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## Biodiversity



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**Biodiversity ('biological diversity')** encompasses the variety of life in all its manifestations. Starting with the Convention on Biological Diversity adopted in 1992, the concept has found its way into various strategies and action plans at the national and international levels, and biodiversity is now treated as a protected resource in environmental impact assessments.

# 1 Definition

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As defined in the Convention on Biological Diversity (CBD), biological diversity, or biodiversity, ‘means the variability among living organisms from all sources [...] and the ecological complexes of which they are part’ (UN 1992: 3). This variability occurs on three levels: within species (genetic diversity), between species, and between ecosystems (including biotic communities, habitats and landscapes). In addition, a fourth level, that of functional biodiversity, is often discussed: the diversity of processes that are defined by the interactions among the members of a community (such as competition, predator-prey relationships or symbioses).

# 2 Biodiversity: from concept to convention

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The term *biodiversity* is short for *biological diversity*. It was coined in the 1980s by prominent American biologists with the strategic political goal of drawing attention to global species decline, habitat destruction, and the rapid decline in genetic diversity among domesticated plants and animals. It then became widely known with the publication in 1988 of *Biodiversity*, a book edited by the evolutionary biologist Edward O. Wilson. The rapid spread of the term, which was intended from the outset to promote a public awareness transcending its fundamental biological meaning (cf. Takacs 1996), was also reflected in the adoption of the Convention on Biological Diversity (CBD) at the UN Conference on the Environment and Development in Rio de Janeiro in 1992. This positioned the concept, which originated in biology, in the broader context of discussions about sustainability. This is made clear in the three main objectives of the CBD:

- the conservation of biological diversity
- the sustainable use of its constituent elements
- the fair and equitable sharing of the benefits arising from the utilisation of genetic resources (Access and Benefit Sharing – ABS, cf. UN 1992: 3).

With these three objectives of equal priority, the CBD endeavours to reconcile ecological, economical and social considerations in addressing biological diversity. In so doing, the CBD goes well beyond traditional protective approaches: in its scope and aspirations, it is the most comprehensive ▷ *Nature conservation* agreement worldwide.

# 3 On the ambivalence of the concept

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This very broad understanding entails the problem that biodiversity, due to the various dimensions it encompasses, lacks clear semantic contours and can scarcely be parameterised and thus measured. Ackermann, Schweiger, Sukopp et al. (2013) presented a set of indicators describing various aspects of biodiversity. Among researchers, biodiversity is known for very heterogeneous and often poorly coordinated approaches to research (Görg 1999). To focus biodiversity research and improve communication among the scientists involved, the German Research Foundation (*Deutsche Forschungsgemeinschaft, DFG*) launched the German Centre for Integrative Biodiversity

Research (*Deutsches Zentrum für integrative Biodiversitätsforschung, iDiv*) Halle-Jena-Leipzig in 2013, a consortium of the universities of Halle, Jena and Leipzig, the Helmholtz Centre for Environmental Research (*Helmholtz-Zentrum für Umweltforschung, UFZ*) and various non-university research institutes.

The oft-lamented loss of biodiversity is difficult to quantify given the lack of standardised indicators and the fact that those indicators that do exist are often based on different data and methods. Given this situation, it also becomes clear why biodiversity often has a one-sided focus on a single individual species or on numbers of species, thus neglecting its other manifestations (for example, cf. criticism in Haber 2003, 2008). Though there is debate about precisely what a species is (Kunz 2002), concentrating on the diversity of species often appears to be the simplest way to make biodiversity tangible. However, it must be borne in mind that species numbers are not by themselves a particularly meaningful characteristic; what matters is always the diversity of species that is typical of a particular region or location.

The fact that biodiversity is claimed to be comprehensive yet cannot be measured or pinned down can be seen as a key factor in the success of the concept, as it satisfies a political need for symbolic terms and concepts that are open to flexible interpretation, while also being difficult to define in concrete term. Eser (2001, 2003) thus describes biodiversity as a *boundary object* that enables communication between different disciplines and can act as a mediator between those who would conserve natural resources and those who would exploit them, but in certain circumstances it may also obscure underlying conflicts of interest.

## 4 Action plans and strategies for biodiversity in the political arena

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As both a term and an idea, biodiversity has had an impact on various nature conservation policy strategies and action plans at the national, European and global level.

When the CBD's 2010 target of significantly slowing the ongoing loss of biological diversity was not reached, the signatory states to the CBD adopted the Strategic Plan for Biodiversity 2011-2020 in Japan in 2010 to protect biodiversity (UN 2010). It is intended to serve as a flexible framework for setting national targets and includes five overarching strategic goals that are subdivided into 20 headline targets. These so-called 'Aichi targets' (named after the Japanese province where the conference took place) are, in contrast to earlier targets, for the most part quantified and thus more verifiable. They represent a paradigm change in that, in addition to ▷ *Species protection* aspects and the expansion of conservation areas (to at least 17% of terrestrial areas and 10% of marine and coastal waters), they also explicitly address land use, the restoration of degraded ecosystems, and financial issues (reduction of environmentally harmful subsidies) (cf. UN 2010: 8 et seq.).

