

»» Biological diversity – why it is so important

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Author: Anke Brüggemann, phone +49 69 7431-1736, anke.brueggemann@kfw.de

The worldwide loss of biological diversity continues unabated. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) determined in its latest reports on the state of the earth's biological diversity that this development poses a risk to the economies, food security and quality of life of people all over the world. Humankind depends on well-functioning ecosystems. Nature makes numerous ecosystem services available, such as fertile soils, food, natural medicines, drinking water and clean air. It regulates the climate and provides recreational opportunities for humans. When ecosystems or their components sustain permanent damage, this poses a threat to the services provided by nature. Although progress has been made in some areas, the decline in biodiversity has not yet been reversed in Germany either.

Human activity is the main driver of biodiversity loss. Destruction and over-exploitation of natural habitats and resources, environmental pollution and climate change are deemed to be the main causes of loss of biological diversity around the world. The economic benefits of an intact natural environment are often not sufficiently recognised. The monetary value of ecosystem services is estimated at USD 125 to 145 trillion per year worldwide.

Protecting biological diversity is deemed to be the most pressing ecological challenge of our time alongside mitigating climate change. Both environmental threats are in a close cause-and-effect relationship. In order to be able to stop the loss of animal and plant species and their habitats, more areas need to be granted conservation status. Crucially, however, production, consumption and agriculture also need to be made sustainable.

The assessment reports on biodiversity published by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services in March 2018 came to an alarming conclusion: biological diversity continues to decline in all regions of the world. This development poses a threat to the economy, food security and quality of life of people all over the world.¹ Despite this worrying finding, the issue is still receiving little public attention. Some seek to allay concerns by arguing that the appearance and disappearance of species is a natural process in the history of our earth. That is true but the extinction of species has accelerated massively since the dawn of modern humankind. Current extinction rates are estimated to be 100 to 1,000 times higher than long-term natural background rates. The extinction of

species is thus taking place at a rate unparalleled since the last global mass extinction event some 65 million years ago – which also killed off the dinosaurs. Unlike in the early history of the earth, however, current trends are not the result of meteorite strikes, volcanic activity or other natural disasters but primarily caused by human intervention in the natural environment.²

The welfare of humankind depends on healthy ecosystems

Biological diversity – or biodiversity – refers to the abundance of animal and plant species and the diversity of the ecosystems inhabited by species (such as forests and oceans), as well as to the genetic diversity within the various species. These three levels of diversity form a complex network of ecological interactions and are the foundation for human life as we know it. Nature provides numerous ecosystem services which are crucial to the welfare of humankind and to the production of many goods and services. These ecosystem services can be subdivided into four categories (see also Figure 1):

1. **Provisioning services:** These usually include marketable goods produced by or with the aid of ecosystems, such as food, drinking water, fuels, construction timber and natural medicinal agents.
2. **Regulating services:** These comprise natural processes which, among others, filter pollutants from the water, air and soil, or regulate the climate. Examples include filtering effects of soil layers that are of fundamental importance to groundwater quality, the reduction of air pollutants by urban green spaces and carbon dioxide storage in forests, peatland and the world's oceans. Flood control through intact alluvial areas, reduction of soil erosion through hedges or pollination services by insects also count as regulating services.
3. **Cultural services:** Intact ecosystems are also of high recreational value to humans. They also serve as sources of inspiration – not least for technical innovation (bionics). For example, the lotus effect observed on the leaves of plants served as a model for the development of water-repellent and self-cleaning surfaces.
4. **Supporting services:** These processes in nature are the prerequisite for the provision of all other ecosystem services and comprise, among others, the water and nutrient cycle and the decomposition of organic substances by microorganisms and microbes (soil formation).

Photosynthesis – probably one of the most important biochemical processes on earth – also falls under this category. Not only does it enable plants to form their biomass, which in turn serves as a source of food and energy for most animal species, including humans. Photosynthesis also releases oxygen, which has enabled higher forms of life on earth to evolve in the first place.

