



# Danube Facts and Figures

## SLOVENIA

(February 2010)

### General Overview

Slovenia covers a territory of 20,273 km<sup>2</sup> and is home to just over 2 million people. It is a diverse country in terms of its landscape and climate, being located at the meeting point of four major European geographical regions: the Alps, the Dinaric Mountains, the Pannonian Basin and the Mediterranean (Adriatic Sea). 81% (16,423 km<sup>2</sup>) of the country is located within the Danube River Basin, which represents 2% of the entire Danube catchment area. Two major Danube tributaries flow through the country, namely the Sava (along with its tributaries, the Kolpa and the Savinja) and the Drava (and its tributary, the Mura). Slovenia shares a border with Austria, Croatia, Italy and Hungary and contains 47 km of coastline along the Adriatic Sea.

The Convention on Co-operation for the Protection and Sustainable Use of the Danube River was signed by Slovenia in December 1994 and came into force in October 1998.

### Topography

The majority of Slovenian terrain is upland, with around 90% of the surface situated at 200m or more (a.s.l.). Mount Triglav is the highest peak at 2864m. In terms of landscape diversity, Slovenia is exceptional in that four major geographical regions meet and interweave within a relatively small area. It can therefore be divided into four basic landscape types: Alpine, Dinaric, Pannonian and Mediterranean.

93% of the rock structure is sedimentary, with carbonate sedimentary rock prevailing in western, southern and central areas (mainly limestone and dolomite and including spectacular karst developments). Carbonate rocks in parts of south-western and central Slovenia often include flysch and similar clastic sedimentary rocks. Oligocene, Miocene and Pliocene postorogenetic sediments occur in the north-east and east, as well as small areas of the south-east. Igneous (accounting for 3%) and metamorphic rock (4%: gneiss, mica schist, amphiboles, eclogites, marbles and slates) are found in a small part of north-eastern and northern Slovenia, the majority located at Pohorje, Strojna, Kozjak and Kobansko. Quaternary sediments form an extensive group in the central Ljubljana Basin, stretching toward Gorenjska and covering part of the north-east. These sediments have formed a number of smaller basins and plains, predominantly gravel, sand and clay, and are the least resistant to weathering.

Due to geological and climatic diversity and also the roughness of terrain, Slovenia has a varied soil composition. Various types of rendzina and cambisol, as well as ranker and dystric cambisol, prevail. Extensive plains of Ljubljansko Polje, Dravsko-Ptujsko Polje, Dolinsko Polje and Ravensko Polje are covered by dystric cambisol on silicate rock, and eutric cambisol on carbonate gravel and sands.

### **Precipitation, climate and water flow**

Slovenia can be divided threefold in terms of climate: a temperate continental climate in the central and eastern region (typical monthly averages for Ljubljana of  $-0.1$  °C (January;) to  $20.4$  °C (July) with a mean annual precipitation of 1368 mm); an alpine climate to the north-west (averages for Rateče:  $-3.9$  °C (Jan) to  $16.1$  °C (July); mean annual precipitation of 1474 mm); and a sub-Mediterranean climate along the coast and its hinterland (averages for Portorož:  $4.1$  °C (Jan) to  $22.5$  °C (July); mean annual precipitation of 931.2 mm). A strong interaction occurs between the three climatic zones across much of the country.

Major variations in the spatial distribution of annual precipitation are characteristic of Slovenia, with the wettest areas receiving as much as four times the amount of precipitation recorded in the driest areas. The highest levels of precipitation occur where warm humid south-westerly air from the Mediterranean reaches the Alpine-Dinaric mountain barrier. Mean annual precipitation exceeds 1600 mm across the entire Dinaric-Alpine zone, increasing to more than 2600 mm where the barrier is greatest – in the upper Posočje and Mount Snežnik areas. Precipitation rates decrease with distance from the mountains: north-east areas have on average less than 900 mm per annum. Rainfall peaks occur at different times of the year in the different climatic areas. In the west, two characteristic precipitation peaks occur – at the end of spring and autumn. To the north-east, where the continental climate predominates, most occurs in the summer. Winter-summer variations occur in the type and duration of rainfall: long lasting precipitation accompanying the passing of a weather front is characteristic of the cold half of the year; short, more intensive showers and storms (often accompanied by hail, strong winds and torrential floods) are characteristic of the summers.

In terms of recent variations, the data clearly indicates that Slovenia's precipitation regime is changing: the autumn peak is increasingly pronounced (throughout the majority of the country) while the amount of precipitation is decreasing fairly uniformly across the majority of the country in the spring and summer, and in the western part of the country in the winter months. However, changes at the annual level are not obvious.

