A step forward
in environmental management

Environment in the palm of your hand

SLOVENIA

A step forward
in environmental management

Environment in the palm of your hand

SLOVENIA

ENVIRONMENT IN THE PALM OF YOUR HAND

Editors
Irena Rejec Brancelj, Nika Zupan

Authors of text
Barbara Bernard Vukadin (BBV), Mojca Dolinar (MD), Nataša Kovač (NK), Urška Kušar (UK), Mirjana Plantan (MP), Vesna Polanec (VP), Gregor Vertačnik (GV), Renato Vidrih (RV), Borut Vrščaj (BV), Nika Zupan (NZ), Polona Zupančič (PZ), Ana Žust (AŽ)

Cartographer
Jerneja Fridl, Anton Melik Geographical Institute SRC SASA

Translation
Translation agency Alamma

Technical editing
Nika Zupan

Photographers
Peter Frantar (p. 66, 93), Špela Guštin (p. 76), Miha Jeršek (p. 8), Albert Kolar (p. 32, 33, 87, 92), Aleš Likar (p. 54), Nina Lozej (p. 67), Stanko Mravljak (p. 55), Lothar Boris Piltz (p. 23), Metka Roethel Kovač (p. 22), Andrej Šegula (p. 9, 86), Bojan Uran (p. 77)

Cover photos
Stanko Mravljak (Lake Ivarčko), Luka Pintar (Blooming meadow), Zdenko Purnat (Red apple)

Design
Marethica d. o. o.

Publisher
Ministry of the Environment and Spatial Planning – Environmental Agency of the Republic of Slovenia
Vojkova 1b, p. p. 2608, 1001 Ljubljana,
e-pošta: gp.arso@gov.si

Electronic design and printing
SYNCOMP d. o. o.

Paper
100% recycled

Print run
1,000 copies

Publication is available at website:
http://eionet.arso.gov.si/publikacije

Ljubljana, October 2008

CIP – Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

502.175(497.4)(047)
574.1(497.4)(047)

ENVIRONMENT in the palm of your hand : Slovenia / [authors of text Barbara Bernard Vukadin ... [et al.] ; editors Irena Rejec Brancelj, Nika Zupan ; cartographer Jerneja Fridl, Anton Melik Geographical Institute SCR SASA ; translation Translation agency Alamma ; photographers Peter Frantar ... et al.]. – Ljubljana : Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia, 2008

1. Bernard Vukadin, Barbara 2. Rejec Brancelj, Irena
241840384

REPUBLIC OF SLOVENIA · MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
ENVIRONMENTAL AGENCY OF THE REPUBLIC OF SLOVENIA

A step forward in environmental management

Contents

Foreword

The modern concept of environmental policy making is based on sustainable development. It is achieving recognition in the international community and in the EC Member States as a development that brings prosperity to future generations. Its goal is to prevent and reduce pollution at the source, and emphasise efficient use of natural resources and preservation of biodiversity. In the environmental field of work, sustainable development is viewed upon as the way of organising the economy, infrastructure and population, and the way of living in the framework of the carrying capacity of the environment.

In compliance with the principles of the protection and conservation of the environment we are striving to achieve a high environmental protection level. Thus our priorities include the development of new legislation and consistent implementation of the existing legislation, promotion of sustainable use of natural resources, inclusion of environmental concepts into sectoral policies, development of new environmental technologies, promotion of sustainable production and consumption, and green finances as well as raising the awareness and dialogue with all interested parties, and public participation in decision making.

In Slovenia, monitoring the state of the environment and reporting to the domestic and foreign public and institutions is an important field of activity. The reporting task includes exchange of environmental information, support in collection of information, and providing free access to this information. All this allows the strengthening of political and social culture in our relation to the environment.

The last few years have witnessed the promotion of the realization that only a correlation between environmental and spatial information provides a suitable basis for environmental management. The process was supported by the activities preceding the preparation of the new INSPIRE Directive, which anticipates the establishment of infrastructure for spatial information in the European Community. Its purpose is to provide information necessary for the development and implementation of the environmental policy without additionally burdening the administrative structures in the Member States and European institutions. This can only be achieved through joint, partitioned, connected and modern infrastructure which will enable efficient quality environmental information management. The system will originate from the existing information, determined by obligations for the Member States described in the European legislation. Much of this information has already been communicated to the European institutions, but it has not been public. The Aarhus Convention and the INSPIRE Directive are the tools with which we can change the existing status. Free access to the existing environmental information in individual countries and at the European level will enable their wide application.

This was the intention of the "Environment in the Palm of Your Hand" report which is before you. For the purpose of communication with the public, it uses modern tools and presentations, originating in the existing geographical information infrastructure. This method is based on establishing mutual interaction of the pollution sources, pressures, state of the environment, impacts on the environment, and responses of the society to the environmental problems. Our wish is for you to find this report useful in your everyday work.

Mitja Bricelj, Ph. D.
State Secretary
Ministry of the Environment and Spatial Planning

Introduction

In the last few years, the State of the Environment Report has gone through many changes required by the new view of understanding and taking actions in the environmental sphere. The emphasis is on the integral evaluation of environmental issues, including their spatial dimensions. The previously established State of the Environment Reports are giving way to the cause-effect and spatial assessments which provide integrity.

By reporting on the state of the environment, we are monitoring the progress in the field of environment, providing a base for decision making at all levels (local, regional, national, international) and improving the awareness and understanding of the developments in the environment in all interest groups.

The report has to satisfy the commitments from the legislation, consider the good practice recommendations (by, for example, the European Environment Agency) and the existing experiences, include the need of the public to get access to environmental information, and enable international comparability of information.

The State of the Environment Report is the evaluation of the state of the environment in Slovenia in a given period. It is prepared in accordance with Article 106 of the Environment Protection Act (EPA-1-OCT1, Official Gazette RS, No. 39/2006). The report is within the competence of the Ministry of the Environment and Spatial Planning. It is prepared every four years in cooperation with other environment-related institutions. Each year, a short report is prepared on the basis of indicators. The content of the report is determined in Article 107 of the Environment Protection Act.

The environmental report includes information, spatial presentations, texts and photos. For this purpose, four pillars of report contents have been developed in the last few years: indicators (Environmental Indicators in Slovenia), maps (Environment in the Palm of Your Hand), texts, and photos of the environment (SOkol). The so-called environmental indicators were developed in order to establish the effectiveness in pursuing environmental objectives. They are based on numerical data indicating the state, specific characteristics or development of a certain phenomenon. They are acquired by connecting the data and observations, as presented in the information pyramid (Fig. 1).

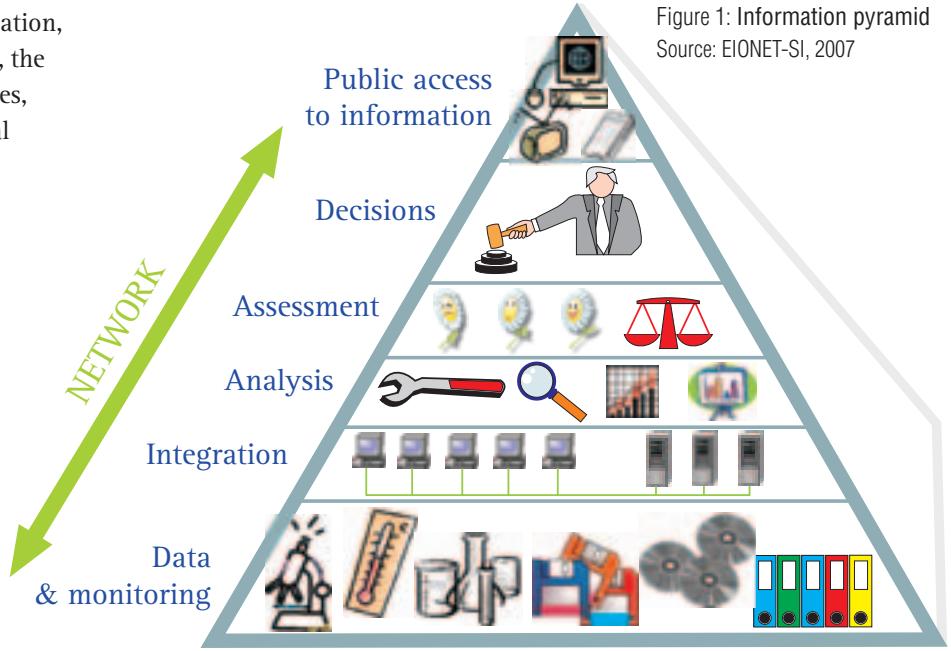


Figure 1: Information pyramid
Source: EIONET-SI, 2007

Indicators provide a temporal insight into the development of a phenomenon (read more about the indicators in the Annex). Cartographic presentations help place this phenomenon into space. Together they present the basis for the analysis of the state and for the development of an evaluation, which is the basis for integral reporting and decision making in the field of environmental management.

In our evaluation we used the five-part framework (Fig. 2), developed by the European Environment Agency which includes Driving forces, Pressures, State, Impacts and Responses.

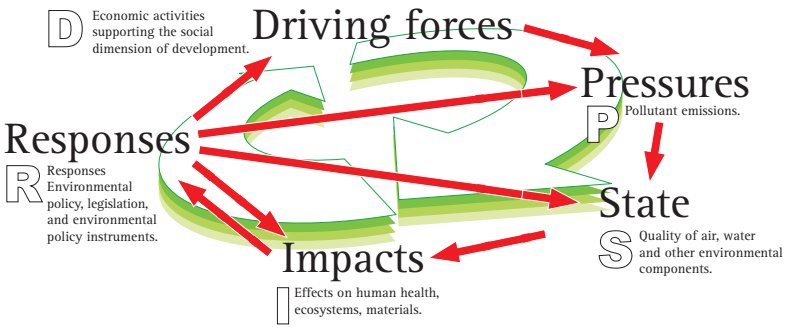


Figure 2: Assessment framework
Source: European Environment Agency, 2002

In many places, spatial presentation of environmental issues opened a new perspective on the evaluation and understanding of phenomena in the environment. It provided a number of comparisons and correlations of key contents for new evaluations. It became one of the pillars of environmental reports, both in printed (in the framework of reports) and digital media (presentation of regional information on websites). New legislation frameworks gave it a fresh impetus by adopting the INSPIRE Directive (Infrastructure for spatial information) which came into force in 2007. The awareness of the importance of this information for decision making in the field of environment stimulated the preparation of a European Commission Communication which is to expedite the implementation of the adopted legislation. Supporting activities have been taking place in Slovenia too and have resulted in the publication before you entitled Environment in the Palm of Your Hand.

Environment in the Palm of Your Hand contains 41 maps classified into 8 thematic groups – chapters: Basic Characteristics, Climate Change, Quality of Life, Nature and Biodiversity, Natural Resources and Waste, Marine and Coastal Environment, Sustainable Consumption and Production and Environmental Quality Monitoring. Each chapter presents a problem from a number of aspects: map, key message, short description, links to environmental indicators on the Internet, and data and sources used in the report.

By using the system of indicators and spatial presentation of environmental phenomena, we would like to bring the report even closer to all target groups: general public, decision makers in public administration and economy, experts and researchers, and the media. Our intention is to inform, educate, and help to reach environmentally friendly decisions.

Irena Rejec Brancelj, Ph. D.
Editor

Basic characteristics

In view of landscape diversity, Slovenia is an exceptional country since four large landscape units, the Alps, the Dinaric Mountains, the Pannonian Basin and the Adriatic Sea, meet and interweave in this small corner of Central Europe. Slovenia is therefore geographically divided into four basic landscape types, namely the Alpine, Dinaric, Pannonian and Mediterranean landscape. The natural geographical division is based on the predominant natural features, particularly the surface, climate and vegetation, and the social elements that form a strong mutual bond with the natural elements, for example land use, distribution of settlements and agricultural activities. It is the latter that causes ecological landscapes to differ from one another according to the level of vulnerability, endangerment of the environment and a number of environmental problems the local population has to deal with.

In Slovenia, carbonate sedimentary rock prevails in the western and southern part, as well as in the central area. Igneous and metamorphic rocks are found in a small part of north-eastern and northern Slovenia, mostly on Pohorje, Strojna, Kozjak and Kobansko. Quaternary sediments form an extensive group in the central Ljubljana Basin, stretching out toward Gorenjska and covering a part of the north-eastern territory of the country. Due to the rock and climatic diversity, and the roughness of the terrain, Slovenia has a variegated soil composition. Different 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.

Forests along with shrubs and herbaceous vegetation cover two thirds of Slovenia's territory, agricultural land covers just under one third, and built up land covers three percent. Characteristic interweaving of different categories of agricultural, forest and other types of land provides great biodiversity and represents a natural and cultural heritage, as well as the unique identity of Slovenian landscapes. Great surface roughness dictates uneven distribution of the population. On the Alpine and Pannonian plains, and in the surroundings of major cities, the density of the population in Slovenia is the greatest and continues to increase, while some areas experience depopulation. According to the 2006 census, the population density was 99 inhabitants/km^2 which ranks Slovenia among countries with medium population density.

Scale: 1 : 900,000. Source: Surveying and Mapping Authority of the Republic of Slovenia, 2002.

Basic geographic facts

Area 20,273 km^2

Land border length
- With Austria: 318 km
- With Croatia: 670 km
- With Italy: 280 km
- With Hungary: 102 km

Coastline 46.6 km

The highest peak 2,864 m, Mount Triglav

The deepest sea point –37.25 m, The Adriatic Sea (off Piranska punta, Cape Madona)

Average elevation 556.8 m

Average inclination 13.1°

Surface watercourses – total length 26,989 km
Longest rivers: the Sava (221 km), the Drava (145 km), The Kolpa (113 km), the Savinja (95 km; from the Črna spring)

Landscape diversity
Contact of 4 major landscape units:
- the Alps,
- the Dinaric Mountains,
- the Mediterranean
- he Pannonian Basin

Rock structure
- Sedimentary rock: 93%
- Igneous rock: 3%
- Metamorphic rock: 4%

Land use (according to CORINE Land Cover 2000)
- Built-up land: 2.7%
- Arable land and permanent crops: 6.5%
- Pastures: 5.7%
- Heterogeneous agricultural areas: 22.7%
- Forest: 56.0%
- Transitional woodland shrub: 2.2%
- Natural grasslands and moors: 2.1%
- Open spaces with no vegetation: 1.4%
- Water and wetlands: 0.7%

Climate
- Temperate continental in central and eastern Slovenia (Ljubljana: January –0.1°C, July 20.4°C, 1,368 mm precipitation; Murska Sobota: January –1.2°C, July 19.7°C, 805 mm precipitation)
- Alpine in northwest of Slovenia (Rateče: January –3.9°C, July 16.1°C, 1,474 mm precipitation)
- Sub-Mediterranean by the coast and in the hinterland (Portorož: January 4.1°C, July 22.5°C, 931.2 mm precipitation)

Nature
- Number of known species: 24,000
- Protected areas: 12% of the area
- Special areas of conservation (Natura 2000): 36% of the area
- Ecologically important areas: 52% of the area

POPULATION

Population 2,010,377 (2006)

Population density 99 inhabitants per km^2 (2006)

National structure of the population
- Slovenes: 83.1%
- Serbs: 2.0%
- Croats: 1.8%
- Bosnians: 1.1%
- Other: 12.0% (2002)

Ethnic minorities
- Italians: 0.1%
- Hungarians: 0.3% (2002)

Birth rate 9.4 ‰ (2006)

Death rate 9.1 ‰ (2006)

Population growth rate 0.4 ‰ (2006)

Age structure
- 0–14 years: 14.0%
- 15–64 years: 70.2%
- 65 and over: 15.7% (2006)

Number of settlements 5,988 (2002)

Number of dwellings 777,772 (2002)

Number of households 685,023 (2002)

Average number of household members 2.8 (2002)

ECONOMY

GDP per capita 15,167 EUR (2006)

Active population
- Persons in employment: 741,586
- Persons in self-employment: 83,252
- Registered unemployed persons: 85,835 (2006)

Unemployment (by ILO methodology) 6.0% (2006)

Persons in employment by activity
- Agriculture: 5%
- Industry and construction: 37%
- Services: 57% (2006)

Export 16,757 million EUR (2006)

Import 18,341 million EUR (2006)

Energy intensity
(Supply with energy/GPD, constant prices in 2000 in EUR)
281 tons/million EUR (2006)

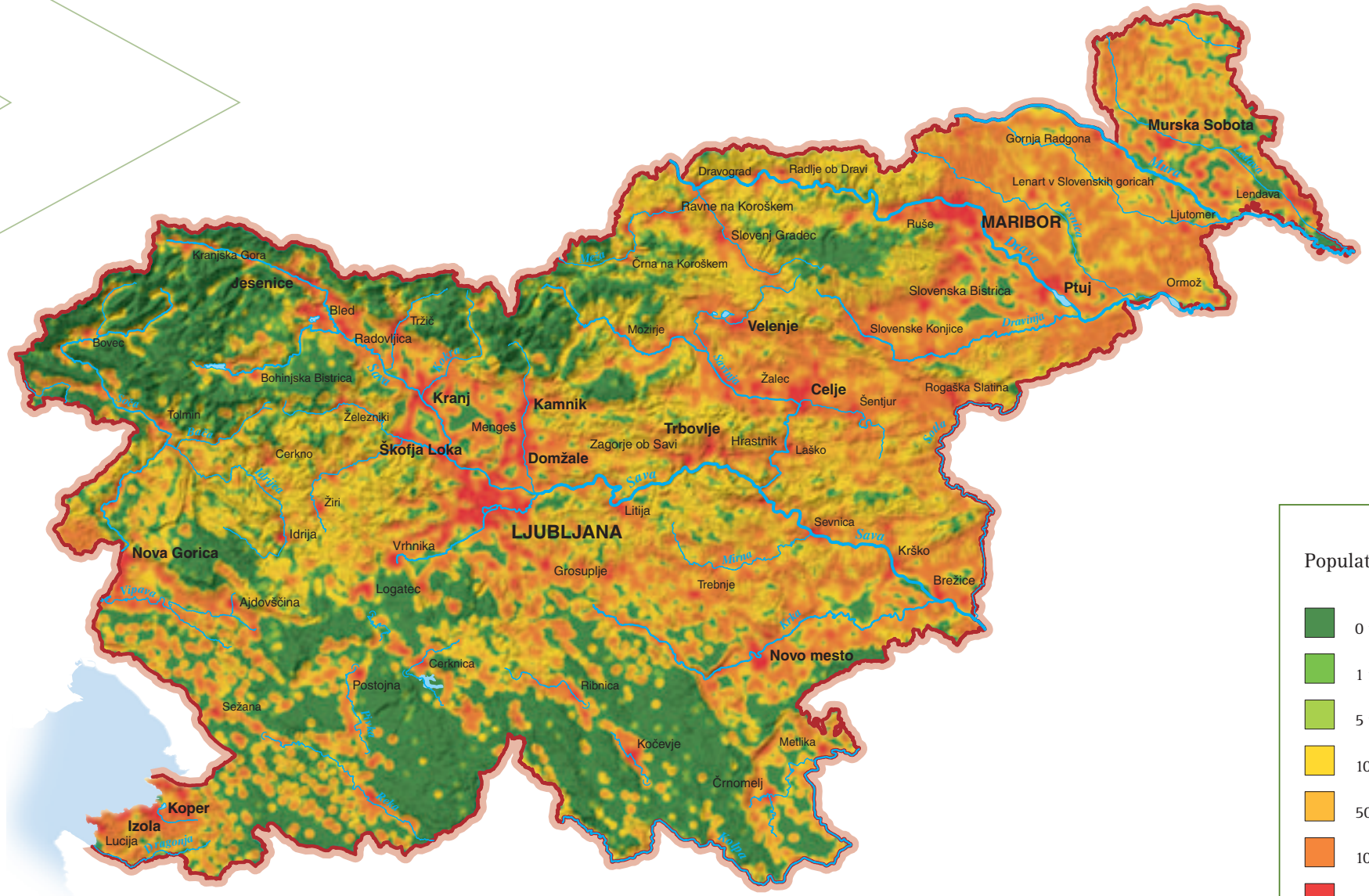
Electricity consumption per capita
6.615 kWh/capita (2006)

Households with permanent consumer goods
- Dwelling or house ownership: 81%
- Car: 80%
- Washing machine: 96%
- Dishwasher: 42%
- Refrigerator: 98%
- Colour TV: 96% (2005)

Use of Internet
- Number of users per 100 inhabitants: 54
- Share of households with Internet access: 54%
- Share of households with broad-band access: 34% (2006)

Source: Ministry of the Environment and Spatial planning, Environmental Agency of the Republic of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia, Statistical Office of the Republic of Slovenia, Government Communication Office, European Environment Agency.

2. Population density



Scale: 1 : 1,100,000. Source: Anton Melik Geographical Institute Scientific Research Centre of the Slovenian Academy of Sciences and Arts, 2007.

Population density is the ratio between the number of inhabitants and the surface area on which they live. It tells us the average number of people per unit of area, and is usually expressed in the number of people per km^2. On the map, population density was calculated from the data on the inhabitants in the Central Population Register per area cell of 100 × 100 m. Concentration in the neighbouring cells was considered as well.

In 2006, the population density in Slovenia was 99 people per km^2. Due to the roughness of Slovenia's terrain, the population density is quite uneven, and continuous thinning (depopulation) or concentrating only increases the differences, which have started to show in the outlook of the cultural landscape. The most pronounced population concentration takes place in the plains and in the vicinity of large cities.

Slovenia has about 6,000 settlements. Small settlements prevail and half of them have less than 100 inhabitants. In 2002, however, only 7% of the entire population lived there. Half of the population lived in settlements with less than 2,000 inhabitants and only 16 settlements had more than 10,000 inhabitants. Ljubljana, the capital city, is the only city with more than 100,000 inhabitants. Between the 1991 and 2002 censuses, the share of the population decreased in the smallest and the largest settlements (less than 100 and more than 5,000 inhabitants), and increased in the medium-sized settlements. Small settlements are characteristic of the Dinaric plateaus, Dinaric valleys and Alpine hills, and large settlements are characteristic of Alpine and Pannonian plains.

Over the entire 20th century, the population density has more than tripled on the Alpine plains and doubled on the Pannonian plains on the one hand, and decreased by more than one third on the Dinaric plateaus and by more than one fifth on the Mediterranean plateaus on the other. In the same period, the population density has been continuously increasing in the areas with altitudes below 600 metres, most of all in the altitude range below 100 metres with coastal cities, and in the altitude range between 200 and 400 metres with the largest Slovenian cities, where it has doubled. At the beginning of the 20th century, the population density was below average in two thirds of Slovenia's current territory. Due to the continuous concentration of the population, the density in the middle of the century was below average in three quarters of Slovenia's territory, and by the end of the century, in as much as four fifths of the territory.

In the most densely populated areas, the increasing population density has only intensified the pressure of man's activities on land use and his influence on the environment. Fertile, flat bottoms of Alpine basins and valleys, Pannonian plains and coastal areas are favourable for agriculture, construction of transport infrastructure and industrial objects, and expansion of settlements. Gravel plains in the basins represent an important as well as vulnerable source of drinking water for the local population, and are endangered mostly by waste water discharges, intentional and accidental discharges of toxic substances from transport, and excessive use of mineral fertilisers and pesticides. Karst areas are scarcely populated so the water there is mostly clean and represents an increasingly important source of drinking water. *(VP)*

In 2006, the population density in Slovenia was 99 people per km^2, which ranks Slovenia among countries with medium density population. Due to the roughness of Slovenia's terrain, the population density is quite uneven. The population density has continuously increased on the Alpine and Pannonian plains. The largest concentrations are found on the flatlands and in the vicinity of large cities.

Link to relevant indicators

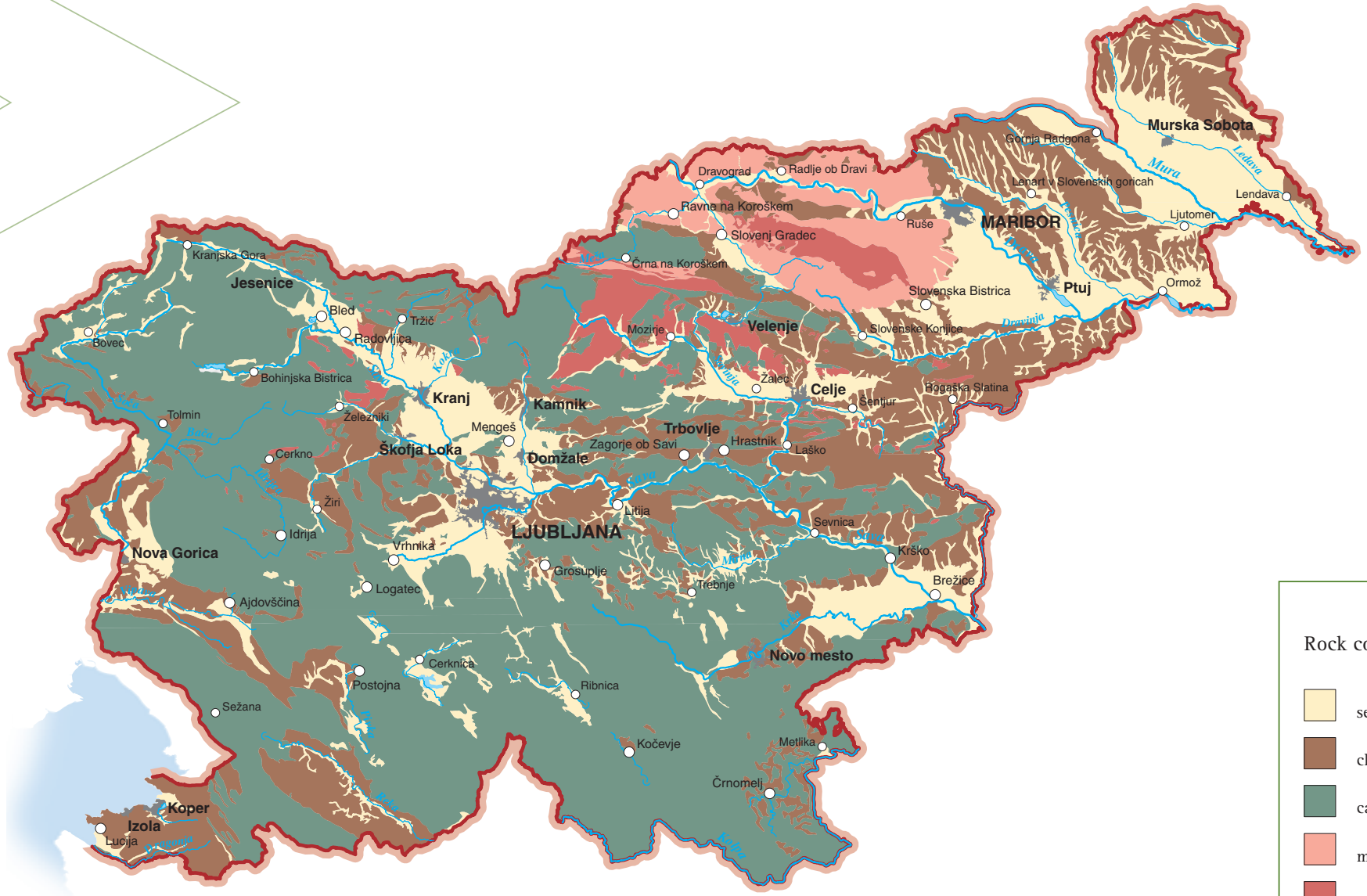
http://kazalci.arso.gov.si

- Land cover and land use
- Nitrates in groundwater
- Pesticides in groundwater
- Drinking water quality
- Air quality

Data and sources:

Perko, D., 1998. Prebivalstvo in naselja. In: Geografski atlas Slovenije: država v prostoru in času. Ljubljana, Državna založba Slovenije.
Census Atlas of Slovenia 2007. Ljubljana, Založba ZRC.
Rejec Brancelj, I., 1998. Pomembnejši naravni viri. In: Geografski atlas Slovenije: država v prostoru in času. Ljubljana, Državna založba Slovenije.
Map: Gostota prebivalstva. Anton Melik Geographical Institute SRC SASA, 2007

3. Rock composition



Scale: 1,100,000. Source: Geological Survey of Slovenia, 1996, Environmental Agency of the Republic of Slovenia, 2007.

The presented lithological map of Slovenia is a very simplified lithostratigraphic map elaborated on the basis of the lithological-stratigraphic characteristics of rocks in individual parts of Slovenia. The basic lithostratigraphic map includes almost 120 different lithological units united into five typical rock groups. Carbonate sedimentary rocks form the largest group – they are found in almost the entire western and southern, as well as in a large part of central Slovenia.

Carbonate rocks in some parts of south-western and central Slovenia often include flysch and similar clastic sedimentary rocks. Oligocene, Miocene and Pliocene postorogenetic sediments build north-eastern, eastern and smaller parts of south-eastern Slovenia. Igneous and metamorphic rocks, differing from sediments by their origin as well as by the chemical and physical properties, are characteristic of a small part of north-eastern and northern Slovenia, most of all Pohorje, Strojna, Kozjak and Kobansko. The last group is composed of Quaternary sediments in the central Ljubljana Basin, stretching out to Gorenjska and covering a part of north-eastern Slovenia. These sediments also build a number of smaller basins and plains. They are predominantly composed of gravel, sand and clay, and are the least resistant to weathering.

The diversity of rocks is the consequence of their origin in the geological past. The oldest rocks are metamorphic. Gneiss, mica schist, amphiboles, eclogites, marbles, slates, etc. were formed from sedimentary and igneous rocks. According to age, they are followed by igneous and some sedimentary rocks, which are about 400 million years old. A large part of the Slovenian territory, mostly the Alpine and Dinaric areas, is predominantly composed of younger rocks, where limestone and dolomite are the prevalent carbonate rocks. It was carbonate rocks where in the past the wonders of the karst world developed.

The rock structure has an influence on the plant and animal life; therefore Slovenia has a very variegated flora and fauna. Diverse rock units and combinations of the less favourable and non-resistant rocks are often the cause of natural disasters. Slovenia has experienced a number of floods, landslides and rockfalls as a result of it. The effect of earthquakes on the surface can vary significantly due to different seismogeological characteristics of rocks as well. In poorly cemented, soft and in water-saturated rocks, the impact of an earthquake of the same magnitude can be by one or two intensity degrees greater than in hard, quality rock in terms of seismogeology. *(RV, PZ)*

In Slovenia, carbonate sedimentary rocks prevail. They stretch throughout the entire western and southern part, as well as a large part of the central area. Igneous and metamorphic rocks are characteristic of a small part of north-eastern and northern Slovenia, mainly Pohorje, Strojna, Kozjak and Kobansko. The next large group is composed of Quaternary sediments in the central Ljubljana Basin, stretching out to Gorenjska and covering a part of north-eastern Slovenia. The rock structure has an influence on the plant and animal life; therefore Slovenia has a very variegated flora and fauna.

Link to relevant indicators

http://kazalci.arso.gov.si

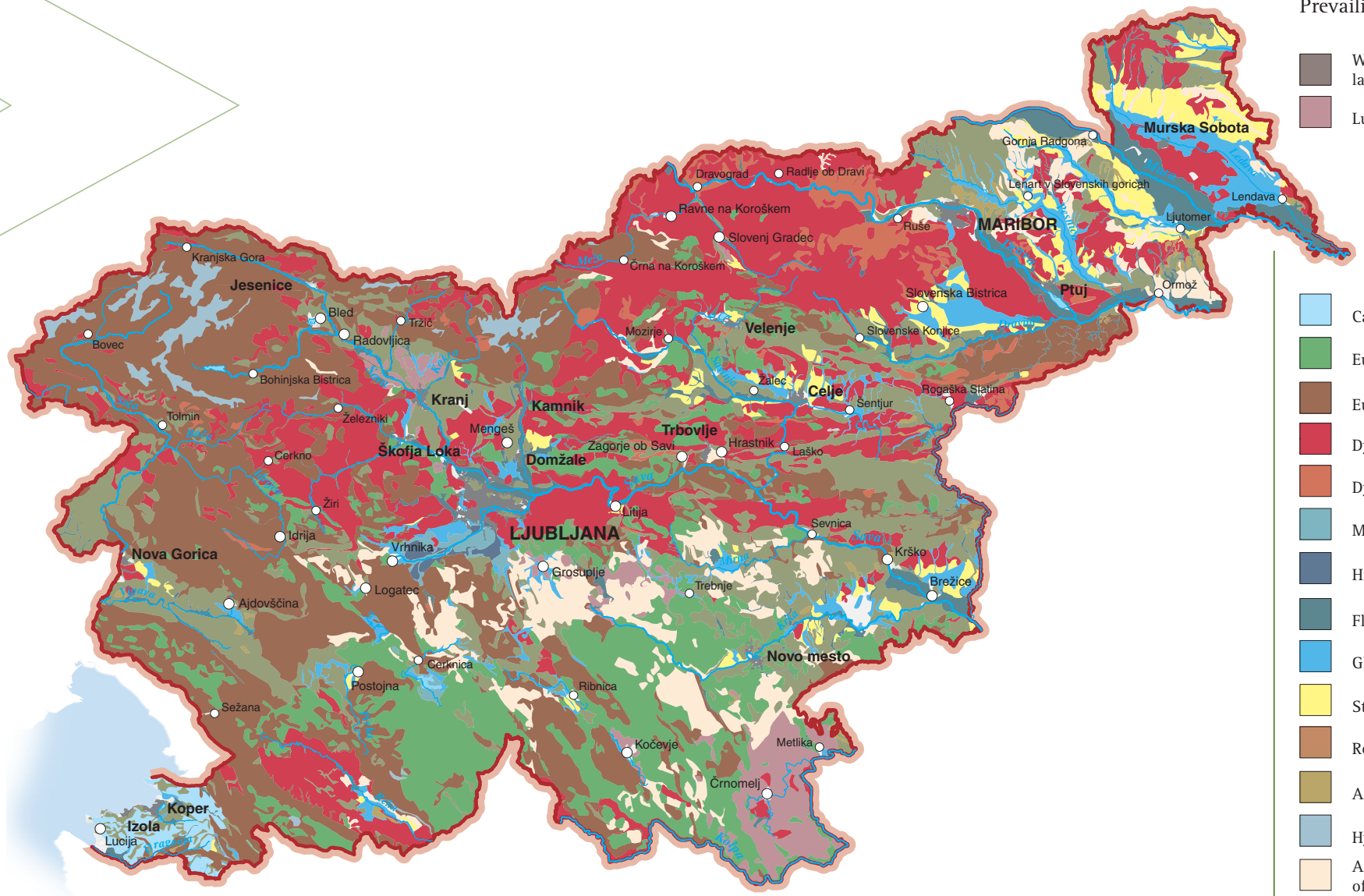
- Estimated damage caused by natural disasters
- Nature areas under protection
- Water use

Data and sources:

Vidrih, R., Zupančič, P., Environmental Agency of the Republic of Slovenia, 2007.

