

Ecosystem Services for Sustainability

Valuable, Vital & Overlooked

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The complex system of processes that make up the environment brings benefits to humans all over the world. These benefits come in the form of regulation of climate and soil, pollination by insects, and aesthetic experiences as well as production of food, freshwater and other primary resources. Increasing human population, wealth and consumption are disrupting these processes and the benefits they bring in ways we do not understand. Until recently, the problem has largely been ignored, but this state of affairs cannot continue. If we are to achieve sustainable and equitable development across the globe, we need to integrate biodiversity and ecosystem services into our decision-making.

Economics of Ecosystems & Biodiversity

Biodiversity and ecosystem services play a critical role in ensuring the well-being of people. They underpin the ability of countries to maintain growth in the long term by providing the necessary natural assets that the socioeconomic sectors depend on. Yet the significance of these resources is overlooked and governments as well as states fail to adequately account for them in their development trajectories.

The Economics of Ecosystems and Biodiversity (TEEB), a two-year study which launched its final report at the Convention on Biological Diversity's 10th Conference of Parties meeting (CBD COP10) in Nagoya, calls for wider recognition of nature's contribution to human livelihoods, health, security and culture by decision-makers at all levels (local to national and business to citizens). It promotes the demonstration, and where appropriate, the capture of the economic values of nature's services through an array of policy instruments and mechanisms. TEEB highlights that the annual loss of opportunity due to the current overexploitation of global fisheries is \$50 billion (World Bank and FAO, 2009). For 2005 the total economic value of insect pollination was estimated at 153 billion euros. This represents

9.5% of world agricultural output for human food in 2005 (Gallai et al., 2009). Moreover, the annual value of human welfare benefits provided by coral reefs ranges between \$30 billion and \$172 billion. Commenting on the private sector, the TEEB report released at COP10 also drives home the message that failure of business to account for the value of natural capital, particularly in sectors such as mining, can pose significant business and social risks. A Britain-based consultancy, TruCost, estimated that the negative impacts, or "environmental externalities," of the world's top 3,000 listed companies total around \$2.2 trillion annually.

The numbers highlighted by the TEEB report show that biodiversity and ecosystem services are extremely valuable in economic terms (*Table*). The loss of these natural resources should be much higher up on the policy agenda than it is. One of the obstacles to achieving this is that designing policies to halt biodiversity loss are fraught with distributional issues. Another obstacle is that biodiversity and ecosystem services are goods for which no markets exist. Since there are no indications of the value of these natural resources (*Chart*), the price of consumption goods that need them during production is too low. This situation has created market distortions that have led to overexploitation of natural resources.

Significance of biodiversity for employment

Sector	Measure	Revenues (\$ billion)	Capital employed (\$ billion)	People employed (million)
Automobiles ⁴		1,882	2,217	4.4
Steel ⁴		530	588	4.5
IT services & software ⁴		942	179	5.7
Protected-area conservation		5,000 ¹	125,000 ²	1.5 ³

Notes: 1. "Economic Reasons for Conserving World Nature" (Balmford et al., 2002). Science magazine 297, estimates "protected areas" could produce goods & services valued at \$4.4 trillion-\$5.2 trillion per annum.

2. Natural capital: present value (PV) of a constant service annuity of \$5 trillion per annum, discounted at 4% annually

3. Estimate of the number employed directly in the maintenance, protection and oversight of "protected areas" globally

4. Global Business Sector estimates from Global Markets Center (GMC), Deutsche Bank

Source: Prepared from authors from above data

Science

Because virtually all goods require natural resources at some point before they arrive in the store, the size of this problem is clear. Scientists from economics and ecology are picking up on the challenge to put values on biodiversity and ecosystem services. If these values were integrated into an economic system governed by prices, then the consumption and production patterns would be able to adjust accordingly and reduce the excessive pressure on the environment. That would represent a major step towards a sustainable society.

Determining the value of biodiversity and ecosystem services is difficult since much about their functioning is simply unknown. Crucially, the level of loss at which biodiversity and ecosystems stop working altogether to deliver their services is unknown. It is generally accepted that a large set of species stabilizes the provision of services from all types of ecosystems from all over the world. The services that humanity benefits from are obviously diverse, such as pollination of agricultural fields, spawning-pool functions of coral reefs that support fisheries and long-term carbon storage potential of tropical forests.

Take pollination services which, in the United States alone, have been estimated to produce a value of \$5 billion-\$14 billion every year. The most common pollinator, the European honey bee, however, is not an effective pollinator of all crop types and its population is declining due to sicknesses, pesticides and other impacts. Where the honey bee cannot provide pollination services, native bee species assume and support the pollination role of the honey bee. Agricultural intensification, however, threatens many of these native species. It is quite possible that pollination services will continue when one bee species should go extinct, but will they after the loss of two, five, 10 species? What are farmers to do if a bee species goes extinct that turned out to be primarily responsible for pollinating a high-value crop? It is simply unknown how long humanity has before crossing ecological thresholds, but it is certain that doing so will be costly and dangerous.