In 2007, the German Federal Government adopted a National Strategy on Biological Diversity (*Nationale Strategie zur Biologischen Vielfalt*) (BMU [Federal Ministry for the Environment, Nature Conservation and Nuclear Safety] 2007). This strategy specifies 330 targets and around 430 measures relating to all relevant sectors of society. In particular, it also addresses the relevance of various uses for the conservation of biodiversity and the importance of issues such as climate

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change (▷ *Climate, climate change*), environmental education, research, technology transfer and poverty alleviation. This is an effort to realise the CBD's aim of bringing biodiversity into the mainstream by introducing biodiversity concerns into other sectors and anchoring them there. The German biodiversity strategy's extensive catalogue of targets and measures is not legally binding. However, as a strategy adopted by the cabinet, it must be taken into consideration by all other ministries and thus represents an important set of fundamental goals and an essential basis of argumentation for ▷ *Nature conservation* and ▷ *Environmental planning*.

In February 2015, the Federal Cabinet adopted an Indicator Report for the National Strategy on Biological Diversity (*BMUB* [Federal Ministry for the Environment, Nature Conservation, Construction and Nuclear Safety] 2015). The report uses 19 indicators to assess the status and trends of the natural environment in Germany. Of 13 indicators which have a specific target value, the values for 11 indicators are still far or very far from their target ranges, clearly pointing to an urgent need for action, especially in the areas of water quality, land take and agriculture and in general to stop the decline in the diversity of species in the landscape.

In May 2011, the European Commission published a biodiversity strategy of its own with which it aims to stop the loss of biological diversity by 2020 (European Commission 2011). In addition, the United Nations declared the decade from 2011 to 2020 the United Nations Decade for Biodiversity, with an emphasis on publicising the matter and environmental education to raise awareness accordingly.

## 5 Biodiversity in spatial planning

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The CBD was legally implemented in 2002 and 2010 with the adoption of the goal to preserve and develop biological diversity, initially in the principles of nature conservation and landscape conservation laid out in the Federal Nature Conservation Act (*Bundesnaturschutzgesetz, BNatSchG*) and later in the targets laid out in section 1(1) *BNatSchG*. When the Environmental Impact Assessment Act (*Gesetz über die Umweltverträglichkeitsprüfung, UVPG*) was amended in 2005, biological diversity was defined as a protected resource that is to be identified, described and assessed in the course of an environmental impact assessment (section 2(1) no. 1 *UVPG*; ▷ *Environmental assessment*).

Even if in formal terms biodiversity is no longer a new issue in ▷ *Spatial planning (Raumplanung)* and environmental planning, the aforementioned problems and the issues related to operational implementation are also reflected there. A Guidance Paper from the European Commission (European Commission 2013) provides information that is aimed less at specific aspects of operational implementation and more at the integration of biodiversity concerns in the individual steps of the EIA process.

## 6 Biodiversity and ecosystem services

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A high degree of biodiversity is often associated with the provision of certain ecological services (for example, cf. Sala et al. 2000), and the question of biodiversity's importance to ecosystem functionality is a focus of ecosystem research (▷ *Ecology*). Though the functional characteristics of species have a strong influence on the characteristics of an ecosystem, high diversity does not automatically result in a higher level of ecosystem services and functions. Instead, it is important to be aware that there are important differences between the concepts of biodiversity and ▷ *Ecosystem services*, both of which play a crucial role in current nature conservation policy debates (Jessel 2011):

- Biodiversity includes the variety of biotic nature at all levels, while ecosystem services also include inanimate/abiotic and spiritual/aesthetic resources.
- While the focus of biodiversity is on the quantity and variety of the biotic components of nature, for ecosystem services it is on the functions for maintaining certain services – a fundamentally different perspective.
- The concept of ecosystem services has an anthropocentric orientation; it concerns the various benefits for humans. In contrast, ethical value (preserving nature for its own sake, i.e. sometimes also independently of the services it provides for people) is only of relevance for biodiversity.
- The protection of biodiversity implies the preservation of diversity in all of its constitutive elements and is thus fundamentally static. For ecosystem services, however, the focus on functions means that all elements may not be absolutely necessary to sustain the services; this ultimately entails greater dynamism and variability.

Biodiversity and ecosystem services can thus be understood as complementary concepts that mutually reinforce each other in nature conservation policy discussions.

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