Mean annual temperatures in the majority of the country are  $8-10^{\circ}\text{C}$ ; increasing to  $10-12^{\circ}\text{C}$  in areas influenced by the continental climate and exceeding  $12^{\circ}\text{C}$  to the west in the Slovenian Istria, a part of Kras, the Vipava Valley and Brda. For the majority of the Alpine and Dinaric mountain region,  $6-8^{\circ}\text{C}$  is typical, and in the

highest parts of the Julian Alps, the annual mean does not exceed 0°C. Between 1971 and 2000, mean annual temperatures throughout the country increased, with 1991-2000 being the warmest decade. The highest rise was recorded in Ljubljana (on average a 1.7°C increase over the last 30 years), with the rest of the country averaging a 1.5°C increase, except where increases are mitigated somewhat by proximity to the sea. Mean summer temperatures showed the greatest increases with no increase being observed in the winter months.

Slovenia is divided into two catchment areas by the Adriatic Sea – Black Sea watershed, with the vast majority (81%; 16,423 km<sup>2</sup>) belonging to the Danube catchment area. The total length of the river network is 26,989 km, with the significant rivers being the Mura, Drava, Sava, Kolpa and Savinja, all located within the Danube River Basin. Slovenia contains 2% of the Danube catchment area, and the Slovenian Sava and Kolpa river basins represent 12% of the Sava catchment area. Slovenian watercourses are short due to the rough terrain and rock composition, with only 46 longer than 25 km (22% of the network). Rivers exceeding 100km include the Sava (221km), Drava, Kolpa and Savinja. In general, Slovenian rivers form a very dense network but it is not uniform. On areas of impermeable and poorly permeable rocks, the network is dense. The Reka, the Sava's tributary near Litija, has a 96 km<sup>2</sup> river basin and a density of 2.8 km/km<sup>2</sup>. Above the mouth of the Črni potok, the Reka River has a density of 3.5 km/km<sup>2</sup>. Sparse river networks occur in the Dinaric region. The high plateaus, for example, have no river network at all. Similar conditions are found in the karstic Alpine area, but areas without river networks are not so extensive. The central part of the gravel flatlands (with deep groundwaters), such as at Kranjsko polje, Sorško polje, Ljubljansko polje and Dravsko polje, also show sparse networks.

## Land use and settlements

According to 2000 data, 56% of Slovenia is forested (the third most forested country in Europe after Finland and Sweden); 29.2% is arable/permanent crops/mixed agriculture; 5.7% pastures; 2.7% built-up areas; 2.2% transitional woodland shrub; 2.1% natural grassland/moor; 1.4% other uses and 0.7% comprises water and wetlands. Put simply, forest and herbaceous vegetation covers just under two thirds of the land cover and agriculture just over one third. The largest areas of dense forest cover the Dinaric-Karst plateaus of southern and south-western Slovenia, and in the Alpine region to the north and north-west. In the north-east, agricultural land prevails. Considering land cover changes since the 1970s, afforestation has been identified as the main change in Slovenia and this process is expected to continue and even accelerate in the future due to the selective abandonment and scrubbing up of agricultural land and the transition to predominantly market-oriented agriculture.

In 2002, there were 5988 settlements in the country. Small settlements prevail with half containing less than 100 inhabitants (but home to only 7% of the population). Only 16 settlements had more than 10,000 inhabitants in 2002, and

Ljubljana, the capital, is the only city with more than 100,000 inhabitants. Small settlements are characteristic of the Dinaric plateaus, Dinaric valleys and Alpine hills; large settlements are characteristic of the Alpine and Pannonian plains. Population distribution is uneven and is governed by the hilly terrain; overall population density is classed as medium, at 99 inhabitants per km<sup>2</sup> (2006 census). Population density is highest on the Alpine and Pannonian plains and surrounding the major cities and is increasing in these areas (more than tripling on the Alpine plains in the 20th century). Almost two thirds of the population live in the basins and valley bottoms, covering approximately one quarter of the country. The largest urban area is located in the Ljubljana Basin, continuing almost without interruption to Kranjsko-Sorško polje. Other areas, such as the Dinaric and Mediterranean plateaus, are experiencing depopulation.

### **Natural highlights**

Slovenia is rich with an exceptionally varied landscape, plant and animal diversity. According to 2008 data, ecologically important areas occupy 52.2% of the country. 39.8% of Slovenia is covered by some form of protected area categorisation i.e. nationally designated nature protected areas, Natura 2000 sites and potential Natura 2000 sites. National designations account for 12% and although encompassing a much smaller surface area than Natura 2000 sites, they are organized to a higher level with elaborated management plans and appointed managers. Many partially overlap with Natura 2000 sites. Natura 2000 sites occupy almost 7203 km<sup>2</sup> or 35.5% of the Slovenian territory. In 2008, areas which fulfil the conditions of Natura 2000 sites under the Birds Directive, covering an extra 340 km<sup>2</sup> or 1.7% of the country, have also been designated.

