

Biodiversity: Striking an economic and environmental balance

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NATURAL resources such as clean air, clean water, soil quality, rare species, and even scenic beauty are considered to be common property owned by society at large. These resources usually are not assigned a monetary value. People, industries, and governments using and damaging these resources without paying more than a minimal cost, sometimes paying nothing at all, create a market failure situation described as the tragedy of the commons (Hardin, 1985). In the more complete systems of "green" accounting being developed, such as National Resource Accounting, the use of common property resources is included as part of the internal cost of doing business instead of being regarded as an externality. When people and organisations must pay for their actions, they will be much likely to stop or minimise damaging the environment (Repetto 1990, 1992; Arrow et al. 1995). Some suggestions for bringing this into reality include higher taxes on fossil fuels, penalties for inefficient energy use and pollution, and mandatory recycling programmes. Severe financial penalties for damaging biological diversity could be developed so that industries would be careful to protect the natural world. The emerging field of ecological economics has begun to strengthen the conservation movement by assigning monetary values to species, communities, and ecosystems (McNeely 1988; McNeely et al. 1990; Perrings 1995).

According to Biodiversity Convention (1992), biodiversity means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: *this includes diversity within species, between species and of ecosystems. The term "biodiversity" is becoming more and more widely used, and the implications of its loss more widely recognised.*

Biodiversity in poverty alleviation and food security: Biodiversity deals with poverty in many ways. Poor people, especially those living in areas with low agricul-

tural productivity, depend heavily and directly on genetic, species and ecosystem biodiversity to support their livelihoods. This support takes the shape of contributions to health and nutrition, reduced vulnerability, crop and stock development, and off-farm resource use. However, their livelihood needs are often subordinated to the interests of more powerful groups, so they receive fewer benefits from biodiversity, and bear most of the cost of development actions that reduce biodiversity.

The husbandry of domesticated species and the harvesting of wild plants and animals are the mainstay of human food production: 840 million people in the world do not have enough to eat and the population is growing. This means that food production will have to increase 50 per cent by 2020. Biodiversity is part of the solution, in that it provides the genetic information used in plant and animal breeding. Furthermore it makes vulnerable livelihoods more resilient by providing risk spreading options across a range of domesticated and wild species rather than relying on a few staples that may become susceptible to disease, pests, climate changes, and market collapse. It also provides diversity for a varied diet.

Biodiversity in production of crops and livestock: Increase in crop production, necessary to feed growing world population, will depend on both improved yields and increased areas under crops. However, this must be done without undermining the biological functioning of the farming system and the wider environment, and without losing the genetic information so crucial to future plant breeding programmes. There are about 7,000 plant species recorded as food and agricultural crops (out of an estimated 270,000+ higher plant species). Only 150 of these are commercially important, and only four (wheat, rice, sugar and maize) account for 63 per cent of the world's plant-derived calorie intake.

However, a range of other crops (for example yams, cassava and plantain) provide staple diets for millions of people across the world. Food security also depends on a varied diet to supply the nutrients not pro-

vided by staple crops. In addition to food for human consumption, 32 per cent of the world's cereal harvest, is used in concentrate feeds for pigs and poultry, generating an additional demand on agricultural land.

It has been estimated that livestock contribute to the livelihoods of at least 70 per cent of the world's rural poor. However, many livestock breeds are under threat, and consequent genetic erosion needs to be addressed to ensure that future development options are not closed. In addition, the impact of changing patterns of livestock production on the environment as a whole needs



Wild animal (monkey) feeding on wild fruit (jackfruit) in the forest of Sylhet. This association indicates the dependence of biodiversity of animals on wild plants in the forest ecosystem.

consideration. Animal domestication began almost 12,000 years ago. Of the 40,000 vertebrate species on the earth, 40 were selected as useful by different human cultures and domesticated. Of these, only 14 species account for over 90 per cent of today's global livestock production.

Biodiversity in fisheries and forests: Global fisheries are commercially extremely important for developing countries, who are the chief global exporters. However, the role of fish in supporting the livelihoods of rural communities is also important. Small-scale exploitation of a wide range of species provides crucial sources of protein, fats, oils and vitamins, as well as a resource in

times of hardship. However, these resources are under threat from a range of pressures, from over-fishing to pollution of water bodies. Some 75 per cent of the earth is covered with water. Living in this water, there are around 28,000 recorded species of fish, 40 per cent of which are fresh water. Some 25 per cent of all marine fish species are associated with coral reefs: the Indo Malay archipelago, for example, contains over 2,000 species. Freshwater system can be equally diverse: the Amazon basin has over 1,300 species, whilst old, deep lakes such as Lake Tanganyika and Lake Baikal each have more

multi-million dollar business, providing significant local and national income. However, unsustainable use is leading to loss and extinction of wild animals; in addition, many species are threatened by loss of wild habitats due to clearance and other disturbances. There are 4,763 recorded species of mammals (75 per cent of which are small rodents, bats and insectivores), 9,946 species of birds, and more than 35,000 species of reptiles, amphibians and fish. Their ecological characteristics vary with habitat; larger savanna species are often migratory, and/or undergo substantial population



Butterfly on the flowering wild bonborai in the forest of Chittagong. This association indicates the dependence of wild plant biodiversity on animals.

changes in response to extreme conditions such as fires or drought. Damage caused by large mammals is an integral part of savanna and forest ecosystems; it is often cyclical, and facilitates dispersion and germination of colonising plants.

