

Biodiversity Loss

Ever since the US President refused to sign the Biodiversity Treaty at the Earth Summit in 1992 the word 'biodiversity' has been bandied around by politicians and economists. But what exactly is biodiversity? How important is it to humanity?

Biodiversity is shorthand for biological diversity or the variability of living organisms and the ecological complexes of which they are part. It is the total variety of genetic strains, species and ecosystems. This diversity is a wonder and a delight but also a great responsibility.

Currently there is much concern over the increasing impact of our human actions on biodiversity. There are widespread calls for political action to halt the loss of species and protect the living world around us.

Worldwide there are an estimated 5 to 30 million species of animals and plants, each genetically unique. Most remain unidentified. Some 1.4 million animal species alive today have been named and described. Named plant species are far fewer, numbering around 400,000.

Biodiversity is not uniformly distributed over the earth's surface. The tropics cover 42% of all land area but contain two-thirds of all animal species. Rainforests cover 6% of all land but contain two-fifths of the world's plant and animal species. Comprehensive measurement of biodiversity is difficult. However, we can compare numbers of species between sites as a simple index of relative biodiversity.

Values of biodiversity

We all depend on the natural world to sustain us with food, clothing and other necessities, establishing a set of use values. But there are many less obvious values of biodiversity, of equal importance, to be considered (see box).

Values from human use

A total of about 3,000 plant species, 200 of which have been domesticated, are used worldwide as a food source. However, just 20 of these plants provide more than 80% of our food at the present time. In order to maintain the high level of production such consumption demands, plant breeders frequently turn to the wild relatives of domestic crops in search of desirable genetic traits such as resistance to disease or drought: wild plants are a valuable reservoir of genetic diversity. A smaller number of animal species provide human food but the scale is often enormous. For example, in 1989 world landings of fish and other aquatic life-forms totalled 99.5 megatonnes, 70 % of which was for human consumption.

Valuing Biodiversity

- Most values are assigned by humans
- Most are related to human survival

Use values

- Direct uses of biodiversity:
 - consumptive – food, medicines
 - non-consumptive - ecotourism
- Subject to trade & commerce
- Monetary value readily assigned
- Varies with demand

Non-use values

- Indirectly related to humans
 - ecosystem services
 - future options
 - aesthetics
- Monetary valuation difficult

Intrinsic value

- Worth 'in themselves'

In addition to food, many of our drugs and raw materials for manufacturing also originate from either plants or animals. Globally 3.5 billion people rely on plant-based medicine for primary health care, and in the USA a quarter of medicines prescribed are based on compounds originally found in plants. Many industrial materials, such as fibres, resins, dyes, waxes, pesticides, lubricants and perfumes derive from plant or animal sources. Trees provide more than 3.8 million cubic metres of wood annually for use as fuel, timber or pulp.

In addition to these long established patterns of consumptive utilisation, there is now a rapidly growing leisure industry which involves the non-consumptive "use" of the living world. For example, ecotourism, based on the observation of wild animals and wilderness habitats, generates between 100 and 200 billion US dollars annually, much of it in needy developing economies.

Non-use values

While we can readily identify uses of biodiversity which directly support human life and are commercially valued, we often overlook a host of 'hidden' functions of living organisms which are equally vital to human well-being. Foremost among these are 'free' environmental services, such as nutrient cycling, soil formation, waste disposal, pollination, watershed protection, oxygen production, carbon sequestration and climate regulation. Placing a cash value on these environmental services is not easy, but one estimate of their global value is US\$ 33 trillion per annum, compared to a world GNP of \$18 trillion.

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There are also vast numbers of species which are not exploited themselves, but are food for economically valuable species, e.g. molluscs and crustaceans have indirect value because edible fish feed on them.

Other non-use values derive from as yet undiscovered possibilities for future uses of wild flora and fauna, such as new drugs from plants and genes usable in breeding new characteristics into crops and domestic animals.

A totally different set of non-use values attaches to the significant contribution of wild organisms to human art, literature and religion. Christianity values biodiversity as a potent reminder to humans of God's personality, power and creative genius (Rom.1:20) and Psalm 104 exclaims: "O Lord, what a variety you have made! And in wisdom you made them all! The earth is full of your riches."

Intrinsic value

All values considered above refer to the multifaceted relationship of living things to humankind, but the Preamble to the Convention on Biological Diversity, signed by 150 nations in 1992, refers to the *intrinsic* value of biodiversity. This notion, which is reflected in most major religions, recognises that creation has a value quite apart from its usefulness to humanity.

For example, Christianity recognises that nature has value because it was made by God for His own glory, not merely for human benefit. The whole of creation belongs to God (Psalm 24:1); Man is His steward, accountable to Him for everything he does with and to nature, especially to living creatures (Gen.2:15).

"It is the generally received opinion, that all this visible world was created for Man... as if there were no other end to any creature but some way or other to be serviceable to Man... yet wise men nowadays think otherwise... 'the creatures are made to enjoy themselves as well as to serve us'."
John Ray, '*The Wisdom of God...*', 1691

Threats to biodiversity

In our eagerness to improve living conditions for the six billion members of our species, we humans are imposing serious threats to the survival of much biodiversity, including many species whose direct value is clearly established. Almost all ecosystems are greatly modified by people who transform habitats and exterminate rivals and competitors.

