

Gardening the Earth

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The human threat to biodiversity - the amazing variety of species that make up life on earth - is not only ethically troubling, but it also puts at risk the enormous store of capital assets that provide the “ecosystem services” necessary to sustain human life. Despite growing awareness of this threat, traditional conservation efforts are not sufficient to meet it. They must be supplemented by a broader, more comprehensive approach that deals with the underlying causes - making conservation economically attractive, fully involving the private sector, and tackling the twin problems of population growth and excessive consumption.

In South Africa in 2003 the World Parks Congress celebrated an important milestone - announcing that slightly more than eleven percent of the terrestrial surface of our planet is now within designated parks, wildlife refuges, wilderness and other protected natural areas. While this is indeed a remarkable achievement, made possible through the work of generations of dedicated conservationists, it is, lamentably, not nearly sufficient to assure the survival of what we call biodiversity - nature as expressed in its extraordinary wealth of plant and animal species, ecosystems, and life-sustaining processes.

Scientists estimate that this existing network of parks and protected areas will help preserve only about ten percent of the earth’s

biodiversity. One explanation for this disappointingly small number is simply that the species diversity is somewhat patchily distributed, generating the presence of “hot spots” with relatively large numbers of endemic species, i.e. those found only in a particular region or locality. Species diversity is highest in the tropics, but species endemism is a more widely distributed phenomenon. A number of protected areas consist primarily of “rocks and ice” or other regions selected for their scenic qualities rather than their biological importance. Moreover, many parks, especially those in the tropics, are fragile “biological islands” threatened from without by economic and demographic pressures. The situation for areas of high biological diversity in the world’s oceans is also critical, since less than one per cent of our oceans are within protected reserves.

Clearly, the struggle to establish and expand parks and protected areas must continue, particularly in the ocean. The vast majority of marine biologists believe that a substantial expansion of marine protected areas is the most important immediately needed action. (As an example, in July 2004 the largest network of Marine Protected Areas in the world came into force in the Great Barrier Reef, improving protection of the Reef and increasing “no-take” zones from 4.6 percent to 33 percent of the Marine Park across all broad habitat types.) But an expansion of protected areas will not be sufficient for either land or sea. On land, even were we to double the acreage of parks and preserves, by no means an assured goal, we would still be far short of saving even a majority of the presently imperiled species and ecosystems of the planet. For there are foreseeable limits to our ability to designate traditional parks and nature reserves where, in the words of the U.S. Wilderness Act, “the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.” Most of the ninety percent of lands (excepting Antarctica) that presently lie outside nature reserves are people dominated regions, landscapes and seascapes where human activity, including forestry, farming, fishing and the grazing of livestock, predominates. And it is in these inhabited areas where most species extinction is taking place.

Sound population policies built on improving the status of women and improving access to appropriate health services - which help meet genuine women's aspirations to prevent unwanted pregnancies - are among the most powerful strategies for preserving biodiversity. Controlling excessive consumption based on the use of depletable raw materials and energy in the U.S. and other developed countries is also critical in the medium and long term. In the shorter term, we can have only modest impacts on existing patterns of occupation and agriculture. Because the potential for expansion of traditional parks and protected areas is limited, we must therefore rethink and change the manner in which we occupy and use the landscapes and seascapes in which people live and work.

Biodiversity in Human Dominated Ecosystems

A meeting of scientists, businesspeople, environmentalists, public officials, and journalists convened by the Aspen Institute to explore policy approaches to biodiversity reached one overarching conclusion: We must now expand the scientific, public and political understanding of biodiversity conservation and the preservation of ecosystems to include not only the back of beyond, but the nearby as well - the human dominated ecosystems in which people reside and make their living. We must begin to integrate and cultivate biodiversity into our daily lives and surroundings. We will need to manage natural habitats to preserve and maintain biodiversity much as gardeners manage natural processes in their back yards. It is a spirit of both enterprise and respect for the land and our biological heritage that is captured in the phrase "gardening the earth." And it will take an unprecedented level of imagination and effort involving not just ecologists and natural scientists, but also local communities, business institutions, individuals and governments.

