4.5 Germany

4.5.1. Fact Box

| **Total estimated value of natural resources to the economy** | Not currently available, although a National TEEB underway |
| **Natural Capital Growth: average annual growth rates, 1990–2008 (from the Inclusive Wealth Report [49])** | Natural Capital Growth (%): -0.47  
Natural Capital per Capita (%): -0.70  
IWI per Capita (%): 1.83 |
| **Status of Ecosystem Services** | Stable, but degraded |
| **Vulnerability to Climate Change and Anthropogenic action** | Pollution, land use change and climate change are threats |
| **National Ecosystem Assessment** | National TEEB Assessment is currently underway |
| **Key legislation or planned legislation** | National Strategy for Sustainable Development (2002)  
Comprehensive environmental legislation, e.g. Federal Nature Conservation Act (BNatSchG) |
4.5.2. Abbreviations: Germany

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BfN</td>
<td>Federal Agency for Nature Conservation, Bundesamt für Naturschutz</td>
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<tr>
<td>BMU</td>
<td>Federal Ministry for Environment, Nature Conservation and Nuclear Safety, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit</td>
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<tr>
<td>DUX</td>
<td>German Environment Index</td>
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<tr>
<td>GEB</td>
<td>German Environment Barometer</td>
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<td>UFZ</td>
<td>Helmholtz Centre for Environmental Research</td>
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4.5.3. Background

Europe’s largest economy (and fifth in the world in PPP terms), and second largest population after Russia, Germany is a key member of Europe’s political and economic organisations. It relies on natural resources such as coal, gas, minerals and timber, and is both one of the world’s biggest exporters (e.g. of motor vehicles, chemicals, electronic products) and biggest importers (e.g. machinery, vehicles, chemicals, oil and gas). In addition, with arable land making up around a third of land area, Germany produces agricultural products such as grains, fruit and livestock for export and domestic consumption.

Germany has been a leader in promoting environmental conservation and sustainable development policies. Sustainability is a fundamental principle of German policy, and the government has committed to a variety of initiatives including 100% renewable electricity supply by 2050, ecological tax reform, globally recognised eco-labelling (Blue Angel), leadership in green technologies and financial incentives for reduced and renewable energy consumption.1 Germany has also shown leadership in promoting natural capital accounting, initiating the TEEB studies, together with the EC,2 and funding ecosystem services projects around the globe.

4.5.3.1. Status of national ecosystems and ecosystem services

Around 48,000 animal species have been found in Germany,3 of which over 33,000 are insects, 91 are mammals and 254 are birds (breeding). A recent biodiversity assessment identified a considerable number of species as endangered or critically endangered, including 48.4% of plants, around 38% of mammals and 37% of breeding birds. The most threatened group is that of amphibians and reptiles, with 71.4% of them considered endangered or extremely rare, closely followed by freshwater fish with 68.6% of them endangered. Natura 2000 sites4 make up

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2 HTTP://WWW.TEEBWEB.ORG/ABOUT/.
3 HTTP://WWW.CBD.INTERN/COUNTRIES/PROFILE/DEFAULT.SHTML?COUNTRY=DE#STATUS.
4 HTTP://WWW.BFN.DE/0316_NATURA2000+M52087573AB0.HTML.
13.5% of Germany’s land area and 41% of marine areas (31% of the exclusive economic zone). In addition, 12 National Parks, 57,800 Nature Conservation Areas, 7,300 Landscape Reserves and 14 Biosphere reserves cover over a third of Germany’s land area, overlapping partially with the 24% of the country made up of 92 Nature Parks. Forest covers 31.7% of Germany’s land area.

The Inclusive Wealth Report [49] finds that the value of Natural Capital in Germany decreased slightly between 1990 and 2008, by 0.47% (or 0.70% per capita), while the World Bank’s Changing Wealth of Nations [17] calculates an increase of 1% of Germany’s natural capital between 1995 and 2005, as a percentage of change in total wealth. An overview of the state of natural capital [129] notes the following trends for ecosystem services in Germany:

- **Air quality**: significant overall decline in air pollution from 1990–2005, although issues of particulate matter and ammonia emissions continue.
- **Water quality**: continuous improvement in both surface and ground water quality since 1982, with reductions in ground water nitrate load. Focus is now on reducing nitrate and organic halogen compounds, probably originating from agriculture. No serious problems with water shortages.
- **Soil and land use**: there has been continuous loss of arable land due to settlements, industry and infrastructure. Soil erosion is also an issue, but is not considered severe.
- **Biodiversity**: Germany saw reasonable losses in biodiversity, particularly from 1950 to 1980, mainly due to agricultural intensification. Currently, 40% of vertebrate species, 25% of ferns and flowering plant species and 75% of ecosystem types are considered endangered. However, the trend seems to have stabilised over the last 15 years, possibly due to agricultural reforms and EU directives.

