Danube Facts and Figures

Germany

(September 2023)

General Overview

About 56,200 km² of the German territory (in Bavaria and Baden-Wuerttemberg) are part of the Danube River Basin – almost 17% of Germany and 7% of the International Danube River Basin. 10 million inhabitants live in this area.

Germany has been a Signatory State to the Danube River Protection Convention since 1994 and a Contracting Party since 1998.

Topography

The source of the Danube is located in the Black Forest in Baden-Wuerttemberg at the confluence of the rivers Brigach and Breg in Donaueschingen. From the Black Forest Mountains to the Austrian border, the river covers 635 km. Near Immendingen, in its upper course, the Danube loses about half its discharge to the Rhine Basin through underground passages.

The German Danube catchment area covers the Swabian and Franconian Alb, parts of the Oberpfaelzer and the Bavarian and Bohemian Forests in the north and the Swabian-Bavarian-Austrian alpine foothills as well as the German part of the Alps in the south. The south-western borderline is formed by the Alpine Rhine and Lake Constance.

The larger tributaries in the German Danube catchment area are the rivers Altmuehl, Naab*, Regen, Iller, Lech*, Isar*, Inn*, and Salzach* (*catchment area > 4000 km² and thus addressed in the International Danube River Basin Management Plan). In addition, large moor landscapes - the Donauried and Donaumoos - are located along the Danube.

In the Alpine foothills many lakes were formed by glacial processes. The most important are: Chiemsee (80 km²), Starnberger See (56 km²), Ammersee (47 km²), Walchensee (16 km²), Waginger See (9 km²), Tegernsee (9 km²), Großer Alpsee (9 km²), Staffelsee (8 km²), Simssee (7 km²), Kochelsee (6 km²) and Koenigssee (5 km²). In addition, there are several large reservoirs, e.g. Forggensee (16 km²), Sylvensteinspeicher (6 km²) and Altmuehlsee (5 km²).

Precipitation, climate, and discharge

In the German part of the Danube basin, average precipitation is 991 mm per year (reference period: 1971-2000). The hydrological winter half-year is drier (408 mm) than the hydrological summer half-year (583 mm). Large parts of Central Franconia and the Upper Palatinate have mean precipitation totals of less than 750 mm per year, whereas in the (sub-)Alpine regions of Upper Bavaria and Swabia, eastern Lower Bavaria as well as the southern Black Forest, precipitation is significantly higher (1500 to 2000 mm per year).

The average annual temperature (1971-2000) for the German Danube basin is 7.8 °C. Since 1931 (until 2015), temperature has risen regionally by an average of 1.3 to 1.5 °C.

Hydrographic key figures from the German part of the Danube

(Data from Deutsches Gewässerkundliches Jahrbuch 2006)

River	Gauge site	Mean low discharge [m3/s]	Mean discharge [m3/s]	Mean high discharge [m3/s]
Danube	near origin (Kirchen-Hausen)	2.4	12.8	136
Danube	„border" Baden-Wuerttemberg – Bavaria (Neu-Ulm)	46.2	125	585
Danube	near confluence with Main-Donau-Kanal (Kelheim)	145	332	1180
Danube	near border Germany – Austria (Achleiten)	610	1430	4140
Naab	near mouth of Naab to Danube (Heitzenhofen)	18.0	49.9	311
Lech	near mouth of Lech to Danube (Augsburg uh. Wertach)	49.5	115	608
Isar	near mouth of Isar to Danube (Plattling)	95.2	175	557
Inn	near mouth of Inn to Danube (Passau-Ingling)	276	740	2960
Salzach	near mouth of Salzach to Inn (Burghausen)	77.9	252	1390

Land use and settlements

Over 10 million inhabitants are living in the German Danube Basin. Agglomerations with more than 100,000 inhabitants are: Ulm, Ingolstadt, Augsburg, Regensburg (Ratisbon) and Muenchen (Munich). Important settlements and industry centres are located around these cities. About 48% of the German Danube catchment area are used for agricultural activities, mainly in the Danube valley and in the northern (Ries, Keuper-Lias-Land) and south-eastern (Hallertau, Gaeuboden) part of the Danube basin. 34% of the area are forests and semi-natural areas.

Human impact

Flood risk management

Baden-Wuerttemberg and Bavaria have a long history of dealing with floods. The first guidelines for the organisation of flood forecasts were set in 1883.