Obviously this concept of actively "gardening" the planet to preserve and enhance biodiversity will require a much better understanding than we have at present of the functional role of species in their communities, their status as unique to one locality or widely distributed, and the size and number of populations and communi-

ties which are unique or play crucial roles in the provision of ecological services to societies. This is neither a simple proposition nor an easy task, particularly when a great proportion of the world's terrestrial and animal and plant species occur in regions where the knowledge of biodiversity is generally scanty or nearly non-existent. Humanity must also learn to manage landscapes and seascapes affected by global warming, planning for the migration of species and biomes over the centuries, and for more and more extreme weather events.

The destruction of forests, especially in the tropics and subtropics, is by far the leading cause of loss of terrestrial biodiversity. In 2003, in the Amazon Basin alone, an area larger than the state of New Jersey was cut and cleared. Similar destruction continues in the Congo Basin of Africa, in the forests of Southeast Asia, in Indonesia, and virtually everywhere within the equatorial zones of the earth. In the oceans, massive conversion of coastal habitats and rampant overfishing are taking a similar toll on marine biodiversity.

Incentives for Conservation

Local peoples, too often overlooked as legitimate stakeholders and actors in conservation efforts, must be the first and strongest line of defense against forest destruction. Many of the most important, and most threatened, tropical and subtropical lands of the earth are occupied by traditional rural groups whose knowledge and systems of belief and worship, as well as their livelihoods, are closely connected to the land and its natural values. Local communities, the owners of these resources, will be in a real measure responsible for the fate of the planet's biodiversity.

But if traditional communities are to be partners in the struggle to preserve biodiversity, they must be accorded stronger incentives to do so. Our challenge will be to support their efforts to preserve traditional land-oriented values, so as to preserve and sustain biodiversity and its invaluable ecological services, while at the same time assisting them to meet rising expectations for economic development and well-being.

The papers in this volume examine ways in which local communities, developing countries, governments, business enterprises and political institutions can collaborate to head off this impending wave of extinctions, helping at the same time to meet the aspirations for social and economic betterment of these rural groups. An important, common theme in many of the papers is that local communities, owners of the ecosystems whose services and biodiversity we need to preserve, are the best guardians of their natural resources, and that it is the task of others - governments, NGOs, and scientists - to assist them.

Ecosystem Services

To conserve ecosystems and their services will require investing in local communities sufficient knowledge and incentives both to maintain those ecosystems and to utilize them in a sustainable fashion. The concept of “ecosystem services” is beginning to provide important insights into how this balance can be achieved. Ecosystem services are the spectrum of benefits that are provided by an ecosystem such as a forest. In addition to wood products, forests also produce many other services of real economic value. They serve as watersheds, storing and regulating the release of water to downstream communities; they act as carbon sinks, sequestering and storing large amounts of carbon drawn from the atmosphere; they affect the local climate by recycling rainfall through evaporation and transpiration back to the atmosphere. Biodiversity in forests and many other ecosystems is an important source of genetic resources for the development of new drugs and improved strains of plants for agriculture. And forests can provide fishing, hunting, ecotourism and recreational and esthetic/spiritual benefits to the wider public.

Many of these benefits, or “ecosystem services,” accrue to the public living outside the forest, farther downstream, or even outside the country in the world at large, where the benefits are received free of charge. If adequate means can be found to transfer some of the economic value of these services back to the owners of the forests, we can thereby create an obvious incentive for rural and indigenous

groups to manage and protect the ecosystems that provide the services. And with forests preserved from destruction, there will be time to develop more and better knowledge as to how best utilize these ecological systems in a still more diversified and sustainable manner for the benefit of the owners.

An example of the way that economic benefits can be quantified and shared with upstream owners can be found in the Province of Alajuela in Costa Rica, where upstream forest communities receive payments from downstream communities for maintaining the headwaters forest that provides a steady source of clean water. A similar example on a larger scale comes from New York City, which takes a large share of its water from an aqueduct that originates in the Catskill Mountains. Faced with an Environmental Protection Agency mandate to begin purifying the water, estimated to cost some six billion dollars, the city instead undertook to preserve and restore the Catskill watershed by paying for waste control on dairy farms, by purchasing forest conservation easements, and by implementing other projects to reduce pollution and to minimize the erosion sending sediment downstream into the city water supply. The cost of upstream watershed protection and restoration represents less than one fifth the cost of constructing purification systems downstream in New York City.