The *Triglav National Park* is the country's only national park, designated in 1981, although its first protection dates back to 1924. Now comprising 880 km<sup>2</sup>, it contains the country's highest peak, Mount Triglav at 2864m. Two larger parks, the *Notranjska Regional Park* and the *Goričko Landscape Park* were designated in 2002 and 2003 respectively. Other parks include the *Ljubljansko barje Landscape Park* and the *Kamniško-savinjske Alpe Regional Park*.

### **Human uses of water resources**

Slovenia has experienced a major concentration of population and economic activities over the last 60 years. In particular, the Pannonian and Alpine plains have seen considerable increases in population density. The basins and valley bottoms are favourable for agriculture, construction of transport infrastructure, expansion of industry and settlements. But the increasing population density has meant increasing environmental pressures in these areas.

#### ▪ Flood and high discharge management

Excluding earthquakes, floods represent the most significant category of natural disasters in Slovenia, causing extensive material damage. Constituting a threat to more than 300,000 ha (15% of the country), high waters are common and occur

annually. They take place at any time but are most frequent in autumn and spring, mainly due to reduced plant cover. Floods due to sudden inflows of large amounts of water occur in summer when short blasts of intensive rainfall are commonplace and have the potential to trigger landslides (frequent in the south-east).

Due to the increasing concentration of the country's population being located in the bottom of basins and broad valleys (where almost two thirds of Slovenes reside), a significant share of the population now lives in areas exposed to floods. This is the case for both rural and urban settlements. About 30 extensive flood areas (approximately 237,000 ha) are found in the wide valleys. 54% of the flood area is located within the Sava River Basin and 42% in the Drava Basin. Flooding also presents a serious threat to areas along torrential rivers and streams. Tidal flood and karst flood areas are less extensive (approximately 70,500 ha).

Torrential flooding occurs mainly in the upland areas, as well as along large rivers, for example on the Savinja, Mislinja, Kamniška Bistrica and Sora rivers. Lowland flooding is characteristic of the lower sections of major rivers and is most extensive along the Dravinja, lower Krka, and Sava in Brežiško polje, and the lower section of the Sotla River. In karst poljes, floods occur slowly and water remains for days or weeks before slowly flowing off through the karst underground. This is common in Cerknjško polje and Planinsko polje, and also Globodol, a Dolenjska karst polje, and Ljubljansko barje.

Slovenia's 2002 Water Act prohibits all activities and encroachments on physical space which, in the event of a flood, could have adverse effects on waters or waterside land, or which increase the flood risk in the area.

#### ▪ Drinking water supply

Slovenia currently has sufficient water resources to provide continuous drinking water supply to its population, although individual areas are indicating periodic deficits. It is evident from increasing water consumption and anticipated development plans that drinking water supply will become a limiting factor in some areas. The increasing demand is the consequence of economic development and inclusion of new water resources, as well as increases in household consumption.

Consideration of water conservation is only lately becoming an issue. Before 2002, protection of drinking water was a matter for local communities and there was no uniform methodology. The 2002 Water Act defined water as a public natural asset, transferring its protection to the national government and establishing a uniform methodology for defining water protection areas. It also protects areas used for mineral, thermal, thermo-mineral and other groundwater abstraction. In 2004, the first new water protection area was defined covering the Ljubljansko polje aquifer. Further protection areas followed: Selniška dobrava aquifer; Ruše, Urbanski plato, Limbuška dobrava and Dravsko polje, Dravsko-Ptujsko polje and Apaško polje aquifers. In order to carry out monitoring and management of drinking water

resources, Slovenia's Environmental Agency established a database of existing water resources. The database now includes 880 water protection areas, which is just above half of all protected areas and more than 60% of their total area. Water protection areas encompass a total of 442,822 ha, almost a quarter of the country.

#### Use of groundwater bodies for drinking water supply

Groundwater supplies greatly exceed surface water supplies and represent the most important source of drinking water in Slovenia, supplying approx. 97% of the population. Slovenia's main groundwater bodies (GWBs) are found in aquifers with intergranular porosity in flatland gravely-sand deposits along the larger rivers. Slovenia has specified 165 aquifer systems combined into 21 GWBs according to their characteristics; 18 of which occur in the Danube catchment area.

In terms of water quality, highest chemical status occurs in the karst and fractured aquifers, mainly in the less populated upland areas. In 2005, *good chemical status* was recorded for 7 GWBs, and estimated in four others. (Evaluation was not possible in two bodies, and for a further 6, no monitoring sites exist.)

