**Ministry of Environment of the Slovak Republic**

# STATE OF THE ENVIRONMENT REPORT SLOVAK REPUBLIC 2010

**Slovak Environmental Agency**

# COMPONENTS OF THE ENVIRONMENT AND THEIR PROTECTION

## • AIR

### Key questions and key findings

♦ **Key questions**

- **What is the recent trend in the area of production of polluting substances in the Slovak Republic?**
- **Is Slovakia fulfilling its obligations given by international conventions in the area of air protection?**
- **Are the air pollutants limit values for human health protection complied with?**
- **Are the air pollutants limit values for vegetation protection complied with?**
- **What has been the trend in the condition of the ozone layer and intensity of solar radiation over the SR territory?**
- **Is the SR fulfilling its international obligations in the area of the Earth's ozone layer protection?**

♦ **Key findings**

- **Emissions of basic pollutants (PM, $SO_2$, $NO_X$, CO) over a long-term horizon (1990-2009) have been consistently reduced; however, the speed of reduction after 2000 has been significantly slower. There was a temporary increase in emissions detected in 2003-2005; however, after 2005 the trend was falling again.**
- **Ammonia emissions have been persistently decreasing over a long time period.**
- **NMVOC emissions over a longer time horizon (1990-2000) have been decreasing persistently. In the period of 2000 to 2009 the values were maintained more-less at the same level, with slight fluctuations in specific years.**
- **Persistent organic pollutants (POPs) emissions dropped significantly over the period of 1990-2000. When the years 2001 and 2009 were compared, there was seen a reduction in the PCDD/PCDF emissions by 50.3%, PCB emissions by 4.4%, and the sum of PAH emissions increased by 29%.**
- **Slovakia is fulfilling its obligations given by international legislation in the area of air protection.**
- **The designated 19 areas of air quality management in 2010 covered the size of 2 904 $km^2$ with 1 404 721 people, which represent 26% of total Slovak population.**
- **Notwithstanding the persistent decrease in the pollutants emission, in 2010 a number of monitoring stations again detected exceeded limit values for selected air-borne pollutants ($NO_X$, $PM_{10}$, $PM_{2.5}$) designated to ensure human health protection.**
- **The massive reduction in national emissions of ozone precursors over the last years has not resulted in reduced ground ozone concentrations in Slovakia. Some ground ozone characteristics in 2010 remained at a relatively high level achieved in the previous years.**
- **Limit values of air-born pollutants ($SO_2$, $NO_X$) designated for the protection of vegetation have not been exceeded. Exceeded values were detected for ground ozone.**
- **Total atmospheric ozone was above the long-term average values, within a 2.4% deviation above the mean value; total sum of daily doses of the ultraviolet erythema radiation decreased.**
- **Slovakia is fulfilling its obligations given by international legislation in the area of ozone layer protection.**

## Emission situation

### ♦ Balance of basic pollutants emissions

**Trend in emissions of particulate matter**

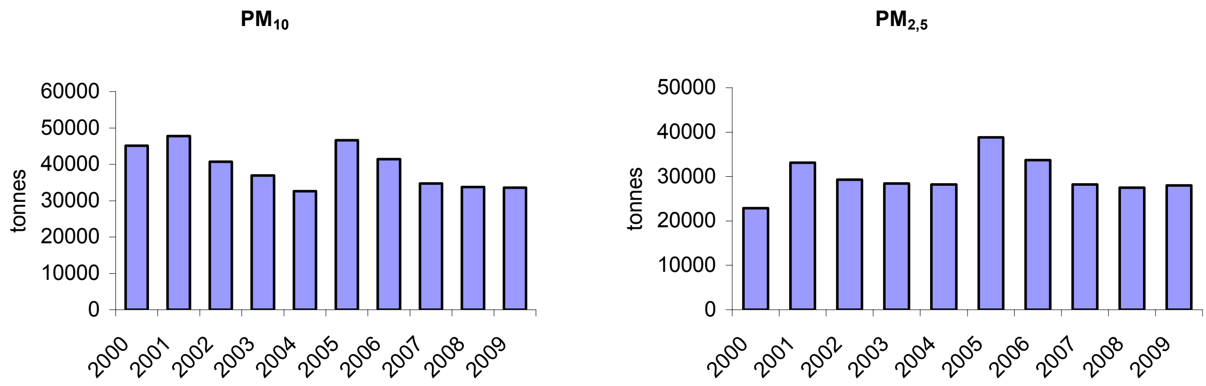
**Emissions of particulate matter** have shown a steady reduction since 1990, which, apart from reduction in production and energy consumption, has been caused by a change within the fuel group toward more purified fuels, as well as by using fuels with higher quality labels.

Reduction in particulate matter emissions was further contributed to by introduction of separation equipment or increasing its efficiency, respectively. Increase in the PM emissions over 2004-2005 was caused by an increased consumption of wood within the sector of small-size sources (heating up of houses) due to increased natural gas and coal prices for small consumers. Reduction in the PM emissions in 2006 was caused mainly by reconstructions of the separation equipment in several power management and industrial installations. Further decrease in the PM emissions by large stationary sources in 2007 was caused by the fact that some incineration units installed at significant sources were out of operation. Since 2008, the PM emissions trend has continued to decrease slightly.

**Balance of $PM_{10}$, $PM_{2.5}$ emissions**

In the sector of road transport, diesel engines are among the major contributors to the $PM_{10}$ and $PM_{2.5}$ emissions. The share of abrasion is less significant than in the case of the PM emissions. In total, the most significant contributors to the $PM_{10}$ and $PM_{2.5}$ emissions include small sources (heating of houses). Increased emissions in this sector reflect the increased consumption of wood caused by growing prices of natural gas and coal.

**Development trends in $PM_{10}$ a $PM_{2.5}$ emissions**




*Emissions were stated to the date 15.2.2011* Source: SHMI

**Trend in emissions of sulphur dioxide**

**Emissions of sulphur dioxide ($SO_2$)** have shown a steady reduction since 1990, which, apart from reduction in production and energy consumption, has been caused by a change within the fuel group toward more purified fuels, as well as by using fuels with higher quality labels.

Decreasing trend in the $SO_2$ emissions until 2000 was caused by reduction in the consumption of brown coal and lignite, heavy heating oil, using of low-sulphur heating oils, and installation of desulphurisation plants at all large power sources. Fluctuating trend in the $CO_2$ emissions in 2001 through 2003 was caused by partial or full operation, by the quality of burnt fuel types, and by the volume of production at energy sources. In 2004-2006, there was another reduction in the $SO_2$ emissions, especially in large stationary sources. This reduction was caused mainly by burning low-sulphur heating oils and coal, and by a reduced production volume. In 2005, there was a significant reduction in the $SO_2$ emissions from road transport, by as much as 77%. This reduction, despite the increased fuel consumption, was caused by implemented measures relating to the sulphur content in fuels (Resolution of the Slovak Ministry of Environment no. 53/2004 Coll.) Further decrease in the $SO_2$ emissions by large stationary sources in 2007 was caused by the fact that some incineration units installed at significant sources were out of operation. Since 2008, the $SO_2$ emissions trend has continued to decrease.

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**Trend in emissions of nitrogen oxides**

Emission of nitrogen oxides since 1990 dropped slightly despite the fact that they grew slightly in 1994-1995 due to an increased natural gas consumption.

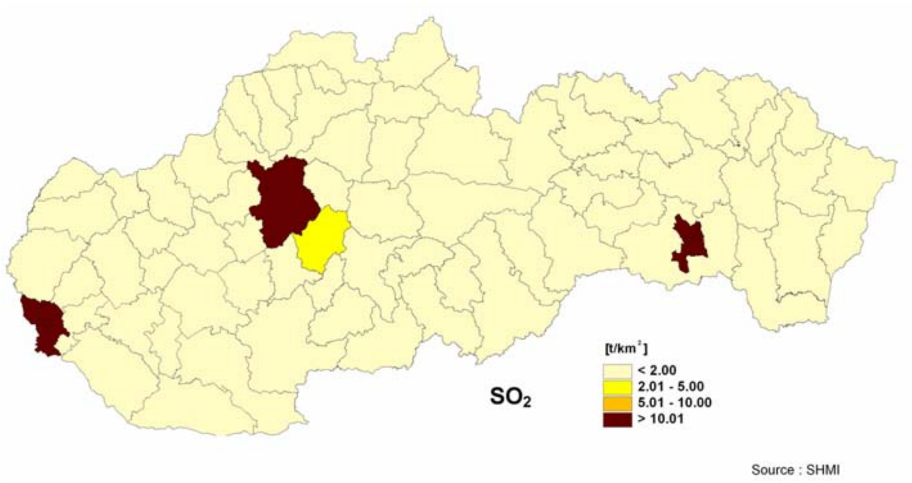
Decrease in nitrogen oxides in 1996 was caused by a change to the emission factor that took into consideration the level of equipment and technology of incineration processes. Reduction in solid fuel consumption since 1997 has led to a further decrease in $NO_X$ emissions. In the years 2002 and 2003, de-nitrification played a significant role in emission reduction (electric power plant Vojany). In 2006, there was a significant reduction in the $NO_X$ emissions, especially in case of large and medium stationary sources. This reduction relates to reduced production (Zemianske Kostoľany and Vojany electrical power plants) and consumption of solid fuels and natural gas (Zemianske Kostoľany and Vojany electrical power plants and the Slovak gas industry company – transit, Inc. Nitra - /SPP/). Mobile sources also, mainly road transportation, have shown significant $NO_X$ emissions.

This reduction also relates to the modernisation of personal and freight vehicles, as well as the use of a more exact emission factor.

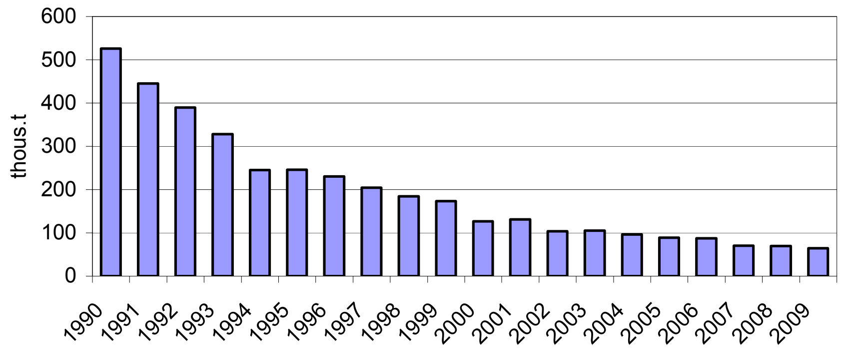
**Trend in carbon monoxide emissions**

**Carbon monoxide emissions (CO)** since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large sources comes from iron and steel industries.

### Element regional emission of $SO_2$ in 2009 ($t.km^{-2}$)

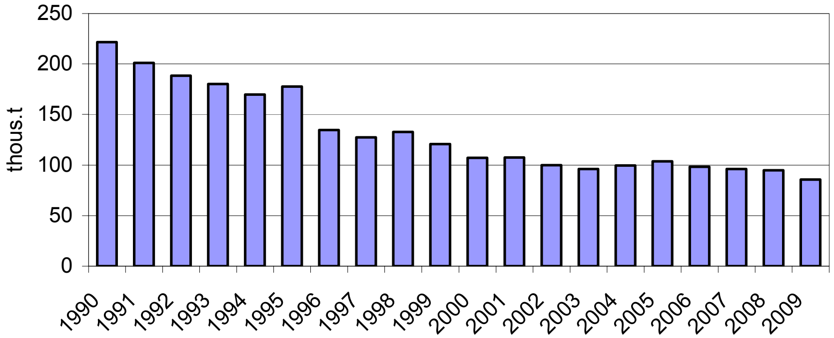



### Trend in emission of $SO_2$



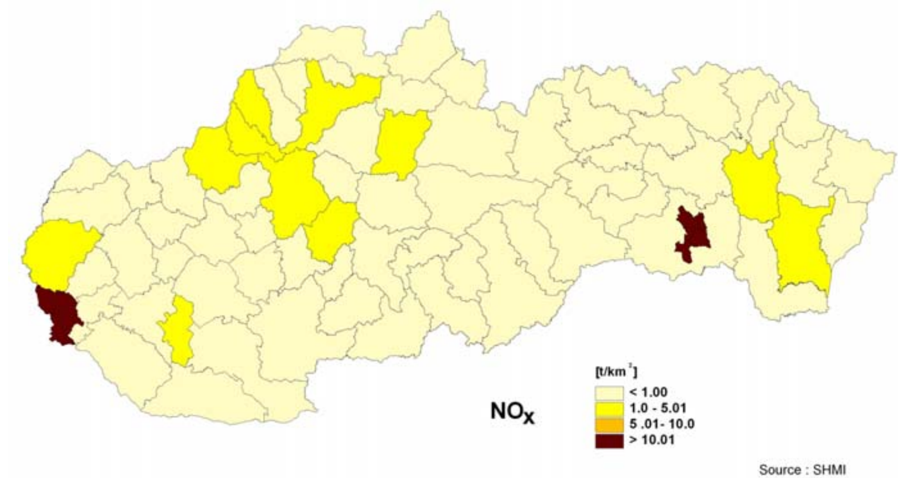

Source: SHMI

### Trend in emission of $NO_X$

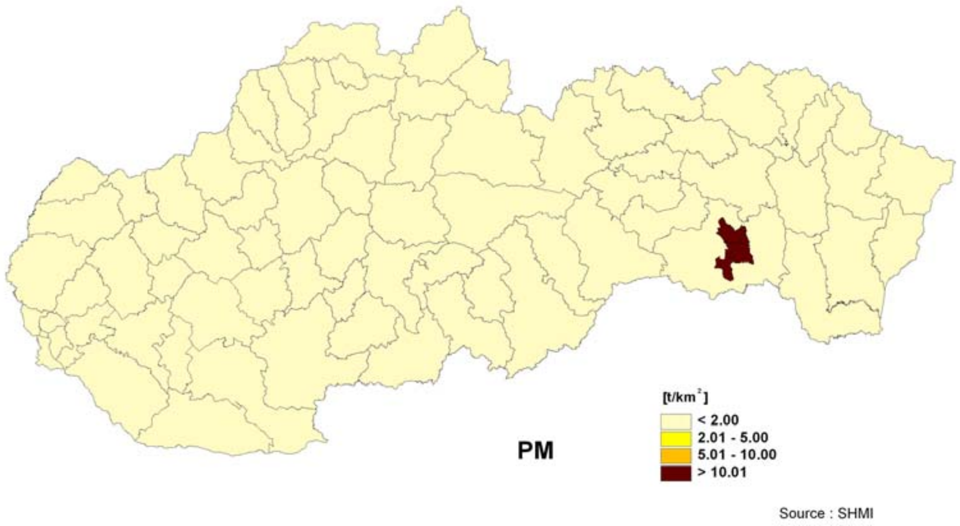



Source: SHMI

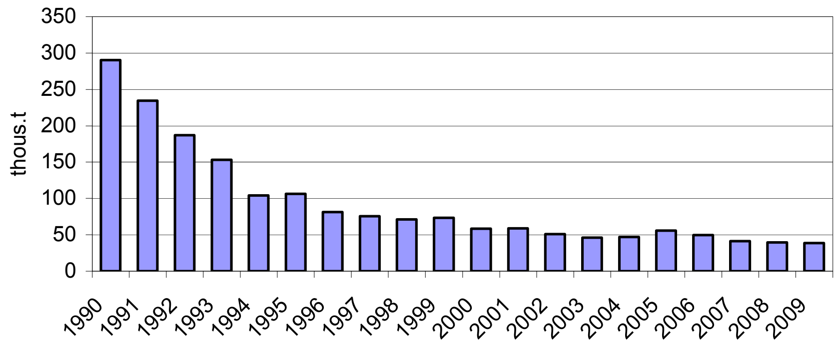
### Element regional emission of $NO_X$ in 2009 ($t.km^{-2}$)



### Element regional emission of PM in 2009 ($t.km^{-2}$)

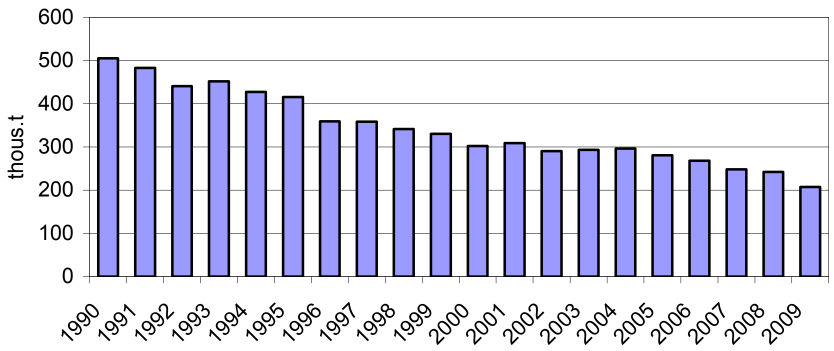



### Trend in emission of PM



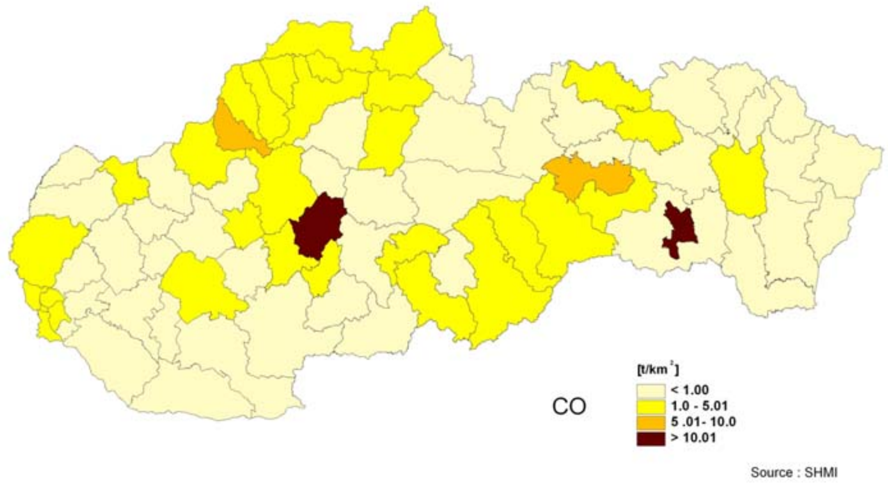

ource: SHMI

### Trend in emission of CO




Source: SHMI

### Element regional emission of CO in 2009 ($t.km^{-2}$)



**Meeting international obligations for the basic pollutants emissions**

Slovakia is a signatory to the UN Economic Commission Convention on Long-Range Trans-boundary Air Pollution (which became effective for ČSFR in March, 1984, and Slovakia being its successor since May, 1993). This Convention became the basis for protocols, which also spelled out obligations for the signatories to reduce individual anthropogenic emissions of pollutants contributing to global environmental problems. The following text shows how individual protocols' obligations in the area of acidification are met:

➢ ***Protocol on further reduction of sulphur emissions***

This protocol was signed in Oslo in 1994. Ratified by the Slovak Republic in January 1998 the protocol became effective in August 1998. Obligations of the Slovak Republic to reduce the $SO_2$ emissions as set forth in the Protocol (compared to the reference year of 1980) include:

**Obligation to reduce $SO_2$ emission pursuant to Protocol on further reduction of sulphur emissions**

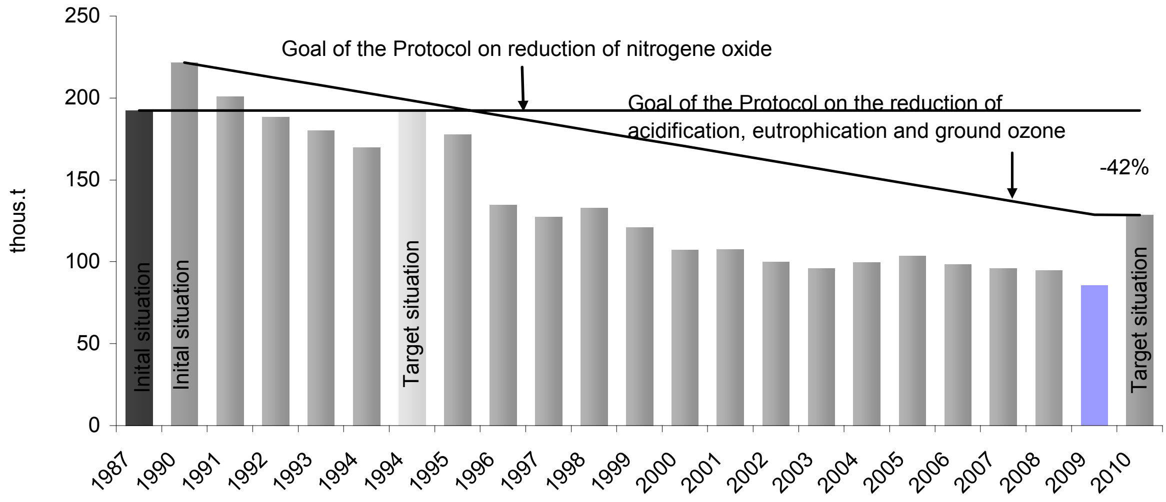
| Year | 1980 (initial year) | 2000 | 2005 | 2010 |
|---|---|---|---|---|
| $SO_2$ emission (thous. t) | 843 | 337 | 295 | 236 |
| $SO_2$ emission reduction (%) | 100 | 60 | 65 | 72 |

Slovakia met one of its Protocol objectives to reduce the $SO_2$ emissions in 2000 by 60%, compared to the reference year of 1980. In 2000, sulphur dioxide emissions reached the level of 123.880 thousand tons, which is 85% less than in the years 1980. In 2005 it was 89 thousand t, which is 89% less than in 1980. In 2009, sulphur dioxide emissions reached the level of 64.082 thousand tons, which is 89% less than in 1980.

➢ ***Protocol on the Reduction of Acidification, Eutrophication and Ground Ozone***

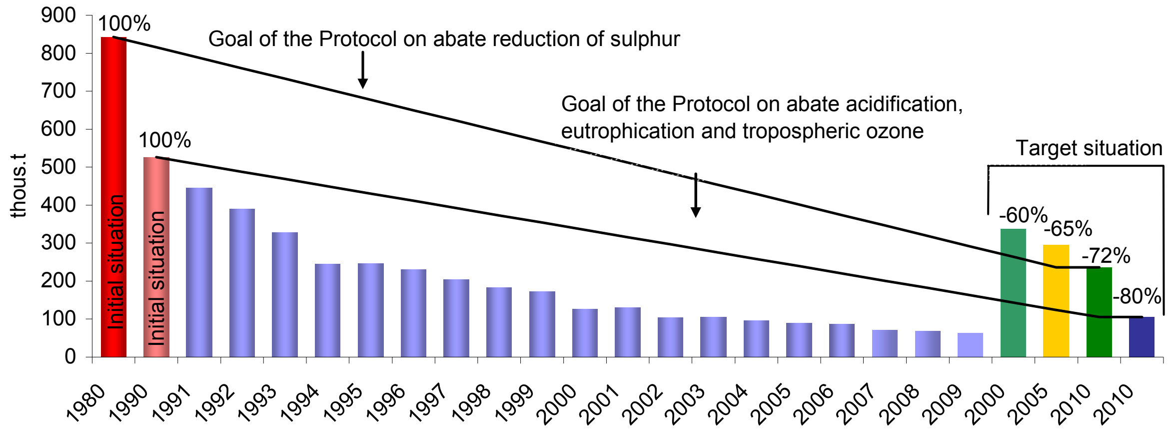
The protocol was signed in Göteborg in 1999. Slovakia signed the protocol in 1999 and ratified in 2005. Slovakia obliged itself to reduce the $SO_2$ emissions by 2010 by 80%, the $NO_2$ emissions by 2010 by 42%, the $NH_3$ emissions by 2010 by 37% and the VOC emissions by 2010 by 6% in comparison to the year 1990. Slovakia has the potential to fulfill this obligation.

