Sustainable Global Commons

Participants in the panel discussion included Sylvia Earle, chief scientist of the National Oceanic and Atmospheric Administration; Joshua Epstein, senior fellow in foreign policy studies at The Brookings Institution; Robert White, president of the National Academy of Engineering; and Edward O. Wilson, Baird Professor of Science and Mellon Professor of the Sciences, Harvard University.

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In opening the session on the "Sustainable Global Commons," Robert White defined "global commons" for purposes of the meeting as "not only those areas of the global environment that are beyond national jurisdiction, in which each nation has a stake and contributes to their deterioration or their enhancement, but also those activities in which there is a global interest—what Harlan Cleveland has referred to as 'common treasures.'"

Biological diversity was chief among the "common treasures" discussed in the session. E. O. Wilson stated that although diversity of life has always been a dominant theme in biology, "a new urgency now drives the study of biodiversity for its own sake, because at the very time that the importance of all life forms for human welfare becomes distinctly clear, we see with equal clarity that the extinction of wild species and ecosystems is accelerating through human action."

Although about 1.4 million species of organisms have been given scientific names, Wilson said that "biologists do not know the amount of diversity in the total world of flora and fauna, even to the nearest order of magnitude." The total number of species on Earth is not 1.4 million, Wilson suggested, but closer to 100 million, with more than 10 million species of arthropods (mainly insects) in tropical forests alone. Only about 4,000 species of bacteria have been officially described, but the actual number could be a hundred or a thousand times that, he continued. "In terms of bacterial diversity on Earth and its potential for scientific knowledge and usefulness to humankind, we are on the edge, literally, of an unexplored world."

Despite the fact that "the fossil record suggests that biodiversity is currently near its all-time high at every taxonomic (at least to the family) level," Wilson warned that we are now in the midst of a "sixth extinction spasm, the greatest since the one that closed the age of the dinosaurs 66 million years ago." The other extinctions were caused by climatic cooling, by reduction of the continental shelves, and possibly by a hit from a giant meteorite, each one requiring between 10 and 100 million years for evolution to catch up again. This one, however, is due to human behavior. But, some ask, isn't humanity a part of nature, and extinction a natural process? "The answer, of course," said Wilson, "is that we are not in this sense part of nature. There has never been anything like the human species before in relation to the remainder of the world's biodiversity."

Wilson does not believe it's too late. "We are certainly going to lose a lot of biological diversity because so much of the natural habitat has been diminished already, but we can still slow and eventually stop the hemorrhaging. Our goal, and this I think must be done by regarding biological diversity of the globe as a common treasure, should be to carry as much of this biodiversity as possible with us through the bottleneck of the next 50 years of overpopulation and environmental degradation. Common treasure it is for all of humanity. Along with our culture itself, that inheritance is going to be—if we save it—the most precious gift we can give to future generations."

Right: Loggers cut a swath through the rainforest in Borneo. Left: A 1988 shot from the space shuttle of Brazil's Rio San Francisco Basin shows the light-colored rectangles of commercial agricultural fields cleared from the forest. Estimates suggest a 25–30 percent increase in land clearing since 1984.

While Wilson's remarks concentrated on the vanishing rain forests, Sylvia Earle was concerned with biodiversity in the oceans. "About 90 percent, by sheer mass, of life on Earth occurs in the sea. And with all due respect to Ed Wilson and to the splintery ends of biodiversity known as species, if you think about the genetic makeup of creatures in terms of the big, broad categories of life from one end of the plant and animal realm to the other, the greatest diversity is in the sea. The sea is not just salty water and rocks. It's a living minestrone. Virtually every spoonful contains something alive, mostly small or microscopic variations on the theme of life on Earth. The history of life on Earth is written in the lives of organisms still present, from microbes to sponges, jellyfish to mammals.

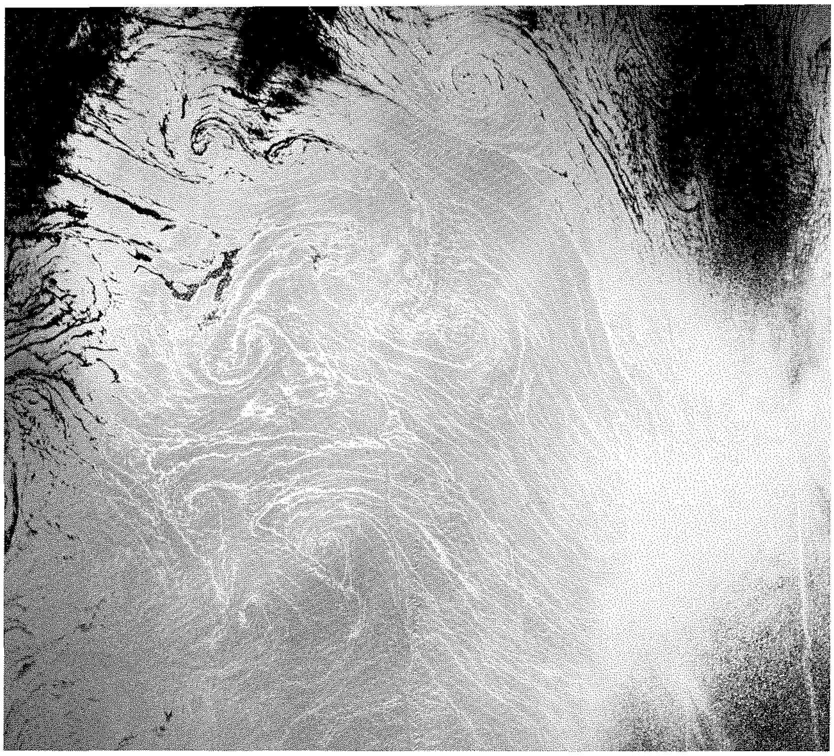
Earle focused on the atmosphere as well as the oceans: "When we speak of one we necessarily touch the other. Heretofore, both have seemed to be infinite, perhaps immutable by the action of puny human beings. And both, heretofore (until the last few decades) have been regarded as free, as have their contents." Earle was optimistic that measures would be taken to put to rights the consequences of human misbehavior in the atmospheric global commons. "It seems so reasonable, so obvious, because we are terrestrial, air-breathing creatures." But she was less sanguine about "our ability to get fired up about the ocean as a vital system that also relates to climate and weather and the atmosphere we breathe."