Map: Lithostratigraphical map of Slovenia. 1996, p. 13. Geological Information System, Geological Survey of Slovenia.
(Supplementation and Generalisation: Vidrih, R., Zupančič, P., Environmental Agency of the Republic of Slovenia, 2007).

4. Soil



Prevailing soil type groups

- Water area, built up area, landfill
- Luvisols and Acrisols
- Calcisols
- Eutric Cambisols
- Eutric Leptosols
- Dystric Cambisols
- Dystric Leptosols
- Mollic Gleysols
- Histosols
- Fluvisols
- Gleysols
- Stagnosols and Planosols
- Regosols
- Anthrosols
- Hyperskeletic Leptosols
- Areas of great variability of soil types

Scale: 1 : 1,100,000. Source: Agricultural Institute of Slovenia, 2007.

Due to its rock and climate diversity, and roughness of the terrain, the territory of Slovenia exhibits a variety of soil types in a small area. Their properties and variegated structure and natural interweaving are the main cause for Slovenia's landscape identity. Soil properties direct land use, affect the quality of groundwater, cause biotic diversity and define the land capability for the production of biomass.

Soil classification means the distribution of soil types into groups according to the selected criteria. The Slovenian national classification pays regard to the principle of the soil genesis and originates from the Russian pedological school, the classification of which is based on the soil development. Basic units of the classification are soil types or soil systematic units.

The range of different soil types is presented by the soil map. The soil map of the largest scale, covering the entire Slovenia, is the Soil Map of 1 : 25,000 scale. It has been elaborated on the national level to assess the quality of soil as a natural resource. The soil map presented in this publication is generalised to present the main soil groups in the scale of 1 : 1 M. The soil cartographic units are combined according to the predominant soil type, hierarchic arrangement, and the surface of the cartographic unit. The soil map has fourteen main groups and sub groups of soil types and an additional mixed cartographic unit, where the prevailing type cannot be determined due to a highly variegated composition. Water areas, built up areas and landfills are classified into a special cartographic unit.

According to the WRB classification, the most widespread soil types in Slovenia are Eutric Leptosols on limestone and dolomite, which cover almost 16% of the country. Eutric Leptosols prevail mostly in the mountains and in the hilly areas of the Alpine and pre-Alpine regions, and on limestones and dolomites of the Karst regions of the Dinaric Mountains, where they interweave with Eutric Cambisols. Dystric Cambisols developed on the non-carbonate rocks of the hilly and mountainous regions of Pohorje, Smrekovec, the Posavje hills and Škofja loka-Žiri hills, and the non-carbonate flysch of the Brkini hills. The soils are characterized by increased acidity and low nutrient content. Highly fertile variety of Eutric Cambisols cover carbonate flysch in the Mediterranean and marl Pannonian hills as well as the hills consisting of soft carbonate rocks. Eutric Cambisols interwoven with Rendzic Leptosols also cover gravel deposits and alluvial fans as well as glacial moraines of limestone-dolomite origin. Dystric Leptosols, shallow skeletic soils with increased acidity, developed on the non-carbonate gravel and sand, for example on Dravsko polje, and on the non-carbonate rocks of steep slopes. Sandy or silty loamy Fluvisols are found directly along the rivers on the sandy-gravel or silty clayey deposits. Gleysoils have developed on impermeable clays and loams and feature hydromorphic properties due to the stagnant water. Histosols have developed in the Ljubljansko barje (Ljubljana Marsh) due to characteristic geomorphological conditions. Anthropogenic influences in the past (cutting peat for firing and later on intensive soil cultivation) were the reason for the peat to develop into unique anthropogenic Mollic Gleysol of various depths. Acidic Luvisols to very acidic Acrisols are present within the area of very old gravel deposits of Gorenjska, and particularly on the leached residual of limestone and dolomite origin in Bela krajina. The combination of soil and the specific agricultural land use in the past (fern cutting) resulted in the meadows populated with birch trees characteristic for Bela krajina. Hyperskeletic Lithosols which develop on hard limestone or dolomite and Regosols which develop on the soft, in Slovenia, prevailingly carbonate rock, range among the shallow soils at the initial development stage. Both types of soils are found on steep slopes of high mountain ridges or hilly areas. *(BV)*

Due to its rock and climate diversity, as well as uneven relief, the territory of Slovenia exhibits a variety of soil types in a small area. Different types of Leptosols and Cambisols prevail due to the relief and a high share of carbonate rocks. Dystric Leptosols and Dystric Cambisols prevail on non-carbonate rock. Few larger lowlands are covered by Dystric Cambisol on silicate gravel, and Eutric Cambisol on carbonate gravel and sands.

Link to relevant indicators

http://kazalci.arso.gov.si

- Land cover and land use
- High nature value (farmland) areas

Data and sources:

Kralj, T. 2008. Consultations on the WRB classification.
Stritar, A., 1990. Krajina, krajinski system. Ljubljana, Partizanska knjiga.
Stritar, A., 1991. Kompendij. Ljubljana, Biotechnical faculty, Department of Agronomy.
Stritar, A., 1997. Raba in varstvo tal v Sloveniji. Ljubljana, Biotechnical Faculty, Department of Agronomy.
Map: Digital Soil Map of Slovenia 1 : 25,000. 2001. Ljubljana, Ministry of Agriculture, Forestry and Food.
Vrščaj, B. and Prus, T., 1998. Soil Map of Europe 1 : 1M (JRC, ESB), Area of Slovenia, (Supplementation and Generalisation: Vrščaj, B., 2007. Agricultural Institute of Slovenia).

5. Land cover

Land cover in 2000

- forests
- shrub and/or herbaceous vegetation
- artificial non-agricultural vegetated areas
- open areas with no vegetation
- pastures
- heterogeneous agricultural areas
- arable land
- permanent crops
- urban areas
- industrial, commercial and transport areas
- mining sites, landfills and construction sites
- inland waters
- inland wetlands
- coastal wetlands
- marine waters

Scale: 1 : 1,100,000. Source: Ministry of the Environment and Spatial planning, Environmental Agency of the Republic of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia, European Environment Agency, 2003.

The map presents land cover according to the CORINE Land Cover methodology combined into 15 different categories at the second level of precision. Forests cover more than half of Slovenia's territory (56%), and together with shrubs and herbaceous vegetation, they cover even more than 60% of the area. The largest areas of dense forests are found in the Dinaric region of southern and south-eastern Slovenia, and in the Alpine region of northern and western Slovenia. Agricultural land stretches on 35% of the territory and prevails mostly in the north-east. The heterogeneous agricultural land category (22% of the territory), including complex cultivation patterns and land principally occupied by agriculture with significant areas of natural vegetation, is characteristic of Slovenia. This interweaving of different categories of agricultural, forest and other types of land provides greater biodiversity, presents natural and cultural heritage and gives a unique identity to Slovenian landscapes. Dispersed urbanization is characteristic of Slovenia, and the CORINE Land Cover Methodology observes 793 urban areas of different types (2.7% of the territory). Urban areas are found mostly at the bottoms of the basins; the largest such area is in the Ljubljana Basin, continuing almost without interruptions to Kranjsko-Sorško polje.

The latest changes observed in Slovenia were in the increase in discontinuous urban fabric and areas intended for industry and road network. The most important driving force in the extensive transformation of forest and agricultural areas into built up areas was the construction of the transport network. From 1995 to 2000, the CORINE Land Cover observed almost 500 ha of new roads, built in accordance with the national programme of motorway construction. In spite of the relatively high economic growth, only a minor increase in urban housing and commercial areas was observed. A decrease in the number of household members and thus increased demand for housing areas per person is a phenomenon which is evident in a significant increase of the housing areas in the majority of European countries. In Slovenia, such development was suppressed by the introduction of the measures in spatial planning which promoted construction of housing units mostly inside urban areas. The dispersed settlement structure where a half of the population lives in small settlements with fewer than 2,000 inhabitants can denote a number of small changes that are not detected by the CORINE Land Cover methodology.

In the framework of Slovenia's natural conditions the above mentioned variegated interweaving of forest and agricultural areas may be considered a quality landscape. From the economic aspect of agricultural production, breaking down agricultural areas is not a desirable process, but from the aspect of the cultural landscape, it is the diversity of landscape patterns and interweaving of different types of use that provides a quality landscape. In the monitored period, agricultural areas recorded an increase in the surface area of pastures, while the non-irrigated arable land, complex cultivation patterns, and the category of land principally occupied by agriculture with significant areas of natural vegetation recorded a slight decrease.

Forests with transitional woodland shrub cover 58% of the territory and constitute the prevailing land cover category in Slovenia, but they are not evenly distributed. The largest dense forest areas cover the Dinaric-Karst plateaus of the southern and south-western Slovenia, and the slopes of the Alps in the north and west. From the 1970s on, afforestation has been identified as the main reason for the changes in land cover in Slovenia. In the future the process is expected to continue and even accelerate, mostly due to the selective abandonment and overgrowing of agricultural land, and the transition to the predominantly market-oriented agriculture. The detected changes in the forests include treecutting mostly in deciduous forests in the framework of forest management, and to a lesser extent, forest clearing due to the increased number of construction sites and transport networks, i.e. motorways. *(UK)*

Forests with transitional woodland shrub cover more than 60% of Slovenia's territory, built-up land of mostly dispersed urbanisation covers three percents, and the rest is agricultural land. Different categories of agricultural, forest and other types of land interweave in Slovenia, providing high biodiversity and representing a natural and cultural heritage, as well as unique identity of Slovenia's landscapes.

Link to relevant indicators

http://kazalci.arso.gov.si

- Land cover and land use
- Nature areas under protection
- Forest damage and tree defoliation
- High nature value (farmland) areas
- Forest area
- Specialisation and diversification of agriculture
- Intensification in agriculture

Data and sources:

Kovač, M., 2005. Uporabnost baze o pokrovnosti tal CLC2000 – Slovenija. Expert Evaluation.

Map: CORINE Land Cover 2000. 2003. Ministry of the Environment and Spatial planning, Environmental Agency of the Republic of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia, European Environment Agency.

6. Landscapes

Scale: 1 : 1,100,000. Source: Anton Melik Geographical Institute SRC SASA, 1995.

In view of landscape diversity, Slovenia is an exceptional country since four large landscape units, the Alps, the Dinaric Mountains, the Pannonian Basin and the Adriatic Sea, meet and interweave in this small corner of Central Europe. Slovenia is therefore divided into four basic landscape types, namely the Alpine, Dinaric, Pannonian and Mediterranean landscape. The natural geographical division is based on the predominant natural features, particularly the surface, climate and vegetation, and the social elements that form a strong mutual bond with the natural elements, for example land use, distribution of settlements, and agricultural activities. These components cause natural landscapes to differ from one another according to the level of vulnerability, endangerment of the environment and a number of environmental problems the local population has to deal with.

The Alpine world lies in the north of Slovenia. The imposing Alpine mountains, composed of limestone and dolomite, are dissected by deep, glacier-reshaped valleys and remain predominantly unpopulated. To the south and east, they continue into slightly lower, similarly dissected Alpine hills, overgrown with forests and spotted with solitary farms and villages. In between, there are Alpine basins with flatlands and terraces co-shaped by rivers which deposited gravel and sand. Gravel bottoms of the alpine basins present an exceptionally important and abundant aquifer, which is very vulnerable due to the dense population, intensive agriculture, extensive traffic, and a number of other activities. The winter temperature inversion characteristic of the Alpine basins and valleys further intensifies the problems with air quality in settlements with industrial and energy plants.

In the westernmost part of the country, the Alpine world meets the Mediterranean world in the immediate vicinity of the Bay of Trieste. Here, the average temperature of the coldest month never descends below the freezing point. The Mediterranean low karst plateaus are marked by the bora winds, while the Mediterranean flysch low hills exhibit a surface river system not found on the karstified plateaus. The Slovenian coast has witnessed heavy concentrations of the population, traffic and other activities. Three coastal cities – Koper, Izola and Piran have managed to preserve their historic city cores. Villages situated on the ridges of low hills in the hinterland are experiencing depopulation. The shallow Slovenian sea is very sensitive and quickly reacts to any ecological endangerment, for example excessive concentrations of nutrients from the fresh water of the Mediterranean rivers, and untreated municipal waste waters. Small amounts of precipitation in the summer months when the tourist season reaches its peak require economical consumption of drinking water and maintenance of bathing water quality.

Eastwards, the Mediterranean world transforms into the Dinaric world with high Dinaric plateaus, Dinaric systems of valleys and corrosion plains. Due to karstification, the Dinaric world, especially the extensive Dinaric plateaus, has few surface waters and a well developed underground world of karst caves with exceptionally rich biodiversity and supplies of water. It is covered by extensive forests. Karst areas are scarcely populated and the groundwater is predominantly clean, thus presenting an increasingly important source of drinking water. Examples of permanent pollution of karst springs resulting from reckless depositing of hazardous substances in the hinterland are a reminder of their exceptional vulnerability.

To the east of Slovenia lies the Pannonian world, a densely populated and intensively cultivated area. Three large rivers, the Mura, the Drava and the Krka, slowly meander through the Pannonian plains along the fertile fields and floodplain forests. In this area, long roadside villages have developed, while settlements on the ridges of the Pannonian hills composed of marl, sand and loam are elongated and scattered. Southern slopes of low hills are very suitable for winegrowing. Agriculture is an important social element of the landscape and depends heavily on the natural factors; hence, the adaptation to climate change, reflected in droughts and exceptional weather events, is a necessity. In some places, the quality of drinking water drawn from groundwater or surface sources is poor, which points to the need for a sustainable development of agriculture and other activities. *(UK)*

In view of landscape diversity, Slovenia is an exceptional country since four large landscape units, the Alps, the Dinaric Mountains, the Pannonian Basin and the Adriatic Sea, meet and interweave in this small corner of Central Europe. This is evident in the division of Slovenia into landscapes according to their natural characteristics. We distinguish four basic landscape types, namely the Alpine, Dinaric, Pannonian and Mediterranean.

Link to relevant indicators

http://kazalci.arso.gov.si

- High nature value (farmland) areas
- Land cover and land use
- Nature areas under protection
- Population size of selected bird species
- Subterranean biodiversity
- Annual growing season length
- River balance
- Development and distribution of tourism
- Outstanding natural features visited
- Air quality
- Nitrates in groundwater
- Pesticides in groundwater

Data and sources:

Perko, D., 1998. Pokrajine. In: Geografski atlas Slovenije : država v prostoru in času. Ljubljana, Državna založba Slovenije.
Perko, D., et al., 1998. Slovenia. Pokrajine in ljudje. Ljubljana, Založba Mladinska knjiga.
Map: Naravnogeografska regionalizacija in tipizacija. Anton Melik Geographical Institute SRC SASA, 1995.

Climate change

Changed atmospheric characteristics, influenced mostly by man, are the main cause for climate change. The increased amount of greenhouse gasses is conditioned mostly by the use of fossil fuels for heating, powering transportation vehicles, production of other forms of energy, and industrial production. Climate change is evident in the rise of the average temperature in the atmosphere, the changed quantity and distribution of precipitation, more frequent and violent exceptional weather events, including droughts and floods, glacier melting and rising sea level. In Slovenia, too, the average temperature has been rising, which is most evident especially in the last twenty years. We can observe a change in the precipitation regime – the autumn highest values are becoming more pronounced and other months experience less precipitation. Plants respond to the warmer atmosphere by prolonging their growth period which makes them more vulnerable to the spring frost. The Triglav glacier is shrinking and thinning and we can expect it to disappear completely in the next five to ten years.

By implementing the measures for the reduction of greenhouse gas emissions, we can limit the global warming and other consequences of climate change to the level where we can keep them under control to prevent further damage. Slovenia welcomed the measures and endeavours of the European Community to limit the greenhouse gas emissions and signed the Kyoto Protocol. In the 2008–2012 period, the average annual emissions should drop by 8% relative to the 1986 base year. In 2005, the emissions totalled 20.28 million tonnes of CO_2 equivalent, which is still 0.6% more than in 1986. To comply with the Protocol commitments, Slovenia had to implement additional measures. Greenhouse gas emissions can be reduced by replacing the existing technologies, fuels and raw materials with nature friendly alternatives, and reducing the extent or abandoning individual activities. Every individual can contribute significantly to the process by changing his or her lifestyle.

7. Precipitation

Mean annual precipitation sum in the 1971–2000 period

- less than 900 mm
- 900 to 1,000 mm
- 1,000 to 1,100 mm
- 1,100 to 1,200 mm
- 1,200 to 1,300 mm
- 1,300 to 1,400 mm
- 1,400 to 1,500 mm
- 1,500 to 1,600 mm
- 1,600 to 1,800 mm
- 1,800 to 2,000 mm
- 2,000 to 2,600 mm
- 2,600 to 3,200 mm
- 3,200 mm and more

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Precipitation has an important influence on water supply, agriculture, production of electric energy, tourism and transport. Major differences in the spatial distribution of annual precipitation are characteristic of Slovenia. The precipitation is heavily influenced by Slovenia's geographic position and very uneven relief.

In Slovenia, the most precipitation occurs when the south-western winds from the Mediterranean bring in warm and humid air. Due to the elevated Alpine-Dinaric mountain barrier, the precipitation intensifies so that in the entire Dinaric-Alpine zone the mean annual amount of precipitation exceeds 1,600 mm. The most precipitation occurs where the barrier is the highest – in the upper Posočje area and in the Mount Snežnik area, where the annual amount exceeds 2,600 mm. The second, slightly lower precipitation peak is found in the Kamnik-Savinja Alps. In the northeast direction, the annual amount of precipitation lowers with increased distance from the Alpine-Dinaric orographic barrier. The northeast areas have less than 900 mm of annual precipitation. Slovenia's wettest areas record as much as four times the amount of precipitation as its driest areas. According to the annual amount of precipitation, the upper Posočje area belongs among the rainiest areas in the Alps as well as in Europe. The intensity of precipitation here is exceptional, too. In a single day, the amount exceeded 400 mm and the record is more than 100 mm in one hour.

The distribution of precipitation according to the seasons varies as well. The areas in the western part record two characteristic precipitation peaks: the end of spring and the end of autumn. The areas in the north-eastern part under the influence of the continental climate receive the most precipitation in the summer. Throughout the year, the form of precipitation changes too. Long lasting precipitation accompanying the passing front is characteristic of the cold half of the year, and short, more or less intensive showers and storms often accompanied by hail, strong winds and torrential floods are characteristic of the summers. Downpours after longer periods of rain are very dangerous. The soaked soil is likely to trigger landslides, which are frequent in the south-eastern part of the country.

Even though global climate change anticipates changes in the amount of precipitation as well, these changes are not really obvious at the annual level. Although numerous monitoring sites throughout Slovenia record a statistically characteristic reduction of the annual amount of precipitation, a number of monitoring sites record no changes at all or even a rise in the annual amount. A study of seasonal changes of precipitation indicates a much more uniform picture. In the autumn, the amount of precipitation increases almost throughout the country, with the exception of individual small regions in Bela krajina, the surroundings of Brežice and in Koroška, where there are no statistically characteristic changes. A uniform spatial pattern is characteristic of winters, when the amount of precipitation reduces throughout the entire western Slovenia, Koroška and Pohorje, while the eastern part of the country records no changes in the winter amount of precipitation. The spring shows a relatively uniform reduction of precipitation throughout the country with the exception of eastern Štajerska, Prekmurje and Goričko. In the summer, less precipitation is characteristic of the entire country with the exception of higher elevations of the Alps, where there are no changes. Therefore it is obvious that the precipitation regime is changing: the autumn peak is increasingly pronounced while in other months, the amount of precipitation is decreasing. *(MD)*

In Slovenia, the changes in the annual amount of precipitation anticipated by global climate change are not yet obvious. However, there is a change in the precipitation regime. The autumn peak is increasingly pronounced and other months record a decrease in the amount of precipitation.

Link to relevant indicators

http://kazalci.arso.gov.si

- Precipitation and temperatures
- Extreme weather events
- Changes in glacier extent

Data and sources:

Cegnar, T., 2006. Živeti s podnebnimi spremembami. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Dolinar, M., 2006. Podnebne razmere v Sloveniji (obdobje 1971–2000). Ljubljana, Environmental Agency of the Republic of Slovenia.
Zupančič, B., 1998. Padavine. In: Geografski atlas Slovenije: Država v prostoru in času. Ljubljana, Državna založba Slovenije.
Map: Meteorological Archive, Environmental Agency of the Republic of Slovenia, 2007.

8. Temperatures

Mean annual
air temperature
in the 1971–2000 period

- –2 to 0°C
- 0 to 2°C
- 2 to 4°C
- 4 to 6°C
- 6 to 8°C
- 8 to 10°C
- 10 to 12°C
- 12°C and more

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

The long-term mean annual air temperature indicates very general temperature characteristics of the areas. The air temperature has a characteristic annual and daily course.

A large temperature span is characteristic of Slovenia. The pronounced annual course is the consequence of Slovenia's location in the temperate latitude with major seasonal differences in solar radiation. Solar energy is the main source of surface heating and the heated surface is the main source of heat for the atmosphere. The sea too has an influence on the air temperature, acting as a giant heat storage area and contributing to the less pronounced temperature changes in the Mediterranean climate.

In addition to longitude and distance from the sea, the air temperature also depends on the altitude, exposure to the wind, inclination and exposition of the surface, as well as vegetation, the degree of urbanisation, and thermal properties of the soil (albedo, heat capacity and the like). The daily temperature oscillation depends on the synoptic weather conditions and is usually the largest in clear, windless weather. In an idealised daily air temperature course, the highest value occurs early in the afternoon, usually between 2 p.m. and 3 p.m., and the lowest value at sunrise. The highest value of the mean annual temperature is in July, and the lowest value in January. In the high mountains, which are an exception, the lowest value occurs in February. The largest differences between the lowest and highest values occur in north-eastern Slovenia, where the continental influence is the strongest. Temperature conditions in high mountains are similar to the conditions in the free atmosphere where the annual and daily spans are smaller than in the lowlands. In tranquil and clear nights, temperature inversion often occurs in the inland of Slovenia. As in the winter nights are longer, these inversions are more pronounced between November and February and sometimes persist throughout the day or for several days in a row. In other months they disintegrate soon after sunrise. Cooling is very pronounced when the ground is covered by snow. When warm air builds up above Slovenia in the winters, the temperature inversions in the basins and lowlands intensify. The air in the higher elevations warms up and cold air persists in the lowlands only to be blown away by the wind accompanying the cold front. In this way the cold front in the basins causes a rise in the temperature instead of a fall. When the cold and humid air covers the Po River lowlands and the northern Adriatic Sea it causes a strong inversion there as well.

The mean annual temperature in the largest part of the country is between 8 and 10°C. This temperature zone includes most of the lowland part of inland Slovenia. The areas influenced by the continental climate are warmer (the Pannonian Plain, the Krško-Brežice basin and Bela krajina) with the mean annual temperature between 10 and 12°C. The situation in Primorska, including the Soča River valley to Kobarid, is the same. The warmest part of Slovenia is the Slovenian Istria, a part of Kras, the Vipava Valley and Brda, where the mean annual temperature exceeds 12°C. The mean annual air temperature falls with altitude, on average by 5.3°C per 1,000 m. The mean annual temperature in a large part of the Alpine and Dinaric Mountains is between 6 and 8°C, and in the highest parts of the Julian Alps it never exceeds 0°C.

In the 1971–2000 period, the mean annual temperatures throughout the country increased. The first decade (1971–1980) was the coldest and the last ten years (1991–2000) were the warmest.

The highest rise in the temperature was recorded in Ljubljana (on average by 1.7°C in the last 30 years), where in addition to the expansion and growth of the city, warming is the consequence of global climate change. The lowest rise in the average temperature was recorded in Primorska (in Bilje, the average annual temperature rose by 1.0°C in the last 30 years), where the change is mitigated by the vicinity of the sea. Elsewhere in Slovenia, the changes are approximately the same, about 1.5°C in 30 years. The rise of the mean summer temperature contributes the most to the average temperature rise. In the winter, no characteristic temperature changes are observed in the lowlands, and in the autumn the high mountains do not record a characteristic temperature increase. *(MD)*

In the 1971–2000 period, the mean annual temperatures throughout the country increased. On average, they increased by 1.5°C, and the main cause was the rise of the average summer temperature.

Link to relevant indicators

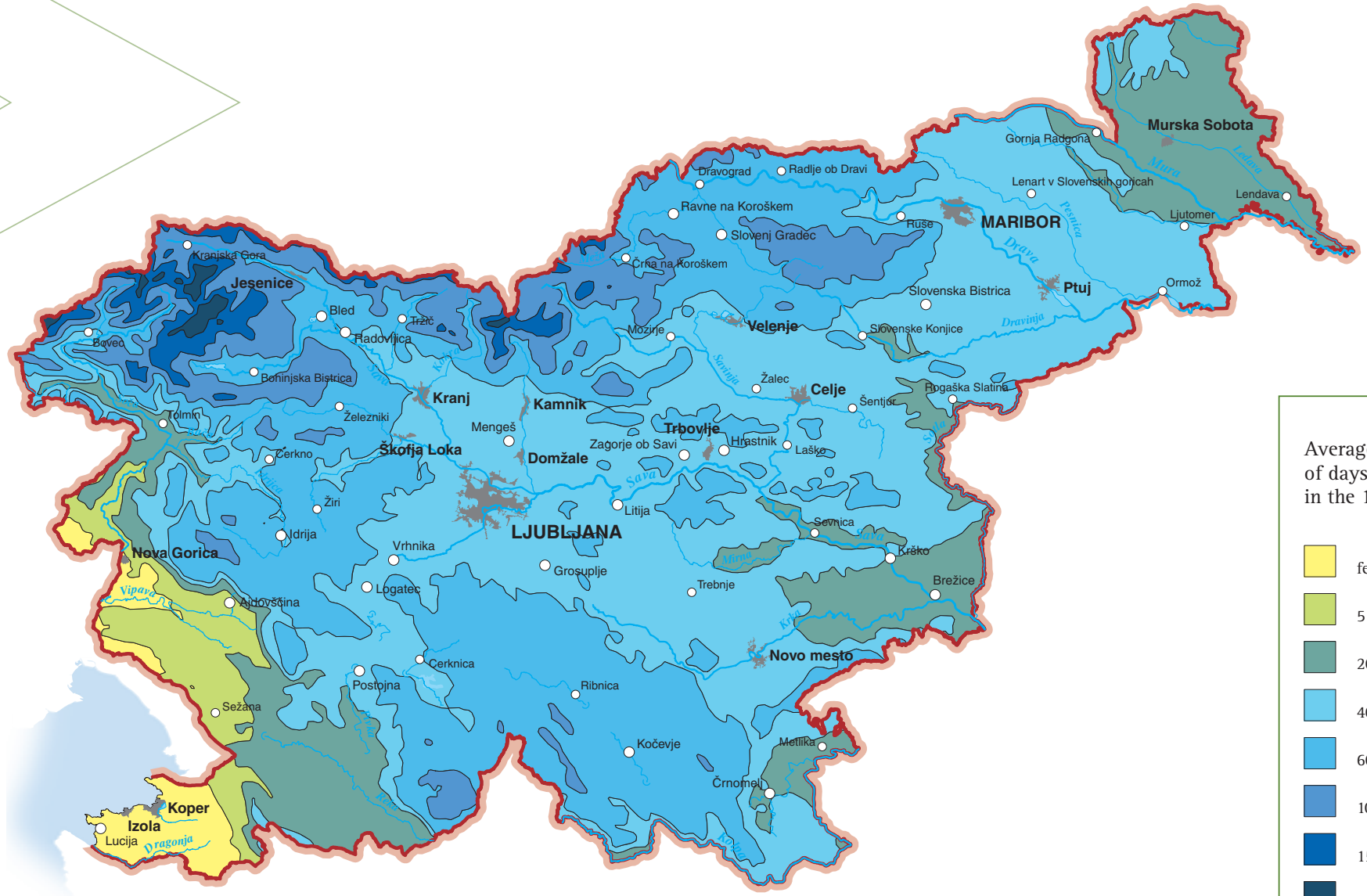
http://kazalci.arso.gov.si

- Precipitation and temperatures
- Extreme weather events
- Changes in glacier extent
- Annual growing season length

Data and sources:

Cegnar, T., 1998. Temperatura zraka. In: Geografski atlas Slovenije Država v prostoru in času. Ljubljana, Državna založba Slovenije.
Cegnar, T., 2006. Živeti s podnebnimi spremembami. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Dolinar, M., 2006. Podnebne razmere v Sloveniji (obdobje 1971–2000). Ljubljana, Environmental Agency of the Republic of Slovenia.
Map: Meteorological Archive, Environmental Agency of the Republic of Slovenia, 2007.

9. Snow cover



Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

In a large part of Slovenia, snowfall is a regular phenomenon which most frequently occurs at higher altitudes in the winter months, and in the high mountains snow can fall even in summer. Snowfall and snow cover have a significant impact on traffic and other facilities, and on watercourses. In the inland lowlands, snowing is common from late autumn to early spring. In the coastal area, snowing is rare and winters without snow are common. In the mountains, the most snow falls in the Julian Alps, while in the lowlands it snows heavily in Alpine valleys north of the Dinaric barrier. There, the snow cover can sometimes be up to two metres high or even more while the inland lowlands get much less snow. Weather events with winter storms and abundant snowfall can cause problems, especially at the end of winter, when new snow falls on the already existing snow cover. In a large part of Slovenia, the most snow falls between December and February, and in the high mountains, in March and April. In the lowlands, snow usually lasts for 50 days, and with increasing altitude, the number of days with snow cover increases as well. The highest altitudes of the Alps are covered by snow for the most part of the year.

Heavy snowfall is usually the result of a secondary cyclone in the Mediterranean. In such conditions, south-western winds blow over Slovenia, lifting the humid air mass across the Alpine-Dinaric barrier. Distinctive orographic precipitation occurs in the western and northern part which can last for several days. In the east, heavy snowfall is possible also with humid eastern winds. The consequence of heavy snowfall or several consecutive snowfalls is a thick snow cover which can cause a number of problems in traffic, supply with electricity and water, and roofs are threatened by the heavy snow cover. The worst consequences can occur in the mountains and hilly areas where avalanches present a serious threat. In the last few decades, avalanches have been among the most frequent causes of death due to natural disasters.

In the last few decades, the heaviest snowfall took place in February 1952, when 15 people died: at the end of January and early February, the snow cover was thick and an extraordinary snow event in mid February led to catastrophic consequences. Large avalanches were triggered from the slopes in north-western and western Slovenia, particularly in the upper Posočje region, and swept away or damaged a number of objects and blocked the roads so that a number of settlements were cut off from the rest of the world for days. The most recent abundant snowfall took place in mid February 1999, when snow cover in the major part of Slovenia was about half a meter thick, while in places the cover reached one meter. It caused some material damage and extensive problems with electricity supply. The thickest snow cover ever in Slovenia was measured on Mount Kredarica in April 2001. It measured seven metres and melted completely only by mid July. So far, the thickest snow cover measured in Ljubljana was in March 1895 and February 1952, when the meter indicated 149 and 146 cm, respectively.

The climate change we have witnessed in the last two decades is sometimes evident in the changed amount of newly fallen snow. In the 1971–2000 period, the amount of snow in western and northern Slovenia decreased but the trend is mostly statistically insignificant, which is partly the consequence of major differences between individual seasons. In eastern Slovenia, the amount of snow remained basically the same. So far, we have experienced a number of very different winters so that in the future, there will be winters with thick snow covers, but in the lowlands, these will be increasingly rare due to the higher temperatures. *(GV)*

In the 1971–2000 period, the amount of newly fallen snow in the western and northern Slovenia decreased but the trend is largely statistically insignificant, which is partly the consequence of major differences between individual seasons. In eastern Slovenia the amount of snow remained about the same.

Links to relevant indicators

http://kazalci.arso.gov.si

- Precipitation and temperatures
- Extreme weather events
- Changes in glacier extent

Data and sources:

Cegnar, T., 2006. Živeti s podnebnimi spremembami. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Kenda, M., in Zadravec, J., 2001. Posledice obilnih snežnih padavin februarja 1999 v elektrogospodarstvu. Ujma, No. 14–15.
Mulej, F., 1994. Snežni plazovi, smrtne žrtve in materialna škoda. Ujma, No. 8.
Trontelj, M., 1997. Kronika izrednih vremenskih dogodkov XX. Stoletja. Ljubljana, Environmental Agency of the Republic of Slovenia.
Vertačnik, G. in Dolinar, M., 2007. Obilna snežna odeja v Sloveniji. Ujma, No. 21.
Map: Meteorological Archive, Environmental Agency of the Republic of Slovenia, 2007.

10. Agricultural drought

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Drought is a continuous period without precipitation, with negligible precipitation, or with an unfavourable distribution of precipitation. According to the incidence, intensity and duration of the water deficit we distinguish meteorological, hydrological and agricultural drought. Meteorological drought is caused by the precipitation deficit in a continuous period, which is connected with the changed circulation of the atmosphere, above average values of air temperature, wind and low relative humidity. Hydrological drought is the consequence of a continuous deficit of precipitation necessary to feed surface waters and groundwater. It is indicated by a smaller river discharge, smaller flow in water reservoirs and lakes, and by the lower table of groundwater. Agricultural drought occurs when plants have a continuous deficit of water which prevents a normal development in the vegetation period. There is not enough precipitation or it occurs at the wrong time, causing damage to plants and, at the extreme stage, permanent withering. According to the period of occurrence, agricultural droughts are classified into spring, summer and autumn droughts, and according to the quantity of the reduced yield into temperate, medium-intensive or medium-distinctive, and intensive droughts. The precipitation deficit is often coupled with two other unfavourable variables: high air temperatures and strong winds.

In the past, droughts in Slovenia were a much rarer event than in the recent period. Studies of climate variability in Slovenia indicated an increasing number of major water deficits that generate droughts. With the existing weather variability, at least 15% of the area in Slovenia in the 1961–1990 period was endangered due to summer droughts. The most endangered regions are Primorska and north-eastern Slovenia. We also observed that major water deficit or drought has moved toward the inland. In the last 15 years, Slovenia was affected by seven summer droughts in 1992, 1993, 1994, 2000, 2001, 2003 and 2006. Agricultural drought has already caused considerable economic damage. In the structure of damage following all natural disasters, drought had a 70% share in 2000, 60% in 2001, and more than 80% share in 2003. In 2006 drought again caused considerable economic damage. More frequent agricultural droughts are the consequence of a number of factors, including increased and inefficient consumption of water, changed land use and climate change. Predictions of droughts anticipate a rise in the average annual temperature by 0.5 to 2.5°C by 2030 for Slovenia as well. It is highly probable that the amount of precipitation in the summer months will decrease, which will reflect in more frequent and more intensive droughts. This will make the most vulnerable areas in Slovenia that already face drought conditions even more vulnerable. Moreover, the predictions indicate that the drought hazard inflicted by climate change can increase significantly. According to the worst scenario, as much as 40% of agricultural land will be at risk. The 2003 climate conditions even exceeded the framework predictions in the change of the amount of precipitation – agricultural drought affected 60% of Slovenia's territory and ranked 2003 among the driest years in the 50-year period. *(AŽ)*

Slovenia belongs among the countries that face droughts relatively frequently. The highest drought incidence is in the coastal area, as well as in the south-western and north-eastern part of the country. Due to climate change, the drought incidence will increase in the future and affect an even larger share of agricultural areas.