**Trend in $NO_X$ emission with regard to following the outcomes of international agreements**




Source: SHMI

**Trend in $SO_2$ emission with regard to following the outcomes of international agreements**



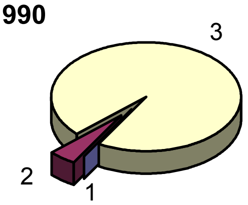

Source: SHMI

## ♦ Balance of ammonia emissions ($NH_3$)

Production of the $NH_3$ emissions$_3$ in 2009 was 25 016.39 tonnes. More than 90% of all $NH_3$ emissions originate in the sector of agriculture - livestock production and animal waste management. $NH_3$ emissions from the use of artificial nitrogen fertilisers also represent a significant category in the sector of agriculture. $NH_3$ emissions from the energy sector/industrial production and transport are less significant. $NH_3$ emissions from industrial production originate mainly from nitric acid production. $NH_3$ emissions from transport originate mainly from road transport.

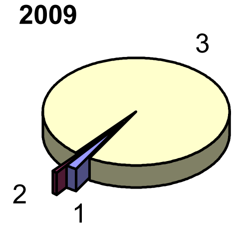
**The contribution of the particular sectors in $NH_3$ emission**

**1990**




| 1990 | Sector | 2009 |
|---|---|---|
| 0.05% | 1. Transport | 1.85% |
| 4.79% | 2. Industry | 0.85% |
| 95.17% | 3. Agriculture | 97.30% |

**2009**

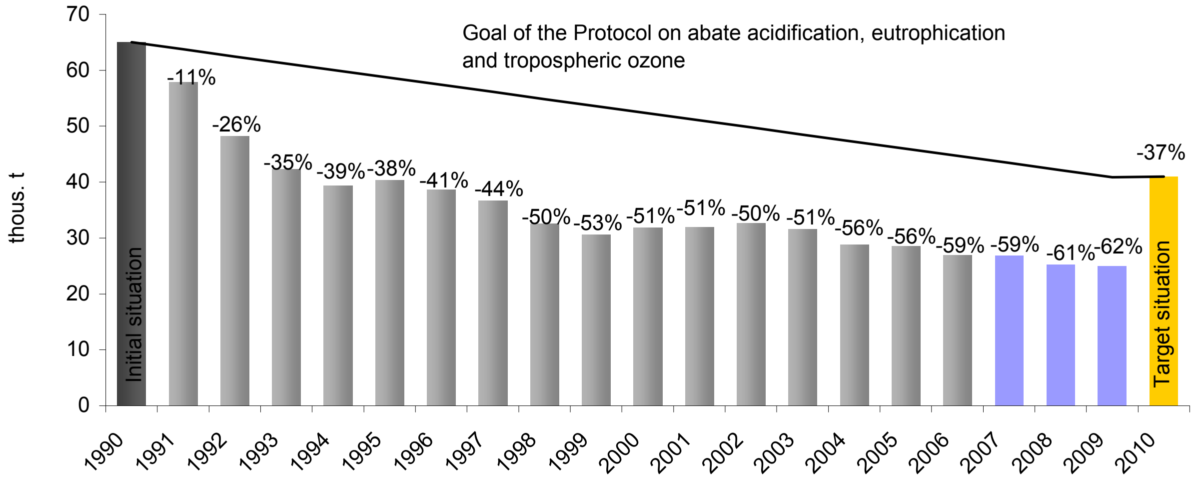



*Emissions were stated to the date 15.2.2011*

Source: SHMI

Over a long-term period, there is a persistent decrease in total volumes of $NH_3$ emissions. This reduction in 2009 represents a 62% decrease compared to 1990.

**Trend in $NH_3$ emission with regard to following the outcomes of international agreements**



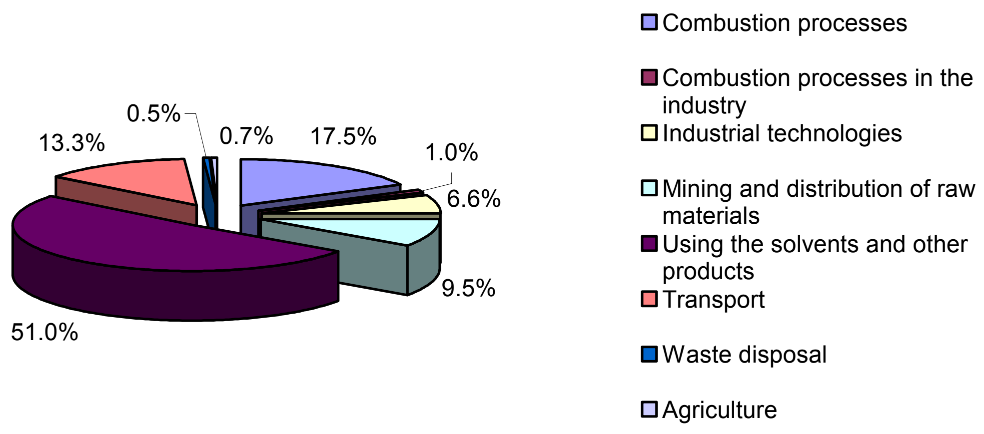

Source: SHMI

### ♦ Emissions of non-methane volatile organic compounds

Drop in total NMVOC emissions was caused by a number of measures, such as reduction in using coating compounds and by gradual introduction of low-solvent types of coatings, extensive introduction of measures in the sector of crude oil processing and fuel distribution, introduction of gas technologies into incineration, especially in the energy area, and by the change to the portfolio of cars toward vehicles equipped with the operated catalyser. Since 2000, the NMVOC emissions in the area of paints and glues have increased by 54%, since the use of these products is part of a wide spectrum of industrial activities and various technological operations. The consumption and import of printer colours and solvent-based paint systems has been continually increasing. In 2004 and 2005 there was a growth in the production of cars, many paint shops were opened, thus increasing also the consumption of paint substances. In 2007, complete time line data for the industrial area of cleansing and degreasing were recalculated due to the need of better precision in calculating the consumption of solvents in the area of paints and glues.

Recalculation of the NMVOC emissions in 2010 was carried out for the sector of waste management for the years 2002, 2004, 2005, and 2008, due to an update in the input data. A new version of the COPERT IV model was used for the road transport emission analysis; therefore, emissions were recalculated until 2000. Total NMVOC emissions dropped from 68.9 kt in 2008 to 65.4 kt in 2009. Reduction in the emissions was caused mainly due to a decreased industrial production.

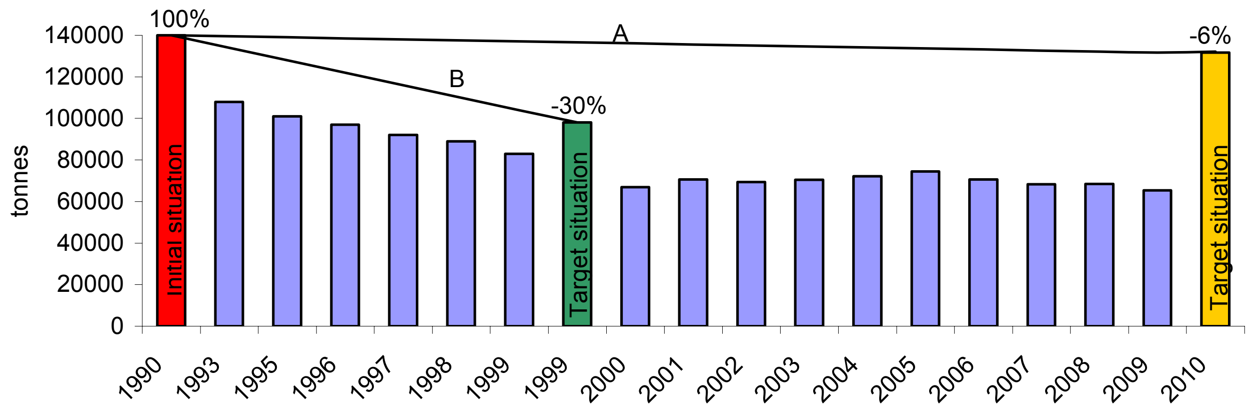
**The contribution of the NMVOC emission according to sector of their origin in 2009**




*Emissions were stated to the date 15.2.2011*

Source: SHMI

**Trend in NMVOC emissions with regard to fulfilling of the international agreements**




Source: SHMI

*A – Reduction aim of the Protocol to abate acidification, eutrophication and tropospheric ozone*
*B – Reduction aim of the Protocol on limitation of VOC emissions or their Cross-Border Transfers*

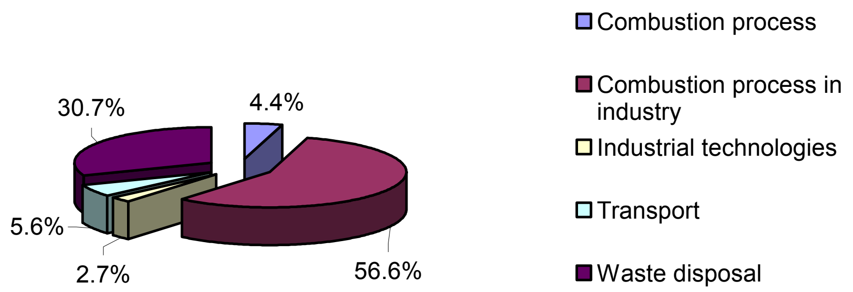
### ♦ Balance of heavy metals emissions

Heavy metal emissions have decreased significantly since 1990. Besides shutting off a number of old-fashioned and non-effective productions, this trend has been influenced by extensive reconstructions of separation equipment, change in raw material used, and, most of all, by transition to using unleaded petrol types since 1996. Since 2004, the register of heavy metals from household fuel burning has included the burning of wood. Trends in the heavy metal emissions over the recent years are characteristic for slight fluctuations. In 2007, lead and mercury emissions dropped, compared to the 2006 figures, due to a reduction in the ore agglomeration and glass production. At the same time, cadmium emissions increased in the same year, which related to an increased copper production. In 2008, lead, cadmium, copper, zinc, and selenium emissions increased due to an increased volume of incinerated industrial waste and increased emissions in the area of industrial, municipal power management , and system power industry.

In 2009, there was a reduction in heavy metal emissions which related to a reduction in the industrial production. In 2010, there was a recalculation carried out in the sector of waste handling for the years 2002, 2004, 2005, and 2008, due to an update in the input data. A new version of the

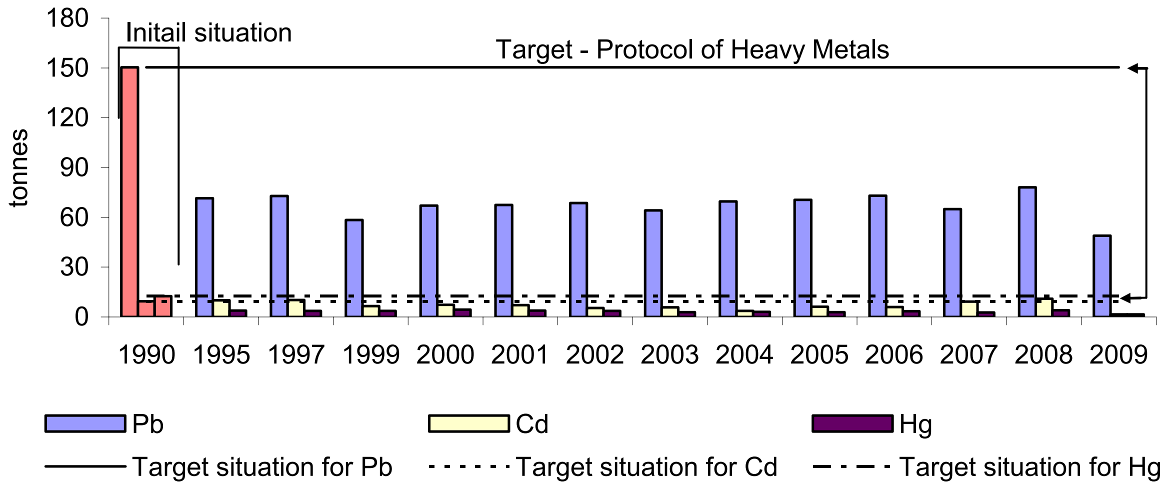
COPERT IV model was used for the road transport emission analysis; therefore, emissions were recalculated until 2000. Next, cadmium emissions from glass production were calculated for the years 2007 and 2008, due to a revised emission factor for colour glass.

**The contribution of the particular sectors in the Pb emission production for year 2009**




*Emissions were stated to the date 15.2.2011* Source: SHMI

**Trend in emissions of heavy metals regarding the fulfilment of the international conventions**



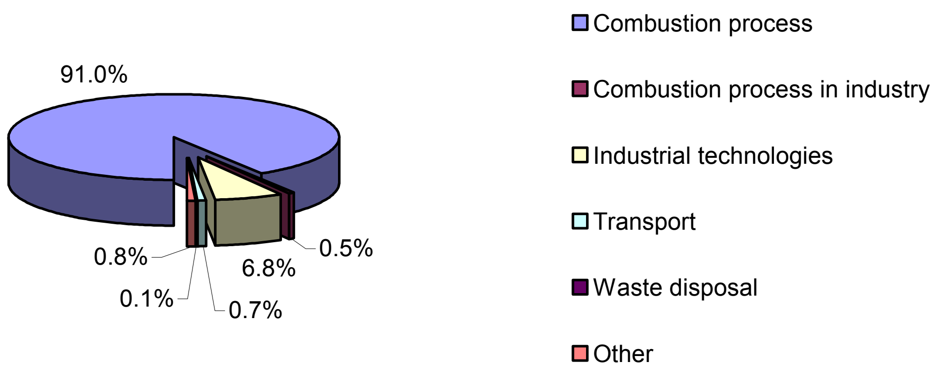

Source: SHMI

## ♦ Balance of Persistent organic pollutants (POPs)

The POPs emissions in 2010 were recalculated for the complete time line while considering technological improvement at waste incineration.

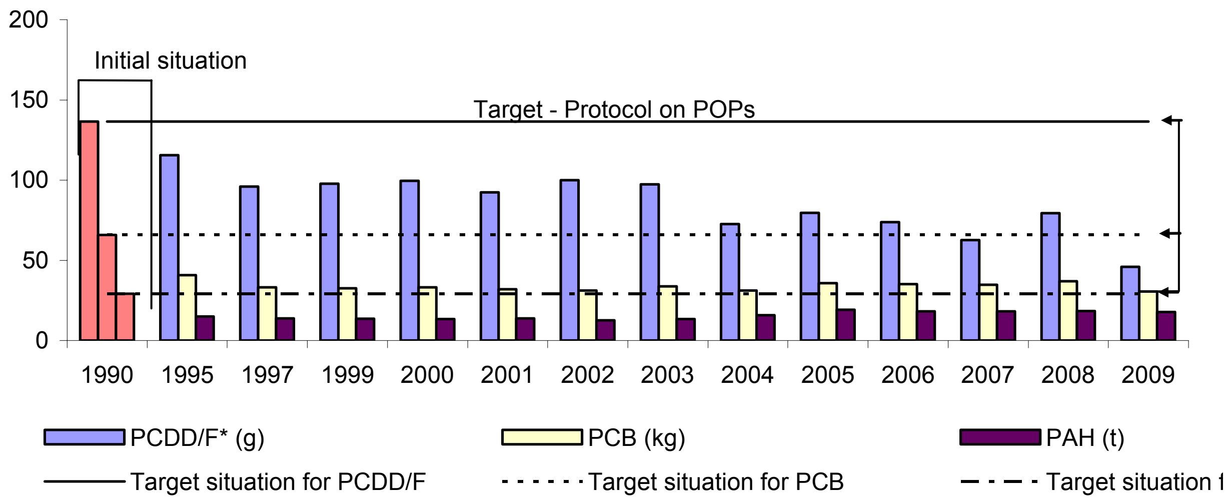
Decreasing trend in the POPs emissions was most clearly seen in the 90ties for PAH where the reduction in emissions was mainly caused by a change to the aluminium production technology. (using previously burnt anodes) Growth in the PCB emissions (polycyclic biphenyls) over the last years has been influenced primarily by an increased consumption of diesel in road transport and an increased consumption of wood by small sources (heating of households). Increased wood consumption in this sector influenced also the growth in total PAH emissions. PCDD/F emissions have dropped since 2000 due to the reconstruction of a number of installations (municipal waste incineration units). PCDD/F emissions are influenced by the volume of incinerated medical waste, volume of agglomerated iron ore, and by fuel composition in the sector of household heating. A slight increase in the emissions of polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAH) caused increased volume of modal split in road transport and an increased fuel consumption. Fluctuating emissions of hexachlorbenzene (HCB) reflects the fluctuating production of secondary copper together with a growth in the volume of modal split in road transport. A slight reduction in the emissions of polychlorinated dioxins and furans (PCDD/PCDF) and polychlorinated biphenyls (PCB) in 2009 was caused by reduced waste incineration; total emissions of polycyclic aromatic hydrocarbons (PAH) show a slight reduction compared to 2008, due to a lower coke production.

**The contribution of the particular sectors in the PAH emission production for year 2009**




*Emissions were stated to the date 15.2.2011* Source: SHMI

**Trend of POPs emissions regarding the fulfilment of the international conventions**




Source: SHMI

## Air pollution

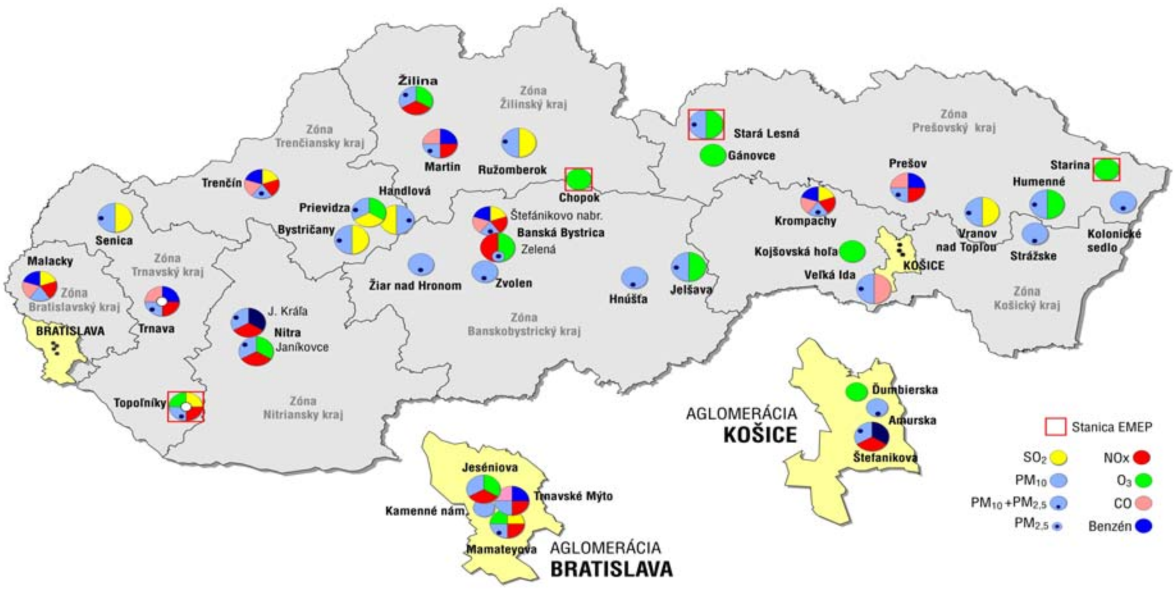
### ♦ Air quality and its limits

In compliance with the requirements of Act **137/2010 Coll.** on air protection, the whole Slovak territory was divided into 8 **zones** and 2 **agglomerations** that are further subdivided into 19 **air quality management areas.**

**Air quality management area** is an agglomeration or a designated part of the zone with exceeded:

- limit values for one substance or more pollutants increased by tolerance threshold,
- limit value of one substance or more pollutants, if no tolerance threshold is set,
- target value for ozone, $PM_{2.5}$, arsenic, cadmium, nickel, or benzo(a)pyrene.

**National monitoring air quality network - 2010**




Source: SHMI

## ♦ Local Air pollution

### Sulphur dioxide

In 2010, no agglomeration showed exceeded levels of pollution in hourly or daily values for public health protection limit beyond what is allowed by Directive 360/2010 Coll. on air quality.

### Nitrogen dioxide

In 2010, annual limit value was exceeded at the monitoring stations of Banská Bystrica-Štefánikovo nábrežie, and Bratislava-Trnavské mýto. The highest average annual concentration of 62.5 $\mu g.m^{-3}$ shown at the Banská Bystrica station significantly exceeded the limit value of 40 $\mu g.m^{-3}$ due to ongoing construction and terrain works on building a road bypass in Banská Bystrica. Exceeded limit value for the protection of human health for hourly concentrations was not detected by any monitoring station beyond what is allowed by Directive 360/210 Coll. on air quality.

### $PM_{10}$

In 2010, daily limit value was exceeded at 21 stations. In the same year, Slovakia was exempted by the EC, pursuant to article 22 of Directive 2008/50/EC from applying daily limit values for $PM_{10}$ defined in Annex XI. This exception can be practically applied for the zones of the Trenčín, Trnava, and Prešov regions on June 11, 2011. None of the 6 stations that exceeded the daily value at the mentioned stations showed exceeded daily values with added tolerance threshold. Assessment of

$PM_{10}$ by the limit value increased with tolerance threshold ended at these stations on June 11, 2011. By then, Slovakia must comply with the limit value for pollution for the whole Slovak Republic. 4 AMS also showed the annual limit value exceeded at the same time.

**$PM_{2.5}$**

There is only the annual limit of 25 µg.m$^{-3}$ set for the $PM_{2.5}$, which will become effective on January 1, 2015; however, this value is considered the target value designated in 2010 and should not be exceeded. In 2010, this value was exceeded at 4 stations.

**Carbon monoxide**

None of the monitoring stations showed exceeded limit values, and the air pollution figures for the previous time period of 2006-2010 remains below the lower assessment threshold.

**Benzene**

The highest value for benzene in 2010 was detected at 2.9 µg.m$^{-3}$, which is significantly lower than the limit value of 5 µg.m$^{-3}$.

**Pb**

None of the monitoring stations showed exceeded limit values. The sector of metallurgic industry shows the highest level of air pollution detected at the Krompachy-SNP station, however, all average annual concentrations are substantially smaller than the lower assessment threshold.

**As, Ni, Cd**

There was no occurrence of exceeded target values for any pollutant in 2010. Cd and Ni concentrations for the last 5 years remained below the lower assessment threshold.

**BaP**

Target value needed be reached by 31.12.2010 was exceeded at the monitoring stations of Bratislava-Trnavské mýto, Veľká Ida-Letná, Krompachy-SNP, and Prievidza-Malonecpalská.

### ♦ Regional air pollution and atmospheric precipitations

In 2010, Slovakia operated 4 stations for monitoring regional air pollution and chemical composition of precipitation water. All the stations are part of the EMEP network.

**Sulphur dioxide, sulphates**

In 2010 regional sulphur dioxide concentrations calculated per sulphur were 0.22 µg.m$^{-3}$ at Chopok, and 0.72 µg.m$^{-3}$ at Starina. Pursuant to Annex 13 to Regulation no. 360/2010 Coll., critical level for the protection of vegetation is 20 µg $SO_2$.m$^{-3}$ for the calendar year and the winter season. This level was exceeded neither for the calendar year (Chopok 0.44 µg $SO_2$.m$^{-3}$ and Starina 1.44 µg $SO_2$.m$^{-3}$) nor for the winter season (Chopok 0.6 µg $SO_2$.m$^{-3}$ and Starina 2.0 µg $SO_2$.m$^{-3}$). Percentage share of sulphates on total particulate matter mass was 15.54% at Chopok and 16.2% at Starina. Sulphates to sulphur dioxide concentration ratios expressed in sulphur was 1.18 at Chopok and 1.16 at Starina.