The basic foundations of life of current and future generations thus depend directly on healthy ecosystems. If ecosystems or their components sustain permanent damage, this also poses a threat to the ecosystem services provided by nature. In addition, biological diversity acts as insurance for the challenges of the future. The greater the diversity of genes, species and habitats, the more easily nature can adapt to changed living conditions. Preserving this adaptation potential is particularly important in times of climate change.³

Figure 1: Nature's ecosystem services



Source: Naturkapital Deutschland – TEEB DE (2012): The Value of Nature for Economy and Society: An Introduction.

The decline in biodiversity continues – around the world and in Germany

Researchers highlighted the dangers posed by the decline in biodiversity that is occurring around the world as far back as in the 1970s. The international community responded in 1992 and adopted the United Nations Convention on Biological Diversity (CBD). The convention aims to preserve biological diversity and organise its sustainable use in a way that enables as many people as possible to sustain their livelihoods from it today and in the future. To implement the convention, a UN biodiversity strategy was adopted in 2010 with goals for the year 2020. Among other things, it aims to at least halve the rate of natural habitat loss and stop the extinction of species known as endangered by 2020.⁴ The international convention has now been ratified by 196 countries including Germany. All signatory states have committed to developing national strategies, plans or programmes for the conservation and sustainable use of biological diversity. Germany fulfilled this commitment by adopting its National Strategy on Biological Diversity in the year 2007.

Although measures have been initiated and progress has been made in individual areas, the necessary trend reversal

in biodiversity loss has not yet been achieved – neither globally nor in Germany.⁵ As a result, the 14th UN Biodiversity Conference, which was held in Egypt in November 2018, came to a sobering conclusion: Most of the UN biodiversity goals for the year 2020 on which the signatory states agreed in 2010 are now out of reach. Many areas of policy and business still pay too little attention to nature conservation. To be able to stop the loss of biological diversity, political efforts need to be stepped up significantly.⁶

The following figures provide an idea of the global dimension which the threat to biological diversity has reached:

- Only around 25% of the world's land area remains free of significant anthropogenic influences. This share is estimated to drop to as little as 10% by 2050. More than one third of the land area is now being used as cropland or pastureland. Natural habitats such as forests, meadows and wetlands are being converted into arable land, particularly in the earth's most biologically diverse ecosystems. Wetlands have been most severely affected, as over half of all the earth's wetlands have been lost since the beginning of the 20th century.⁷

- Earth's population of wild vertebrates — mammals, birds, fish, amphibians and reptiles — experienced an overall decline of 60% from 1970 to 2014. By comparison, the decline between 1970 and 1995 was 30%. The drop in the population of species is most pronounced in the tropics, with South and Central America experiencing the sharpest decline. The vertebrate population in this region fell by 89% between 1970 and 2014.⁸

- In drafting the Red List of Threatened Species, the International Union for Conservation of Nature (IUCN) assesses the situation of the populations of some 97,000 plant and animal species – out of some 1.7 million species described so far worldwide. The organisation currently estimates that some 27,000 plant and animal species are threatened by extinction. That is around 10,000 more species than just ten years ago and nearly 28% of all species assessed in 2018.⁹

- The Food and Agriculture Organisation (FAO) of the United Nations estimates that one third of the earth's fish stocks are currently overfished – a more than 20 percentage-point increase from 1974.¹⁰

What is the state of biodiversity in Germany? Here, too, overall figures do not show a trend reversal in biodiversity loss

- In the context of the German Federal Government's sustainability reporting, the indicator 'species diversity and landscape quality' plays a key role in assessing the state of nature and landscapes in Germany. The indicator shows the development of the populations of 51 selected species of birds which represent the most important landscape and habitat types in Germany (farmland, forests, settlements, inland bodies of water, coasts and oceans). The size of the

populations directly reflects the suitability of the landscape as a habitat for these birds. As many animal and plant species rely on intact habitats as well, the indicator also indirectly maps the diversity of species and the sustainability of land use in Germany. With the aim of conserving biological diversity, the German Sustainability Strategy defined a target population size standardised at 100% for the selected bird species for the year 2030. Initially, this target size should already have been achieved by the year 2015. The reason for shifting the target date is shown in Figure 2. In the past ten years (2005 to 2015), no upward trend could be observed in the development of the overall indicator. In 2015 the average bird population was 70.3% of the target value and thus slightly under the value of 2005 (71.1%). During that period, in particular bird populations in farmland, coastal and oceanic landscapes developed negatively. By contrast, populations in forests, settlements and inland water bodies increased. If the overall indicator develops at the same rate, the target value will not be achieved in 2030.

