2018

Report on the Environment of the Czech Republic

cenia

Ministry of the Environment of the Czech Republic

Drawn up by
CENIA, Czech Environmental Information Agency

Overall editing
T. Kochová and L. Hejná

Authors
V. Céza, E. Čermáková, T. Kochová, J. Mertl, J. Pokorný, J. Přech, M. Rollerová, V. Vlčková

ISBN 978-80-87770-80-1

Contact
CENIA, Czech Environmental Information Agency
Vršovická 1442/65, 100 10 Prague 10
E-mail: info@cenia.cz
http://www.cenia.cz

Typesetting
Daniela Řeháková

List of cooperating organisations

Bohemian Switzerland National Park Administration
Central Institute for Supervising and Testing in Agriculture
Charles University Environment Centre
Czech Environmental Inspectorate
Czech Gas Association
Czech Geological Survey
Czech Hydrometeorological Institute
Czech Society for Ornithology
Czech Statistical Office
EKO-KOM company
Energy Regulatory Office
Evernia, Ltd.
Forest Management Institute
Forest Stewardship Council Czech Republic
Forestry and Game Management Research Institute
Institute of Agricultural Economics and Information
Institute of Sociology of the Czech Academy of Sciences, public opinion research centre
Krkonoše Mountains National Park Administration
Masaryk University, Faculty of Social Studies
Ministry of Agriculture
Ministry of Finance of the Czech Republic
Ministry of Industry and Trade
Ministry of the Environment of the Czech Republic
Ministry of Transport
National Institute of Public Health
National Reference Laboratory for Municipal Noise
Nature Conservation Agency of the Czech Republic
PEFC Czech Republic
Podyjí National Park Administration
Povodí Labe, state enterprise
Povodí Moravy, state enterprise
Povodí Odry, state enterprise
Povodí Ohře, state enterprise
Povodí Vltavy, state enterprise
Railway Infrastructure Administration
Research Institute for Soil and Water Conservation, public research institution
Road and Motorway Directorate of the Czech Republic
State Administration of Land Surveying and Cadastre
State Environmental Fund of the Czech Republic
Šumava National Park Administration
T. G. Masaryk Water Research Institute, public research institution
Transport Research Centre

Table of contents

Introduction

The Report on the Environment of the Czech Republic (hereinafter the "Report") is drawn up every year on the basis of Act No. 123/1998 Coll., on the right to information on the environment, as amended, and Government Resolution No. 446 of 17 August 1994 and Government Resolution No. 934 of 12 November 2014, and submitted for approval to the Government of the Czech Republic and subsequently submitted to the Chamber of Deputies and the Senate of the Parliament of the Czech Republic for discussion.

It is a comprehensive document, which assesses the state of the environment in the Czech Republic, including the entire context, on the basis of the data available for the given year of assessment.

CENIA, Czech Environmental Information Agency, has been responsible for drawing up the Report on the Environment of the Czech Republic since the 2005 Report.

The 2018 Report was discussed and approved by the Government on December 9, 2019 and then submitted for consideration by both chambers of the Czech Parliament.

The 2018 Report is published in electronic form (http://www.cenia.cz and http://www.mzp.cz) and it is also distributed along with the Statistical Yearbook of the Environment of the Czech Republic 2018 and Reports on the Environment in the Regions of the Czech Republic 2018.

Key messages of the 2018 Report

In 2018, the state of the environment was influenced by both the growing performance of the economy and the extreme temperature and precipitation conditions. The year 2018 was the warmest in the Czech Republic in the history of observation and at the same time it was significantly dry. The combination of high temperatures and lack of precipitation, augmented by the fact that 2018 was the fifth dry year in a row, led to the development of extreme manifestations of hydrological and soil drought. Long-term drought has had a major impact on the levels of surface water and groundwater (in many cases the discharge and level minimums have been reached) and on the agriculture, forestry and water management sectors. The material and energy intensity of the economy is decreasing.

As a result of long-term targeted measures, despite the economic growth, emissions of pollutants into the air have been decreasing. At the same time, the share of stations at which the limit values for the annual average concentration of benzo(a)pyrene were exceeded was also reduced in 2018. An important contributor to air pollution, especially in agglomerations, is road transport. In smaller municipalities with insignificant burden from transport and from large sources of air pollution, the decisive factor in air pollution is the local heating of households.

Due to the significantly dry year 2018, water abstraction for agriculture increased, but overall abstraction by all sectors decreased compared to 2017. At the same time, due to the reduced abstraction of surface and groundwater, there was also a decrease in discharged wastewater into surface waters. Thanks to reconstruction of the water management infrastructure, drinking water losses in the water supply network were also reduced.

The state of the environment in the Czech Republic is negatively influenced by the land management practices. In a long term, the area of agricultural land is decreasing mainly due to its conversion into built-up and other areas; but in 2018, the expansion of other areas stopped year-on-year for the first time, mainly due to decrease in mining areas. On arable land, topsoil is compacted by agricultural vehicles, and unsuitable farming practices. As a result, the loss of topsoil by erosion, as well as the risk of erosion events increases, especially in the context of climate change, and most of these events are recorded on soils with absent soil conservation measures.

The state of forest ecosystems in 2018 was influenced mainly by the large volume of total and salvage logging, which was the highest in history in both cases. Most of the logging was carried out following the spread of drought and bark beetle calamity. The reason for the low resilience of forest stands is, despite a gradual slight increase in the share of deciduous trees, their low ecological stability, caused mainly by an inappropriate species composition and low spatial diversity.

In connection with land use, the population levels of several specialized and less numerous species of animals and plants are declining and are being replaced by widely spread species, leading to unification of communities and loss of biodiversity.

Despite significant efforts, there is no apparent progress in the prevention, generation and treatment of waste, waste generation has long been growing due to economic growth. At the same time, despite a significant share of material recovery, the situation in the area of municipal waste treatment is not entirely satisfactory, as landfilling predominates.

The funding released for environmental protection, or addressing and preventing negative environmental impacts, grew in volume year-on-year in 2018, mainly thanks to support from European funds. The main source of financing from the European funds in 2018 was again the Operational Programme Environment.

Main findings of the 2018 Report

Climate system

- In terms of temperature, the year 2018 was exceptionally above-normal on the territory of the Czech Republic, the average annual air temperature 9.6 °C was higher by 1.7 °C than the long-term average in 1981–2010. The summer period, i.e. the months of June–August, as a whole, together with the summer of 2003, was the hottest since 1961. On average, there were 71 summer days in the Czech Republic (the most in history) and 19 tropical days. In terms of precipitation, the year 2018 was significantly below normal in the Czech Republic, the annual total precipitation (522 mm) was the second lowest since 1961.

- In 2018, the Czech Republic was affected by a significant drought. At the end of the growing season, the moisture balance of precipitation and evapotranspiration in the driest areas of the Czech Republic dropped below -350 mm; comparing the moisture balance with the long-term average and based on the precipitation-evapotranspiration index (SPEI), the 2018 drought was exceptional to extreme. At the end of August, the values of water reserves in the soil fell below the critical value of 10% of available water capacity (AWC) in most of the Czech Republic, with the exception of mountain locations. A mild to extraordinary hydrological drought in 2018 manifested itself continuously from April to December on most shallow wells and springs. The average annual flow rate did not reach 100% of the long-term average in any of the selected profiles in 2018, the worst situation was in July, when many rivers did not even reach 30% of the long-term average monthly flow rates.

- Greenhouse gas emissions in the Czech Republic declined by 35.1% in the period 1990–2017 and by 0.9% year-on-year, despite the year-on-year GDP growth of 4.4%. Emissions from energy and manufacturing industry dropped significantly year-on-year. On the other hand, emissions from waste show a growing trend (by 46.6% since 2000), especially emissions from landfills. Likewise, greenhouse gas emissions from transport have risen by 53.8% since 2000.

- The objective of the Climate and Energy Package and of the State Environmental Policy 2012–2020 for emissions outside the EU-ETS system is being met.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
1. Temperature and precipitation conditions	☹	☹	☹	☹
2. Occurrence of drought, runoff conditions and groundwater status	☹	☹	☹	☹
3. Greenhouse gas emissions	☺	☺	😐	😐

Air quality

- Year-on-year, all emissions of basic pollutants decreased in 2018, the greatest decrease was in emissions of SO_2 by 10.9%.

- The percentage of stations where the daily limit value for suspended PM_{10} particles was exceeded decreased from 46% in 2017 to 40% of stations in 2018[1]. The share of stations where the annual limit value for benzo(a)pyrene was exceeded in 2018 – also decreased year-on-year by 56.4% of stations in 2018 and by 65.8% of stations in 2017.

- In 2018, 10 smog situations were declared in the Czech Republic due to high concentrations of PM_{10} (39 smog situations in 2017) and 12 smog situations were declared due to high concentrations of tropospheric ozone (in 2017 only 2).

- In 2018, the limit values set for arsenic, cadmium lead, nickel, sulphur dioxide and carbon monoxide were not exceeded, but the annual limit value for benzene was exceeded.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
4. Emissions of basic pollutants	🙂	🙂	🙂	🙂
5. Emissions of heavy metals	🙂	🙂	🙂	😐
6. Air quality in terms of human health protection	🙂	😐	😐	😐
7. Air quality in terms of the protection of vegetation and ecosystems	N/A	😐	😐	😐

Water management and water quality

- Year-on-year, the total water abstraction declined by 2.4% to 1,591.1 mil. m^3. Specific consumption of water per capita supplied by public water supply increased slightly by 0.6% to 166.0 $l.inhabitant^{-1}.day^{-1}$. In households, water consumption increased by 0.7%, in 2018 households consumed 89.2 $l.inhabitant^{-1}.day^{-1}$.

- The volume of wastewater discharged decreased year-on-year by 9.5% to 1,540.8 mil. m^3.

- The share of inhabitants connected to the sewerage network did not change in comparison with 2017, and in 2018 it was 85.5%. 17.6% of the population is not yet connected to a sewerage system terminated with a WWTP.

- A number of groundwater samples were found to be contaminated, in particular, as in 2017, by ammonium ions (11.0% of the samples were above limit) and nitrates (10.6% of the samples were above limit). Among the organic substances, pesticides and their metabolites are particularly problematic.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
8. Water abstraction	🙂	🙂	🙂	😐
9. Wastewater discharge	🙂	🙂	🙂	🙂
10. Wastewater treatment	🙂	🙂	🙂	😐
11. Water quality	🙂	🙂	🙂	😐

[1] *Calculated from automatic stations.*

© Jarmila Cikánková/CENIA

Nature and landscape

- The total area of the agricultural land resources of the Czech Republic decreased by 1.8% in the period 2000–2018. Agricultural land is diminishing mainly in favour of built-up and other areas, whose size increased by 4.1% between 2000 and 2018 and by 0.04% year-on-year against 2017.

- Based on land cover data, the Czech Republic has lost 27.7 thous. ha of forests since 2012 due to logging, despite the increase in the registered stand area.

- In the period 2013–2018, 19.4% of habitats of Community importance were assessed as being in a favourable status, compared to 16.1% in the period 2007–2012. However, despite a long-term positive trend, 79.6% of habitats of Community importance still have an inadequate or unfavourable status.

- The populations of common bird species have stagnated since 1982, in 2018 they were 0.4% larger than in 1982. The populations of forest bird species had long been decreasing with a gradual reversal of the trend in recent years, they were 9.9% smaller in 2018 than in 1982. The populations of agricultural land birds have decreased by 33.5% since 1982.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
12. Land use	😐	😐	😐	😐
13. Landscape fragmentation	☹️	☹️	☹️	☹️
14. Nature protection	😐	😐	😐	😐
15. Status of animal and plant species of Community importance in 2006, 2012 and 2018	N/A	N/A *	😐 **	N/A
16. Status of natural habitats of Community importance in 2006, 2012 and 2018	N/A	N/A *	😐 **	N/A
17. Indicator of common bird species	☹️	☹️	☹️	☹️

** Change since 2007 (change between 2001–2006 reports and 2007–2012 reports)*
*** Change since 2013 (change between 2001–2006 reports and 2013–2018 reports)*

Forests

- Damage to forest stands in the Czech Republic expressed as a percentage of defoliation remains high, especially in coniferous stands. The main reasons for defoliation are insect pests damage and drought damage. In terms of human activity, defoliation is influenced by burdening the forest ecosystems with acidifying emissions of nitrogen (NO_x) and sulphur (SO_2). Unsuitable species composition of forests and the clearcutting method of timber harvest create a prerequisite for high defoliation.

