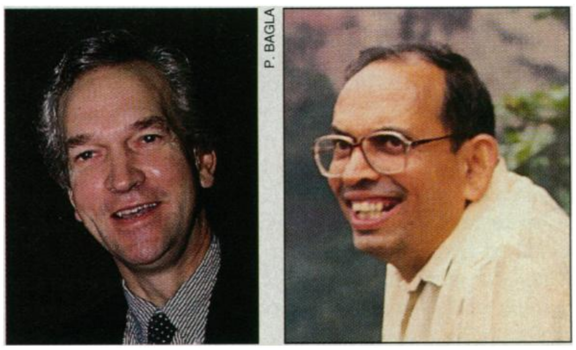
The new research grants are an example of that flexibility. Targeted research has been excluded from GEF funding on the grounds that projects are supposed to generate immediate benefits to the environment and, thus, should make use of existing technology. However, the program's Scientific and Technical Advisory Panel (STAP) lobbied the governing GEF Council to change its policy, and the Assembly endorsed a proposal to devote a few percentage points of GEF's budget to research and data-collecting efforts that would strengthen existing projects or point the way to new opportunities.

"The idea is to get maximum global benefits from the projects that GEF is funding," says Pier Vellinga, a Dutch environmental scientist and chair of STAP. "GEF's role is to add a global environment component to projects that now often have a national focus, and research will help to develop the best projects." The panel has already received 10 proposals, ranging from a study of nutrient loads on coastal seas to analyzing how to supply off-grid electricity in rural areas, and it plans a June meeting to discuss the ground rules for future applicants.

Sometimes, however, the science behind a GEF project can itself be controversial. That's the case with a $74 million project to reduce the human impact on seven environmentally sensitive regions in India, including reserves for tigers, lions, and elephants. Some researchers warn that any effort to minimize human-animal interactions will be hampered by a dearth of baseline data in ecosystems already heavily altered by humans. Vellinga agrees that "hard science does not exist on these disturbed ecosystems," but adds that "we have to make a start somewhere." And political scientist Gareth Porter of Washington, D.C., chair of the panel that recently reviewed GEF's overall performance, believes that "one has to look at what would happen without this injection of funds. Surely the tiger would not survive."

A key element in GEF projects is the ability of the host country to sustain an activity once the outside money is gone. One successful example is a coal-bed methane project in China that began as a $10 million pilot effort to find alternative energy sources and to reduce air pollution. The project demonstrated several techniques to extract and use methane from deep underground coal seams, thereby avoiding its release into the atmosphere and substituting a cleaner burning fossil fuel. In conjunction with a new injection of GEF funding, Hutton Archer, senior external relations coordinator for GEF, notes that China has allocated $80 million to exploit the technology.

Less successful is a $15 million effort to generate hydroelectric power in the Himalayas. The project has run into local resistance that threatens its continuation. Villagers have been slow to embrace the new technology, preferring the traditional wooden water wheels to the new steel turbines because they are easier to repair. Six months before the scheduled end of the 42-month project, none of the 20 sites is operating as planned, and officials have extended the project for 18 months.



P. BAGLA

Changing hands. India's Madhav Gadgil, right, prepares to take over STAP chair from Holland's Pier Vellinga.

Sometimes internal and external forces combine to dim the outlook for a GEF project. That's the situation facing a $12 million scheme in Indonesia that would restore and make available globally a plant collection begun almost 2 centuries ago and, at the same time, train a new generation of taxonomists. Although the effort has won high marks for its scientific merit, its progress is threatened by the country's economic crisis. Cost overruns in obtaining the necessary cabinets and supplies to refurbish and house the collection have forced officials to suspend plans to develop a computer database that would be accessible via the Internet. They have also shelved efforts to create and disseminate a host of products—such as documentation kits and field guides—to help would-be collectors.

The Indonesian effort illustrates what Vellinga and others call the experimental nature of GEF projects, which includes a willingness to take risks. "In retrospect, I believe the World Bank might have limited the scope of the project more and eliminated some items that were not so urgent," says Kathy MacKinnon, senior biodiversity specialist with the bank's global environment division. Still, MacKinnon applauds the Indonesian government for proposing "such an exciting and ambitious project as a national priority."

The importance of developing countries in shaping GEF's agenda is highlighted by the recent selection of Madhav Gadgil, a human ecologist at the Indian Institute of Science in Bangalore, to succeed Vellinga as chair of the scientific committee. India is the second largest recipient of GEF funds, and his appointment "is long overdue," says microbiologist Mostafa Kamal Tolba, the former executive director of UNEP.