Link to relevant indicators

http://kazalci.arso.gov.si

- Extreme weather events
- Annual growing season length
- Estimated damage caused by natural disasters

Data and sources:

Ranljivost slovenskega kmetijstva in gozdarstva na podnebno spremenljivost in ocena predvidenega vpliva. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/vreme/agrometeorologija/.

Sušnik, A., 2006. Vodni primanjkljaj v Sloveniji in možni vplivi podnebnih sprememb: Master's thesis. Ljubljana, University in Ljubljana, Biotechnical faculty.

Map: Meteorological Archive, Environmental Agency of the Republic of Slovenia, 2007.

Impact of the environment on health and quality of life

A quality of life depends on a number of social, cultural, economic and environmental factors. The latter have an impact on the health of the population. The most important environmental factors are: quality of air, drinking water and bathing waters, soil pollution, and electromagnetic and ionising radiation. The environment and people's health are threatened primarily by chemicals from the industry, trade, agriculture and households. Their use is on the increase and so is their adverse impact on people. They enter the body by ingestion, breathing or through the skin.

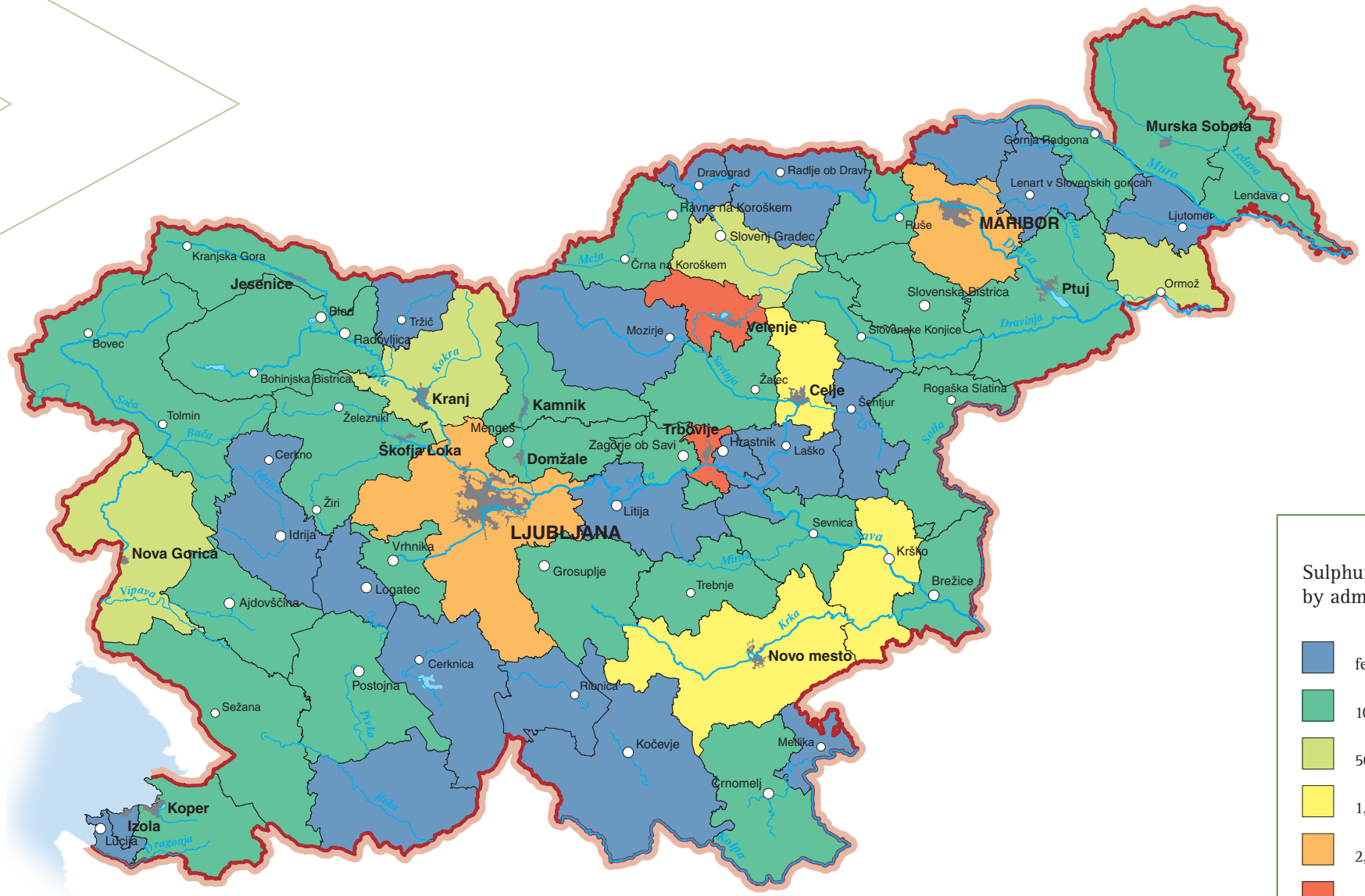
Air quality in Slovenia is improving. In spite of that, individual areas still remain overpolluted. This is indicated by the excessive sulphur and nitrogen oxide emissions mostly generated from the energy sector, and nitrogen dioxide emissions from road transport. The quality of ambient air throughout Slovenia is additionally decreased by overpollution with particles.

Groundwater is the most important source of drinking water in the country. Groundwater of the highest quality is found in the karst and fractured aquifers, and the lowest quality is in the north-eastern lowland part of Slovenia, where agriculture presents the main source of pressures. The content of the residues of pesticides in groundwater is decreasing, while the content of nitrates does not indicate any signs of decrease. In order to prevent and mitigate the pollution of groundwater sources as much as possible, they are protected by water protection areas with limitations for individual activities. For the most part, the quality of drinking water is suitable. The quality of surface waters is on the increase as well because 80% of the waters achieved good chemical status. The quality of natural lakes is affected by the accumulation of nutrients, and the quality of the artificial retention basins is also affected by heavy metals and pesticide decomposition products.

The quality of bathing waters is regularly monitored to protect the health of the bathers. In the areas of inland bathing waters, the quality is on the increase. In 2006, all bathing waters in Gorenjska, Goriška and Notranjska met the requirements of the Bathing Water Directive.

Among natural disasters, droughts, floods, hale and strong winds have caused the most damage in the past decade.

11. Sulphur dioxide emissions



Sulphur dioxide emissions by administrative units in 2003

- fewer than 100 tons
- 100 to 500 tons
- 500 to 1,000 tons
- 1,000 to 2,500 tons
- 2,500 to 10,000 tons
- 10,000 tons and more

Scale: 1 : 1,100,000. Source: Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia, 2003.

Point sources present the main source of ambient air pollution with sulphur dioxide (SO_2). They include thermal power plants and heating plants, as well as smaller boiler rooms in urban areas using fossil fuels (coal, oil) as fuel. The cartographic presentation takes into account SO_2 emissions by administrative units in 2003. They include emissions from large point sources, industrial and non-industrial combustion, transport and production processes. It is evident from the map that SO_2 sources are not evenly distributed throughout Slovenia. The most polluted areas are those around the Šoštanj and Trbovlje thermal power plants. Pollution with SO_2 in Zasavje is a burning problem mostly due to its unfavourable basin position and frequent temperature inversions, especially in the winter months. In the last few years, the situation has improved, mostly due to the operation of the device for desulphurisation of fuel gases at the Trbovlje thermal power plant. On the other hand, the Šoštanj thermal power plant is solving the SO_2 problem in the frame of a rehabilitation programme, by using natural gas with low sulphur content.

In Slovenia, SO_2 emissions are decreasing. The large, 82% decrease in the 1980–2005 period is mostly due to the decrease in point source emissions, such as thermal power generation objects and small fire boxes, as well as mild winters and the activation of the Krško Nuclear Power Plant. The adoption of a standard requiring lower content of sulphur in liquid fuels in the 1980–1990 period had a positive effect too. In 1995 and 2001, respectively, desulphurisation devices started to operate on Blocks 4 and 5 of the Šoštanj thermal power plant and brought more improvements in the energy industry. The energy sector and industry (industrial boiler houses) continue to contribute the largest share to the SO_2 pollution.

In 2006, Slovenia ratified the Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone and is committed to comply with it as signatory to the Convention on Long-Range Transboundary Air Pollution (CLRTAP). Together with the 2001/81/EC Decree on National Emission Ceilings for Atmospheric Pollutants, the convention determines 27,000 tons of SO_2 as the emission ceiling that has to be attained by 2010. In 2005, total SO_2 emissions reached 42,000 tons. To achieve the set objective by 2010, additional national measures are anticipated in the field of energetic efficiency, replacement of solid fossil fuels with natural gas and renewable energy sources. Slovenia has also envisaged stricter emission standards for vehicles and measures in the field of the prevention and integral control of industrial pollution (use of best available technologies). *(NK)*

Sulphur dioxide (SO_2) emissions affect people's health and their quality of life, mostly due to the heavy acidification effect. SO_2 is generated mostly in burning fossil fuels (oil, coal), and the energy sector and industry contribute the most to these emissions.

Link to relevant indicators

http://kazalci.arso.gov.si

- Emissions of sulphur dioxide
- Emissions of nitrogen oxide
- Emissions of acidifying and eutrophying substances
- Emissions of ozone precursors
- Air quality
- Air pollution with sulphur dioxide
- Air pollution with particulate matter
- Greenhouse gas emissions

Data and sources:

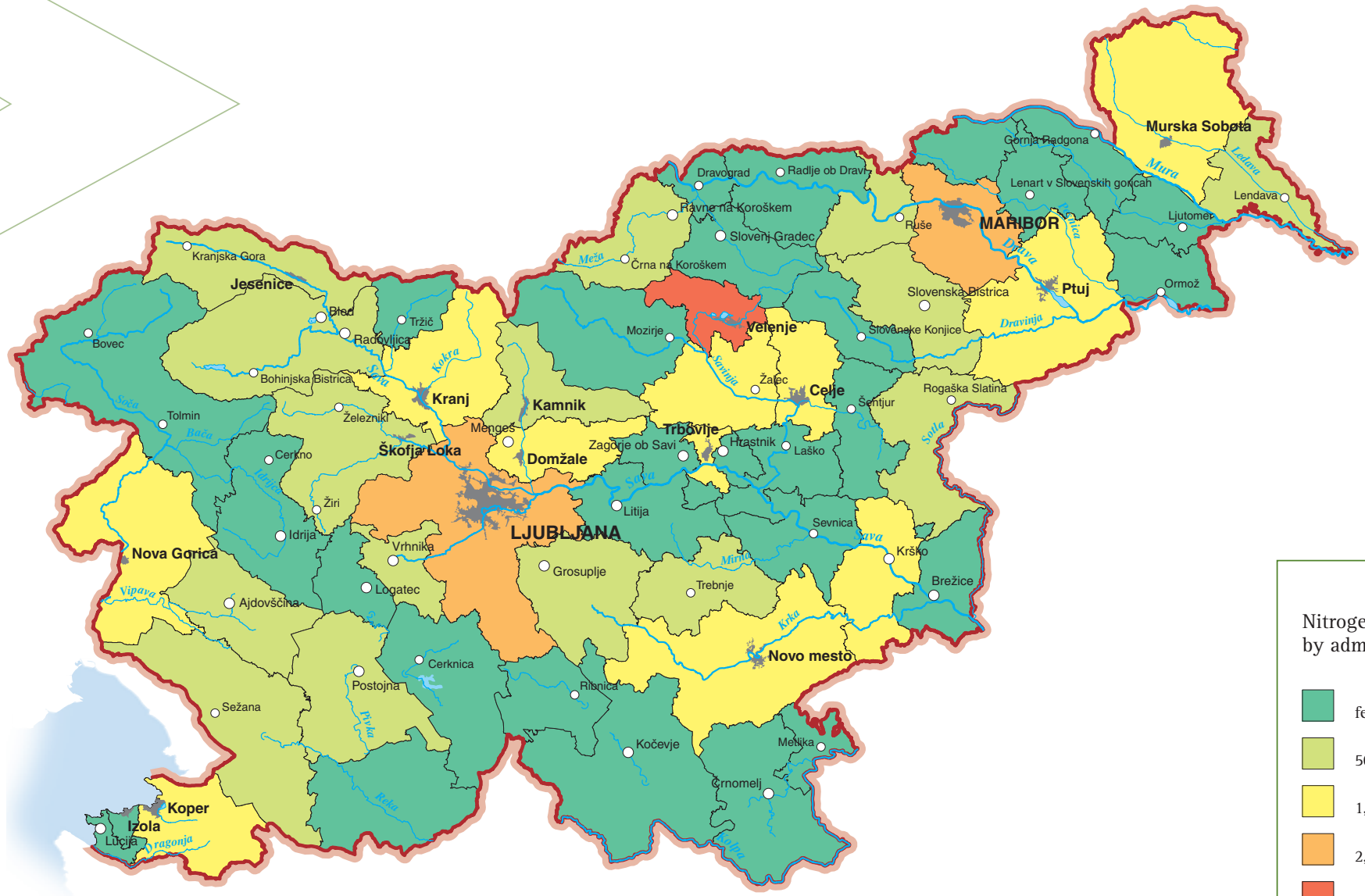
National Emission Inventory, Environmental Agency of the Republic of Slovenia, 2001.

Informative Inventory Report 2007 for Slovenia: Submission under the UNECE Convention on Long-range Transboundary Air Pollution. 2007. Ljubljana, Ministry of Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Map: Planinšek, A., Čemas, D., Šegula, A., Turk, D., Kovač, N., Lešnjak, M., Rode, B., Podobnik, R., Marolt, D., 2003. Predhodna ocena onesnaženosti zraka z SO_2, NO_2, delci, svincem, CO in benzenom v Sloveniji. Ljubljana, Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia.

12. Nitrogen dioxide emissions



Nitrogen dioxide emissions by administrative units in 2003

- fewer than 500 tons
- 500 to 1,000 tons
- 1,000 to 2,500 tons
- 2,500 to 10,000 tons
- 10,000 tons and more

Scale: 1 : 1,100,000. Source: Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia, 2003.

The main sources of pollution with nitrogen dioxide (NO_2) are line sources, for example traffic, and to a lesser degree, point sources, such as thermal power plants and heating plants. The cartographic presentation takes into consideration NO_2 emissions by administrative units in 2003. They include emissions from large point sources, industrial and non-industrial combustion, transport and production processes.

Increased NO_2 emissions are found mostly at road junctions, in major urban centres (Ljubljana, Maribor) and in the area of the Šoštanj thermal power plant. Pollution with NO_2 is a burning problem mostly due to the increased volume of road and freight transport and non-sustainable consumption of final energy. The transport sector is the largest consumer of final energy in Slovenia, which is proven by the fact that in the 1992–2002 period the consumption of final energy increased by as much as 59% and is still on the rise. It is almost entirely (99%) based on the consumption of fossil fuels, with significant contributions from road and freight transport. Slovenia is recording an alarming increase of transit freight transport on its roads, mostly at border crossings with Hungary. In 2005, these border crossings recorded a 50% increase in freight transit.

A look at NO_2 emissions in the 1990–2005 period points to an increase in the years between 1990 and 1997, and a decrease from 1997 on. The increase is due to the increased volume of road traffic, and the decrease to the rehabilitation measures in the energy sector, increased use of catalyst converters, and the renewal of the vehicle fleet. In spite of that, road traffic and the energy sector continue to contribute the largest share of NO_2 emissions.

In 2006, Slovenia ratified the Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone and is committed to comply with it as signatory to the Convention on Long-Range Transboundary Air Pollution (CLRTAP). Together with the 2001/81/EC Decree on National Emission Ceilings for Atmospheric Pollutants, the convention specifies 45,000 tons of NO_2 as the emission ceiling that has to be attained by 2010. In 2005, total NO_2 emissions reached 58,000 tons. To achieve the set objective by 2010, additional measures are anticipated in the field of energetic efficiency, replacement of solid fossil fuels with natural gas and renewable energy sources. Slovenia has also envisaged stricter emission standards for vehicles and measures in the field of the prevention and integral control of industrial pollution (use of best available technologies). *(NK)*

Nitrogen dioxide emissions (NO_2) cause adverse effects on people's health and ecosystems. In addition to oxidising ability (with increased solar radiation, it causes the generation of ground-level ozone), NO_2 has a strong acidifying effect and accelerates the occurrence of corrosion. In Slovenia, road traffic and the energy sector contribute the largest share to the nitrogen oxide emissions.

Link to relevant indicators

http://kazalci.arso.gov.si

- Emissions of nitrogen oxides
- Emissions of sulphur dioxide
- Emissions of acidifying and eutrophying substances
- Emissions of ozone precursors
- Air quality
- Air pollution with nitrogen oxides
- Air pollution with sulphur dioxide
- Greenhouse gas emissions
- Transport emissions of air pollutants

Data and sources:

National Emission Inventory, Environmental Agency of the Republic of Slovenia, 2001.
Informative Inventory Report 2007 for Slovenia: Submission under the UNECE Convention on Long-range Transboundary Air Pollution. 2007. Ljubljana, Ministry of Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Environmental Indicators: Transport, URL: http://kazalci.arso.gov.si/kazalci/index_html?Sku_id=27&tSku_naziv=PROMET&ttip_skup=1 (accessed on 29 October 2007)
Map: Planinšek, A., Čemas, D., Šegula, A., Turk, D., Kovač, N., Lešnjak, M., Rode, B., Podobnik, R., Marolt, D., 2003. Predhodna ocena onesnaženosti zraka z SO_2, NO_2, delci, svincem, CO in benzenom v Sloveniji. Ljubljana, Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia.

13. Air quality

Levels of air pollution due to sulphur dioxide in 2003

Exceeded limit value

- level 1
- level 2

Limit value is not exceeded

- level 3
- level 4
- level 5

Scale: 1 : 1,100,000. Source: Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia, 2003.

In view of air quality, Slovenia is divided into four zones (SI1, SI2, SI3 and SI4) and two agglomerations (SIL – Ljubljana, SIM – Maribor). The division in the figure presents the state of air quality in 2003 in Slovenia when the preliminary evaluation of ambient air pollution was elaborated. The pollution areas are combined statistical units, and agglomeration boundaries are specified by the city municipality boundaries. The worst ambient air quality due to sulphur dioxide pollution (SO_2) is found in the SI2 zone. This zone is the location of the largest NO_2 sources in Slovenia – the Šoštanj and Trbovlje thermal power plants and industrial plants. This problem is continuously improving, mostly due to the additional rehabilitation measures implemented by the state. Particles generated from transport, fire boxes, industry and thermal power present another major pollution problem. They are dispersed throughout Slovenia and in addition to exceeded ozone concentrations, particle air pollution is becoming a principal problem in providing quality ambient air. Particularly problematic is the synergy impact of particles and gaseous pollutants on people's health.

Traffic is considered a major line source pollutant which is dispersed throughout Slovenia and contributes a large share to the nitrogen dioxide (NO_2) air pollution. Apart from traffic, thermal power facilities too are the sources of NO_2 but their emissions in the area of influence are not high enough to cause exceedance of NO_2 limit values. Lead emissions in Slovenia have been decreasing since 1994, when the use of catalyst converters in new cars with petrol engines became compulsory. The pricing policy contributed an important share by lowering the prices of leaded petrol, and in 2001 the use of leaded petrol in transport was banned altogether. This eliminated the largest non-point source of lead in Slovenia. Traffic presents the largest source of carbon monoxide (CO). Industrial plants contribute their share to the emissions as well. Carbon monoxide concentrations in ambient air are very low, thus CO air pollution does not present a major problem in Slovenia. The situation with benzene air pollution is similar; in the last few years, benzene emissions have decreased significantly, mostly due to the use of catalyst converters in cars with petrol engines. Also, the European standard permitting only 1% content of benzene in the fuel was introduced. Shorter city rides when the catalyst converter is not warmed up are problematic because they contribute significantly to the pollution of ambient air in the cities.

Ozone is a photochemical oxidant generated from photochemical reactions with ozone precursors. The most important group of precursors are nitrogen oxides and carbohydrates. The main sources of these pollutants are transport and chemical industry, and to a certain degree natural resources. Reactions resulting in ozone take place in the presence of sunlight. The reaction balance is influenced by the amount of the sunlight. More sunlight generates more ozone. The state of air pollution with ozone is described with a comparison of concentrations with target values and set long-term values. In Slovenia, measurements at all monitoring sites indicated exceeded target values, which means that all areas are classified into the worst quality class. *(NK)*

Air quality affects people's health and quality of life. Increased concentrations of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) in ambient air cause damage in ecosystems and buildings – corrosion, while particle pollution and ozone pollution may cause numerous respiratory diseases. In Slovenia, the particle pollution is the most problematic.

Link to relevant indicators

http://kazalci.arso.gov.si

- Emissions of acidifying and eutrophying substances
- Emissions of ozone precursors
- Air quality
- Air pollution with particulate matter
- Air pollution with nitrogen oxides
- Air pollution with ozone
- Air pollution with sulphur dioxide
- Transport emissions of air pollutants

Data and sources:

National Emission Inventory, Environmental Agency of the Republic of Slovenia, 2001.
Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Decision on the Designation of Areas and Level of Pollution Caused by Sulphur Dioxide, Nitrogen Oxides, Particulates, Lead, Benzene, Carbon Monoxide and Ozone in Ambient Air, Official Gazette RS, No. 72/2003.
Database of the National Network of Automatic Measurements for Air Quality Monitoring, Environmental Agency of the Republic of Slovenia, 2003.
Map: Planinšek, A., Čemas, D., Šegula, A., Turk, D., Kovač, N., Lešnjak, M., Rode, B., Podobnik, R., Marolt, D., 2003. Predhodna ocena onesnaženosti zraka z SO_2, NO_2, delci, svincem, CO in benzenom v Sloveniji. Ljubljana, Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia.

14. Catchment areas and river basins

Water catchment areas and main river basins

watershed between two catchment areas

The Black Sea catchment area

the Mura river basin

the Drava river basin

the Sava river basin

the Kolpa river basin

The Adriatic Sea catchment area

the Soča river basin

river basins of other Adriatic rivers

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Slovenia is divided into two catchment areas by the Adriatic Sea – Black Sea watershed: 81% (16,423 km^2) of the territory belongs to the Danube or the Black Sea catchment area, and 19% to the Adriatic catchment area. According to central rivers, they are divided into the Mura, Drava and Sava with the Kolpa river basins in the Danube catchment area, and the Soča river basin and the river basins of other Adriatic rivers in the Adriatic catchment area.

The hydrographical diversity of Slovenia is the result of the paleogeographic development of the river network, neotectonics and geographical characteristics, particularly a large share of carbonate rocks (about 40% of Karst) and Quaternary sediments (about 20%), relief characteristics with steep slopes, and climatic diversity with an above-average quantity of precipitation. The consequence of all these characteristics, more or less distinctly pronounced in individual areas, is the presence of diverse river regimes including the rain, rain-snow, snow-rain, and the snow regime.

Slovenian watercourses are short due to the rough terrain of the territory and rock composition. The total length of the river network is 26,989 km and only 46 watercourses are longer than 25 km, which is 22% of the network. The Sava, Drava, Kolpa and Savinja rivers are longer than 100 km. From the springs of the Sava Dolinka in Zelenci to the Croatian border, the Sava measures 221 km. The Savinja too exceeds 100 km in length; it disappears in the gravel of the Logarska dolina valley and appears again in the spring of the Črna (95 km). The Soča (95.8 km to the Italian border) and the Krka (94 km) rivers are of about the same length. Only five watercourses longer than 25 km are located in the Adriatic catchment area.

According to the size of the river basins, Slovenia does not have large rivers, either. The Black Sea catchment area in Slovenia presents only 2% of the entire Danube catchment area, and the Slovenian Sava and Kolpa river basins present 12 percent of the entire Sava catchment area. According to the size of the water basin catchment area, the Drava is Slovenia's largest river, the river basin of which measures in excess of 15,500 km^2 to the border with Croatia. Four fifths of the river basin are located in Austria and Italy. The Mura water basin catchment area exceeds 11,000 km^2 before leaving Slovenia, but almost nine tenths of it are located in Austria, and a small part in Hungary. The Sava is in third place, its water basin catchment area measuring 10,870 km^2. In this respect, too, the Sava is Slovenia's largest river.

Slovenian flowing waters form a very dense river network; its density averages as much as 1.33 km/km^2. The density is not equal throughout Slovenia, though. The differences are the result of the hydrogeological rather than climatic conditions. The Dinaric Slovenia has a sparse river network. High Dinaric plateaus, for example, otherwise belonging among the most water-abundant areas, have no river network at all. They have a major water balance surplus, which runs off as groundwater to their edge, feeding abundant karstic springs. Similar conditions are found in the karstic Alpine area, where the areas without river networks are not so extensive. A sparse river network is found in the central part of gravel flatlands with deep groundwater (for example Kranjsko polje, Sorško polje, Ljubljansko polje and Dravsko polje).

The river network on impermeable and poorly permeable rocks in Slovenia is dense. The Reka, the Sava's tributary near Litija, has a 96 km^2 river basin and its density is 2.8 km/km^2. Above the mouth of The Črni potok, the Reka River still has about 40 km^2 of water basin catchment area in sandstone and claystone and a density of 3.5 km of watercourses per km^2. It should be mentioned that riverbeds or channels, as well as the entire river network, are constantly changing and adapting to the conditions in the local water circulation system. Some changes are rapid, for example, when the shape or the course of the channel changes in high water conditions. Other changes are more gradual, for example, when the riverbed dries out due to the lowered level of groundwater and karstification. In the last few hundred years, people have been changing the river network directly or indirectly. *(NZ)*

The Adriatic-Black Sea watershed separates Slovenia into the Black Sea catchment area with 81% of the territory and the Adriatic catchment area with 19%. Due to the rough terrain and heterogeneous rock composition the watercourses are short and form a dense river network.

Link to relevant indicators

http://kazalci.arso.gov.si

- River balance
- Quality of watercourses
- Organic pollution and the self-purifying capacity of rivers

Data and sources:

Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
State of the Environment Report 2002. URL: http://www.arso.gov.si/varstvo%20okolja/poro%C4%8Dila/poro%C4%8Dila%20o%20stanju%20okolja%20v%20Sloveniji/
Vodno bogastvo Slovenije. 2003. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Map: Hidrografska območja. Digital Map and Data Storage, Environmental Agency of the Republic of Slovenia, 2007.

15. Quality of surface water bodies

Chemical status of surface watercourses at monitoring sites in 2005

- good
- poor

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

For the purpose of water management, surface waters are divided into water bodies. According to the Water Framework Directive, they are classified into four types: rivers, lakes, transitional waters and coastal waters. Hydrologically or morphologically reshaped water surfaces are defined either as artificial or heavily modified water bodies. The transitional water bodies are not found in Slovenia because in view of the set criteria, their areas are too small; therefore they are classified as water bodies of watercourses or coastal water bodies. Thus Slovenia exhibits 155 surface water bodies complying with the Water Framework Directive regulations, 134 water bodies of watercourses, 15 water bodies of lakes and artificial lake developments, and six coastal water bodies; 22 of the above mentioned have characteristics of heavily modified water bodies, and four of artificial water bodies (3%).

According to the results of regular monitoring of the water quality of surface watercourses in 2005, good chemical status was established for 73 monitoring sites, and poor for 15. In most cases the poor chemical status was established due to the exceeded limit values for phenolic substances, adsorbable organic halogens (AOX), metolachlor, anion active detergents and pesticides. Limit values for mineral oils and polychlorinated biphenyls (PCB) were exceeded at individual monitoring sites.

The main sources of the pollution of surface watercourses are point sources (emissions of industrial and communal waste waters and rainwater from urbanised areas). Standing or slowly flowing surface waters where eutrophication occurs due to excessive amounts of nutrients present a special problem.

Due to "standing waters", lakes, retention basins and large river accumulations are more susceptible to the input of different substances from the catchment areas than flowing surface waters. The accumulation of phosphorous and nitrate nutrients and the eutrophication connected with it is the basic problem of permanent natural lakes like Lake Bled and Lake Bohinj. In addition to nutrients, artificial retention basins face the problem of accumulation of other pollutants, such as heavy metals and phytopharmaceutical products with decomposition products.

The OECD criteria with five trophic categories continue to be used for the evaluation of the state of lakes. Successful rehabilitation activities reestablished Lake Bled among the mesotrophic lakes years ago. In spite of the increased pressures from the lake catchment area, the state of the lake in 2005 did not change significantly due to the operation of the rehabilitation facilities. The state of Lake Bohinj in 2005 did not change significantly relative to the state in the past either, and according to the OECD criteria, it ranks among the oligotrophic lakes. In 2005, the content of total phosphorus in all retention basins of central and north-eastern Slovenia, i.e. the Šmartinsko, Slivniško, Perniško and Ledavsko jezero lakes, exceeded 100 µg/l. According to the above mentioned criteria, this is characteristic of hypereutrophic lakes. The content of nitrogen compounds in these lakes also points to the excessive load of nutrients. Poor chemical status was established in the effluent from the Ledavsko jezero lake 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 thus rank among the mesotrophic retention basins. Lake Cerknica hardly experiences eutrophication due to intermittence and a large metabolic role of wetland plants. The accumulation of different types of pollutants, mostly heavy metals from industrial plants in the wider and narrower catchment area, presents a much larger problem. Still, good chemical status was established in 2005 at Stržen, the Cerkniščica and Rak. *(NZ)*

In 2005, good chemical status was established at 83% monitoring sites on surface watercourses, and poor at 17%. The accumulation of phosphorous and nitrogen nutrients and the eutriphication process connected with it is the basic problem of permanent natural lakes like Lake Bled and Lake Bohinj. Artificial retention basins are facing the problem of accumulation of nutrients as well as other pollutants, for example heavy metals and phytopharmaceutical products with decomposition products.

Link to relevant indicators

http://kazalci.arso.gov.si

- River balance
- Quality of watercourses
- Organic pollution and the self-purifying capacity of rivers
- Phosphorus in lakes

Data and sources:

Izvajanje Vodne direktive v Sloveniji: Predstavitev prvih ocen možnosti doseganja okoljskih ciljev za vodna telesa v Sloveniji po načelih Vodne direktive. 2006. Ljubljana, Institute for Water of the Republic of Slovenia.

Monitoring kakovosti površinskih vodotokov v Sloveniji v letu 2005. 2007. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/vode/reke/

Poročilo o kakovosti jezer za leto 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia, Ljubljana, October 2006. URL: http://www.arso.gov.si/vode/jezera/

Map: Uniform Database on Water Quality Monitoring, Environmental Agency of the Republic of Slovenia, 2007.

16. Quality of groundwater bodies

Chemical status of groundwater bodies in 2005

- good chemical status
- poor chemical status
- chemical status not evaluated
- no monitoring sites
- drinking water pumping stations with samples not in conformity with the demands of the rules

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Groundwater means all water which is below the surface of the ground in the saturated zone and in direct contact with the ground or subsoil. It is found in geological structures called aquifers. Groundwater heavily exceeds the volume of surface water bodies and presents the most important source of drinking water in Slovenia, supplying about 97% of the population. This is why maintaining an appropriate quality and quantity of groundwater and protecting its sources from pollution is one of the main objectives of sustainable water management.

The Water Framework Directive distinguishes aquifers in the Slovenian territory by the type of porosity and abundance. A more detailed classification further divides them into the intergranular, fractured, and karst aquifers, and groups them according to the basic petrographic composition. Karst aquifers are also divided according to the degree of karstification. The main areas of groundwater are found in aquifers with intergranular porosity in flatland gravelly-sand deposits along Slovenia's largest rivers. Based on the described classification, Slovenia specified 165 aquifer systems combined into 21 groundwater bodies according to their characteristics. Thus, 18 groundwater bodies were specified in the Danube catchment area, and three in the Adriatic.

The quality of groundwater for individual years is evaluated on the basis of the chemical status. The highest quality was achieved in the karst and fractured aquifers, mostly in the less populated hilly areas. In 2005, good chemical status was specified for seven groundwater bodies, and estimated for four bodies. The evaluation of the chemical status was not possible in two groundwater bodies, and in six bodies there are no monitoring sites.

The groundwater bodies under the most pressure are found in the north-eastern lowland part of Slovenia where aquifers with intergranular porosity prevail. Available information for 2005 indicates excessive pollution in two such bodies called the Drava and the Mura basins. Groundwater is mostly susceptible to pollution from non-point sources (agriculture and urbanisation), which is the most pronounced in the very north-eastern part of Slovenia. Critical pollutants significantly contributing to the pollution are desetilatrazine, nitrates and atrazine. There is a predominantly falling trend in the contents of atrazine and desetilatrazine, indicating that the ban on the use of products that contain these elements was effective. Individual places still indicate an increasing trend of nitrogen content, which is alarming.

In groundwater bodies called the Western Slovenske gorice and Eastern Slovenske gorice, regular quality monitoring has not yet been established so it is not possible to assess the trends of characteristic pollutant contents in the groundwater. Two other most important groundwater bodies in alluvial aquifer systems, i.e. the Krško basin and the Sava basin with Ljubljansko barje, exhibit significant loads with locally exceeded impacts, but the results of the existing regular quality monitoring indicate good chemical status. *(NZ)*

Slovenia has 21 groundwater bodies. Groundwater in the karst and fractured aquifers, mostly located in the less populated and hilly areas, exhibited the best quality. The most polluted underground water bodies are found in the north-eastern lowland part of Slovenia, where aquifers with intergranular porosity prevail. In 2005, two underground water bodies indicated excessive pollution, called the Drava and the Mura basins.

