Danube Facts and Figures

SERBIA (September 2006)

General Overview
The Republic of Serbia covers an area of 88,361 km\(^2\) and includes two provinces: Vojvodina (21,506 km\(^2\)) and Kosovo and Metohija (10,887 km\(^2\)); the latter being currently under an international protectorate. 92% of the country, 81,374 km\(^2\), lies within the Danube Basin, (10% of the total basin), of which, 30% is forested.

Approximately 90% of available water originates from outside national territory; international cooperation on water issues is thus vital. The FR Yugoslavia / Serbia and Montenegro ratified the Danube River Protection Convention on 30 January 2003, becoming a full member of the ICPDR in August 2003.

Topography
Serbia is predominantly upland and can be divided into two distinct topographical regions. The northern region forms part of the Pannonian Plain, intersected by rivers (the Danube, Sava, Tisza, Tamiš and Begej), canals of the Danube-Tisza-Danube (DTD) system and lakes. To the south of the Danube, the terrain is hilly and mountainous and can be sub-divided five-fold: the Rhodope Mountains (northern, central and southern Serbia); the Carpathians (in the north-east); the Balkan range (extending across the east and south); the Dinarics (in Metohija); and the Skardo-Pind mountains (of Kosovo and Metohija). This central-southern region connects to the southern Balkans via the Morava and Vardar/Axios Basins.

Precipitation, climate and water flow
Serbia’s climate is temperate continental with an average annual temperature of 11-12\(^{\circ}\)C and January and June averages of -1 to +1\(^{\circ}\)C and 22 to 23\(^{\circ}\)C respectively. The major water balance components vary widely with respect to time and space. Annual rainfall is lowest in the north (average <500 mm) and highest in the south-west (over 2,500 mm). During the growing season, rainfall in some regions is only 28% of the annual average. Land and climate conditions are highly conducive to agriculture. Average annual precipitation is c. 65 km\(^3\) and annual run-off c. 16 km\(^3\). With an annual inflow of c. 162.5 km\(^3\), the total annual runoff to the Danube on leaving Serbia is c. 178.5 km\(^3\).

Serbia is rich in Quaternary, Neogene and karstic groundwaters. There are 6 hydro-geological entities in Serbia: Backa and Banat; Srem, Macva and Posavo-Tamnava; and the south-western; western; central; and eastern regions.

Land use and settlements
Topography determines Serbia’s land use, providing an area of c. 60,000 km\(^2\) suitable for agricultural production. Until the late 60s, the economy was
dominated by agriculture. With the industrialization that followed came migration to larger industrial, administrative, educational and cultural centres. Total population is 7,498,001, excluding Kosovo and Metohija Province (2002 census), with the valleys of the Danube, Sava, Morava and Tisza being the most densely populated and developed regions. They also house the major traffic and energy supply corridors and most major cities: Beograd (1.7 million inhabitants), Niš (250,000 inhabitants) and Novi Sad (300,000 inhabitants).

Natural highlights
Four international Ramsar sites have been selected in Serbia: Obedska Bara, Ludaško Lake, Stari Begej/Carska Bara and Slano Kopovo. Of the 35 Important Bird Areas identified, many are part of already protected areas: Gornje Podunavlje (Upper Danube), Suboticka jezera i pustare (lake and wilderness areas near Subotica), Jegricka, Kviljiski Rit, Bosutske šume (Bosut Forests), Zasavica, Obedska Bara, Slano Kopovo, Deliblatska peščara (Deliblato Sands), Mount Tara, Ovcaro-kablarška klisura (Ovcar-Kablar Gorge), Uvac-Mileševka, Mount Kopaonik, Mount Stara Planina-Vidlic, Resavska klisura (Resava Gorge), Dubovac-Ram and Djeđapska klisura (Iron Gate Gorge).

Gornje Podunavlje Special Nature Reserve is the most significant wetland in the upper part of the Serbian Danube, situated adjacent to Kopacki Rit in Croatia. Other significant wetlands are Tikvara and Karadjordjevo.

The Iron Gate (Djerdap) National Park, on the Danube between Golubac and Kladovo, consists of gorges, valleys and river terraces of remarkable biodiversity. Designated in 1974, the area has significant historical and cultural importance, making it one of the most important natural and archaeological areas of Europe.

The Tara National Park, located on the River Drina between Bajina Bašta (Serbia) and Višegrad (Bosnia and Herzegovina), comprises a unique complex of gorges including the remarkable 1000 m high Drina Gorge.

Human uses of water resources
The main uses of Danube waters in Serbia are for domestic and industrial water supply, irrigation, navigation and cooling of thermal power plants.