### Nitrogen oxides, nitrates

Concentration of nitrogen oxides at regional stations expressed in $NO_2$-N were in 2010 0.76 μg.m$^{-3}$ at Chopok and 1.13 μg.m$^{-3}$ at Starina. Pursuant to Annex 13 to Regulation no. 360/2010 Coll., critical level for the protection of vegetation is 30 μg $NO_X$.m$^{-3}$ for the calendar year. This level was not exceeded over the last calendar year (Chopok 2.51 μg $NO_X$.m$^{-3}$ and Starina 3.72 μg $NO_X$.m$^{-3}$). Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2010 were in comparison with the aerosol ones lower at both stations. Despite the fact that gaseous and particulate nitrates are trapped and monitored separately, their sum is expressed in line with EMEP, since their phase distribution depends on atmospheric temperature and humidity. Percentage share of nitrates on atmospheric aerosol was 9.2% at Chopok and 8.8% at Starina. Ratio of total nitrates ($HNO_3$ + $NO_3$) to $NO_X$-$NO_2$, as expressed in nitrogen, was 0.14 at Chopok and 0.29 at Starina.

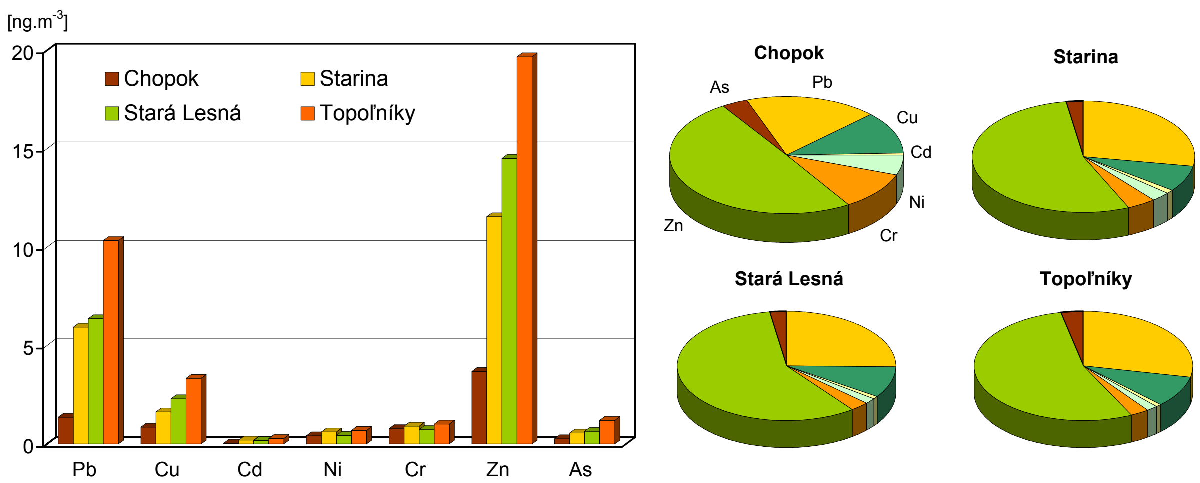
### Ammonia, ammonium ions, and alkali metals

In compliance with the requirements of the EMEP monitoring strategy, measurements of ammonia, ammonium ions, and ions of sodium, potassium, calcium, and magnesium in the air at the station of Stará Lesná were initiated in May 2005. The measurements were completed in 2007. Measurements for these ions began at Starina in July 2007. For ammonia ions the annual concentration was 0.84 μg N.m$^{-3}$ and their percentage proportion in PM was 7.1%. For ammonia, the annual concentration is 0.27 μg N.m$^{-3}$ and the ratio of the ammonia ions and ammonium concentration expressed in nitrogen is 3.1.

### Atmospheric aerosol, heavy metals

Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.14 and 0.19%.

**Heavy metals in the air and percentage share of heavy metals in 2010**



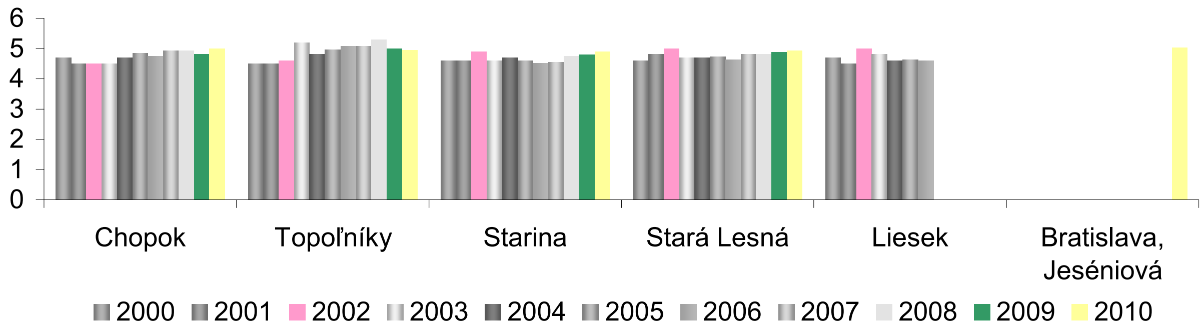

Source: SHMI

### Atmospheric precipitations

Beside the 4 EMEP stations, the quality of rainfalls is also measured at the Bratislava-Jeséniova station, which serves only for the purposes of making comparisons with the regional stations.

In 2010, total atmopheric precipitations at regional stations were between 926.3 and 1 377.4 mm. Upper limit of the interval was occupied by the highest located station of Chopok, while the bottom limit was occupied by Topoľníky, with the lowest altitude. Acidity of atmospheric precipitations was dominant at Starina, copying the lower limit of the pH interval of 4.9-5.0. Time sequence and pH trend over a longer time period show a reduced acidity.

**Trend of pH precipitation**




Source: SHMI

Concentrations of dominant sulphates in precipitation water showed the interval of 0.39-0.45 mg.$l^{-1}$. Sulphates concentrations measured at two stations - Chopok and Starina, are the same for the annual average values; they have been slightly lower at Stará Lesná and little higher at Topoľníky. The overall reduction in sulphate concentrations over a long period corresponds to the reduction of $SO_2$ emissions since 1980.

**Nitrates** that show less influence on the acidity of precipitations than sulphates showed the concentration interval of 0.23-0.37 mg N.$l^{-1}$. Chopok and Stará Lesná represent the lower limit of the span, while Topoľníky forms the upper limit. Ammonium ions also belong to the major ions and their concentration span has been 0.28-0.44 mg.$l^{-1}$.

**Annual averages of heavy metals in monthly precipitation - 2010**

| Station | Precip. mm | Pb µg/l | Cd µg/l | Ni µg/l | As µg/l | Zn µg/l | Cr µg/l | Cu µg/l |
|---|---|---|---|---|---|---|---|---|
| **Chopok** | 1 145 | 1.86 | 0.07 | 0.33 | 0.19 | 23.71 | 0.16 | 0.94 |
| **Topoľníky** | 873 | 0.95 | 0.04 | 0.25 | 0.13 | 5.71 | 0.22 | 0.63 |
| **Starina** | 967 | 0.96 | 0.05 | 0.42 | 0.10 | 10.6 | 0.09 | 0.95 |
| **Stará Lesná** | 1 027 | 1.27 | 0.10 | 0.30 | 0.12 | 9.94 | 0.08 | 1.23 |
| **Bratislava, Jeséniova** | 1 071 | 1.66 | 0.07 | 0.46 | 0.18 | 17.24 | 0.18 | 2.10 |

Source: SHMI

### Tropospheric ozone

Average annual concentrations of ground ozone in Slovakia in contaminated urban and industrial locations in 2010 were within the interval of 44-87 µg.$m^{-3}$. Greatest average annual ground ozone concentrations in 2010 were recorded at the Chopok station (87 µg.$m^{-3}$).

Target value for ground ozone concentration in terms of public health protection is set by the MoE SR Resolution No. 360/2010 Coll. on air quality at 120 μg.m$^{-3}$ (max. daily 8-hour value). Alert threshold (240 μg.m$^{-3}$) for warning the public was exceeded in 2010 at the station in Bratislava-Jeséniova. Information threshold (180 μg.m$^{-3}$) for informing the public has been exceeded at two stations (Bratislava-Jeséniova, and Bratislava-Mamateyova).

**Number of days with exceeded target value for protection of public health - 2008, 2009, 2010, average for 2008-2010**

| Station | 2008 | 2009 | 2010 | Averaged in 2008-2010 |
|---|---|---|---|---|
| Bratislava, Jeséniova | 32 | 24 | 24 | 29 |
| Bratislava, Mamateyova | 24 | 22 | 21 | 22 |
| Košice, Ďumbierska | 6 | 106 | 14 | 42 |
| Banská Bystrica, Zelená | - | [b] 18 | 17 | 18 |
| Jelšava, Jesenského | 22 | 17 | 4 | 14 |
| Kojšovská hoľa | 39 | 71 | [a] 55 | 55 |
| Nitra, Janíkovce | - | [a] 85 | [a] 16 | 50 |
| Humenné, Nám. slobody | 10 | 43 | 8 | 20 |
| Stará Lesná, AÚ SAV, EMEP | 32 | 15 | 15 | 21 |
| Gánovce, Meteo. st. | 14 | 5 | 7 | 9 |
| Starina, Vodná nádrž, EMEP | 5 | 22 | 2 | 10 |
| Prievidza, Malonecpalská | 13 | 19 | 9 | 14 |
| Topoľníky, Aszód, EMEP | 39 | 41 | 23 | 34 |
| Chopok, EMEP | 66 | 62 | 36 | 55 |
| Žilina, Obežná | 21 | 36 | 20 | 26 |

*[a] 75-90 %, [b] 50-75 % of valid measurements*

Source: SHMI

Target value for the **AOT 40 vegetation protection exposition index** is 18 000 μg.m$^{-3}$.h (MoE SR Resolution No. 360/2010 Coll. on air quality). This value applies to the concentrations calculated as the average for the period of five years. Average values for the years 2006-2010 were exceeded at all reference urban and rural stations, with the exception of Banská Bystrica, Starina, and Prievidza.

**Values for the AOT 40 for vegetation protection - the year 2008 and for the averaged period of 2006-2010**

| Station | Averaged in 2006-2010 | 2010 |
|---|---|---|
| Bratislava, Jeséniova | 22 499 | 21 253 |
| Bratislava, Mamateyova | 18 991 | 14 712 |
| Košice, Ďumbierska | 20 482 | 12 496 |
| Banská Bystrica, Zelená | 16 144* | 15 110 |
| Jelšava, Jesenského | 18 081 | 8 542 |
| Kojšovská hoľa | 25 822 | 23 077 |
| Nitra, Janíkovce | 22 550* | 12 991 |
| Humenné, Nám. slobody | 21 806 | 9 606 |
| Stará Lesná, AÚ SAV, EMEP | 18 007 | 12 894 |
| Gánovce, Meteo. st. | 18 185 | 12 786 |
| Starina, Vodná nádrž, EMEP | 12 823 | 5 107 |
| Prievidza. Malonecpalská | 14 734 | 11 874 |
| Topoľníky, Aszód, EMEP | 23 245 | 16 764 |
| Chopok, EMEP | 28 096 | 20 815 |
| Žilina, Obežná | 20 044 | 16 248 |

** the station did not measure data for enough years*

Source: SHMI

The reference AOT 40 value for the protection of forests for annual reporting to EC is 20 000 $\mu g.m^{-3}.h$, and is valid for urban, rural and rural reference stations. These stations show values that are exceeded every year, at some stations during the photochemical active years, the values are exceeded more than two times as much. In 2010, this value was not exceeded at 3 stations.

## Ozone layer depletion

### ♦ International liabilities concerning ozone layer protection

Due to the urgency of this global problem, the international community adopted at its UN platform a number of steps to eliminate the ozone layer depletion. First international forum with the first-ever mentioning of the ozone layer took place in Vienna in 1985, with the **Vienna Convention on the Ozone Layer Protection** signed there. In 1987, this document was closely followed by adopting the first enforcing protocol to the **Montreal Protocol on Ozone-depleting Substances**. Since that year, signatories to the Montreal Protocol met five times (in London (1990), in Copenhagen (1992), in Vienna (1995), in Montreal (1997) and in Beijing (1999)), to limit or, if necessary, totally eliminate the production and consumption of substances that deplete the ozone layer.

Slovakia made effective the **Montreal Annex** to the Montreal Protocol on February 1, 2000. This document prohibits Slovakia to import and export all controlled substances, including methyl bromide, from and to non-signatory countries, as well as sets forth the obligation to introduce a licensing system for import and export of controlled substances. In 2002, Act 408/2000 Coll. was adopted, which amends Act 76/1998 Coll. on the Earth’s ozone layer protection and on amendment to Act 455/1991 Coll. on small business (Small Business Act) as amended, which transposed the decisive majority of responsibilities stipulated under the European Parliament and Commission Directive 2 037/2000 EC and banned the production of brom-chloro-methane, creating conditions for ratification of the **Beijing Annex** of the Montreal Protocol. (for Slovakia effective as from August 20, 2002). Since January 1, 2010, a new Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer.

### ♦ Consumption of controlled substances

Sovakia does not produce any ozone-depleting substances. All such consumed substances come from the export. These imported substances are used mainly in cooling agents and detection gases, solvents, and cleaning chemicals.

**Consumption of substances under control in SR (t)**

| Group of substances | 1986/ 1989# | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AI - freons** | 1 710.5 | 4.1 | 0.996 | 0.81 | 0.533 | 0.758 | 0.29 | 0.43 | 0.46 | 0.34 | 0.49 |
| **A II - halons** | 8.1 | - | - | - | - | - | - | - | - | - | - |
| **BI* - freons** | 0.1 | - | - | - | - | - | - | - | - | - | - |
| **B II* - $CCl_4$** | 91 | 0.03 | 0.01 | 0.009 | 0.047 | 0.258 | 0.045 | 0 | 0.016 | 0.099 | 0.119 |
| **BIII* - 1,1,1** | 200.1 | - | - | - | - | - | - | - | - | - | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **trichloroethane** | | | | | | | | | | | |
| **C I*** | 49.7 | 66.8 | 71.5 | 52.91 | 38.64 | 48.76 | 43.94 | 41.32 | 34.35 | 31.12 | 0.578 |
| **C II - HBFC22B1** | - | - | - | - | - | - | - | - | - | - | - |
| **E** - $CH_3Br$** | 10.0 | 0.48 | 0.48 | 0.48 | 0.48 | - | - | - | - | - | - |
| **Total** | 2 019.5 | 71.4 | 72.986 | 54.21 | 39.7 | 49.78 | 44.28 | 41.75 | 34.83 | 31.56 | 1.187 |

# Initial usage

Source: MoE SR

* Initial year 1989

** Initial year 1991

***Note 1****: 0.48 tons of methyl bromide were imported in 2001-2004 for Slovakofarma as a raw material for the production of medications, which is not considered as consumption, according to the valid methodology.*

***Note 2****: Consumption of C1 substances in 2010 represents the import of regenerated R22. As from January 1, 2010, Regulation no. 1005/2009/EC allows to introduce to the market and use only recycled or regenerated substances for the maintenance and service of mechanisms; import, introduction and use of pure C1 substances is prohibited.*

**Usage of substances under control in 2010 (t)**

| **Usage** | **Group of substances** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AI | A II | BI | B II | BIII | C I | C II | E |
| **Coolant** | | | | | | 0.578 | | |
| **Detection gases, diluents, detergents** | 0.49 | | | 0.119 | | | | |

Source: MoE SR

## ♦ Total atmospheric ozone and ultraviolet radiation

The average annual value of total atmospheric ozone in 2010 was 346.3 Dobson units (D.U.), which is 2.4% above the long-term average from measurements in Hradec Králové in 1962-1990. Values from these measurements have been used also for our territory as the long-term normal value.

**Average monthly devations within 2010**

| **Month** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Year** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average (DU)** | 365 | 377 | 394 | 396 | 360 | 344 | 335 | 310 | 315 | 307 | 306 | 349 | **346.3** |
| **Deviation (%)** | 7 | 2 | 3 | 3 | -3 | -4 | -2 | -4 | 4 | 7 | 6 | 13 | **2.4** |

Source: SHMI

# • WATER

## Key questions and key findings

### ♦ Key questions

- What is the situation and trend in the use of water in terms of preserving the water sources?
- Has there been a reduction to the pressure on the surface water quality expressed by the volume of pollution discharged into surface water?
- What is the quality of water in Slovakia?
- What is the trend in connectedness of the public to public water supplies and sewerage systems?

### ♦ Key findings

- In 2010, there was an increase in surface water abstraction by almost 60%, compared to the previous year. Significant increase was detected in the category of industry. In terms of comparing the long-term trends (2000 - 2010), decreasing trend was recorded until 2007, which was followed by a period of increase in 2008, decrease in 2009, and another increase in 2010. Abstractions in 2010 represented approximately 60% of all abstractions in 2000.
- Ground water abstractions in 2010 dropped by 2.04%, compared to 2009. This points to a continuing long-term trend in ground water use. Ground water abstractions in 2010 represented a reduction in yearly abstracted volumes by 24%, compared to the abstractions in 2000.
- In 2010, 20% more waste water was discharged into surface water than in 2009. From the perspective of long-term trend we can see a reduction in waste water in 2010 by 40% compared to 2000 with a significant change in the proportion of treated to untreated waste water discharged into watercourses with a significant reduction in waste water contamination.
- Surface water quality at all monitoring sites complied with the limits for selected general indicators and the radioactivity indicators. Exceeded limit values were recorded mainly for synthetic and non-synthetic substances, hydrobiological and microbiological indicators, and nitrite nitrogen.
- Condition of surface water formations was classified as adverse and critically adverse in 3.4% of water formations, reaching the length of 1 179.95 km. 86 water formations (5%) do not show favourable chemical balance.
- Monitoring for ground water chemical balance in 2010 was carried out within the framework of basic monitoring (175 objects) and operational monitoring (211 objects). Both types of monitoring showed exceeded values for set contamination limits.
- Drinking water quality has long been of the high level. In 2010, the share of favourable drinking water analyses for compliance to limit values reached 99.39%.
- Altogether, of 38 swimming areas, 94.4% (34 swimming recreational areas) which complied with the bathing water quality criteria. This represents an increment of 3%, compared to the previous year. 15 bathing sites complied with the recommended limit values, which is 41.7% and represent a reduction by 46.5%. In 2010, Delňa was the only water formation classified in the system of European monitoring that was assessed as a site that does not comply with the criteria of the Directive on recreational water. This was due to a high concentration of Escherichia coli. Bathing prohibition was issued for one recreational site, Zemplínska Šírava - Hôrka, due to exceeded values for the following indicators: intestinal enterococci, E.coli, and coliform bacteria.
- Number of inhabitants connected to drinking water from public water supplies reached 86%. This value does not reach the values shown by the neighbouring countries.
- Number of inhabitants connected to public sewerage systems reached 60.4%. This level is comparable to Hungary, Poland; however, it is significantly lower than that of the Czech Republic and Austria.

## Surface water

### ♦ Water balance

Significant part of the Slovak surface water fund flows in from the neighboring states and the usability of this fund is limited. In total, the long-term in-flow average is approximately 2.514 $m^3.s^{-1}$ of water, which is about 86% of our total surface water fund. In the long run, there is approximately 398 $m^3.s^{-1}$ of water springing in Slovakia, which represents 14% of the water fund.

**Annual inflow** to Slovakia in 2010 was 71 810 mil.$m^3$, which was abreast of the previous year 2009. **Runoff** from the territory has grown by 12 978 mil.$m^3$, compared to the previous year.

**Total water volume** as of 1.1.2010, in water reservoirs was 931 mil.$m^3$, which represented 80% of total usable water volume in water reservoirs. As of 1.1.2011, total available volume of the assessed accumulation tanks compared to the previous year 2010 incerased to 1 003.3 mil.$m^3$, which represents 86% of total exploitable water.

**Total hydrological balance of water resources in the SR**

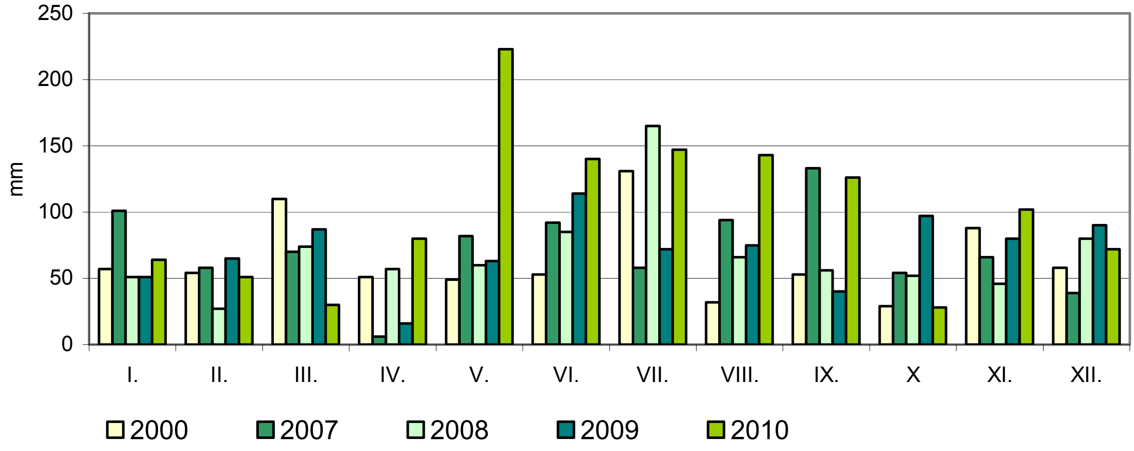
| | **Volume (mil. $m^3$)** | | |
|---|---|---|---|
| | **2008** | **2009** | **2010** |
| **Hydrological balance** | | | |
| Rainfall | 40 049 | 41 715 | 59 117 |
| Annual inflow to the SR | 69 005 | 71 767 | 71 810 |
| Annual runoff | 73 387 | 85 546 | 98 524 |
| Annual runoff from the territory of the SR | 10 146 | 10 382 | 22 939 |
| **Water management balance** | | | |
| Total abstraction of the surface and ground water in the SR | 664.6 | 627.81 | 602.27 |
| Evaporation from water reservoirs and dams | 51.9 | 61.68 | 48.08 |
| Discharge into surface waters | 608.9 | 605.27 | 698.49 |
| Impact of water reservoirs (WR) | 12.6 | 123.27 | 72.00 |
| | **accumulation** | **accumulation** | **accumulation** |
| Total volume in WR as of 1st January of the following year | 809.4 | 931.1 | 1 003.3 |
| % of supply volume in accumulation WR in the SR | 70 | 80.30 | 86.0 |
| Rate of water exploitation (%) | 6.55 | 5.80 | 2.63 |

Source: SHMI

### ♦ Precipitation and runoff conditions

Total **atmospheric precipitations** in the Slovak territory in 2010 reached the value of 1 206 mm, which represents 158% of the normal level. In terms of precipitations, this year had been considered exceptionally humid. Total excess of precipitations reached the value of 444 mm.

**Average monthly precipitation in the area of the SR in 2000 and 2007- 2010**




Source: SHMI

In 2010, based on the rainfall indicators, all Slovakian watersheds were exceptionally humid when expressed in % (144 to 185% of the corresponding normal values). The lowest volume of precipitations expressed in % was shown for the Morava region. (144% of the corresponding normal values, which is 983 mm).