- Habitats in Germany can be distinguished into roughly 863 different types. According to the current Red List from the year 2017, nearly two thirds of the types of biotopes existing in Germany remain under overall threat (albeit to different degrees) and thus at risk of loss. Since the most recent update to the Red List was released in 2006, in particular the situation in many grassland biotopes (meadows and pastures) has deteriorated – mainly as a result of higher-intensity farming. The continuing consumption of land for settlement and transport is also exacerbating the threat situation for many types of biotopes of cultural landscapes such as meadow orchards. What has stabilised, on the other hand, is the threat situation for many forest biotopes. Among other things, this is due to more sustainable forestry

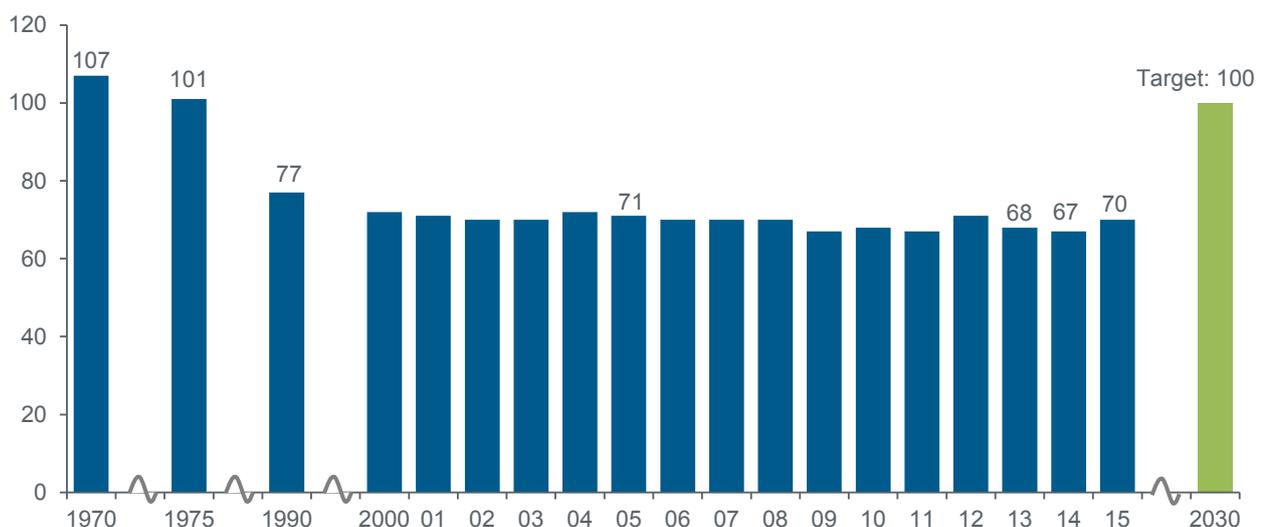
practices, particularly in public forests. Coastal biotopes and flowing waters have also recovered. This is a result of the designation of coastal protected areas, successes in the renaturation of rivers and alluvial areas and improved sewage treatment plants. No turnaround has been achieved yet, however, in other types of water such as groundwater and many standing waters (such as lakes and ponds) where the threat situation has continued to intensify as a result of high nitrogen loads caused mainly by farming activity.¹¹

- The damage being inflicted on natural habitats is also reflected in the threat situation for flora and fauna. Thirty-one per cent of all wild plant species native to Germany are under threat. They are particularly affected by high nutrient loads in soil from farming activity.¹² Some 48,000 animal species are native to Germany, 11,000 of which the Federal Agency for Nature Conservation (BfN) has assessed regarding their threat status in the German Red List. Here again, the result is alarming, as 30% of all animal species assessed are now classified as threatened. For invertebrates, which include insects for example, the proportion is even 46%.¹³ A specific Red List for Germany's breeding birds shows that almost half of the overall 248 native breeding bird species (118 species) have been assigned one of the threat levels.¹⁴ What is noteworthy is the trend that common birds such as the barn swallow and house martin as well as the house sparrow are becoming increasingly rare. One important explanation is the lack of suitable breeding sites and food. This is primarily the result of intensive land use and fragmentation of habitats but also due to the sharp decline in insect populations.¹⁵