- Water supply
Municipal water abstraction has increased from c. 100 litres/user/day in the 1950s to 450 l/user/day in the 1990s (according to the Republic of Serbia Water Resources Development Master Plan, 2002). Municipal abstraction totalled c. 750 million m³ in 1991, with 45% for domestic consumption; 30% for industrial supplies and 25% other uses (hospitals, public institutions, restaurants etc.). Total industrial water supply in 1991 was c. 615 million m³ of water, of which, 55% was used in the Central Serbia region, 30% in Vojvodina and 15% in Kosovo.
- **Irrigation**
  Irrigation use is closely linked to agricultural production. <3% of agricultural land is irrigated, requiring 175 million m$^3$ of water in 1991 (levels continue to decline).

- **Flood and high discharge management**
  The Pannonian Plain of the north is dissected by water courses bordered by levees, (e.g. the Danube, Sava, Tisza, Tamiš, Begej and DTD canals). A similar situation exists for the major valleys of central Serbia (e.g. the Morava and Kolubara) where all major cities and significant industrial facilities are located in potential flood areas. Smaller rivers in this region are prone to torrents, with frequent flash floods and landslides; control measures are only partially developed.

- **Use of hydroelectric power**
  Hydropower is a significant power generator in Serbia accounting for 31% of total production in 2004 (11,021 GWh). Major reservoirs (greater than 10 million m$^3$) where the main purpose is energy production are listed below.

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>River</th>
<th>Main Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vlasina</td>
<td>Vlasina</td>
<td>V,E</td>
</tr>
<tr>
<td>Međuvršje</td>
<td>Zap. Morava</td>
<td>E</td>
</tr>
<tr>
<td>Zvornik</td>
<td>Drina</td>
<td>E</td>
</tr>
<tr>
<td>Kokin Brod</td>
<td>Uvac</td>
<td>E</td>
</tr>
<tr>
<td>Bajina Bašta</td>
<td>Drina</td>
<td>E</td>
</tr>
<tr>
<td>Potpec</td>
<td>Lim</td>
<td>E</td>
</tr>
<tr>
<td>Iron Gate I</td>
<td>Dunav</td>
<td>E</td>
</tr>
<tr>
<td>Gazivode</td>
<td>Ibar</td>
<td>E,P,N,V</td>
</tr>
<tr>
<td>Lisina</td>
<td>Božicka reka</td>
<td>E</td>
</tr>
<tr>
<td>Uvac</td>
<td>Uvac</td>
<td>E</td>
</tr>
<tr>
<td>Lazici</td>
<td>Beli Rzav</td>
<td>E</td>
</tr>
<tr>
<td>Iron Gate II</td>
<td>Dunav</td>
<td>E</td>
</tr>
<tr>
<td>Zavoj</td>
<td>Visocica</td>
<td>E</td>
</tr>
</tbody>
</table>

Key plants include Iron Gate I, at Danube km 943. 80 kilometres downstream, Iron Gate II acts as a compensation reservoir. Zvornik and Bajina Bašta plants on the River Drina and Potpec on the River Lim allow daily and weekly water regulation. Storage plants include Vlasina and Limske (Uvac, Kokin Brod and Bistrica). The energy system of Serbia has one specific plant, a pumped storage hydropower unit at Bajina Bašta with an upper storage reservoir at Lazici near Mount Tara.

- **Navigation**
  The basic elements of the 1700 km inland waterway network comprise the Danube, Sava and Tisza rivers, plus the network of canals and canalised rivers of the Danube-Tisza-Danube (DTD) system. All are directly or indirectly connected with the Danube, and thus with the European inland network.

The Serbian Danube can be divided into upper and lower sections. The first, covering the stretch from the Hungarian border (km 1433) to Belgrade (km 1166),...
comprises a near-natural hydrologic-hydraulic regime. The second sector from Belgrade to the Bulgarian border (km 845) is located mainly within the Iron Gate I and II complex, offering excellent navigation. Improvements in the navigability of the Danube channel have been systematic and continuous.

The Serbian stretch of the Tisza is navigable over 164 km, with good conditions throughout (with the exception of short stretches covering <2% of the length).

The Sava is navigable over 207 km, from its mouth to Jamena, and forms part of the Sava international waterway connecting Croatia, Bosnia and Herzegovina and Serbia with the Danube. Channel improvements will be implemented soon.

Navigation is one of the key purposes of the DTD system. Consisting of a 930km network of mostly canalised rivers and canals, navigation is possible along 600km.

- **Use of groundwater bodies**
  Groundwater is the primary source of municipal and industrial water supply, whether from alluviums, Neogene or karstic aquifers.

- **Rivers as receiving waters for effluents**
  Rivers are used as receiving waters for both municipal and industrial waste water effluents (see below).

**Pressures and impacts on rivers**

- **Pollution**
  Changes in the Serbian economy have resulted in a significant reduction in pollution emissions. The economic downturn plus the transformation to private ownership has resulted in a significant variation in the production output of various industries during the period 1998-2002.

  The list of significant point sources covers 46 communities and 14 industries (however many of the major industries are not covered due to lack of reliable data). Industry is a significant source of hydraulic wastewater volume, while the nutrient load from municipal sources is significantly higher – due to the fact that municipal wastewaters are, for the most part, discharged untreated and that current industrial output is low. Additionally, most industrial wastewater quality analyses do not include data on the content of specific pollutants. NB Data on agricultural point sources and diffuse sources are not available.