**Average rates of precipitation and runoff in particular catchment areas**

| Catchment area | Dunaj | | Váh | | Hron | | | Bodrog a Hornád | | | | SR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subcatchment area | *Morava | *Dunaj | Váh | Nitra | Hron | *Ipeľ | Slaná | Bodva | Hornád | *Bodrog | *Poprad a Dunajec | |
| Catchment area extent (km$^2$) | 2 282 | 1 138 | 14 268 | 4 501 | 5 465 | 3 649 | 3 217 | 858 | 4 414 | 7 272 | 1 950 | 49 014 |
| Average precipitation (mm) | 983 | 954 | 1 243 | 1 081 | 1 294 | 1 183 | 1 285 | 1 253 | 1 153 | 1242 | 1 371 | 1 206 |
| % of normal | 144 | 152 | 147 | 156 | 164 | 173 | 163 | 185 | 164 | 170 | 163 | 158 |
| Character of rainfall period | MV | MV | MV | MV | MV | MV | MV | MV | MV | MV | MV | MV |
| Annual runoff (mm) | 220 | 48 | 510 | 279 | 554 | 383 | 520 | 544 | 472 | 494 | 630 | 468 |
| % of normal | 167 | 133 | 161 | 195 | 192 | 282 | 275 | 259 | 159 | 301 | 183 | 179 |

* watercourses and corresponding data only for the Slovak part of the watershed Source: SHMI
Characteristics of the precipitation season: N - normal, S - dry, SS - very dry, V – humid, VV – very humid, MV – exceptionally humid

Average annual run-off from the Slovak territory was 468 mm, which is 179% of the long-term normal value. In individual partial watersheds, the run-off values fluctuated between 48 mm (partial Danube watershed) and 630 mm (watersheds of Poprad and Dunajec). The lowest percentage of normal values was recorded for the Danube watershed (1.33%), the highest percentage of normal values was shown for the Bodrog watershed (301%).

## ♦ Surface water abstraction

In 2010, surface water abstractions increased to 446.7 mil.m$^3$, which is 59.6% more than in the previous year. Abstractions for industry in 2010 were at 392.7 mil. m$^3$, which was a significant growth by 176.3 mil.m$^3$, i.e. 81.5%, compared to 2009. A slight reduction was recorded also in surface water abstractions for waterlines, which, compared to the previous year, dropped by 2.8 mil.$m^3$, that is 5.6%. Surface water abstractions for irrigation grew and reached the value of 5.8 mil.$m^3$.

**Surface water exploitation in the SR (mil.$m^3$)**

| Year | Public water-supplies | Industry | Irrigation | Other agriculture | Total | Discharging |
|---|---|---|---|---|---|---|
| **2000** | 70.571 | 575.872 | 90.540 | 0.0440 | 737.027 | 989.825 |
| **2008*** | 52.057 | 251.797 | 9.133 | 0.0040 | 312.991 | 608.997 |
| **2009*** | 51.045 | 216.397 | 12.319 | 0.0020 | 279.763 | 605.271 |
| **2010*** | 48.200 | 392.700 | 5.800 | 0.0000 | 446.700 | 744.600 |

* data from database „Aggregate balance sheet of water“ Source: SHMI

## ♦ Surface water quality

Surface water quality assessment has been carried out on the basis of data obtained during the water level monitoring process. In 2010, surface water quality monitoring in the Slovak Republic was divided by the **MoE SR Resolution 418/2010 Coll. on implementation of selected provisions of the Water Act** into basic monitoring, operational monitoring, and monitoring of protected areas (PA). Quality surface water indicators in 2010 were monitored in compliance with the approved Programme of Water Balance Monitoring for 2010. 277 sites were monitored under the basic and operational monitoring schemes.

**The number of monitored surface water sampling sites in 2010**

| Sub-basin | The number of monitoring sites per type of monitoring | | |
|---|---|---|---|
| | Basic | Operational | Basic and Operational |
| **Morava** | 8 | 12 | 8 |
| **Dunaj** | 11 | 2 | 4 |
| **Váh** | 19 | 64 | 15 |
| **Hron** | 3 | 26 | 7 |
| **Ipeľ** | 6 | 18 | 2 |
| **Slaná** | 1 | 8 | 4 |
| **Bodrog** | 8 | 14 | 2 |
| **Hornád** | 3 | 16 | 2 |
| **Bodva** | - | 2 | 3 |
| **Dunajec and Poprad** | 4 | 4 | 1 |
| **Total** | **63** | **166** | **48** |

Source: SHMI

Quality indicators monitored at all monitoring sites (basic and operational) in 2010 were assessed pursuant to the **SR government Regulation 269/2010 Coll. which sets forth criteria for achieving a favourable water balance.** General requirements for surface water quality were met at all monitoring sites for the following indicators: **general indicators** (part A) - total organic carbon, dissolved substances (dried as well as annealed), magnesium, sodium, chlorides, free ammonia, organic nitrogen, surface active substances, non-polar extractable substances (UV, IR) phenolic index, chlorobenzene, dichlorbenzenes. Also, **radioactivity indicators** complied with the requirements (part D): bulk volume alpha and beta activity, tritium, stroncium, and caesium.

Surface water quality criteria were exceeded in the **synthetic substances** category (part B) by the indicators for arsenic, cadmium, copper, lead, zinc. In the category of **non-synthetic substances** (part C) the following substances did not comply with the criteria for the annual average: atrazine, di-(2-ethyl hexyl) phtalate (DEHP), fluoranthene, naphtalene, 4-nonylphenol, tetrachloroethylene, trichloromethane, cyanides, and 4-methyl-2 6-di-tert-butylphenol. **Hydrobiological and microbiological indicators** (part E) included the bioseston saprobic index, abundance of phytoplankton, chlorophyll a, coliform bacteria, thermotolerant coliform bacteria, intestinal enterococci. Nitrite nitrogen indicator has often been exceeded in all partial watersheds for the **general indicators** group. Most exceeded criteria in the group of hydrobiological and microbiological indicators included those for intestinal enterococci (in 7 partial watersheds), thermotolerant coliform bacteria (in 9 partial watersheds), and coliform bacteria (in 5 partial watersheds).

### ♦ Evaluation of status of surface water bodies

Assessment of surface water formations balance is based on the assessment of their ecological condition, i.e. their ecological potential and chemical balance.

Resulting water balance is determined by the worse of the pair of chemical or ecological balance that forms the basis for the subsequent activities relating to the compliance with one of the environmental quality goals under Framework Water Directive (FWD) - to reach a favourable water balance for all water formations by 2015.

In total, 1 760 surface water formations of Slovakia have been assessed.

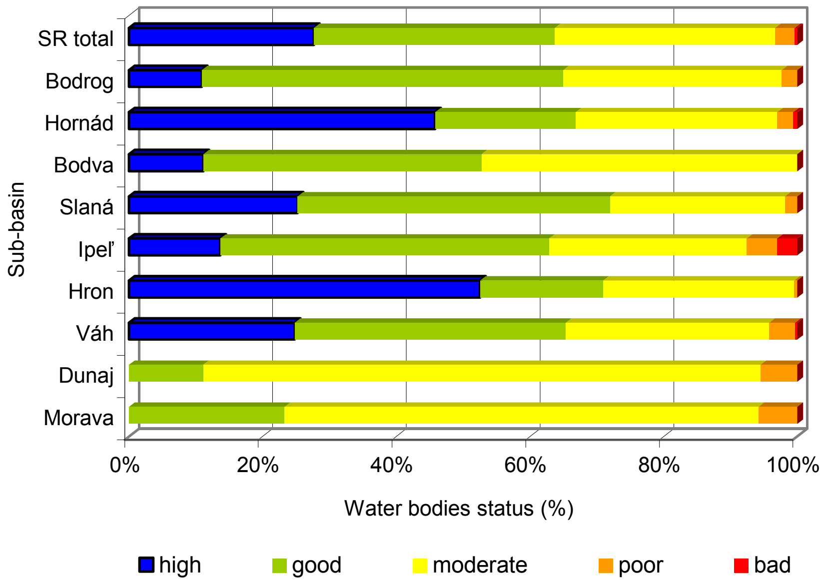
**Classification of ecological status/potential of surface water bodies in SR years 2007 – 2008**

| | Water body status (number) | | | | |
|---|---|---|---|---|---|
| | high | good | moderate | poor | bad |
| Danube River Basin District | 426 | 630 | 563 | 51 | 7 |
| Vistula River Basin District | 61 | 5 | 16 | 1 | 0 |
| **SR total** | **487** | **635** | **579** | **52** | **7** |

Source: MoE SR

Of the total number of water formations, very favourable and favourable ecological balance/potential was shown for 63.7% of them. In terms of water formations' length, the number represents 53.9%. (10 265.44 km) A relatively high number of water formations showed average balance/potential, specifically 32.9% of them, which represents the length of 7 600.78 km. Condition of surface water formations was classified as adverse and critically adverse in 3.4% of water formations, reaching the length of 1 179.95 km.

**Share of the total number of water bodies classified into the individual ecological status/potential in the river basin of SR**




Source: MoE SR

Assessment of water **chemical balance** involved assessing the occurrence of 41 priority substances in surface water formations. Compliance of the outcomes of monitoring with the environmental quality standard (EQS) means compliance with the criteria for favourable chemical balance. Monitoring of priority substances in 2007 and 2008 was implemented in 132 water formations. Scope of the monitored indicators and the frequency of their monitoring differed.

Based on the performed assessment, of total number of 1 760 water formations, 1 674 of them (95.0%) showed a favourable chemical balance, while 86% of them do not.

**Evaluation of chemical status of water bodies per river basin district**

| River basin | Water bodies achieving good chemical status | | Water bodies not achieving good chemical status | |
|---|---|---|---|---|
| | number | length (km) | number | length (km) |
| Morava | 95 | 822.10 | 8 | 197.10 |
| Dunaj | 16 | 318.08 | 2 | 56.20 |
| Váh | 609 | 6 324.50 | 32 | 777.94 |
| Hron | 204 | 1 828.45 | 13 | 261.00 |
| Ipeľ | 124 | 1 517.20 | 8 | 103.30 |
| Slaná | 106 | 1 077.50 | 1 | 13.00 |
| Bodva | 35 | 309.25 | 1 | 35.80 |
| Hornád | 158 | 1 551.65 | 8 | 151.35 |
| Bodrog | 247 | 2 498.30 | 10 | 301.80 |
| Danube River Basin District | 1 594 | 16 246.95 | 83 | 1 897.49 |
| Vistula River Basin District | 80 | 786.85 | 3 | 115.10 |
| **SR total** | **1 674** | **17 033.80** | **86** | **2 012.59** |
| | **95.0%** | **89.4%** | **5.0%** | **10.6 %** |

Source: MoE SR

## Groundwater

### ♦ Water resources

In 2010, based on the hydro-geological assessment and surveys in the SR, there were **78 672 $l.s^{-1}$ available groundwater resources**. In comparison with the previous year 2009, there was observed a slight increase of the efficient groundwater volume by 115 $l.s^{-1}$, i.e. by 0.15%. In the long-term evaluation, the increase of the efficient volume in comparison with 1990 makes 3 897 $l.s^{-1}$, i.e. 5.2%.

On the basis of assessment of water management balance expressed by the balance status (proportion of abstractable volumes/abstractions), which is the indicator that shows the rate of wate sources abstraction, we see that in **2010, out of total number of 141 hydro-geological regions in SR, 126 regions show good balance status, 14 regions show acceptable status and one region show critical status.** Emergency balancing state did not occur in any region.

### ♦ Groudwater levels

In 2010, compared to 2009, **average annual levels** in Slovakia showed almost consistent elevations in ground water levels. Average annual values for ground water levels grew in most instances up to + 60 cm, occasionally up to +300 cm ,in all watersheds of Slovakia, with the exception of Morava and Danube where the growth was up to +40 cm. Occasional drops of up to -10 cm occurred in the Danube watershed.

Average annual levels in 2010, compared to long-term average annual levels, almost consistently grew up to +110 cm in the whole territory, with more intensive values in the watersheds of the Central and Eastern Slovakia. Occasional reductions of up to -50 cm were recorded in the watersheds of Danube and middle and upper Váh.

### ♦ Well capacities

Increase, for the most part, of up to 200% in the Slaná watershed, compared to the previous year, was recorded, give the **average annual** spring **yields.** Occasional drops in the average annual yields were recorded in the watersheds of the upper Váh, Turiec, Morava, and Hornád. (from 83% to 97%).

Average annual yields compared to long-term average yields grew almost consistently up to 200% in the watershed of Slaná, and even beyond 300% of the watershed of Bodva. Occasional drops were recorded in the watersheds of Morava, Upper Váh, Orava, Turiec, Nitra, and Poprad (from 71% to 99%).

### ♦ Groundwater abstraction

In 2010 there was being **extracted 10 820 $l.s^{-1}$ of ground water in average** by the users (which are subjects to reporting obligation) in Slovakia that was 13.8% of the documented efficient volume. During the year 2010 the groundwater extractions slightly decreased by 225.1 $l.s^{-1}$ which means 2.04% in comparison with year 2009.

**Groundwater extraction in 2010 according to the purpose of use ($l.s^{-1}$)**

| Year | Public water supplies | Food-processing industry | Other industr. | Agricult. and Livestock | Vegetable prod. Irrigation | Social purposes | Others | Total |
|---|---|---|---|---|---|---|---|---|
| **2007** | 8 441.59 | 383.87 | 891.32 | 267.84 | 146.25 | 333.44 | 901.65 | 11 365.96 |
| **2008** | 8 468.82 | 284.98 | 823.02 | 253.29 | 67.52 | 271.23 | 953.23 | 11 122.09 |
| **2009** | 8 475.40 | 268.13 | 762.18 | 232.07 | 93.80 | 249.44 | 963.58 | 11 044.60 |
| **2010** | 8 295.00 | 265.00 | 781.00 | 217.20 | 48.70 | 254.40 | 967.20 | 10 819.50 |

Source: SHMI

## ♦ Monitoring of groundwater quality

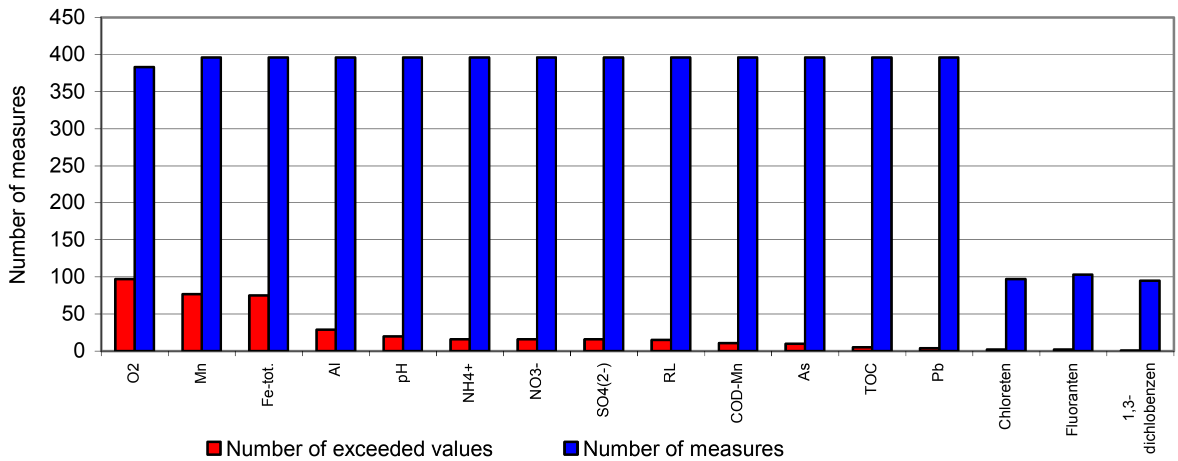
Pursuant to the WFD requirements, the older system of dividing Slovakia into significant water management areas was abandoned. Since 2007, classification has been based on delineation of groundwater formations. Monitoring of ground water chemical situation has been divided into:

- basic monitoring,
- operation monitoring.

In 2010, ground water quality was monitored at 175 basic monitoring facilities. Ground water samples were extracted 2 times from 53 quaternary objects, 1 times in 64 pre-quaternary objects, and 4 times in 56 pre-quaternary karst objects.

Adverse **oxidation-reduction** conditions dominate at ground water **basic monitoring** facilities, apparently caused by most frequent occurrences of exceeded acceptable concentrations of total Fe (75 times), Mn (77 times), and $NH_4^+$ (16 times). Besides these indicators, there has been an untypical event of exceeded concentrations in the group of **physical - chemical indicators,** specifically in the case of the $Cl^-$, $SO_4^{2-}$, and $NO_3^-$ anions, $COD_{Mn}$ and $H_2S$. Most frequently recorded excessive concentrations in **trace elements** included Al (29 times), As (10 times), Pb (4 times), Sb (8 times), Hg (1 time) and Ni (1 time). Contamination by **specific organic substances** shows only local character and the majority of specific organic substances was recorded below the detection limit. In 2010 was recorded exceeding the limit values in the group of pesticides, follow in group of polyaromatic hydrocarbons, volatile aromatic hydrocarbons and group of volatile aliphatic hydrocarbons.

**Occurrence of exceeded indicators at basic monitoring facilities pursuant to the SR Government Directive 496/2010 Coll. in 2010**



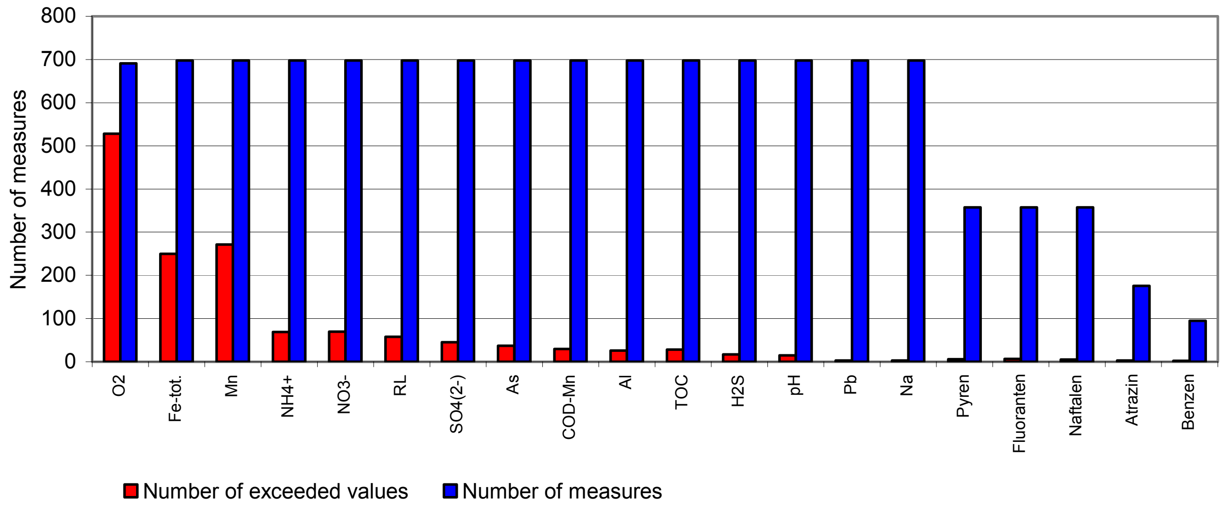

Source: SHMI

**Operational monitoring** was conducted at all ground water formations that were assessed as high-risk in terms of not being able to reach a favourable chemical balance. In 2010, within the operational monitoring 211 objects were monitored with the assumption to detect a potential penetration of contaminants from a potential contamination source or group into the ground water. The area of Žitný ostrov forms a separate part of the SHMI monitoring network, since it plays an important role within the whole process of water quality changes in Slovakia, and since the area itself represents a reservoir of drinking water for our territory.

Ground water at **operation monitoring** is relatively low in oxygen, with the exception of the Žitný ostrov area. This is also apparent from the fact that the recommended percentage value for oxygen water saturation was reached only in 23.59% of the samples. Most frequently exceeded indicators include Mn and total Fe, which suggests persisting adverse **oxidation-reduction situations.** Exceeded $Cl^-$ and $SO_4^{2-}$ limit values also indicate the impact of anthropogenic pollution on ground water quality. The limits for the following basic parameters were exceeded: soluble substances at 105°C (58 times), $H_2S$ (17 times), Mg (5 times) and Na (3 times). Character of land use (agricultural exploitation) is reflected into increased contents of oxidized and reduced nitrogen forms in ground water, with ammonia ions $NH_4^+$ (69 times) and $NO_3^-$ (70 times) being the most prevalent. In 2010, the acceptable value set by legislation was exceeded in **6 trace elements** (Al, As, Sb, Cd, Ni, and Pb) at operation monitoring facilities. Most frequently recorded increased contents include Al (26 times) and As (37 times). The impact of anthropogenic activity on groundwater quality is indicated by the increased concentration of $COD_{Mn}$ (30 times). The limit for non.polar substances ui ($NEL_{UV}$) were exceeded 8 times and for TOC 18 times. The presence of specific organic substances in groundwater is an indicator of the impact of human activity. A wider range of **specific organic substances** was recorded within the operational monitoring.

The most exceeded limit values were recorded in indicators from the pesticides group (phenmedipham, S-metolachlor, desethylatrazine, bentazon, atrazine, metamitron, prometryn, propisochlor, clopyralid) and polyaromatic hydrocarbons (fluoranthene, naphtalene, phenanthrene, chrysene, acenaphtene, b(a,h)anthracene). Exceeded were also the limit values in the group of volatile aromatic hydrocarbons and volatile aliphatic hydrocarbons.

**Occurrence of exceeded indicators at operation monitoring facilities pursuant to the SR Government Directive 496/2010 Coll. in 2010**




Source: SHMI

### ♦ The groundwater status assessment

75 water formations have been designated in Slovakia (16 quaternary and 59 pre-quaternary) that were in 2010, with the exception of 2 pre-quaternary formations.

Objects were assessed for each water formation based on compliance to the Slovak Government Resolution no. 496/2010 Coll. which amends Slovak Government Resolution no. 354/2006 Coll. **which sets forth criteria for water for human consumption and its quality assessment.** Objects showing the exceeded threshold value set by legislation by at least one indicator were labelled as unfavourable.

On the basis of assessment of the ground water chemical balance, of the total number of 75 ground water formations:

- 13 ground water formations were declared as those with unfavourable chemical balance - 7 quaternary and 6 pre-quaternary
- 62 ground water formations were declared as those with favourable chemical balance.

**Summary of chemical status evaluation in the groundwater bodies in SR**

| SR water bodies | Chemical status classification | | | | Total area |
|---|---|---|---|---|---|
| | good | | poor | | |
| | km$^2$ | % | km$^2$ | % | |
| Quaternary | 6 081 | 57.1 | 4 565 | 42.9 | 10 646 |
| Pre - quaternary | 39 446 | 80.5 | 9 536 | 19.5 | 48 982 |
| **SR total** | **45 527** | **76.4** | **14 101** | **23.6** | **59 628** |

Source: MoE SR

Favourable chemical balance was indicated for 82.7% of groundwater formations, i.e. 76.4% of total size of formations (quaternary and pre-quaternary). Favourable chemical balance was indicated for 17.3% of groundwater formations, i.e. 23.6% of total size of formations (quaternary and pre-quaternary).

**Quantitative balance of groundwater formations** involves assessing the impact of the documented phenomena on the groundwater formation as such. In Slovakia, this involves assessing the impact of groundwater abstractions. For the purposes of assessment of the quantitative balance of groundwater formations within quaternary sediments and pre-quaternary rocks, outcomes of four assessments have been summarised. 5 groundwater formations in the territory of the Slovak Republic have been classified as having an adverse quantitative balance.

