Danube Facts and Figures

AUSTRIA

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General Overview

Austria has been a Signatory State to the Danube River Protection Convention (DRPC) since 1994 and a Contracting Party since 1998. Vienna is home to the Secretariat of the International Commission for the Protection of the Danube River (ICPDR).

Over 96% (80,593km²) of Austria's territory is drained by the River Danube, accounting for approximately 10% of the area of the Danube Basin. In Austria 7.6 million inhabitants live within the Danube Basin (i.e. 9.4% of the population of the Danube Basin).

Topography

Austria is a mountainous state with the majority of its relief formed by the Alps: approx. 62% of the land area comprises mountainous terrain; the remainder is hilly, with low-lying plains to the East. Alpine geological formations run in a predominantly west-east direction, with water draining northwards to the Danube and south to the Drava/Drau and Mura/Mur. The gradient of the Austrian section of the Danube is approximately 0.4 ‰, being much steeper than in Lower Bavaria (c. 0.2 ‰) and along the Hungarian Plain (c. 0.06 ‰). The larger tributaries joining the Danube in Austria directly are Inn, Enns and Morava/March.

The majority of agricultural activities, settlements and infrastructure are located between the Alps and the Bohemian mass to the north (Mühlviertel and Waldviertel), and along alpine valley floors. Other agricultural areas include land in the east, both north of the Danube (Weinviertel) and to the east and southeast of the Alps. Lake areas exist north of the Alps (e.g. in Salzburg and Upper Austria) as well as south of the Alps (e.g. in Carinthia).

Precipitation, climate and water flow

Average precipitation can be quite high in Alpine areas (up to 3,500mm/annum), whereas <500mm/annum is recorded in the dry northeast. Average precipitation within the Austrian part of the Danube Basin is 1,090mm/annum, with an evapotranspiration rate of c. 500 mm/annum and an outflow via the Danube and

southern/eastern tributaries of 575mm/annum (with groundwater flow accounting for the remainder).

Consequently, Austria contributes roughly with one drop out of four to the total yearly discharge of the Danube (c. 200 km^3/annum) to the Black Sea; in this aspect, conditions in Austria differ markedly from those in other Danube Basin states. Characteristic flows of River Danube on leaving Austria are: average low flow: 940 m^3/s; average flow: 2000 m^3/s; average high flow 6,600 m^3/s (for the time series 2000 – 2016. The climate in Austria is continental, with minimum temperatures in January and maximal values in July.

Land use and settlements

Land use is strongly determined by topographic conditions. More than 40% of Austria's Danube Basin is used for agriculture, settlements and infrastructure. The rest is predominantly mountainous and generally not well suited to such land uses. The major Danube cities are Linz, the country's industrial core in Upper Austria (c. 300,000 inhabitants in the greater metropolitan area) and Vienna, the capital and main administrative centre, situated east of the Alps (c. 2 million inhabitants in the greater metropolitan area). Graz, on the banks of the River Mura/Mur, is also of note (c. 300,000 inhabitants in the greater metropolitan area).

Selected natural highlights on rivers and lakes

The *Wachau Valley*, a stretch of Danube between Melk and Krems, is an outstanding example of a fluvial and cultural landscape bordered by mountains. Much of its evolution since prehistoric times is preserved in the landscape, architecture, urban design and agricultural use (principally vine cultivation). As a result, UNESCO honoured the Wachau with World Heritage Site status in 2000.

The *Donau-Auen National Park* is a green ribbon linking Vienna and Bratislava, providing protection to a large floodplain area of the Danube. It is still ecologically intact to a high degree displaying characteristics of a large Alpine stream. The National Park covers an area of 9,300 hectares and represents a complex ecosystem with an enormous diversity of habitats, plants and animals.

The *Thayatal National Park* is an impressive protected area on the River Thaya/Dyje on the Austrian - Czech border. Its characteristic meandering breakthrough valley landscape is home to diverse habitats (meadows, forests, dry grassland and rocky areas) plus numerous rare animals and plants.

Neusiedler See (*Fertő-tó* in Hungarian), a large shallow lake in the border region between Austria and Hungary, is the only steppe lake in Central Europe. It extends over 315km^2, with more than half dominated by reeds. Situated at 115.75 m above sea level (on average), its deepest point is 1.8m and it is characterised by a high salt concentration (more than 2,000mg/l). Rainfall and aridity cause significant

variations in the lake's water level. In the past, the lake has completely disappeared several times, most recently in the second half of the 19th century. The cross-border *Neusiedler See - Seewinkel - Fertő-tó National Park* is a UNESCO World Heritage Site.