### 4.5.3.2. Ecosystems vulnerability to climate change and anthropogenic action

The main threats to ecosystems are identified as soil and water degradation (through pollution and eutrophication), air pollution, agricultural intensification, land use conversion and encroachments on the water balance.

Climate change is a threat to ecosystem services, and is predicted to cost Germany up to €800 billion by 2050 if global action is not taken, mainly through crop losses, flood damages, etc. [130], reported in [129].
4.5.4. Assessing natural capital

4.5.4.1. Institutions and institutional capacity for environmental accounting

- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)\(^5\) is responsible for environmental policy, including international environmental policy debate.

- Federal Agency for Nature Conservation (BfN)\(^6\) is the central scientific authority of the German federal government for both national and international nature conservation, reporting to the BMU.

- Federal Statistics Office, DeStatis\(^7\) provides and disseminates statistical information,

- Environmental-economic accounting unit of the Federal Statistics Office deals with the interrelations between the economy and the environment, describing three components: environmental burdens, state of the environment and environmental investments. It describes and analyses trends of various environmental indicators in the sustainability strategy and shows interrelations with economic and social aspects in the biennial Indicator Report.

4.5.4.2. Ecosystem and ecosystem services assessments

A national ecosystem services assessment for Germany has not yet been started. With the financial support of the German Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Agency for Nature Conservation, a national TEEB study was launched in October 2012 (Naturkapital Deutschland – TEEB DE 2012 [131]).\(^8\) “Natural Capital Germany – TEEB-DE” will produce four reports focusing on: (1) biodiversity and climate; (2) green infrastructure in semi-natural and rural areas; (3) green infrastructure in urban areas; and (4) mainstreaming the economics of nature in Germany: instruments and policies (Synthesis Report), to be published between 2012 and 2015 [132]. It is planned to set up physical accounting and mapping of selected ecosystem services in Germany.

Other ecosystem assessments and valuation studies in Germany include a 2009 overview of the state of natural capital [129].

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\(^5\) Often referred to simply as the Federal Environment Ministry, https://www.bmu.de/.

\(^6\) Http://www.bfn.de/.

\(^7\) Http://www.destatis.de/.

\(^8\) Http://www.naturkapital-teeb.de/.
4.5.4.3. Natural capital/environmental services accounts

The German Federal Statistical Office was engaged in developing a system of EEA even in the early 1990s [133] as reported in [110]. These included five subject areas:

- material, energy and emission flows
- a GIS system on the use of land and space
- a state of environmental indicators
- environmental protection activities accounts
- accounts of the imputed costs of achieving standards for the sustainable use of the environment

The Federal Statistical Office has continued to develop these and other environmental-economic accounts which are regularly updated and used to inform potential policy [134]. Much of the current German EEA accounts are based on the UN SEEA, and include [135]:

- Physical Flow Accounts:
  - Economy-wide material flow accounts
  - Energy flow accounts by sector
  - Primary material by sector
  - Emission accounts by sector
  - Water accounts by sector
  - Physical input and output tables
- Physical Stock Accounts: quantitative and qualitative changes in the stock of natural assets in physical units
  - Housing and transport by sector
  - Intensity of use of agricultural ecosystems
- Environment related flows and stocks (in monetary terms):
  - Environmental protection measures
  - Environmental taxes

In addition, the follow sectors have separate reporting modules:

- Transport
- Agriculture
- Forestry
- Private households

Pilot projects have been carried out to develop accounting for ecosystems and landscapes, but these are not yet included in the EEA. There are also no accounts showing the stocks of mineral resources (a low priority for Germany) [135].
The integrated accounting data from the SNA, and its two satellite accounts, SEA and EEA, are used for various analyses, including descriptive approaches such as the calculation of an eco-efficiency indicator on a national or industry level. The same data are also used in environmental-economic models, simulating proposed measures and investigating the effects on variables such as energy use, CO2 emissions, GDP and tax revenue.