Link to relevant indicators

http://kazalci.arso.gov.si

- Nitrates in groundwater
- Pesticides in groundwater
- Drinking water quality

Data and sources:

Izvajanje vodne direktive na Vodnem območju Donave. Ministry of the Environment and Spatial Planning, July 2005. URL: http://www.wfd.mop.gov.si/porocilo_donava.pdf

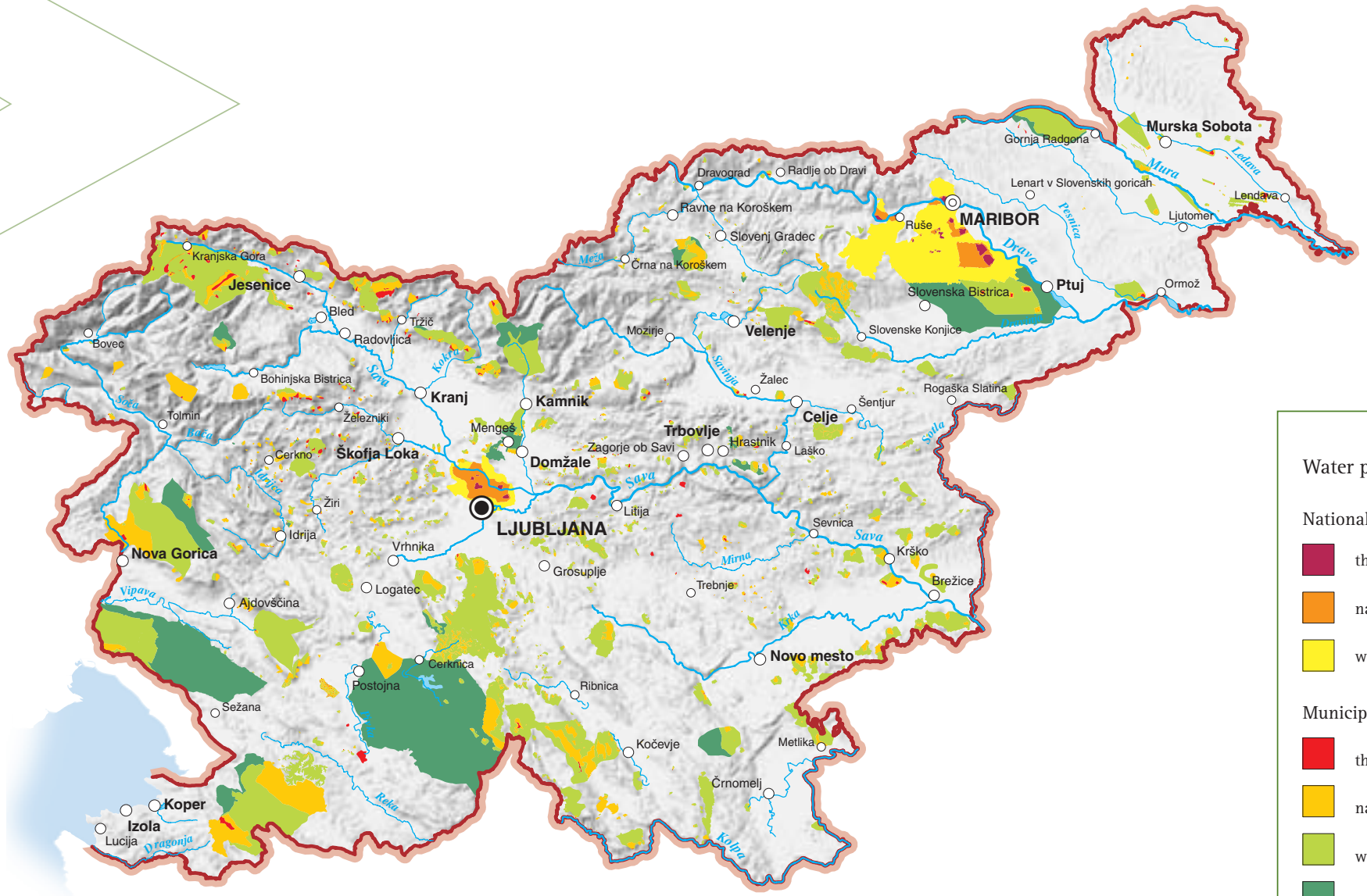
Izvajanje Vodne direktive v Sloveniji: Predstavitev prvih ocen možnosti doseganja okoljskih ciljev za vodna telesa v Sloveniji po načelih Vodne direktive. 2006. Ljubljana, Institute for Water of the Republic of Slovenia.

Monitoring kakovosti podzemne vode v Sloveniji v letih 2004 in 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Poročilo o stanju okolja 2002. URL: http://www.arso.gov.si/varstvo%20okolja/poro%C4%8Dila/poro%C4%8Dila%20o%20stanju%20okolja%20v%20Sloveniji/

Map: Uniform Database on Water Quality Monitoring, Environmental Agency of the Republic of Slovenia, 2007.
Database on the Systems for the Supply with Drinking Water, Institute of Public Health of the Republic of Slovenia 1999/2003.

17. Water protection areas



Water protection areas

National level

- the narrowest area
- narrow area
- wider area

Municipal level

- the narrowest area
- narrow area
- wider area
- area of influence

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Water protection areas are protected in order to best prevent and limit the point and non-point sources of pollution which can pollute drinking water. Protection measures, prohibitions and limitations refer to the construction of objects, as well as management of agricultural and other types of land, and they exercise different levels of severity in individual internal water protection areas.

Slovenia has a relatively sufficient amount of water to provide a continuous supply of drinking water to the population, but individual areas already indicate periodical deficits. It is evident from the increasing consumption of water and anticipated development plans that in individual areas, supply with drinking water will become a limiting factor. To a certain degree, the increasing demands for water are the consequence of economic development and inclusion of new water resources into the water supply system, and the consumption of water in households is on the increase as well. The mentality and actions of people concerning drinking water have started to change only recently.

Until 2002, water was treated as public property. Protection of drinking water was left to local communities, and there was no uniform methodology to help deal with the situation. The new Water Act from 2002, however, defines water as a natural public asset. The Act transferred the protection competences to the Government of the Republic of Slovenia and established a uniform methodology for defining water protection areas. In addition to water bodies used for the abstraction of water or intended for the supply of the population with drinking water, the Act can also protect the areas used for the abstraction of mineral, thermal, thermo-mineral and other groundwater for the production of drinks. In 2004, the water protection area of the Ljubljansko polje aquifer water body was the first to be defined according to the new methodology. In 2006, it was followed by the water protection area of the Selniška dobrava aquifer water body, and in 2007, the water protection area of the Ruše, Vrbanski plato, Limbuška dobrava and Dravsko polje aquifer water body, the water protection area of the Dravsko-Ptujsko polje aquifers water body, and the Apaško polje aquifer water body. The last two have not yet been included in the cartographic presentation.

Different levels of protection in water protection areas enable the formation of internal areas or water protection zones with different protection regimes, limitations, bans and measures. Protection measures in the narrow and the narrowest protection zones are stricter than in the wider areas and areas of influence. Rock composition of the surface, surface and underground watersheds, tectonics and hydrogeological characteristics of the territory provide the base for the definition of the water protection zones.

In order to carry out integral monitoring and management of the drinking water resources, the Environmental Agency of the Republic of Slovenia established a database of the existing water resources intended for the supply of the population, including the current protection regime. 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. It also contains 422 acts on the protection of drinking water resources. Water protection areas encompass a total of 442,822 hectares, which is almost a fourth of Slovenia. *(NZ)*

Water protection areas are protected in order to prevent and limit the sources of pollution which can pollute drinking water as much as possible. In individual internal water protection areas, protective measures, bans and limitations exercise different levels of severity. Water protection areas encompass a total of 442,822 hectares, which is almost a quarter of Slovenia.

Link to relevant indicators

http://kazalci.arso.gov.si

- Use of water resources
- Household water consumption
- Drinking water quality
- Nitrates in groundwater
- Pesticides in groundwater

Data and sources:

Izvajanje Vodne direktive v Sloveniji: Predstavitev prvih ocen možnosti doseganja okoljskih ciljev za vodna telesa v Sloveniji po načelih Vodne direktive. 2006. Ljubljana, Institute for Water of the Republic of Slovenia.
Water Protection Area Register. Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia, 2007.
Decree on the Water Protection Zone for the Aquifer of Ljubljansko polje. Official Gazette RS, No. 120/2004, 7/2006.
Decree on the Water Protection Zone for the Aquifer of Selniška dobrava. Official Gazette RS, No. 72/2006.
Decree on the Water Protection Zone for the Aquifers of Ruše, Vrbanski plato, Limbuška dobrava and Dravsko polje. Official Gazette RS, No. 24/2007.
Decree on the Water Protection Zone for the Aquifers of Dravsko-ptujsko polje. Official Gazette RS, No. 59/2007.
Decree on the Water Protection Zone for the Aquifer of Apaško polje. Official Gazette RS, No. 59/2007.
Waters Act. Official Gazette RS, No. 67/2002, 110/2002 – ZGO-1, 2/2004 in 41/2004 – ZVO-1.
Map: Interaktivni naravovarstveni atlas: Vode, Vodovarstvena območja virov pitne vode. URL: http://kremen.arso.gov.si/NVatlas/.

18. Inland bathing water quality

Inland bathing water quality in 2006

- not complying with mandatory values
- complying with mandatory values
- complying with guide values

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, Institute of Public Health of the Republic of Slovenia, 2007.

In Slovenia, bathing waters are divided into natural bathing sites with organised bathing and bathing water areas, where people can bathe at their own responsibility. In 2006, Slovenian inland waters had 14 bathing water areas and four natural bathing sites. In all natural bathing sites, quality is monitored throughout the bathing season, which is defined from 15th June to 31st August for inland waters. In this period, sampling takes place every 14 days, and one sample is analysed before the official opening of the bathing season. In accordance with the Bathing Water Directive, the suitability of bathing waters is established on the basis of physical-chemical and microbiological parameters. According to the mandatory requirements, bathing water is unsuitable if more than 5% of the samples in the season qualify as unsuitable.

In Gorenjska, there were no non-compliant bathing waters in 2006. All waters met even the stricter or guideline requirements of the Bathing Water Directive. All bathing waters in Goriška, too, were compliant with the mandatory values, and the Soča in Čezsoča and the Nadiža above Podbela to Robič satisfied the stricter criteria. The quality compliant with the stricter values was met at Lake Cerknica as well. The situation is slightly worse in Dolenjska, because bathing areas on the Krka (Žužemberk and Straža) and the Kolpa rivers (the Učakovci – Vinica bathing area) were not compliant with the limit values. The cause was an increased value of one of the microbiological parameters in a single sample, which presented more than 5% of all samples. Other bathing waters on the Kolpa River meet the mandatory requirements of the Directive. The causes for microbiological pollution are the following: discharges from municipal waste water treatment plants, other discharges of faecal, rainwater or mixed type, rain washing out embankments, as well as bathers. Non-compliant samples were determined in August, which was in 2006 an abnormally cloudy and often rainy month. This very precipitation might have been the cause of the non-compliance due to embankment being washed out in storms and downpours.

The quality of Slovenian bathing waters has improved: in 2005, half of the inland bathing waters were non-compliant with the mandatory values, and in 2006, only three failed to comply, which represents 16.7%. The quality of inland waters has improved in the bathing areas in the Kolpa River in Adlešiči, Dragoša – Griblje and Prelesje – Srednji Radenci. In Goriška, the quality improved in the Soča River near Solkan and Tolmin, and at the confluence of the Idrijca and the Bača rivers.

The compliance of inland bathing waters with the guideline values has improved by 5%. Šobčev bajer is the latest bathing site to achieve this quality, and the quality from the previous year is maintained at the bathing areas at Lake Bled (the Vila Bled Hotel and the Grand hotel Toplice natural bathing sites, and the Castle bathing area), as well as the Nadiža above Podbela to Robič, the Soča near Čezsoča, Fužinski zaliv, Lake Bohinj and Dolenje jezero – Otok bathing areas. *(NZ)*

In 2006, 14 bathing water areas and four natural bathing areas were specified in inland waters of Slovenia. Their quality continues to increase. In 2006, three bathing areas were non-compliant with the mandatory requirements, which represents 16.7%. The compliance of inland bathing waters with the recommended values increased by 5%.

Link to relevant indicators

http://kazalci.arso.gov.si

- Inland bathing water quality
- Quality of watercourses
- Waste water treatment
- Organic pollution and the self-purifying capacity of rivers

Data and sources:

Kakovost naravnih kopalnih voda v Sloveniji v letu 2006. Ljubljana, Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/vode/kopalne%20vode/

Environmental indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Poje, M., 2007. Poročilo Evropski komisiji o izvajanju direktive o kopalnih vodah 76/160/EGS v letu 2006. 2006. Ljubljana, Ministry of the Environment and Spatial Planning. URL: http://www.arso.gov.si/vode/kopalne%20vode/

Map: Natural Bathing Sites Database, Institute of Public Health of the Republic of Slovenia, 2007.
Bathing Water Areas Database, Environmental Agency of the Republic of Slovenia, 2007.

19. Flood areas

Flood areas

- frequent floods
- rare floods
- exceptional floods

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Apart from earthquakes, floods represent the most intensive natural disasters in Slovenia, causing significant material damage. We cannot prevent them, but we can prepare for them or avoid them. As a rule, exceptional floods only occur every few decades or even centuries, and we often tend to forget about them.

According to the Water Act, flood areas encompass water, waterside and other land where water occasionally flows out of the water land as a result of natural factors. All activities and encroachments on physical space which, in the event of a flood, could have adverse effects on waters, water or waterside land, or which increase the flood risk in the area, are prohibited in flood areas, with the exception of encroachments intended to protect against the adverse effects of floods.

High waters are common in Slovenia and they occur each year. They can occur in any season. They are most frequent in autumns and springs, mostly due to the reduced protection role of the plant cover. Floods due to sudden inflows of large amounts of water (storms) also occur in summers. Their origin and development are in most cases in direct connection with the natural and socio-economic causes and conditions. After World War 2 Slovenia experienced an intensive concentration of the population and economic activities at the bottoms of the basins and broader valleys. These areas represent about a fourth of the surface in Slovenia and almost two thirds of the entire population lives there. Thus a significant share of the population lives in areas exposed to floods, both in rural and urban settlements, for example Celje, the southern part of Ljubljana, Murska Sobota, etc.

In Slovenia, floods present a threat to more than 300,000 ha of the area or 15% of the national territory. About 30 extensive flood areas (approximately 237,000 ha) are found in the broadened parts of the valleys, and floods also present a serious threat to areas along the torrential rivers and streams. Tidal floods and karst floods are less extensive (approximately 70,500 ha). More than half (54%) of the flood area is located in the Sava river basin. The Drava river basin occupies 42% of the Slovenian flood area and the Soča river basin with tributaries flowing directly to the sea covers 4% of the flood area.

Flood areas are divided into areas of frequent floods with extensive landscape impacts, and areas of rare and exceptional but less extensive landscape impacts. Floods vary considerably and so does their impact on the landscape and the risk that floods pose to people and properties. Torrential floods are short and exceptionally violent. Waters rise rapidly, carrying a lot of flotage, depositing it on the fans or flatlands, and recede within hours. They occur mostly in the mountains or hills, as well as along individual large rivers, for example the Savinja, Mislinja, Kamniška Bistrica and Sora rivers. Lowland floods are characteristic of the lower sections of major rivers and occur due to the difference in the speed of high waters inflow and the discharge capacity of the riverbeds. This type of floods is the most extensive along the Dravinja, lower Krka, and Sava rivers in Brežiško polje, and the lower section of the Sotla River. In karst poljes, floods occur slowly and the water remains there for days or weeks before slowly flowing off through the karst underground. Floods are characteristic of Cerkniško polje and Planinsko polje and Globodol, a Dolenjska karst polje. Floods in Ljubljansko barje belong to the latter type as well. Sea floods occur during the interweaving of high tide, low air pressure and the jugo winds, when the level of the sea briefly rises above the level of the regular high tide mark and floods the shoreline. In Slovenia, this type of flood can occur in Piran and Koper. *(NZ)*

Floods are one of the prevailing natural-geographic phenomena reshaping the landscape in the flatland-lowland areas and have a direct impact on the purpose and use of land. In Slovenia, floods present a risk to more than 300,000 ha of the area or 15% of the entire national territory.

Link to relevant indicators

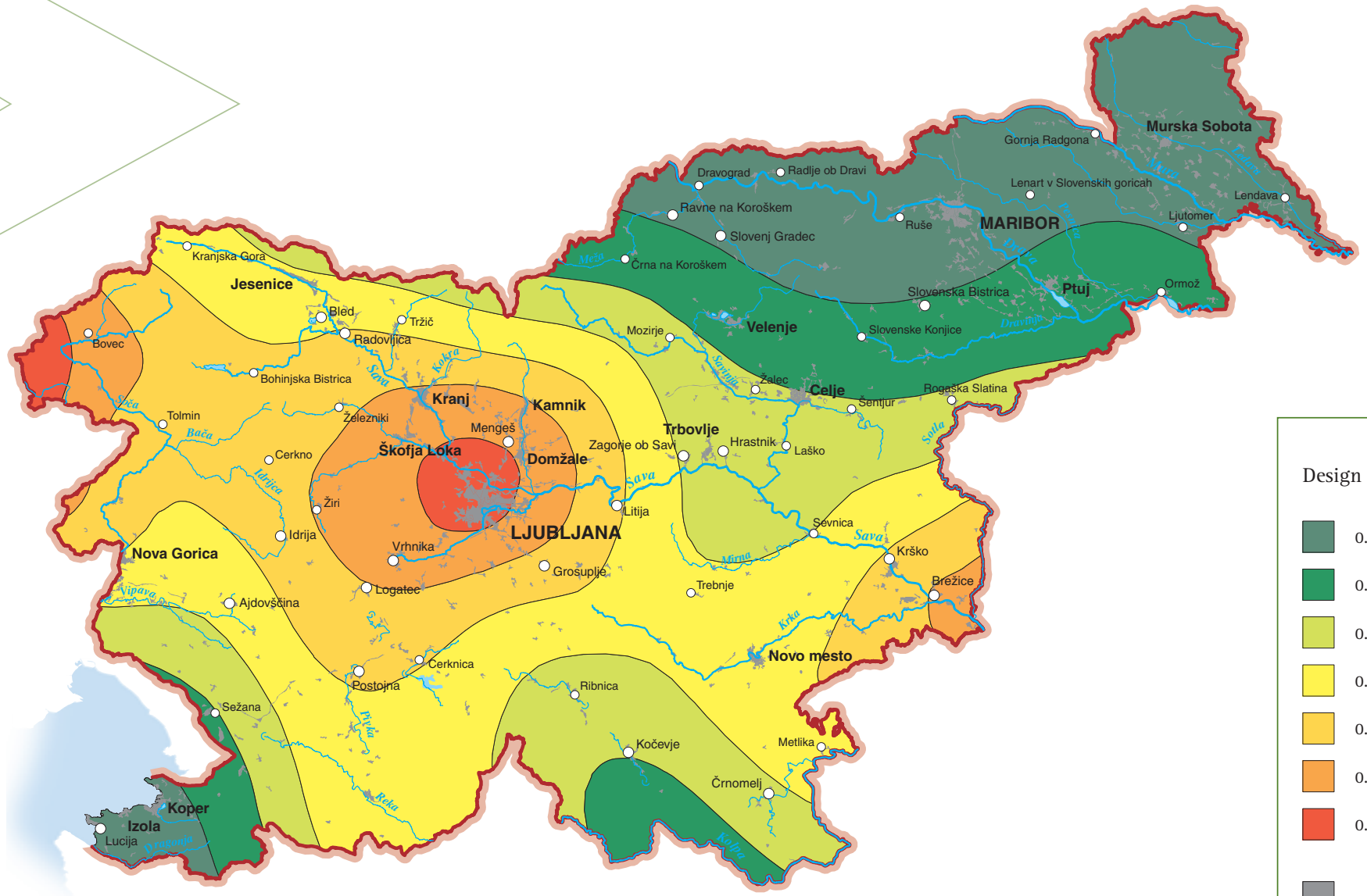
http://kazalci.arso.gov.si

- River balance
- Sea level
- Estimated damage caused by natural disasters

Data and sources:

Protection and Disaster Relief Plan in Case of Floods, Version 3.0. 2005. Ljubljana, Ministry of Defence, Administration for Civil Protection and Disaster Relief.
Natek, K., 2005. Poplavna območja v Sloveniji. Geografski obzornik, Vol. 52, No. 1.
Water Act. Official Gazette RS, No. 67/2002, 110/2002 – ZGO-1, 2/2004 and 41/2004 – ZVO-1.
Map: Območja pogostih, redkih in katastrofalnih poplav. Digital Maps and Data Storage, Environmental Agency of the Republic of Slovenia, 2007.

20. Seismic hazard



Design ground acceleration

- 0.100 [g]
- 0.125 [g]
- 0.150 [g]
- 0.175 [g]
- 0.200 [g]
- 0.225 [g]
- 0.250 [g]
- built-up areas

Scale: 1 : 1,100,000. Source: Authority of the RS for Geophysics, 2001.

According to the number and intensity of earthquakes, the territory of Slovenia belongs to the relatively active areas, because it is located on the active southern rim of the Eurasian geotectonic plate, the north-eastern rim of the Mediterranean-Himalayan seismic zone, which is one of the most active seismic areas on Earth. The tiny Slovenian territory is the meeting point of three regional geotectonic units: the Alps in the north and west, the Dinaric Mountains in the southern, south-western and central part, and the Pannonian Basin in the north-east. The reasons for the occurrence of a number of weak, as well as violent earthquakes lie in the complex geological and tectonic structure of Slovenia's territory, situated on the small Adriatic plate, squeezed between the African plate in the south and the Eurasian plate in the north. The Adriatic plate moves counter-clockwise, which causes different movements mostly on its northern and eastern side. Movements cause tensions which can trigger earthquakes. In the territory of Slovenia the most common are earthquakes originating along the north-west (Dinaric direction) and northeast-southwest faults (cross Dinaric direction), and along the thrusts running in the east-west direction.

It is impossible to predict earthquakes and assess their scale, intensity and damage they are going to cause in advance, but it is possible to forecast the areas where they are going to occur. In such predictions we rely upon the earthquake hazard assessments. Assessments are elaborated on the basis of data on earthquakes in the past, the result of which are the seismic hazard maps. The basic seismic hazard map in Slovenia is the Design Ground Acceleration Map for a Return Period of 475 Years, designed in compliance with the requirements of the European Eurocode 8 standard.

Slovenia is a country with a moderate seismic hazard. Even though earthquakes here do not reach very large magnitudes values, their impacts can be relatively destructive due to the relatively shallow epicentres. In the past, Slovenia experienced more than 3,000 known earthquakes, 60 of which were destructive. In addition to material damage, they claimed numerous human lives. In the 20th century alone there were 20 earthquakes that were of or exceeded intensity VII on the European Macroseismic Scale (EMS), meaning they caused material damage.

The higher seismic hazard zone runs in the central part of Slovenia in the north-west–south-east direction. With increased distance from the zone toward the north-east and south-west the earthquake hazard visibly decreases. Slovenia has three areas with the highest seismic hazard. The first area is western Slovenia, which experienced the most intense earthquake events in the past. 1511 saw the most devastating earthquake with an epicentre in Slovenia in the Idrija area. The 1998 earthquake in the upper Posočje area was one of the two greatest 20th century earthquakes in Slovenia. To a large degree, high values of design ground acceleration in this area are the consequence of big and frequent earthquakes in the neighbouring Friuli area in Italy, where the last big earthquakes occurred in 1976. The second area is Ljubljana and the surroundings where weak earthquakes are relatively frequent and slightly stronger earthquakes are not rare either. The biggest known earthquake in this area occurred in 1895 in Ljubljana. The third is the Brežice area. Here, numerous relatively weak and rare strong earthquakes contribute to the relatively high value of the design ground acceleration. Here, the largest known earthquake occurred in 1917 as one of the two greatest 20th century earthquakes in Slovenia with an epicentre in the Slovenian territory. Earthquakes on the neighbouring Croatian side and big earthquakes north of Zagreb additionally contribute to the earthquake hazard of the area. *(RV, PZ)*

Slovenia is a country with a medium--seismic hazard. Even though earth--quakes here do not reach large magnitudes, their impacts can be severe because of relatively shallow epicentres. The seismic hazard is large in the central, north-western and south--eastern part of Slovenia, while hazard towards north-east and south-west decrease rapidly.

Link to relevant indicators

http://kazalci.arso.gov.si

- Estimated damage caused by natural disasters

Data and sources:

Earthquake Hazard Assessment of the Republic of Slovenia. Version 1.0. 2006. Ljubljana, Ministry of Defence, Administration for Civil Protection and Disaster Relief.
Potresi. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/potresi (accessed on 3 August 2007).
Map: Lapajne, J., Šket Motnikar, B., Zupančič, P., 2001. Potresna nevarnost Slovenije – projektni pospešek tal. Ministry of the Environment and Spatial Planning, Authority of the RS for Geophysics.

Nature and biodiversity

Slovenia is one of the countries with above-average biodiversity, where a large number of species are found in a small place. It is home to about 24,000 species of living beings, and the number of all potential species is between 45,000 and 120,000, of which 800 animal and 66 plant species are endemic. On a global scale, Slovenia boasts one of the highest underground biodiversities. With preserved forests harbouring a great number of species and covering 58% of the territory, it is one of the most wooded countries in Europe. The western part of the country exhibits the largest diversity of plant life, but in the last decade, the share of invasive species has increased at an alarming rate. The establishment of protected areas of nature is in its conclusive phase. Today, 12% of the territory is located in the protected areas, 52% in ecologically important areas and 36% of the territory is protected by the Natura 2000 programme. 14,901 natural units have the status of a valuable natural feature, 8,381 of which are caves, where encroachments and activities are possible only if there are no other spatial or technical alternatives. The system of permits regarding nature preservation and the compensation system for damage caused by the preserved species of animals are working well. 2006 saw 850 damaging incidents, in most cases caused by bears, and compensation costs totalled in excess of EUR 230,000. We have established a system of control over trade with wild animal and plant species and their parts. The process of upgrading the information systems to facilitate everyday work is in progress. Providing information to the public on the status, preparation and implementation of the legislation is carried out in accordance with the programmes. The system for monitoring the status of biodiversity has not yet been established.

21. Protected areas

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Valuable natural features encompass all natural heritage in the Republic of Slovenia. The objects and areas of valuable natural features include mostly rare, precious or well-known geological phenomena, minerals, fossils, mineral and fossil sites, surface and subterranean karst features, caves, gorges and other geomorphological phenomena, glaciers and glacial forms, springs, waterfalls, rapids, lakes, bogs, brooks and rivers with banks, sea-shore, plant and animal species and exceptional specimens and habitats thereof, ecosystems, landscape, and designed landscape.

Slovenia has protected 14,901 valuable natural features, 8,381 of which are caves. The areas designated for the protection of one or several valuable natural features are called protected areas. There are a number of different protected areas. Large-scale protected areas include national, regional and landscape parks, and small-scale protected areas include natural monuments, strict nature reserves and nature reserves. Slovenia has one strict nature reserve, 52 nature reserves, and 1,185 natural monuments.

A national park is a large area possessing numerous valuable natural features and great biodiversity. Nature in its original state, with preserved ecosystems and natural processes, is present in the major portion of the national park. In the smaller portion of the park there may be areas where human influence is relatively large, but in harmony with nature. The Triglav National Park is the only Slovenian national park. It covers 838 square kilometres, which is more than four percent of Slovenia's surface. It belongs among the oldest European parks, with the first protection measures introduced in 1924 when the Alpine Protection Park was founded.

A regional park is an extensive area of ecosystems and landscapes characteristic of a specific region with large portions of nature in its original state and areas of valuable natural features interwoven with parts of nature where human influence is relatively large, but in harmony with it. Slovenia has three regional parks: the Kozjansko Park, the Notranjska Regional Park and the Škocjan Caves Regional Park.

A landscape park is an area of high ecological, biotic and landscape value with pronounced high-quality and long-term interaction of people and nature. Slovenia has 42 landscape parks. According to the surface area, the Goričko Landscape Park is the largest and together with the parks in the neighbouring Austria and Hungary it forms the Goričko-Raab-Örség Trilateral Park.

A strict nature reserve is an area of naturally preserved geotopes, habitats of endangered, rare or representative plant or animal species or an area important for biodiversity conservation where natural processes take place without human influence.

A nature reserve is an area of geotopes, habitats of endangered, rare or representative plant or animal species or an area important for biodiversity conservation which is maintained through sustainable human activity.

A natural monument is an area containing one or more valuable natural features which have an outstanding form, size, content or location or are a rare example of a valuable natural feature. *(UK)*

Protected areas are designated for the protection of one or a number of natural features, including the natural heritage of Slovenia. Currently, the country has one strict nature reserve, 52 nature reserves and 1,185 natural monuments, 42 landscape parks, three regional parks and one national park.

Link to relevant indicators

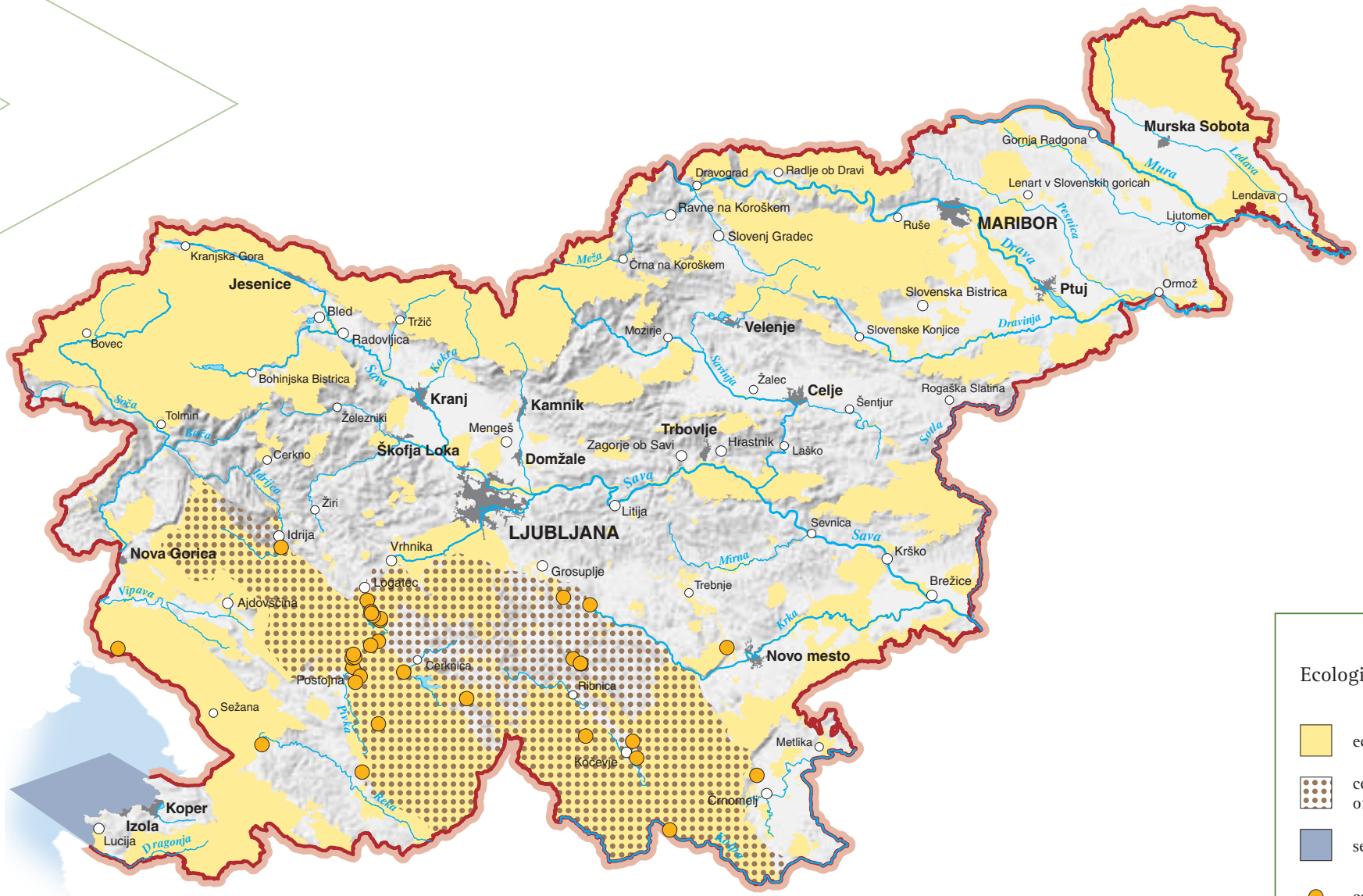
http://kazalci.arso.gov.si

- Nature areas under protection
- Natura 2000
- Ecologically important areas
- Valuable natural features
- Nature areas under protection and agriculture
- Outstanding natural features visited

Data and sources:

Goričko Landscape Park. URL: http://www.park-goricko.org/default.asp (accessed on 2 August 2007).
Rules on the Designation and Protection of Valuable Natural Features. Official Gazette RS, No. 111/2004 and 70/2006.
Register of Protected Areas. Environmental Agency of the Republic of Slovenia, 2005.
Triglav National Park (TNP). URL: http://www.tnp.si/ (accessed on 2 August 2007).
Varstvo naravnih vrednot. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/narava/ (accessed on 3 August 2007).
Nature Conservation Act. Official Gazette RS, No. 96/2004-NCA-OCT-2.
Zavarovana območja. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/narava/ (accessed on 2 August 2007).
Map: Zavarovana območja. Digital Map and Data Storage, Environmental Agency of the Republic of Slovenia, 2007.

22. Ecologically important areas



Ecologically important areas

- ecologically important areas
- central habitat of large carnivores
- sea and coastline
- cave entrance

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

According to rich biodiversity determined on the basis of different methodologies by the domestic and foreign experts, Slovenia ranks at the top of European countries. It has a number of areas with conserved habitat types which are the consequence of extensive agricultural land use and sustainable, multipurpose forest management. In spite of that, it is estimated that 10% of all fern and seed plants, as well as 56% of all vertebrates (mammals, birds, reptiles, amphibians and fish) are endangered. Individual habitat types are endangered as well, especially the subterranean, coastal and sea habitats, still and flowing waters, and dry and wet grasslands. The greatest responsibility of Slovenia is to conserve biodiversity in endemic species and in species, their habitats and habitat types that are disappearing in Slovenia as well as in Europe.

According to the Nature Conservation Act, an ecologically important area is an area containing a habitat type, a part of a habitat type or a large ecosystem unit which significantly contributes to biodiversity conservation. It includes the areas of habitat types which are exceptionally diverse or well preserved with regard to biotic characteristics, areas with habitats of endangered or endemic or protected plant or animal species, and areas which significantly contribute to the maintenance of natural balance, such as migration routes of animals. Mutually connected and evenly biogeographically distributed ecologically important areas can compose an ecological network.

According to these criteria, 52% of the territory in Slovenia is located in ecologically important areas specified by the government in a regulation in 2004. The specified ecologically important areas include the central habitat of large carnivores, measuring 347,784 ha, 32 karst caves, marked on the map with cave entrances, as well as the sea and the coastline with 22,545 ha. The Natura 2000 areas forming an ecological network at the European level are a constituent part of ecologically important areas.

The framework of ecologically important areas enables the conservation of habitat types in a favourable state. Habitat types are considered to be in a favourable state when the natural distribution of the type and the areas it covers are balanced or on the increase, and when the appropriate structure, natural processes and appropriate land use are anticipated to preserve this state in the future. Certain protection measures and rules of conduct therefore apply which have to be observed in spatial planning and the use of natural features. These measures are one of the starting points for the preparation of nature protection policies. Furthrermore, they provide mandatory guidelines in spatial planning and use of natural features, but it is not necessary to obtain nature protection conditions and nature protection consents for encroachments in these areas.

We have envisaged continuous monitoring with the help of indicators to determine the status and efficiency of the protection measures for plant species, animal species and habitat types in ecologically important areas. Special attention is paid to those species whose status best reflects the changes in the habitats of other species or habitat types. Such species, for example, are birds and butterflies. *(UK)*

Ecologically important areas cover 52% of Slovenia's territory and their purpose is to ensure the conservation of biodiversity. For this reason, certain protection measures and rules of conduct apply to these areas that have to be observed in spatial planning and use of natural features.