## Waste water

In 2010, 744 756 thous.$m^3$ of **waste water** were discharged into the surface water, which represents a growth by 124 416 thous.$m^3$ (20.0%) compared to the previous year. When compared with 2000, it is less by 302 925 thous.$m^3$ (40.1%)

Volumes of organic pollution in the surface water characterised by the oxygen demand parameters: chemical oxygen demand by dichromate (CODcr) and biochemical oxygen demand (BOD) remained at the level of last year. The indicator for insoluble substances (IS) recorded a more significant growth by 1 311 thous.t. per year.

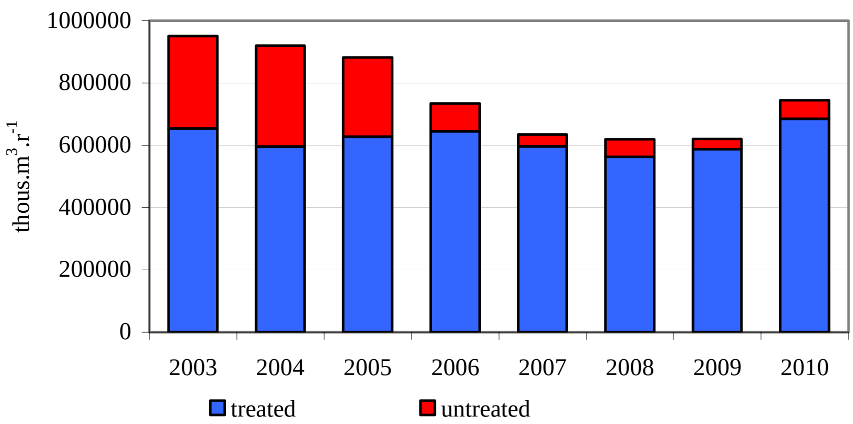
**Percentage of discharged treated** waste water to **total volumes of waste water** discharged into watercourses in 2010 was 91.94%.

**Load of the balanced contamination sources discharged into surface watercourses in the period of years 2000-2010**

| Discharged waste water | Volume (thous.$m^3.y^{-1}$) | IS ($t.y^{-1}$) | $BOD_5$ ($t.y^{-1}$) | $COD_{Cr}$ ($t.y^{-1}$) | $NES_{uv}$ ($t.y^{-1}$)) |
|---|---|---|---|---|---|
| **2000** | 1 047 681 | 23 825 | 20 205 | 61 590 | 298 |
| **2007*** | 634 419 | 9 405 | 6 521 | 26 913 | 58 |
| **2008*** | 619 286 | 8 736 | 6 641 | 26 688 | 31 |
| **2009*** | 620 340 | 7 707 | 5 546 | 25 660 | 31 |
| **2010*** | 744 756 | 9 018 | 5 580 | 25 750 | 32 |

* data from database „Aggregate balance sheet of water“ Source: SHMI

**Trend in discharging of the treated and untreated waste waters into watercourses in the period of 2003-2010**




Source: SHMI

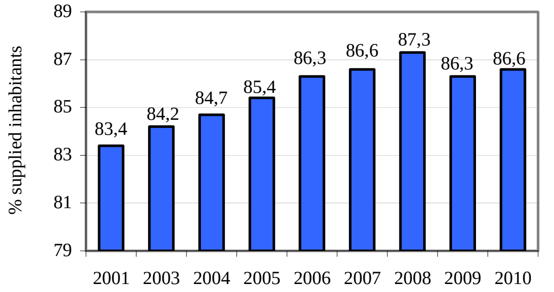
## Public water supplies, sewerage lines, and wastewater treatment plants

### ♦ Public water supplies

**Number of inhabitants supplied with drinking water from the public water supply** in 2010, reached the number of 4 705 thousand, which represented 86.6% of supplied inhabitants. There were in the SR 2 297 individual municipalities that were supplied with public water supply, and their portion on total SR municipalities was 79.5%.

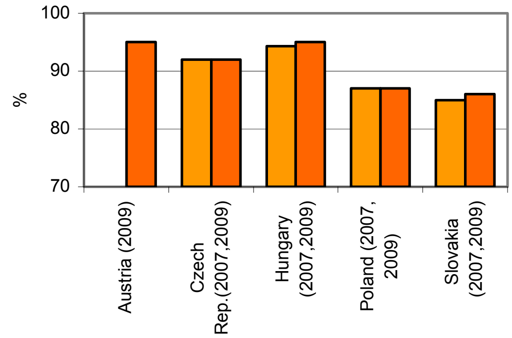
In 2010, major changes were registered in drinking water abstraction. **Volume of produced drinking water** reached the value of 313 mil. $m^3$ of drinking water, which, compared to 2009, represents a reduction by 1 mil. $m^3$. Of all groundwater sources, 267 mil.$m^3$ was produced (increased by 3 mil.$m^3$), while 46 mil.$m^3$ of drinking water was produced of all surface water sources (reduction by 4 mil.$m^3$) Of total water produced at water management facilities, **water losses** by pipe network were 27.6% in 2010. **Specific water consumption by households** decreased to 83.4 l per person per day. This is alarming not only due to the fact that these abstractions are close to the sanitary limits, but mainly because the high drinking water prices motivate the people to build their own drinking water sources whose drinking water quality is, in most cases, far below the sanitary standards.

**Drinking water supplying of the inhabitants from the public water supplying in the SR**




Source: SO SR, VRI

**Comparison of the drinking water supplying of the inhabitants from the public water supplying in selected countries**

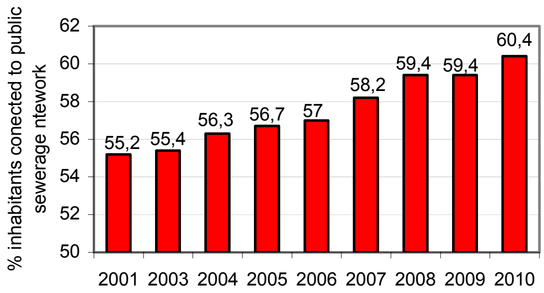



Source:Eurostat, SO SR

### ♦ Sewerage system

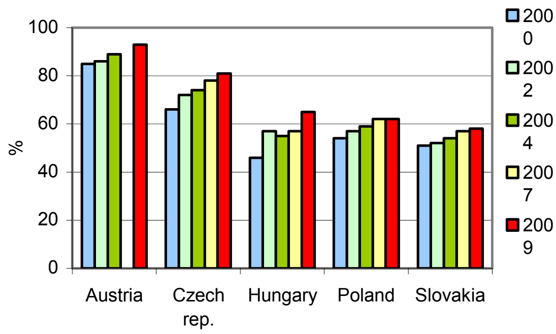
Development of public sewerage systems lags behind that of public water supplies. **Number of inhabitants** living in households **connected to public sewerage systems** in 2010 reached the number of 3 282 thous. inhabitants, which is 60.4% of all inhabitants. Of the number of 2 891 of stand-alone municipalities in 2010, 908 of them had public sewerage systems in place (i.e. 31.4% of all Slovak municipalities).

**Connecting of the inhabitants to the public sewerage network in the SR (%)**




Source: SO SR, WRI

**Comparison of the connecting of the inhabitants to the public sewerage network in the selected countries (%)**




Source: Eurostat

## ♦ Waste water treatment plants

In 2010, 607 waste water treatment plants were in the Administration of water supplies and water sewerage systems (VaK) scheme, of which greatest share had mechanical-biological WWTPs (93.5%). WWTP's capacity was reaching the value of 2 196.9 $m^3.day^{-1}$ in 2010.

In 2010, watercourses with public sewerage system (administered by municipalities and water management companies) received 507 $mil.m^3$ of discharged waste water, which was by 80 $mil.m^3$ more than in the previous year, and the volume of treated waste water discharged into the public sewerage system reached 497 $mil.m^3$.

**Volume of the discharged wastewater by the public sewerage system (in administration of VaK and in administration of the municipalities) in 2010**

| Water discharged by the public sewerage and WWTP | Sewage | Industrial and other | Precipitation | Separate | Administration of the municipalities | Total |
|---|---|---|---|---|---|---|
| | (thous.$m^3.year^{-1}$) | | | | | |
| **Treated** | 113 762 | 92 514 | 61 125 | 229 638 | 0 | 497 039 |
| **Untreated** | 3 084 | 776 | 1 946 | 4 217 | 0 | 10 023 |
| **Total** | 116 846 | 93 290 | 63 071 | 233 855 | 0 | 507 062 |

Source: WRI

**Sludge from WWTPs** is a necessary by-product of the waste water treatment process. Sludge volumes produced in Slovakia at WWTPs operated by regions or water management companies remained virtually unchanged, with fluctuations within 53 - 58 thous. tonnes of sludge dry matter.

**Sludge produced in the waste water treatment plant**

| Year | Amount of the sludge (tons of dry residue) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Used | | | Disposed | | | |
| | | Applied into the agricultural soil | Applied into the forest soil | Composted and used in other way | Incine-rated | Land filled | | In other way |
| | | | | | | Total | Suitable for the further use | |
| **2006** | 54 780 | 0 | 0 | 39 405 | 0 | 9 245 | 8 905 | 6 130 |
| **2007** | 55 305 | 0 | 0 | 42 315 | 0 | 3 590 | 583 | 9 400 |
| **2008** | 57 810 | 0 | 0 | 38 368 | 0 | 8 676 | 0 | 10 766 |
| **2009** | 58 582 | 0 | 0 | 47 056 | 0 | 2 696 | 0 | 8 830 |
| **2010** | 54 760 | 923 | 0 | 35 289 | 0 | 16 | 0 | 6 681 |

Source: WRI

## Drinking water

### ♦ Drinking water quality monitoring and assessment

Drinking water indicators are defined under the **SR Government Regulation 354/2006 Coll.,** which stipulates requirements on water designated for human consumption and its quality control. Water quality control for radioactivity follows the **Resolution of the Ministry of Health no. 528/2007 Coll.** which stipulates details on requirements to limit the level of irradiation from natural radiation.

Besides the **complete water analysis**, the implemented **minimum analyses** - e.g. analyses of 28 water quality indicators, is carried out to monitor and obtain periodic information on the stability of water bodies and effectiveness of water treatment, mainly water desinfection, biological quality and the sensoric properties of drinking water.

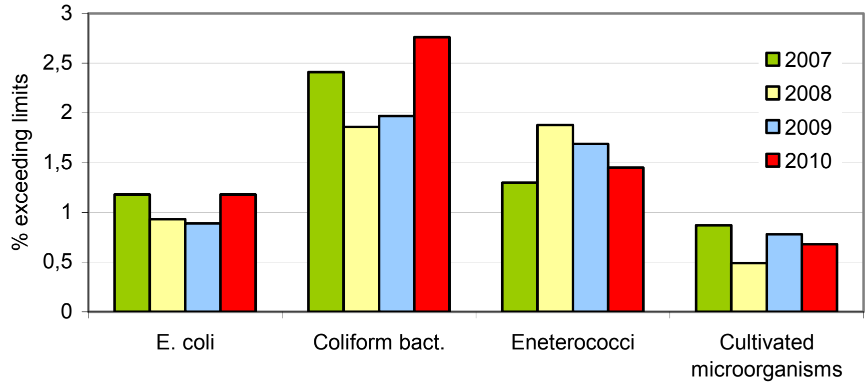
In 2010, were analysed at operation laboratories of water management companies 8 542 samples. The samples were abstracted at sites located within distribution networks and 246 263 analyses were carried out to monitor individual drinking water quality indicators. Share of drinking water analyses that complied with the sanitary limits in 2010 reached 99.39% (in 2009 it was 99.46%). Percentage of samples that meet drinking water quality demands for all indicators reached 90.51% (in 2009 it was 91.20%). These samples did not include the active chlorine indicator, as this test was done separately, in relation to the microbiological quality of drinking water.

**Exceeding limits in drinking water samples in accordance with the SR Government Resolution no. 354/2006 Coll. on demands on drinking water and drinking water control**

| | 2008 | 2009 | 2010 |
|---|---|---|---|
| Share of drinking water samples that do not meet the NMH and MHRR limit. | 2.34% | 1.77% | 2.03% |
| Share of drinking water quality indicators analyses that do not meet NMH and MHRR | 1.02% | 0.88% | 0.87% |
| NMH - maximum threshold values, MHRR – threshold values of the reference risk | | | |

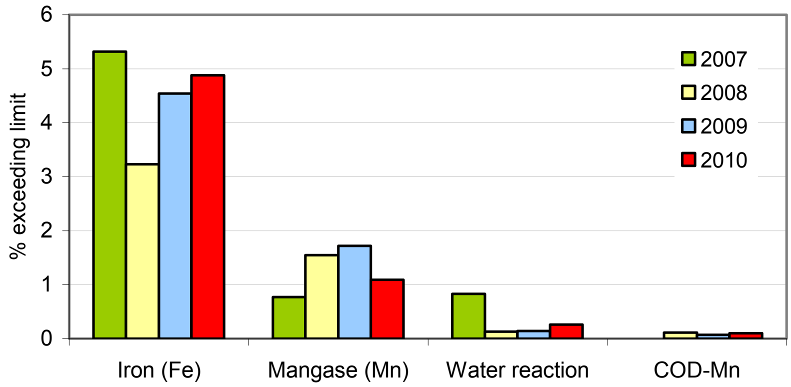
Source: WRI

**Results of monitoring the microbiological and biological indicators of drinking water within Slovakia's distribution networks**




Source: WRI

**Results of physical and chemical drinking water indicators monitoring within Slovakia's distribution networks - indicators that cannot adversely affect drinking water sensorial quality**




Source: WRI

## Bathing water

### ♦ Bathing water quality

Through **Act no. 355/2007 Coll. on protection, support and promotion of public health and amendments to other laws as amended by Act no. 140/2008 Coll., as well as through the Slovak Government Regulation no. 87/2008 Coll. on requirements on natural recreational water formations**, the Slovak Republic designated a responsibility for carrying out monitoring of water formations appropriate for bathing for the National and Regional Public Health Authority of the Slovak Republic and for site operators, in line with the appropriate frequency and methods set forth by Directive 2006/7/EC concerning the management of recreational water quality.

The assessment included 77 natural sites - gravel pits, sand pits, and enclosed water tanks used for a number of purposes, including recreation. Of this, recreational activities are organised at 18 sites and their operation was licensed by the Regional Public Health Authority. Some sites host so-called partially organised recreational activities, i.e. only the surrounding beaches were operated excluding the water surface, or the municipality and the operators of facilities on the surrounding beaches co-administered the water surface. At other sites there were unorganised recreational activities, which monitoring by the Regional Public Health Authority was carried out in relation to the number of visitors and the actual situation. In 2010, 36 monitored natural sites in Slovakia were declared by generally binding resolutions issued by Regional Environmental Offices as those with water suitable for bathing. Frequency in water quality monitoring was roughly every other week and depended on the site's significance.

Over the season, 531 water samples were extracted and 6 883 tests were done on chemical, physical, microbiological, and biological water quality indicators. Limit value (LV) for set indicators was exceeded for 241 samples and in 373 indicators, which is 45.39% of total number of samples. (increased by app. 7%, compared to the previous year). When assessed by indicators, proportion of non-compliant indicators is only 4.81%, since with almost each non-compliant sample only one water quality indicator was exceeded. A number of water surfaces showed physical and chemical indicators that were impacted by weather conditions. These represented 80.4% of total number of non-compliant indicators. Most frequently occurring physical and chemical indicators included: transparency, colour, total phosphorus, water reaction, phenols, and less frequently total nitrogen and water oxygen saturation. The greatest number of non-compliant microbiological indicators included intestinal enterococci, less E. coli, and occasional coliform bacteria. Notwithstanding the occasionally exceeded limit values for microbiological and biological indicators, over this year's recreation season no diseases or health complications have been detected that would relate to bathing at a natural bathing water surface.

# • ROCKS

## Key questions and key findings

### ♦ Key questions

- **What is the trend in the development of geological hazards that threaten the natural environment and ultimately also the humans?**

### ♦ Key findings

- **Large number of newly formed accidental landslides occurred due to extremely intensive precipitations in 2010.**
- **Extreme precipitations have negatively impacted also the condition of already existing slides and slope deformities.**
- **In terms of long-term stability, there is an increased risk of damage to the physical stability of the sludge beds of Slovinky and Nižná Slaná.**
- **Adverse situation in environmental pollution remains at the sites monitored within the subsystem of environmental loads of Anthropogenic sediments character, as well as at other sites classified into the system of monitoring the impact of mineral extraction on the environment.**
- **Alluvial sediments of the rivers of Váh (upper and lower region), Hron (upper region), Muráň, and Danube together with the majority of water courses of the East-Slovakian lowland and the adjacent territories are in fact free of contamination, and concentrations of substances represent mainly their natural contents. Sediments of selected profiles of the Rivers of Nitra, Štiavnica, Hornád, and Hnilec show significant and permanent contamination.**

## Geological environmental factors

In 2010, monitoring of three basic land movements was implemented within this subsystem - slides (14 monitored sites), creeps (4 sites), and signs of falls activation (10 sites). Sites within the Stabilisation embankment in Handlová and the projected territory of the PVE Ipeľ represent a special group of specific cases for the assessment of the environment stability.

In 2010, 5 878 tele-seismic, regional, or local seismic phenomena were interpreted on the basis of records of seismic stations More than 26 000 seismic phases were determined on the seismic records. 80 - 90 earthquakes were localised with the epicentre in the focal area of the Slovak Republic.

With regard to the type of environmental threat in 2010, environmental monitoring of landfills and sludge beds was implemented (the sites of Bojná, Myjava, Surovín, and Holíčov hill), Šulekovo, Krompachy - Halňa, Zemianske Kostoľany - Chalmová, Poša, Modra, Hrabovčík, and Uzovská Panica) along with geotechnical passportisation and the assessment of sludge beds. Sites in the territory of **ore deposits** (Rudňany, Slovinky, Smolník, Novoveská Huta and Rožňava, Pezinok, Kremnica, Špania Dolina, Dúbrava, Nižná Slaná and Banská Štiavnica ore deposits) were monitored in 2010, along with the sites in the areas of **magnesite and talc extraction** (Jelšava, Lubeník, Hnúšťa - Mútnik and Košice - Bankov) and **brown coal extraction** (Mines of the Horná Nitra region).

## Geothermal energy

At present, there are 26 designated geothermal areas in Slovakia, taking up 27% of the state's territory. So far, 124 geothermal wells have been made in these designated areas and 1 835 l/s of water with the outflow temperature of 18 - 129°C were analysed. Geothermal water was detected through boreholes of the depth of 92 - 3 616 m. Thermal output of geothermal water at these wells, at using the reference temperature of 15°C, is 313.83 MWt, which represents 5.6% of total above-mentioned geothermal energy potential of Slovakia.

## Abandoned mining works

Pursuant to Act No. 44/1988 Coll. on protection and exploitation of mineral deposits (Mining Act), as amended, MoE SR also ensures searching for abandoned mining works. The State Geological Institute of Dionýz Štúr in Bratislava was commissioned to maintain the Register.

**Abandoned mining works (state to the date 31st December 2010)**

| Type of abandoned mine | |
|---|---|
| Mining shaft | 5 561 |
| Pit (hole) | 695 |
| Chute | 65 |
| Cut, excavation | 133 |
| Pingo | 3 988 |
| Pingo field | 107 |
| Pingo draw | 130 |
| Dump | 6 646 |
| Old randing | 204 |
| Sink mark | 281 |
| Placer | 26 |
| Tailings dump | 53 |
| Other | 146 |
| **Total** | **18 035** |

Source: SGI DS

## Minerals deposits balance

Under the geology legislation and pursuant to the GS SR status - the GEOFOND department keeps the register of survey areas for selected geological activities. In 2008, there were 44 survey areas and 50 registered proposals to designate a survey area. As of December 31, 2008, there were 157 recognised areas.

**Energy deposits (state to the date 31st December 2010)**

| Raw material | Number of deposits included into balance | Number of free balance deposits | Number of deposits for mining | Unit | Balance deposits free |
|---|---|---|---|---|---|
| Anthracite | 1 | - | thous. t | 2 008 | 8 006 |
| Bitumen sediments | 1 | - | thous. t | 9 778 | 10 795 |
| Brown coal | 11 | 4 | thous. t | 118 599 | 469 211 |
| Flammable natural gas – gasoline gas | 9 | 2 | thous. t | 202 | 398 |
| Lignite | 8 | 1 | thous. t | 111 535 | 618 665 |
| Non-resinous gases | 1 | - | mil. $m^3$ | 680 | 1 360 |
| Underground stores of natural gas | 12 | 1 | mil. $m^3$ | 133 | 5 373 |

| | | | | | |
|---|---|---|---|---|---|
| Crude oil non-paraffinic | 3 | - | thous. t | 1 632 | 3 422 |
| Crude oil - semi-paraffinic | 8 | 4 | thous. t | 129 | 6 367 |
| Uranium ores | 2 | - | thous. t | 1 396 | 5 272 |
| Natural gas | 35 | 12 | mil. $m^3$ | 7 919 | 24 520 |
| **Total** | **91** | **24** | | **-** | **-** |

Source: SGI DS

**Ore deposits (state to the date 31st December 2010)**

| Type of ore | Number of deposits included into balance | Number of deposits for mining in 2005 | Unit | Balance deposits free | Geological deposits |
|---|---|---|---|---|---|
| Sb ores | 9 | 0 | thous. t | 85 | 3 291 |
| Complex Fe ores | 7 | 0 | thous. t | 5 751 | 57 762 |
| Cu ores | 10 | 0 | thous. t | - | 43 916 |
| Hg ores | 1 | 0 | thous. t | - | 2 426 |
| Poly-metallic ores | 4 | 0 | thous. t | 1 623 | 23 671 |
| Wolfram ores | 1 | 0 | thous. t | - | 2 846 |
| Gold and silver ores | 12 | 1 | thous. t | 58 334 | 172 605 |
| Fe ores | 2 | 0 | thous. t | 14 476 | 18 743 |
| **Total** | **46** | **1** | | **80 269** | **325 260** |

Source: SGI DS

**Non-metallics deposits (state to the date 31st December 2010)**

| Minerals and minerals based products | Number of deposits included into balance | Number of deposits for mining | Unit | Balance deposits free | Geological deposits |
|---|---|---|---|---|---|
| Anhydride | 7 | 1 | thous. t | 658 908 | 1 250 101 |
| Baryte | 6 | 1 | thous. t | 9 203 | 12 653 |
| Bentonite | 23 | 7 | thous. t | 34 758 | 47 906 |
| Cast basalt | 5 | 1 | thous. t | 22 563 | 39 738 |
| Decorative rock | 22 | 2 | thous. $m^3$ | 11 811 | 26 193 |
| Diatomite | 3 | 0 | thous. t | 6 556 | 8 436 |
| Dolomite | 21 | 8 | thous. t | 645 284 | 671 751 |
| Precious stones | 1 | - | ct | 1 205 168 | 2 515 866 |
| Graphite | 1 | - | thous. t | - | 294 |
| Halloysite | 1 | - | thous. t | - | 2 249 |
| Rock salt | 4 | - | thous. t | 838 697 | 1 349 679 |
| Kaolin | 14 | - | thous. t | 50 891 | 59 778 |
| Ceramic clays | 38 | 6 | thous. t | 117 778 | 192 661 |
| Quartz | 7 | - | thous. t | 301 | 327 |
| Quartzite | 15 | - | thous. t | 17 448 | 26 950 |
| Magnesite | 10 | 3 | thous. t | 757 337 | 1 159 843 |
| Talc | 5 | 1 | thous. t | 93 706 | 242 171 |
| Mineralized I - Br waters | 2 | - | thous. $m^3$ | 3 658 | 3 658 |
| Pearl stone | 5 | 1 | thous. t | 30 164 | 30 484 |
| Pyrite | 1 | - | thous. t | - | 14 839 |
| Gypsum | 6 | 1 | thous. t | 49 192 | 93 428 |
| Sialitic raw material | 5 | 2 | thous. t | 109 021 | 122 384 |
| Glass sands | 4 | 2 | thous. t | 410 742 | 589 468 |
| Mica | 1 | - | thous. t | 14 073 | 14 073 |
| Building rock | 133 | 85 | thous. $m^3$ | 637 959 | 756 272 |
| Gravel sands and sands | 23 | 11 | thous. $m^3$ | 145 491 | 164 577 |
| Brick clay | 38 | 7 | thous. $m^3$ | 96 322 | 118 944 |
| Techn. usable miner. crystals | 3 | - | thous. t | 253 | 2 103 |
| Limestone – unspecified | 30 | 15 | thous. t | 1 933 740 | 2 293 424 |
| High-content limestone | 10 | 4 | thous. t | 3 189 433 | 3 353 355 |
| Limestone-marl | 8 | 2 | thous. t | 164 669 | 166 921 |
| Zeolite | 6 | 3 | thous. t | 108 024 | 113 215 |
| Foundry sands | 14 | 1 | thous. t | 277 336 | 508 028 |
| Refractory clays | 7 | - | thous. t | 3 090 | 5 314 |
| Feldspars | 8 | - | thous. t | 20 548 | 21 786 |
| **Total** | **487** | **164** | - | – | - |