- In 2018, the volume of logging reached the highest level in history, 25.7 mil. m^3, the share of salvage (calamity) logging in total logging in 2018 was 89.6%. At the same time, more than half of the salvage logging in 2018 was insect-caused logging (mainly bark beetle), namely 13.1 mil. m^3 without bark.

- The share of deciduous trees in the total forest area in the Czech Republic is gradually increasing. In 2018, it accounted for 27.3% of the total forest area, approaching the share of 35.6% defined as the recommended forest composition.

- The age structure of forests in the Czech Republic is uneven; the area of old stands above 120 years of age has long been growing. This phenomenon is positive in the context of biodiversity conservation.

- The PEFC-certified forest area in 2018 was 65.7% of the forest area. The FSC-certified forest area is slightly increasing, but it is below 2% of the total forest area. The share of certified forests decreases overall.

- A long-term problem is nibbling by cloven-hoofed game, which causes considerable damage, especially in the stands being restored.

© Zbyněk Stein/CENIA

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
18. Defoliation of forest stands	☹	☹	☹	☹
19. Logging	☹	☹	☹	☹
20. Species composition and age structure of forests	☺	😐	😐	😐
21. Responsible forest management	☺	😐	😐	😐

Soil and Agriculture

- In 2018, a total of 276 erosion events were recorded in the Czech Republic (168 in 2017). Since 2010, when only 7 of these events were recorded, there has been a significant increase in their number. In almost 76% of cases, erosion events occurred on soils without applied soil conservation measures.

- The consumption of livestock manure has been stagnating since 2014, 70.0 kg.ha^{-1} of livestock manure and organic fertilizers was used in 2018. In comparison with 2017, the consumption of mineral fertilizers decreased by 11.1% to 122.9 kg of net nutrients.ha^{-1} in 2018.

- A high potential vulnerability by compaction was assessed on 16.2% of agricultural land.

- The total area of organically farmed land has been growing very slowly since 2011; in 2018, it was 539.0 thous. ha, i.e. by 18.9 thous. ha more than in 2017. Permanent grasslands occupy a large part of the total area (80.8%). In 2018, the set target of achieving a 15% share of organically farmed land in the agricultural land resources was not met, as this share was only 12.8% in 2018.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
22. Risk of soil erosion and slope instabilities	☹	☹	☹	☹
23. Consumption of fertilisers and plant protection products	☺	☹	☹	☺
24. Quality of agricultural land	☺	😐	😐	😐
25. Organic farming	☺	☺	☺	☺

© Jiří Přech/CENIA

Industry and energy

- In 2018, the industrial production index increased by 3.0% year-on-year.
- There is an increase in energy consumption. In 2017[2], the target of the State Energy Concept not to exceed the value of 1,060 PJ of final energy consumption by 2020 was exceeded. Final consumption in 2017 amounted to 1,067.0 PJ.
- Household heating accounted for 59.1% of total PM_{10} emissions in 2017 and for 98.3% of B(a)P.
- Heat production from solid fossil fuels and natural gas has been decreasing slightly in the long term, while the share of renewable sources and biofuels increased from 2.6% to 8.0% in 2010–2017.
- The total energy dependency of the Czech Republic on imports from abroad is increasing; in 2017 it increased year-on-year from 33.0% to 37.3%.
- The production of heat from renewable energy sources has increased significantly, in the period 2010–2017 it increased 2.5 times.
- The target of the share of renewable energy sources in gross final energy consumption of 13% by 2020 has been met since 2013, in 2017 it was 14.8%.
- In the period 2010–2018, under remedial measures registered in the Evidence System of Contaminated Sites, remediation was completed on 369 sites of old environmental burdens, in 2018, remediation was completed on 26 sites (48 sites in 2017).

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
26. Extraction of raw materials	🙂	🙂	🙂	🙂
27. Industrial production	🙂	🙂	🙂	🙂
28. Final energy consumption	🙂	🙂	😐	☹️
29. Fuel consumption in households	🙂	😐	😐	☹️
30. Energy intensity of the economy	🙂	🙂	🙂	🙂
31. Electricity and heat generation	🙂	🙂	😐	😐
32. Renewable energy sources	🙂	🙂	🙂	😐
33. Contaminated sites	N/A	🙂	🙂	🙂

[2] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

© Jarmila Cikánková/CENIA

Transport

- Passenger transport performance has been steadily increasing in connection with economic growth, it rose by 28,2% in the period 2000–2018.

- The transport performance and the number of passengers transported by rail are increasing, in comparison of 2017–2018 it increased by 3.6% to 189.5 mil. people. The share of public transport in the overall performance of passenger transport (without air transport) in 2018 reached 33.4%.

- Energy consumption in transport is increasing; in 2018 it increased by 4.8% year-on-year. The share of renewable energy sources in total energy consumption in transport reached 6.6% in 2017[3]. Thus, the target of the National Action Plan for Renewable Energy set at 10% of renewable energy in transport by 2020 was not met in 2018.

- CNG consumption has a rising trend and has increased tenfold over the period 2009–2018. The number of registered new electric vehicles and hybrids doubled in year-on-year comparison in 2018, despite this dynamic development, electromobility remains marginal in the Czech Republic.

- NO_x emissions from transport decreased by 30.0%, VOC emissions by 71.0%, CO emissions by 79.8% and suspended particle emissions by 9.2% over the period 2000–2018. However, PAH emissions increased in the period 2000–2018 by 131.0%. CO_2 transport emissions also increased – by 65.8% in the period 2000–2018. The largest share of that growth was generated by road transport, accounting for 92.6% of total CO_2 emissions from transport in 2018. CO_2 emissions from road transport increased by 66.0% between 2000 and 2018.

- The number of inhabitants exposed to high noise pollution from road transport exceeding the limit value between 2012 and 2017 in total for the whole of the Czech Republic decreased by 24.0% (51.2 thous. persons) in the indicator of all-day (24 hours) noise pollution and by 12.5% (34.9 thous. inhabitants) in the night noise pollution indicator. However, the exposure to road transport noise above the limit value increased in the Prague agglomeration to 8.4% of the agglomeration population exposed all day and 10.1% of the population exposed at night.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
34. Transport performance and infrastructure	☹	😐	😐	😐
35. Energy and fuel consumption in transport	☹	☹	☹	☹
36. Emissions from transport	😐	😐	😐	😐
37. Noise pollution burden of the population	N/A	N/A	☺	N/A

[3] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Material flows

- The domestic material consumption of the Czech Republic decreased by 7.7% in the period 2000–2017[4]; but it grew between 2016 and 2017 by 0.6% (1.1 mil. t).

- The material intensity of the Czech economy has been decreasing in the long term; it decreased by 41.9% in the period 2000–2017, but a decrease in the material consumption with a concurrent economic growth has not been achieved yet.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
38. Domestic material consumption	🙂	😐	😐	☹️
39. Material Intensity of GDP	🙂	🙂	🙂	🙂

Waste

- The total waste generation in the period 2017–2018 increased by 9.5% to 37,784.8 thous. t due to construction development. Since 2009[5], it grew by 17.1%.

- The waste treatment is dominated by material recovery (83.4% in 2018) and its share is increasing at the expense of landfilling (9.4% in 2018).

- The rate of landfilling of municipal waste (46.0% in 2018) is still high, although it reduces in favour of material recovery (38.6% in 2018) and energy recovery (11.7% in 2018).

- The rate of recycled packaging waste is on the rise and the targets for packaging waste are being met.

- Strategic objectives for selected products are continuously being met, their take-back is increasing.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
40. Total waste generation	N/A	☹️*	☹️	☹️
41. Municipal waste generation and treatment	N/A	😐*	😐	😐
42. Waste treatment structure	N/A	🙂*	🙂	🙂
43. Packaging waste generation and recycling	N/A	😐*	😐	😐
44. Generation and recycling of waste from selected products	N/A	🙂*	🙂	🙂

**Change since 2009*

[4] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

[5] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Financing

- The volume of expenditures both from central sources (i.e. mainly from the state budget and state funds) and from territorial budgets increased slightly in 2018 year-on-year. In the case of environmental protection expenditure from central sources, the growth was 1.4% to CZK 45.4 bil. and, from territorial budgets 13.6% to CZK 40.5 bil.

- Under the Operational Programme Environment for the 2014–2020 programming period with a total allocation of EUR 3.2 bil. (i.e. approx. CZK 86.2 bil.) of total eligible expenditure, 23 new calls offering EUR 518 mil. were announced in 2018 (i.e. CZK 13.5 bil.) of total eligible expenditure.

- Investments in environmental protection have long been above the EU28 average in the Czech Republic.

Indicator	Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
45. Investments and non-investment costs in environmental protection				
46. Public expenditure on environmental protection				

 The trend is developing positively, in accordance with the set objectives.

 The trend is developing neither positively nor negatively and can be referred to as stagnating.

 The trend is developing negatively, not in accordance with the set objectives.

N/A It is not possible to evaluate the state and trend.

Change since 1990 – a change for the period from 1990 to the last available year of assessment
Change since 2000 – a change for the period from 2000 to the last available year of assessment
Change since 2010 – a change for the period from 2010 to the last available year of assessment
Last year-on-year change – change for the period between the last two available years assessment

1 Climate system

© Miluše Rollerová/CENIA

Climate system

The protection of the climate system of the Earth ranks among the key environmental topics. The importance of its protection lies, inter alia, in the fact that climate change and the measures associated with it immediately affect both the economy and human welfare. Measures to protect the climate system and to reduce the negative impacts of climate change are divided into mitigation and adaptation. The mitigation measures focus on the mitigation of climate change through reducing the anthropogenic burden on the climate system, which occurs in the form of changes in the composition of the atmosphere (greenhouse gas emissions) and changes in the character of the Earth's surface (e.g. deforestation). The second group of measures is adaptation, which aims to reduce the impact of manifestations of climate change on natural and anthropogenic systems.

In addition to long-term climate changes, the state of the environment, human health and ecosystems are also affected by the development of the hydrometeorological situation in the given year. The hydrometeorological conditions have a direct impact on the dispersion of pollutants in the atmosphere, and thus on their atmospheric concentrations, the formation of ground-level ozone, the quantity and quality of surface water and groundwater, water balance, and may increase the risk for human health because of high temperatures. The hydrometeorological conditions also affect sectors of the national economy, mainly agriculture, forestry, energy or water management, and also the degree of environmental burden caused by those sectors. For example, this means emissions from the production of electricity and heat, pollution of water due to the consumption of fertilizers in agriculture or water abstraction for irrigation. The development of the economic burden is then projected into the state of the environment and risks to human health.