Link to relevant indicators

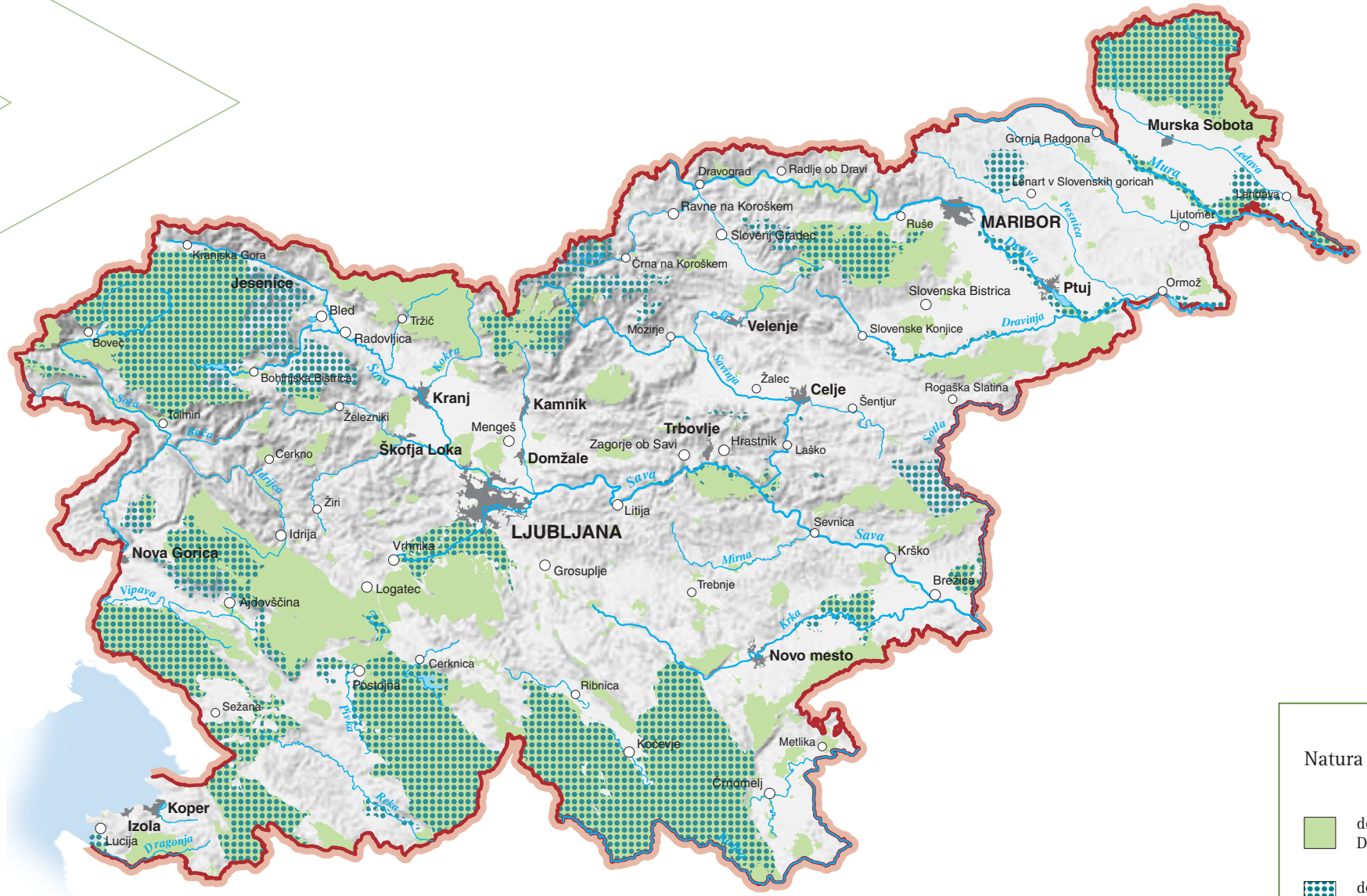
http://kazalci.arso.gov.si

- Nature areas under protection
- Natura 2000
- Ecologically important areas
- Valuable natural features
- Nature areas under protection and agriculture
- Endangered species
- Population size of selected bird species
- Subterranean biodiversity
- Brown bear

Data and sources:

Ekološko pomembna območja. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/narava/ (accessed on 15 September 2007).
Resolution on National Environmental Action Plan 2005–2012. Official Gazette RS, No. 2/2006.
Decree on Ecologically Important Areas. Official Gazette RS, No. 48/2004.
Nature Conservation Act. Official Gazette RS, No. 96/2004-NCA-OCT-2.
Karta: Ekološko pomembna območja. Digital Maps and Data Storage, Environmental Agency of the Republic of Slovenia, 2007.

23. Special areas of conservation (Natura 2000)



Natura 2000 areas

- defined by the Habitats Directive (pSCI)
- defined by the Birds Directive (SPA)

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Natura 2000 is a European network of special areas of conservation designated in the EU Member States with the aim to conserve and prevent biodiversity from decreasing. Special areas of conservation are intended for the conservation of animal and plant species and habitats which are rare or endangered due to man's activities at the European level. The Natura area is an ecologically important area vital in the European Union for the conservation or achievement of a favourable status of bird species (on the basis of the Birds Directive – SPA or special protected areas) and other animal and plant species, their habitats and habitat types (on the basis of the Habitats Directive – pSCI areas or proposed sites of Community importance). Proposals of areas that Slovenia defined on the basis of Habitats Directive are accepted by the European Commission in a special procedure that usually takes a few years.

Slovenia has specified 26 special protected areas with a total area of 462 thousand hectares under the Birds Directive, and proposed 260 special areas of conservation with a total area of 640 thousand hectares under the Habitats Directive. The Natura areas occupy a total of 36% of the territory of Slovenia, and 60% of the areas proposed by the Habitats Directive overlap with special protection areas under the Birds Directive. A large part of these areas is covered by forests, there is a large share of areas with no vegetation (litosols, etc.), 5% of the areas are located above the forest line, and there is an important share of grassland. In these areas the favourable status must be maintained by means of different measures. Some of the possibilities are to continue with the existing activities, for example pasture or grass-cutting on dry or humid meadows after blooming and nesting, to abandon individual activities, or prevent the introduction of certain activities, for example agroamelioration of wetlands. Just under 30% of the Natura areas are also designated as protected areas in the framework of landscape, regional or national parks and natural monuments, which represents as much as three quarters of such protected areas.

Like all other EU Member States, Slovenia is committed to adequately conserve the Natura areas. The Member States can select the type of protection of the Natura areas as they deem appropriate. In the European countries, the most frequent practice in maintaining biodiversity is by means of contractual protection or stewardship, e.g. contracts in the framework of the agricultural-environmental programme on habitat types with agricultural use. EU's financial programmes for co-financing nature-protection projects (LIFE), nature-friendly farming methods (rural development funds and structural funds), and other sustainable development activities (structural funds) are available for the Natura areas.

In the 2000–2006 financial perspective period (LIFE III NATURE), 11 projects were carried out or are still in progress. The European Commission's share in co-financing these projects was very high (on average 64%) and totalled EUR 6.2 million. The projects are: Peatlands in the Triglav National Park, Renaturation and Conservation of Habitats and Birds in the Škocjanski zatok Nature Reserve, Management Plan for Dry Grasslands on Oslica and Vetrnik, Conservation of Large Carnivores in Slovenia (brown bear), Protection of Endangered Species and Habitats in the area of the future Karst Park, Conservation of Endangered Species and Habitats in the Sečovlje Salina Nature Park, Establishment of Long-Term Protection for Corn Crake (*Crex crex*) in Slovenia, NATURA 2000 in Slovenia – Management Models and Information System, Conservation of the Otter Population (*Lutra lutra*) in Goričko, Intermittent Lake Cerknica, and Conservation of Biodiversity on the Mura River in Slovenia. *(UK)*

In the European Union, special areas of conservation (Natura 2000) are of great importance for the conservation or achievement of a favourable status of birds and other animal and plant species, their habitats and habitat types. Special areas of conservation cover 36% of Slovenia's territory and this favourable status should be maintained by means of different measures.

Link to relevant indicators

http://kazalci.arso.gov.si

- Nature areas under protection
- Natura 2000
- Ecologically important areas
- Valuable natural features
- Nature areas under protection and agriculture
- Endangered species
- Population size of selected bird species
- Subterranean biodiversity
- Brown bear

Data and sources:

Council Directive 79/409/EEA from 2nd April 1979 on the Conservation of Wild Birds.
Council Directive 92/43/EEA from 21st May 1992 on the Conservation of Natural Habitats and Wild Animal and Plant Species.
Ekološko pomembna območja. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/narava/ (accessed on 3 August 2007).
Kaj je Natura 2000. Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/narava (Summarised 3 August 2007).
LIFE III – Nature in Slovenia: Review of Projects. 2007. Ljubljana, Ministry of the Environment and Spatial Planning.
Decree on Special Protection Areas (Natura 2000 areas). Official Gazette RS, No. 49/2004, 110/2004 and 59/2007.
Map: Natura 2000. Metadata Portal, Environmental Agency of the Republic of Slovenia. URL: http://gis.arso.gov.si/mpportal/ (accessed on 3 August 2007).

24. Wetlands

Wetlands

- large wetlands
- small wetlands
- Ramsar locality

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, Institute for water of the Republic of Slovenia, 2000.

Wetlands are dynamic ecosystems with a characteristic composition of plants and animals. They combine characteristics of water and land ecosystems, which are mutually connected and often interwoven. This gives them diversity, dynamics and an abundance of life forms. It is water that dictates the basic rhythm in the wetlands.

Wetlands are marsh, fen, peat bog, or water areas, of natural or anthropogenic origin, permanent or periodical, with still or running water. Water can be fresh, brackish or salty. Wetlands also include areas of shallow coastal sea.

Wetlands are important from the ecological, social and economic aspect. They play an important role in the metabolism and retention of nutrients and sediments, primary production, retention of high waters and enrichment of low waters. Their role in the circulation of water and chemical substances helps preserve the quality of water; thus we can say they are natural water treatment plants. Wetlands characteristically demonstrate high biodiversity. They present important habitats to a number of animal and plant species, especially to the rare and endangered species. They also offer attractive relaxation and recreation areas. In addition to that, they produce and provide a number of goods which, if wisely used, are always at our disposal, offering fish, wood, fodder or agricultural products. On the other hand, wetlands are very susceptible ecosystems the existence of which can be threatened by even relatively minor changes of factors in the environment.

The Slovenian wetland inventory from 2000 includes more than 3,500 locations. The majority of the surveyed wetlands are smaller than 0.15 ha. Those are puddles, claypits, smaller retention basins and channels. As much as 83% of all locations and 61% of the area of all wetlands formed due to man's impact. Considering all flood areas, wetlands cover less than 5% of Slovenia's territory. The most extensive are flood and wet meadows, the majority of which are found at Ljubljansko barje, Cerkniško polje, Planinsko polje, Radensko polje, Bloška planota and Jovsi. The most frequent natural wetlands are small lakes (including mountain lakes) and marshes, while intermittent lakes (the largest being Lake Cerknica) and marshes are the most extensive. The most extensive inland wetlands are found on the plains or the lower parts along the Mura, Drava, Sava and Krka rivers or karst poljes (the karst part of the Ljubljanica River with Cerkniško polje and Planinsko polje). Smaller, but more frequent wetlands are found on plateaus – bogs on Pokljuka and Pohorje, and fens on Bloška planota. The Sečovlje and Strunjan saltpans with Štjuža and Škocjanski zatok are the only large, still preserved wetland areas on the Slovenian coast.

Wetlands are directly endangered due to man's encroachments and activities: draining or damming, regulation of watercourses, reinforcement of embankments or shores, and felling of riparian growth. Indirect endangerment is caused by changing the water regimes, overabstraction of water, and pollution with chemical substances and waste. Thus, in many places ecosystems are destroyed and disappearing. The most wetlands were lost in the coastal area (coastal plains of the Rižana and Badaševica rivers), and flood plains along the central courses of rivers, for example in Pomurje, in the valleys of the Ščavnica and Pesnica rivers, and in Primorska along the Vipava, Rižana and Dragonja rivers. In most cases the cause was the promotion of agriculture. In the coastal area, wetlands were also destroyed by the rapid development of industry, for example Luka Koper, by the expansion of tourism, for example in Lucija, and by the urbanisation of Koper.

For the purpose of the conservation of wetlands of international importance, the Convention on Wetlands or the Ramsar Convention was signed in the Iranian city of Ramsar in 1971. Because of their special importance, three wetlands in Slovenia, the so-called Ramsar Localities, are on the list of internationally important wetlands totalling 8,205 ha in size. In 1993, the Sečovlje Saltpans were the first locality on the list, in 1999 they were followed by the Škocjan Caves, and in 2006, by Lake Cerknica with the surroundings. *(NZ)*

Wetlands combine characteristics of water and inland ecosystems, which are mutually connected and often interwoven. They are important from the ecological, social and economic aspect. Slovenia has more than 3,500 preserved wetlands, most of them of small size. The most important wetlands were proclaimed Ramsar Localities, which means they are of international importance as well: the Sečovlje Saltpans, the Škocjan Caves and Lake Cerknica.

Links to indicators

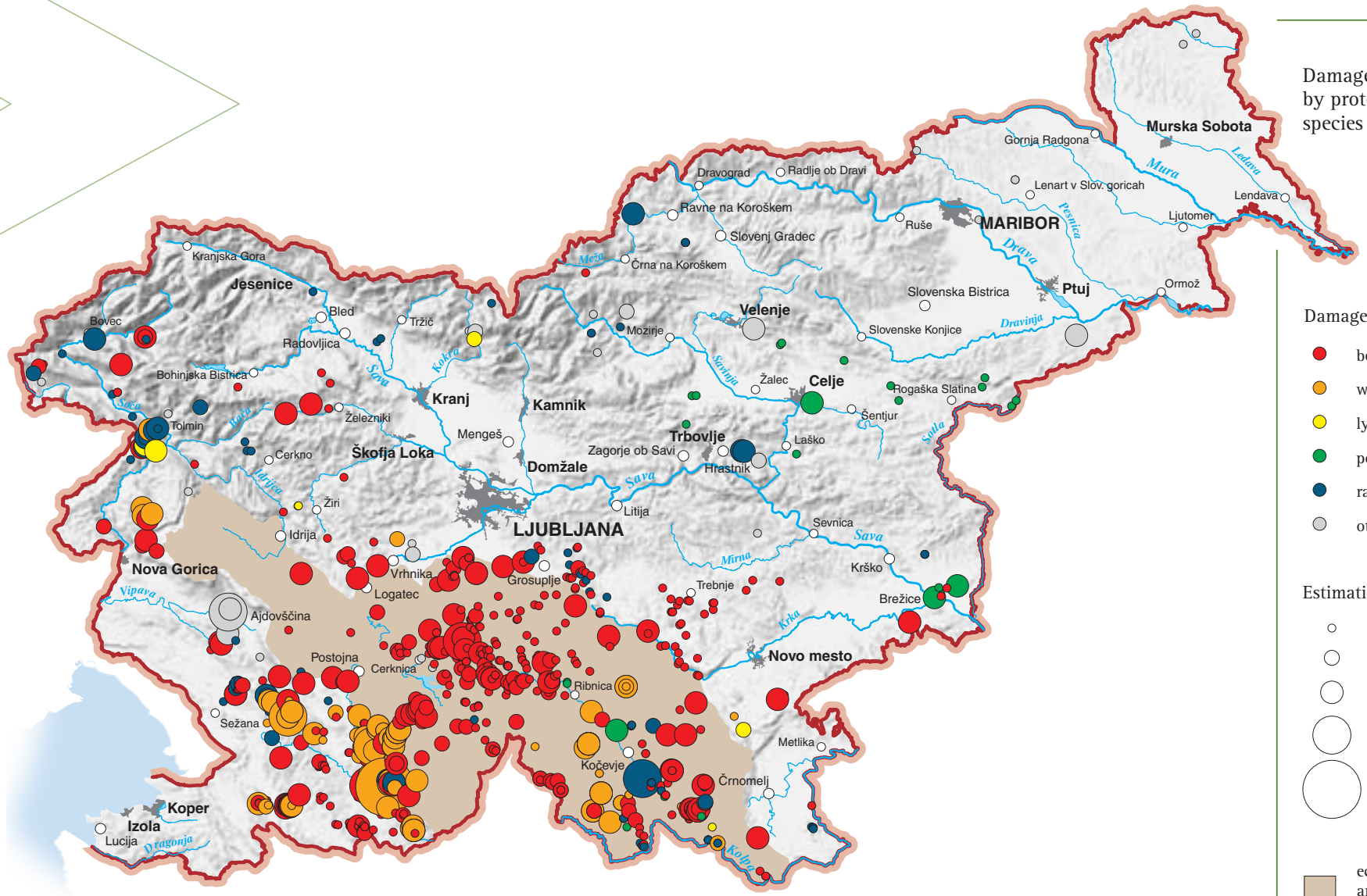
http://kazalci.arso.gov.si

- Nature areas under protection
- Endangered species
- Population size of selected bird species
- Subterranean biodiversity

Data and sources:

Vodno bogastvo Slovenije. 2003. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
The List of Wetlands of International Importance. URL: http://ramsar.org/sitelist.doc (state on 18 April 2007).
Map: Wetland Inventory, 2000. Ljubljana, Institute for water of the Republic of Slovenia. Mokrišča (Wetlands). Digital Map and Data Storage, Environmental Agency of the Republic of Slovenia, 2000.

25. Damage caused by protected animal species



Damage caused by protected animal species in 2006

Damage caused by

- bear
- wolf
- lynx
- polecat
- raven
- other

Estimation of damage value

- 0 to 210 EUR
- 210 to 420 EUR
- 420 to 2,090 EUR
- 2,090 to 4,170 EUR
- 4,170 EUR and more

ecologically important area – central habitat of large carnivores

Scale: 1 : 1,100,000. Source: Slovenia Forest Service, 2007.

Protected animals include all wild animals endangered due to the development of infrastructure, urbanisation and degradation of forest complexes. They are endangered by large encroachments on the environment, which narrow their living space and deteriorate their prospects. Bears as a protected species have been in the centre of attention and in Europe, funds are available for the endeavours to conserve the remains of the population and reintroduce bears to the areas they once inhabited.

Under a regulation from 2004, the Environmental Agency of the Republic of Slovenia is responsible for the compensations to cover for the damage caused by the animals listed as protected species. The damage is assessed by the Slovenia Forest Service. 1,085 incidents were treated in 2006. Compensation claims included compensation for damage caused by animals of 11 protected species. For 995 incidents, payments for total or partial compensation claims were granted in the total of EUR288,632.20. Property owners observed most of the damage caused by animals of protected species between June and October.

60% of incidents for which compensation was granted were caused by the brown bear (*Ursus arctos*). A third of the damage was caused to sheep and goats, and just under a fourth in fruit-growing. Ravens (*Corvus corax*) caused damage in 19% of incidents, wolf (*Canis lupus*) in 17%, and lynx (*Lynx lynx*) and polecat (*Mustela putorius*) in 2%. Other recognised protected species that caused damaging incidents were: birds of prey – golden eagle (*Aquila chrysaeto),* songbirds – Carrion Crow (*Corvus corone*), European starling (*Sturnus vulgaris*), song thrush (*Turdus philomelos*) and fieldfare (*Turdus pilaris*), as well as wildcat (*Felis silvestris*) and great-spotted woodpecker (*Dendrocopos major*).

The most incidents (53%) involved sheep and goats, for which the most financial means were granted (60%). 14% of the incidents were recorded in fruit-growing, for which 7% of the financial means were paid. Fodder production incidents occurred in 9%; most of the damage was caused to the bales of silage grass and 6% of the financial means were granted for compensations. Arable farming (maize silage, grain maize, wheat, oats, carrots) incidents occurred in 8% and got 4% of financial means. 7% of the incidents occurred in beekeeping (damage on apiaries, destroyed hives, colonies, honey) and 12% of financial means were granted for the compensations.

In 2006, the lowest compensation paid for the damage caused by animals of protected species was EUR 2.28; the incident was caused by a brown bear. The highest compensation in the same period totalled EUR 4,027.41 and was caused by a raven. *(MP)*

Protected species of animals include all endangered wild animals due to man's increasing encroachments on the environment. The Environmental Agency of the Republic of Slovenia is responsible for decisions on compensation claims for damage caused by these animals. The most incidents are caused by the brown bear and wolf on sheep and goats, and the most financial means are paid for the damage they cause.

Links to indicators

http://kazalci.arso.gov.si

- Endangered species
- Damage caused by protected animal species
- Brown bear

Data and sources:

Simonič, A., 1998. Srečanja z medvedom. Ljubljana, Ministry of Agriculture, Forestry and Food of the Republic of Slovenia Ulamec, P., 2007. Analiza odškodninskih zahtevkov za škodo, ki so jo povzročile živali zavarovanih prosto živečih živalskih vrst v letu 2006. Ljubljana, Environmental Agency of the Republic of Slovenia.

Decree on Protected Wild Animal Species. Official Gazette RS, No. 46/2004, 109/2004 and 84/2005.

Map: Slovenia Forest Service, 2007.

Natural resources and waste

Forests, water, agricultural and non-metal mineral resources are the most important natural resources in Slovenia. They are limited and with the growing economy the demand for them is still increasing. One third of resources for the production and consumption processes are imported. Forests cover 58% of the territory of Slovenia and their annual growing stock and increment are increasing. In the last decade, the realisation of allowable cut has been 75 percent. Groundwater supplies 95% of the population with drinking water. Hydroelectric power plants contribute 20 to 30% of electric energy. Non-mineral resources are used predominantly in construction. To prevent overexploitation, the Government of the Republic of Slovenia grants special rights for the use of natural resources.

Use of natural resources in production and consumption causes environmental impacts. In 2006, 70% of the waste waters were treated and the length of the sewage system totalled 6,000 km. The annual amount of waste in Slovenia totals about six million tons, 90,000 tons of which is hazardous waste. The production and service activities generate about five million tons of waste, and households generate above 800,000 tons. Near two million tons of total waste was landfilled in 2006, which is from the environmental aspect the least desirable way of waste management, since it reflects in the increased environmental pressure and the loss of natural resources. This is why becoming a recycling society and utilising the waste as a resource is the EU's long-term objective. In the last ten years, the majority of recovered waste has come from the industry while about 80% of municipal waste has been landfilled. The amount of recovered municipal waste is expected to increase by establishing regional centres, additionally encouraging municipalities to promote separate waste collection, introducing different financial instruments and increasing the awareness of the population to purchase products that enable simple recovering.

26. Natural resources

Use on the basis of concessions in 2007

- non-metal mineral resources
- energy mineral resources
- hydroelectric power plants above 10 MW
- hydroelectric power plants below 10 MW
- other types of water use

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, Geological Survey of the Republic of Slovenia, 2007.

Forests, water, agricultural land and non-metal mineral resources are the most important natural resources in Slovenia.

Natural resources are limited. To ensure their sustainable use, the Government of the Republic of Slovenia, among other things, grants concessions for their use for a limited period.

Forests cover as much as 58% of the country's territory, which ranks Slovenia among the most wooded countries in Europe. The largest dense forest areas cover the Dinaric-Karst plateaus of southern and south--western Slovenia, and the areas of the Alps in the north and the west. According to the growing stock of forests and the increment, Slovenian forests have been on the increase for decades, which is mostly due to successful forest management. The ratio between the coniferous and deciduous trees is changing: after 2000, the share of conifers fell below 50%. The realisation of the allowable cut in the past decade has been 75%. There were 653 encroachments on forests in 2006 in a total area of 240 ha, which is slightly above the average in the previous periods. But 215 ha of grubbed forests were located in the immediate vicinity of large cities, which was mostly the consequence of urbanisation and construction of infrastructure.

Water as a natural resource is used for different purposes: for supplying the population with drinking water, production of energy, for process water, etc. More than 95% of the drinking water for the population is supplied by groundwater. According to the estimates by the Environmental Agency of the Republic of Slovenia, overall there is enough available groundwater, but individual regions have experienced major problems with water supply. In addition to that, we cannot neglect the anticipated long-term impacts of climate change on water circulation which can further aggravate the supply with water in individual regions.

For energy purposes, water is used mostly for the production of electric energy in hydroelectric power plants. Depending on the hydrological conditions, electric power plants contribute 20 to 30% to the total of electric energy production. Most hydroelectric energy is produced by the electric power plants on the Drava, Sava and Soča rivers. For this purpose, the country utilises about 50% of economically available capacities of Slovenian watercourses. Specific rights for the exploitation of water are governed by the Water Act determining water rights, which are acquired by means of concessions or water permits prior to building permits. By 2007, 419 concessions for the construction of hydroelectric power plants with up to 10 MW maximum net power were granted, and 16 for the construction of hydroelectric power plants with maximum net power above 10 MW. Just under 100 concession grants were signed for fish and mussel farming, ten for the extraction of alluvial deposits, twelve for the production of drinks and one for exploitation of thermal waters.

In Slovenia, agricultural land covers a fourth of the territory, but the share of areas with significant vegetation is lower. From the economic aspect of agricultural production, fragmentation of agricultural land is not desirable, but from the aspect of the cultural landscape, diversity of landscape patterns and interweaving of different types of land use provides greater biodiversity and presents a natural-cultural heritage and identity of the Slovenian landscape.

Mineral resources which are directly or indirectly economically exploitable are governed by the Mining Act. In Slovenia, energy, metal and non-metal mineral resources are found in the given geological conditions. Non-metal mineral resources of lower values prevail and are used in construction, ceramic and chemical industry, food industry, etc. *(BBV)*

Natural resources are limited. To ensure their sustainable use, The Government of the Republic of Slovenia grants concessions. Most concessions on waters were granted for the construction of hydroelectric power plants that produce 20 to 30% of all electric energy in Slovenia. For mineral resources, the most concessions were granted for non-metal mineral resources, which are predominantly used in the construction industry.

Link to relevant indicators

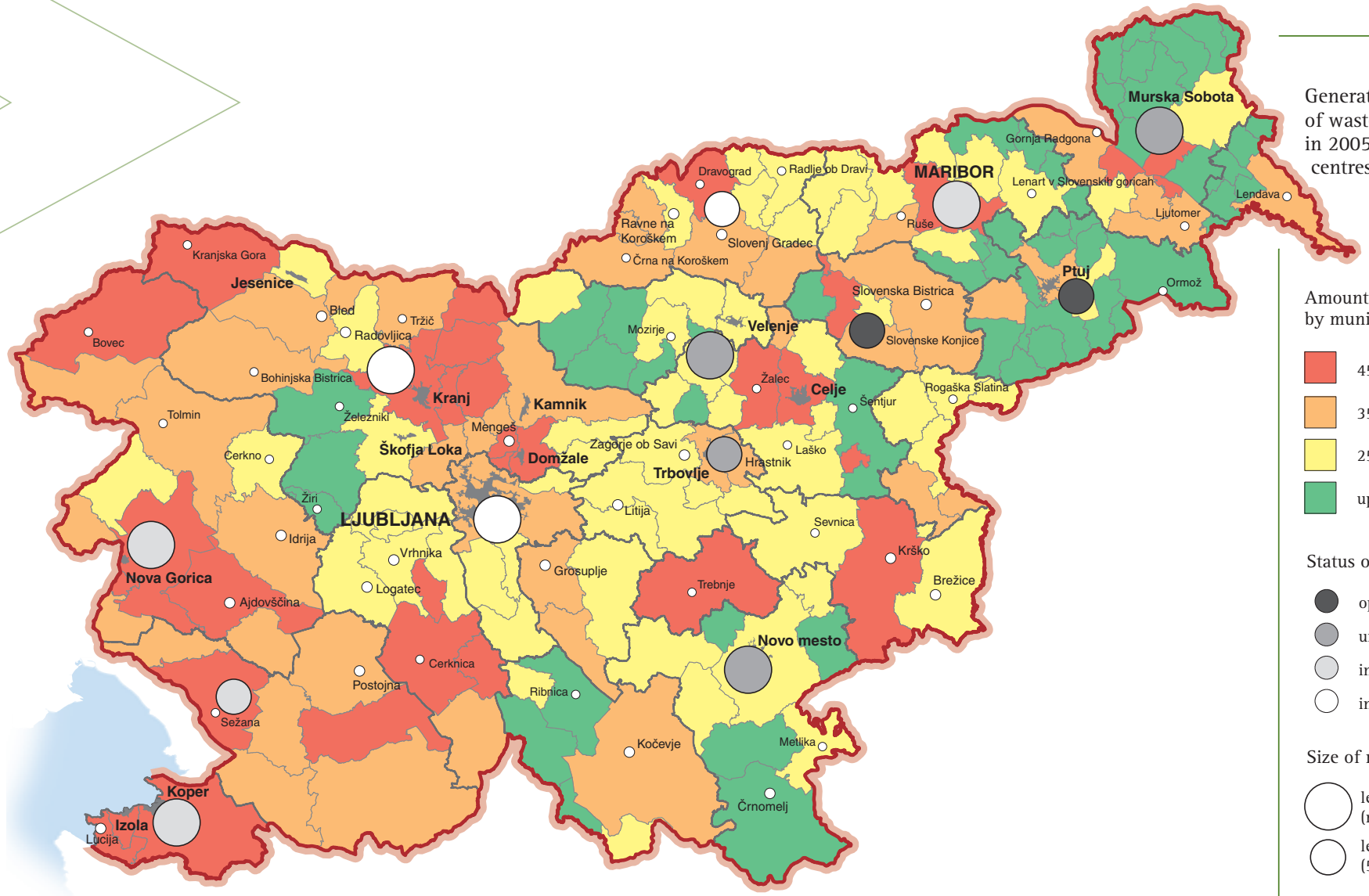
http://kazalci.arso.gov.si

- Land cover and land use
- Use of water resources
- Direct material input and domestic material consumption
- Naturalness of forests

Data and Sources:

Andjelov, M., Gale, U., Kukar, N., Trišič, N., and Uhan, J., 2006. Ocena količinskega stanja podzemnih voda v Sloveniji. In: Geologija, Vol. 49, 2.
Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Poročilo RS Evropski Komisiji o implementaciji Direktive 2001/77/ES Evropskega parlamenta in Sveta o spodbujanju proizvodnje električne energije iz obnovljivih virov energije. 2005. Ljubljana, Ministry of the Economy.
Resolution on the National Energy Programme. Official Gazette RS, No. 57/2004.
Resolution on National Environmental Action Plan 2005–2012. Official Gazette RS, No. 2/2006.
Šolar, S. V., 2004. Sustainable Mineral Resource Development in Slovenia. Ljubljana, Geological Survey of the Republic of Slovenia.
Map: Deposits of Mineral Resources with Concession. Geological Survey of the Republic of Slovenia, 2007.
Concession Contracts for the Use of Water Resources Record. Environmental Agency of the Republic of Slovenia, 2007. Manager: Tomaž Štembal.

27. Waste generation and collection



Generation and collection of waste by municipalities in 2005 and status of regional centres in 2006

Amount of municipal waste by municipalities per capita

- 451 kg/capita and more
- 351 to 450 kg/capita
- 251 to 350 kg/capita
- up to 250 kg/capita

Status of regional centres

- operational
- under construction
- in search of a location
- in preparation

Size of regional centres

- level 1 (more than 90,000 residents)
- level 2 (55,000 to 90,000 residents)
- regional boundaries

Scale: 1 : 1,100,000. Source: Ministry of the Environment and Spatial Planning, Statistical Office of the Republic of Slovenia, 2007.

The amount of waste generated by municipalities and waste management in individual municipalities vary considerably. To a certain part, it depends on the life style of the residents and their awareness, on the available capacities for waste disposal, and on the willingness of the municipality to find new solutions. On average, 400 kg of municipal waste per year is produced per person in Slovenia or more than one kg per day. Large quantities of waste are not necessarily related to the urban way of life. More than 450 kg of waste per resident are generated in seven out of eleven city municipalities and also in four municipalities with less than 2,000 residents.

Municipal waste is household waste and other waste similar in nature and structure. There is a variety of structure: hazardous waste, packaging, bulky waste, biodegradable and other types of waste. Until recently, all types of municipal waste were deposited together in containers and municipal companies would transport them to non-hazardous municipal waste landfills. This is causing emissions in the air, water and soil, and hazardous substances were released into the environment. The weakest point in this type of management was the consumption of natural resources. The majority of this waste can be returned to the production process as input material, but for this purpose, separate waste collection is a must.

The waste management programmes originate in the EU Waste Framework Directive. In Slovenia, scattered population, natural and spatial conditions aggravate establishment of central facilities for the recovery and disposal operations which is practiced abroad for economical reasons. Extensive analyses have determined that the problem of municipal waste should be handled in the framework of the so-called regional centres for waste management and that twelve centres would be adequate. In addition to that for some specific areas of Slovenia the facilities and plants for waste management in so-called "sub-centres" would be an appropriate solution.

Level 1 centres or regional centres for waste management are the highest form of inter-municipal merging; they include 90,000 or more residents and form the basic network for waste management. *Level 1 centre areas are*: Pomurje, Podravje, the Savinja area, Dolenjska, Central Slovenia, Gorenjska, Northern and Southern Primorska. For spatial, logistic and other reasons, Level 2 centres supplement the basic network and cover the areas with 55,000 to 90,000 residents. *Level 2 centre areas are*: Eastern Prekmurje, Lower Podravje, the Dravinja area, Koroška, the Upper Savinja area, Zasavje and the Kras-Notranjska area. Level 3 centre areas or sub-centres round off smaller areas which do not have the sufficient number of residents for economical waste management, but they are a homogenous area with longer transport distances or already elaborated long-term starting-points for waste management. There are two operational centres: Slovenske Konjice and Gajke in Spuhlja, four are in the construction phase, and other centres are in the preparation phase or in search of a suitable location. *(BBV)*

Slovenia generates just over one kg of municipal waste per capita per day. Four of the municipalities with the highest generation of waste have less than 2,000 residents. Regional centres have been established to solve the municipal waste management problem. Inter-municipal merging into centres for waste management will provide a higher share of separate collection of waste suitable for material and energy recovery of waste. Two centres are in operation, four are under construction, and seven are in the preparation phase or in search of a location.