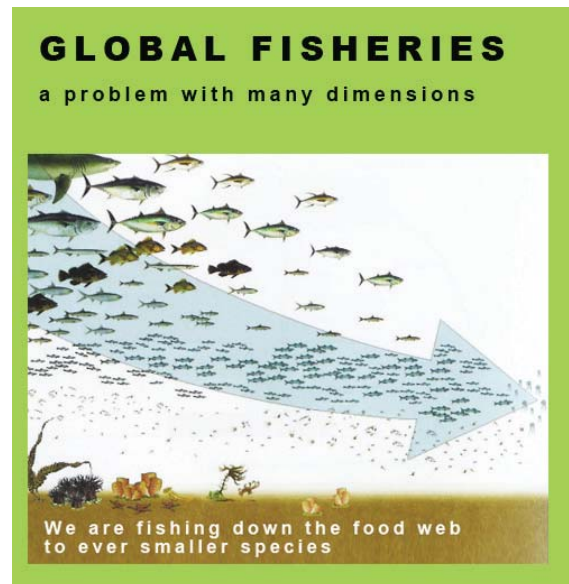
Ethics

It should be stressed that to value natural resources is not a goal in itself. Valuing nature should be viewed as a useful tool for assessing various policy options. Decisions that affect the loss of biodiversity and ecosystems are made every day and these decisions are being made under incomplete information. North American farmers pay beekeepers to have Western honey bees pollinate their crops. These farmers could save \$30 million annually simply by reducing their use of that particular bee species. Implementing this policy would create ecological room for native bee species, particularly when small strips of land are left as wild habitat. Farmers could save money and reduce their long-run dependence on diminishing populations of the Western honey bee, while simultaneously allowing bee biodiversity to flourish, along with the pollination service that the bees provide. Putting a value on pollination services has enabled farmers to compare the costs and benefits of possible agricultural practices.

At the international level, policy-making becomes more complicated because the distributions of both remaining biodiversity and economic wealth are skewed. The developed world has already sacrificed much of its biodiversity and ecosystems to economic development. Globally, 30% of coral reefs, 35% of mangroves and 50% of wetlands have been lost. High rates of economic growth in South America, Southeast Asia and Africa will continue to put pressure on the pristine natural areas that remain in the world. This creates a pressing global policy problem. The developed world is rich, but is not as important to global biodiversity levels nor the provision of global ecosystem services as the developing world. But since the economies of many developing countries are based on intensive use of natural resources, they will bear a disproportionate share of the costs of stopping further biodiversity loss.

Distributional issues

Trade in agricultural products between the developed world and developing countries is usually considered in terms of flows of goods and payments. The import of these goods often implies a simultaneous trade in ecosystem service provision and deficits. One



Ben ten Brink (MNP) presentation at the workshop "The Economics of the Global Loss of Biological Diversity" in Brussels, Belgium, March 5-6, 2008

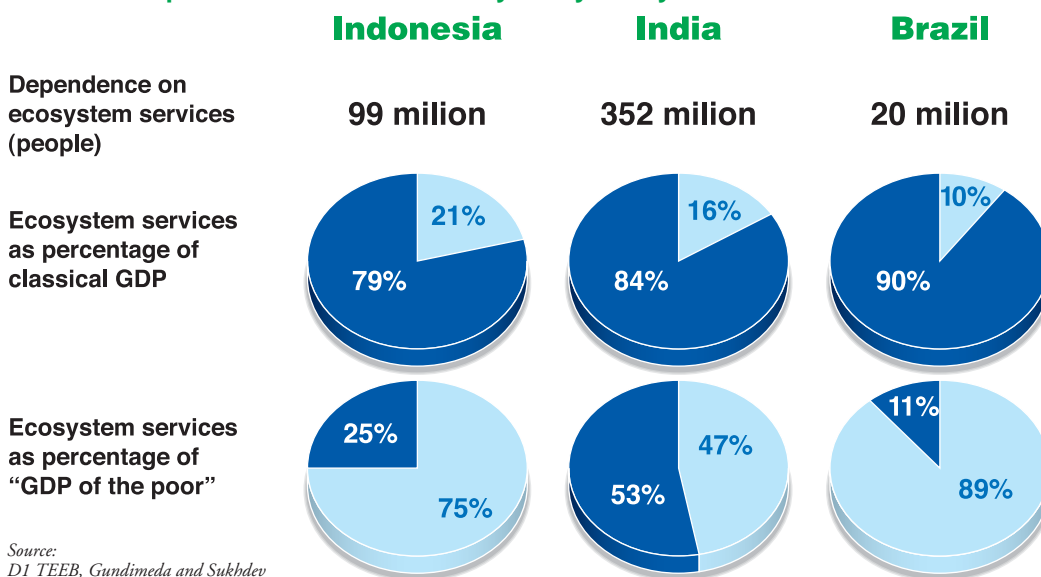
single cup of coffee, for instance, requires 140 liters of water in its entire production chain. Most of that is used for growing coffee beans. For every coffee consumed in the Western world, therefore, the largest coffee-producing countries, notably Brazil, miss out on 140 liters of freshwater that they could have used for other purposes. This is a pressing example as annually, global coffee consumption diverts 140 billion cubic meters of freshwater from irrigation and water consumption in coffee-producing countries. Western consumption will continue to put pressure on biodiversity and ecosystems in developing countries.