References to current conceptual, strategic and legislative documents

Paris Agreement
- keeping the global average temperature rise well below 2 °C against pre-industrial levels and striving to keep the temperature increase below 1.5 °C compared to pre-industrial levels, and acknowledging that it would significantly reduce the risks and impacts of climate change
- increasing the capacity to adapt to the adverse impacts of climate change and strengthening resilience to climate change and low-emission development in a way that does not jeopardize food production

Kyoto Protocol to the United Nations Framework Convention on Climate Change, 2nd Control Period, Climate and Energy Package up to 2020
- a 20% reduction in aggregate greenhouse gas emissions in the EU by 2020 compared to 1990; as part of the common EU target, the Czech Republic should reduce emissions under the EU-ETS by 21% and not increase emissions from installations outside the EU-ETS by more than 9% by 2020 compared to 2005 levels

Europe 2020 – strategy for smart, sustainable and inclusive growth
- reducing greenhouse gas emissions in the EU by 20% against 1990, increasing in energy efficiency by 20% (both compared to the reference scenario) and increasing in the share of RES in the final energy consumption to 20% (targets 20/20/20 by 2020)

EU's 2030 energy and climate policy framework
- reducing aggregate greenhouse gas emissions in the EU by at least 40% by 2030 compared to 1990, achieving a 32% share of renewables in final consumption and a 32.5% increase in energy efficiency
- the sectors covered by the ETS will reduce emissions by 43% by 2030 compared to 2005, and those not covered by the ETS by 30%

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy
- mitigation of the effects of floods and droughts, the provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced and equitable water use

European Parliament and Council Directive 2007/60/EC on the assessment and management of flood risks
- a framework for the assessment and management of flood risks in order to reduce the adverse effects on human health, the environment, cultural heritage and economic activity

Strategic Framework Czech Republic 2030
- increasing the resilience and adaptability to hazards related to climate and natural disasters
- mainstreaming climate change measures in national policies, strategies and planning
- improving education in and raising awareness of climate change, expanding human and institutional capacity for climate change mitigation, adaptation, reducing its effects and early warning

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- reducing greenhouse gas emissions in the EU-ETS by 21% and not increasing the emissions outside the EU-ETS by more than 9% by 2020 compared to the 2005 levels

Climate Protection Policy of the Czech Republic (2017)
- reduction of greenhouse gas emissions of the Czech Republic up to 2020 by at least 32 Mt CO_2 eq. in comparison with 2005, and by 44 Mt CO_2 eq. by the year 2030
- achieving an indicative level of 70 Mt CO_2 eq. of emissions in the year 2040 and 39 Mt CO_2 eq. emissions in the year 2050

Strategy on Adaptation to Climate Change in the Czech Republic (2015)
- mitigating the impacts of climate change by adaptation to it, maintaining the welfare and preserving, and possibly improving, the economic potential
- analysing the effectiveness of measures related to climate change adaptation

National Action Plan on Adaptation to Climate Change (2017)
- reducing the vulnerability of human society and ecosystems to the effects of long-term drought and water scarcity, in particular by improving integrated water resource management across the territory, including: improving water regime in forests and agricultural landscapes; improving rainwater management in settlements and the production sector including its use, increasing the natural retention abilities of watercourses and floodplains and effective protection and use of water resources including verification of the implementation of new water sources (e.g. reservoirs, artificial infiltration, underground sources)

Concept of protection against the effects of drought in the Czech Republic
- summary of measures to increase the available amount of water in each part of the hydrological cycle, measures to reduce water consumption and measures to influence its quality by the society
- creating a strategic framework for the adoption of effective legislative, organizational, technical and economic measures to minimize the impacts of drought and water scarcity on the lives and health of the population, the economy, the environment and the overall quality of life in the Czech Republic

Resolution of the Government of the Czech Republic No. 620/2015 on preparation for the implementation of measures to mitigate the negative impact of drought and lack of water
- implementation of the measures to fulfil the objectives of protection against negative effects of drought
- the draft concept of protection against the effects of drought for the territory of the Czech Republic with the use of the implemented measures

State Energy Policy of the Czech Republic
- achieving a 40% decrease in CO_2 emissions by 2030 compared to 1990 and a further decrease of emissions in line with the EU strategy towards decarbonisation of the economy by 2050 with regard to the economic possibilities of the Czech Republic

Environmental Security Concept 2016–2020, with an outlook to 2030
- extension of the existing measures that will lead to an increase in environmental safety in terms of risk sources of anthropogenic origin, which are most often the cause of serious accidents and can be misused for terrorist attacks, and in terms of danger of natural origin (extreme weather events, extensive floods, long-term drought, slope instability, natural fires and other)

1 | Temperature and precipitation conditions

Key question

What were the temperature and precipitation conditions on the Czech Republic's territory in 2018?

Key messages

The year 2018 was exceptionally above the long-term temperature normal on the territory of the Czech Republic, it was the warmest year since 1961. The months of April and May were exceptionally warm. The summer period, i.e. the months of June–August, as a whole, together with the summer of 2003, was the hottest since 1961. On average, there were 71 summer days in the Czech Republic (the most in history) and 19 tropical days.
In terms of precipitation, the year 2018 was significantly below normal in the Czech Republic, the annual precipitation (522 mm) was the second lowest since 1961, only the year 2003 was drier. The driest in comparison with the normal were the northern and eastern parts of Bohemia, especially the Liberec, Hradec Králové and Pardubice Regions.

Overall assessment of the trend

Long-term development since 1961

Change since 2000

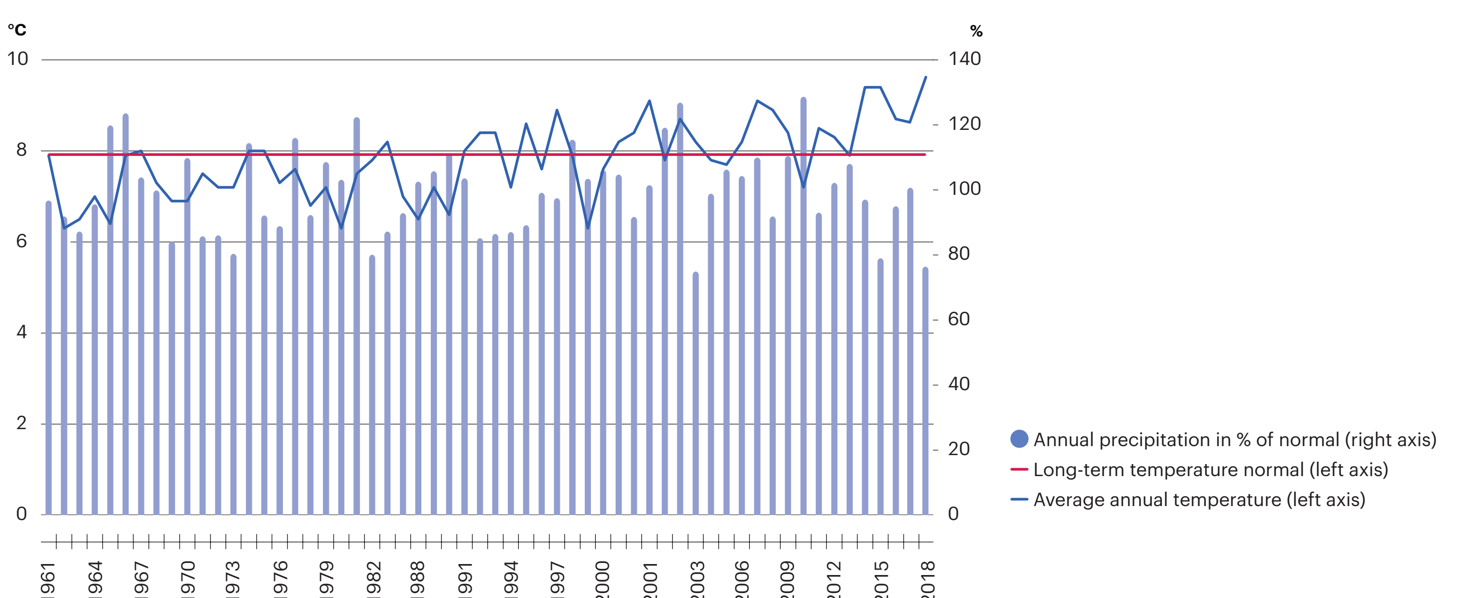
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

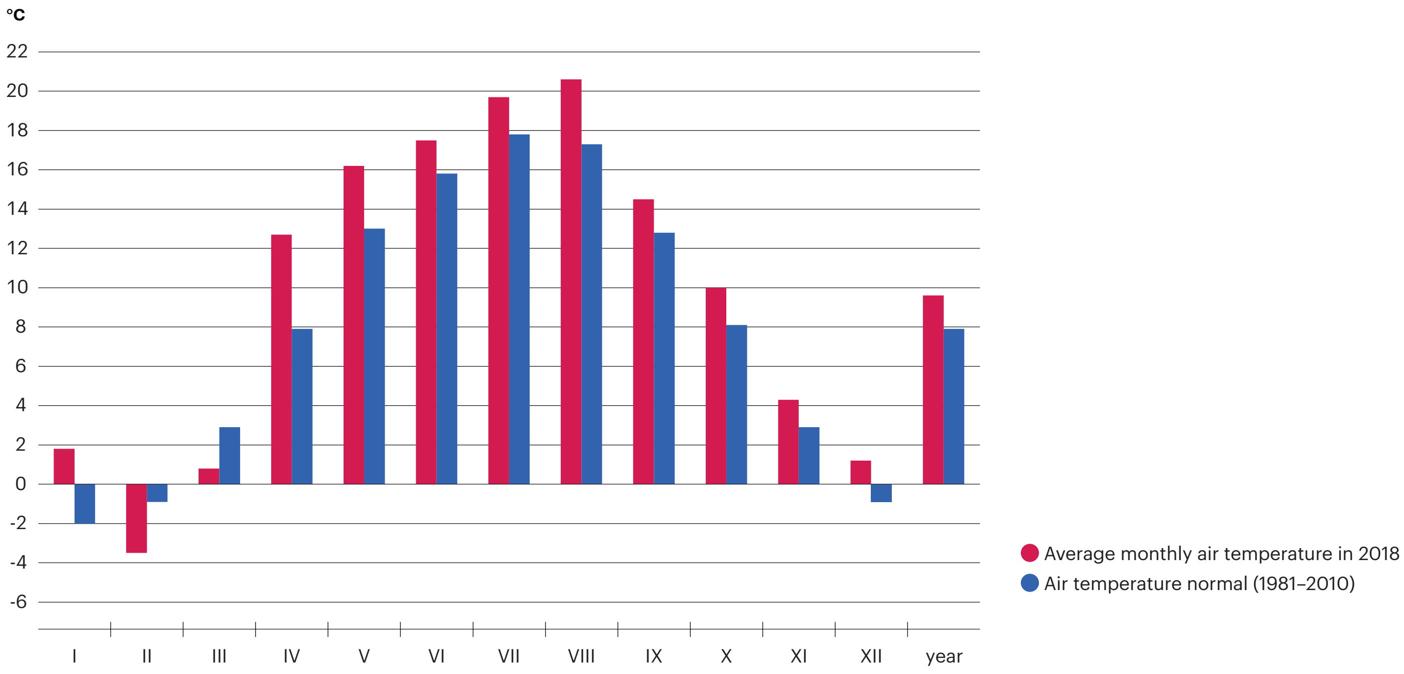
Long-term development of annual average air temperature and annual precipitation totals on the territory of the Czech Republic compared with the long-term normal of 1981–2010, 1961–2018 [°C, %]



Data source: Czech Hydrometeorological Institute

Chart 2

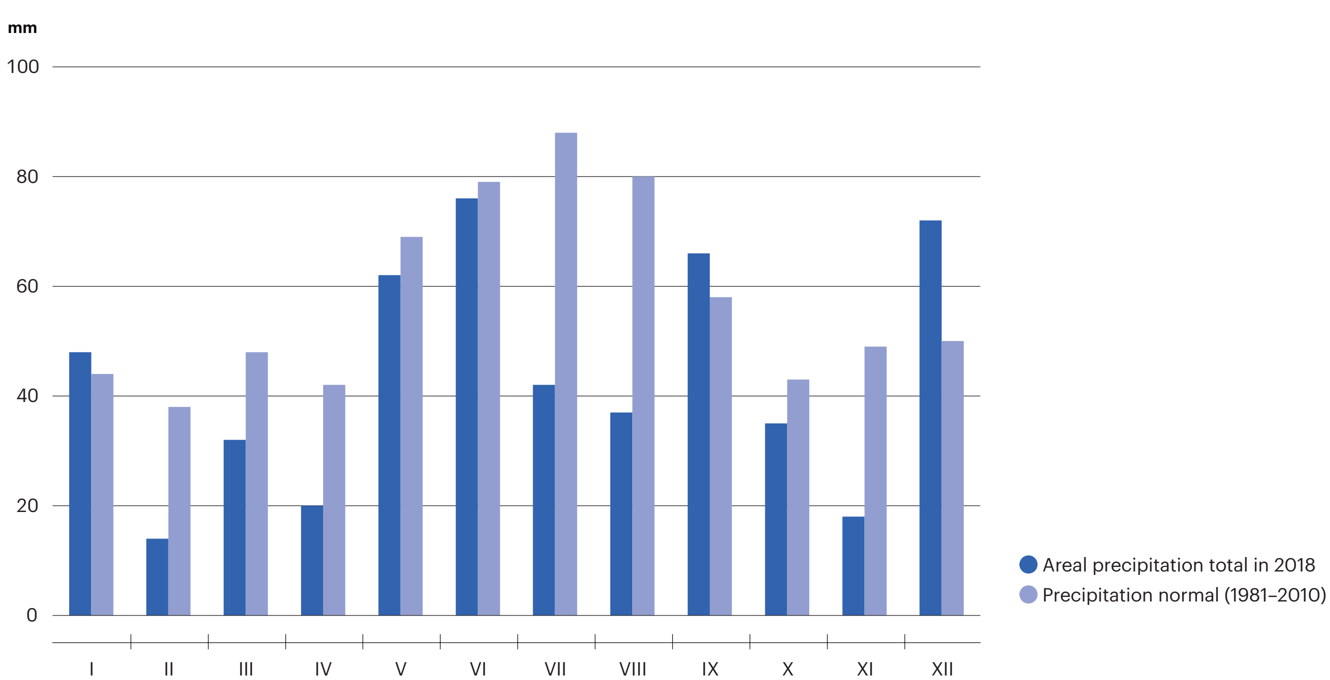
Monthly average air temperature in the Czech Republic territory (areal temperatures) compared with the 1981–2010 long-term temperature normal [°C], 2018