- **Municipal sources**
  According to available data, municipal sources account for 4.36 million population equivalent (PE), with an annual total of c. 457 million m³ of wastewater. The
organic load amounts to 232 kt/a COD and 91 kt/a BOD, while total nitrogen load is 9.1 ktN/a and total phosphorous load 3.6 ktP/a.

Most small communities (<2000 people) do not have wastewater treatment plants and a number of existing plants are not operational. With a large proportion of Serbia’s population remaining in small settlements (27% live in communities of <2000; 21% in communities of 2-10,000), this has a significant impact for wastewater management.

The most significant municipal pollution sources stem from the major cities of Beograd, Novi Sad and Niš, with emission levels >150,000 PE. These sources discharge untreated wastewater and are sources of significant organic and nutrient pollution. Two municipalities (Subotica and Kragujevac) have wastewater treatment plants (WWTPs) with capacities >100,000 PE. 41 communities with discharges in excess of 10,000 PE are without WWTPs, exerting a significant impact on water quality (according to COD and BOD parameters).

- **Industrial sources**
  It is important to note that industrial plants are currently operating at significantly reduced capacities. Existing data indicate the largest polluters are the food industry (mostly organic emissions) and heavy industries (specific pollutants). 28 industrial pollution sources have been identified, one-third of which belong to the food industry. Total hydraulic volume of industrial wastewaters is 134 million m$^3$/year. Total organic load is 25.2 kt/a COD and 12.8 kt/a BOD with a total nitrogen load of 687 tN/a and total phosphorus load of 23 tP/a.

- **Agricultural sources**
  No reliable data are available. Farms can be categorised as follows:

  **Livestock:** Current numbers of cattle and pigs are very low.
  i) Small dairy / bovine farms: generally family owned with up to 100 dairy cows and their offspring, located within the vicinity of villages with land often away from the main farm facilities. Livestock are usually kept indoors and husbandry standards are high. Farms own and operate slurry tankers and solid waste handling and spreading equipment and occasionally have concrete solid-waste platforms with liquid waste collector tanks. Dumpsite capacities are inadequate.

  ii) Large dairy farms: former state owned, now privatized, with capacity for up to 3,000 dairy cows. Slurry is routed to underground storage tanks and spread by means of tankers. Solid waste is deposited on concrete platforms. The most frequent problem is wastewater drainage; the waste mixed with straw is deposited on large surfaces not provided with drainage systems.

  iii) Large pig farms: former state owned, now privatized, farms with annual output as high as 50,000 heads of fattened swine. Some have their own
slaughterhouses and occasionally their own meat production facilities and retail outlets inherited from the former state-owned system. The wet method is most frequently used for slurry removal. On some large farms, waste is recycled in fields, but in other cases the slurry is so diluted that it does not have a nutritive value. Waste is generally deposited in large lagoons which are usually of poor design and cannot be readily discharged. Serial sedimentation lagoons occur infrequently. Waste is stored for a period of time and, after sedimentation, the liquid phase is generally released into watercourses/drainage canals. However, discharge direct into canals and watercourses without prior storage or sedimentation also occurs.

**Arable**: Crops include wheat, maize, barley, leguminous plants, sugar beet, sunflowers, onions and potatoes. Chemical fertilizers are the preferred method for most farmers and are widely used. Their use dropped from 195 kg/ha in 1991 to 44 kg/ha in 1999 but 2002 saw an increase to c. 60 kg/ha (compared with Western Europe rates of 300-800 kg/ha). The current trend in pesticide-use is downward since 1989 and is also much lower than in EU countries. However, it is expected to increase in the future. The data indicate that copper-based pesticides are the most common. Only 14 of the 25 *EU List of Priority Pesticides* are legal in Serbia and Montenegro. Aldrin and DDT are prohibited. Major problems with regard to the distribution and use of pesticides persist including: inadequate or non-existent distribution control; use of prohibited pesticides; illegal trade; use of outdated products; poor storage methods and inappropriate use.

**Useful web links**

- [www.srbijavode.com/](http://www.srbijavode.com/)
- [www.vodevojvodine.co.yu/](http://www.vodevojvodine.co.yu/)
- [www.jcerni.co.yu/](http://www.jcerni.co.yu/)
- [www.plovput.co.yu/](http://www.plovput.co.yu/)
- [www.natureprotection.org.yu/](http://www.natureprotection.org.yu/)
- [www.ibiss.bg.ac.yu/](http://www.ibiss.bg.ac.yu/)
- [www.eps.co.yu/](http://www.eps.co.yu/)
- [www.npdjerdap.co.yu/](http://www.npdjerdap.co.yu/)
- [www.serbia-tourism.org/](http://www.serbia-tourism.org/)

**Key reports**