Flood forecasts were and are constantly improved thanks to state-of-the-art technology and data from the German Meteorological Service. Today, the Danube water level can be predicted for a period of up to 96 hours by the Environment Agencies of Baden-Wuerttemberg and Bavaria. In addition, technical flood protection measures were implemented and are constantly improved.

In 2010, the contracting parties to the Danube River Protection Convention (DRPC) agreed to implement the EU Floods Directive and develop one International Danube Flood Risk Management Plan (FRMP) – coordinated by the International Commission for the Protection of the Danube River (ICPDR) and synergized with the EU Water Framework Directive and Danube River Basin Management Plan. On the German national level, the plans and programs according to the Floods Directive are drawn up in the "Flussgebietsgemeinschaft Donau" (for documents, see FGG Donau website https://www.fgg-donau.bayern.de/).

Navigation

Downstream of Kelheim, the Danube is an international waterway. The river is also linked with the Rhine River Basin by way of the Main-Donau-Canal, connecting the Main River at Bamberg with the Danube at Kelheim. Construction of the canal started in 1960 and was completed in 1992. The canal is 55 m wide and 4 m deep.

Hydroelectric power

In Germany, gross electricity generation from hydropower corresponds to a share of about 3% of the total electricity generated in Germany (destatis, 2019) or about 11 % of elec-

tricity production from renewable energies (BMWi, 2019). Electricity generation from hydropower thus ranks fourth among renewable energy sources. In total, there were over 7,000 hydropower plants in Germany in 2016 (Bundesnetzagentur, 2019), of which only around 400 plants have an installed capacity of more than 1 MW (UBA, 2019). Due to the topographical conditions, there are significantly more hydropower plants in the Southern federal states of Germany. The majority of the hydropower stations in the German Danube basin are situated in the alpine tributaries of the Danube: Iller, Lech, and Isar. Measures have been taken to restore river continuity.

Rivers as receiving waters for effluents and drainage

Rivers have always been used as receiving waters for municipal and industrial wastewater. They also absorb diffuse pollution from surface runoff or drainage. Over the past decades, large investments have been made in wastewater collection and treatment. Today , further efforts are taken to reduce the input of micro-pollutants and microplastics.

Drinking water supply

Most of the drinking water in the German Danube basin is extracted from groundwater (70%) and from natural springs (17%); extractions from enriched groundwater (< 1%), lakes and reservoirs (approx. 1%), bank filtrate (approx. 7%) and river water (approx. 5%) play only a minor role. In 2016, a total of about 810 million m³ of raw water was extracted for public water supply. More than half of the abstracted water requires no purifying treatment. The rest is processed largely for technical reasons: substances such as iron, manganese or carbonic acid, which might cause corrosion or deposits in the pipes, are removed. Only a small amount of the water has to be disinfected for healthcare purposes.

Transfer of surplus water from the Danube basin to the Main/Rhine-basin

Water availability in Bavaria is marked by heavy regional differences. While the Southern part receives plenty of rain and snowfall, the Northern part of Bavaria at times suffers from a lack of water. For this reason, an inter-regional water transfer system was set up between Southern and Northern Bavaria, i.e., between the Danube and the Main. The Main-Donau-Kanal and new reservoirs are used to transport water from the Danube area to the Main-Rhine area across the main European watershed. Depending on the needs and the discharge of the Danube, up to 20 m³/s or 125 mio m³/year are transferred.

Significant water management issues in the German part of the Danube basin

The following important water management issues have been identified for the German part of the Danube:

Hydro-morphological impacts regarding river morphology, continuity and water balance.

Due to the alteration of watercourses in the past for settlements, industry/commerce, agriculture, hydropower utilization, and navigation, in many cases, hydro-morphological structure and dynamics are impaired compared to the natural status; this concerns water bodies of all sizes. The issue of river continuity is relevant not only with respect to the migration of aquatic organisms, but also in relation to the transport of solids and sediments.

In some cases, there is a lack of sufficient minimum flows caused by water withdrawals (e.g. , for irrigation purposes) and diversion (e.g., for hydropower utilization).

Nutrient and pollutant inputs from point and diffuse sources to surface waters and groundwater and soil inputs to surface waters

For surface waters, the input of phosphorus compounds represents a considerable burden. Diffuse phosphorus inputs occur, for example, through surface runoff or via drainage systems from agricultural land. Point source nutrient inputs come from municipal wastewater treatment plants and from industrial direct discharges.