GWBs under most pressure are found in the north-eastern lowland areas of Slovenia, where aquifers with intergranular porosity prevail. Available information for 2005 indicates excessive pollution in two such GWBs: in the Drava and Mura Basins. Groundwater is mostly susceptible to pollution from non-point sources (agriculture and urbanisation), which is most pronounced in the very north-eastern part of Slovenia. Critical pollutants significantly contributing to this pollution are desethylatrazine, nitrates and atrazine. Concentrations for atrazine and desethylatrazine are generally declining, indicating that the ban on the use of products containing these substances has been effective. Individual areas still indicate an increasing and alarming trend for nitrogen pollution. In the Western and Eastern Slovenske Gorice GWBs, regular monitoring is not yet established and so an assessment of pollution trends is not possible. Two other major GWBs in alluvial aquifer systems (the Krško Basin and the Sava Basin with Ljubljansko barje) exhibit significant loads and local hotspots, but results from the existing regular monitoring programme indicate *good chemical status*.

#### Use of surface waterbodies for drinking water supply

Using EU Water Framework Directive methodology, Slovenia contains 155 surface waterbodies, 134 of which are classed as watercourses, 15 are lakes/artificial lake developments, and 6 coastal water bodies. 22 of the above-mentioned have characteristics of heavily modified water bodies and four of artificial water bodies. Based on the monitoring programme in 2005, *good chemical status* was established for 73 monitoring sites, and *poor status* in 15. In most cases, *poor chemical status* was the result of limit values being exceeded for phenolic substances, absorbable organic halogens (AOX), metolachlor, anion active detergents and pesticides. Limit values for mineral oils and polychlorinated biphenyls (PCB) were also exceeded in some monitoring sites.

The major source of surface water pollution is from point sources (emissions from industrial and communal wastewaters and rainwater from urbanised areas). In still or slow-flowing surface waters, the occurrence of eutrophication due to excessive amounts of nutrients is a significant problem. Accumulation of phosphorous and nitrate nutrients, and the eutrophication connected with this, is the main issue affecting permanent natural lakes in Slovenia, such as Lake Bled and Lake Bohinj. Successful rehabilitation activities re-established Lake Bled as a mesotrophic lake many years ago. In spite of increased pressures from the lake's catchment area, the state of the lake (as assessed in 2005) has not changed significantly, thanks to the operation of the rehabilitation facilities. Studies in 2005 of Lake Bohinj also indicated that its status has not declined significantly from its past state, and according to OECD criteria, it ranks among the oligotrophic lakes.

In 2005, total phosphorus levels in all central and north-eastern retention basins (Šmartinsko, Slivniško, Perniško and Ledavsko Jezero lakes) exceeded 100 µg/l, characteristic of hypereutrophic lakes. The levels of nitrogen compounds also points to excessive nutrient loads. *Poor chemical status* was identified for Lake Ledavsko Jezero where cadmium and metolachlor exceeded the limit value set by the Decree on the Chemical Status of Surface Waters. In other retention basins, chemical status was evaluated as *good*. The Klivnik and Molja retention basins, in the vicinity of Ilirska Bistrica, are less polluted with nutrients and rank among the mesotrophic retention basins. Lake Cerknica hardly experiences eutrophication due to intermittence and the significant metabolic role of wetland plants. The accumulation of different types of pollutants, mainly heavy metals from industrial plants in the catchment area, represents a much larger problem. Despite this, *good chemical status* was established in 2005 at Stržen, Cerkniščica and Rak.

## Useful web links

Environmental indicators in Slovenia website:

<http://kazalci.arso.gov.si/kazalci/index.html?lang=1>

"Environment in the Palm of Your Hand" website:

<http://eionet.arso.gov.si/publikacije/Datoteke/OND07en/EnvironmentInThePalm-min.pdf>

Ministry of the Environment and Spatial Planning (Department for Waters):

[www.mop.gov.si/si/delovna\\_podrocja/direktorat\\_za\\_okolje/sektor\\_za\\_vode/](http://www.mop.gov.si/si/delovna_podrocja/direktorat_za_okolje/sektor_za_vode/)

Environmental Agency of Slovenia: Water Balance of Slovenia 1971 - 2000:

[http://www.arso.gov.si/vode/poro%c4%8dila%20in%20publikacije/vodna%20bilanca/vodna\\_bilanca.html](http://www.arso.gov.si/vode/poro%c4%8dila%20in%20publikacije/vodna%20bilanca/vodna_bilanca.html)

Photo gallery of the Environmental Agency of Slovenia:

<http://nfp-si.eionet.eu.int/sokol/thumbnails.php?album=23>