Data source: Czech Hydrometeorological Institute

Chart 3

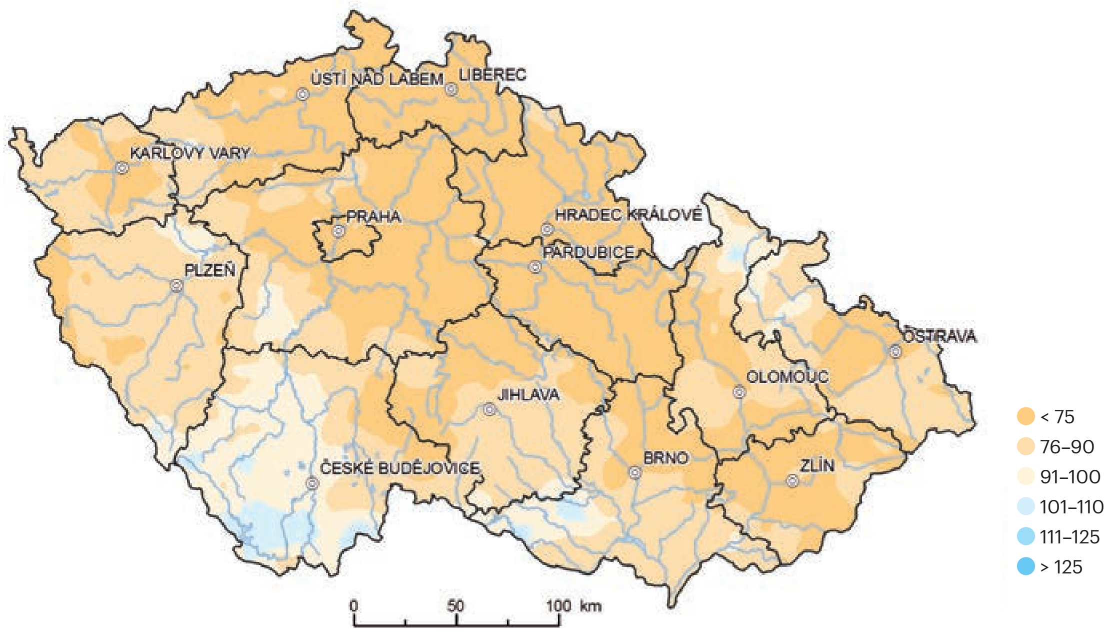
Monthly precipitation totals on the territory of the Czech Republic (areal precipitation) compared with the normal of 1981–2010 [mm], 2018



Data source: Czech Hydrometeorological Institute

Figure 1

Annual precipitation total in the Czech Republic compared with the normal of 1981–2010 [%], 2018



Data source: Czech Hydrometeorological Institute

In terms of **temperature**, the year 2018 was **exceptionally above-normal** on the territory of the Czech Republic, the average annual air temperature of 9.6 °C was higher by 1.7 °C than the long-term normal of 1981–2010 (Chart 1). The year became the **warmest year** in the Czech Republic recorded since 1961. Most of the months of 2018 had a **positive deviation of the average monthly temperature** from normal (see Chart 2). The exceptionally hot months were April (+4.8 °C) and May (+3.2 °C), the months with temperature significantly above normal were January (+3.8 °C), June (+1.7 °C) and August (+3.3 °C). A negative deviation of the average monthly temperature from the normal was recorded only in February (-2.6 °C) and March (-2.1 °C). In terms of temperature extremities, those two months are classified as below-normal in terms of temperature.

The annual average temperature exceeded the normal value in the whole territory of the Czech Republic. The greatest positive deviations from the normal were observed in the belt stretching from the Liberec Region through Eastern Bohemia to South Moravia. The regional breakdown, the highest positive deviation of the average annual temperature from the normal was recorded in the Hradec Králové (+2.8 °C), Liberec (+2.6 °C) and Pardubice (+2.6 °C) Regions, the highest average temperature was in the South-Moravian Region (10.8 °C, i.e. 2.5 °C above the normal of 1981–2010). The coldest Region with the lowest positive deviation from normal (+1.3 °C) was the Karlovy Vary Region in 2018.

The average daily temperature in **January** was mostly above normal. Above-average temperatures continued at the beginning of February, but in the second half of the month it cooled significantly and the coldest period of the year started, continuing still in the beginning of March. Between 25 and 28 February, the average daily temperature was more than 10 °C below the long-term normal. The lowest February temperature, which was the lowest temperature of the whole year 2018, was measured on 28 February at the station Jelení (Karlovy Vary Region), where the minimum daily temperature dropped to -28.8 °C.

The months of **April** and **May** of 2018 were, as a whole, the hottest since 1961. The first summer day came already on 9 April, the first tropical day was recorded on 3 May, when the maximum daily air temperature of 30 °C and higher was measured at several stations in the Ostrava region. The average temperature in the **summer period** of 2018 (June–August) reached 19.3 °C, which was 2.3 °C above the 1981–2010 normal. **Summer 2018**, along with the summer of 2003, was the hottest since 1961. The average daily temperature in the Czech Republic exceeded the normal values for almost the whole of July and August. A markedly warm period, which can be classified as a heat wave, occurred on 24 July, and despite a slight cooling down on 5 and 6 August, it continued on a part of the Czech Republic until 9 August. The highest daily maximum temperature of 38.0 °C in this period, and also in the whole of 2018, was measured on 1 August at the station Husinec, Řež.

Autumn (September–November) as a whole with the average temperature in the Czech Republic of 9.6 °C was 1.7 °C warmer than the 1981–2010 normal. A longer period, when the temperature dropped below normal, occurred only at the turn of

September and October and then in the second half of November. In terms of temperature, December 2018 was classified as above-normal, the average air temperature of 1.2 °C in the Czech Republic was higher by 2.1 °C than the long-term average of 1981–2010.

In 2018, in national average, there were 74 **summer days** (177% of normal) and 19 **tropical days** (233% of normal). The number of summer days is the highest since 1961, the number of tropical days is the third highest after 2015 and 2003. The highest numbers of summer and tropical days were registered in the Polabí and South Moravia regions, with 51 tropical days recorded at the Doksany station. Frost and ice days occurred less than in the normal period, but deviations from the normal were not significant. An average of 103 frost days (89.5% of normal) and 32 ice days (88.9% of normal) were recorded.

In terms of precipitation, the year 2018 in the Czech Republic was **significantly below normal**, the annual rainfall of 522 mm is only 76% of the 1981–2010 normal. Since 1961, a lower total precipitation was recorded only in 2003, namely 504 mm. Precipitation totals in most months of 2018 were below the value of the 1981–2010 normal (Chart 3). November was exceptionally dry, with only 37% of the normal precipitation in the Czech Republic on average. Significantly below-normal precipitation was in April (48% of normal), July (48% of normal) and August (46% of normal), while February (37% of normal) was classified as below-normal. Only the total precipitation in December was assessed as above-normal, with 144% of the precipitation normal.

The lowest precipitation totals compared to the normal were registered in **the north and east of Bohemia** in 2018 (Figure 1). In the Regions of Liberec, Pardubice, Hradec Králové and Ústí nad Labem, less than 70% of the precipitation normal fell in 2018. In the Pardubice, Liberec and Hradec Králové Regions, this is the lowest recorded total annual precipitation since 1961. On the other hand, the highest precipitation compared to the normal fell in the South Bohemian Region (90% of the normal). The above-mentioned distribution of precipitation on the territory of the Czech Republic was caused by uneven distribution of precipitation totals during the year. In February, the lowest precipitation totals compared to normal were measured in the Regions of Liberec (7% of normal), Ústí nad Labem (14% of normal) and Hradec Králové (15% of normal). Also in the summer months of July and August, the driest area was the northern half of Bohemia, where less than 35% of the precipitation normal for the two months fell, while northeast Moravia was richer in precipitation. In September when the precipitation was normal, the wetter part was the east of the Czech Republic, with 140% of the normal falling in Moravia and Silesia, while Bohemia received 100% of the normal. The above-average precipitation in December was the richest in the South Bohemian and Pilsen Regions, where more than 170% of the December normal fell.

Significant precipitation episodes were unique in 2018 and affected only a small territory of the Czech Republic, but caused a discharge response on the rivers with a short-term flood activity level. In the third decade of May, intensive rainfall with storms affected the upper Berounka, the Litavka and the Upper Ohře basins, some of the smaller affected streams reached the 3rd level of flood activity in their peak. On 12 June, heavy rainfall occurred in the Šumava region (the highest 24-hour total of 127 mm was recorded at the Bučina station) as well as the Central Bohemia Region and Prague. The most significant increases in water levels were recorded in the Otava river basin, the 3rd level of flood activity was shortly reached in Rejnštejn, the 2nd level of flood activity was reached on the Rokytka stream in Vysočany and on the Botič stream in Prague-Nusle. At the end of the second decade of July, heavy and long rainfall was recorded in the northeast of the Czech Republic with the highest total on the Lysá hora mountain (153 mm in 24 hours, 230 mm in three days).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

2 | Occurrence of drought, runoff conditions and groundwater status

Key question

How did the temperature and precipitation conditions of 2018 reflect in the amount of surface water and groundwater, i.e. on the water regime of the landscape?

Key messages

In 2018, the Czech Republic suffered a significant drought. At the end of the growing season, the moisture balance of precipitation and evapotranspiration in the driest areas of the Czech Republic dropped below -350 mm; comparing the moisture balance with the long-term average and based on the SPEI, the 2018 drought was exceptional to extreme. At the end of August, the values of water reserves in the soil fell below the critical value of 10% of available water capacity in most of the Czech Republic, with the exception of mountain locations.
A mild to extraordinary drought in 2018 manifested itself continuously from April to December on most shallow wells and springs.