Conversion of natural habitat to agriculture

(from Pearce and Moran, 1994 - figures given are in million hectares p.a. cropland)

	1900	1980	% change
Sub-Saharan Africa	73	222	+204
Latin America	33	142	+330
South Asia	89	210	+136
China	89	134	+51
S-E Asia	15	55	+267
North America	133	203	+53
Europe	145	137	-5
Ex-USSR	147	233	+58

Habitat degradation

The greatest threat is the loss and fragmentation of natural habitats. This includes clearing forests for timber or plantations, overgrazing, draining wetlands and the destruction of heathlands and coral reefs.

Pollution also degrades habitats. Pesticides, sewage, oil, combustion emissions and acid rain contaminate soils, freshwater, oceans and air. One alarming effect of atmospheric pollution is accelerating changes in climatic patterns to which ecosystems are adapted by long-term evolutionary processes. Anticipated results include dramatic changes in the geographical distribution of some species leading to ecosystem imbalance, and the extermination of others due to flooding and other climate-related phenomena.

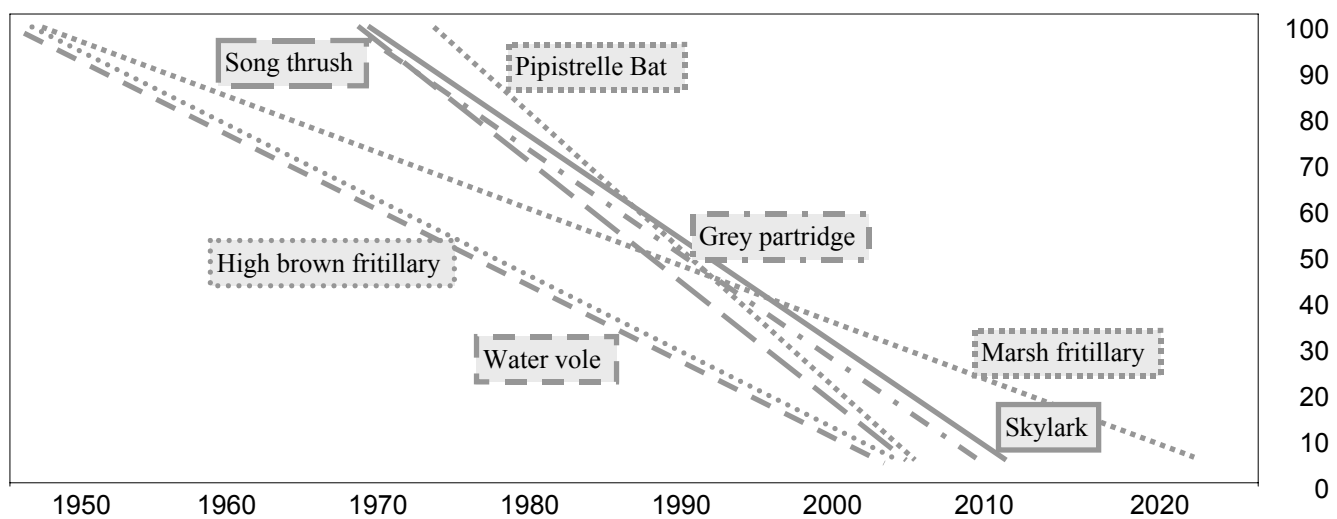
Over-exploitation

Excessive exploitation has pushed some species to the verge of extinction. Included are the tiger, Giant Panda, Black Rhinoceros, cod and several whale species. Between 1979 and 1989 the African elephant population was halved by ivory poaching. Other species have been relentlessly persecuted as vermin, often based on wrong assumptions about the supposed harm they caused. For centuries in Britain, Red Kites had a price on their head as 'lamb-killers', in spite of their lack of strength for such a task.

Results of threats

Resulting from this array of human threats, rates of extinction are now estimated to be between 1,000 and 10,000 times greater than in the recent past. Tropical forests are being destroyed at the rate of 0.8 to 2.0% per annum, sending some of their estimated 5 million species into extinction. We know that 484 species of animal and 654 plants have become extinct since 1600 AD. IUCN considers that one in eight plant species is at risk of extinction. In Britain eleven tree species are classified as 'Critically Endangered' by IUCN, including Ley's Whitebeam (15 individuals left) and the Welsh Whitebeam (44 left).

Projected extinction of seven animal species in Britain based on present rates of decline



In the animal world too, many species face imminent extinction. For example, 116 species of European farmland birds are now of conservation concern. It is estimated that over the last 20 years in Britain alone ten species of farmland birds have between them ten million fewer breeding individuals. This is just one of the devastating effects of the intensification of agriculture on biodiversity.

