

What is biodiversity?

The variety of life on Earth: the ecosystems on the planet such as deserts, rainforests and coral reefs, all of the species of plants, animals, and microorganisms in those ecosystems, and the diversity of genes in those species all comprise the biological diversity of the planet. [1]

Why is biodiversity important?

Healthy biodiversity offers many (free) natural services: [1]

- **Ecosystem services**:

- Protection of water resources (ex. Streams with a larger number of algae species are better biofilters for pollutants [2])
- Formation/protection of soil (ex. Soil organisms suppress pests, parasites, and disease [3])
- Nutrient storage and recycling (ex. Bacteria in soil and certain roots of plants participate in the nitrogen cycle by capturing nitrogen and converting it to ammonia which is used by plants for growth and reproduction [6])
- Pollution breakdown and absorption (ex. Trees and other vegetation absorb pollutants such as excessive nitrogen dioxide, ozone and particulate matter, through their leaves and needles and thereby help improve air quality – less plant cover = less filtering capacity [7])
- Contribution to climate stability (ex. Soil organisms aid the capture of carbon [3])
- Maintenance of ecosystems
- Recovery from unpredictable events (ex. Increasing plant diversity decreases the extent to which extremely wet or dry conditions disrupt grassland productivity [4], more generally: preservation of diversity within ecosystems could potentially minimize the effects of several stressors on ecosystem functions including climate change due to the fact that species may differ in the degree and rate by which their populations respond to stressors... competitive interactions can create compensatory effects between species, in which the sensitivity of one species to a stressor creates an opportunity for a more tolerant competitor and results in a more stable community [5])

- **Biological resources**:

- Food
- Medicinal resources and pharmaceutical drugs
- Wood products
- Ornamental plants
- Reservoirs/breeding stocks: populations of males/females who will procreate
- Future resources

- **Social benefits**:

- Recreation and tourism (ex. Biodiversity contributes significantly to the attractiveness and quality of destinations, and therefore to their competitiveness: for example, coastal water quality and natural vegetation are both ecosystem services that contribute to destination attractiveness. And biodiversity is a direct attraction at the heart of nature-based tourism products – such as wildlife watching, scuba diving or tourism in protected areas [8])
- Cultural values (ex. Nature provides the setting in which cultural processes, activities and belief systems develop, all of which feedback to shape the local environment and its diversity [9])
- Research, education and monitoring (ex. Scientists look to nature resulting from millions of years of evolution for inspiration in engineering – as an example, some spiders produce silk made with proteins with a higher tensile strength than many alloys of steel [1])

Biodiversity ensures survival of species: [1]

- **Species require a variety of genes** to ensure successful survival: Genetic diversity lowers chances of extinction – variety of genes prevent genetic defects caused by in-breeding
- **Species depend on each other** for survival:
 - The nitrogen cycle: relates soil, plants, bacteria, and other life
 - A field used in agriculture: crop byproducts feed cattle → cattle waste feeds soil, nourishes crops → food sources for humans and animals + benefit soil organisms → soil organisms provide various soil services
 - Bees: one third of all our food (fruits and vegetables) would not exist without pollinators
 - The marine ecosystem: killing whales → killer whales (which usually prey on younger whales) prey on other animals such as seals → number of seals declines → killer whales prey on otters → number of otters declines → urchins and other food targets for otters flourish → they destroy kelp forests where many fish larvae grew and were well-protected → exposed fish larvae are easily found and eaten by variety of sea life → fishermen's livelihoods are destroyed (note: fishermen campaigned for killing whales because they were a threat to the fish supply, however this solution had the same, and more severe, effect)
 - Large carnivores (75% are in decline due to shrinking habitats and human persecution): in the short term, loss of carnivores leads to higher populations of their herbivore prey who graze more which can result in environmental deterioration
 - A note on human intervention vs. natural interdependency: nature can be surprisingly resilient often without the need of human intervention. (ex. Two national parks in Africa with growing elephant populations: park where elephant population was culled to maintain ecosystem balance remained in poor condition, park where things were left alone naturally regenerated to reach an ecosystem balance)

Biodiversity has economic value and is fundamental to economics.

Supporting/protecting biodiversity services is of economic interest: [1]

- An estimated 40% of world trade is based on biological products or processes.
Examples of sectors dependent on genetic resources:

Sector	Size of Market	Comment
Pharmaceutical	US\$ 640 bn. (2006)	25-50% derived from genetic resources
Biotechnology	US\$ 70 bn. (2006) from public companies alone	Many products derived from genetic resources (enzymes, microorganisms)
Agricultural seeds	US\$ 30 bn. (2006)	All derived from genetic resources
Personal care, Botanical and food & Beverage industries	US\$ 22 bn. (2006) for herbal supplements US\$ 12 bn. (2006) for personal care US\$ 31 bn. (2006) for food products	Some products derived from genetic resources. represents 'natural' component of the market.

- Protection of biodiversity and implementation of pro-biodiversity policy generates more in benefits than in costs in the long term (ex. Numerous studies also show that investments in protected areas generate a cost-benefit ratio of 1 to 25 and even 1 to 100 in some cases. Planting and protecting nearly 12,000 hectares of mangroves in Vietnam costs just over a million dollars but saved annual expenditures on dyke maintenance of well over seven million dollars)
- The market and economic measures such as GDP fail to recognize the value of ecosystem services and environmental costs/externalities.

Biodiversity is a key element of environmental justice: Economically disadvantaged groups pay the heaviest costs of losing biodiversity. [1]

- ex. Commercially overfishing a region means fish in that area become less available and more expensive. While commercial entities can go elsewhere to exploit resources, local fishermen go out of business and poorer people in the area may face food insecurity.

Sources

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