Biodiversity can contribute to the health of humans, and to the health of animals and plants on which they depend, by keeping populations of disease-causing organisms and pests in check; providing the basic materials for medicines and a balanced diet; providing genetic information as a raw material for medical research; and keeping people healthy by contributing clean water and air. Many diseases and pests have been controlled successfully through a combination of measures which include the use of modern medicines and agro-chemicals. The genetic variability of crops, fish, livestock and human populations is a vital base from which new defences can evolve against ever-changing parasites, diseases and pest attacks.

Regional approaches in biodiversity: National policies and planning for biodiversity management take place at the country level, but biodiversity and ecological processes, such as migration and species dispersal, do not conform to national boundaries. Nor is the impact of human activity on biodiversity limited by political frontiers. Trans-frontier and regional initiatives are needed to address cross-boundary issues, although they involve range of management and institutional complexities. An ecoregion is defined as a relatively large unit of land or water containing a geographically distinct assemblage of species, natural communities and environmental conditions. Eco-regions typically cross several international boundaries, such as the Pantanal Flooded Savannas (Bolivia, Brazil, Paraguay) and the Western Congo Basin Forests, (Cameroon, Equatorial Guinea, Congo, DRC, Gabon). The main elements of ecoregion-based management include:

- & defining the critical areas of land and/or water to be managed, ensuring that they are representative of the

ecoregion, and sufficiently extensive to maintain ecological processes and viable populations over the long-term;

- & analysing the causes of biodiversity loss and understanding how local, national, and international activities contribute to this process;
- & working with local communities, governments and other stakeholders (including the private sector) to help define and implement a management vision for the ecoregion that includes development of regional institutions.

Genetic resource use in

frequently undervalued in these markets because little or no account is taken of external social and environmental benefits. Efficient markets require good information and mechanisms to ensure the users of any resource bear the full costs of its use. This presents two difficulties: first, tracing the path from increased trade to the impact on resources and biodiversity, and second, the design and enforcement of regulations and incentives.

Sustainable use of biodiversity: Incentive measures seek to address the underlying causes of biodiversity depletion, particularly the fact that some individuals or organisations benefit from exploiting biodiversity without covering the full costs borne by society as a whole. Article 11 of the Convention on Biological Diversity (CBD) requires that "each contracting party shall, as far as possible and as appropriate, adopt economic and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity." The removal or reform of perverse incentives (i.e. policies which encourage biodiversity losses) is the first priority. Perverse incentives can include subsidies, tax relief and below-cost resource pricing in the agricultural, energy, forestry, fisheries, mining and transport sectors, as well as marketing restrictions and seed distribution systems which encourage a narrower range of agricultural species and varieties. Their reform can be a very cost-effective approach to biodiversity conservation and sustainable use, sometimes generating additional economic benefits.

Tourism and biodiversity: The quality of their natural environments gives many developing countries a comparative advantage in tourism. Tourism can capture some of the global willingness-to-pay for biodiversity by raising funds for investment in conservation and sustainable use, and can raise the awareness of developing countries of the value of their biodiversity. But at the same time, tourism can

threaten the biological resources on which it and other economic activities depend. A major challenge is therefore to enhance the economic benefits of tourism while limiting its negative environmental and social impacts. Tourism is an important part of the global economy. The opportunities for tourism development continue to expand as the number of tourists increases, but tourism activities are not evenly distributed between or within different continents.

Biodiversity enables ecosystems to respond to external influences, to recover after disturbance, and to maintain the organisms essential for its ecological processes. Human activities can impact adversely on biodiversity by altering habitats, introducing invasive species, or reducing the population or ranges of species. Conserving the diversity of organisms should support the ability of ecosystems to function, reproduce, and remain productive. Therefore, all naturally occurring organisms should be maintained in the ecosystem. Increasing human populations, changing resource consumption patterns and economic systems do not value biodiversity. For some local communities, maintenance of biodiversity is essential for survival; for urban or other communities, maintenance of biodiversity has broader economic, intrinsic, altruistic, and environmental values. There is a need in all countries to enhance scientific understanding, and to develop methods to direct science and policy to the conservation of biodiversity. There are many approaches and methods to enhance and maintain biodiversity. These approaches vary in time and space, and within and among countries. The value of a range of sources of knowledge should be accepted as a basis for decision making including both scientific based systems and the traditional knowledge of forest dwellers and users.

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