Urban consumers living thousands of miles away can also be mobilized as an effective constituency for sustainable use of forests. Consider the purchasing power available to consumers of forest products and other natural resources. The Forest Stewardship Council is an international effort that seeks to recognize and certify timber companies that manage forests for sustainable use. Retailers such as Home Depot now offer certified wood products, providing consumers an opportunity to support sustainable forestry. Another example is the campaign by some coffee companies in different parts of the world to promote shade grown coffee, derived from coffee trees planted in a matrix of natural forest that provides important habitat for birds that is largely absent in monocultures of “sun coffee.” Consumer choice was also effective in the campaign that led to “dolphin safe” tuna labeling, and the subsequent convention to

revise tuna fishing practices. A comparable effort, originated by the World Wildlife Fund and Unilever, to certify sustainable ocean fisheries shows promise of attracting consumer support. The increasing public preference for organically grown produce and for livestock goods produced without antibiotics similarly demonstrates the possibilities of mobilizing public opinion in favor of more earth friendly, sustainable agricultural and fishing practices.

Expanding Food Production

With expanding population and growing consumption, we are vastly increasing the pressure on all ecosystems. The clearing and destruction of forests is not driven just by demand for timber and wood products. Typically, the chain-saw and the machete are followed by the plow and herds of cattle as forest ecosystems are irretrievably transformed to farming and grazing. More than forty per cent of the habitable lands of the planet are now devoted to agriculture and the raising of livestock, and the increasing demand for food is leading to the conversion of coastal habitats for aquaculture and systematically wiping out fish populations. And these pressures will only continue as the human population of our planet, currently some 6.5 billion, reaches toward nine billion within the next 50 years, absent any surprises. This implies even greater numbers in the 22nd century and will impose increasing demands per capita on energy and other resources that stimulate consumption beyond the limits of sustainability.

According to the Food and Agriculture Organization (FAO), more than four million hectares a year of tropical forest are being cleared for agriculture. A combination of high birth rates, the imperative of increasing living standards of large marginalized populations, the extraordinarily wasteful consumption in most developed and in sections of developing countries, as well as the displacement of peoples by civil strife, all create pressure to convert land from natural ecosystems - mostly forested - to agriculture. The FAO has calculated that world food production would have to double to provide adequately for nine billion people.

Productivity gains on existing agricultural lands based on appropriate, ecologically sustainable technology will be necessary. The green revolution of the 1960s, centered on improving plant varieties, resulted in huge productivity gains. And undoubtedly there are still more productivity gains to come through the use of appropriate technologies, including genetically modified crops. But productivity gains will not likely be sufficient, in either quantity or equitable distribution of benefits, to fully offset the pressures for additional land conversion to agriculture. Inevitably, additional large expanses of forested land will be cleared for agriculture. Much of this land conversion will take place on marginal soils and in semi arid regions with unpredictable rainfall regimes, which in turn will create further demands for the diversion and depletion of natural river systems, with attendant destruction of aquatic ecosystems and species.

Conserving Biodiversity in Human Dominated Landscapes

These facts underscore the need for strategies to make agriculture not only more productive, but also less destructive of natural ecosystems and more hospitable to biodiversity. Ultimately, such strategies require investments in understanding ecosystem functions and values. They also require a reorientation of government policies, for agriculture and other sectors.

In the developed world, American agriculture is widely recognized for its productivity. The cornfields of Iowa and the prairie wheat lands of Kansas, vast regions where crops are planted horizon-to-horizon on lands stripped of all natural cover, exemplify the yield driven achievements of modern industrial agriculture. These forms of monocrop agriculture, however, are also the most destructive to local biodiversity. There is little room left for the natural world when the land is devoid of natural cover and the denuded streams run brown with sediments year round, eroding away topsoil and concentrating pesticides and nutrients in quantities sufficient to create an extensive eutrophic dead zone a thousand miles downstream in the Gulf of Mexico. There are now fifty other such “dead zones” in different parts of the world’s oceans.