Source: SGI DS

### Classification of mineral deposits by state of extraction (state to the date 31st December 2010)

| Extraction symbol | Characteristics | Number of deposits |
|---|---|---|
| **1** | *Deposits with developed extraction activity* include exclusive mineral deposits sufficiently open and technically apt for extraction of industrial deposit. | 225 |
| **2** | *Deposits with fading extraction activity* include extraction mineral deposits where extraction activity will cease in a near future (within 10 years) | 29 |
| **3** | *Deposits before completion* include exclusive mineral deposits with documented deposits that give basis to one of the construction phases (starting with the projection phase) | 27 |
| **4** | *Deposits with ceased extraction* include exclusive mineral deposits with definitely or temporarily stopped extraction activity. | 92 |
| **5** | *Non-extracted deposits* include documented exclusive mineral deposits soon to be constructed and extracted. | 43 |
| **6** | *Non-extracted deposits* include documented exclusive mineral deposits with no plans for their extraction. | 200 |
| **7** | *Surveyed deposits* include deposits of exclusive and non-exclusive minerals with various degree of mapping. | 13 |
| **Total** | | **629** |

Source: SGI DS

### Non-reserved mineral deposits (state to the date 31st December 2010)

| Raw material | Number of listed deposit sites | Number of sites with extraction activities |
|---|---|---|
| **Slate** | 3 | - |
| **Floatation sand** | 1 | - |
| **Tailing rocks** | 7 | 2 |
| **Clay** | 1 | - |
| **Other minerals** | 2 | - |
| **Sialitic raw material** | 6 | - |
| **Building stone** | 175 | 52 |
| **Gravel sand and sands** | 218 | 77 |
| **Brick clay** | 45 | - |
| **Tuff** | 2 | - |
| **Brucite** | 1 | 1 |
| **Total** | **461** | **132** |

Source: SGI DS

### Other raw material deposits (state to the date 31st December 2010

| Raw material | Number of listed deposit sites | Number of sites with extraction activities |
|---|---|---|
| **Slate** | 3 | - |
| **Floatingsand** | 1 | - |
| **Tailing rocks** | 7 | 2 |
| **Clay** | 1 | - |
| **Other minerals** | 2 | - |
| **Sialitic raw material** | 6 | - |
| **Building stone** | 175 | 52 |
| **Gravel sand and sands** | 218 | 77 |
| **Brick clay** | 45 | - |
| **Tuff** | 2 | - |
| **Brucite** | 1 | 1 |
| **Total** | **461** | **132** |

Source: SGI DS

## Ground water volumes

### Ground waters deposits in the SR (state to the date 31st December, 2010)

| Category | A | B | C | Total |
|---|---|---|---|---|
| **Efficient deposits of the ground waters (l.s-1)** | 824.10 | 2 166.72 | 5 484.52 | 8 475.34 |
| **Efficient amounts of the ground waters (l.s-1)** | - | - | 15 796.47 | 15 796.47 |

Source: SGI DS

*Legend:*
*A calculated on the basis of hydrogeological mapping with semi-operational test*
***B calculated on the basis of hydrogeological mapping with long-term extraction test***
*C calculated on the basis of assessment of the existing hydrogeological mapping*

# • SOIL

## Key questions and key findings

### ♦ Key questions

- **What is the trend in the situation of the agricultural land types in terms of their contamination by risk elements?**
- **What is the share of the agricultural land types threatened by erosion?**

### ♦ Key findings

- **Based on the recent observations we can say that over the course of monitoring there was a slight increase in the contents of cadmium, copper, chrome, and lead in the agricultural land's arable soil. However, no statistically significant difference has been detected when assessing the mentioned elements. There was detected an increased content of cadmium and lead in fluvisols caused by the accumulation of these elements within the fluvial sediments and from the surrounding areas, as well as from the areas that are more distant. Content of cadmium in rendzinas was also increased, as its accumulation is facilitated by the organic matter and a neutral soil reaction at which this element is less mobile.**
- **In comparison with the beginning of land types monitoring in Slovakia (the year 1993), the recently detected values of monitored high-risk elements in agricultural land types have been statistically insignificant. This means that the soils that had already been contaminated in the past are still contaminated, so they are to be monitored in the future as well.**
- **There are approximately 40% of all agricultural land types threatened by the water erosion and about 5% of all agricultural land types threatened by the wind erosion.**

## Land use

Total size of the Slovak Republic is 4 903 644 ha. In 2010, the share of agricultural land was 49.24% of total land size, while the share of forestland was 41.02%, and the share of non-agricultural and non-forest lands was 9.74%.

**Land Use categories (state to the date 1st January 2011)**

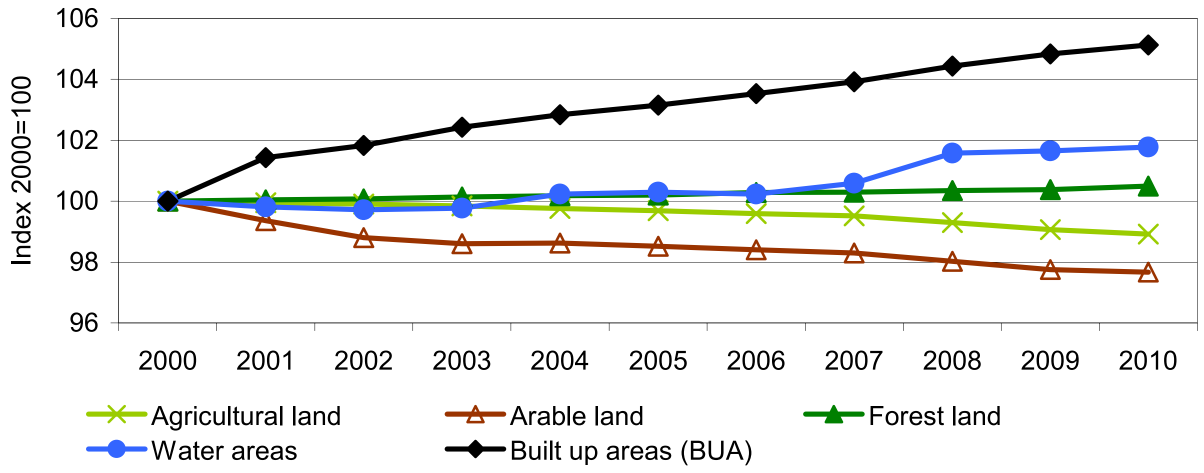
| Land category | Area (ha) | % of total area |
|---|---|---|
| Agricultural land | 2 414 291 | 49.24 |
| Forest land | 2 011 250 | 41.02 |
| Water areas | 94 761 | 1.93 |
| Build-up land | 230 589 | 4.70 |
| Other land | 152 753 | 3.11 |
| **Total area** | **4 903 644** | **100.00** |

Source: GCCA SR

Anthropogenic pressure to use soil for purposes other than its primary production and environmental functions brings about its gradual decrease.

Analysis of the changes to overall values of land types for the year 2010 as compared to 2009 suggests that the loss of agricultural land in 2010 (-3 642 ha) when compared with 2009 (-5 545 ha) is smaller by 1 903 ha. Loss of arable land in 2010 (-1 350 ha) when compared with 2009 (-3 869 ha) is smaller by 2 519 ha. Increment of forestland in 2010 (2 407 ha) when compared with 2009 (586 ha) is greater by 1 821 ha. Trend in the land types of the Slovak Republic in 2010 was marked by a continuing loss of agricultural and arable land types to forest, non-agricultural and non-forest land types, as well as by an increase in forestland at the expense of agricultural land, non-agricultural and non-forest land types.

**Development of individual land types in the SR**




Source: GCCA SR

## Soil properties

Information on state and trend in agricultural soil properties and their degradation may be obtained from the Partial Monitoring System - Soil (PMS-S) carried out by the Soil Science and Conservation Research Institute (SSCRI) and from the Agrochemical soil testing (AST) carried out by Central Controlling and Testing Institute in Agriculture (CCTIA). Information on state and trend in forest soil properties may be obtained from the Partial Monitoring System – Forests (PMS-F) carried out by the National Forest Centre – Forest Research Institute.

### ♦ Yield potential of land

Primary objective in reviewing the yield potential of agricultural land types and territory is a single-purpose synthesis of ecological and economic review of performance of agricultural production under various soil and ecological conditions. The greatest value of 100 points is assigned to loess-based Chernozem, medium-heavy and deeper than 60 cm, with favourable water regime, in warm, slightly humid climatic region found of plane surfaces. The lowest value of 6 points is assigned to a soil type on steep slopes (over 30%) under very unfavourable weather conditions and covered with grass. The mean value for land types in Slovakia corresponds to 33 points. Lands **with the highest yield potential** in Slovakia are located in the **region of Trnava** (the mean yield potential of 69.6), while **lands with the lowest yield potential** are located in the **region of Žilina** (the mean yield potential of 25.7).

## Chemical degradation

Serious soil degradation includes contamination with heavy metals and organic pollutants, acidification, as well as soil salinisation and sodification.

### ♦ Soil contamination by hazardous substance

Outcomes of the II. PMS - S monitoring cycle with samples extracted in 1997 showed a slight improvement in the sanitary condition of agricultural land types. Apparent vertical migration of high-risk elements in the soil profile was detected. Results from the III. cycle with samples extracted in 2002 showed that the content of the majority of risk substances in selected agricultural land of Slovakia was below the limit, especially in case of arsenic, chromium, copper, nickel, and zinc. In case of cadmium and lead, excessive limit values were recorded only in soils situated in higher altitudes, podsols, andosols, which may relate to remote transfer of emissions.

Soil samples extracted in the 4th extraction cycle were processed and analysed in 2010. (2007 being the year of extraction) Chemical analyses of monitored land types for PG as well as AL categories were completed.

Present situation in the contamination of the analysed land types with extraction carried out in 2007 was first monitored pursuant to annex 2 of Act 220/2004 Coll. on the protection and use of agricultural land and on amendment to Act 245/2003 Coll. on integrated environmental pollution prevention and control and amendments to selected laws as amended, which sets forth the limit values for high-risk elements within the agricultural land. For this reason it is not possible to compare contamination with the previous monitoring cycles there were assessed pursuant to the legislation then valid.

**Limit values of risk elements in the agricultural land types defined on the basis of the soil structure and value of soil reaction as well as the critical value of risk elements within the agricultural soil to plant relationship**

| **Risk element** | **Limit values for risk elements in agricultural soil** (in mg.kg$^{-1}$ of dry matter, aqua regia decomposition, Hg total content) | | | **Critical values for risk elements as they relate to the agricultural soil and plant** (in mg.kg$^{-1}$ of dry matter, in leachate of 1 mol/l amonnium nitrate, F in water leachate) |
|---|---|---|---|---|
| | Sandy, loam-sandy soil | Sand-loamy, loamy soil | Clay-loamy soil, clay | |
| Arsenic (As) | 10 | 25 | 30 | 0.4 |
| Cadmium (Cd) | 0.4 | 0.7 (0.4)* | 1 (0.7)* | 0.1 |
| Cobalt (Co) | 15 | 15 | 20 | - |
| Chromium (Cr) | 50 | 70 | 90 | - |
| Copper (Cu) | 30 | 60 | 70 | 1 |
| Mercury (Hg) | 0.15 | 0.5 | 0.75 | - |
| Nickel (Ni) | 40 | 50 (40)* | 60 (50)* | 1.5 |
| Lead (Pb) | 25 (70)* | 70 | 115 (70)** | 0.1 |
| Selenic (Se) | 0.25 | 0.4 | 0.6 | - |
| Zinc (Zn) | 100 | 150 (100)* | 200 (150)* | 2 |
| Fluorine (F) | 400 | 550 | 600 | 5 |

**Note:** Supplied data apply to samples obtained in arable land types from the upper layer of 0.2 m and air-dried to reach constant weigh, * if pH (KCl) is less than 6, ** if pH (KCl) is less than 5,

During the process of monitoring the Slovak land types were monitored contents of high-risk elements through applying the aqua regia solution (for As, Cd, Co, Cr, Cu, Ni, Pb, Zn) while assessing determined basic statistical parameters (Xmin - minimum value, Xmax - maximum value, Xp - mean value) for the 4th extraction cycle applied to the following types of monitored soils:

1. Podsols, rankers and lithomorphic soils on acidic substrates - high-altitude mountain sites (PG) – **S1**
2. Pseudogley and pseudogley luvisols on polygenetic loess loams (AL) - **S13**

3. Pseudogley soils on polygenetic loess loams (PG) - **S14**
4. Brunisolic soils and loess-based pseudogley brunisolic soils (mostly AL)
5. Regosols on calcareous blown sands (AL) - **S21**
6. Regosols on non-calcareous blown sands (AL) - **S22**

**Proportion of As, Cd, Co (in mg.kg$^{-1}$ in aqua regia) in selected soils within the 4th extraction cycle (year of extraction - 2007)**

| Group of soils | Culture | Soil depth | As | | | Cd | | | Co | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Xmin | Xmax | Xp | Xmin | Xmax | Xp | Xmin | Xmax | Xp |
| S1 | PG | 0-10 | 2.3 | 47.1 | 13.5 | 0.24 | 2.14 | 0.88 | 1.0 | 2.5 | 1.3 |
| | | 35-45 | 3.1 | 23.9 | 10.9 | 0.05 | 0.51 | 0.23 | 1.0 | 8.1 | 3.2 |
| S14 | PG | 0-10 | 6.4 | 18.4 | 10.3 | 0.14 | 1.69 | 0.40 | 1.0 | 16.8 | 7.8 |
| | | 35-45 | 3.8 | 14.1 | 9.07 | 0.03 | 0.24 | 0.123 | 3.1 | 61.7 | 13.8 |
| S13 | AL | 0-10 | 2.1 | 53.8 | 9.8 | 0.1 | 1.3 | 0.3 | 4.9 | 28.3 | 10.2 |
| | | 35-45 | 1.8 | 49.4 | 9.8 | 0.06 | 3.54 | 0.31 | 5.0 | 27.6 | 11.0 |
| S15 | AL | 0-10 | 3.1 | 15.5 | 9.2 | 0.14 | 0.5 | 0.24 | 3.6 | 20.8 | 10.0 |
| | | 35-45 | 3.0 | 15.6 | 9.1 | 0.05 | 0.48 | 0.18 | 4.6 | 21.5 | 10.1 |
| S21 | AL | 0-10 | 3.0 | 4.3 | 3.7 | 0.07 | 0.3 | 0.1 | 1.0 | 4.5 | 2.0 |
| | | 35-45 | 1.8 | 7.7 | 3.9 | 0.009 | 0.123 | 0.072 | 1.8 | 14.2 | 6.5 |
| S22 | AL | 0-10 | 1.5 | 4.8 | 2.8 | 0.07 | 0.16 | 0.11 | 1.0 | 2.0 | 3.9 |
| | | 35-45 | 0.8 | 4.9 | 2.3 | 0.07 | 0.126 | 0.090 | 1.0 | 3.8 | 1.9 |

Source: SSCRI

**Note:** $x_{min}$ – the minimum set value of a selected group, $x_{mas}$ - the maximum set value of a selected group, $x_2$ average value of a selected group, AL - arable land, PG - permanent grassland

**Proportion of Cr, Cu, Ni (in mg.kg$^{-1}$ in aqua regia) in selected soils within the 4th extraction cycle (year of extraction - 2007)**

| Group of soils | Culture | Soil depth | Cr | | | Cu | | | Ni | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Xmin | Xmax | Xp | Xmin | Xmax | Xp | Xmin | Xmax | Xp |
| S1 | PG | 0-10 | 2.0 | 35.6 | 14.5 | 3.0 | 39.7 | 10.6 | 1.1 | 9.6 | 5.6 |
| | | 35-45 | 2.0 | 24.2 | 11.4 | 2.4 | 23.4 | 7.7 | 5.0 | 27.1 | 10.0 |
| S14 | PG | 0-10 | 22.2 | 74.8 | 45.3 | 7.8 | 17.7 | 13.8 | 7.8 | 24.5 | 16.8 |
| | | 35-45 | 23.3 | 61.4 | 41.8 | 4.7 | 19.7 | 14.2 | 1.0 | 33.6 | 19.0 |
| S13 | AL | 0-10 | 5.5 | 101.1 | 42.1 | 9.5 | 44.7 | 18.0 | 0.2 | 100.0 | 25.3 |
| | | 35-45 | 6.9 | 81.3 | 47.3 | 9.8 | 41.2 | 18.8 | 8.1 | 141.0 | 30.9 |
| S15 | AL | 0-10 | 10.8 | 74.1 | 41.5 | 13.8 | 80.7 | 22.9 | 14.3 | 45.5 | 32.6 |
| | | 35-45 | 5.0 | 94.9 | 45.9 | 11.0 | 31.4 | 20.1 | 16.9 | 51.2 | 36.3 |
| S21 | AL | 0-10 | 18.5 | 50.1 | 29.2 | 9.2 | 58.5 | 22.6 | 10.0 | 20.5 | 15.0 |
| | | 35-45 | 2.0 | 90.1 | 29.2 | 5.5 | 53.1 | 22.8 | 7.2 | 55.9 | 19.9 |
| S22 | AL | 0-10 | 1.0 | 7.8 | 3.3 | 4.4 | 11.9 | 7.6 | 0.8 | 16.0 | 7.1 |
| | | 35-45 | 2.0 | 11.1 | 5.0 | 2.5 | 10.9 | 5.9 | 1.0 | 7.7 | 16.2 |

Source: SSCRI

**Note:** $x_{min}$ – the minimum set value of a selected group, $x_{mas}$ - the maximum set value of a selected group, $x_2$ average value of a selected group, AL - arable land, PG - permanent grassland

**Proportion of Pb, Zn, Hg (in mg.kg$^{-1}$ in aqua regia) in selected soils within the 4th extraction cycle (year of extraction - 2007)**

| Group of soils | Culture | Soil depth | Pb | | | Zn | | | Hg | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Xmin | Xmax | Xp | Xmin | Xmax | Xp | Xmin | Xmax | Xp |
| S1 | PG | 0-10 | 18.3 | 207.0 | 81.0 | 22.2 | 68.9 | 38.1 | 0.07 | 0.64 | 0.27 |
| | | 35-45 | 5.0 | 30.6 | 14.3 | 20.5 | 54.4 | 40.6 | 0.03 | 0.13 | 0.08 |
| S14 | PG | 0-10 | 12.0 | 41.9 | 23.8 | 50.9 | 77.6 | 64.7 | 0.036 | 0.176 | 0.075 |
| | | 35-45 | 8.0 | 20.0 | 13.6 | 44.5 | 71.8 | 54.7 | 0.03 | 0.14 | 0.05 |
| S13 | AL | 0-10 | 7.8 | 199.5 | 24.4 | 198.7 | 42.0 | 67.3 | 0.22 | 0.328 | 0.073 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 35-45 | 7.1 | 74.8 | 17.8 | 42.2 | 111.0 | 64.4 | 0.02 | 0.13 | 0.049 |
| **S15** | **AL** | 0-10 | 5.5 | 47.4 | 20.2 | 48.6 | 89.6 | 68.8 | 0.0281 | 0.084 | 0.05 |
| | | 35-45 | 5.0 | 30.6 | 16.6 | 42.0 | 98.5 | 68.0 | 0.012 | 0.079 | 0.041 |
| **S21** | **AL** | 0-10 | 5.0 | 17.9 | 9.3 | 35.7 | 62.4 | 45.8 | 0.02 | 0.03 | 0.03 |
| | | 35-45 | 5.0 | 17.2 | 8.5 | 21.8 | 106.0 | 59.0 | 0.05 | 0.073 | 0.026 |
| **S22** | **AL** | 0-10 | 5.0 | 5.0 | 5.0 | 19.8 | 53.9 | 33.0 | 0.021 | 0.027 | 0.024 |
| | | 35-45 | 5.0 | 5.0 | 5.0 | 9.3 | 49.4 | 26.2 | 0.011 | 0.024 | 0.017 |

Source: SSCRI

**Note:** $x_{min}$ – the minimum set value of a selected group, $x_{mas}$ - the maximum set value of a selected group, $x_2$ average value of a selected group, AL - arable land, PG - permanent grassland

**Comparison of the contents of heavy metals inside the soil profile for the assessed soil categories within the IV. extraction cycle:**

| | |
|---|---|
| **Arsenic** | Contents of arsenic for individual categories of analysed soils of a new extraction cycle (extraction year of 2007) shows lower values in the depth of 35-45 cm than in the upper horizon. |
| **Cadmium** | Contents of cadmium for individual categories of analysed soils shows lower values in the depth of 35-45 cm than in the upper horizon. |
| **Cobalt** | Contents of cobalt for individual categories of analysed soils shows slightly higher values in the depth of 35-45 cm for all soil categories with the exception of regosol arable land on non-calcareous blown sands, which points to the vertical migration of Co in the direction of the deeper strata of the soil profile. |
| **Chromium** | Contents of chromium for individual categories of analysed soils shows that both horizons have almost identical or only slightly raised contents in the depth of 35-45 cm. |
| **Copper** | Contents of copper for individual categories of analysed soils shows that in the depth of 35-45 cm for brunisolic soil and loess-based pseudogley brunisolic soil, podsols, rankers, and lithomorphic soils on acidic substrates, and regosols on non-calcareous blown sands, the contents of copper is lower than inside the A-horizon. Within the second half of the analysed categories there has been a slight increase in the contents of copper. |
| **Nickel** | Contents of nickel for individual categories of analysed soils in the depth of 35-45 cm is slightly higher for all categories, which points to vertical migration of Ni in the direction of the deeper strata of the soil profile. |
| **Lead** | Contents of lead for individual categories of analysed soils shows significantly lower values in the depth of 35-45 cm than in the depth of 0-10 cm. |
| **Zinc** | Contents of zinc for individual categories of analysed soils shows higher values in the depth of 0-10 cm than in 35-45 cm, with the exception of the categories of podsols, rankers, and lithomorphic soils on acidic substrates, and regosols on calcareous blown sands. |
| **Mercury** | Contents of mercury for individual categories of the new extraction cycle (extraction year of 2007) shows significantly lower contents in the depth of 0-10 cm than in the depth of 35-45 cm. |

Source: SSCRI

In terms of soil contamination by **organic pollutants,** notwithstanding the fact that the production of polychlorinated biphenyls (PCBs) had been stopped in the past, soil contamination remains high. However, this type of contamination is only point contamination that is often very difficult to also illustrate in space. With the exceeding limit for polycyclic aromatic hydrocarbons (PAH) we detected in the soil mainly fluoranthene (Fl), benzo(a)pyrene (BaP), benzo(b)fluoranthene (BbF), and other compounds that show carcinogenic properties together with direct or late toxicity. Also exceeded values for these substances have been detected only locally and as individual points. They are typical especially for the sites of Strážske, and Žiar nad Hronom.