Overall assessment of the trend

Change since 1990

Change since 2000

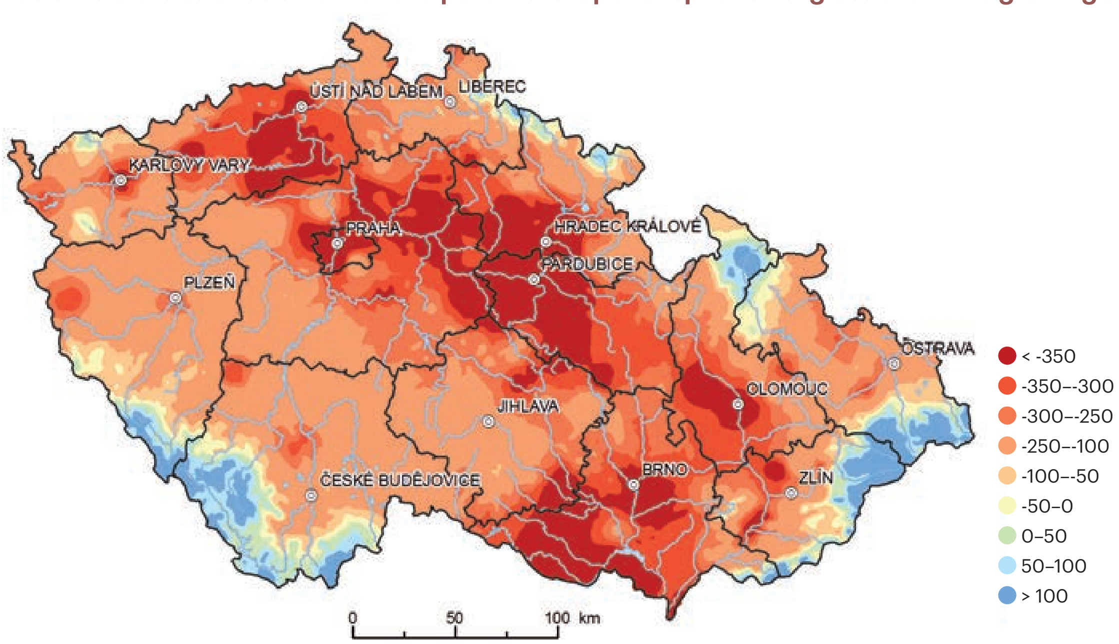
Change since 2010

Last year-on-year change

Indicator assessment

Figure 1

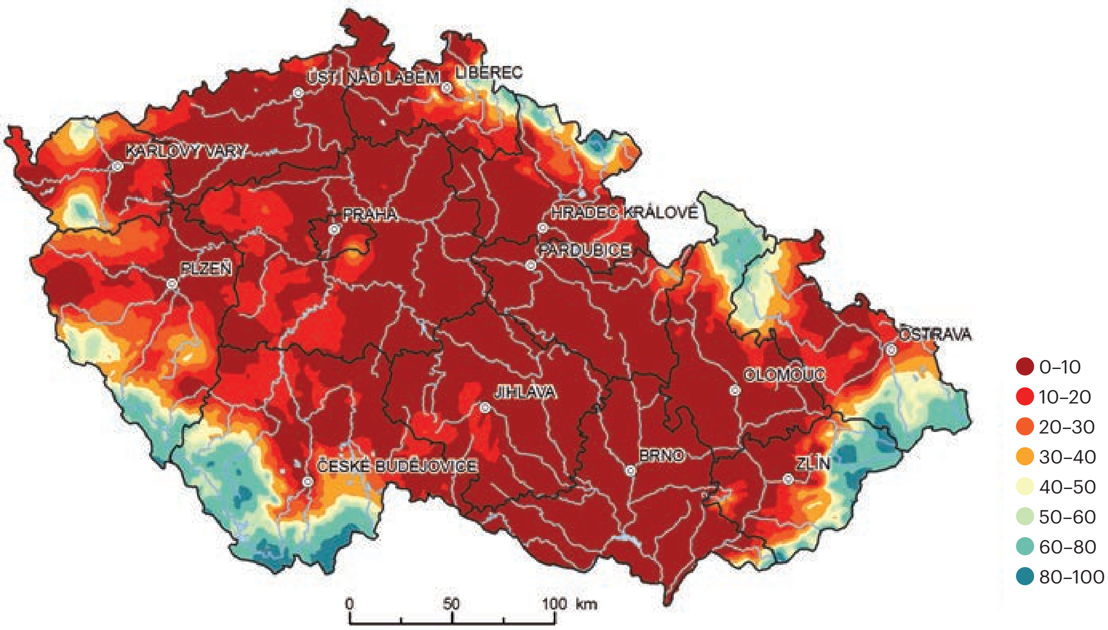
Basic moisture balance of rainfall and potential evapotranspiration of grassland in the growing season 01.04.–30.09.2018 [mm]



Data source: Czech Hydrometeorological Institute

Figure 2

Available water capacity in soil (AWC = 170 mm.m^{-1}) – current state of the modelled value as of 19 August 2018 [% of AWC]

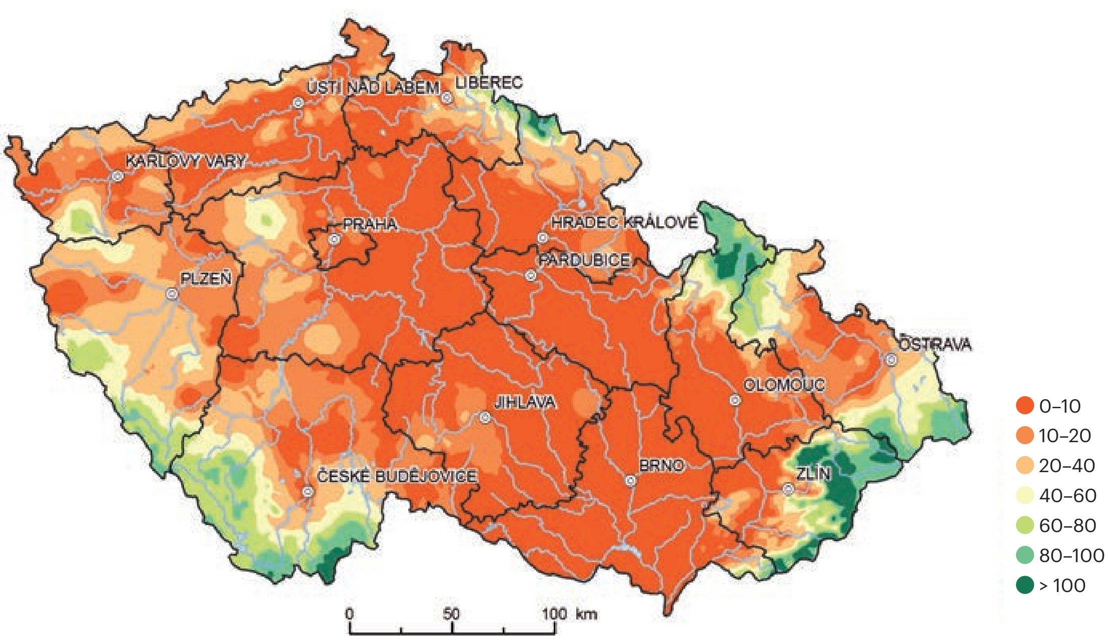


The date of 19 August was chosen because the drought culminated.

Data source: Czech Hydrometeorological Institute

Figure 3

Available water capacity in soil (AWC = 170 mm.m^{-1}) – comparison in % with long-term average of 1961–2010 as of 19 August 2018 [%]

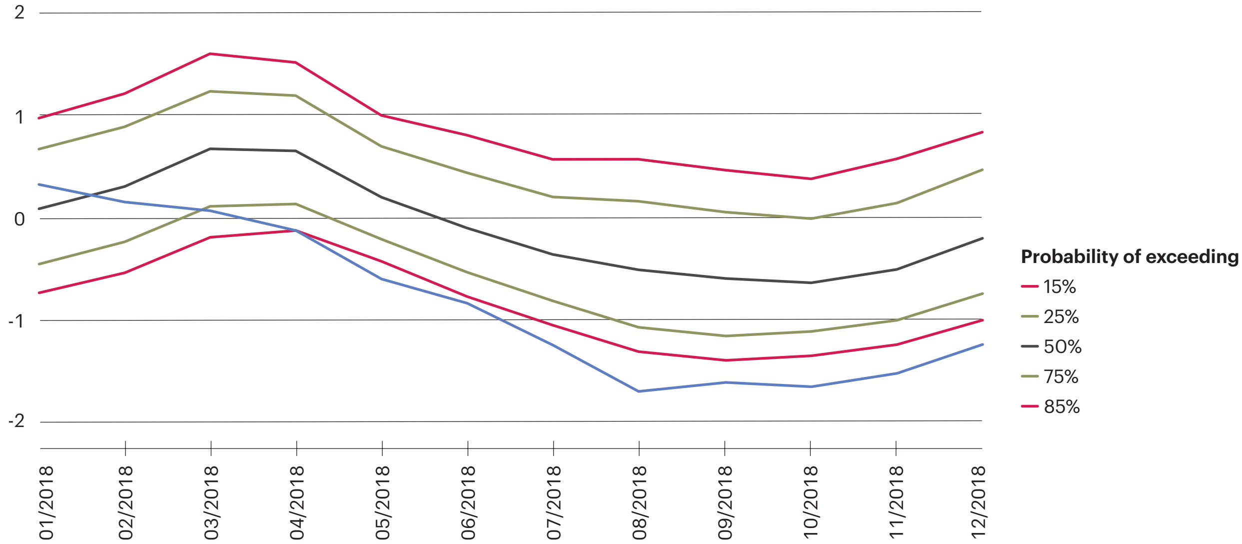


The date of 19 August was chosen because the drought culminated.

Data source: Czech Hydrometeorological Institute

Chart 1

Average standardized level of shallow wells of the reporting network for the whole Czech Republic in 2018 (in blue) compared to long-term monthly values of 1981–2010

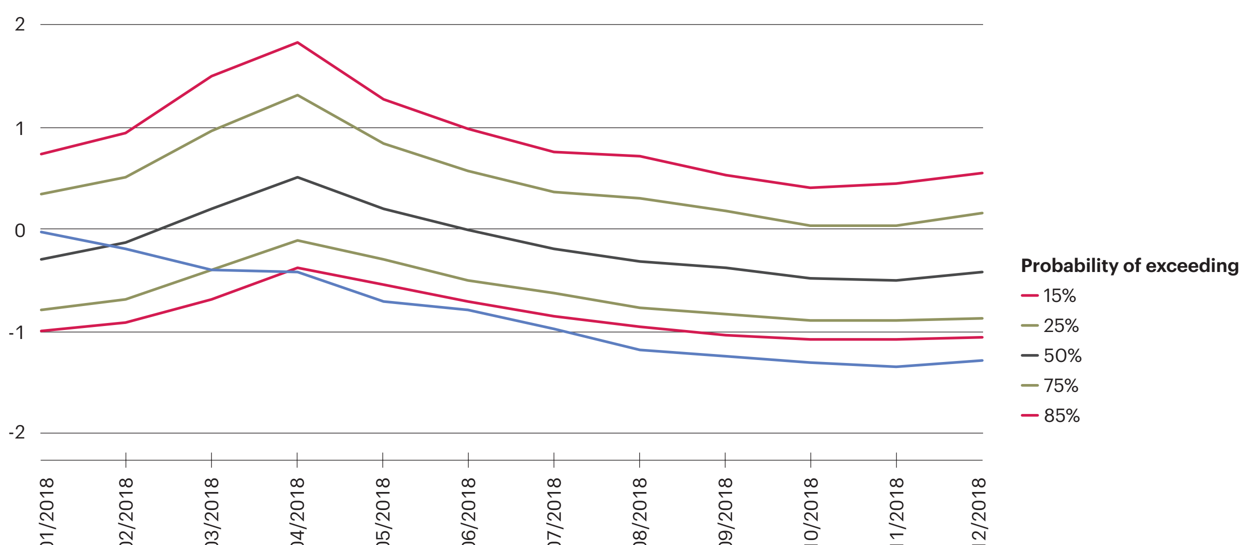


Average standardized level of shallow wells of the reporting network for the whole Czech Republic in 2018 (in blue) compared to long-term values of the 1981–2010 period. The vertical axis represents the standard deviation. The probability of exceeding 50% is in black, 25% and 75% in green and 15% and 85% in red.

