Biodiversity IN Development

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Biodiversity – what is it, and why is it being lost?

The term 'biodiversity' is becoming more and more widely used, and the implications of its loss more widely recognised. However, biodiversity is a complex and vague term, which often does more to complicate a problem than to clarify it. This Brief attempts to identify the key characteristics of biodiversity, and the reasons for global biodiversity losses.

Biodiversity is very often equated with spectacular large mammals in the African savannahs, yet much biodiversity is microscopic, hidden in the soil, submerged under the sea, or cloaked in rain forest foliage. The concept relates to all life on earth; it goes beyond the organisms themselves to include their genetic make-up, and the invisible ecosystem processes of which individual species are a part (e.g. photosynthesis, soil formation and pollination). All of these aspects of biodiversity (or more correctly, biological diversity) underpin much of human development (see other BBs).

The Convention on Biological Diversity defines biodiversity in three inter-linked levels – genetic, species and ecosystem (see text box).

According to the Convention on Biological Diversity, biodiversity is ***the variability among living organisms from all sources, including 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.***

Genetic biodiversity – evolution and information

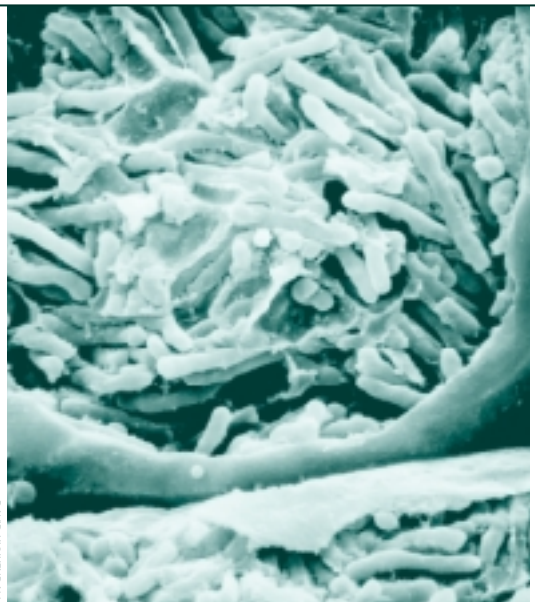
Genetic biodiversity refers to the frequency and variety of genes within and between populations of the same species (varieties of plants or breeds of animals). Genetic variation is a key quality of all biological entities – domestic populations, their wild relatives and other wild populations. It is the engine room for evolutionary change. Genetic information provides the basis for plant and animal breeding programmes; by influencing processes of evolution through artificial selection, substantial improvements in crops and stock have been achieved.

Today's genetic biodiversity is the product of millions of years of adaptive evolution, and the information accumulated through geological time is a non-replaceable resource. Modern technology can duplicate but a fraction of these elements and thus any loss of genetic biodiversity is largely permanent.

European Commission

DFID Department for International Development

IUCN The World Conservation Union



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Microbes such as viruses, bacteria, algae and protozoa, account for 6% (90,000 described species) and fungi for 4% of all described species. These rhizobium bacteria live in nodules on the roots of plants and assist plant growth.

Erosion of genetic capital

Genetic biodiversity can be lost even if species are not. The main cause of loss is the spread of commercial agriculture, which encourages monoculture cultivations. New crop varieties, often associated with commercial agriculture, have led to the replacement and loss of traditional, highly variable farmer varieties. Up to 90% of cabbages, field maize and tomato varieties have been lost in recent times, for example. Linked with these losses, is the loss of vital knowledge about how different varieties and breeds were produced and where they best flourish.

Species biodiversity – numbers, abundance and bioquality

The transition from genetic to species diversity is not always clear because evolution and population isolation are slow and erratic processes. Even taking this into account, estimates of the total number of species on earth vary between 10 and 100 million, with 14 million species currently being the best accepted estimate.

Recent habitat and ecosystem losses

- Some 37% of wildlands in developing countries were lost in the 20 years between 1960 and 1980.
- Up to 20% of tropical forests have disappeared in the 30 years between 1960 and 1990.
- Some 50% of wetlands worldwide were lost in the eight years since 1990.
- Worldwide, 35% of coral reefs are threatened with extinction in the next 30 years through sedimentation, and unsustainable use.
- At present, 6% of the land's surface comprises man-made deserts, which are increasing annually at the rate of 60,000 km^2.
- About 70% of irrigated and rain-fed croplands, and rangelands are degraded in Africa, Asia and Latin America.

