Danube Facts and Figures

Germany

(September 2018)

General Overview

About 56,200 km² of the German territory (in Bavaria and Baden-Wuerttemberg) are part of the Danube River Basin – almost 16 % of Germany and 7 % of the international Danube River Basin. 9.7 million inhabitants live in this area, about 11,7% of the population in the entire Danube Basin.

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-Württemberg at the confluence of the Brigach and Breg Rivers in Donaueschingen. From the Black Forest Mountains to the Austrian border, the river covers 584 km. Near Immendingen, in its upper course, the Danube loses about half its discharge to the Rhine Basin through underground passages.
The larger tributaries (> 4000 km²) in the German Danube catchment area are the Naab, Isar, Lech, Inn and Salzach Rivers. In addition, rather large moor landscapes - the Donauried and Donaumoos - are located along the Danube.
The German Danube catchment area covers the Swabian and Frankonian Alb, parts of the Oberpfaelzer and the Bavarian and Bohemian Forests in the north and the Swabian-Bavarian-Austrian 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.
In the Alpine foothills many lakes were formed by glacial processes. The most important are: Chiemsee (80 km²), Starnberger See (56 km²), Ammersee (46 km²), Walchensee (16 km²), Waginger See (7 km²), Tegernsee (9 km²), Großer Alpsee (9 km²), Staffelsee (8 km²), Simssee (7 km²), Kochelsee (6 km²) and Königssee (5 km²). In addition there are several large reservoirs as Forggensee (15 km²), Sylvensteinspeicher (4 km²) and Altmühlsee (5 km²) in the Bavarian part of the Danube region.

Precipitation, climate and discharge

The German Danube region is influenced by the Atlantic Climate with an average precipitation of about 1020 mm per year in the period 1981-2010, increasing from north to south. The average monthly temperature is at its minimum in January (Danube Valley –1.0°C, Bavarian Forest –1.4°C, Alps –2.9°C) and reaches its maximum temperature in July (Danube Valley 18.0°C, Bavarian Forest 17.4°C, Alps 14.3°C).

Hydrographic key figures of the German Danube

Rivers	Gauge Site	Series	Mean Low Discharge [m3/ s]	Mean Discharge [m3/ s]	Mean High Discharge [m3/ s]
Donau	Berg	1930-2006	13.1	39.2	205.0
Donau	Neu-Ulm, Bad Held	1954-2012	45.1	124.0	579.0
Donau	Achleiten	1901-2012	620.0	1420.0	4140.0
Iller	Wiblingen	1971-2012	7.92	53.9	425.0
Lech	Augsburg u. d. Wertachmündung	1960-2012	48.9	113.0	589.0
Isar	Plattling	1926-2012	94.9	174.0	557.0
Naab	Heitzenhofen	1954-2012	18.0	50.1	309.0
Regen	Marienthal	1901-2013	11.7	37.7	304.0
Altmühl	Beilngries	1985-2012	6.33	17.0	86.2
Inn	Passau-Ingling	1921-2013	287.0	741.0	3000.0

Land use and settlements

Of the 9.7 million inhabitants living in the German Danube Basin, 23 % live in urban agglomerations with more than 100,000 inhabitants: Ulm, Ingolstadt, Augsburg, Regensburg (Ratisbon) and Munich. The most important settlements and industry centres are located around these cities, such as the automobile, machine and electric industries as well as the petrochemical and chemical industries. 51.5 % of the German Danube catchment is are used for agricultural activities, mainly in the Danube valley (Donaumoos), in the northern (Ries, Keuper-Lias-Land) and south-eastern (Hallertau, Gaeuboden) part of the Danube basin. In addition, the processing of agricultural products is also very important.

Human uses of water and water bodies

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 of 2015. The Danube FRMP that was published in 2015 presents an overview of measures that countries will take (with national examples) relative to the different objectives. Detailed descriptions of all planned measures are presented in the national flood risk management plans. Bavaria and Baden-Wuerttemberg set up and published in 2015 two separate plans for the German part of Danube River Basin (DRB) in the first cycle of flood risk management. In the second cycle, only one flood risk management plan will be prepared and published for the DRB part in Germany until the end of the year 2021.

Use of hydroelectric power
Hydropower currently covers 15 % of the total energy consumption in Bavaria. About 13 billion kilowatt hours are generated annually by 4,200 hydroelectric power stations – 91 % of the hydropower is produced in 235 "large plants" of over 1,000 kilowatt capacity. The majority of the hydropower stations are situated in the alpine tributaries of the Danube: the Iller, Lech and Isar Rivers. Measures have been taken to restore river continuity for fish and other aquatic organisms (fish-ladders, by-passes). Further expansion of hydropower requires solutions that take into account the interest of environmental protection and of energy management.