Link to relevant indicators

http://kazalci.arso.gov.si

- Municipal waste
- Waste management
- Packaging waste

Data and Sources:

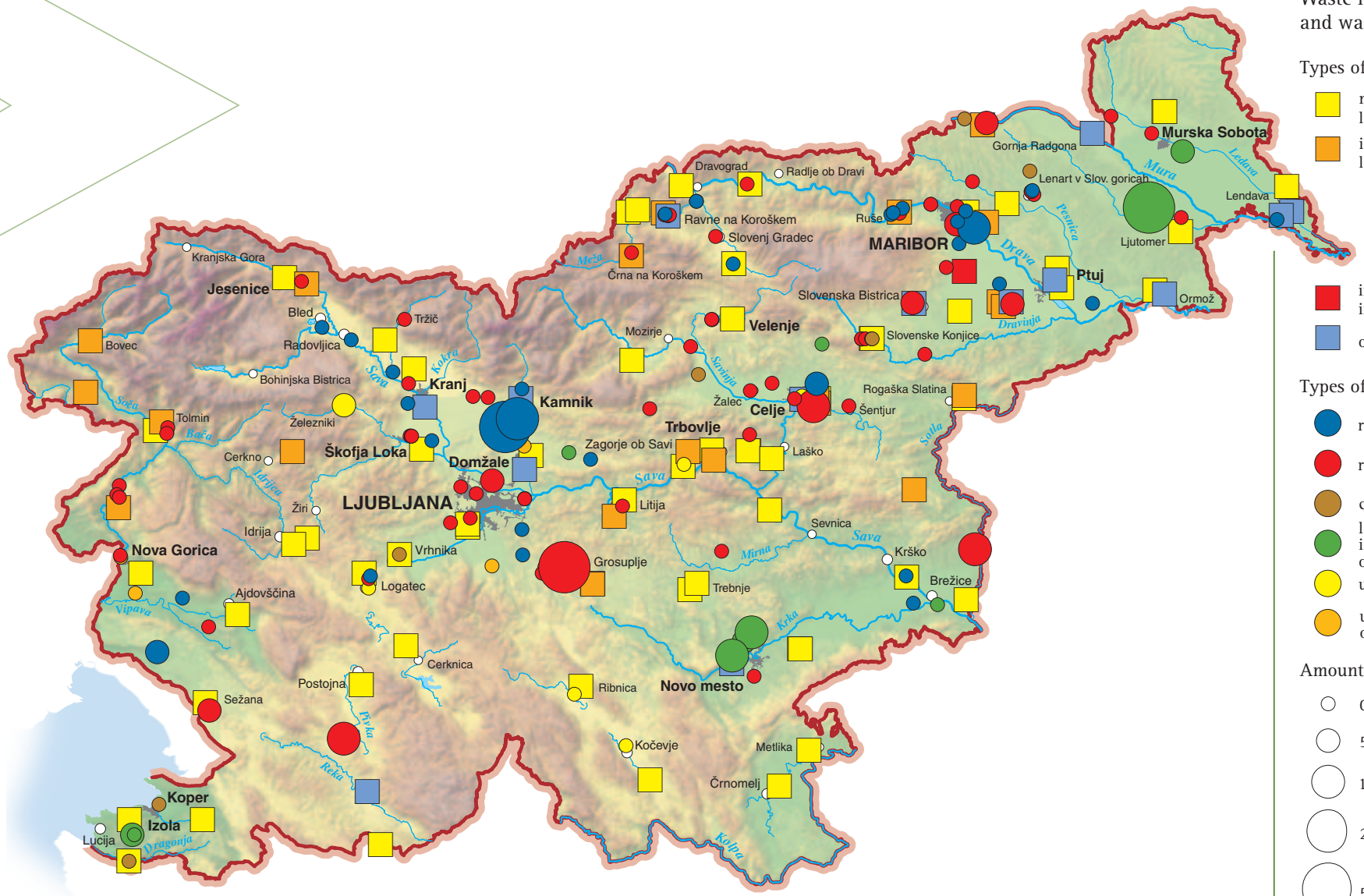
Analiza podatkov iz letnih poročil o ravnanju z odpadki v RS za leto 2005. 2007. Ljubljana, National Institute of Chemistry Ljubljana, Environmental Agency of the Republic of Slovenia.

Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Operativni program odstranjevanja odpadkov s ciljem zmanjšanja količine biorazgradljivih odpadkov za obdobje do konca leta 2008. 2004. Ljubljana, Ministry of the Environment and Spatial Planning.

Map: Operativni program odstranjevanja odpadkov s ciljem zmanjšanja količine biorazgradljivih odpadkov za obdobje do konca leta 2008. 2004. Ljubljana, Ministry of the Environment and Spatial Planning.
Statistical Office of the Republic of Slovenia. URL: http://www.stat.si/ (accessed in October 2007).

28. Waste management



Waste recovery and waste disposal

Types of waste disposal in 2005

- municipal waste landfills
- industrial waste landfills
- industrial waste incineration plant
- other types of waste disposal

Types of waste recovery in 2006

- recycling of construction waste
- recycling of other types of waste
- composting
- land treatment resulting in benefit to agriculture or ecological improvement
- used for fuel or energy
- used for the production of solvents

Amount of waste recovery

- 0 to 50,000 tons
- 50,000 to 100,000 tons
- 100,000 to 250,000 tons
- 250,000 to 500,000 tons
- 500,000 to 10,000,000 tons

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

About six million tons of waste is produced in Slovenia every year. In the last few years, the amount has been slowly on the increase. The majority of the waste, as much as 73%, is generated in the processing industry and the energy sector. The waste generators recover and dispose of just under a half of all their waste by themselves, the rest is left to general waste management.

Waste management emphasises the waste minimisation at the source, the reuse and recycling of waste, incineration of certain types of waste, while landfilling is the last and least desired option.

Waste recovery is gaining importance in Slovenia too. One of the reasons is improved technical facilities for their processing, which is not only less burdening for the environment but also economically justified. It includes recycling, reuse and thermal processing, where waste is used as an alternative fuel source. The Environmental Agency of the Republic of Slovenia issues environmental permits for waste recovery specifying the types and manners of processing, as well as total amounts of waste that can be processed in a specific facility every year.

From 2002 on, Slovenia has recovered more than half of its industrial waste. The situation in municipal waste is much worse, the majority of it is still landfilled – about 80% in 2006. The situation in hazardous waste is similar to that in industrial waste: less than 40% of waste is landfilled.

For the time being it is impossible to recover all the waste, because even waste recovery generates residues that have to be landfilled. In 2005, Slovenia recorded 83 landfills, 60 of which were for non-hazardous municipal waste and are considered public infrastructure, and 23 landfills for industrial waste. Of the total number of landfills which are public infrastructure, 24 landfills for non-hazardous municipal waste are envisaged to be closed in compliance with the legislation. 28 landfills are in the process of adaptation to the technical requirements of the regulation on waste landfilling, and the remaining eight are built under the demands of the current legislation. According to the data of the Environmental Agency of the Republic of Slovenia, in 2005, waste was landfilled (in accordance with the plan of non-realised works in the framework of the adaptation programme or the programme of landfilling in the new landfills) in 44 landfills for non-hazardous municipal waste.

Relative to 2000 the quantity of the deposited waste in 2002 reduced by about 14%. In 2003 and 2004, we observed a fluctuation in the amount of waste in the non-hazardous municipal waste landfills: first an increase by 2.7% in 2003 relative to 2002, and then a decrease by 1.4% in 2004 relative to 2002. A comparison of data for 2004 and 2005 again indicates a decrease in the total volume of the landfilled waste relative to the base year of 2000, by 15% in each individual year.

An average structure of the deposited waste in the non-hazardous municipal waste landfills in 2005 was as follows: municipal waste 86%, construction waste 5%, sewage sludge 4%, packaging waste 2%, and other landfilled waste 3%.

In 2005, 210,600 tons of waste generated in the production and service activities was landfilled in landfills managed by the industry. More than half of them were inert waste. *(BBV)*

Waste recovery in Slovenia is gaining importance due to economical instruments, technical capacities, as well as the awareness that in this way we are protecting the natural resources. We recover more than 70% of industrial, and more than 60% of hazardous waste. For the most part, municipal waste is still being mostly landfilled. In 2005, there were 44 landfills of non-hazardous municipal waste.

Link to relevant indicators

http://kazalci.arso.gov.si

- Waste management
- Packaging waste
- Construction waste
- Waste oils
- Landfill of waste
- Health-care waste
- Waste edible oil and fat
- Organic kitchen waste
- Sewage sludge from urban waste water treatment plants
- Waste batteries and accumulators
- Transboundary shipments of waste
- End-of-life vehicles
- End-of-life tyres

Data and Sources:

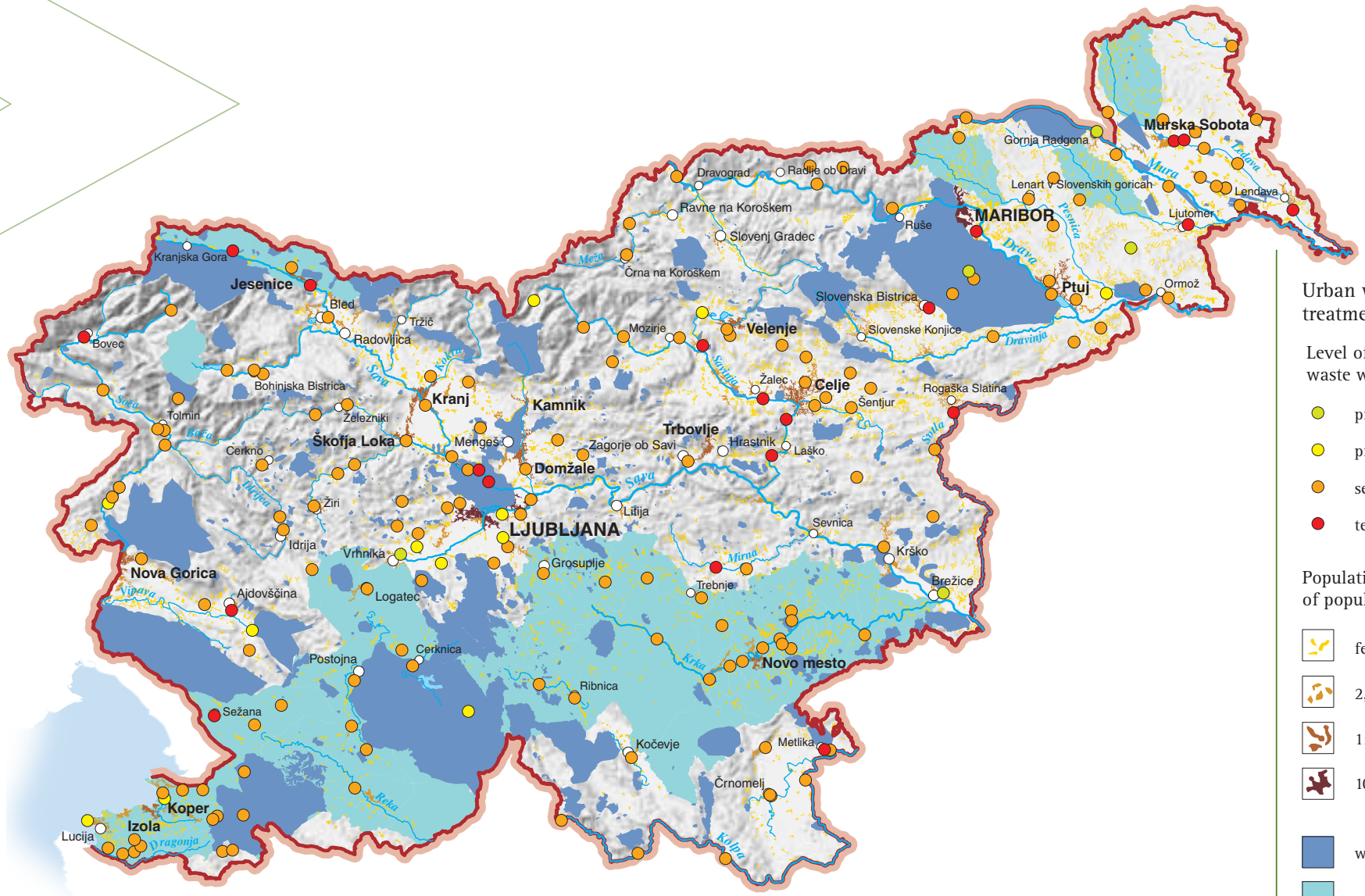
Analiza podatkov iz letnih poročil o ravnanju z odpadki v RS za leto 2005. 2007. Ljubljana, National Institute of Chemistry Ljubljana, Environmental Agency of the Republic of Slovenia.

Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

Map: Odlagališča komunalnih in industrijskih odpadkov. 2007. Digital Map and Data Storage, Environmental Agency of the Republic of Slovenia.

Environmental Protection Permits for Waste Management. 2007. Environmental Agency of the Republic of Slovenia, Manager: Brigita Šarc.

29. Urban waste water treatment



Urban waste water treatment in 2005

Level of purification of the urban waste water treatment plant

- pre-treatment
- primary treatment
- secondary treatment
- tertiary treatment

Population areas by the size of population equivalents (PE)

- fewer than 2,000 PE
- 2,000 to 15,000 PE
- 15,000 to 100,000 PE
- 100,000 to 250,000 PE

- water protection areas
- sensitive areas

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Urban waste water treatment is important for the conservation of clean drinking water, as well as water ecosystems. A large part of Slovenia is covered by smaller watercourses, which are ecologically more vulnerable than the larger ones. Waste water treatment provides protection for surface and underground waters from nitrogen and phosphorus emissions due to the discharge of urban waste water, and from pollution with faecal bacteria in the water protection areas and bathing areas.

Very dispersed population, topography and a large number of settlements with fewer than 2,000 residents have a large impact on the extent and structure of the urban infrastructure and organisation of the treatment services. In 2006, the total length of the sewage system was just under 6,000 km, which is almost 300 km more than in 2004. In 2006, 70% of waste water was treated.

The operational programme for discharging and treatment of urban waste water specifies areas of settlements or parts of settlements that have to be provided with a public sewage system and a waste water treatment plant within a specified period. Thus the end of 2005 was the deadline for the construction of waste water treatment plants for population areas with more than 100,000 population equivalents; water treatment plants in Ljubljana and Maribor, home to more than a fourth of all Slovenes, are already operational. By the end of 2010, population areas with 15,000 to 100,000 population equivalents must be provided with waste water treatment plants, and by 2015, areas with 2,000 to 15,000 population equivalents are to be serviced. Deadlines were also specified for sensitive areas (2008) and water protection areas (2015). By 2008, settlements in sensitive areas with pressures more than ten population equivalents must be serviced, and by 2015, settlements in sensitive or water protection areas with population density 20 or ten population equivalents per hectare must be serviced.

In addition to waste water treatment in large central systems and extensive machinery and electric mechanisation, ecoremediation methods are gaining importance. Constructed wetlands are one of such methods. Their efficiency is 90%. Construction, operation and maintenance costs are low and operation does not require any energy or machinery.

Sewage sludge is the by-product of waste water treatment plants. In the past, more than half it was deposited in the non-hazardous waste landfills. Directive on the landfill of waste envisages a gradual decrease of its volume. The sludge contains 40–50% of organic matter and its decomposition contributes to the amount of greenhouse gases. Just over one percent of the sludge was recovered into compost and deposited on agricultural land. Sludge from water treatment plants is rich with nutrients but when generated in common waste water treatment plants in urban centres and industrial areas, it can contain hazardous substances. Due to their properties and volume these substances can have a negative impact on land use or the quality of underground waters when the sludge is deposited on agricultural land. Thus it is necessary to comply with the specifications outlined in regulations – the sludge has to be biologically, chemically or thermally pre-treated, long-term stored, or recovered in some other corresponding way. This decreases the fermentation ability and hazard to health in its use. A part of the sludge was exported, used for artificial preparation of soil and other recovery processes.

In 2006, 70% of waste water was treated. In Ljubljana and Maribor, home to a fourth of Slovenia's population, waste water treatment plants are already operational. In the past, more than half of the sludge generated in the treatment plants was deposited. Due to the high contents of organic matter, sludge landfilling is planned to gradually decrease.

Link to relevant indicators

http://kazalci.arso.gov.si

- Waste water treatment
- Sewage sludge from urban waste water treatment plants
- Landfill of waste

Data and Sources:

Urban Waste Water Treatment Directive (91/271/EEA).
Ecoremediation in Integrated Water Management. Limnos d. o. o., URL: http://www.limnos.si/files/LIMNOS_prospekt.pdf (accessed on 11. 9. 2007).
Griessler Bulc, T. Ekoremediacije za kakovost vode z naravnimi procesi. URL: http://www.ifb.si/radensko/ekoremediacije.htm (accessed on 11. 9. 2007).
Environmental Indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Operativni program odvajanja in čiščenja komunalne odpadne vode. 2004. Ministry of the Environment and Spatial Planning.
Resolution on National Environmental Action Plan 2005–2012. Official Gazette RS, No. 2/2006.
Decree on the limit input concentration values of dangerous substances and fertilisers in soil Official Gazette RS, No. 84/2005.
Map: Komunalne in skupne čistilne naprave. Digital Map and Data Storage, Environmental Agency of the Republic of Slovenia, 2007.

Marine and coastal environment

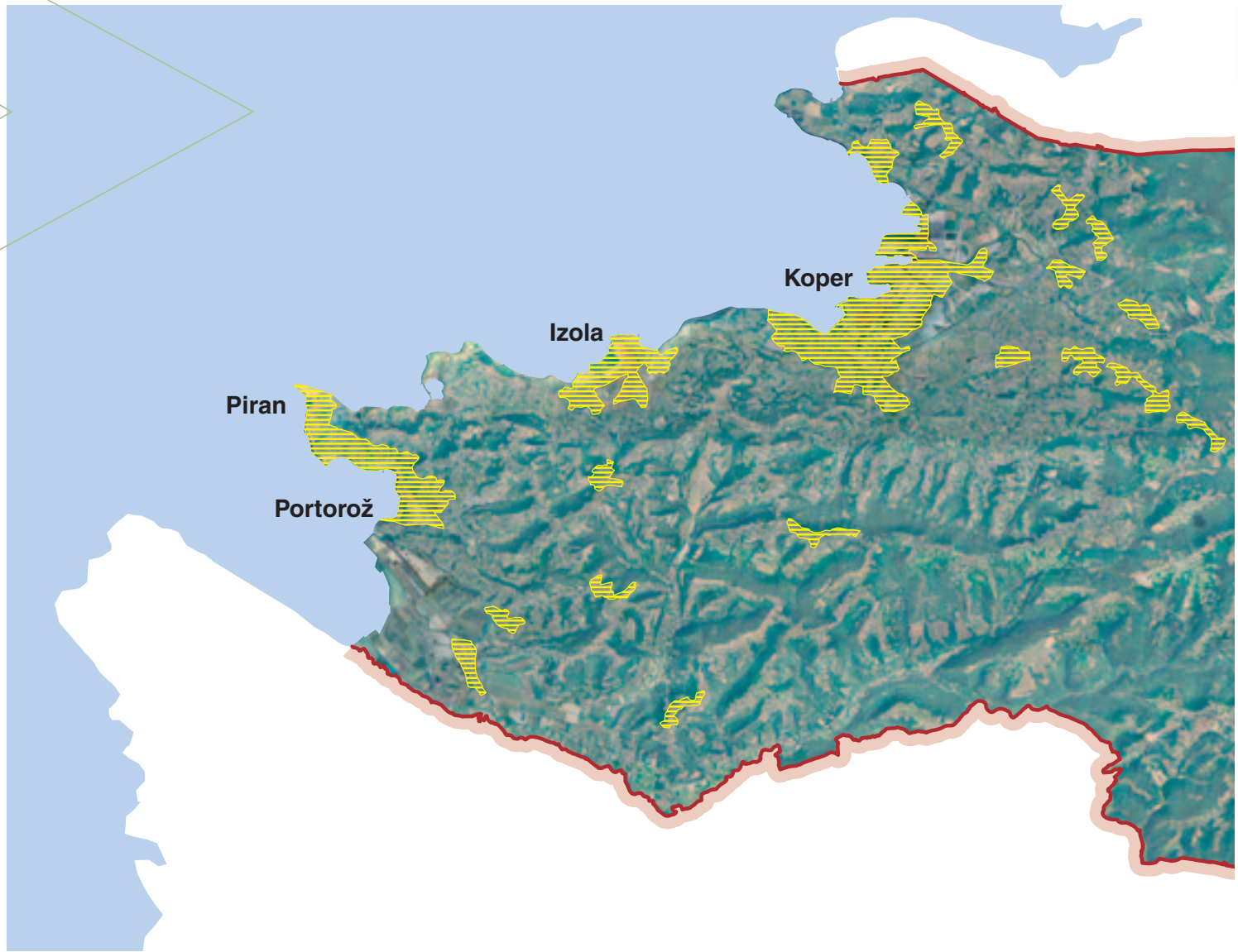
The Slovenian coastal strip has been witnessing an intensification of various activities, e.g. settlement, tourism, transport, population growth and an increase in construction. The hinterland has rather weak ties with the coastal zone and is facing numerous issues that hinder its development.

The Slovenian sea is a relatively shallow basin with a wide array of pressures in the coastal strip and the hinterland; these characteristics significantly influence the ecological processes and the state of the sea. In 2005, results of regular quality monitoring indicated a good chemical and trophic level as well as suitable conditions for mariculture. The Slovenian coast comprises 13 natural bathing sites and 6 bathing water areas. In 2006, the quality of the bathing water areas was in full compliance with the mandatory criteria outlined in the bathing water directive.

In addition, the Slovenian sea is a relatively rich habitat for marine flora and fauna. Certain large areas are protected: the Sečovlje Salina Nature Park, the Strunjan Landscape Park, the Škocjanski zatok Nature Reserve and natural monuments Cape Madona and Cape Debeli rtič. The marine ecosystem, however, is constantly endangered due to heavy shipping which may result in the import of alien species and in intentional or accidental discharges from ships. Marine transport has been on the rise – the annual throughput at the Luka Koper port increased to 14 million tonnes in 2006. 37% of the coast has undergone notable to significant morphological changes while 12% is inaccessible due to special security regimes (customs piers, Luka Koper).

Tourism has seen a considerable boost as well. In the coastal zone, water consumption increases significantly during the summer months in households and in agriculture, though the increase is mostly due to the greater number of tourists. We are bound by environmental objectives to maintain our waters in good condition and protect the marine environment. An effective tool for achieving this is to prepare a management plan for the coastal zone which promotes international cooperation, thereby surpassing the traditional sectoral approach and establishing cooperation among all interested parties. Some successful steps in that direction have been taken with the management programme outlined in the project CAMP Slovenia.

30. Urbanization of the coast



Urbanization of the coast

densely built-up areas

Scale: 1 : 145,000. Source: Ministry of the Environment and Spatial Planning, Environmental Agency of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia, European Environment Agency, 2003.

Slovenians see the sea as an extremely valuable natural feature and an important resource. People have always been drawn to the areas where water comes in contact with the land. The coast provides excellent opportunities for development in terms of urbanization, transport, recreation and tourism.

The traditional economic activities in the coastal areas were agriculture, salt production, shipbuilding and fishing, all of which were closely connected with the environment's natural resources. These activities created a traditional landscape pattern of the Slovenian coastal strip marked by a plush combination of natural vegetation, decorative plant life and crops on terraced slopes. Cultivated terraces on flysch slopes were of great importance as they reduced erosion, increased the areas available for cultivation and improved moisture retention. Furthermore, the cultivated areas on plains and salt-pans gradually altered the coastline. In the Koper Bay, for example, the shallow water area had reduced by 4 km^2 in 200 years.

Today, the entire coastal strip is densely populated. Characteristic traits of coastal settlements are well-preserved in Piran, Izola and Koper. These ancient towns abound in narrow buildings and boast well-protected, recognizable cultural and historical centres. Conversely, Portorož is a modern urbanized section of the coast and may be classified as a riviera-type town. Scattered settlements intertwined with cultivated terraces are prevalent on the southern slopes and flattened ridges in the vicinity of the sea. The character of the coastal landscape is being transformed by an uncontrollable expansion of individual buildings, mainly holiday cottages and tourist facilities. Only 25% of the coast remains in its natural state. The greatest part of the coast (38%) is moderately changed while 37% is notably to significantly changed. The latter part encompasses ports, marines and urban sections which encroach upon the intertidal zone and the sea. 12% of the coast is inaccessible due to special security regimes (customs piers, Luka Koper).

Tourism is also intensifying. In the summer months, water consumption increases dramatically in the coastal area, which may be contributed to increased household and agricultural use but mainly to the greater number of tourists in the summer season. Population growth, the rising number of tourists and economic development further exacerbate the environment by producing larger quantities of waste water, as effective waste water treatment facilities are still in the construction phase. Marine transport is growing; the annual throughput at the Luka Koper port increased to 14 million tonnes in 2006. A significant rise in passenger and freight transport on land and at sea is putting additional pressures on land use, air quality and marine water quality due to intentional or accidental discharges of pollutants from ships.

While the Slovenian Istria coastal strip is seeing a proliferation of activities, infrastructure and consequently a growth in population and construction, the much larger hinterland is facing various structural problems and issues which hamper its development. *(UK)*

The Slovenian coastal strip is seeing a proliferation of various activities (settlement, tourism, transport etc.), the population is growing and construction is on the increase. 37% of the coast has undergone notable to significant morphological changes, while 12% of the coast is inaccessible due to special security regimes (customs piers, Luka Koper). The hinterland has weak ties with the coast and is facing various problems and issues which hinder its development.

Link to relevant indicators

http://kazalci.arso.gov.si

- Land cover and land use
- Air quality
- Freight transport
- Outstanding natural features visited
- Development and distribution of tourism

Data and sources:

Bricelj, M., et al., 2002. Moje tvoje morje: slovensko Sredozemlje in trajnostni razvoj. Ljubljana, Ministry of the Environment and Spatial Planning.

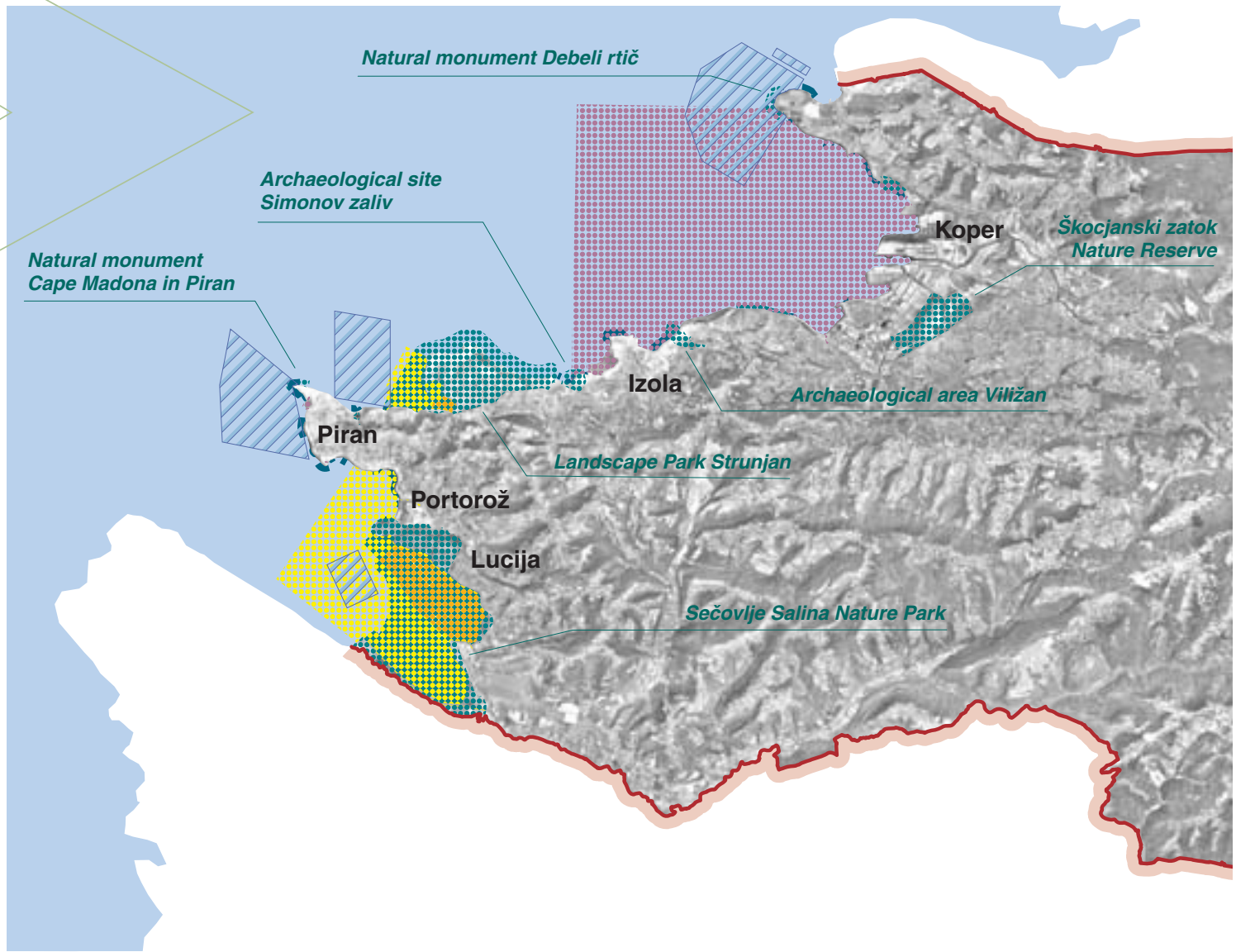
Gabrijelčič, P., et al., 2005. Podrobnejša zasnova prostorskih ureditev obalnega pasu. Annex to the integral report. MAP CAMP Slovenia. Ljubljana, Faculty of Architecture.

Hudoklin, J., et al., 2006. Analiza stanja in razvojnih možnosti ter vizija prostorskega razvoja regije. Regional strategy of spatial development in the southern Primorska region. MAP CAMP Slovenia. Novo Mesto, Acer, d. o. o.

Technical background for a temporary water management plan – surface waters. 2006. Ljubljana. Institute for Water of the Republic of Slovenia.

Map: CORINE Land Cover 2000. 2003. Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia, Surveying and Mapping Authority of the Republic of Slovenia, European Environment Agency.

31. Use of marine resources



Use of marine resources

- bathing
- maintenance of the natural and cultural heritage
- transport
- fishing and mariculture
- salt-pans
- areas suitable for mussel cultivation

Scale: 1 : 145,000. Source: Faculty of civil and geodetic engineering, Department of fluid mechanics, 2004.

The Slovenian sea is an extraordinary natural resource and an important window to the world. It enables various activities such as tourism, transport, production of food and other goods. These activities, however, may be mutually exclusive in their use of the sea and the coastal land. The unique importance of the Slovenian sea is evident from numerous legislative documents in various sectors which employ a range of legal regimes to regulate sea and coastal land use. A legal regime is a set of rules implemented on the basis of regulations which determine the manner of exercising the granted right to sea and coastal land use and the associated obligations.

In general, the coastal area is regulated by a legal regime for a natural or constructed (dyke, dam, excavation) public asset whose purpose is to grant equal general use under equal conditions to everyone. Specific regulations are intended to manage such use to the benefit of everybody. The legislation governing marine fishing determines fishing preserve areas (Strunjan and Portorož preserve), where fishing and the speed of sailing are limited. Furthermore, the legislation defines areas where the water quality is suitable to support marine bivalves and gastropods, i.e. areas of current or future mussel cultivation.

Areas integral for the preservation of nature and cultural heritage are protected with acts of various status types (e.g. nature reserve, landscape park, archaeological area, planned nature conservation area, area of ecological importance and Natura 2000 area). Certain larger areas are protected, e.g.: the Sečovlje Salina Nature Park, the Strunjan Landscape Park, the Škocjanski zatok Nature Reserve and natural monuments Cape Madona and Cape Debeli rtič. The marine ecosystem, however, is constantly endangered due to heavy shipping which may result in the import of alien species and in intentional or accidental discharges from ships.

Sea use in the predominant part of the Koper Bay and in some integral smaller areas in the vicinity of other coastal towns is governed by legal regimes in compliance with the navigational code (waterways, public transport port, local port etc.) dealing mainly with unobstructed navigation and consequently restricted use for other purposes (bathing, in some areas fishing etc.). Marine transport is growing; the annual throughput at the Luka Koper port increased to 14 million tonnes in 2006. Access to the sea as a national asset is largely restricted due to transport operations – as much as 12% of the coast is inaccessible due to special security regimes (customs piers, Luka Koper). Safe bathing in the sea is ensured by means of a legal regime for bathing waters and sites paying special attention to bathing water quality.

We are bound by environmental objectives to maintain our waters in good condition and protect the marine environment. An effective tool for achieving this is to prepare a management plan for the coastal zone which promotes international cooperation, thereby surpassing the traditional sectoral approach and establishing cooperation among all interested parties. Some successful steps in that direction have been taken with the management programme outlined in the project CAMP Slovenia. The following has been formulated within the scope of the project: a spatial development plan for the southern Primorska region and the coastal strip, management of nature protected areas, a regional strategy for sustainable tourism development, a regional environmental protection programme and environmental sensitivity maps of the Slovenian coast. *(UK)*

The importance of the Slovenian sea is evident from numerous legislative documents in various sectors which employ a range of legal regimes to regulate sea and coastal land use. Certain areas are allocated for fishing preserves and cultivation of marine organisms, other areas are intended for the conservation of nature and cultural heritage, sections of the coast are reserved for safe bathing, and locations of waterways, ports and other marine transport uses are defined.