Of these, about 1.75 million have been described worldwide, with about 15,000 new species being described annually.

Discussions about species biodiversity tend to focus on larger animals and plants. Yet, there are one million tiny invertebrate species (mostly insects), which account for 73% of all described species. The importance of these microscopic organisms is often overlooked unless they have conspicuous impacts, such as causing disease. Many of them, however, have important functions, such as maintaining soil fertility.

The number of species alone is not a measure of species biodiversity; it is merely a measure of the species richness of an area. As well as numbers, species diversity needs to include measures of abundance. With this information, the reproductive and regenerative capacity of individuals or populations can be linked with sustainable levels of cropping or harvesting.

In addition to quantitative measures (number, abundance and taxonomic relatedness), it is important to understand a species' biological qualities: for instance, whether a species has a role in recycling nutrients; or whether it can be eaten; whether it is a disease vector. These 'bioqualities' can all be important factors for supporting sound development.

An extinction spasm

Best estimates indicate that current extinction rates are 1,000 to 10,000 times faster than average extinction rates over geological time, leaving 1 in 4 mammal and 50% of some plant species threatened with extinction. The main cause of this extinction spasm is habitat loss, compounded by unsustainable harvesting levels. For example, 28% of 8,600 threatened tree species worldwide are declining because of over-felling. A widely recognised instance of trade pressure leading to species decline is capture fisheries, with 22% of commercial world fish stocks overexploited or depleted. Another major direct cause of species extinctions is the widespread introduction of alien species, cited as the single most common cause (about 40%) of documented causes of mammal extinctions.

Ecosystem biodiversity – processes and productivity

Ecosystem biodiversity refers to the dynamic complex of plant, animal and micro-organism communities and their non-living environment, interacting as a functional unit. Biological processes produced when different

species interact, include pollination, seed dispersal, predation, and symbiosis, and interactions between an ecosystem's biotic and abiotic components include nutrient recycling, soil formation and water filtration. These 'ecosystem services' underpin human development at the local level. Furthermore, ecosystem services can scale-up to impact at regional or even global levels, the loss of forest cover and climate change, or agricultural activities and coral reef sedimentation.

Maintaining landscape productivity

Human use of species products and ecosystem services is an integral part of ecosystem biodiversity, often a very long-standing one. Use brings about changes to ecosystem composition, structure and function. The magnitude of changes varies according to the intensity of extraction, the degree to which time is left for natural regeneration, or what resources are allocated to rehabilitation management.

Much human development depends on maintaining ecosystem services for productive landscapes (which can often be done despite many species losses). However, there are substantial habitat and ecosystems losses taking place in many developing countries as resources are over-exploited; areas are converted to farmlands, urban development and infrastructure and land, sea and air are polluted.

Other factors contribute to biodiversity loss. Natural phenomena and cycles such as the El Niño event of 1997/98 have been implicated in the spread of vast forest fires in Brazil and Indonesia, and the mortality of over 50% of coral reefs in the Indian Ocean is attributed to changes in sea temperature. And at even wider scales, human activity has released greenhouse and ozone-depleting gases into the atmosphere.

Underlying causes of biodiversity loss

In addition to the direct causes of genetic, species and ecosystem biodiversity loss that have been described above, there are various underlying factors which give rise to the conditions that encourage or allow the direct loss of biodiversity.