4.5.5. Governance

4.5.5.1. Governance bodies for natural capital

The “Natural Capital Germany – TEEB DE” project is supported by the Federal Agency for Nature Conservation and funded by the Federal Environment Ministry. The work is coordinated by the Helmholtz Centre for Environmental Research (UFZ).

The Secretary of State Committee for Sustainable Development (“Green Cabinet”) is a newly established institution consisting of state secretaries from relevant sectors (e.g. economics, environment, agriculture, social affairs and transport). It is responsible for coordinating and supervising the implementation and further development of the National Sustainable Development Strategy. It meets regularly and is supported by a working committee (heads of under-directorates) from federal ministries.9

4.5.5.2. Mechanisms integrating natural capital values into policy

In Germany, Environmental-Economic Accounting (EEA) data are expressly used as a policy approach for integrating environmental concerns into policy, specifically for Sustainable Development Policy [136].

In addition to EIA and SEA requirements, since May 2009 ministries have had to carry out a sustainability check (an impact assessment from the point of view of sustainability) for each draft law or ordinance. The Parliamentary Advisory Council on Sustainable Development is responsible for reviewing these results.

4.5.5.3. Reporting

Every two years, a National Sustainable Development Strategy progress report is published by the Federal Statistical Office presenting and analysing trends in the sustainability indicators (e.g. the most recent was in 2012 [137]).

Previously, two environmental monitoring tools, the German Environment Barometer (GEB) and the German Environment Index (DUX), were used to report on environmental trends. The GEB was introduced in 1998, and developed further after the introduction of the National Sustainability Strategy. Both were discontinued in 2011, replaced by the German Core Indicator System (KIS).

4.5.6. Legislation
4.5.6.1. Legislative process
In Germany, the Bundestag is the most important organ of the legislative branch. The German Bundesrat is also involved in the legislative process as an organ through which the sixteen Länder of Germany participate in the legislation of the Federation.

The Federal Government introduces most legislation; when it does so, the Bundesrat reviews the bill and then passes it on to the Bundestag. If a bill originates in the Bundesrat, it is submitted to the Bundestag through the executive branch. If the Bundestag introduces a bill, it is sent first to the Bundesrat. The Joint Conference Committee resolves any differences over legislation between the two legislative chambers. Once the compromise bill that emerges from the conference committee has been approved by a majority in both chambers and by the cabinet, it is signed into law by the federal president.

4.5.6.2. Support and implementation of international objectives
Germany is a signatory to the CDB, and as such submitted the Fourth National Report on Biodiversity in 2010 and the National Biodiversity Strategy and Action Plan. Germany is also subject to EU Resolution on Environmental Economic Accounts (see Box 10 [overleaf]).

4.5.6.3. Legislation and strategy
National Strategy for Sustainable Development, 2002
In 2002, the Federal Government adopted the National Strategy for Sustainable Development in Germany, making sustainability a fundamental principle of German policy [13]. It integrates the three dimensions of sustainable development (economic development, social development and environmental protection) in four guidelines (intergeneration equity, quality of life, social cohesion, international responsibility).

In 2011, the EU adopted Regulation No. 691/2011 on European Environmental Economic Accounts [14] requiring the 27 member countries to regularly report on environmental taxes, various resources and emissions to air, land and water. This is to be revised every three years, with the opportunity to expand the scope of the areas covered by national accounts.

In 2011 the European Parliament adopted the EU Biodiversity Strategy to 2020 [15] aimed at halting the loss of biodiversity and ecosystem services by 2020. This is in line with global commitments made in Nagoya in 2010 and CBD targets, and follows commitments made by EU leaders in 2010. It also includes the 2050 vision that “By 2050, European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity’s intrinsic value and for their essential contribution to human well-being and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided”.

The EU Biodiversity Strategy to 2020 includes Action 5: improve knowledge of ecosystems and their services in the EU, calling for member states to “assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020”.

Reporting on the proceedings, Dutch MEP Gerben-Jan Gerbrandy noted “The services that nature provides us with, like clean water, clean air, fertile soil, food, are not only crucial for the well-being of human kind, they also represent an astronomical economic value. According to economists, each year we lose 3% of GDP due to the loss of biodiversity. That costs the EU €450 billion year after year. Compared to these figures, investing €5.8 billion per year in Natura 2000 is a bargain!”