We must not continue to replicate these mistakes in the pursuit of short term production at the expense of the long term health of the land and its biota. We must develop new forms of agriculture that harmonize with the natural diversity of the land. There are alternative models, in both developed and developing countries, where agriculture is more diverse, consisting of a variety of crops, cultivated within a matrix landscape of trees, hedgerows, orchards, pastures, woodlots, canopy streams, wetlands and forests. There are also opportunities for intensified, sustainable practices on existing agricultural lands, which in turn could reduce pressure for conversion of natural ecosystems.

Recent developments in the Mato Grosso regions of Brazil provide a suggestive approach. Much of the forest and woodland in this region has been cleared for grazing and the large scale production of soy beans, and undoubtedly that trend will continue. Rather than replicating an Iowa landscape, however, farmers, environmentalists and the state government have settled upon requirements for a variegated agricultural landscape on which farmers preserve ribbons of undisturbed natural forest along the streams, protecting the waters and providing habitat and migratory pathways across the landscape for wildlife. A total of 50 to 80% of the forest cover of each property must be retained. The result is a landscape designed both for farming and for biodiversity. It is neither a natural landscape nor a purely industrial landscape; it is an artificial ecosystem, designed to acknowledge the inevitable transformation of some land, while seeking to maintain basic ecosystem functions.

Science and Information

The task of nurturing biodiversity through sustainable forestry, as is the case in several indigenous and rural communities in the States of Oaxaca and Michoacán in Mexico, through less destructive forms of agriculture and by empowering local communities to safeguard and utilize their lands, must be based on solid scientific research and information. The role of science in setting priorities for the selection of protected areas is increasingly recognized. Less appreciated is the

importance of comprehensive scientific assessments, as well as local traditional knowledge in human dominated landscapes and seascapes, for proper management of forestry, agriculture, fishing, the design and location of infrastructure, and rural and coastal development policies.

To manage biodiversity, countries must establish a comprehensive knowledge of their biological riches in order to understand, manage and preserve their natural capital. In developed countries such knowledge has been based in the development of a strong infrastructure of science, which comprises scientific collections, institutions that maintain them, and human capital in the form of taxonomists and specialists in many animal and plant groups. Such human, scientific and physical infrastructures have taken decades - if not centuries - to build up, and they represent a huge accumulated investment. Their absence represents a major handicap for developing countries in acquiring knowledge about its biodiversity patrimony and its distribution and abundance, and this constitutes a serious limitation to applying policies that would help them protect and benefit from the rational use of such patrimony. Building a capacity to know, understand and manage their natural resources the “orthodox” way (i.e. training scores of taxonomists, raising substantially large scientific collections and housing them in appropriate physical installations, etc.) is for most countries an overly costly, time consuming and inadequate approach. Fortunately, however, there are instructive examples of more practicable approaches to build capacity to know about the biological resources of a country and learn how to use them sustainably and preserve them adequately. Examples of countries which have developed institutions for collecting, systematizing and analyzing information on their biodiversity are Australia (ERIN), Costa Rica (InBio), South Africa (SaBoNet) and Mexico (CONABIO).

In Mexico, CONABIO provides an important example of how a developing country can, in a relatively short time and with a limited budget, act to remedy the deficit of biological information. CONABIO, by just gathering and synthesizing information available from specimen collections in both national and foreign institutions,

without collecting a single specimen in the field, now has what amounts to one of the two largest biodiversity information data bases in the world, with nodes distributed in over thirty institutions in half a dozen countries.

Mexico now has in CONABIO an institution that can provide this type of scientifically sound information to be used for decision making in the management of its natural resources. It also serves as a “translator institution” that bridges the research results of taxonomists, biogeographers, and ecologists to assist policy makers on issues ranging from setting priorities and selecting national protected areas, to assessing the risks of spreading transgenic materials into the wild, to establishing public health prevention programs, to providing daily information on forest fires to aid in control and suppression. These results have been achieved in a decade on an average yearly budget of three to four million US dollars.

