

DEFINITION OF BIODIVERSITY*

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Biodiversity, a contraction of the phrase "biological diversity," is a complex topic, covering many aspects of biological variation. In popular usage, the word **biodiversity** is often used to describe all the species living in a particular area. If we consider this area at its largest scale - the entire world - then biodiversity can be summarized as "life on earth." However, scientists use a broader definition of biodiversity, designed to include not only living organisms and their complex interactions, but also interactions with the abiotic (non-living) aspects of their environment. Definitions emphasizing one aspect or another of this biological variation can be found throughout the scientific and lay literature (see *Gaston, 1996: Table 1.1[2]*). For the purposes of this module, **biodiversity** is defined as:

the variety of life on Earth at all its levels, from genes to ecosystems, and the ecological and evolutionary processes that sustain it.

Genetic diversity is the "fundamental currency of diversity" (*Williams and Humphires, 1996[6]*) that is responsible for variation between individuals, populations and species. Therefore, it is an important aspect of any discussion of biodiversity. The interactions between the individual organisms (e.g., reproductive behavior, predation, parasitism) of a population or community, and their specializations for their environment (including ways in which they might modify the environment itself) are important functional aspects of biodiversity. These functional aspects can determine the diversity of different communities and ecosystems.

There is also an important spatial component to biodiversity. The structure of communities and ecosystems (e.g. the number of individuals and species present) can vary in different parts of the world. Similarly, the function of these communities and ecosystems (i.e. the interactions between the organisms present) can vary from one place to another. Different assemblages of ecosystems can characterize quite diverse landscapes, covering large areas. These spatial patterns of biodiversity are affected by climate, geology, and physiography (*Redford and Richter, 1999[4]*).

The structural, functional, and spatial aspects of biodiversity can vary over time; therefore there is a temporal component to the analysis of biodiversity. For example, there can be daily, seasonal, or annual changes in the species and number of organisms present in an ecosystem and how they interact. Some ecosystems change in size or structure over time (e.g. forest ecosystems may change in size and structure because of the effects of natural fires, wetlands gradually silt up and decrease in size). Biodiversity also changes over a longer-term, evolutionary, time-scale. Geological processes (e.g., **plate tectonics**, **orogenesis**, erosion), changes in sea-level (marine transgressions and regressions), and changes in climate cause significant, long-term changes to the structural and spatial characteristics of global biodiversity. The processes of natural

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selection and species evolution, which may often be associated with the geological processes, also result in changes to local and global flora and fauna.

Many people consider humans to be a part of nature, and therefore a part of biodiversity. On the other hand, some people (e.g., *Redford and Richter, 1999* [4]) confine biodiversity to natural variety and variability, excluding biotic patterns and ecosystems that result from human activity, even though it is difficult to assess the "naturalness" of an ecosystem because human influence is so pervasive and varied (*Hunter, 1996*[3]; *Angermeier, 2000*[1]; *Sanderson et al.,2002*[5]). If one takes humans as part of nature, then cultural diversity of human populations and the ways that these populations use or otherwise interact with habitats and other species on Earth are a component of biodiversity too. Other people make a compromise between totally including or excluding human activities as a part of biodiversity. These biologists do not accept all aspects of human activity and culture as part of biodiversity, but they do recognize that the ecological and evolutionary diversity of domestic species, and the species composition and ecology of agricultural ecosystems are part of biodiversity. (For further discussion see the modules on Human evolution and Cultural Diversity; in preparation.)

Glossary

Definition 1: Biodiversity

the variety of life on Earth at all its levels, from genes to ecosystems, and the ecological and evolutionary processes that sustain it

Definition 2: Plate Tectonics

the forces acting on the large, mobile pieces (or "plates") of the Earth's lithosphere (the upper part of the mantle and crust of the Earth where the rocks are rigid compared to those deeper below the Earth's surface) and the movement of those "plates".

Definition 3: Orogenesis

the process of mountain building.

References

- [1] P.L. Angermeier. The natural imperative for biological conservation. *Conservation Biology*, 14(2):373–381, 2000.
- [2] K.J. Gaston. What is biodiversity? In K.J. Gaston, editor, *Biodiversity: a biology of numbers and difference*, pages 1–9. Blackwell Science Ltd., Oxford, U.K., 1996.
- [3] M. Jnr. Hunter. Benchmarks for managing ecosystems: are human activities natural? *Conservation Biology*, 10(3):695–697, 1996.
- [4] K.H. Redford and B.D. Richter. Conservation of biodiversity in a world of use. *Conservation Biology*, 13(6):1246–1256, 1999.
- [5] M. Jaiteh M.A. Levy K.H. Redford A.V. Wannebo Sanderson, E.W. and G. Woolmer. The human footprint and the last of the wild. *BioScience*, 52(10):891–904, 2002.
- [6] P. H. Williams and C. J. Humphries. Comparing character diversity among biotas. In K.J. Gaston, editor, *Biodiversity: a biology of numbers and difference*, pages 54–76. Blackwell Science Ltd., Oxford, U.K., 1996.