- In 2017, a highly regarded study released by the Entomological Society of Krefeld, Germany, revealed that not only the diversity of insect species is declining but also their

Figure 2: Indicator of species diversity and landscape quality, Germany

Index 2030=100



Note: The indicator shows the development of the populations of 51 selected bird species which represent the most important landscape and habitat types in Germany, in the form of an overall index. Here the population sizes of the relevant bird species are referred to the relevant target population value for the year 2030; the target value for 2030 was defined in the context of the German Sustainability Strategy.

Source: Federal Statistical Office (2018): Nachhaltige Entwicklung in Deutschland. Indikatorenbericht 2018 (*Sustainable development in Germany. Indicator report 2018* – our title translation, in German).

population size. The study documents a drastic decline in biomass (total weight) of flying insects by more than 75% in several protected areas in Germany within the past 27 years (1989 to 2016).¹⁶ Many insect species deliver elementary ecosystem services. Among other activities, they decompose organic matter and thereby contribute to preserving soil fertility, they pollinate a large portion of plants and serve as a source of food for many other animals. The close ecosystem interactions mean that the decline in insect populations has immediate negative consequences for the development of other animal and plant populations and is therefore a source of further ecological threats. The causes of insect population declines are multifaceted and complex. Key reasons include the advancing degradation of the landscape structure, the use of plant protection agents, the input of nutrients in soils and water bodies (overfertilisation) and light pollution in and around settlements.¹⁷

Anthropogenic activity is the main driver of biodiversity loss

The above examples underscore that human activity is the main cause of the worldwide decline in biological diversity. The main threats originate from, among others:¹⁸

- The loss and fragmentation of natural habitats as a result of increasing population density, industrialisation and infrastructures such as roads and hydraulic structures (in Germany alone, an average of 62 hectares of new land is still used every day for human settlement and transport¹⁹);
- Intensification of agriculture (e.g. logging of tropical rainforests to make way for palm oil plantations or, in Germany, conversion of grassland into farmland, planting of monocultures, high pesticide loads, overfertilisation of soils and water from nutrient inputs such as nitrogen and phosphorus);
- Overexploitation of natural resources, for example through unsustainable forest practices, overfishing and poaching of protected species;
- Contaminant and nutrient input from industry, transport, energy generation, wastewater and waste disposal;
- Introduction by humans of alien species or organisms that compete with native species for habitat and
- Climate change (e.g. dying of coral reefs as a result of changes in the temperature and acidity of the ocean, loss of habitat for cold-adapted species in mountain regions and the Arctic).

The economic benefits of an intact natural environment are often underestimated

Why are economic decisions often made at the expense of nature? From an economic perspective, the main reason is that because nature is a collective good, or a public good, most of the ecosystem services it provides can be used at no cost. As a result, the value of nature is not sufficiently

recognised in private and public decision-making processes. Vast parts of the population take the services provided by nature for granted and believe they are available in unlimited quantities. The absence of scarcity signals emitted by market and pricing mechanisms ultimately leads to overexploitation of nature as a resource. This market failure requires government intervention to protect nature and biodiversity.

In order to provide economic arguments for the social importance of nature and for the protection of biodiversity, a variety of initiatives have formed in the research community to carry out a monetary valuation of the ecosystem services provided by nature.²⁰ Such a valuation is complex because the absence of market prices – particularly for the regulating, supporting and cultural services of nature – requires valuation approaches to be applied that are fraught with great uncertainties. Despite methodological challenges and problems, however, quantifying the value of these services is often helpful because economic arguments often play a dominant role in political decision-making processes. A balanced cost-benefit analysis of the use of environmental goods should therefore not only take investment and employment effects into account. It should also seek to establish clarity as to which ecosystem services are being provided by nature – and what economic damage occurs when nature fails to deliver them. The monetisation of ecosystem services contributes to integrating the value of biodiversity more strongly into decision-making processes.