Global Cooperation and Trade Liberalization

Finally, we must not overlook the role of governments. If the gardening of the earth is intrinsically a local process, that fact does not in any way foreclose the need for national approaches to conserving biodiversity. None of the proposals made here are possible unless national governments ensure that the laws governing resource management and regulating economic sectors foster these kinds of approaches, and also take an active role in ensuring that the conservation efforts of local communities are guided by the needs of the much larger ecosystems they inhabit. The Biodiversity Convention, now in effect after having been ratified by some 180 countries, has potential for enhancing the commitment of all countries to biodiversity conservation, and it should be ratified by remaining hold-outs, including the United States.

The continuing globalization of the economy will have profound consequences for preserving natural ecosystems and biodiversity within managed landscapes and seascapes. Increased world demand for food, fiber and minerals is a predictable consequence of liberal-

ized trade with possible destructive consequences for biodiversity. This issue is now front and center, for the World Trade Organization is currently negotiating major changes in the heretofore highly protected agricultural sector, seeking to lower the trade barriers created by the extensive systems of subsidies that characterize agriculture in the United States, Europe, Japan and other developed countries.

Agricultural trade liberalization will have far reaching effects on biodiversity. When subsidies for cotton and soybeans in the United States and other developed countries are significantly reduced, the likely impact will be expanded production and additional land devoted to agriculture in countries as diverse as Chad and Sierra Leon (cotton) and Brazil and Argentina (soybeans). And were the various subsidies and quotas for sugar cane, the most highly protected of all American and European crops, to be reduced, there would likely be a significant increase in production from the Caribbean islands and coastal areas throughout the tropics. Fishing subsidies by various countries are also a huge problem, totaling tens of billions of dollars and driving overfishing all over the world.

Not all trade liberalization will work to the immediate economic advantage of developing countries. In the case of NAFTA, the North American Free Trade Agreement, quite the reverse has occurred. The lowering of Mexican trade barriers to American corn has led to economic crisis in the Mexican countryside where small milpa farmers, unable to compete, face economic and social dislocation, which may result in the loss of the extraordinarily valuable resource of the germplasm bank of the nearly fifty native races of maize that now exist there and are almost exclusively cultivated by these farmers.

What these cases demonstrate is the urgent need to integrate trade and social impacts and the conservation of biodiversity much more carefully. Despite the inclusion of the trade and environment issue in the Doha Round negotiations, international trade negotiations still proceed largely without consideration of social and environmental impacts, a practice which must be radically revised if we are to conserve what remains of the world's biodiversity.

The current round of agricultural trade liberalization presents an important opportunity to change past practices and to integrate issues of trade, sustainable rural development and the environment. Existing subsidies to the farm sector are not likely to be eliminated; trade rules only require that economic assistance programs be separated out from trade-distorting production incentives. Worldwide, agricultural subsidies total more than \$300 billion per year. There may soon be an opportunity to begin redirecting these subsidies toward land restoration and sustainable agricultural practices in both developed and developing countries. Meanwhile, opportunities to bring market forces to bear upon the way humanity extracts its living from the earth, demanding the best environmental practices for the production and harvesting of food and agricultural commodities, must be pursued relentlessly.

Conclusion

An expanded awareness of the importance of biodiversity and ecosystem services and of the inadequacy of traditional conservation methods can open up a range of additional approaches. A central challenge is to design biodiversity conservation into the entire landscape - into agriculture, forestry and all kinds of development - and to focus on the causes rather than the symptoms of biodiversity loss.

These new approaches must involve the provision of financial incentives to local people to conserve natural resources that primarily benefit others - in short, paying for ecosystem services. Multinational corporations must adopt biodiversity conservation goals and promote sustainable resource development practices among their myriad suppliers and partners. National governments must act not only to set aside protected areas but also to remove perverse incentives for unsustainable forestry, fishing, and other uses of natural resources. They must encourage and support scientific institutions that can assess a country's natural capital and help set priorities for preservation. Acting internationally, through environmental and trade agreements, they must accord higher priority to the preservation of ecosystems and the biodiversity they comprise.

Finally, if we wish to live in harmony with our surroundings, managing and preserving the earth in trust for generations to come, its beauty and productivity undiminished by our presence, we must acquire and accept an ethic of personal responsibility. We must educate ourselves to the fundamental threat posed by the loss of species and the degradation of ecosystems. Then, as consumers and as citizens, we must become true stewards of the planet and responsible gardeners of the earth.