## ♦ Acidification of soils

Acidification as a process of raising the soil's acidity represents one of the important processes of chemical degradation. Ability of the agro-ecosystem to cope with natural and anthropogenic acidification is defined by the capacity and potential of the buffering function of the soil. This reflects a degree of soil resistance to acidification.

Outcomes from the third monitoring cycle with the extraction year of 2002 showed significantly greater acidification tendencies, especially in cases of mollic fluvisols, cambisols, rendzinas, podsols, rankers, and lithomorphic soils.

The table shows the results obtained from the soil samples treated and analysed since 2010 for the IV. monitoring cycle with extraction of samples in 2007.

**Shown pH values dependent on active aluminium in selected SR soils for the A horizon within the basic partial monitoring system in fourth monitoring cycle (active Al determined in soils with pH in KCl of < 6.0)**

| Soil representative | pH in $H_2O$ | Al in $mg.kg^{-1}$ x | $Al^{3+}/Ca^{2+}$ |
|---|---|---|---|
| Chernozems AL | 7.14 | - | - |
| Brunisolic soils AP | 6.66 | 7.28 | 0.63 |
| Pseudogley soils AL | 6.45 | 3.43 | 0.33 |
| Pseudogley soils PG | 5.88 | 12.52 | 0.92 |
| Rendzinas AL | 7.97 | - | - |
| Rendzinas PG | 7.27 | 3.92 | 0.25 |
| Regosols AL | 6.90 | - | - |
| Cambisols AL | 6.24 | 11.81 | 1.99 |
| Cambisols PG | 5.48 | 60.65 | 18.33 |
| Solonchaks and Solonetz PG | - | - | - |
| Podsols PG | 3.77 | 455.57 | 38.73 |

AL – arable land, PG – permanent grassland, x – arithmetic average Source: SSCRI

In total, there has been a reduction in the mean value of the active soil reaction (compared to 1993) in four out of six assessed soil categories. These results point to an alarming trend in the development of slightly acidic and acidic soils.

The ratio of equivalent values of the exchange cations of $Al^{3+}/Ca^{2+}$ indicates a degree of soil degradation in relation to acidification for the assessed soil categories that are used as arable lands. This value was exceeded in 35% of sites for the category of pseudogley soils and pseudogley luvisols found on polygenetic loess loams, and in 28% it was exceeded in the categories of brunisolic soil and pseudogley loess brunisolic soil, which represents an active aluminium stress for the cultivated crop.

### ♦ Salinisation and sodification

The process of soil monitoring assesses the contents of sodium salts and sodium ions in the soil. Their exceeded values deteriorate soil properties and thus prevent good growth of plants. **Processes of salinisation and sodification** have been monitored through a built network of stationary monitoring sites. The network includes both weak and medium solonchaks and solonetz, as well as the typical solonetz soil types. Of the total number of 8 monitored sites, 6 are situated in the Podunajská rovina (Podunajská plane). Anthropogenic soil sodification is measured in Central Slovakia by the exhausts from the aluminium production plant in Žiar nad Hronom. In the Eastern Slovakian Lowland, the monitoring network includes a typical solonetz in the cadastre area of Malé Raškovce.

The monitored area shows concurrent processes of salinisation and sodification, with sodification being more dominant.

Weak - initial to medium **salinisation,** with salt content of 0.10 - 0.35% was recorded within individual horizons of these sites: Iža, Gabčíkovo, Zemné, Komárno-Hadovce, Zlatná na Ostrove, and Malé Raškovce. High (0.36 - 0.70%) to extremely high (over 0.71%) salt content was detected at Kamenín and at Žiar nad Hronom where these salts are of anthropogenic origin.

Over the last eleven years no significant trends have been recorded in the process of salinisation.

Soil sodification as a process of binding exchangeable sodium onto the sorption complex of monitored soil in 2010 is comparable with the previous years. Its trend over the recent years (2000-2010) can be assessed by the content of exchangeable sodium percentage (ESP) and soil reaction (pH).

Content of exchangeable sodium within the sorption complex of 5-10% indicating a weak sodification was detected within the lower horizons of these sites: Zemné, Gabčíkovo, Zlatná na Ostrove, as well as throughout the whole Komárno-Hadovce site. High (10-20%) to very high (over 20%) content of exchangeable sodium was recorded in these sites: Malé Raškovce, Kamenín, and Žiar nad Hronom.

The soil reaction values (pH) as the soil sodification indicator suggest strongly alkaline reaction (pH>7.7) within the lower horizons of these sites: Iža, Zemné, as well as throughout the whole soil type of Zlatná na Ostrove, Žiar nad Hronom, Malé Raškovce, and Kamenín.

The provided data on salinisation and sodification shows that total trend in saline soils is not linear in space and time. The measured main characteristics of saline soil trend (salt content, ECe, pH, ESP) are significantly different per different soil types and horizons in time and space and there is little mutual correlation among them. This is determined both by their significant spatial variability, as well as by the type of trend itself.

## Physical degradation

Erosion and soil compaction belong among the major phenomena of physical degradation in Slovakia.

### ♦ Soil erosion

Potential erosion means possible threat to agricultural land types by processes of water erosion if we do not take into account the soil-protective effect of the vegetation cover. Water erosion (of different intensity) impacts 957 173 ha of agricultural land types in Slovakia.

**Sizes of land categories potentially impacted by water erosion**

| Erosion categories | Water erosion | |
|---|---|---|
| | Land area in ha | % from Agricultural Land |
| **No erosion or slightly** | 1 457 118 | 60.35 |
| **Medium** | 245 734 | 10.18 |
| **Strong** | 356 897 | 14.78 |
| **Extremely strong** | 354 542 | 14.69 |
| **Total** | **2 414 291** | **100.00** |

Source: SSCRI

Size of agricultural land types potentially impacted by wind erosion is 130 301 ha. These are mainly light granulated soil types with lower content of organic matter that are highly vulnerable to drying (and thus to wind erosion) especially when they are without vegetation cover.

**Sizes of land categories potentially impacted by wind erosion**

| Erosion categories | Wind erosion | |
|---|---|---|
| | Land area in ha | % from Agricultural Land |
| **No erosion or slightly** | 2 283 990 | 94.62 |
| **Medium** | 54 717 | 2.26 |
| **Strong** | 45 046 | 1.86 |
| **Extremely strong** | 30 538 | 1.26 |
| **Total** | **2 414 291** | **100.00** |

Source: SSCRI

## ♦ Soil compaction

For soil types, granulated heavy soil types show higher rate of compaction over the whole soil profile. In soil assessed for compaction the most resistant were regosols followed by sand and loamy pseudogley soil and brunisolic soil, while the least resistant were clay-loamy pseudogley soil and brunisolic soil. Of all the soil types, brunisolic soil shows the greatest rate of compaction, most likely due to its intensive exploitation.

# • FLORA, FAUNA AND PROTECTED PARTS OF NATURE

## Key questions and key findings

### ♦ Key questions

- **What is the state of protection of plant and animal species of European importance?**
- **What is the situation in the protection of habitats of European importance?**
- **What is the trend in the state of protected areas?**

### ♦ Key findings

- **Assessment of the situation with the protection of species of European importance suggests unfavourable state of protection. Half of the assessed vascular plants together with half of the assessed mammals, 70% of reptiles, and 90% of amphibians, show unsatisfactory or adverse situation.**
- **Assessment of the state of habitats of European importance shows unsatisfactory or adverse level of protection for 60% of forest habitats. The same situation exists for half of the shrubs habitats, 70% of grassland habitats, and also for 70% of freshwater habitats.**
- **State of protected areas has significantly improved - approximately 82% of the size of small-sized protected areas was in the optimal state in 2010, compared to 55% of these areas in 2000.**

## Flora

### ♦ Endangerment of plant taxons

State of endangerment for individual taxons is elaborated on the basis of the *Red List of Plants and Animals of Slovakia, 2001.*

| Group | Total number of taxons | | Endangered (IUCN cat.) | | | | | | Ed |
|---|---|---|---|---|---|---|---|---|---|
| | World (global estimation) | Slovakia | EX | CR | EN | VU | LR | DD | |
| Cyanophytes and Algae | 50 000 | 3 008 | - | 7 | 80 | 196 | - | - | - |
| Lower fungi | 80 000 | 1 295 | - | - | - | - | - | - | - |
| Higher fungi | 20 000 | 2 469 | 5 | 7 | 39 | 49 | 87 | 90 | - |
| Lichens | 20 000 | 1 585 | 88 | 140 | 48 | 169 | 114 | 14 | - |
| Bryophytes | 20 000 | 909 | 26 | 95 | 104 | 112 | 85 | 74 | 2 |
| Vascular plants | 250 000 | 3 352 | 77 | 266 | 320 | 430 | 285 | 50 | 220 |

Source: ŠNC SR

Level of **endangerment of non-vascular plants** in Slovakia is presently **17.6%** (including fungi). Level of **endangerment of vascular plants** is **42.6%** (for all endangerment categories), or **30.3%** (for the CR, EN, and VU categories).

**Comparison of the vascular plant endangerment* in selected countries**

| | Slovakia | Austria | Hungary | Poland | Czech Rep. |
|---|---|---|---|---|---|
| **Vascular plants (%)** | 30.3 | 33.4 | 19.8 | 11.0 | 42.5 |

Source: OECD Environmental Data Compendium, 2008

* Among “endangered” taxons are those taxons classified under categories: CR, EN, and VU under IUCN.
Czech Rep.: Data include extinct species.

### ♦ Protection of plant taxons

Protection of plant taxons is in the presence regulated by the **Resolution of MoE SR No. 24/2003 Coll.** to the *Act on Nature and Landscape Protection No. 543/2002 Coll.* as amended by Resolution 492/2006 Coll., Resolution 638/2007 Coll and Resolution 579/2008 Coll.. Number of the **state protected taxons** is now **1 418** (vascular plants – 1 285; bryophytes – 47; higher fungi – 70; lichens – 17). Also the species of European importance classified under the **Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora** not found in Slovakia are protected by pertinent legislation. Of total number of 1 418 protected taxons, **823 taxons** are found **in Slovakia** (713 of vascular plants, 23 of bryophytes, 70 of higher fungi, 17 of lichens).

**Wild-growing plant taxons in Slovakia protected by international conventions and EU regulations**

| | Cyanophytes and Algae | Fungi | Lichens | Bryophytes | Vascular plants |
|---|---|---|---|---|---|
| In attachment II of **Habitats Directive** | - | - | - | 9 | 40 |
| In attachment IV of **Habitats Directive** | - | - | - | - | 42 |
| In attachment V of **Habitats Directive** | - | - | - | 2* | 3** |
| In attachment I and II of **CITES** | - | - | - | - | 110 |
| In attachment I of **Bern Convention** | - | - | - | 8 | 35 |

* *Leucobryum glaucum* and the entire genus *Sphagnum* Source: SNC SR
** *Artemisia eriantha*, *Galanthus nivalis*, including the entire genus *Lycopodium*

**State of protection of plants of European importance, 2004-2006[1] (%)**

| Taxons | Favourable | Inadequate | Bad | Unknown | Total |
|---|---|---|---|---|---|
| Vascular plants | 10 | 40 | 10 | 40 | 100 |
| Other plants | 20 | 40 | 30 | 10 | 100 |

1) Assessment of 200 species registered pursuant to article 17 of the Habitat directive Source: MoE SR

Within the implementation of **transfers, reintroductions and restitutions** of endangered species of plants, there was a transfer of seeds and 147 cruciferous leaf formations of the Rose Campion (*Lychnis coronaria*) and 2 clusters of the Roundhead bulrush (*Scirpoides holoschoenus*).

**Rescue programmes** (RP) were developed and implemented in 2010 for the following species of vascular plants (VP):

| | VP taxons |
|---|---|
| **Developed in 2010** | - |
| **Implemented in 2010** | *Liparis loeselii*, *Tephroseris longifolia* ssp. *moravica*, *Carex pulicaris*, *Glaux maritima*, *Herminium monorchis*, *Spiranthes spiralis*, *Drosera anglica*, *Radiola linoides*, *Lycopodiella inundata* |

Protection of the natural taxonomic composition of ecosystems through **regulation of the occurrence of non-native plant species** was carried out in 2010. Elimination of the non-native invasive and invasive-like plant species was carried out at 99 sites within the scope of 20 organisation units of the SR State Nature Conservancy. Interventions were carried out in the area of 77.03 ha and were focused primarily on 3 species: *Heracleum mantegazzianum, Solidago canadensis,* and *Fallopia japonica.*

**Overview of the most spread invasive plant species as of 2010**

| | Name | |
|---|---|---|
| The most spread **invasive species** | *Fallopia japonica* | |
| | *Fallopia sachalinensis* | |
| | *Helianthus tuberosus* | |
| | *Impatiens glandulifera* | |
| | *Impatiens parvifora* | |
| | *Solidago gigantea* | |
| | *Solidago canadensis* | |
| | *Aster novi-belgii* | |
| | *Aster lanceolatus* | |
| | *Heracleum mantegazzianum* | |
| | *Asclepias syriaca* | |
| | *Stenactis annua* | |
| | *Galinsoga parviflora* | |
| | *Bidens frondosa* | |
| | *Parthenocissus quinquefolia* | |
| | *Robinia pseudoacacia* | |
| | *Negundo aceroides* | |
| | *Ailanthus altissima* | |
| **Total** | **number of known taxons of invasive sp. in the SR** | **% of total number of vascular plants taxons** |
| | **125*** | **3.7** |

Data as shown in the publication **Gojdičová, E., Cvachová, A., Karasová, E., 2002: Zoznam nepôvodných, inváznych a expanzívnych cievnatých rastlín Slovenska 2.** and includes categories of invasive taxons (neophytes - 28, archaeophytes - 19) potentially (regionally) invasive taxons - 49, and expansive taxons - 29.

## Fauna

### ♦ Endangerment of animal species

State of endangerment for individual animal species is elaborated on the basis of actual red lists (2001, 2005, 2008).

**State of endangerment of the particular invertebrate taxons**

| Taxons | Number of taxons | | Categories of endangerment (IUCN) | | | | | | | Endanger-ment total* | Endang. % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Group | World | SR | EX | CR | EN | VU | LR | DD | NE | | |
| Mollusca | 128 000 | 277 | 2 | 26 | 22 | 33 | 45 | 8 | 135 | 134 | 48.4 |
| Aranea | 30 000 | 934 | 16 | 73 | 90 | 101 | 97 | 45 | - | 406 | 43.5 |
| Ephemers | 2 000 | 132 | - | 8 | 17 | 16 | - | - | - | 41 | 31.1 |
| Odonata | 5 667 | 75 | 4 | - | 14 | 11 | 13 | 5 | - | 43 | 57.3 |
| Orthoptera | 15 000 | 118 | - | 6 | 7 | 10 | 20 | 10 | - | 53 | 44.9 |
| Heteroptera | 30 000 | 801 | - | 14 | 7 | 6 | 4 | - | - | 31 | 3.9 |
| Coleoptera | 350 000 | 6 498 | 2 | 15 | 128 | 490 | 81 | 2 | - | 716 | 11.0 |
| Hymenoptera | 250 000 | 5 779 | - | 23 | 59 | 203 | 16 | - | - | 301 | 5.2 |
| Lepidoptera | 100 000 | 3 500 | 6 | 21 | 15 | 41 | 17 | 11 | - | 105 | 3.0 |
| Diptera | 150 000 | 5 975 | - | 5 | 10 | 71 | 19 | 93 | - | 198 | 3.3 |

* without the category of EX and NE — Source: SNC SR

**Endangerment of invertebrates** in Slovakia is now about 8.4% (or **5.4%** just within CR, EN and VU categories). For **vertebrates**, 59% of them are endangered (or **23.5%** when limited to only CR, EN and VU categories).

### State of endangerment of the particular vertebrate taxons

| Taxons | Number of taxons | | Categories of endangerment (IUCN) | | | | | | | Endanger-ment total* | Endang. % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Group | World [1] | SR | EX | CR | EN | VU | LR | DD | NE | | |
| **Lampreys** | | 4 | - | - | 1 | 1 | 1 | - | - | 3 | 75.0 |
| **Pisces** | 25 000 | 79 | 4 | - | 6 | 9 | 40 | - | - | 55 | 69.6 |
| **Amphibians** | 4 950 | 18 | - | - | 3 | 5 | 10 | - | - | 18 | 100.0 |
| **Reptiles** | 7 970 | 12 | - | 1 | - | 4 | 6 | - | - | 11 | 91.7 |
| **Birds**[2] | 9 946 | 219 | 2 | 7 | 23 | 19 | 47 | 4 | 19 | 100 | 45.7 |
| **Mammals** | 4 763 | 90 | 2 | 2 | 6 | 12 | 27 | 15 | 4 | 62 | 68.9 |

* without the category of EX and NE Source: SNC SR

[1] Source: UNEP – GBO

[2] only nesting birds – of total number of 341 birds of Slovakia, only the all 219 species of nesting birds were assessed

### Comparison of animals endangerment[1] in selected countries (%)

| | Slovakia | Austria | Hungary | Poland | Czech Rep. |
|---|---|---|---|---|---|
| Invertebrates | 5.3 | - | > 0.9 | - | 13.1 |
| Pisces | 24.1 | 50.6 | 43.2 | 21.0 | 41.5 |
| Amphibians | 44.4 | 60.0 | 27.8 | - | 61.9 |
| Reptiles | 38.5 | 64.3 | 33.3 | 33.3 | 72.7 |
| Birds | 14.0 | 27.7 | 14.5 | 7.8 | 50.0 |
| Mammals | 21.7 | 22.0 | 37.8 | 13.5 | 20.0 |

Source: OECD

[1] "endangered" taxons include species under categories: CR, EN, and VU under IUCN
Austria) invertebrates: *insecta, decapoda, mysidacea* and *mollusca*, birds: only nesting birds
Czech Rep.) data refer to autochthonous species and EX including, birds: only nesting birds, pisces: including lampreys
Hungary) birds: all species recorded in Hungary since 1800
Poland) pisces: including lampreys.

## ♦ Protection of animal species

Protection of animal species is regulated by the **Resolution of MoE SR No. 24/2003 Coll.**, which implements the *Act on nature and landscape protection No. 543/2002 Coll.* as amended. The number of **animal taxons under state protection** is now **813 taxons** on the level of species and subspecies and to **12 taxons** on the level of genus.

### Animal wildlife in Slovakia protected by international conventions and EU regulations

| | Invertebrates | Pisces | Amphibians | Reptiles | Birds | Mammals |
|---|---|---|---|---|---|---|
| **In annex II of** Habitats Directive | 53 | 23 | 5 | 1 | - | 24 |
| In annex IV of **Habitats Directive** | 50 | 1 | 10 | 9 | - | 46 |
| In annex I of **Birds Directive** [1] | - | - | - | - | 114 | - |
| In annexes I and II **of CITES** | 2 | 2 | - | 1 | 53 | 5 |
| In annexes II and III of **Bern Convention** | 33 | 38 | 19 | 12 | 357 | 65 |
| In annexes II and III of **Bonn Convention** | - | 3 | - | - | 209 | 24 |
| In annex of **AEWA** [2] | - | - | - | - | 129 | - |

[1] including migratory birds Source: SNC SR

[2] AEWA – African-Eurasian Migratory Water Bird Agreement

### State of protection of animals of European importance[1], 2004-2006 (%)

| | Favourable | Inadequate | Bad | Unknown | Total |
|---|---|---|---|---|---|
| **Mammals** | 5 | 30 | 20 | 45 | 100 |
| **Pisces** | 10 | 10 | 0 | 80 | 100 |
| **Amphibians** | 5 | 70 | 20 | 5 | 100 |
| **Reptiles** | 30 | 60 | 10 | 0 | 100 |
| **Mollusca** | 30 | 10 | 30 | 30 | 100 |
| **Arthropoda** | 30 | 10 | 30 | 30 | 100 |
| **Other species** | 0 | 100 | 0 | 0 | 100 |

Assessment of 200 species registered pursuant to article 17 of the Habitat directive Source: MoE SR

## ♦ Care of protected and threatened animal species

**Rescue programmes (RP)** in 2010 were processed for the following taxons: *Bison bonasus, Castor fiber* and butterflies of *Maculinea* genus.

In **rehabilitation stations** operated by the nature and landscape protection organizations there were **adopted** in 2010 altogether **361** injured individuals or otherwise disabled animals. Back to wild nature there were **released** altogether **230** individuals and there was spent 4 840 EUR. No animals were bred (and released) in maturation facilities in 2010.

Due to the lack of funds, **guarding the nests of the bird of prey** in 2010 was carried out only occasionally, hence, also the data on the number of brought up 128 nestlings are incomplete. Expenditures associated with guarding the nests of the bird of prey were assumed partly by non-government organisations.

In term of in situ animal preservation in 2010 there were organized **transfers and restitutions** of protected and endangered animals into proper nature biotopes by nature and landscape protection organizations. There were these animals – *Spermophilus citellus, Marmota marmota latirostris, Emys orbicularis, Felis sylvestris* and *Amphibia*.

In the area of practical care of the protected animal species, the SR State Nature Conservancy ensures the **installation of foil barriers** in the problematic areas of roads at the time of spring migration of amphibians and the subsequent carrying of amphibians, mainly frogs, across the road. In total, **53 399 of amphibians were carried over** in 2010 and 20 980 m of barriers were installed, with 4 927 EUR funded.

## ♦ Game stock and hunting and fishing

To 31st March 2010, the **spring stock numbers** of the ungulate game species were higher in comparison to the previous year. Hunting for the rare animal species is strictly regulated.

**Spring stock of game and game hunting as of March 31 (pieces)**

| Species | 2008 | | 2009 | | 2010 | |
|---|---|---|---|---|---|---|
| | stock | hunting | stock | hunting | stock | hunting* |
| **Deer** | 44 316 | 16 889 | 46 207 | 18 854 | 51 856 | 19 374 |
| **Fallow deer** | 9 068 | 3 210 | 10 511 | 3 654 | 11 240 | 4 214 |
| **Roe deer** | 92 680 | 24 704 | 96 650 | 27 035 | 100 080 | 22 382 |
| **Wild boar** | 29 290 | 29 700 | 31 652 | 31 473 | 34 577 | 38 903 |
| **Brown hare** | 203 123 | 34 470 | 205 028 | 32 570 | 196 994 | 11 965 |
| **Grey partridge** | 13 453 | 462 | 12 562 | 342 | 10 956 | 419 |
| **Pheasant** | 190 279 | 135 332 | 200 863 | 115 730 | 186 494 | 88 694 |
| **Chamois** | 661 | 12 | 882 | 11 | 823 | 0 |
| **Bear** | 1 939 | 34 | 1 940 | 27 | 2 001 | 47 |
| **Wolf** | 1 563 | 121 | 1 698 | 130 | 1 823 | 149 |
| **Otter** | 680 | 0 | 742 | 0 | 933 | 0 |

* Actual hunting in numbers, excluding other kills

Source: SO SR

Amount of the fish **caught** in the fish ponds, water dams and water flows for economic and sport purposes achieved **2 295.9 t** in 2010. The waters were **stocked** by **35 721 366 pieces of setting**.