Data source: Czech Hydrometeorological Institute

Chart 2

Average standardized yield of springs in the reporting network for the whole Czech Republic in 2018 (in blue) compared to long-term monthly values of 1981–2010

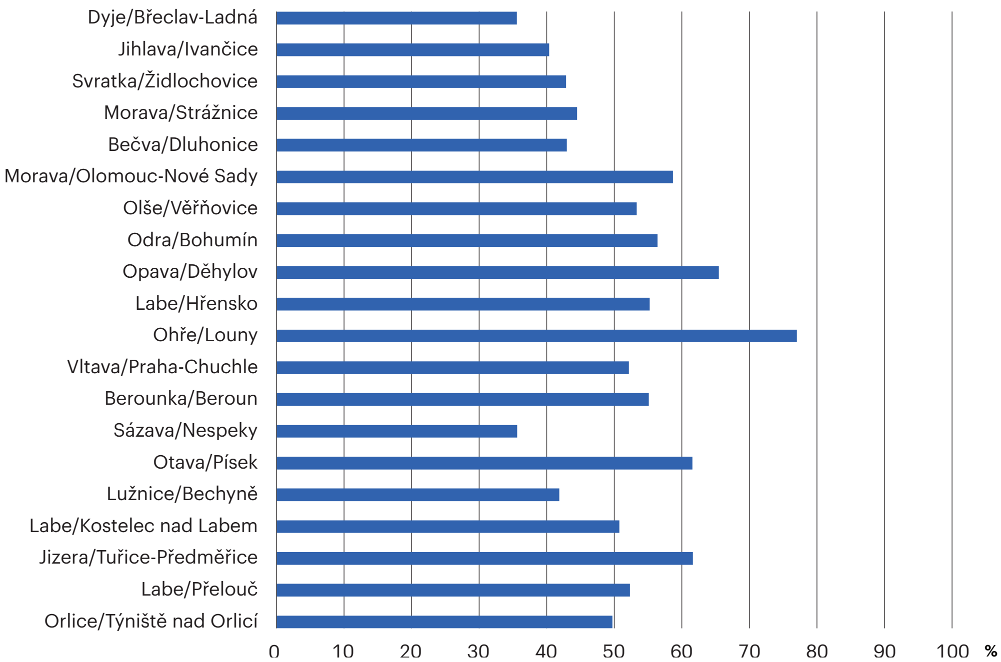


Average standardized yield of springs in the reporting network for the whole Czech Republic in 2018 (in blue) compared to long-term values for the 1981–2010 period. The vertical axis represents the standard deviation. The probability of exceeding 50% is in black, 25% and 75% in green and 15% and 85% in red.

Data source: Czech Hydrometeorological Institute

Chart 3

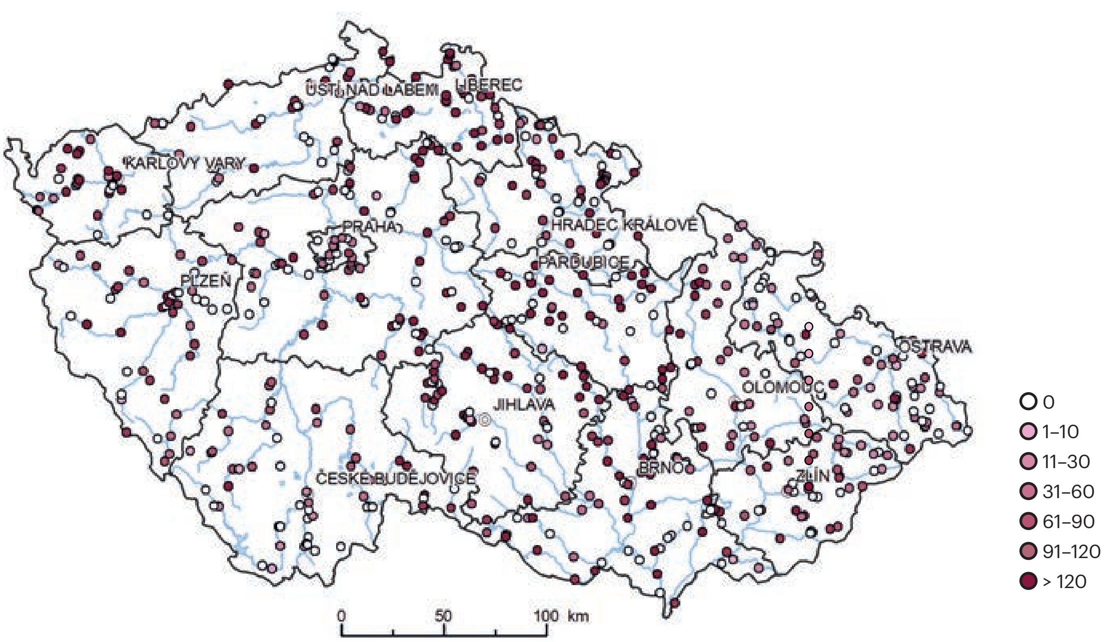
Average annual flow rates in comparison with the long-term averages for the period 1981–2010 [%], 2018



Data source: Czech Hydrometeorological Institute

Figure 4

Flow rate lower than the long-term 355day flow rate for the period 1981–2010 [number of days], 2018



Data source: Czech Hydrometeorological Institute

The combination of significantly above-average temperatures and lack of precipitation led to the development of **climatological and subsequently soil and hydrological drought** in 2018. Since the end of the exceptionally warm April, the negative moisture balance, i.e. the balance of precipitation and potential evapotranspiration, was deepening. This markedly negative development of the balance continued until the end of August. The worst affected were the areas of Polabí and south Moravia. At the beginning of September, there was a slight improvement in the balance in South Moravia and Haná, but the decline in the moisture balance values persisted in Poohří (along the Ohře river) and strongly also in Polabí, with continued drought. In total, for the growing season (April–September), the moisture balance in Polabí, the South Moravian Region and the Haná region decreased at places even below -350 mm (Figure 1), the moisture deficit thus reached 350 $l.m^{-2}$. Compared to the long-term average, the balance value was more than 150 mm lower at the end of summer in most of the Czech Republic. At the end of 2018, the moisture balance deviated from the normal below -200 mm in more than two thirds of the territory of the Czech Republic; these were extremely below-normal values.

According to the values of the internationally used **standard precipitation evapotranspiration index** (SPEI) measuring the extremity of climatological drought, the drought in the growing season (April–September) of 2018 can be classified as extreme; SPEI-6 for the growing season reached -2.1 in national average. Monthly SPEI-1 values indicated drought occurrence in all 6 months of the growing season, the highest drought extreme was recorded in April (SPEI-1 was -2.5, i.e. extreme drought) and in August (-2.0, i.e. between exceptional and extreme drought).

That development in the moisture regime was reflected in the decreased **water reserves in the soil**. By the end of June 2018, soil moisture levels in most of the Czech Republic had fallen below 50% of available water capacity (AWC), in agricultural areas of South Moravia and Haná even below 30% of AWC, indicating significant water stress for plants. During July and August, the decrease in soil moisture reserves continued and at the end of August it reached **critical levels below 10% of AWC** in most areas, except for mountain locations (Figure 2). In comparison with the long-term average, by the end of summer 2018, the available water capacity in the soil was below 20% of the long-term normal of 1961–2010 in the vast majority of the territory of the Czech Republic (Figure 3), it was a significantly below-normal state. The situation in Moravia improved during September, while the situation in Bohemia, mainly in the northern half, remained unchanged with critically low water reserves in the soil. Even in Moravia, the water reserves in the soil decreased again in October, when values below 20% of AWC were indicated in most of the Czech Republic. The situation began to improve significantly only in December.

As regards groundwater levels, 2018 was exceptionally below-normal. The accumulation of the rainfall deficit since 2014 has contributed to the relatively rapid decline in groundwater levels already from the beginning of the evaluated year 2018. Below-normal levels in **shallow wells** were apparent since the spring when the groundwater level usually reaches its maximum. At the end of April, the levels of almost half of the shallow wells were at around 85% of the probability of being exceeded (i.e. at the level of severe drought), Chart 1. In 2018, a number of the monitored wells reached historical lows of groundwater levels for the observation period. The highest occurrence of the historically lowest levels was in August, when the below-normal level was reached in 42% of the shallow wells. The yield in the **springs** was also below-normal since April, it then decreased to varying intensities during the year, being the most critical in November and December, when 75% of the springs had yield at a significantly or exceptionally below-normal level (Chart 2). Water levels in **deep wells** were normal at the beginning of the year, drought began to be felt in March, more markedly in April, when 8% of deep wells were exceptionally below-normal and 11% of wells were significantly below-normal, 14% were slightly below-normal.

The **average annual flow rate** did not reach 100% of the long-term average of 1981–2010 in any of the selected profiles in 2018 (Chart 3). The most critical situation was in the Dyje and the Morava basins. The lowest flow rates were recorded in the profiles Břeclav-Ladná (the Dyje river) and Nespeky (the Sázava river), where they reached only 36% of the long-term average. The highest flow rate compared to the long-term normal was measured on the Ohře river in Louny, reaching only 77% of the long-term normal. During the year, the flow rates varied significantly in the individual months. The worst situation was in July, when many rivers did not even reach 30% of long-term average monthly flow rates, e.g. the Lužnice in Bechyně reached only 6%, the Morava in Strážnice 13% and the Sázava in Nespeky 11% of long-term average values of 1981–2010. On some rivers, the flow rates reached the lowest levels observed to date, e.g. on the Smědá, the Jizera, the Sázava or the Morava. Significant drought was recorded in some parts of the Czech Republic also when monitoring the **flow rate of less than Q_{355}**, that is, one that is reached or exceeded on 355 days a year on average, and is important for maintaining the basic water management and ecological functions of the watercourse and its deficit is known as hydrological drought (Figure 4). The worst situation was on the Bělá watercourse (Velký Řečkov-Malá Bělá), where the number of days on which the flow rate was lower than Q_{355}, was 363 days, and on the Karvinský brook (Dětmarovice), where that number was 362 days.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

3 | Greenhouse gas emissions

Key question

Is the development of greenhouse gas emissions in the Czech Republic heading towards meeting national objectives and international commitments?

Key messages

Greenhouse gas emissions in the Czech Republic declined by 35.1% in the period 1990–2017[1] and by 0.9% year-on-year. Emissions from the energy industry dropped significantly year-on-year. The Czech Republic contributes to the common EU objective within the 2nd commitment period of the Kyoto Protocol. The target of the Climate and Energy Package and State Environmental Policy 2012–2020 for emissions outside the EU-ETS is being met, with an increase of 1.1% in the period 2005–2017, which is below the target of maximum 9% increase by 2020.

Greenhouse gas emissions from transport have risen by 53.8% since 2000, growing steadily. F-gases emissions produced from the use of products replacing freons are increasing sharply, during the period 2012–2017 they more than doubled. In the comparison of 2016 and 2017, the emission removals in the LULUCF sector decreased significantly.
Despite the decreasing trend in emissions, the Czech Republic has not yet met the common EU target resulting from the climate-energy package and State Environmental Policy 2012–2020 for emissions from installations falling under the EU-ETS system. Between 2005 and 2018, emissions fell by 18.9%, while the target is 21% by 2020. Similarly, the reduction target of the Czech Republic's Climate Protection Policy up to 2020 is also not met with a significant margin.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