Since then, the EC have produced the technical report Mapping and Assessment of Ecosystems and their Services, an analytical framework for ecosystem assessments under Action 5 of the EU Biodiversity Strategy to 2020 [16].
To measure the effectiveness of Germany’s 2002 National Strategy for Sustainable Development, a set of sustainability indicators on 21 topics with 38 targets was specified. Many of these indicators are embedded into Germany’s expanded accounting system, which includes the SNA, and the EEA and SEA satellite accounts. This includes indicators on public sector financing, capital–outlay ratio, GDP, energy and raw materials productivity, greenhouse gas emissions, land use for housing and transport, transport intensity and share of railways in providing transport, air pollution and labour force participation rate. Particularly relevant to environment policy, the Sustainable Development Strategy includes the following goals:12

- To double raw material productivity between 1994 and 2020.
- To double energy productivity between 1990 and 2020.
- To reduce primary energy consumption by 20% by 2020 compared to 2008, and by 50% by 2050.
- To reduce greenhouse gas emissions by 21 percent (compared to 1990 levels) by 2010/2012. This goal was already achieved in 2008. Climate gas emissions are to be cut by 40 percent by 2020 and by 80 to 95% by 2050 (both compared to 1990 levels).
- To raise the share of renewable energies in final energy consumption to 18% by 2020 and to 60% by 2050.
- To increase the share of electricity from renewable sources in total electricity consumption to at least 35% by 2020 and at least 80% by 2050.
- To limit, by 2020, the use of undeveloped land in Germany to 30 hectares per day. In the period between 1993 and 1996 that figure was 140 hectares per day, in 2012 87 hectares per day.
- To increase biological diversity in Germany to an index value of 100 by 2015.
- To reduce the nitrogen surplus to 80 kg/hectare of agricultural land by 2010, and to achieve further reductions by 2020.
- To increase the share of organically farmed land in total agricultural land to 20% (no target year).

This also includes the aim to improve urban life, by increasing public parks areas, calling on the public sector to serve as a role model. Industry is called on to respect certain ecological standards and eco-balances from German industry shall include national and international effects on biodiversity at all stages of a product’s life cycle.

12 Http://www.bmu.de/en/topics/strategy-legislation/sustainability/sustainability/?cHash=708635c8a9f766bc5d0c165b53867c44.
**National Strategy on Biological Diversity, 2007**

In addition to goals for improving the status of endangered species, increasing the area of natural forests and restoring habitats such as peat bogs, there are also ecosystem function goals, such as increasing storage capacity for CO2 within terrestrial systems by 10%.

**Other relevant legislation**
- Federal Nature Conservation Act (BNatSch) of 2009 (entry into force: 1st March 2010)\(^{13}\)

**4.5.7. Case studies**

**4.5.7.1. The extinction of beavers reduces ecosystem functionality**

The loss of beavers, a keystone species in Germany, led to the loss of ecosystem functionality [17]. The subsequent reintroduction of beavers in the Spessart Mountains in Hesse, and the ecosystem changes caused by their dam building has increased the total river surface by 17%. As a result, the hydraulic load (the measure for denitrification) has reduced by 15%, which extrapolated to the whole study area would mean the retention of an estimated addition 2800kgN/a in the river and of 1900 kgN/year in the floodplains. In addition, the increased economic value for recreation and tourism in the region, as measured by the average willingness to pay (WTP), puts estimates for the benefits of biodiversity conservation in the Spessart mountains to at least €0.55 million per year.

**4.5.7.2. Dam construction and floodplain transformation on the Danube leads to significant reduction in ecosystem services**

Between 1985 and 1995, two dams were constructed on the Danube River, between Regensburg and Straubing. This led to a decline in fish species, which made fishing uneconomic in that stretch of the river. This alteration of the ecosystem also resulted in mass development of noxious insect populations, increasing the discomfort of homeowners near the dam [17].

In other parts of the river, across the whole of the Lower Danube (Danube delta), it has been estimated that the changes to the floodplain, the intensification of agricultural techniques and the loss of ecosystem services led to a loss of US$500 million per year in the 1980s [17]. Following significant restoration programmes, the value of stored ecosystem services were estimated in 2006 as over US$160 million per year:

• Restored river fisheries – around US$16 million per year
• Restored habitat providing improved nitrogen and phosphorous absorption and cycling – around US$112.5 million and US$18.2 million respectively
• Restored wetland habitat and the consequent increases in tourism value – US$16 million per year

For more EU case studies where the loss of biodiversity and ecosystem services has led to economic costs, see Kettunen and ten Brink (2006) [17].