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% (80,563km^2) of Austria's territory is drained by the River Danube, accounting for approximately 10% of the area of the Danube Basin. In Austria 7.7 million inhabitants live within the Danube Basin (i.e. 9.5% 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. The gradient of the Austrian section of the Danube is circa 0.4 ‰, being much steeper than in Lower Bavaria (c. 0.2 ‰) and along the Hungarian Plain (c. 0.06 ‰). The only larger tributary to the Danube with a mainly gentle gradient is the Morava/March, entering Austria from the Czech and Slovak Moravian Basin.

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 south-east 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 evapo-transpiration 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: 950 m^3/s; average flow: 1955 m^3/s; average high flow 6,500 m^3/s (for the time series 1951 – 2000). 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 activities. 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 break-through 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.

Human uses of water and water bodies

- <u>Flood and torrent management, landslides</u>

Austrians have a long history of dealing with floods and landslides owing to the need to squeeze development into a small area of inhabitable land and general conditions in mountainous areas. The requirement to use all available valley floor space 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 a marked impact on the course of these rivers. The steep river gradients result in limited inundation zones unable to store large quantities of water (even under "natural conditions") causing particular problems in heavy floods.

Landslides and rapid mass movement of the bed-load in torrents (Wildbäche) make the situation more critical and have a significant impact on human settlements. For these reasons, the Austrian service on the management of torrents and avalanches (Wildbach- und Lawinenverbauung) is active since 1885. The work of this service has led to a decrease in erosion from alpine and hilly areas, reducing the impacts on the larger river network.

- <u>Use of hydroelectric power</u>

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 the preceding measures undertaken against floods.

- <u>Navigation</u>

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

- <u>Rivers as receiving waters for effluents</u>

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).

- <u>Use of groundwater bodies: drinking water supply</u>

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

- <u>Sewerage and organic pollution</u>

By 2002, 86% of Austrians lived in houses with urban sewerage linked to wastewater treatment plants (c. 1,500 plants serving communities with at least 50 population equivalents (p.e.), and where the 22 large plants > 150,000 p.e. cover 47% of the total treatment capacity, and the 187 plants between 15,000 and 150,000 p.e. additional 38% of the total treatment capacity). The requirements for wastewater treatment fixed over time anticipated the approach of the Urban Waste Water Directive (a strong emphasis on emission controls based on best practise techniques) even before Austria joined the EU in 1995; 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 in-stream processes and contain external treatment plants, where the approved approaches are also set down in emission ordinances.

The remaining 14% of the population are not connected to urban sewerage systems (2002 data); the existing individual systems comprise cess pits or other treatment methods such as septic tanks (65% of total), and individual biological treatment plants or constructed wetlands (constituting the remaining 35%).

The outstanding challenge for the coming years covers wastewater management in rural areas, keeping the existing systems in shape, and by the same token improving their effectiveness.

- <u>Nutrient discharge</u>

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 June 2005 for point source emissions into the river network towards the Black Sea within Austria are 13.3 kt/a for reactive nitrogen, and 1.24 kt/a for phosphorus.

ii) D*iffuse discharges:* Here the situation is less favourable. 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, the latest findings show that fluxes – formed by low concentrations from Alpine areas with very limited agricultural activity, stemming mainly from atmospheric deposition (originally reduced nitrogen from ammonia evaporation as well as nitrous oxides) at high run-off – 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 June 2005 of the diffuse emissions of reactive nitrogen into the river network towards the Black Sea within Austria is 83.2 kt/a, out of which 54.8 kt/a are allocated to agricultural activities.
With regard to *phosphorus* the estimate from June 2005 of the diffuse emissions into the river network towards the Black Sea within Austria is 4.72 kt/a, out of which 1.43 kt/a are allocated to agricultural activities. The relative size of the background flux is – in comparison to other states – due to the mountainous character of Austria also elevated.

- 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

- Impacts from organic pollution, nutrients and hazardous substances (based on the *Year 2004 National Analysis* for Water Framework Directive implementation).

i) *Surface water bodies* (greater than 100km², for c. 1,000 bodies with a total length of approx. 12,000km) with regard to the saprobic conditions and general physico-chemical parameters: 14% are classified[1] "at risk", 9% "not yet clear" and 77% as "not at risk".
ii) *Groundwater bodies*: 3.7% of the territory of Austria in the Danube Basin is classified as "at risk", mainly due to high concentrations of nitrate (criterion:

[1] The EU Water Framework Directive defines the term "at risk" as a potential failure to meet "good ecological status" (respectively potential) of a water body by 2015, based on the knowledge available in 2004. The term "not yet clear" arises from lack of available data.

more than 50% of the data recorded exceeds the limit value set by the Austrian Water Act of 45 mg/l nitrate); 96.3% of the area is thus "not at risk".
With regard to *specific pollutants* 4% of surface water bodies are classed as "at risk"; 7% are "not yet clear" and 89% are "not at risk". *(specific pollutants* are defined as *priority substances* listed in the WFD, *substances* listed in List I Dir. 76/464/EEC and *other hazardous substances* according to the WFD).

- Impacts from hydro-morphological alterations (based on the *Year 2004 National Analysis* for Water Framework Directive implementation, including the initial classification of heavily modified water bodies).

For the same set of surface water bodies the initial classification of heavily modified water bodies (HMWB) and artificial water bodies showed the following results: 18% are not classified as HMWB; 43% are classified as HMWB; 38% are classed as "not yet clear" and 1% as artificial water bodies.

For the same set of water bodies the results showed 55% are "at risk" of failing "good ecological status" (due to hydro-morphological pressures); 27% are classed as "not yet clear" and 18% are "not at risk". Linking the future final classification of HMWB and the risk analysis of failing to reach "good status" will in future lower the share of water bodies that are at risk of failing "good ecological status".

Analysis of the factors causing 55% of water bodies to be "at risk" indicates that the flow of residual water (mainly due to hydroelectric power generation) is the contributing factor for 19% of the water bodies (for 5% this is surge respectively flush); damming (with backwater) accounts for 15%; longitudinal interruptions are the main cause for 41%; and structural changes impact for 25%.

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 future efforts on hydro-morphological pressures and their impacts.