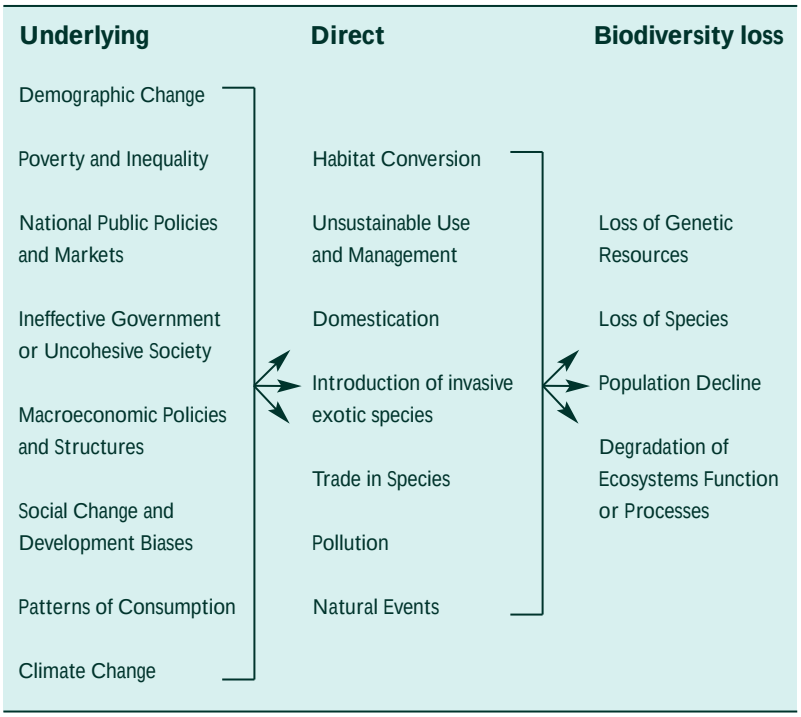
Human population growth, distribution and migration patterns are the most significant factors in environmental degradation. Four-fifths of world's population of 6 billion people live in developing countries and 95% of population growth by 2015 will occur in these countries. Large human populations have a direct impact through use or conversion of natural habitats, and urban areas create an indirect impact through demand for produce from natural habitats and farmlands. Local natural resources are further stressed by mass immigration because of wars or civil disturbance, government settlement schemes and the search for work.

The effects of these population pressures can be exacerbated or mitigated by changing patterns of natural resource use, which include the introduction of new technologies, and/or rejection or ignorance of traditional land management practices. In general, these combine to produce unsustainable natural resource use which results in biodiversity loss.

Poverty and inequality shape resource use at all levels. Poor people without access to financial and human resources, and without secure land tenure, are often forced onto unoccupied lands - protected areas or marginal lands: it is estimated that 60% of the world's poor live in areas of high ecological vulnerability. Without secure rights over use of the land and its resources, they have no incentive to invest in sustainable harvesting practices. This problem is compounded when land ownership laws require areas to be under cultivation before ownership rights can be registered.

Macroeconomic polices and trade practices have a major impact on biodiversity in developing countries because revenues are mainly

Causes of biodiversity loss



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generated from export of agricultural produce and natural resources. Many poor attempts have been made in structural adjustment programmes and other national economic reforms to internalise environmental or social costs in the price of traded goods. As a result, natural resources are being destroyed for short-term profits with few benefits to the poor who depend on such resources. Furthermore, trade practices can open a gateway for trading in illegally harvested goods, alongside those obtained legitimately.

National policies that fail to address the perverse incentives lead to biodiversity losses and environmental damage at various levels:

- Exploitation and use of land with no or unclear land ownership, for example in remote forest reserves, leads to unsustainable use.
- Subsidies for agriculture development, livestock rearing and other intensive production systems have resulted in unsustainable development programmes and large losses of biodiversity.
- Excluding local stakeholders from decision-making on land use plans and research programmes leads to unsustainable harvesting by powerful outside groups, to the detriment of local people and of environmental quality.

These underlying causes of biodiversity loss show how closely improved management of components of biodiversity that support human development depends on adopting sustainable development approaches that address issues of governance, poverty and equality.

The challenge

The challenge for development cooperation is to ensure that biodiversity continues to provide goods and services needed for human development. This means preserving a broad base of genetic resources and sustainably managing natural habitats to continue supporting livelihoods, especially in areas of low agricultural productivity. It also means addressing activities which impact on biodiversity, such as infrastructure, to prevent or mitigate negative impacts on biodiversity and poor communities.

This will only be effective if the institutional context and policy and market instruments, which influence the links between underlying and direct causes of biodiversity loss, and undermine sustainable use options, are corrected. Central to this process of policy development and capacity building is to try and ensure that the true costs and benefits of all levels of biodiversity need to be shared equitably. This needs to be achieved through promoting decentralisation, securing access or tenure of land/resource for communities dependent on them, and defining intellectual property and other rights, and capacity building to allow effective participation and negotiation between stakeholders.

Further information

- Hilton-Taylor, C. 2001. *2000 IUCN Red List of Threatened Species.* IUCN, Switzerland and UK.
- IUCN *http://www.iucn.org*
- UNEP. 1995. *Global biodiversity assessment.* UNEP/Cambridge.
- World Resources Insitute *http://www.wri.org*
- reference to other Biodiversity Briefs is denoted as (see BB#).

Website

All Biodiversity Development Project (BDP) documents can be found on the website: http://europa.eu.int/comm/development/sector/environment