Ministers of 5 countries Austria, Croatia, Hungary, Serbia and Slovenia, have agreed in March 2020 to set up a UNESCO *„5-country Biosphere Reserve Mura-Drava-Danube*" with 1,000.000 ha floodplains and 13 protected areas, 3 rivers with 700 km. Joint vision of „Amazon of Europe": conservation, restoration, wise use and harmonised management, as a best practice example of international cooperation in river basin management.

Human uses of water and water bodies

Flood risk management, torrent control and landslides

Austrians have a long history in dealing with floods and landslides owing to the high land use pressure especially in river valleys. Limited availability of inhabitable land and general conditions in mountainous areas demand a comprehensive consideration of different interests. The requirement for agriculture, settlements and infrastructure (such as in the Inn, Salzach, Enns, Drau, Mur and Danube valleys, as well as in many smaller valleys) has led to an accumulation of values on the course of these rivers. The partly steep river gradients result in limited inundation areas to store large quantities of water (even under natural conditions) causing particular problems in case of flooding. Landslides and and flash floods from torrents (Wildbäche) can even worsen the situation, having significant impacts on human settlements and their potential development. These boundary conditions stress the need for and integrated flood risk management approach which is based on the European Floods Directive. Flood risk management plans are, therefore, in force and are updated according to the EU Floods Directive. On the level of the whole Danube catchment an international Danube flood risk management plan had been elaborated with significant contributions of non EU member state countries.

Use of hydroelectric power

Austria lacks significant fossil fuel supplies (coal, gas and oil) and deriving energy from running water is an important power source for the country. Investment in hydroelectric power grew significantly after the Second World War and large power stations are now located in the Alps (with reservoirs for peak power) as well as along main rivers (for the production of a regular band of electricity). Hydropower infrastructure often superimposed preceding measures carried out to mitigate floods.

Navigation

Navigable waters comprise: (i) River Danube (350 km of international waterway between Wolfsthal in the east and below Passau in the west), Enns and (ii) River Morava / March till km 16.

Rivers as receiving waters for effluents

Rivers have been used as receiving waters for both urban and industrial waste water effluents for hundreds of years. They also transport diffuse pollution loads (see below).

Use of groundwater bodies: drinking water supply

Austria is rich in groundwater bodies, both alluvial and karstic. Their use is critical for the supply of the country's potable water, with nearly 100% of Austria's domestic supply stemming from ground water resources. Half of this is obtained from springs – predominantly in karstic areas – and half from alluvial groundwater bodies, which mainly coincide with valley floors. Key measures to safeguard the quality of these resources include the strict application of protection zones. This is not only valid for areas with existing supplies; the protection of expansion zones for future supply is equally important. Water treatment for potable supply is almost completely unnecessary in Austria.

Pressures on surface and groundwater bodies

Sewerage and organic pollution

By 2016, 95,2 % of people in Austria at whole lived in houses with urban sewerage linked to wastewater treatment plants. Approx. 1,500 plants serve communities with at least 50 population equivalents (p.e.). 19 large plants with each more then 150,000 p.e. cover 47% of the total treatment capacity. More than 200 plants between 15,000 and 150,000 p.e. provide additional 41% of the total treatment capacity. Most of them are located in the Danube catchment area. The remaining 4,8 % of the population are not connected to urban sewerage systems. The existing individual systems use i.a. individual biological treatment plants or constructed wetlands.

Even before Austria joined the EU in 1995 the requirements for wastewater treatment anticipated the approach of the Urban Waste Water Directive (a strong emphasis on emission controls based on best practise techniques); a combined approach as set out in Article 10 of the Water Framework Directive (WFD) is also observed. Limit values for urban wastewater effluents are set down in the urban wastewater emission ordinance. All industrial plants operate on instream processes and contain external treatment plants, where the approved approaches are also set down in emission ordinances.

Future development will include maintenance and optimization of existing facilities, wastewater management in rural areas as well as addressing aspect of new challenges just like micro-pollutants.