Link to relevant indicators

http://kazalci.arso.gov.si

- Freight transport
- Bathing water quality in costal zones
- Development and distribution of tourism
- Accidental oil tanker spills
- Quality required of water supporting marine bivalves and gastropods

Data and sources

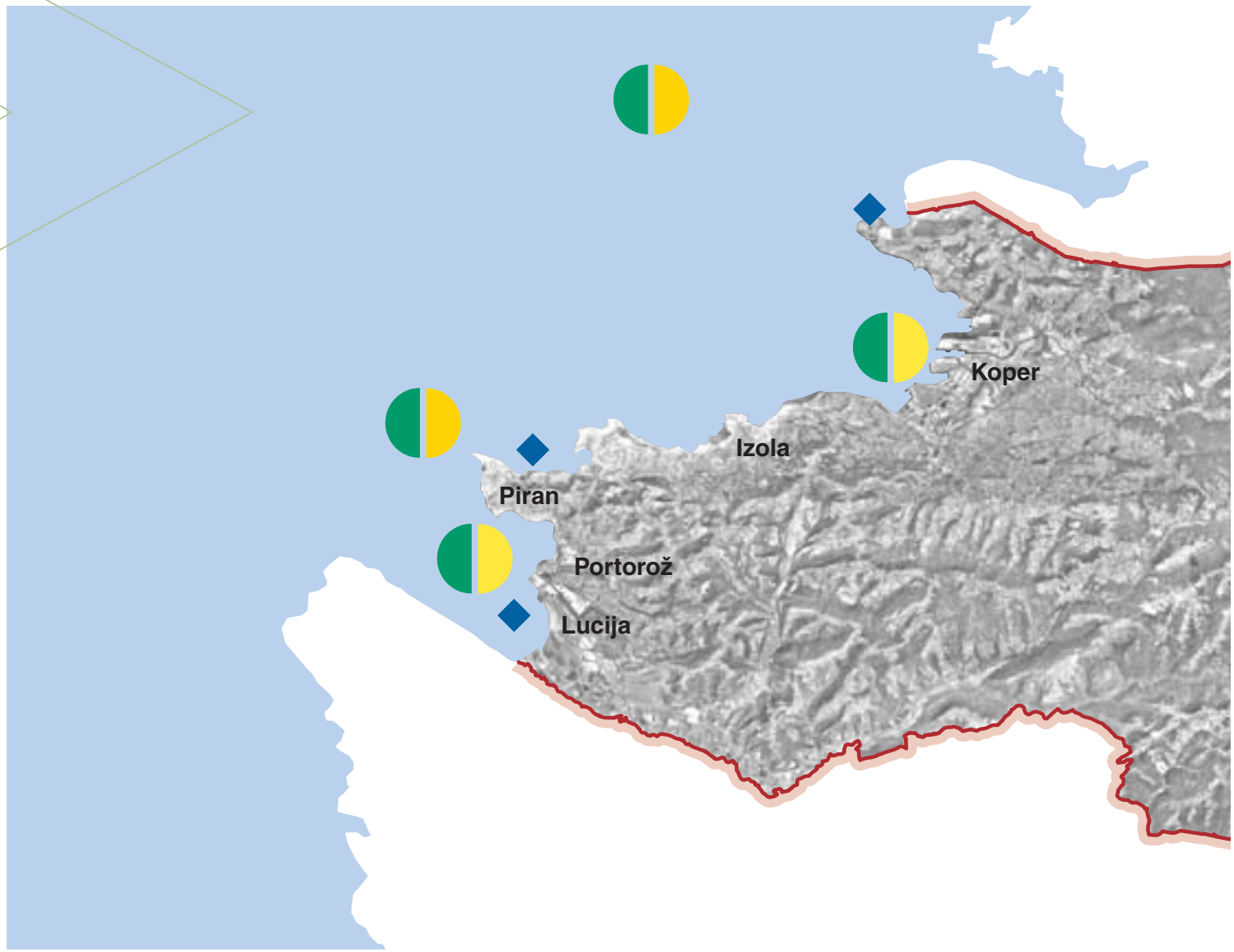
Bricelj, M., 2007. Marine and coastal environment management. Environment in Slovenia. (Presentation, Ljubljana, 31. 1. 2007)

Gabrijelčič, P., et al., 2005. Podrobnejša zasnova prostorskih ureditev obalnega pasu. Annex to the integral report. MAP CAMP Slovenia. Ljubljana, Faculty of Architecture.

Raba morja. 2004. University in Ljubljana, Faculty of civil and geodetic engineering, Department of fluid mechanics.

Map: Rules on determining marine areas where the quality of water is suitable to support marine bivalves and gastropods. Official Gazette of the Republic of Slovenia, no. 84/2007.

32. Marine water quality



Marine water quality in 2005

Chemical status

- good
- poor

Trophic index (TRIX)

- excellent (2 to 4)
- good (4 to 5)
- mediocre (5 to 6)
- poor (6 to 8)

Suitability of water to support marine bivalves and gastropods

- suitable
- unsuitable

Scale: 1 : 180,000. Source: Environmental Agency of Slovenia, 2007.

The Slovenian sea stretches along 46.6 km of coast and encompasses a surface area of up to 12.2 nautical miles from the coastline. It is a relatively shallow marine basin with a small volume; for this reason, atmospheric factors have a rapid and strong influence on its salinity and temperature. The dynamics of water masses in the coastal strip are mainly affected by tide, wind and freshwater influx. The main features of the coastal strip and the hinterland are dense settlement, areas of intensive agriculture, industry, transport, tourism and various service activities. All of these features are reflected in the quantity of urban and industrial waste water discharged in the sea, which, in turn, has a significant impact on the ecological processes and thus on the state of the sea. The rivers contributing the majority of the suspended particles and nutrients are Rižana, Dragonja, Badaševica and Drnica.

Due to its modest size (shallow water, small volume and weak currents), the Slovenian part of the Trieste Bay is environmentally sensitive. The influx of inland waters containing large amounts of nutrients, certain direct discharges and water treatment plant discharges exert pressure on the Slovenian sea. The area under the most pressure is the interior section of the Koper Bay, mainly due to the rivers Rižana and Badaševica carrying some direct discharges of municipal and industrial waste water.

Marine water quality is constantly monitored by analyzing samples of marine water, the sediment and the flesh of marine organisms captured in specific intervals at precisely determined monitoring sites and depths. The map shows three aspects of marine water quality: chemical status, trophic status and suitability to support marine bivalves and gastropods.

The standards for estimating the chemical status of water (good or poor) are established by the legislation. Limit values are determined for chemical compounds in the water and the sediment (e.g. heavy metals, pesticides etc.) and should not be exceeded. From a chemical point of view, in 2005 the quality of marine water as shown in the map was good. The load of nutrients is indirectly demonstrated by the trophic index, also known as TRIX. The index takes into account dissolved nitrogen, phosphorus and chlorophyll as well as oxygen saturation and transparency of the sea. In a string of measurements over several years, the average TRIX values measured and calculated at measurement sites in the coastal waters have ranged between 4, 5 and 6. These values indicate a moderate eutrophication of water, i.e. a moderate increase in the value of nutrients in the water which reduce the oxygen saturation and transparency of the sea. TRIX index levels in 2005 indicate good trophic conditions at all monitoring sites.

In certain sections of the sea, the quality of water is suitable to support marine organisms. As these are mainly organisms intended for market sales, in 2003 two monitoring sites were chosen in the interior of the Strunjan Bay and the Piran Bay, where *Mytilus galloprovincialis* mussels have traditionally been grown. In 2005, a new monitoring site was added at a new cultivation site near Cape Debeli rtič. The quality of marine water is determined on the basis of physical, chemical and microbiological parameters. Cadmium and mercury levels were also determined in the sediment and mussel flesh. In 2005, the quality of the water body at all three mussel cultivation sites was estimated as suitable. *(UK)*

The Slovenian sea is a relatively shallow marine basin facing various pressures in the coastal strip and in the hinterland. These characteristics have a significant impact on the ecological processes and on the state of the sea. Marine water quality is constantly monitored by analyzing samples of marine water, the sediment and the flesh of marine organisms. In 2005, the chemical status, trophic status and suitability to support marine organisms were good.

Link to relevant indicators

http://kazalci.arso.gov.si

- Bathing water quality in coastal zones
- Bottom oxygen concentrations
- Chlorophyll-*a* in the coastal sea
- Accidental oil tanker spills
- Chemical and trophic status of the sea
- Quality required of water supporting marine bivalves and gastropods
- Sea level

Data and sources:

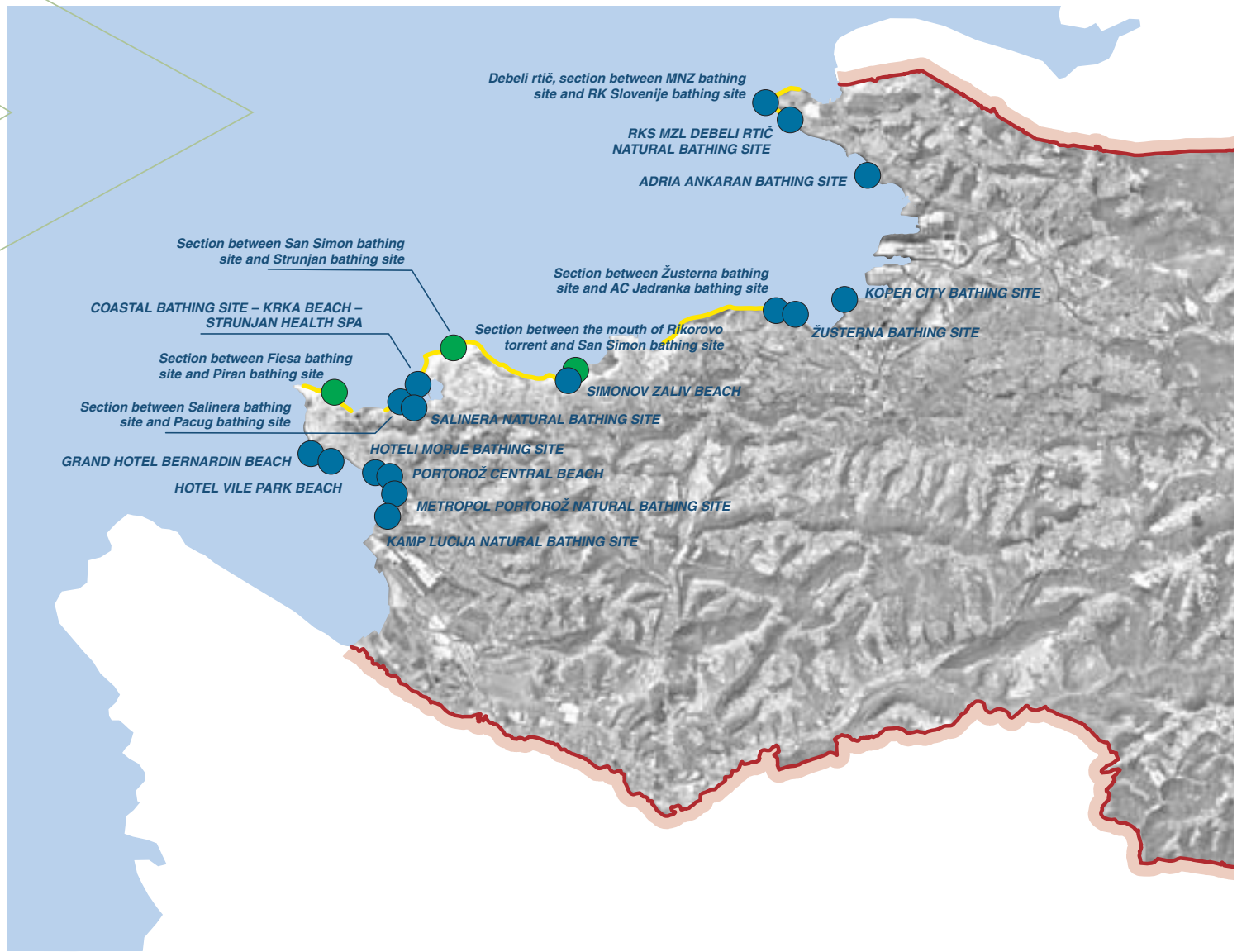
Rules on determining marine areas where the quality of water is suitable to support marine bivalves and gastropods. Official Gazette of the Republic of Slovenia, no. 106/2004.

Rejec Brancelj, I., 2003. Morje. In: Vodno bogastvo Slovenije. Ljubljana, Environmental agency of the Republic of Slovenia.

Decree on the chemical status of surface waters. Official Gazette of the Republic of Slovenia, no. 11/2002 and 41/2004-EPA-1.

Map: Programme for monitoring the ecological and chemical status of marine waters. Environmental agency of the Republic of Slovenia. URL: http://www.arso.gov.si/vode/morje/ (accessed on 6. 9. 2007).

33. Coastal bathing water quality



Coastal bathing water quality in 2006

- not complying with mandatory values
- complying with mandatory values
- complying with guide values
- bathing water areas

Scale: 1 : 145,000. Source: Environmental agency of Slovenia, Institute of Public Health, 2007.

The Slovenian coast comprises 13 supervised natural bathing sites and 6 bathing water areas used by a large number of people where bathing is not prohibited. To ensure safe bathing in those areas with respect to health and hygiene, special attention is paid to marine water quality. Marine water compliance is determined according to the standards outlined in the national legislation and the Bathing Water Directive. The site is not in compliance if more than 5% of the samples within one bathing season exceed or fail to meet the prescribed standards. 2006 was the first year that the quality of Slovenian coastal bathing waters reached 100% compliance with mandatory values determined in the Bathing Water Directive. These results rank us at the top of European countries. Furthermore, as many as 16 coastal bathing waters met even stricter guideline values. The suitability of coastal bathing water is of extreme importance for tourism.

Estimates show that at the height of the bathing season almost 40,000 bathers occupy the coastal beaches. These numbers exceed the capacity of the beaches as not all areas where bathing is possible are sufficiently equipped and accessible. Natural bathing sites must be equipped with chemical toilets, waste bins and containers which must be regularly cleaned and emptied. Access routes must be marked, public transport stops and parking spots must be provided at main access points and vehicles must be blocked from entering protected areas. Access to such sites by means of vessels is gaining popularity, though anchoring in areas of protected natural values at the sea bottom must be prevented.

Water quality is one of the criteria taken into account when awarding the Blue Flag eco-label. The Blue Flag system is well-established in Europe and to many tourists it serves as a guarantee of bathing site safety and maintenance. The label is awarded every year. The application process is open to municipalities with natural bathing sites at the coast or at the shores of standing inland waters and to marinas. Operators of these sites must comply with various sets of criteria: bathing water quality, safety and services, environmental management as well as environmental education and information-sharing. Recipients of the Blue Flag provide the bathers with a clean, safe and pleasant environment intended for recreation in the water and on the shore. They must also offer regular updates and educational activities for the users. In 2007, the Blue Flag eco-label was awarded to six natural coastal bathing sites (the Portorož Central Beach, the Krka Strunjan Health Spa bathing site, the Salinera bathing site in the municipality of Piran, the Simonov zaliv bathing site in the municipality of Izola, the Youth Health and Holiday Centre Debeli rtič and the Žusterna beach, both in the municipality of Koper), Marina Portorož and Marina Izola. *(UK)*

The Slovenian coast comprises 13 natural bathing sites and 6 bathing areas. In 2006, the quality of Slovenian bathing waters reached 100% compliance with the mandatory values determined in the bathing directive. In 2007, the Blue Flag eco-label was awarded to 6 natural bathing sites, Marina Portorož and Marina Izola.

Link to relevant indicators

http://kazalci.arso.gov.si

- Bathing water quality in coastal zones
- Bottom oxygen concentrations
- Chlorophyll-*a* in the coastal sea
- Accidental oil tanker spills
- Development and distribution of tourism

Data and sources:

Jurinčič, I., 2006. Analiza nosilne zmogljivosti: Regionalna strategija trajnostnega razvoja turizma Južne Primorske. MAP CAMP, Hosting, d. o. o.
Environmental indicators 2005. 2006. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Blue Flag Campaign in Slovenia. 2007. Doves FEE. URL: http://www.drustvo-doves.si/mz/
Poje, M., 2007. Kakovost naravnih kopalnih voda v Sloveniji v letu 2006. Ljubljana, Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/vode/kopalne%20vode/.
Report to the European Commission on the implementation of the Bathing Water Directive 76/160/EEC in 2006. 2006. Ljubljana, Ministry of the Environment and Spatial Planning. URL: http://www.arso.gov.si/vode/kopalne%20vode/.
Map: Collection of data on natural bathing sites, Public Health Institute, 2007.
Collection of data on bathing water areas, Environmental Agency of the Republic of Slovenia, 2007.

Sustainable consumption and production

Sustainable development inevitably requires a change in consumer habits and the introduction of environmentally friendly production. Production encompasses industry as well as the service sector (health care, trade, construction), agriculture, transport and energy. In order to meet the set objectives the issue must be tackled in an integrated manner and should entail the cooperation of all policies and sectors. Only an integrated approach will help to reduce the consumption of energy, raw materials and natural resources, and cut down on the amount of waste. New technologies which enable economical energy consumption in households and the tertiary sector and improve waste management have shown a lot of potential. Despite the promising innovations, however, several obstacles will still have to be overcome in order to achieve the desired results.

The sectors which exert the most pressure in terms of sustainable consumption and production are transport, industry and households. In the past decade, consumption in households has grown by a third. The number of vehicles and rides, particularly on short distances between 1.5 and 5 km, is also on the rise. Analyses show that the busiest national roads in Slovenia are the motorways around Ljubljana, i.e. the Ljubljana ring and its northern junction. Increased transit traffic also poses a major problem. Greater mobility and a higher number of motor vehicles result in higher greenhouse gas emissions. Although the state has introduced several measures in an effort to control these problems, e.g. energy counselling, awareness-raising, information-sharing and training of key users, the current status indicates that the input has not yielded adequate results.

As far as sustainable production is concerned, environmental protection permits are gaining importance; by introducing the best available technologies in industry, these permits promote an integrated prevention of air, water and soil pollution, economical use of raw materials, noise reduction and improvement of energy efficiency.

34. Traffic volume on Slovenian roads

Average annual daily traffic volume in 2005

- 0 to 5,000 vehicles
- 5,001 to 10,000 vehicles
- 10,001 to 25,000 vehicles
- 25,001 to 50,000 vehicles
- 50,001 and more vehicles

Scale: 1 : 1,100,000. Source: Slovenian Roads Agency, 2006.

In recent years, a high volume of traffic has posed a serious problem for Slovenia. The motorway infrastructure is being constructed at a fast pace in order to reduce gridlocks and promote polycentric development, though these efforts are intensifying the pressure on the environment. The transport infrastructure physically alters the environment and endangers people's health and ecosystems due to emissions of pollutants in the air. Some sections of the Slovenian motorway network are subjected to increased burdens on the habitat due to the high volume of traffic. The average annual daily traffic (AADT) is shown as the number of vehicles.

The busiest roads in Slovenia carry high volumes of local, intercity and transit traffic simultaneously. Analyses indicate that the highest volume of traffic on Slovenian national roads is borne by the motorways surrounding Ljubljana, i.e. the Ljubljana ring and its northern junction. In 2005, the average annual daily traffic was 66,710 vehicles daily in the western section of the Ljubljana ring between Koseze and Brdo, and 61,102 vehicles in the north-eastern section between Šmartinska and Dunajska. The number of vehicles is relatively high in the Celje and Maribor regions, though still considerably less than in the Ljubljana and Koper regions. During the tourist season, a high volume of traffic is observed in the Primorje motorway section (more than 60,000 vehicles daily) and the coastal motorway (more than 70,000 vehicles daily).

In 2005, traffic on main roads was heaviest in the Ljubljana area; on main roads Medvode–Ljubljana (26,283 vehicles daily) and Trzin–Tomačevo (36,221 vehicles daily). The highest volume of main-road traffic in Primorska is on the Koper–Izola road (28,135 vehicles daily), in Gorenjska on the Lesce–Naklo road (26,540 vehicles daily) and in Štajerska on the Maribor junctions (approximately 30,000 vehicles daily).

The highest volume of traffic, almost 62%, is borne by motorways, high-speed roads and main roads, all of which combined cover less than 23% of the entire length of the national road network. Motorways and high-speed roads, which represent 7.3% of the entire length of the national road network, carry more than 37% of traffic. Main roads, which represent 14.7% of the entire length of the national road network, carry almost 25% of the traffic and the remaining national roads accommodate slightly over 38% of the traffic.

Due to increased mobility and a higher number of motor vehicles, emissions of greenhouse gases into the atmosphere, particularly CO_2, are on the rise. The share of road traffic is rising steadily while the share of public, railway and bus transport has been stagnant or has decreased. Road traffic has seen an increase in freight vehicles due to transit traffic, which poses an additional burden on the environment. The busiest transit lines link the following zones: Italy and Croatia (Istria), Croatia (Zagreb) and Austria (Graz), Italy and Croatia (Reka) and Croatia (Zagreb) and Austria (Klagenfurt) or Italy. *(NK)*

The busiest roads in Slovenia carry high volumes of local, intercity and transit traffic simultaneously. Analyses show that the busiest national roads in Slovenia are the motorways around Ljubljana. The highest volume of traffic, almost 62%, is borne by motorways, high-speed roads and main roads, all of which combined cover less than 23% of the entire length of the national road network. Due to increased mobility and a higher number of motor vehicles, emissions of greenhouse gases into the atmosphere, particularly CO_2, are on the rise.

Link to relevant indicators

http://kazalci.arso.gov.si

- Passenger transport
- Freight transport
- Transport final energy consumption
- Infrastructure investments
- External costs of transport
- Public awareness

Data and sources:

Analiza tranzitnega prometa skozi Republiko Slovenijo in ocena možnih prometno-političnih ukrepov za zmanjšanje le-tega. Final report. 2006. Maribor, University in Maribor, Faculty of Civil Engineering.

State of the environment report 2002. URL: http://www.arso.gov.si/varstvo%20okolja/poro%C4%8Dila/poro%C4%8Dila%20o%20stanju%20okolja%20v%20Sloveniji/

Promet 2005. Data on traffic volume monitoring on national roads in the Republic of Slovenia. 2006. Ljubljana, Ministry of Transport, Slovenian Roads Agency.

Resolution on Transport Policy of the Republic of Slovenia (Intermodality: time for synergy). Official Gazette of the Republic of Slovenia, no. 58/2006.

Map: Collection of data on traffic volume monitoring on national roads in the Republic of Slovenia, Ministry of Transport, Slovenian Roads Agency, 2006.

35. Installations causing large-scale pollution

Type of activity

- energy
- manufacture and processing of metals
- non-metallic industry
- chemical industry
- waste management
- other activities

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

As the European industry generates a significant pressure on the environment, the European Commission adopted the so-called IPPC Directive (Directive 96/61/EC concerning integrated pollution prevention and control) in 1996. The directive requires member states to issue permits for the operation of industrial installations. These measures are outlined in the action plans by the European Integrated Pollution Prevention and Control Bureau and cover all industry sectors. Integrated pollution prevention in this case refers to a reduction of emissions in the air, water and soil, rational use of raw materials, noise reduction and improvement of energy efficiency. Where prevention is not possible, the directive mandates a reduction in emissions to minimize the negative impact on the environment. The objectives of the directive were introduced to the Slovenian legislation in April 2004 with amendments to the Environment Protection Act.

In Slovenia, there are 173 enterprises which require an environmental protection permit in order to operate. In terms of activities 6 enterprises are engaged in energy industry, 20 in chemical industry, 20 in waste management and 59 in other areas.

An environmental protection permit is issued to operators by the Environmental Agency of the Republic of Slovenia, which keeps a database of issued permits in the IPPC information system. The database includes information from various inventories (water emissions inventory, air emissions inventory, waste inventory), information on economic instruments of environmental protection (water fees, water pollution tax, CO_2 tax, waste disposal tax), administrative procedure data (consents issued on the basis of environmental impact assessments, register of waste-related applications and permits) as well as information from some external sources such as the Register of Spatial Units, Cadastre of Buildings, Land Cadastre (the Surveying and Mapping Authority of the Republic of Slovenia databases) and information on IPPC operations and issued administrative acts (data by the Environment and Spatial Planning Inspectorate of the Republic of Slovenia). During the process of issuing environmental protection permits, authorities consider the possibilities to reduce emissions in the air, water and soil, assess the rational use of raw materials, noise and waste reduction and improvement of energy efficiency of the installation by using BAT – Best Available Technologies. Data on the geographical location of the industrial facility, the climate and technical characteristics of the installations are also crucial.

BAT technologies are described in the so-called BREF documents (BAT Reference Documents) that provide a valuable tool for the management of environmental approaches. The documents offer useful information on the environment, control and permits and are intended for the industry as well as the general public interested in the topic. In order to better monitor the implementation of the IPPC directive objectives, the European Environment Agency is establishing an online register known as EPER (European Pollutant Emission Register). Its purpose is to improve public awareness on the state of the environment in the EU and Slovenia. *(NK)*

Within the system of integrated pollution prevention and control, the EU requires member states to issue environmental protection permits in compliance with the IPPC directive. In Slovenia, there are 173 installations which may cause large-scale environmental pollution.

Link to relevant indicators

http://kazalci.arso.gov.si

- Emissions of acidifying and eutrophying substances
- Emissions of ozone precursors
- Landfill of waste
- Environmental management systems

Data and sources:

Dolenc, T., 2006. Pristopi in praksa pri izdaji IPPC dovoljenj v Republiki Sloveniji. Ljubljana, Ministry if the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.

IPPC portal. URL: http://okolje.arso.gov.si/ippc/ (accessed on 11. 10. 2007).

Decree on activities and installations causing large-scale environmental pollution. Official Gazette of the Republic of Slovenia, nos. 97/2004 and 71/2007.

Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06 MetAA, 66/06-Dec. CC, 112/06-Dec. CC and 33/07-Sp. PlA.

Map: IPPC Information System, Environmental Agency of the Republic of Slovenia (accessed on 11. 10. 2007).

Environmental quality monitoring

The objective of the environmental policy is to attain a high level of environmental protection while taking into account the diversity of natural conditions. To achieve this, environmental and spatial information is integral for the creation and implementation of environmental legislation and other environment-related policies. Environmental data, information and services need to be exchanged, shared, used and accessed. Access should be user-friendly and preferably, all data should be available from a single spot. Spatial information, which is crucial for environmental management, has been hindering the effective preparation, implementation, monitoring and assessment of the environment due to the various forms and manners of its organization and storage. For this reason, various environment-related databases should be merged. Furthermore, international aspects should also be considered in environmental management. Cooperation between Slovenia and other countries should be strengthened and access to their databases should be made available.

Environmental data associated with the monitoring of natural phenomena are compiled in compliance with the Environment Protection Act. The Act stipulates the monitoring and management of meteorological, hydrological, seismologic, ecological and other geophysical phenomena. The monitoring is carried out by the Environmental Agency of the Republic of Slovenia, which has set up a number of monitoring networks: air and precipitation quality monitoring network, meteorological monitoring network, seismological monitoring network and water monitoring network. The Agency performs its water management activities through regional offices which correspond to the principle of territorially organized units.

36. Network of seismic stations

Network of seismic stations

▲ seismic station

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Seismic activity is monitored in compliance with the Environment Protection Act. Expert tasks related to safety and protection from seismic, geologic and other hazards are of particular importance, since Slovenia is ranked among the most seismically active areas on the southern part of the Eurasian plate. In 2004, seismic stations recorded over 8400 seismic events, 5398 of which were local, 956 were regional, 905 were remote and 1167 were artificial earthquakes. While the entire territory of Slovenia is earthquake-prone, the highest seismic hazard is in the Ljubljana, Idrija, Tolmin and Krško-Brežice areas. The purpose of the seismic station network is to provide the most accurate definition of the key seismic parameters based on a deep-profile geophysical model of the Slovenian territory, as well as to promptly communicate information on earthquakes to the interested public.

The national network of seismic stations, operated by the Seismology and Geology Office at the Environmental Agency of the Republic of Slovenia, consists of permanent (digital and analog) stations, stations for monitoring strong earthquakes and temporary seismic stations. The temporary stations are generally set up when major quakes occur in order to obtain as much data as possible and monitor seismic activity in a wide area above the epicentre. The number and distribution of the observation stations depend on the seismic risk and hazard assessment, the size of the monitored area and the purpose of data collection.

26 permanent monitoring sites are continuously operating within the national network of seismic stations. They are equipped with digital broadband seismographs. The oldest and central seismic station is located at the Golovec observatory in Ljubljana. Systems consisting of digital equipment offer a much greater dynamic range and resolution. In Slovenia, the first digital seismograph network was set up in 1996. The national strong motion network is comprised of 9 stations which are intended solely for recording strong earthquakes (Bogenšperk, Bovec, Dolsko, Gotenica, Ilirska Bistrica, Kobarid, Krško Nuclear Power Plant and two stations in Ljubljana (Faculty of Civil and Geodetic Engineering and Golovec). A crucial milestone with respect to the construction of seismic stations was reached on April 12, 1998 when a devastating earthquake shook the Posočje region. In the wake of that event, the Government of the Republic of Slovenia approved the construction of the national network of seismic stations.

Seismic station equipment consists of a sensor, a data acquisition unit, communication equipment for continuous data transfer to the processing centre and a continuous power supply. The network is designed to inform the public of the main characteristics of an earthquake within 10 minutes of its occurrence. The data acquired from the seismic station network allow the data acquisition and analysis centre in Ljubljana to regularly inform the public of the basic earthquake parameters (the coordinates of the epicentre, the depth, strength and extent of the earthquake) with adequate precision and reliability in real time. The Slovenian seismic station network is also connected to networks in the neighbouring countries, i.e. Austria, Italy and Croatia, to ensure a continuous exchange of data. *(RV)*

The national seismic station network consists of permanent (digital and analog) stations, stations for monitoring strong earthquake and temporary stations. Seismic activity is continuously monitored at 26 permanent seismic stations within the national seismic station network. The oldest and central seismic station is located at the Golovec observatory in Ljubljana. The network is designed to inform the public of the main features of an earthquake within 10 minutes of its occurrence.

Link to relevant indicators

http://kazalci.arso.gov.si

- Estimated damage caused by natural disasters

Data and sources:

Vidrih, R., 2006. Potresi v letu 2004. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06-MetAA, 66/06 Dec. CC, 112/06 Dec. CC and 33/07-SpPlA.
Map: Network Information System. Digital map and data storage, Environmental Agency of the Republic of Slovenia, 2007.

37. Network for monitoring ionizing radiation in the atmosphere

Network for monitoring ionizing radiation in the atmosphere

◆ Environmental Agency of the Republic of Slovenia monitoring site

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Ionizing radiation is monitored in compliance with the Environment Protection Act. The purpose of monitoring is to reduce the damage and radioactive contamination of the habitat as much as possible due to the effect of ionizing radiation on human health. Radiation data, subject to continuous monitoring, assist the competent authorities of the Republic of Slovenia in their decision-making and thus form the basis for a successful implementation of population protection measures. The objective of monitoring is to provide prompt information on radiation risks and to set up an alarm system in the event of an unanticipated radiation cloud occurring in our territory. A radiation cloud may be caused by nuclear plant accidents (e.g. the Chernobyl disaster in 1986), radiological accidents (e.g. radioactive source melting at an ironworks) as well as terrorist attacks.

In Slovenia, the first system for early warnings of increased ionizing radiation in the atmosphere was set up soon after the Chernobyl disaster (1986) by the Slovenian Nuclear Safety Administration, which continues to manage the system to this day. The system enables continuous monitoring of ionizing radiation levels in Slovenia. It comprises 77 measuring probes located in various subsystems managed by the Environmental Agency of the Republic of Slovenia, the Krško Nuclear Power Plant, the Slovenian Nuclear Safety Administration, the Milan Vidmar Electric Power Research Institute and Slovenian thermal power plants. The Environmental Agency of the Republic of Slovenia system encompasses 53 gamma radiation gauges and new meteorological data acquisition units, including precipitation gauges. The data obtained from the entire network are collected and analysed at the Slovenian Nuclear Safety Administration, where a 24-hour state of readiness system is set up. The system provides data on ionizing radiation and issues prompt warnings of any increased external radiation levels. Due to its comprehensive radiation monitoring in the territory of the Republic of Slovenia, the Slovenian Nuclear Safety Administration also acts as an advisory body to the National Civil Protection Headquarters in the event of radiological accidents – it provides immediate information and environmental assessment in the event of radioactive contamination due to a nuclear or radiological accident at home or abroad. For the purpose of ionizing radiation monitoring in the neighbouring countries, international data are available from the EURDEP (European Radiological Data Exchange Platform) system. Data are also regularly exchanged with Austria, Croatia and Hungary.

The gauges, which are a constituent part of the ionizing radiation monitoring network, continuously measure the dose of external gamma radiation. Dose measurements are critical, as in the event of increased radiation and elevated concentrations of radioactive particles, the leaching and deposition of radionuclides may lead to the contamination of soil, drinking water or food. The purpose of monitoring is therefore to control the level of general radioactive contamination and natural radioactivity in the environment, to track the radionuclide concentration trends and to provide timely warnings of potential sudden increases in radiation in the Slovenian territory. *(NK)*

The ionizing radiation monitoring system enables regular monitoring of radioactive contamination and radioactivity levels in the environment, tracks radionuclide concentration trends and provides timely warnings of potential sudden increases in radiation in the Slovenian territory. The system comprises 77 probes as well as data from various subsystems managed by the Environmental Agency of the Republic of Slovenia, the Krško Nuclear Power Plant, the Slovenian Nuclear Safety Administration, the Milan Vidmar Electric Power Institute and Slovenian thermal power plants.

Link to relevant indicators

http://kazalci.arso.gov.si

Data and sources:

Radioactivity monitoring. Slovenian Nuclear Safety Administration. URL: http://www.ursjv.gov.si/si/monitoring/ (accessed 12. 11. 2007).

Poročilo o varstvu pred ionizirajočimi sevanji in jedrski varnosti v letu 2007. Ljubljana, Ministry of the Environment and Spatial Planning, Slovenian Nuclear Safety Administration.

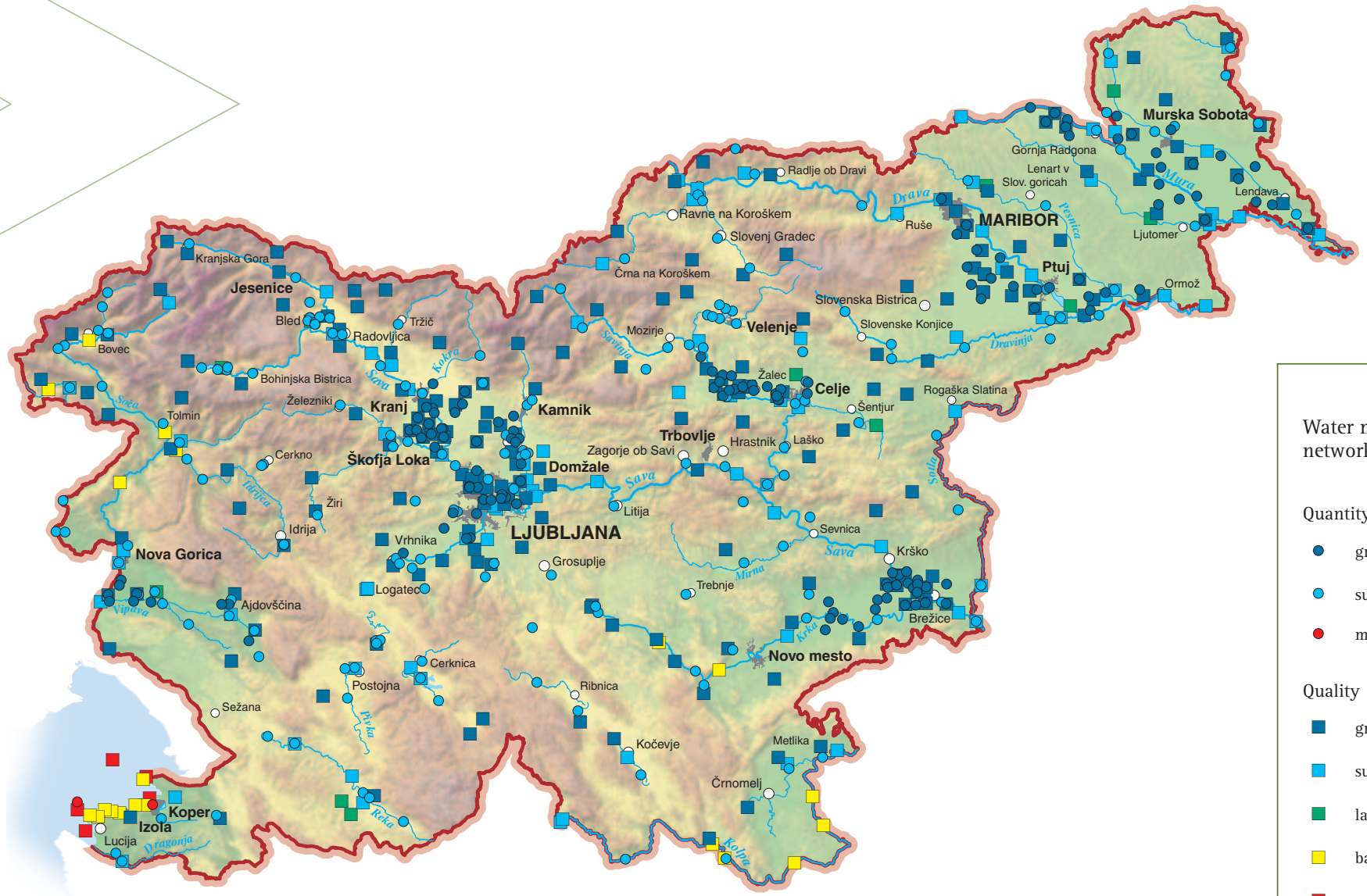
Posodobljeni sistem za avtomatski monitoring sevanja. 2006. Ljubljana, Slovenian Nuclear Safety Administration.
URL: http://www.ujv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/medijsko-sredisce/sevalne-novice/sev-nov-9.pdf (accessed on 12. 11. 2007).

Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06-MetAA, 66/06 Dec. CC, 112/06 Dec. CC and 33/07-SpPlA.

Ionizing Radiation Protection and Nuclear Safety Act. Official Gazette of the Republic of Slovenia, no. 102/2004-ZVISJV-UPB2.

Map: Network Information System. Digital map and data storage, Environmental Agency of the Republic of Slovenia, 2007.

38. Water monitoring network



Water monitoring network

Quantity

- groundwater
- surface water
- marine water

Quality

- groundwater
- surface water
- lakes
- bathing water
- marine water

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Water is monitored in compliance with the Environment Protection Act. The monitoring encompasses the determination of water status in terms of quantity and quality. The objective of the water monitoring network is to provide information on the level of pollution, to determine the quantity, hydrologic properties of water and the water balance, as well as to analyse and forecast hydrologic changes. The information obtained by monitoring helps improve the quality of life and is valuable for the promotion of sustainable use of natural resources and more economical use of water for various purposes.

The water status monitoring program includes measurements of chemical, biological and physical parameters. The chemical and biological parameters provide information on the ecological state of waters while the physical parameter monitoring is limited to the quantitative status of water. The monitoring is carried out within the hydrologic monitoring network, which consists of three types of hydrologic stations: hydrometric stations (representing the reference point for water level measurements), limnigraphic stations (enabling the continuous monitoring of water status) and automatic stations (enabling continuous real-time monitoring and prompt warnings in the event of emergency hydrologic situations). The main factors influencing the development and upgrades of the hydrologic monitoring network are flood protection of settlements, the use of water for energy, technology and supply purposes, and recently the need to study and protect the environment. The ecological monitoring network is developed and upgraded in compliance with two European guidelines – the Water Framework Directive and the Bathing Water Directive.

The first hydrometric stations in Slovenia were introduced in 1850, while quality monitoring was not established until later on, in 1965. The number of stations gradually grew, as did the number of monitored parameters. The physical parameter monitoring was eventually limited to the hydrologic monitoring network comprised of groundwater and surface water monitoring stations as well as marine water stations. In addition, quality monitoring stations are located on lakes and bathing water sites. International standards indicate that Slovenia undoubtedly has an adequate density of hydrologic stations in the monitoring network, containing one station per 124 km^2 of territory. According to recommendations by the World Meteorological Organization, countries should have one station per 100–250 km^2. 52 (or 27.3%) of the hydrologic stations are hydrometric, 124 (or 65.3%) are limnigraphic and 14 (7.4%) are automatic. Considering the density and significance of the watercourse network, the stations are placed disproportionately and are sparser in the southern, karstic and eastern regions of Slovenia.

The water quality monitoring network comprises groundwater and surface water monitoring stations. In recent years, the water status monitoring program has been amended to reflect the responsibilities imposed by the newly adopted European legislation. Surface water quality has been monitored in lakes, marine and transitional waters as well as bathing waters. Furthermore, the water was monitored for its quality to support marine bivalves and gastropods as well as for pollution from land-based sources. The quality of surface watercourses is categorized into five classes based on their hydromorphologic, chemical and ecological status. Groundwater quality monitoring has expanded from the initial monitoring sites to include the monitoring of the chemical status of groundwater bodies. The quality of the groundwater bodies is categorized into two classes. In the future, water status will be monitored at three types of networks to comply with the water framework directive. The surveillance monitoring network is used to assess the overall water status in a specific river basin. The operative monitoring network is intended to determine the water status and assess the effects of pressure mitigation measures. The investigative monitoring is intended to determine the causes for poor water status in cases where the pollution source is not known. *(NK)*

Water status monitoring comprises both qualitative and quantitative aspects of the water. The qualitative status is limited to the hydrologic network, whose density is adequate according to international standards. The water quality monitoring network comprises monitoring stations at surface water, groundwater and marine water sites.

Link to relevant indicators

http://kazalci.arso.gov.si

- Phosphorus in lakes
- Organic pollution and the self-purifying capacity of rivers
- Inland bathing water quality
- Drinking water quality
- Quality of watercourses
- River balance
- Nitrates in groundwater
- Pesticides in groundwater
- Household water consumption
- Use of water resources
- Waste water treatment

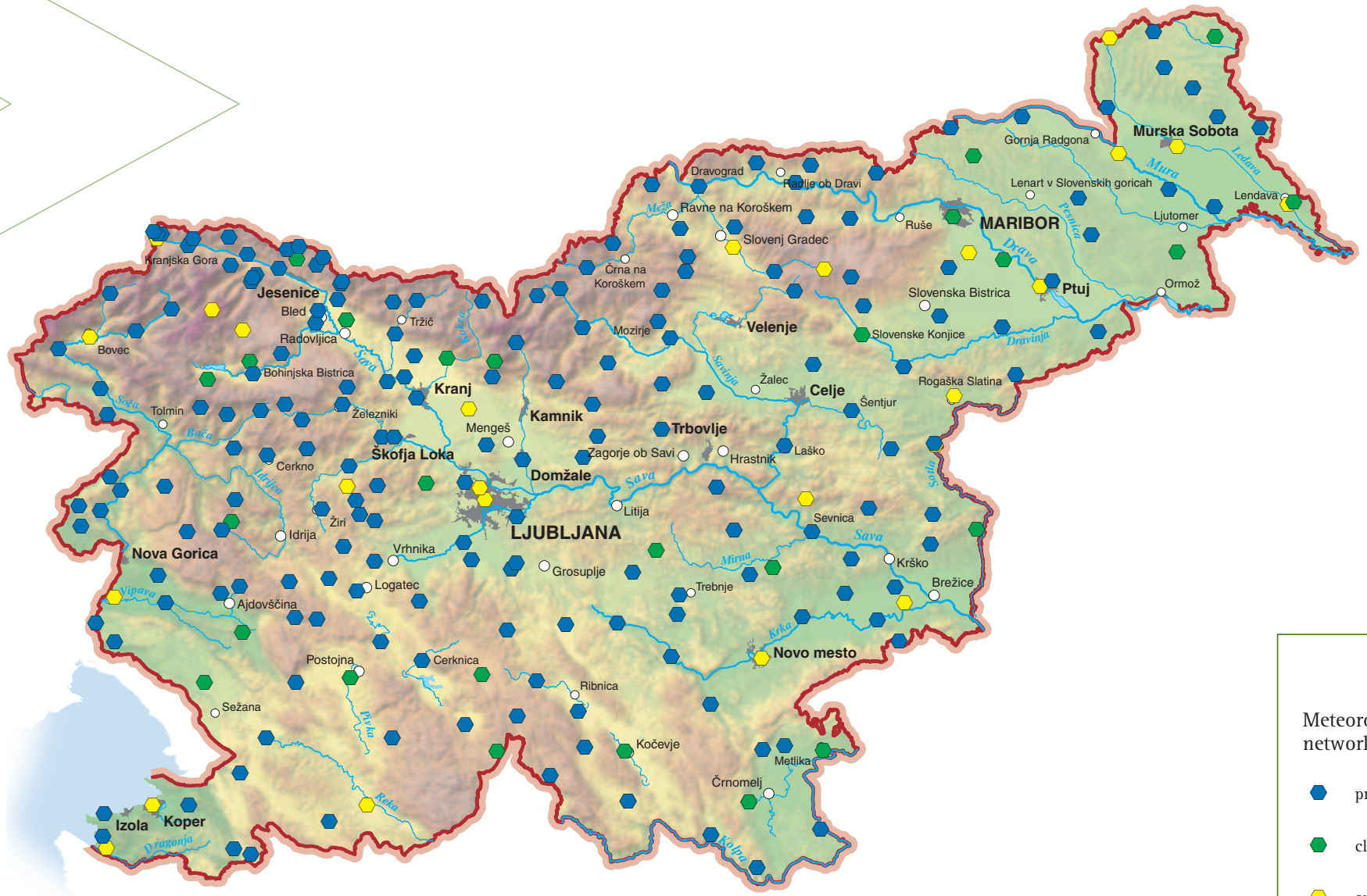
Data and sources:

Izvajanje Vodne direktive v Sloveniji: Predstavitev prvih ocen možnosti doseganja okoljskih ciljev za vodna telesa v Sloveniji po načelih Vodne direktive. 2006. Ljubljana, The Institute for Water of the Republic of Slovenia

Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06-MetAA, 66/06 Dec. CC, 112/06 Dec. CC and 33/07-SpPlA.

Map: Network Information System. Digital map and data storage, Environmental Agency of the Republic of Slovenia, 2007.

39. Meteorological station network



Meteorological station network

- precipitation stations
- climatological stations
- automatic stations

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

The Slovenian national meteorological network was established based on provisions in the Environment Protection Act. Its activities are laid down in detail in the Meteorological Activities Act. In addition to the meteorological station network, the Act outlines the requirements for the registration of a meteorological station, the use of meteorological data and other meteorology-related matters. The objective of the national meteorological network is to prepare and provide reliable meteorological information required for the purpose of environmental protection, protection against natural and other disasters, traffic safety, national defence, international cooperation in the field of meteorology and other national or municipal tasks of public interest. The tasks related to the management and development of the network are performed by the National Meteorological Service under the auspices of the Environmental Agency of the Republic of Slovenia.

The national meteorological network consists of remote, precipitation, climatological, automatic, agrometeorological, aviation meteorological and avalanche monitoring stations. In addition, the network comprises monitoring stations required for the activities of the Slovenian Army and stations located in areas threatened or affected by natural and other disasters. The highest-lying meteorological station in Slovenia is Kredarica at 2514 m above sea level while the lowest-lying station is Portorož Airport at 2 m above sea level.

The precipitation station network consists of 189 stations (176 of them monitor rainfall and 13 of them monitor snowfall), while the climatological station network comprises 38 stations, 13 of which are synoptic stations employed by expert observers. In 2006, the density of the precipitation network was 8.7 stations per 1000 km^2 and the density of the climatological network was 2.0 stations per 1000 km^2. The climatological station network is gradually being replaced by the automatic station network, which currently includes 32 stations and is steadily expanding. The advantage of the automatic network is the acquisition of data in real time; on the other hand, the network frequently suffers blackouts, particularly during extreme weather (storms, showers). It is thus reasonable to preserve the standard meteorological monitoring and keep a log of daily observations alongside automatic stations and remote detection systems.

Observers at precipitation and climatological stations monitor precipitation, total snow cover thickness, newly fallen snow, atmospheric phenomena (fog, frost, dew), types of precipitation (rain, hail, snow), storm winds and storms. Furthermore, the climatological stations also monitor maximum and minimum temperatures, humidity, visibility, cloudiness, soil conditions, wind speed and wind direction. Monitoring at synoptic stations is more frequent (e.g. every 24 hours at airports) and also covers air pressure using the standard mercury barometer, soil temperature, water equivalent of the snow cover, sea temperature, duration of sunshine and evaporation. All measurements and observations are recorded in the logbook and coded data are exchanged at the international level.

The National Meteorological Service uses the data obtained from meteorological stations to prepare warnings required for the performance of national, municipal and public activities, to monitor and warn against avalanches, to provide meteorological warnings and forecasts for protection against natural and other disasters, to provide services required for national protection and maritime affairs, and to provide aviation meteorological services. The observed and recorded data also serve as a basis for studying the weather and climate as well as for other scientific research. Weather and climate studies are extremely valuable for various fields – agriculture, forestry, water management, construction, protection from natural disasters, medicine, as well as marine, land and air transport. *(NK)*

The meteorological network consists of remote, precipitation, climatological, automatic, agrometeorological, aviation meteorological and avalanche monitoring stations. The precipitation station network consists of 189 stations and the climatological network comprises 38 stations. It is gradually being replaced by an automatic station network, which currently includes 32 monitoring sites.

Link to relevant indicators

http://kazalci.arso.gov.si

- Precipitation and temperatures
- Extreme weather events
- Changes in glacier extent
- Annual growing season length

Data and sources:

Cegnar, T., 2006. Živeti s podnebnimi spremembami. Ljubljana, Ministry of the Environment and Spatial Planning, Environmental Agency of the Republic of Slovenia.
Vreme in podnebje – meritve. URL: http://www.arso.gov.si/vreme/o%20meritvah/ (accessed on 6. 11. 2007)
Meteorological Activities Act. Official gazette of the Republic of Slovenia, no. 49/2006.
Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06-MetAA, 66/06 Dec. CC, 112/06 Dec. CC and 33/07-SpPlA.
Map: Network Information System. Digital map and data storage, Environmental Agency of the Republic of Slovenia, 2007.

40. Air and precipitation quality monitoring network

Air and precipitation quality monitoring network

Air

national monitoring station

supplementary monitoring station

Precipitation

national monitoring station

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

Ambient air and precipitation monitoring is carried out in compliance with the Environment Protection Act. The objective of the monitoring is to provide information on the level of pollution and thus improve the current state, enhance the quality of life, promote sustainable use of natural resources and develop sustainable patterns of energy use. As air pollution affects people's health and quality of life, establishing a system of information-sharing, education and awareness raising is of particular importance. Such a system should encourage sustainable production and consumption, support the development and use of best available technologies and promote the implementation of the "polluter pays" principle.

The air and precipitation quality monitoring network consists of stations located at various monitoring sites around Slovenia. The national monitoring sites, managed by the Environmental Agency of the Republic of Slovenia, are positioned in an urban environment subjected to various sources of pollution (transport, industry, agriculture) as well as in rural areas. The supplementary network stations monitor ambient air quality in the vicinity of thermal power plants, i.e. major point sources of pollution. These stations are managed by the Milan Vidmar Electric Energy Institute.

Within the framework of the national observation network, automatic measurements of air pollution are taken at 11 monitoring sites. Two of these sites are located in pressure-free areas away from local sources of pollution (Iskrba near Kočevska Reka and Krvavec). Due to their location, the two stations are exposed to air masses from a greater surrounding area and are representative of a broader region. For this reason, they are included in the international monitoring network of the World Meteorological Organization (within the Global Atmosphere Watch programme – GAW) and the United Nations Organization (within the European Monitoring and Evaluation Programme – EMEP). The GAW programme is implemented within the framework of the Convention of the World Meteorological Organization, while the EMEP programme is implemented within the framework of the Convention on Long-Range Transboundary Air Pollution – CLRTAP.

Within the national monitoring framework, the levels of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM10 and PM2.5), carbon monoxide (CO), benzene (BTX measurements), ozone (O_3) and heavy metals are monitored in the ambient air. Precipitation quality is monitored at five sampling sites evenly distributed around Slovenia. Precipitation quality measurements at the Iskrba near Kočevska Reka sampling site are representative of a broader area. The Park Škocjanske jame sampling site monitors the deposition of substances from the air into the Mediterranean Sea. Precipitation quality is monitored in order to determine the chemical composition of precipitation and study its influence on deposition. In addition to the quantity, the precipitation samples are also tested for acidity/alkalinity (pH), electric conductivity, anion content (sulphate, nitrate, chloride) and cation content (ammonium, sodium, potassium, calcium, magnesium). The supplementary network of stations near thermal power plants (Šoštanj, Trbovlje, Ljubljana, Brestanica) monitors pollutants discharged into the air by activities in the energy sector – sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3). In addition, particulate matter (PM10) is monitored at the Šoštanj Thermal Power Plant. The Environment Protection Act stipulates that an environment monitoring system may also be implemented by a municipality. In line with this provision, municipal monitoring of ambient air quality is established in the municipalities of Ljubljana, Maribor and Celje. *(NK)*

Ambient air quality is monitored at 11 national and 19 supplementary monitoring sites. Concentrations of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM10 and PM2.5), carbon monoxide (CO), benzene (BTX measurements), ozone (O_3) and heavy metals are monitored in ambient air. Precipitation quality is monitored within the framework of national monitoring network at 5 monitoring sites.

Link to relevant indicators

http://kazalci.arso.gov.si

- Emissions of acidifying and eutrophying substances
- Emissions of ozone precursors
- Air quality

Data and sources:

Kakovost zraka v Sloveniji v letu 2006–2007. Ljubljana, Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/zrak/kakovost%20zraka/poro%c4%8dila%20in%20publikacije/LETNO2006.pdf (accessed on 3. 11. 2007)

Spremljanje kakovosti zunanjega zraka in padavin v Sloveniji. 2006. Ministry of the Environment, Spatial Planning and Energy, Environmental Agency of the Republic of Slovenia. URL: http://www.arso.gov.si/zrak/kakovost%20zraka/podatki/merilna_mreza.pdf. (accessed on 3. 11. 2007)

Environment Protection Act. Official Gazette of the Republic of Slovenia, no. 39/06-EPA-1-OCT1, 49/06-MetAA, 66/06 Dec. CC, 112/06 Dec. CC and 33/07-SpPlA.

Map: Network Information System. Digital map and data storage, Environmental Agency of the Republic of Slovenia, 2007.

41. Institutional and territorial structure of water management

Water management

Institutional structure

- regional office of the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
- regional office of the Environmental Agency of the Republic of Slovenia
- Geological Survey of Slovenia
- Institute for Water of the Republic of Slovenia
- Marine Biology Station

Territorial structure

- the Mura river basin
- the Drava river basin
- the Sava river basin
- the Kolpa river basin
- the Soča river basin
- the river basins of other Adriatic rivers

Scale: 1 : 1,100,000. Source: Environmental Agency of the Republic of Slovenia, 2007.

The water management policy is determined in the National water management programme, which strives to accomplish the following objectives: achieving good water status including marine water, supplying the population with drinking water, ensuring water protection in the designated protection areas, reaching the economic price of water and minimizing the hazards posed by the harmful effects of water.

In terms of institutional coordination, effective water management is the responsibility of the Ministry of the Environment and Spatial Planning with tasks delegated to departments within the Ministry, to the Environmental Agency of the Republic of Slovenia and to the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning. The Institute for Water of the Republic of Slovenia was established to carry out expert assignments. The institute cooperates with the Geologic Survey of the Republic of Slovenia and the Marine Biology Station to undertake projects related to surface waters, groundwater and marine water. The collaboration brings together various factions of water research, a demanding and heterogeneous field, and enables experts to continuously observe the dynamics of different processes.

The Ministry of the Environment and Spatial Planning is in charge of preparing fundamental documentation relevant to the implementation of the water management policy; in addition, they oversee the engagement of the public in the water management process. Furthermore, the Ministry is competent to prepare regulations, governmental acts determining water use and water protection, water management acts in relation to water and waterside land, water infrastructure and endangered areas, as well as to coordinate and harmonize policies and other water-related content at the level of European Commission institutions.

The Environmental Agency of the Republic of Slovenia operates in accordance with the territorial principle of water zones, river basins and catchment areas. The Agency is responsible for the following tasks: database maintenance (Water Cadastre and Water Register), monitoring of the quantitative, ecological and chemical status of water, preparation of administrative acts in relation to water protection (environmental protection permits and water pollution permits), use of water resources (water permits), water management (water consents), public water management services and hydrologic forecasts of natural disasters (floods, avalanches, droughts). The Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning is structured in a similar manner and is responsible for overseeing the implementation of the relevant legislation. The Institute for Water of the Republic of Slovenia carries out activities related to surface waters while the Geologic Survey of the Republic of Slovenia supervises the groundwater research. The Marine Biology Station, active under the auspices of the National Institute of Biology, monitors the state of marine waters and represents the Republic of Slovenia within the Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention).

The territorial bases for water management follow the naturally formed hydrographic borders of basins and catchments. The basic territorial-administrative division consists of two water areas: the Danube water area and the Adriatic rivers area including coastal water. The Danube water area covers 81% of Slovenian territory and comprises basins of the rivers Mura, Drava and Sava. The water area of Adriatic rivers including coastal water covers slightly under 20% of the Slovenian territory and encompasses the catchments of the Soča River and Adriatic rivers including coastal water. Both water areas are parts of international catchment areas; for this reason, national objectives must take into account common international goals (water management, use, protection). Water areas are divided into surface and groundwater bodies, which are interrelated. *(NK)*

In terms of the institutional structure, water management is the responsibility of the Ministry of the Environment and Spatial Planning with tasks delegated to departments within the Ministry, to the Environmental Agency of the Republic of Slovenia and to the Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning. Expert assignments are carried out by the Institute for Water of the Republic of Slovenia, the Geologic Survey of the Republic of Slovenia and the Marine Biology Station. The territorial bases for water management follow the naturally formed hydrographic borders of basins and catchments.

Link to relevant indicators

http://kazalci.arso.gov.si

- Use of water resources
- River balance
- Waste water treatment
- Quality of watercourses
- Organic pollution and the self-purifying capacity of rivers
- Phosphorus in lakes
- Nitrates in groundwater
- Pesticides in groundwater
- Inland bathing water quality
- Coastal bathing water quality

Data and sources:

Izvajanje Vodne direktive v Sloveniji: Predstavitev prvih ocen možnosti doseganja okoljskih ciljev za vodna telesa v Sloveniji po načelih Vodne direktive. 2006. Ljubljana, The Institute for Water of the Republic of Slovenia.

Water Act. Official Gazette of the Republic of Slovenia, no. 67/2002, 110/2002 – CA-1, 2/2004 and 41/2004 – EPA-1.

Map: Resolution on the National Environmental Action Plan 2005–2012. Official Gazette of the Republic of Slovenia, no. 2/2006.

Annex

Environmental indicators in Slovenia

Environmental indicators are one of the four pillars of environmental reporting (data – indicators, maps, text – comments, photographs). Every map in this publication is complemented with a selection of indicators from the list of Environmental Indicators in Slovenia which further illustrate the discussed topic, particularly its temporal dimension. The indicators are available at the web portal **Environmental indicators in Slovenia** at the following address:

http://kazalci.arso.gov.si

The web portal Environmental Indicators in Slovenia provides access to over 100 indicators which use graphs and comments to present the environmental trends in Slovenia. The indicators are organized into thematic groups – chapters covering environmental components (e.g. water, air), environmental issues (e.g. climate change, nature protection, loss of biodiversity, waste management) and the incorporation of environmental content in the formulation of sector policies (e.g. transport, agriculture, tourism, energy, instruments of environmental policy).

WHY ENVIRONMENTAL INDICATORS?

Environmental indicators are among the most effective tools for reporting on the environment. They are based on numerical data that demonstrate the state, a particular feature and above all the development of the selected phenomenon. Thus the indicators serve as warning signs for certain trends. They help us measure or determine the quantity of numerous and diverse aggregated data. The term 'indicators' therefore denotes data selected and presented in an agreed manner which we attempt to tie to environmental policy objectives. Appropriately selected indicators that are based on a sufficiently long time series of data may point at key development trends of a specific phenomenon. They may assist decision-makers in environmental planning and management as well as help the general public understand the environmental issues.

INTEGRATION OF INDICATORS IN THE ENVIRONMENT MANAGEMENT CYCLE

Environmental indicators must be designed to answer key questions arising from the environment management cycle (Figure 1). The cycle is comprised of several phases: planning, doing and evaluating the effectiveness of environment management policies. In the planning phase, an interaction is established between the society recognizing certain values and visions on the one hand and policy-makers on the other hand. Key environmental issues are determined in this phase and it is integral that the environmental indicators reflect these issues. In the doing phase, an effective system of data collection and processing is established. This system enables long-term monitoring of a phenomenon, which serves as a basis for examining the effectiveness of policies in the evaluating phase, the final and most important phase of the environment management cycle.

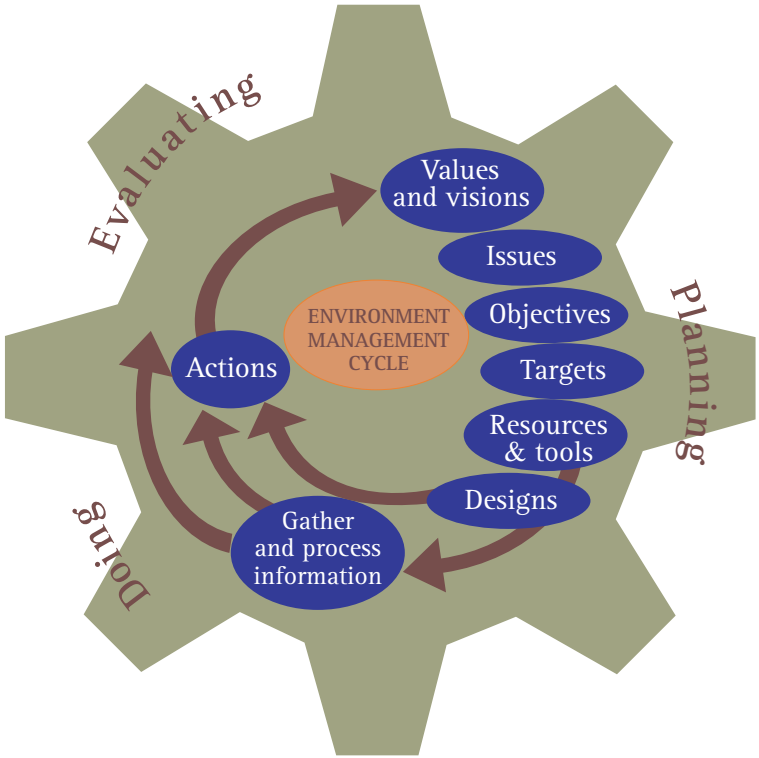


Figure 1: Environment Management Cycle
Source: A Guidebook to Environmental Indicators, CSIRO, 1998

CHOOSING ENVIRONMENTAL INDICATORS

Sets of indicators are formulated using an assessment framework which helps determine the function of each indicator. The United Nations Commission for Sustainable Development first used a tripartite framework (Driving Forces – State – Responses) for sustainable development indicators. The European Environment Agency expanded this model to a five-part framework known as DPSIR (Driving forces – Pressures – State – Impact – Responses). Each of the components reflects a specific purpose of the framework (Figure 2):

- **Driving forces** are socio-economic factors and activities which either increase or mitigate the pressures on the environment, e.g. the extent of economic, transport or tourist activities.
- **Pressures** are direct anthropogenic pressures and impacts on the environment, e.g. pollutant discharges or use of natural resources.
- **State** implies the current condition and trends of a certain environmental phenomenon such as the degree of air, water and soil pollution, biodiversity in a specific geographic area, the availability of natural resources (e.g. wood, freshwater).
- **Impacts** are the effects of the changed environment on the health of humans and other species.
- **Responses** are reactions of the society to environmental issues. Responses may include specific state measures, e.g. taxes on the use of natural resources. Decisions by businesses and individuals, e.g. corporate investments in pollution control or purchases of recycled goods by households, are equally important.

Within the context of the DPSIR Assessment Framework as developed by the European Environment Agency, indicators help us understand the cause-and-effect and particularly interdependence relationships in the environment.

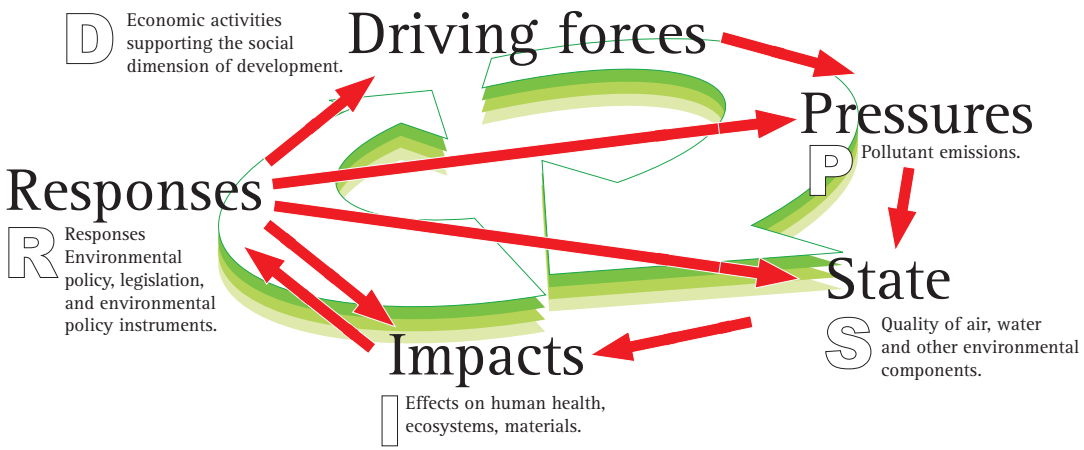


Figure 2: Assessment Framework developed by the European Environment Agency
Source: European Environment Agency, 2002

PRESENTATION OF INDICATORS

All indicators are presented in the same manner; they include specific elements and follow the format shown in Figure 3.

The images next to the **title** of the indicator graphically illustrate the **classification** of the indicator in the DPSIR Assessment Framework and the **assessment of the trend** symbolized by a daisy. The symbol summarizes the expert evaluation of the phenomenon on the basis of the data presented and the set objectives. The main points of the indicator analysis are given in the **key message**.

In order to effectively evaluate the development of a certain phenomenon, the envisaged trend and intensity of development must be clearly identified. Each indicator is therefore accompanied by a **goal**. The required trends are mostly drawn from the fundamental document laying down an environmental protection programme, i.e. the Resolution on the National Environmental Protection Programme (Official Gazette of the Republic of Slovenia, no. 2/2006), as well as from other sectoral documents and programmes.

Each indicator is given a **definition** providing basic information on the methodology of conducted measurements. The indicators employ internationally verified methodologies and are thus generally comparable on the international level. The indicators were prepared using methodological sheets for indicators drafted by the European Environment Agency, primarily from the Core Set of Indicators. Where so required by a certain phenomenon, the manner of monitoring, accessibility of data or by any other technical factor, the methodology has been adapted to conditions specific to Slovenia.

The quantitative values of a given indicator are shown in **graphs**. The indicator is further detailed in a **comment**, which interprets the trend and explains possible reasons for it.

Symbols assessing the trends of individual indicators

positive development indicating the achievement of a qualitatively or quantitatively defined goal

undefined course of development, development not sufficient to achieve qualitative or quantitative goals, possibly a variable trend within a given indicator

unfavourable course of development

The section **Data and sources** contributes to the transparency of the monitoring methods employed for the selected indicators. In addition to the data presented in tables, this section further describes the data sources used for the indicator and provides additional notes on the methodology.

The data used for the environmental indicators were collected from databases at the Environmental Agency of the Republic of Slovenia as well as from sources at other institutes (e.g. Statistical office of the Republic of Slovenia, Agency of the Republic of Slovenia for Agricultural Markets and Rural Development, Chamber of Commerce and Industry of Slovenia etc.). The reports obtained through data analysis and integration and accompanied by expert opinions may assist decision-makers in their political deliberations and may also serve to satisfy the public's right to be informed on the state of the environment and the efficiency of environmental policies.

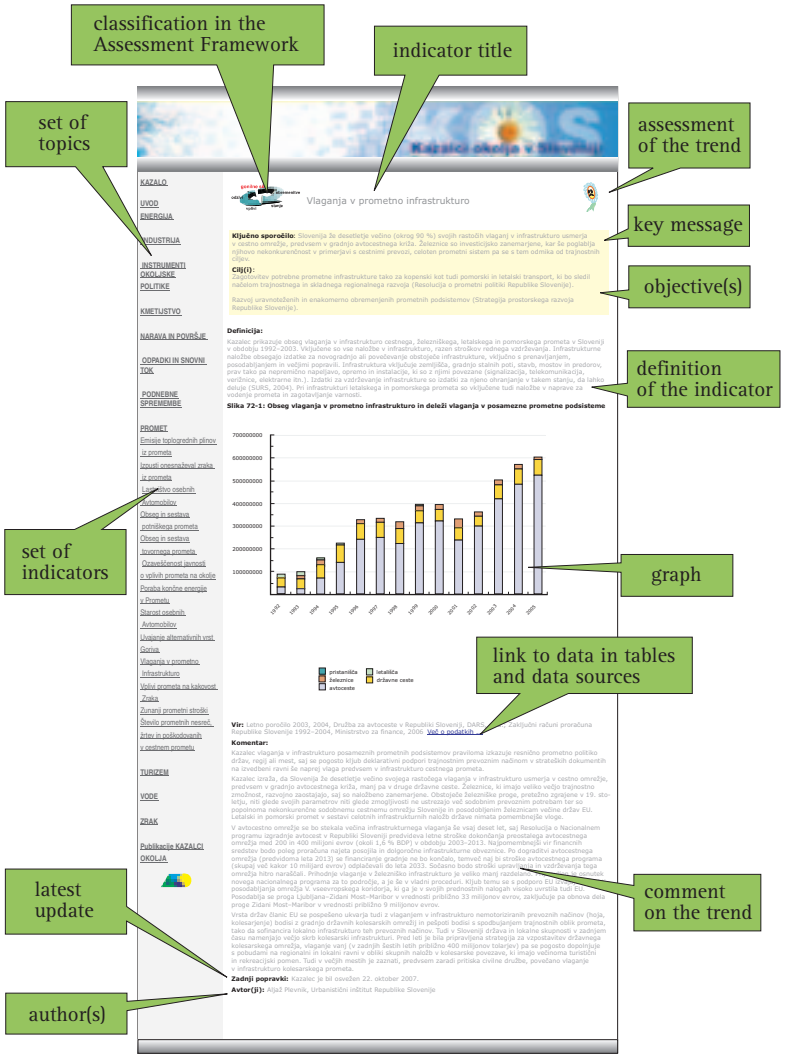


Figure 3: Format of selected indicators presented at the web portal Environmental Indicators in Slovenia (http://kazalci.arso.gov.si)

THE FUTURE DEVELOPMENT OF INDICATORS

Experience by other countries and international institutions shows that indicators are a sufficiently cost-effective and useful tool for monitoring and reporting on the state of the environment and on the progress of environmental policies. In the future, the Environmental Agency of the Republic of Slovenia will strive to enhance the quality of input data and information as well as to achieve comparability of the selected set of indicators with international sets. We will endeavour to bring the indicators in line with the national objectives of environmental protection and to select the indicators which reflect sustainability in the environmental dimension of Slovenia's development.

REPUBLIC OF SLOVENIA • MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
ENVIRONMENTAL AGENCY OF THE REPUBLIC OF SLOVENIA