In practice, most economic valuation studies focus on individual ecosystem services. Costanza et al. undertook an estimate of the aggregate global value of all ecosystem services in 2014. They estimated that the global monetary value of ecosystem services amounted to USD 125 to 145 trillion in 2011 (in US dollars 2007). By way of comparison, global GDP in 2011 amounted to around USD 75 trillion (in US dollars 2007). Moreover, the worldwide loss of ecosystem services resulting from changes in land use during the period from 1997 to 2011 was estimated at around USD 4.3 to 0.2 trillion annually.²¹

The valuation studies show that natural ecosystems should not be recklessly degraded for economic reasons alone. Nature delivers many services free of charge for which cost-intensive technological solutions would otherwise be required²² – if a technical substitution were at all possible in all cases.

Conclusion

Along with climate change, the loss of species and their habitats is the second major environmental crisis of our time. Both developments are closely interconnected in cause and effect.

The advancing biodiversity loss is increasingly destroying humanity's natural basis of life. Besides, the economic benefits of an intact natural environment are often underestimated. In order to stop the loss of biodiversity, policymakers and society must give the issue higher priority.

Significantly more nature conservation areas are necessary. Crucially, however, production, consumption and agriculture also need to be made sustainable.

In order to effectively reverse the loss of biological diversity in Germany, the main step is to realign agriculture towards environmentally sustainable land-use practices.²³ Germany also has a responsibility towards the rest of the world. Its activities affect not just the country's own biodiversity but global biodiversity as well – through its shared responsibility

for climate change, the use of resources and the consumption of globally traded goods and services. Germany's high consumption of meat, for example, and a high share of imported animal feed for its industrialised livestock farming place high pressure on environmental goods in exporting countries. Between 2004 and 2014 alone, the area used outside Germany to grow animal feed for German livestock farming increased by 40% to nearly 2.7 million hectares.²⁴ ■

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¹ Cf. IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018): Media Release: Biodiversity and nature's contributions continue dangerous decline, scientists warn (04.05.2018), <https://www.ipbes.net/news/media-release-updated-biodiversity-nature%E2%80%99s-contributions-continue-dangerous-decline-scientists>

² Cf. Rockström, J. et al (2009): A safe operating space for humanity. In: *Nature* Vol 461, p. 472–475.

³ Cf. BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2007): National Strategy for Biological Diversity. Cabinet decision of 7 November 2007, Berlin; German Advisory Council on the Environment (2017): Für eine bessere Finanzierung des Naturschutzes in Europa nach 2020 (*For better financing of nature protection in Europe after 2020* – our title translation, in German only). Statement, Berlin.

⁴ Cf. The UN Strategic Plan for Biodiversity 2011-2020 – A ten-year framework for action by all countries and stakeholders to save biodiversity and enhance its benefits for people (2010), www.cbd.int/sp/

⁵ Cf. Natural Capital Germany – TEEB DE (2018): The Value of Nature for Economy and Society. A Synthesis. Helmholtz Centre for Environmental Research – Leipzig; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2018): Biologische Vielfalt in Deutschland. Rechenschaftsbericht 2017 (*Biological diversity in Germany. Annual report 2017* – our title translation, in German only), Berlin.

⁶ Cf. CBD – Convention of Biological Diversity (2018): Updated assessment of progress towards selected Aichi biodiversity targets and options to accelerate progress. Draft decision submitted by the Chair of Working Group I (21 Nov. 2018), <https://www.cbd.int/doc/c/3824/7957/5bb56cbf504e73bf00282e9/cop-14-l-02-en.pdf>

⁷ Cf. IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018): Media Release: Worsening worldwide land degradation now 'critical', undermining well-being of 3.2 billion people (23.03.2018), <https://www.ipbes.net/news/media-release-worsening-worldwide-land-degradation-now-%E2%80%98critical%E2%80%99-undermining-well-being-32>

⁸ Cf. WWF – World Wide Fund for Nature (2018): Living Planet Report – 2018: Aiming higher, Gland (Switzerland).