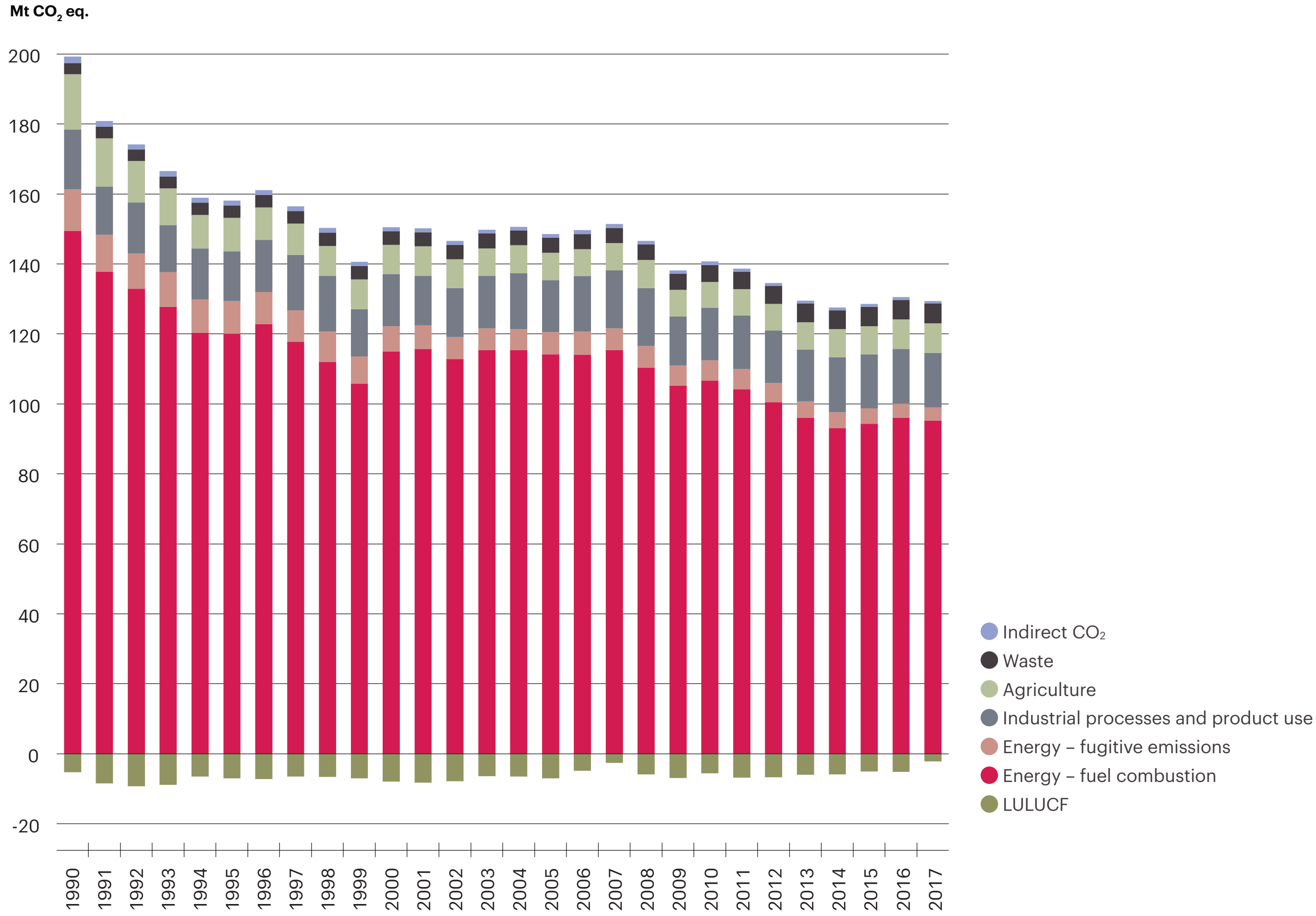
Last year-on-year change

[1] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Chart 1

Development of aggregated greenhouse gas emissions in the Czech Republic by sector [Mt CO_2 eq.], 1990–2017

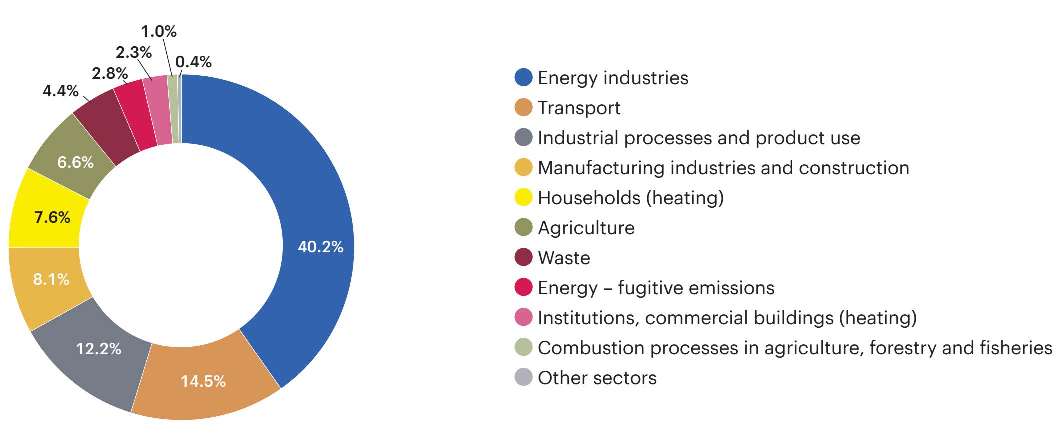


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

Chart 2

Structure of aggregated greenhouse gas emissions by source category, excluding LULUCF and indirect CO_2 [%], 2017

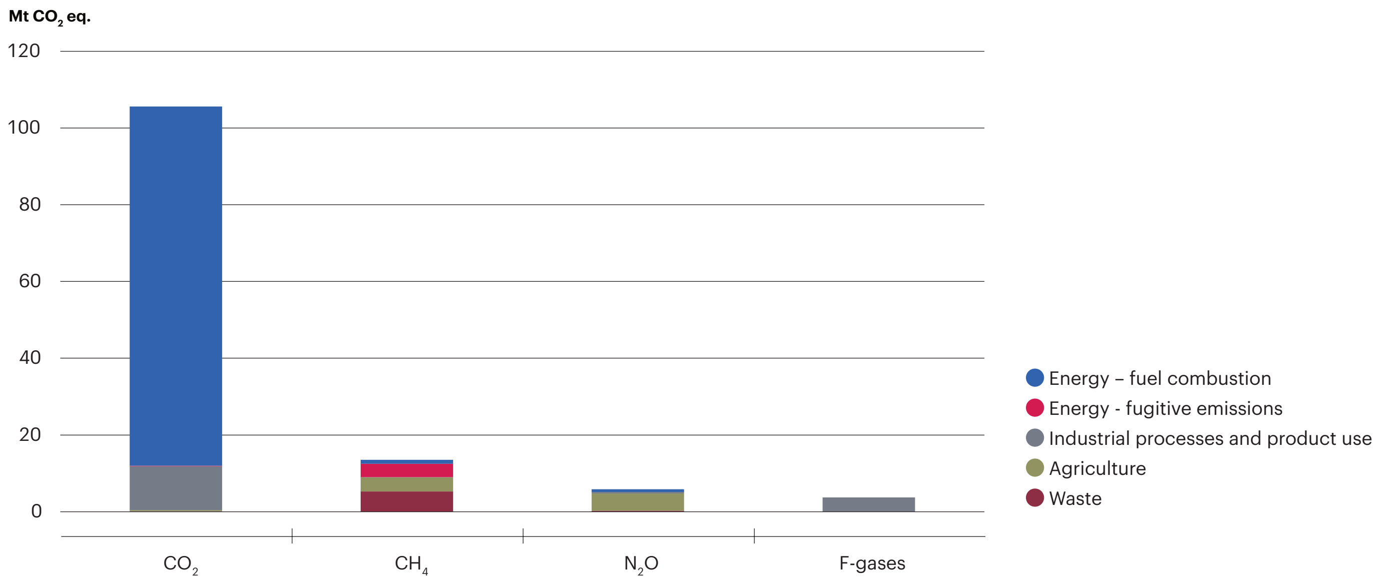


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

Chart 3

Emissions of the individual greenhouse gases by main category of source, excluding LULUCF and indirect CO_2 [Mt CO_2 eq.], 2017

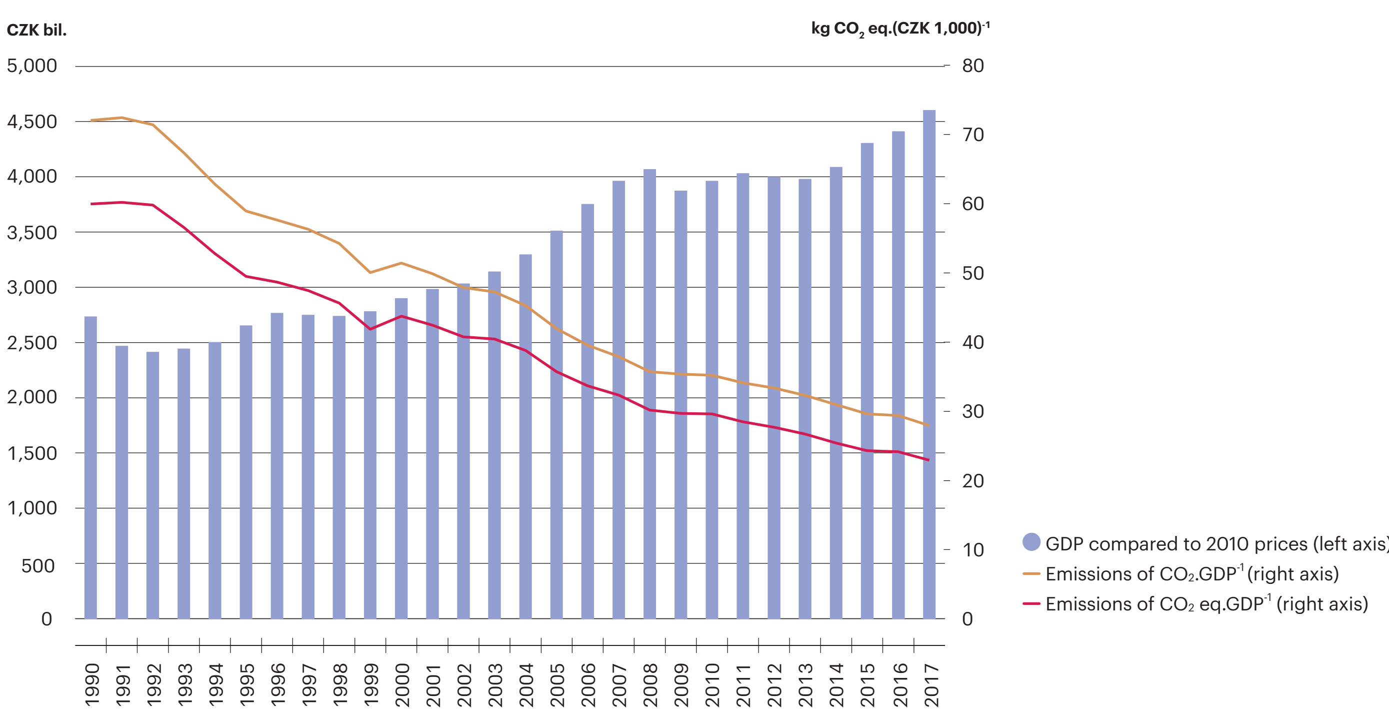


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

Chart 4

Evolution of the emission intensity of the economy of the Czech Republic [kg CO_2 eq.(CZK 1,000)$^{-1}$ compared to 2010 prices] and GDP [CZK bil. compared to 2010 prices], without the LULUCF sector and indirect CO_2, 1990–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute, Czech Statistical Office

Total aggregate greenhouse gas emissions in the Czech Republic in 2017[2] totalled 129.4 Mt CO_2 eq. (without LULUCF and indirect CO_2), which corresponds to a reduction by 35.1% against 1990 and by 0.9% against 2016 year-on-year (Chart 1). Since 2005, the baseline for the objectives of the **Climate Protection Policy of the Czech Republic**, aggregated emissions fell as of 2017 by 12.9% (19.2 Mt CO_2 eq). The reduction target of the Climate Protection Policy for 2020 (a decrease of 32 Mt compared to 2005, i.e. to 116.5 Mt CO_2 eq.) has not yet been met. Emissions after 2005 fluctuated depending on economic development, after 2013, i.e. in the period of economic growth (cumulative GDP growth in 2013–2017 reached 15.6%), emissions have stagnated.

Given the significant year-on-year reduction **in LULUCF** emission removals (from -5.2 Mt CO_2 eq. in 2016 to -2.1 Mt in 2017, the lowest since 1990), aggregated net emissions including LULUCF grew in 2017 by 1.6% year-on-year. The lower emission removals in LULUCF, and thus the lower carbon storage in biomass, were due to high timber harvesting in 2017, which was mainly caused by salvage bark-beetle logging and logging after windfalls.

The development of greenhouse gas emissions broken down by source category is characterized by a **continuous increase in transport emissions**. This growth reflects an increase in energy consumption in transport as a result of growth in the transport sector and the continued dependence of transport on fossil energy sources. Since 2000, emissions from transport have risen by 53.8% and in 2017 year-on-year by 2.8% (0.5 Mt CO_2 eq.). **Waste emissions** have also been on the rise (by 46.6% since 2000), particularly landfill emissions are growing. The greatest growth dynamics are seen in emissions of **F-gases** which are used to replace the banned freons previously used as propellants in sprays and refrigeration equipment. In the period 2000–2017, F-gas emissions increased approximately eight times, in the last 5 years of the period under review (2012–2017) by 132.0%.