Nutrient discharge

i) P*oint source discharges:* nitrification is required for all treatment plants serving more than 50 p.e; with phosphate removal necessary for plants with more than 500 p.e. and nitrate removal obligatory for greater than 5,000 p.e. Such treatment levels go beyond the requirements of the Urban Waste Water Directive, but the cost-benefit ratio is considered to be good. Effluents can even be discharged to small receiving rivers – without major quality problems in most cases – as the oxygen demand and danger of ammonia toxicity are significantly reduced. Efficient conventional biological treatment also effectively reduces pathogens (by 3 orders of magnitude) as well as other potentially dangerous substances. The estimates from 2019 for point source emissions into the river network towards the Black Sea within Austria are 10.4 kt/a for reactive nitrogen, and 0.9 kt/a for phosphorus.

ii) D*iffuse discharges:* Past data for *reactive nitrogen* show elevated, although declining, concentrations in some groundwater bodies. Such concentrations are increased where agricultural activities take place above groundwater bodies with a limited recharge rate and are caused by limited dilution; such water bodies exist predominantly in the northeast and east, with some other areas also affected. These areas contribute to the relative total flux of reactive nitrogen from Austria to the Black Sea. However, fluxes from Alpine areas with agricultural activity as well as areas with fluxes originating mainly from atmospheric deposition (originally reduced nitrogen from ammonia evaporation as well as nitrous oxides), both with lower concentrations in groundwater and high exfiltration rates to surface waters– are even more important in terms of their relative share. Due to the large run-off from Austria background fluxes are also elevated in relative terms when compared with other states. The estimate from 2019 of the diffuse emissions of reactive nitrogen into the river network towards the Black Sea within Austria is 65 kt/a, out of which 59 kt/a are allocated to agricultural activities.

With regard to *phosphorus* the estimate from 2019 of the diffuse emissions into the river network towards the Black Sea within Austria is 5.9 kt/a, out of which 1.5 kt/a are allocated to agricultural activities. The relative size of the background flux is elevated too – in comparison to other states – due to the mountainous character of Austria.

Priority substances

A larger set of emission 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 internal ("front of pipe") measures, such as prevention of raw material losses or water reuse added by reasonable "end of pipe" techniques of wastewater treatment.

Impacts on surface and groundwater bodies

i) Surface water bodies: Austria has a network of rivers (catchment areas >10 km²) which is approximately 32,500 km long. As far as the ecological status is concerned 37 % are assessed as being "high" and "good", 32 % percent as "moderate", 13 % percent as "poor" and 4 % as "bad". 2 % of the water bodies show a "good and better" potential and 10 % a "moderate or worse potential"; these bodies of water have been identified as artificial or heavily modified.

The main reasons for rivers to fail good ecological status are hydromorphological alterations, such as insufficient flow, channelization, impoundments and continuity interruptions. About 22% of the rivers are affected by impacts from nutrients, organic pollution or hazardous substances.

There are more than 25,000 stagnant water bodies with a size exceeding 250 m² in Austria. 62 of them are larger than 50 ha. As far as the ecological status is concerned 16 % of the large lakes are assessed as being "high", 32 % percent as "good", 10 % percent as "moderate" and 2 % as "poor". Seven Austrian lakes (Lake Mondsee, Lake Ossiach, Lake Lange Lacke, Lake St. Andäer Zicksee, Lake Illmitzer Zicklacke, Lake Walchsee and Lake Traunsee) fail "good status" ~~has been missed~~ due to eutrophication, hydromorphological alterations or fisheries management. 25 lakes have been designated as artificial or heavily modified waterbodies all of them lakes correspond to the good ecological potential.

ii) Groundwater bodies: 3.3% of the territory of Austria in the Danube Basin is classified as "at risk" and 0.5% is not in a good chemical status because of nitrate (criterion: more than 50% of monitoring stations of a groundwater body exceed the limit value set by the Austrian Water Act of 45 mg/l nitrate); 96.7% of the area is "not at risk".

Concluding remarks

Having tackled point-source discharges and currently making efforts to address diffuse discharges of nutrients, Austrian authorities are aware of the need to focus on hydro-morphological pressures and their impacts on waterbodies and their ecosystems. Furthermore i.a. micro-pollutants, micro-plastic and sediment transport will have to be adressed. Climate change will be a cross-sectoral challenge for all water related issues. This includes droughts, water scarcity and flood risk management.