Environmental policies in the developed world moreover tend to export loss of biodiversity and ecosystems to developing countries. In order to address rising carbon dioxide emissions from the transport sector, many developed countries have adopted policies to increase the share of renewable energy sources in the fuel supply. The first generation of these biofuels came under attack for diverting agricultural production from consumption to powering trucks and cars and raising food prices everywhere. Next-generation biofuels may be less critical in this respect, but land is still needed to grow them and this often leads to deforestation and draining of wetlands. Malaysia, a major supplier of biofuels, already has 2.8 million hectares, 8.5% of its area allocated to the production of palm oil. Demand for biofuels remains high, but productive land is getting scarce. Further deforestation, including in protected areas, is very likely to occur.

Developing countries largely bear the costs of stopping biodiversity loss, and may be caught in a vicious cycle. Conservation is necessary because many people in developing economies are dependent on the delivery of ecosystem services. Gathering fuelwood, agricultural production and consumption of freshwater are all crucial to the survival of many. Humans increasingly live concentrated in cities, where an estimated one billion people live without adequate supplies of clean water. Large stands of forest improve the quality of water supply, but pressures on deforestation continue because marginalized populations often need to cut down woods for their livelihoods. Conservation efforts can therefore prevent economic and social development, which tragically increases the pressure on the environment.

Ecosystem losses & poverty

“GDP of the poor” is the most seriously hit by ecosystem losses



Source:
D1 TEEB, Gundimeda and Sukhdev

The loss of biodiversity, ecosystems and the services they provide is driving many people from their homes. In some cases, the cause will be local overexploitation of resources. In others, it will be the effects of climate change, such as desertification and sea-level rise. In others again, economic interests cause these people to be forcefully removed from their homes. Whatever the cause, environmental problems will only be deepened as human populations become more and more concentrated. The capital of Yemen, Sana'a, has doubled its population every six years since 1972. At the same time, the water level of the aquifer that supplies the city with freshwater falls by 6 meters every year. The shift of populations towards urban concentrations, which can be seen throughout the developing world, will lead to extreme pressures on the remaining ecosystems and possibly to social conflict.

Marine & Coastal Habitats

Loss of biodiversity and ecosystem services is not limited to terrestrial human activities, but it is also prevalent in marine and coastal ecosystems. Overexploitation of fish stocks is a well-known global problem. In 2001, European cod stocks were reported to have dropped to dangerous levels. The European Commission imposed a recovery plan, rather than a moratorium on cod fishing, and simultaneously increased the quota for haddock, which has a bycatch of cod. The bluefin tuna population in the Mediterranean Sea is near its extinction threshold, yet landing quotas are not strictly enforced. Estimates are that annual quotas are being exceeded by 50%. Similar examples can be found throughout the world. Total engine power in the Gulf of Tonkin, Vietnam, increased 11-fold between 1986 and 2006. This had a large impact on both near-shore and deep-sea fishery resources: the total catch increased only threefold during that period.

It is not just industrialized fishing fleets that are reducing the marine environment's ability to provide food. Many people are active in small-scale fisheries that are also taking their toll on marine biodiversity and ecosystems. This type of fishery will often target and deplete stocks of the top predator in the ecosystem first, which can have catastrophic effects on the ecology of coral reefs, mangroves

and seagrass. Shrimp farming often makes use of chemicals and antibiotics to increase yields. The effluents from these farms simply wash into the surrounding ecosystems and have been linked to irreversible pollution and salinization of these environments. Tourism is another cause of degradation of coastal ecosystems. Corals are taken to be sold as souvenirs and careless divers can break them by dropping their anchors or kicking the corals. All of these activities threaten the livelihoods of many humans that need pristine coastal and marine ecosystems in order to survive.

Conclusion

The financial crisis in 2008 shook the world. The ecological crisis has not, even though it has an extremely large potential to cause economic loss and human suffering. There is still an opportunity to improve the way humanity uses biodiversity and ecosystems for its existence. This requires a significant research effort to better understand the way our environment works so policies can be developed to reduce the pressure that human activities put on it. These policies need to be structured so that future pressure points and conflicts are avoided. That will require accounting for the different needs and possibilities of the developed world and people in developing countries. Most importantly, we all need to think about our own consumption needs and the way these affect the environment and social conditions elsewhere. A good start would be to think about investments that can be made to promote sustainable means of production so that humanity can ensure its longevity.

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