Groundwater is primarily impacted by nitrate inputs due to nitrate leaching from agricultural land outside the growing season.

Pollutants of supra-regional importance, mainly from diffuse sources, include in particular: Mercury, polycyclic aromatic hydrocarbons (PAHs), brominated flame retardants, polyfluorinated hydrocarbons, pesticide-active substances.

Consideration of the consequences of climate change

The consequences of climate change and the necessary adaptation to them are important issues of environmental policy and the content of adaptation strategies. Long- and medium-term changes in temperature and precipitation clearly influence the flow regime in rivers, the occurrence of extreme events (floods, drought), but also the landscape water balance and groundwater recharge. As a result, climate change also affects the ecological and chemical status of surface waters and the quantitative and chemical status of groundwater. Climate change impacts may vary regionally within the river basin, but adaptations to climate change require joint strategic action.

Status of water bodies and fields of action

In the German Danube catchment, in 2021, 0.3% of the river water bodies achieved very good ecological status, 22% good ecological status or good ecological potential, 40% were classified as moderate, 27% unsatisfactory, and 11% poor. The quality components of fish fauna, macrozoobenthos - sub-module general degradation - as well as macrophytes and phytobenthos are particularly decisive for the failure to achieve the target.

Of the 45 lake water bodies to be assessed in the German Danube basin according to the WFD requirements, 7% achieve very good ecological status, 53% good status or good ecological potential, 22% of the lake water bodies have moderate status and 18% unsatisfactory status. The quality elements macrophytes / phytobenthos and phytoplankton are mostly decisive for the classifications of the lakes.

The chemical status of surface waters is assessed on the basis of compliance with the environmental quality standards (EQS) for certain substances. As the so-called "one-out-all-out" principle is applied, the overall chemical status is already classified as "not good" if the EQS of only one substance is exceeded. Due to low EQS for critical substances with ubiquitous distribution (such as mercury and brominated diphenyl ethers), the good chemical status of all surface waters is classified as "no good" and will only be achieved in the long term. A more differentiated picture gives an assessment of the chemical status without taking the above-mentioned substances into account; the national management plan contains statements and presentations on this.

With regard to the quantitative status of groundwater, all but one groundwater body in the German Danube basin is in good status.
In terms of chemical status, 53 groundwater bodies (28%) still fail to achieve good status, mainly due to pollution by nitrates and pesticide active substances.

In accordance with the "DPSIR approach", the relevant fields of action were identified:

- Establishment of river continuity in 70% of the surface water bodies in the German Danube catchment
- Improvement of the water body structure (morphology) in 74% of the surface water bodies
- Improvement of the water balance in 48% of the surface water bodies
- Reduction of nutrient and pollutant inputs from point and diffuse sources into surface waters in 35% and 46% of surface water bodies in the German Danube basin, respectively
- Reduction of inputs of the ubiquitous pollutants mercury and brominated diphenyl ethers in all surface water bodies

- Reduction of nutrient and pollutant inputs from point and diffuse sources into groundwater in 40% of groundwater bodies
- Reduction of quantitative pollution in 4% of groundwater bodies in the German Danube catchment area

Status of the implementation of measures and programmes of measures

In addition to the basic measures, i.e. the implementation of binding, mostly legal requirements, which are carried out independent of the respective status of a water body, supplementary measures are implemented to reduce a specific water body pollution in a cause-related manner: In the first and second WFD management periods, numerous measures to establish river continuity and improve watercourse morphology have already been completed or started. Also in the field of wastewater treatment, necessary additional measures were started, especially in the field of municipal wastewater treatment plants. Due to more in-depth and new findings in the context of the 2021 update of the plans and programs, a higher need for measures than before was identified, especially in the fields of action: wastewater treatment and hydro-morphology.

Web-links

Federal Environment Ministry (https://www.bmuv.de)
Baden-Wuerttemberg (https://um.baden-wuerttemberg.de/de/umwelt-natur/wasser)
Bavaria (https://www.stmuv.bayern.de/themen/wasserwirtschaft/index.htm)
Flussgebietsgemeinschaft Donau (https://www.fgg-donau.bayern.de/index.htm)