Although the success or failure of individual projects is important, environmental scientists from both North and South say that GEF's biggest challenge will be to incorporate sustainable development into the actions of every participating nation. "GEF is a unique international experiment of learning by doing," says biologist Thomas Lovejoy, chief biodiversity adviser to the Smithsonian Institution and to the World Bank. "Living within natural ecosystems must become the accepted way for people to live on Earth."

–Pallava Bagla

With additional reporting by Jeffrey Mervis.

AUTONOMOUS OCEANOGRAPHY

Mixed Results From the Labrador Sea

It was the most ambitious venture yet in robotic oceanography: Launch two automated submarines in the stormy Labrador Sea in midwinter and then go home, leaving them behind to explore how frigid surface waters sink to the ocean floor. Bottom-water formation, as this sinking is called, feeds currents that snake through the abyss around most of the globe, but it takes place only in remote, icy seas. The designers of the experiment hoped to study the process from the comfort of their home laboratories, as the autonomous underwater vehicles (AUVs) probed the sinking water to depths of 2000 meters or more and relayed data back to them.

It didn't quite work out that way for the team, from the Massachusetts Institute of Technology (MIT), the Woods Hole Oceanographic Institution (WHOI), and the University of Washington. The ambitious experiment, which ran for 2 weeks in early February, did give investigators a detailed view of how kilometers-wide parcels of water cool and sink. But a mechanical glitch prevented the AUVs from "parking" automatically at a docking station moored deep underwater, so they could not be left unattended for long-term study. "A number of factors conspired against us," explains WHOI research engineer Mark Johnson, a principal investigator on the cruise. "Almost all the engineering was novel—every component on the edge of what you dare take to sea."

The concept behind the experiment, autonomous ocean sampling, promises a cheaper, less arduous way to study the ocean. It also offers the potential for making fine-scale observations not easily captured by ships. AUVs can patiently wait for episodic, short-lived events, and they can freely roam the ocean, changing course to concentrate on the most interesting areas as the experiment unfolds. They are ideal for studying deep-water formation, says Martin Visbeck, an oceanographer at Lamont-Doherty Earth Observatory in Palisades, New York, who was not on the cruise. "AUVs can move very fast [10 knots] horizontally and measure vertical sinking to see whether it occurs over a distance of 1 kilometer, 5 kilometers, or more."

But these 2-meter-long, $100,000 vehicles need tending: Every few hours, they have to recharge their batteries, dump their data, and receive new instructions. To meet these needs, a team from WHOI designed a docking station that can be moored 500 meters down, where it serves as a high-tech "garage" for the subs. The docking station, in turn, communicates by cable with a surface buoy that can relay signals directly to the ship and, via satellite, to shore. James Bellingham of MIT, the chief scientist, and his colleagues hoped that automated docking—never before attempted in the deep ocean—would enable them to release the AUVs in the Labrador Sea for about 3 months of data collecting.

J. BELLINGHAM/MIT

Helping hand. Glitches prevented prolonged autonomous operations.

Once they had deployed the equipment at a site roughly 350 kilometers east of the Labrador coast, the team quickly scored several firsts. After a couple of days of tinkering, the AUVs homed in on an acoustic beacon on the dock. They also sent some data via acoustic signals to the dock, which relayed the data via the surface buoy to the ship and satellite system. Says WHOI senior engineer Keith von der Heydt, "This was the first time data were automatically sent from AUV to dock to desktop."

But the fatal glitch soon became apparent. A "carriage" piece designed to secure the AUVs to the dock was jammed, which meant that a vehicle could not "park," recharge its batteries, or download and upload data. After trying to fix the carriage by driving an AUV into it—"ramming it with a $100,000 hammer," says Bellingham—the researchers had to launch and recover the AUVs from the side of their ship, the *Knorr*, limiting them to 2 weeks of data collecting.

This snafu and other difficulties, including problems charging the AUVs' batteries, cut deeply into the project's scientific yield, team members say. The AUVs could not monitor bottom-water formation during its peak later in February and March. Still, radio signals from the 70 subsurface floats set adrift during the cruise are allowing the oceanographers to track the movements of parcels of especially salty, dense water that may be destined to sink. And the AUVs did make measurements that would not have been possible from the ship, such as tracing sharp variations in the depth of the boundary layer between the warmer surface water and cooler water below. This uneven boundary, says Bellingham, may hold clues about how bottom water begins to form.

Visbeck thinks it may take 5 years or longer before oceanographic experiments can be left to run themselves, but it will be worth the wait. AUVs and other autonomous ocean sampling devices, he says, "will enable us to do things we can't do now or can only do in inconvenient ways."

–Steve Nadis

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