Sustaining biodiversity in the oceans is more difficult than on land. Earle noted in particular that about 300 species of cephalopods (the squids and the octopuses) remain, as well as 300 species of sharks, all of them vulnerable to changes initiated by humankind, including recent unprecedented high catches and overall environmental modifications. They, and countless other marine organisms, are "residents, not of territory that can be protected with a fence, but of the global commons, the oceans." She also stressed the interrelationship between the atmosphere and the oceans. "The good health of the atmosphere leads to the good health of the oceans, and the good health of the oceans to that of the atmosphere."

Earle introduced two ideas for sustaining the oceanic part of the global commons:

1. Reevaluating allowable take: "Whose fish or krill or squid are these? If a population of desirable species can be determined that would maintain a sustained take of x number or tons of individuals, this allowable portion could, in theory, be skimmed off in a sustainable way. But is it necessary that the whole 'take' be taken? And is it necessary that one nation or several nations be favored in terms of the take? Or might the allotment be divided among many interested nations, or maybe all nations? Some could opt to put their part back in the system. For example, if it were agreed that 3,000 minke whales could be taken on a sustainable basis from Antartica, some nations could say, 'Well, this is my portion, but I opt to keep mine in the bank.'"

2. Protected areas: "This is like an insurance policy—an ecosystem approach to protection in the global commons that would guard against loss of biodiversity, a hedge against the unknown.



Spiral eddies in the Mediterranean Sea photographed from the space shuttle.

There are precedents in the U.S. for protection of areas in the global commons. In deep-sea mining legislation, there is a provision for stable reference zones—protected zones—to be established as a standard to monitor change. Large biosphere reserves have been suggested for terrestrial habitats, and now this concept is extending into the sea. Some of the prime candidates for protection include scientific research areas, places known to be vital for fisheries, and sites that can be identified as critical habitats or essential areas for vital processes, locally, regionally, or globally. These are obvious targets, but most important is reaching an understanding of what must be done to ensure the health of the system as a whole. And then doing it."

The health of the atmosphere was the first transnational environmental issue to seize the world's attention. "Global warming has been the issue that crystallized this great international political drive to try to confront problems of global change," according to Robert White. "The problems of the global environmental commons, those which all nations have a stake in solving, such as climate warming, destruction of stratospheric ozone, and pollution of the coastal oceans, render all nations environmentally interdependent. These are problems that can be addressed effectively only by concerted international action."

Joshua Epstein discussed global warming and biodiversity in terms of complex systems. "Even the most isolated ecosystems are complex, nonlinear systems, whose overall response to small perturbations is often very difficult to foresee." He presented several examples of what he called "nonlinear cascade effects" that can result from those small disruptions. He described the counterintuitive system-wide repercussions of removing a single predator from the top of a food chain. And he explained that even adding species can cause a chain reaction of ecological disaster. Drawing on the work of biologist J. D. Murray, Epstein recounted the disastrous 1960 introduction of the Nile perch into Lake Victoria, the largest lake in East Africa. This virtually wiped out several hundred smaller fish species important to the local economy. Some of these species, in turn, had helped control the population of a particular snail that forms an essential link in transmitting bilharzia, a disease fatal to humans. The "complexity of the problem" is what Epstein kept emphasizing. His current work on sustainability concerns the nonlinear interaction of large-scale processes such as population growth, climate change, species extinction, weapons proliferation, declining equity, and economic evolution.

Epstein explained his analysis, published recently with Raj Gupta, on control of the greenhouse-gas emissions that lead to atmospheric warming. He proposed a tradable-permit scheme (also applicable to global catch quotas for, say, fish, or to permits that could be earned by reforestation), which he described as efficient, equitable, and fostering risk-taking and technological transitions. "Suppose someone is making an investment in a risky clean-air technology, *T*. Let's imagine that the investor buys carbon permits as he makes this investment. If the technology fails, then the carbon permit price should rise, as hopes of supplanting fossil-fuel energy sources with *T* are dashed. If the permit prices are higher, losses on the investment can be partially offset. Because of this negative correlation between the permit price and the project's success, the variance of returns to the investor, the risk, is reduced."

By emitting greenhouse gases without restraint, Epstein said, "we're toying with basic parameters of a complex system, whose sensitivities we do not understand very well. But if we wait for complete certainty that intolerable damage is being done, that damage may be difficult to reverse." □