Examples of birds at risk of extinction in Britain are the Skylark, whose breeding population has declined 54% in just 25 years, the Song Thrush, down 73% in many areas, and the Grey Partridge, whose numbers have halved in the past 25 years. Such is the significance attached to the decline of bird populations that the current Environment Secretary has included a composite trend of 139 species in the list of indicators of sustainable development upon which the government reports annually.

The search for solutions

Political level

The international Convention on Biological Diversity at Rio in 1992 focused attention on the need for sustainable use (rather than non-use) of the components of biodiversity, and the fair and equitable sharing of benefits - such as profits from new drugs based on tropical plants. Nations are required to develop their own strategies that integrate biodiversity conservation and sustainable use into the entire range of national decision-making. The UK's action plan (1994), in addition to the conservation of species and habitats, emphasised a need for involvement of individuals and communities, as well as government.

Conservation legislation is costly to enforce and only works well if it reflects widely accepted values in the community. Attempts to tackle biodiversity loss politically are unlikely to succeed unless they fully

take into account the underlying causes of the crisis, viz. the social organization and growth of the human population; patterns of natural resource consumption; global trade; economic systems and policies that fail to value the environment; and inequity in ownership, management and the flow of benefits from the use and conservation of biological resources.

Policy level

Many governments rely on technical fixes to combat the problem. Conservation-conscious nations set up parks and reserves to protect and rehabilitate wildlife and examples of natural vegetation. However, Michael Soulé, a respected US biologist, points out that a 90 % habitat loss can result in a 50 % loss of species. This means that a country protecting 10% of its area (an ambitious target; many aim at only 5 %) may lose 50 percent of its species.

In Britain, schemes offering incentives to farmers to preserve traditional landscape features between them encompass only about 12.5% of agricultural land. A preferred approach would be to temper all agricultural production with conservation measures, as well as encouraging organic farming, which promotes habitat diversity of benefit to many forms of wildlife.

Reduction of industrial and domestic pollution is a worldwide priority, particularly in the rich nations. In many cases the technology for pollution reduction is available but industrialists are reluctant to pay for it.

Over-exploitation has been restrained by bodies such as the International Whaling Commission and the Convention on International Trade in Endangered Species (CITES). Both organizations aim to ensure that use of wild species is sustainable, rather than to attempt absolute bans. However, continual vigilance is required and trade in thousands of species such as orchids or tropical butterflies is often difficult to assess and regulate.

Our response as individuals

Where do I stand as an individual or member of my community on the accelerating degradation of our planet's biodiversity? How acute is my appreciation of nature, aesthetically and as an indispensable resource for the continued well-being of humankind? Has the urbanisation of modern society removed me from vital contact with the living world?

How often do I thank God for the natural world and - *together with my fellow creatures* - worship Him? How aware am I of my God-given responsibility as a custodian of His creation?

Most of us need to address questions such as these and take deliberate steps to remedy any shortcomings they expose. It may be that we need to be better informed by appropriate reading or by attending a seminar on biodiversity. We will then be better equipped to discuss these matters with colleagues, address a luncheon club or church group, or even lobby our local MP.

Christians are exhorted to be "salt" and "light" in the world around them (Matt.5.13-14). Surely this should include campaigning for greater care for the environment so that its living resources will continue to support humankind and serve as a reminder of the God who made them (Rom.1.20 & 25). There may be a need to request more biblical teaching on creation care in your church through sermons, home groups or literature distribution. What God is redeeming ought to be of serious concern to his followers (Rom.8.19-22).

Further reading

Anon., 1994. *Biodiversity: the UK Action Plan*. HMSO, London.

Gaston, K.J. and J.I.Spicer, 1998. *Biodiversity - an Introduction*. Blackwell Science, Oxford.

Pearce, D. and D.Moran, 1994. *The Economic Value of Biodiversity Loss*. IUCN & Earthscan, London.

World Conservation Monitoring Centre, 1992. *Global Biodiversity: Status of the Earth's Living Resources*. Chapman and Hall, London.

<http://www.jri.org.uk/biodiversity.htm>

Lifestyle

In addition to being well informed and spreading the message, we need to check our lifestyle. Is our wood from sustainable forestry and our newspaper recycled? Do we design parts of our gardens for the benefit of wildlife?

Above all, our pattern of expenditure will reflect the seriousness of our commitment to caring for the living world around us. Are we helping protect nature and its sustainable use? This could be done by supporting a conservation organization such as RSPB, WWF, A Rocha or a local Wildlife Trust.

Progress in curtailing the alarming loss of biodiversity in our modern world will depend on the commitment and sacrifices of individuals just as much as the actions of governments.

This briefing was prepared for the John Ray Initiative by Dr John Sale, an International Biodiversity Consultant. Thanks are due to Dr David Moyer and the JRI Trustees, for all their helpful comments.

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The *John Ray Initiative* promotes responsible environmental stewardship in accordance with Christian principles and the wise use of science and technology. JRI organises seminars and disseminates information on environmental stewardship.

Inspiration for JRI is taken from John Ray (1627-1705), English naturalist, Christian theologian & the first biological systematist of modern times, preceding Carl Linnaeus.

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