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-Danube 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.

Rivers as receiving waters for effluents and drainage
Rivers always have been used as receiving waters for both urban and industrial waste water. They also collect diffuse pollution from surface run-off or drainage. Over the past decades, large investments into wastewater collection and treatment were made. (see below → pressures, sewerage and organic pollution)

Use of groundwater bodies: drinking water supply
93 % of the drinking water originate from groundwater. More than 10,000 wells and springs currently supply about 0.9 billion m^3 of groundwater with drinking water quality per year. Almost two-thirds 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 health care purposes.

Use of surface water bodies: drinking water supply

Groundwater is not available everywhere in the quantity water suppliers need. In parts of Upper Franconia and the Bavarian Forest, e.g., water supply has been secured by the construction of drinking water reservoirs. Some regions also rely on bank filtrate.

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

Water supply 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-Danube Canal 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 m^3/s or 125 Mio m^3/year are transferred.

Pressures on surface and groundwater bodies

Sewerage and organic pollution

In the year 2017, about 97 % of the Bavarian population were connected to public wastewater treatment facilities. The wastewater of the remaining 3 % is treated in around 190,000 small wastewater plants. For lakes, ring-sewer systems led to a complete end of wastewater input. Since 1975, water pollution control also includes measures specifically relating to the treatment of combined sewer overflow and of separate rainwater collection systems. So far, storm water storage tanks with a total capacity of 1.95 million m^3 have been built.
Water quality improved substantially, due to reduction of oxygen-consumption by organic substances and nutrients (mainly phosphate and nitrogen).

Hydromorphological alterations

Nearly three quarters of the rivers have been altered within the last 200 years due to development of industry and agglomerations. Rivers were regulated, river banks reconstructed, rivers dammed, etc. Water abstractions from surface waters were / are essential in industrial processes, for hydropower use and for agriculture and fish farming.
In the RBMP 2016-2021, pressures caused by water abstractions were observed for about 1/4 of the surface water bodies and deficits in river continuity for about 2/3 of the surface water bodies as well as morphological alterations.

Nutrient input

Reduction and retention of nitrogen and phosphorus in waste water treatment plants have reached a high level (obligations due to German legislation). Thus, today a main focus lies on diffuse input from agricultural land use.
In order to assess nutrient emission from different sources and regions, modelling tools are employed. For Bavaria, the nutrient-balancing-model MONERIS (MOdelling Nutrient Emissions in RIver Systems) was used. Calculations for the RBMP 2016-2021 added up

to about 107 kt/a nitrogen and 4,6 kt/a phosphorus input into the Bavarian Danube river system.

Priority substances
Since 2010, driven by the EU-Industrial Emissions Directive, a larger set of emissions ordinances specifies the requirements for industrial wastewater discharges to waters and public sewerage systems. The effective implementation of emission based requirements for industrial effluents is primarily characterised by "measures at source", such as the prevention of pollution or the promotion of water reuse added by reasonable "end of pipe" techniques of wastewater treatment.
Thus, priority substances are discharged in low amount; immission data confirm this.

Impacts on surface and groundwater bodies

Impacts on rivers (WFD River Basin Management Plan 2015)
Ecological Status/Potential:
- good and better: 13 %
- moderate and worse: 87 %

Chemical Status:
- poor: 100 % (due to ubiquitous substances PAH, Hg)

Impacts on lakes (WFD River Basin Management Plan 2015)
Ecological Status/Potential:
- good and better: 65 %
- moderate and worse: 35 %

Chemical Status:
- poor: 100 % (due to ubiquitous substances PAH, Hg)

Impacts on groundwater (WFD River Basin Management Plan 2015)
Quantitative Status:
- good: 100 %

Chemical Status:
- good: 76 %
- poor: 24 %

Measures

For the implementation of targeted measures, the causes of deficits in the water body have to been known in detail. Only then, measures can be optimally designed to remedy these deficits. In WFD-context, the principle of targeted planning in water management practice is referred to as so-called DPSIR approach; it describes and systematizes cause-and-effect relationships.
For harmonized programs of measures, a uniform catalog of measures was established in Germany, which defines a total of 109 measures for implementing the WFD. A distinction is made between measures for the reduction of punctual and diffuse loads as well as deficits due to flow regulation and morphological changes. In addition to the technical measures, the so-called conceptual measures play a decisive role in terms of

acceptance and willingness to implement measures. They include all non-technical measures, such as agricultural consultations or research projects, but also information and training events.
For further and more detailed information about the program of measures see the river basin management plans.

Web- links

https://um.baden-wuerttemberg.de/index.php?id=13678
www.wrrl.bayern.de