**Fishing for the economic and sport purposes in 2010 (t)**

| Fish species | 2008 | | 2009 | | 2010 | |
|---|---|---|---|---|---|---|
| | total | of this SFA* | total | of this SFA* | total | of this SFA* |
| **Fish total** Of these: | **2 734** | 1 639 | **2 584.2** | 1 751.5 | **2 295.9** | 1 596.3 |
| **Carp** | 1 430 | 1 166 | 1 394.6 | 1 235.4 | 1 275.7 | 1 151.9 |
| **Trouts** | 833 | 52 | 698.6 | 58.4 | 608.8 | 55.9 |
| **Crucians** | 94 | 62 | 76.0 | 70.4 | 51.9 | 50.2 |
| **White amur** | 41 | 36 | 61.5 | 50.2 | 39.9 | 34.9 |
| **Bighead carps** | 10 | 3 | 14.4 | 4.5 | 11 | 3.1 |
| **Sheat fish** | 37 | 36 | 40.2 | 39.1 | 36.6 | 35.2 |
| **Maskalonge** | 55 | 54 | 51.1 | 50.6 | 52.4 | 51.5 |
| **Sand-eel** | 63 | 63 | 62.2 | 61.5 | 62.1 | 61.7 |
| **Grayling** | 7 | 6 | 5.9 | 5.8 | 3.9 | 3.3 |
| **Huchen** | 0.7 | 0.7 | 0.5 | 0.5 | 0.4 | 0.4 |
| **Breams** | 70 | 69 | 81.6 | 81.6 | 65.6 | 65.5 |
| **Torgoch** | 2 | 0 | 2.2 | 0.8 | 2 | 0.0 |
| **Chevins** | 14 | 14 | 13.9 | 13.9 | 11.6 | 11.6 |
| **Other fish species** | 78 | 76 | 81.5 | 78.7 | 74 | 71.1 |

*SFA – Slovak Fishing Association

Source: SO SR

## Protected trees

**The network of protected trees** in 2010 was created by 459 protected trees and their groups including alleys - protected objects (in 2009 it was 462). Physically it is represented by 1 271 solitary trees of 67 taxons, including 32 domestic and 35 alien taxons (there are 3 less individual protected tree species than in the last year).

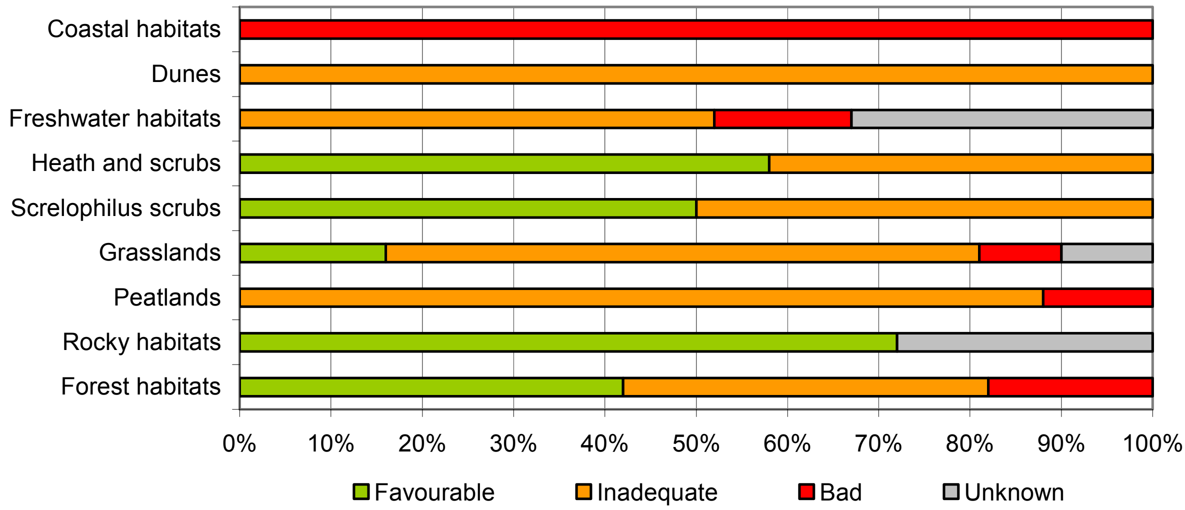
There were 295 in the **optimal** state (64.3%), 139 were **endangered** (30.3%) and 25 **degraded** (5.4%) of the protected trees and their groups. This is a slight improvement in the situation, compared to the previous year.

14 protected trees and their groups were **treated** in 2010. The funding involved the owners of individual lots where the trees grow, municipalities, non-government organisations and part of the money came from revitalisation measures applied to damaged habitats.

## Habitats

Most endangered in Slovakia are saline habitats, which is the result of the decline in the level of ground water, extinction of traditional farming and secondary succession. On the other hand, best characteristics are recorded for rock habitats thanks to their inaccessibility and forest habitats thanks to a relatively sensible management of forests. The endangered habitats within the whole of Central Europe include peats and bogs, wetlands, flooded meadows, saline grassland, and sands.

**Conservation of the condition of habitats of the European importance***




* data from reporting pursuant to article 17 of the Habitat directive - assessment of 66 habitats Source: MoE SR

## Protected minerals and fossils

**Protection of minerals and fossils** is regulated by § 32 and § 38 **of Act No. 543/2002 Coll.** on nature and landscape protection and **Resolution of MoE SR No. 213/2000 Coll.** on protected minerals and protected fossils and on their social evaluation, which stated the list of protected minerals and protected fossils and their social value.

The list of **protected minerals** includes:

- 12 typological minerals, first time scientifically documented from the Slovak territory,
- 61 significant minerals or rare occurrence in Slovak sites, and having European significance, or minerals with specific morphological shape or trend,
- meteorites found in Slovakia's territory.

The list of **protected fossils** includes:

- 655 typological fossils that represent an irreplaceable, unique material of extinct plants and animals that served to describe the specific taxonomic group for the first time,
- selected groups of fossils with rare occurrence that thanks to their characteristics and degree of preservation are unique testimonies of the evolution of organisms in the Slovak geological past.

The samples of protected minerals and protected fossils are deposit especially in the collections of state nature scientific museums.

## Care of the protected nature parts

### ♦ Implementation of the CITES in 2010

**CITES scientific body of the SR**, pursuant to the national and EU legislation in 2010, **commented** 39 applications filed by the SR Ministry of Environment to import of species exemplars belonging to the species listed under the CITES convention, 7 applications of the MoE SR to export such species, 49 applications of the MoE SR or local environmental offices for consultation regarding the origin of exemplars and 20 applications of the MoE SR at issuing certificates. Further, the body **produced**, upon the request of the MoE SR, local environmental offices, custom offices and police, other 48 position papers that relate to the implementation of the CITES convention. At the same time, the SR scientific body in 2010 **provided** assistance to state authorities in 69 cases of identification of species exemplars categorised in annexes of the CITES convention.

## ♦ Protection of caves

There are **more than 5 400 caves** registered in Slovakia. They are natural monuments at the same time. Of these, 44 most significant were classified among the national natural monuments. Protective zone was also declared for 18 caves.

Presently, there are **17 accessible caves,** 12 of them are administered by the Slovak Caves Administration, while 5 are administered by other subjects. Beside this, there are 30 caves that were declared publicly accessible caves.

In 2010, 12 proposals for declaration of freely accessible caves for the public were processed and sent to locally pertinent Regional Environmental Offices.

## ♦ Protected areas

8 new protected areas were **declared** in 2010 (8 PS, all being part of the Natura 2000 network) and 3 of them came into effect as late as in 2011. Also, 11 special protection areas were declared, 3 of which came into effect as late as in 2011. 2 protected areas were **updated** (1 NR and 1 NM) and 1 protective zone was declared. 1 nature monument was **cancelled**.

**Comparison of protected areas in the SR in 2002 and 2010**

| Category | 2002 | | | | 2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | Number | Area (ha) | | % of SR territory | Number | Area (ha) | | % of SR territory |
| | | core area | protective zone | | | core area | protective zone | |
| Protected landscape areas | 14 | 525 547 | - | 10,7 | 14 | 522 582 | - | 10,66 |
| National parks | 9 | 317 821 | 238 124 | 12,1 | 9 | 317 890 | 270 128 | 11,99 |
| **Large-size protected areas** | **23** | **843 368** | **238 124** | **22,8** | **23** | **840 471** | **270 128** | **22,65** |
| Protected sites | 189 | 7 001 | 2 263 | 0,19 | 172 | 5 534 | 2 419 | 0,16 |
| Nature reserves | 376 | 11 767 | 243 | 0,25 | 388 | 13 175 | 247 | 0,27 |
| National nature reserves | 231 | 85 905 | 3 383 | 1,82 | 219 | 84 130 | 2 239 | 1,76 |
| Nature monuments | 230 | 1 531 | 208 | 0,04 | 254 | 1 585 | 496 | 0,05 |
| National nature monuments | 60 | 59 | 27 | 0,002 | 60 | 59 | 2 352 | 0,05 |
| Protected landscape fragment | - | - | - | - | 1 | 3 | - | 0,00 |
| **Small-size protected areas** | **1 086** | **106 263** | **6 124** | **2,3** | **1 094** | **104 486** | **7 752** | **2,29** |

Source: SNC SR

In total, **in the territory of PLA** there are **245 small-size** protected areas (SSPA) (this represents 2.3% **of total PLA territory**), **in the territory of NP** there are **206** SSPA (**22.5%** of the NP area), while **in the territory of NP protective zones** (PZ) there are **66** SSPA (**0.9%** of the NP protective zones area). **Outside PLA, NP, and NP PZ**, which means **the open landscape**, there are **577** small-size protection areas (0.7% of the open landscape area).

**Overview of protected areas in the SR by types and levels of protection (as of 31.12.2010)**

| Level of protection* | Category | Area (ha) | % of SR territory |
|---|---|---|---|
| **1th level** | „ open landscape “ | 3 767 274 | 76.83 |
| **2th level** | PLA**, NP PZ**, D zones | 759 267 | 15.48 |
| **3th level** | NP**, PS, PS PZ, NR PZ, NNR PZ, NM PZ, NNM PZ, C zones | 265 686 | 5.42 |
| **4th level** | NNR, NR, NNM, NM, PS, NR PZ, NNR PZ, NM PZ, NNM PZ, B zones | 18 045 | 0.37 |
| **5th level** | NNR, NR, NNM, NM, A zones | 93 129 | 1.90 |
| **2-5th level** | special protected nature parts in the SR | **1 136 126** | **23.17** |

Source: SNC SR

* excluding territories without the level of protection (SPAs and PZs of caves and natural waterfalls)
** area without SSPA

### Endangerment and degradation of the protected areas

Of the total number of 1 094 small-size protected areas, there were **degraded** 24 territories of area of 283 ha (this area presents 0.3% of total area of SSPA), 435 were **endangered** of area of 20 303 ha (18.1% of SSPA) and in the **optimal condition** there were 635 territories of area of 91 652 ha (81.6% of SSPA).

### Care of the protected areas

Professional nature protection organisations carried out **regulatory intervention** in the field of practical care of the specially protected nature and landscape parts, with total cost of over 174.7 thous. EUR. A number of measures were implemented at the same time within individual areas; just like in the previous years, the activities involved mainly cutting of volunteer trees and mowing, including the removal of the biomass from the area. Beside these activities, the other activities included mulching, grazing, fence building and fence repairs, elimination of invasive species, collection and disposal of waste, etc. Part of these regulatory interventions has been funded from the state budget, while another part came from donors. 14 protected tree types and their groups were treated.

During the year 2010 State Nature Conservancy of the SR elaborated 7 674 **expert viewpoints**. The biggest rate was created by the department of tree species protection and building and regional planning activities. Beside these, 745 so-called **declarations** (declarations by the body responsible for monitoring of the NATURA 2000 territories) were processed by all organisational units of the SR State Nature Conservancy on the basis of applications from the state government bodies, local governments or investors. These declarations concerned the projects applying for the EU funding, mostly from the operational programmes of environment, transboundary cooperation, and transport.

Professional nature protection organisations in 2010, due to the lack funding, did not carry out any **inventory surveys** within the small-size protected areas, or they were performed only occasionally as parts of other activities.

In 2010, 37 **education paths** or **education localities** were repaired or reconstructed. **13 information centres of nature protection** and the **Nature Protection School** in Varín were administered.

## Protected areas within the international context

***European Diploma of Protected Areas***

So far, there have been 2 protected areas that received the European Diploma:

- NNR Dobročský prales (A category) and
- NP Poloniny (B category).

***Man and the Biosphere* Programme *(MaB):***

The following 4 protected areas have been included into the biosphere reserves in Slovakia:

- PLA - Poľana biosphere reserve
- NP - Slovak karst biosphere reserve
- NP - East Carpathian biosphere reserve (trilateral BR)
- Tatra NP - Tatra biosphere reserve (bilateral BR).

As of 2010, **14** wetlands were declared and registred in *List* of *Wetlands* of International Importance as **Ramsar sites** with total size of **40 697 ha** under the *Convention on Wetlands of International Importance Especially as Waterfowl Habitat* (**Ramsar Convention**):

| Name of wetland | Area (ha) | District | Date of registration |
|---|---|---|---|
| 1. Parížske swamps | 184.0 | Nové Zámky | 2.7.1990 |
| 2. Šúr | 1 136.6 | Pezinok | 2.7.1990 |
| 3. NNR Senné - ponds | 424.6 | Michalovce | 2.7.1990 |
| 4. Donau floodplains | 14 488.0 | Bratislava II, V, Senec, D. Streda, Komárno | 26.5.1993 |
| 5. Flat of Morava river | 5 380.0 | Bratislava IV, Malacky, Senica, Skalica | 26.5.1993 |
| 6. Latorica river | 4 404.7 | Michalovce, Trebišov | 26.5.1993 |
| 7. Alluvium of Rudava river | 560.0 | Malacky, Senica | 17.2.1998 |
| 8. Wetlands of Turiec | 750.0 | Martin, Turčianske Teplice | 17.2.1998 |
| 9. Poiplie | 410.9 | Levice, Veľký Krtíš | 17.2.1998 |
| 10. Wetlands of Orava basin | 9 287.0 | Námestovo, Tvrdošín | 17.2.1998 |
| 11. Orava river and its confluents | 865.0 | Dolný Kubín, Tvrdošín | 17.2.1998 |
| 12. Domica cave | 621.8 | Rožňava | 2.2.2001 |
| 13. Tisa river | 734.6 | Trebišov | 4.12.2004 |
| 14. Caves of Demänovská valley | 1 448.0 | Liptovský Mikuláš | 17.11.2006 |

**Review of Biosphere Reserves and Ramsar sites in selected countries**

| | | Slovakia | Czech Rep. | Poland | Hungary | Austria |
|---|---|---|---|---|---|---|
| **Biosphere Reserves (BR)** | Number | 4 | 6 | 9 | 5 | 6 |
| **Ramsar wetlands** | Number | 14 | 12 | 13 | 28 | 19 |
| | area (km$^2$) | 407.0 | 546.8 | 1 450.8 | 2 354.1 | 2 524.0 |

CR) BR: one common with Poland
Source: SNC SR
Slovakia) BR: one common with Poland and one with Poland and Ukraine together
Poland) BR: one common with Czech Republic, one with Slovakia and one with Slovakia and Ukraine together

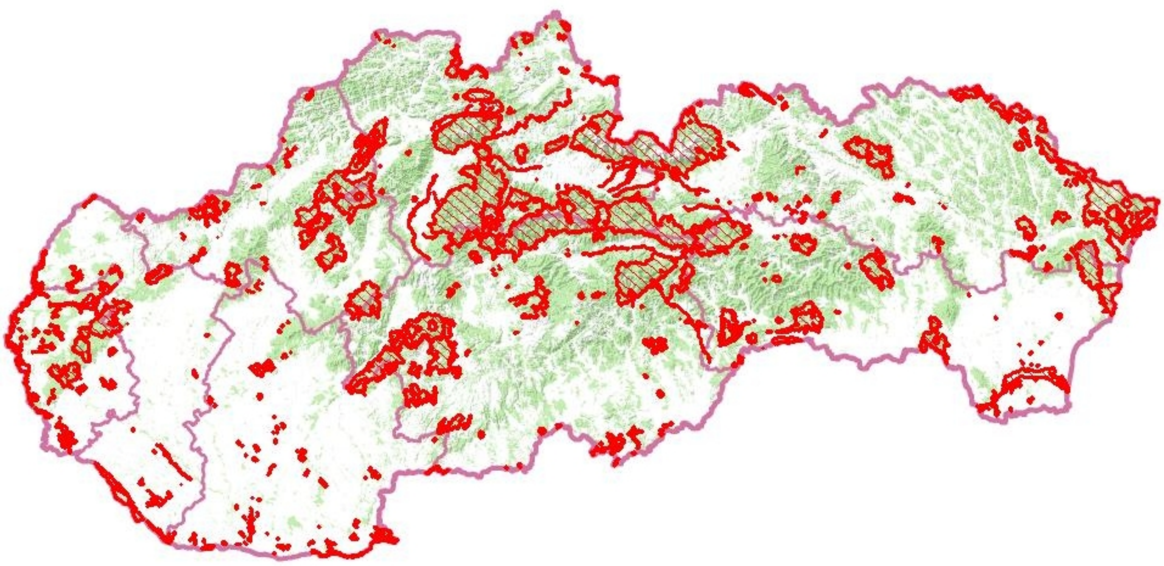
## NATURA 2000 in Slovakia

The NATURA 2000 network (pursuant to sect. 28 of the Act No. 543/2002 Coll. on nature and landscape protection uses the following wording: *"Coherent European Network of Protected Areas"* comprises two types of areas:

### Sites of Community Importance (SCI)

- national list of SCI was approved on 17.3.2004 by the Slovak Republic government and published *on the basis of the MoE SR Edict* of July 14, 2004 and was sent to the European Commission for approval;
- SCI are proposed for **44 plant taxons**, **96 animal species** and **66 types of biotopes**;
- Into the **proposed list** of the SCI there were originally listed **382 territories** with the area of **573 690 ha**. The territories cover **11.7% of the SR area**, lapping with present network of protected areas is **86%.** From the total area of the SCI, there is 86% on forest land, 10% is on agricultural land, 2% is created by water areas and 2% are other areas;
- these territories are presently under the so-called **preliminary protection**, which means the proposed protection level;
- since 2008, or since the publication of decisions of the European Commission (EC) which adopted lists of the Sites of Community Importance in the Pannonian and Alpine bio-geographical regions, Slovakia has been in the **6-year time limit of SCI declaration** for protected areas under the national classification of protected areas, specifically in the category of nature reserve and protected site;
- on the basis of the outcomes of **bio-geographical seminars**, European Commission requires that the SCI national list be **completed**. State Nature Conservancy of the Slovak Republic elaborated a scientific draft for adding 267 areas into the SCI national list and at the same time proposed to eliminate from the original list 5 areas that are considered scientific fallacy;
- of the present **381 areas** located in Slovakia, 204 fully overlap with the existing system of protected areas. Of the remaining 177 SCI, 74 are located outside the existing system of protected areas and 103 areas partly overlap with the system. These areas need to be **declared as protected areas by May 1, 2012**.

**Sites of Community Importance in the SR**

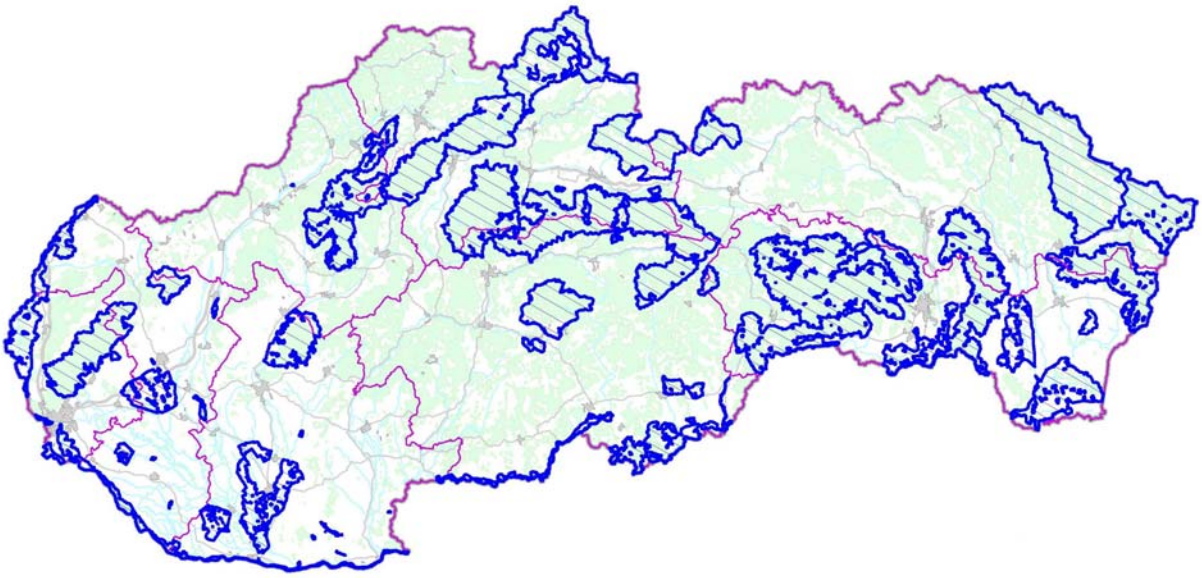


Source: SNC SR

### Special protection areas (SPA)

- the Slovak Government approved the SPA national list on July 9, 2003. In 2004 began the process of creating resolutions and care programmes for individual SPA. National list includes **38 SPA** with total area of **1 154 111 ha** and covers **23.5% of the SR area** and lapping of SPA with the existing network of protected areas in the SR presents **55%**;
- Slovak Government Resolution 345/2010 of 25/05/2010 **revised and amended** the national list. **5 new** areas were added to the list and **2** areas were **taken out.** At present, the national list contains **41 areas** with total size of **1 287 296 ha**;
- ongoing monitoring of birds within individual SPAs was focused on analysing the species composition as well as their number in particular SPA;
- as of 2010, 35 SPAs were declared (of the total number of 41) with the size of 1 032 930 ha.

**Special protection areas in the SR**



Source: SNC SR

**Agricultural and forest land in the NATURA 2000 territories**

| NATURA 2000 | Number | Area (ha) | Agricultural land area (ha) | Share of agricultural land (%) | Forest land area (ha) | Share of forest land (%) |
|---|---|---|---|---|---|---|
| SPA | 38 | 1 287 296 | 365 102 | 28.4 | 802 204 | 62.3 |
| SCI | 381 | 573 690 | 54 657 | 9.5 | 497 295 | 86.7 |

Source: SNC SR

**Comparison of the SCI and SPA areas in Slovakia with selected countries of EU (as of May, 2010)**

| Country | SPA | | | SCI | | |
|---|---|---|---|---|---|---|
| | number | area (km²) | % of country area | number | area (km²) | % of country area |
| Austria | 96 | 9 869 | 11.8 | 168 | 8 978 | 10.7 |
| Czech rep. | 39 | 9 684 | 12.3 | 1 082 | 7 854 | 10.0 |
| Hungary | 55 | 13 512 | 14.5 | 467 | 13 973 | 15.0 |
| Poland | 141 | 55 228 | 15.6 | 823 | 38 003 | 11.0 |
| Slovakia | 38 | 12 236 | 25.1 | 382 | 5 739 | 11.7 |
| **EU-25*** | **5 315** | **593 486** | **11.4** | **22 529** | **719 015** | **13.7** |

* only terrestrial NATURA 2000 sites

Source: EC (NATURA 2000 Barometer)