⁹ Cf. IUCN – International Union for Conservation of Nature (2018): The IUCN Red List of Threatened Species (Version 14 Nov. 2018), https://nc.iucnredlist.org/redlist/content/attachment_files/2018_2_RL_Stats_Table_1_new.pdf

¹⁰ Cf. FAO – Food and Agriculture Organization of the United Nations (2018): The State of World Fisheries and Aquaculture 2018. Meeting the sustainable development goals. Rome.

¹¹ Cf. BMUB – Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, BfN – Federal Agency for Nature Conservation (2017): Press information: Publication of the Red List of threatened biotopes (31 May 2017), Berlin.

¹² Cf. BfN – Federal Agency for Nature Conservation (2018): Press release: Rote Liste – Zunehmende Nährstoffbelastung gefährdet Wildpflanzen (*Red List – Growing nutrient load is endangering wild plants* – our title translation, in German only, 5 December 2018), Berlin, Bonn.

¹³ Cf. BfN – Federal Agency for Nature Conservation (2015): Artenschutz-Bericht 2015. Tiere und Pflanzen in Deutschland (*Species Protection Report 2015. Animals and plants in Germany* – our title translation, in German only), Bonn.

¹⁴ Cf. DDA – Federation of German Avifaunists (2016): Neue Rote Liste der Brutvögel Deutschlands veröffentlicht (*New Red List of Germany's breeding birds published* – our title translation, in German only). In: DDA-Aktuell 4/2016.

¹⁵ Cf. LBV – Landesbund für Vogelschutz in Bayern (*Regional Society for Protection of Birds in Bavaria*) (2016): Red List of Germany's breeding birds published (News article published in German on 25 August 2016), <https://www.lbv.de/news/details/rote-liste-der-brutvoegel-deutschlands-2016-veroeffentlicht/>

¹⁶ Vgl. Hallmann et al. (2017): More than 75 percent decline over 27 years in total flying insect biomass in protected areas (published: 18 Oct. 2017), <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>

¹⁷ Cf. German Advisory Council on the Environment, advisory board for biodiversity and genetic resources at the German Federal Ministry of Food and Agriculture (2018): Für einen flächenwirksamen Insektenschutz (*Towards broadly effective insect protection* – our title translation, in German only). Statement, Berlin, Bonn.

¹⁸ Cf. Secretariat of the Convention on Biological Diversity (2010): Global Biodiversity Outlook. Summary, Montréal, Canada; BMU – Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2007): Fakten zum Thema Biodiversität (*Facts on the topic of biodiversity* – our title translation, in German only); BMU (2007): National Strategy on Biological Diversity. Cabinet decision of 7 November 2007, Berlin.

¹⁹ Cf. Federal Statistical Office (2018): Nachhaltige Entwicklung in Deutschland. Indikatorenbericht 2018 (*Sustainable development in Germany. Indicator report 2018* – our title translation, in German only).

²⁰ Examples include the TEEB (The Economics of Ecosystems and Biodiversity) initiative, which was created on the fringes of the G8 Summit in Potsdam in 2007. It is an international research initiative that has generated a series of studies with the aim of recommending and implementing approaches for the economic valuation of biological diversity and ecosystem services.

²¹ Cf. Costanza et al. (2014): Changes in the global value of ecosystem services. *Global Environmental Change* 26, p. 152–158. Note: This TEEB-study was financed by Germany, the United Kingdom, the Netherlands, Sweden, Norway and Japan and coordinated by UNEP and the TEEB offices.

²² For example, the canalisation of watercourses permanently impairs the natural flood storage function of alluvial areas. This often creates the need to build flood protection structures.

²³ Cf. Interview with Federal Minister for the Environment Svenja Schulze on heute.de (17 November 2018): Umsteuern bei der Landwirtschaft (*Realigning agriculture* – our title translation, in German only), <https://www.zdf.de/nachrichten/heute/interview-schulze-zu-rueckgang-artenvielfalt-100.html>

²⁴ Cf. Natural Capital Germany – TEEB DE (2018): The Value of Nature for Economy and Society. A Synthesis. Helmholtz Centre for Environmental Research – UFZ, Leipzig.