Emissions from the **energy industry** depend on the structure of the energy mix and fluctuate according to electricity and heat consumption in a given year. Since 2000, emissions from this sector have decreased by 16.6%, in 2017 year-on-year by 4.9% (2.7 Mt CO_2 eq.). The significant decrease in emissions from the energy industry in 2017 was affected by a decrease in the consumption of solid fossil fuels for electricity and heat production, by 5.5% (24.9 PJ) year-on-year. Emissions from combustion processes in **manufacturing and construction** have had a downward trend since 1990 and also after 2000 (by 55.5% between 2000 and 2017), but in 2017 they increased year-on-year in response to industrial production growth by 9.9% (0.9 Mt). **Fugitive emissions** from mining and transport of fuels also have a downward trend; they decreased by 49.0% in the period 2000–2017 and by 9.8% year-on-year. The development of fugitive emissions is influenced by the decline in coal mining.

The largest **sources of greenhouse gas emissions** in 2017 were the energy industry (40.2% of aggregate emissions without LULUCF) and transport (14.5%), Chart 2. In 2017, fuel combustion generated 74.1% of aggregate emissions. In the **structure of aggregated greenhouse gas emissions** in 2017 (excluding LULUCF and indirect CO_2), the share of CO_2 was 82.1%, CH_4 10.5%, N_2O 4.5% and F-gases 2.9%. The predominant source of CO_2 emissions was combustion of fossil fuels (88.6% in 2017), Chart 3. The largest share of CH_4 emissions was generated by waste management (38.9%) and agriculture (27.2%) which is the source of 76.7% of

[2] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

N_2O emissions. The shares of greenhouse gases in total aggregated emissions do not change significantly over time, with the exception of F-gases, whose share increased by 2.5 p.p. in the period 2000–2017.

Total verified greenhouse gas emissions from stationary industrial and energy establishments covered by **the EU-ETS** (European Union Emission Trading Scheme) decreased in the period 2005–2018 by 18.9% (15.5 Mt CO_2 eq.) to 66.9 Mt CO_2 eq. The installations in the EU-ETS thus make a significant contribution to reducing total greenhouse gas emissions. However, the Czech Republic has not yet met its common EU target resulting from the EU **Climate and Energy Package**, which is to reduce emissions in the EU-ETS by 21% by 2020. The target set for the Czech Republic for emissions **outside the EU-ETS** (maximum increase of 9% by 2020 compared to 2005) is being met; in the period 2005–2017 the emissions outside EU-ETS grew only by 1.1%.

In 2018, emissions in the EU-ETS fell by 0.8% year-on-year, accounting for 51.8% of total emissions reported in the emission inventory in 2017. The category with the largest share in total emissions under the EU-ETS is combustion of fuels (especially the energy industry and combustion processes in the manufacturing industry) with the share being 79.1% in 2018, the second most important category is the iron and steel production (8.7%).

The **emission intensity of the GDP generation** in the Czech Republic is decreasing. The specific emissions per unit of GDP decreased in the period 1990–2017 to less than a half (by 61.3%). Since 2000 they decreased by 45.7% and in 2017 they decreased year-on-year by 5.0% to 27.9 kg CO_2 eq.(CZK 1,000)$^{-1}$ compared to 2010 prices (Chart 4). The development in the emission intensity is linked to a downward trend in energy and material intensity of the Czech economy.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

Climate system in the global context

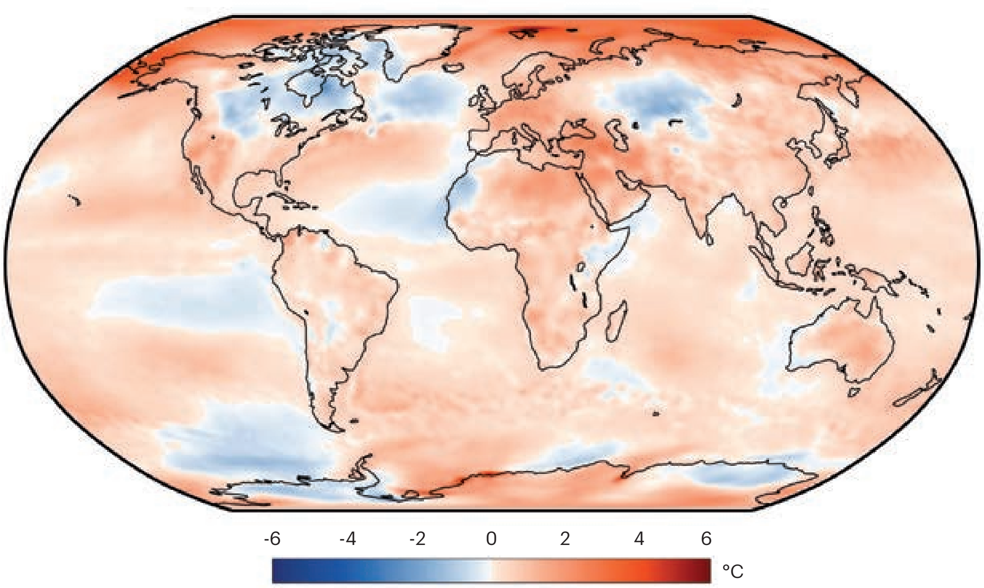
Key messages

- Year 2018 was, from the global perspective, the 4th hottest in the history of observation. All the past four years of the 2015–2018 period were among the warmest globally.
- The greatest positive deviations of average annual temperature from normal were observed in the northern polar regions in 2018. Europe also had the average annual temperature well above normal – in the Czech Republic, Germany or France, 2018 was the hottest in observation history.
- In Europe, 2018 was a very dry year. The greatest drought extremity in the summer months was observed in northern Europe.
- Greenhouse gas emissions per capita and per unit of GDP in the Czech Republic are above average in European comparison. In 2017[3], the emission intensity of the Czech economy was by 61.2% higher than the EU28 average.

Indicator assessment

Figure 1

Distribution of the annual average air temperature expressed as deviation from the normal period 1981–2010 [°C], 2018

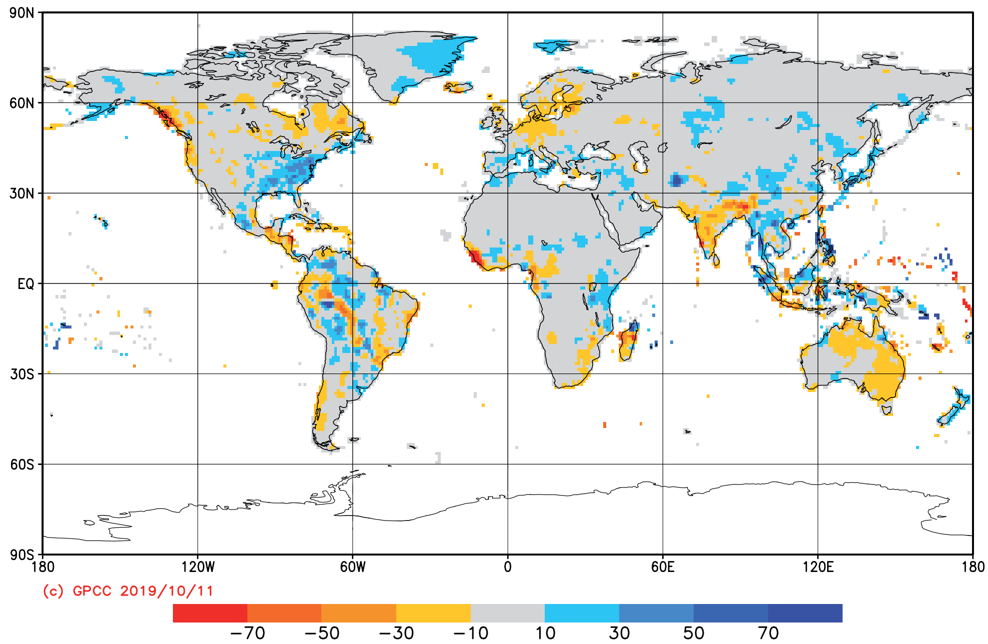


Data source: Copernicus Climate Change Service, ECMWF

[3] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Figure 2

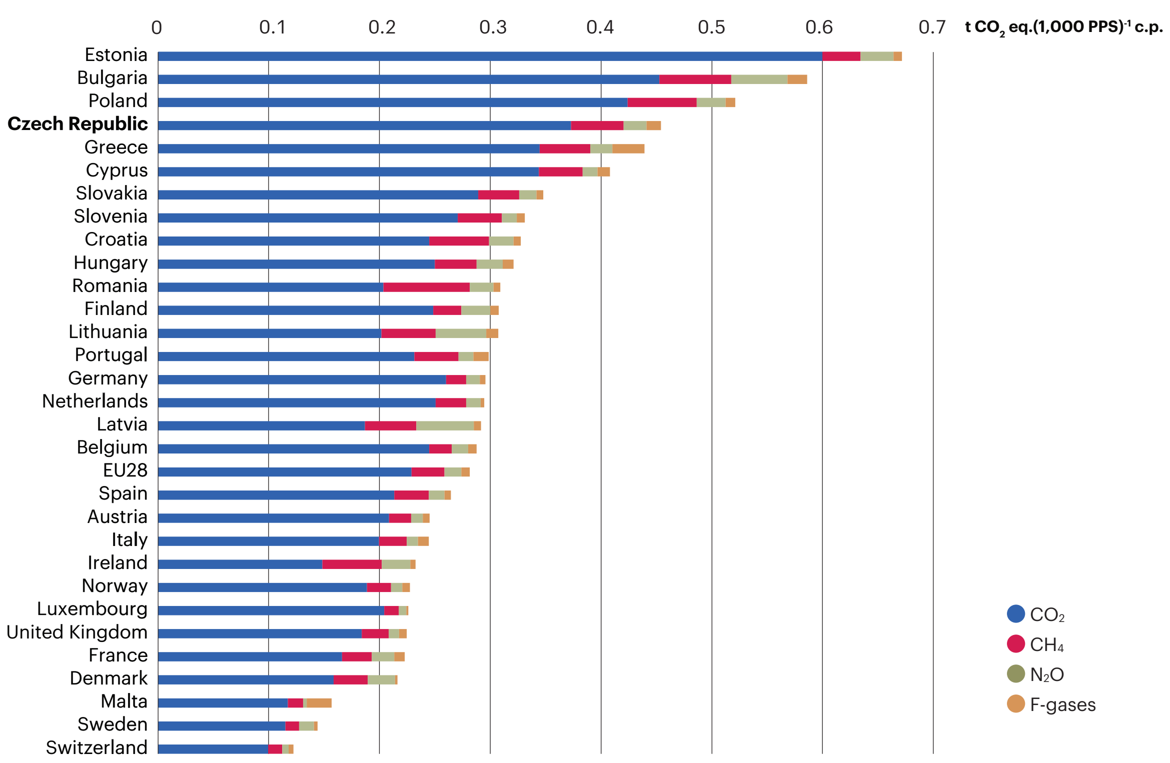
Deviation of annual precipitation in 2018 from average precipitation for the period 1951–2000 [mm.month[-1]]



Data source: Global Precipitation Climatology Centre, Deutscher Wetterdienst (DWD)

Chart 1

Emission intensity of GDP generation, without LULUCF [t CO_2 eq.(1,000 PPS)[-1]], 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency, Eurostat

According to the WMO Report on Global Climate, the **global annual average temperature of the Earth's surface** (land and ocean surface) in 2018 was 0.99 °C higher compared to the pre-industrial period, which is considered to be the period 1850–1900. This deviation ranks 2018 as the **4th hottest year** in instrumental observation history right after the previous three years 2015–2017 which were globally among the hottest since the beginning of observation.

The **year 2018 was above-average warm** on most of the Earth's surface, except for North America, it was among the 10 warmest years in observation history on all continents. The highest positive deviations of average annual temperature from normal were recorded in the Arctic, where temperature anomalies exceeded +2 °C and locally even +3 °C (Figure 1). However, even at lower latitudes, in a belt extending across Europe to the northeastern part of Africa, the Middle East and South Asia, it was exceptionally warm. Several countries in that area, including the Czech Republic, Germany and France, registered the hottest year in the history of observation. Other very warm areas were the southwest of the USA, the eastern part of Australia and New Zealand. In contrast, areas with below-average annual temperatures were territorially delimited and included the northeast of Canada, the west coast of Greenland, central Asia, the west of North Africa, and a part of the west coast of Australia where negative deviations from normal were not so significant.

Also in 2018, significant positive and negative **deviations of annual precipitation from climatological normal** were recorded. Significantly above-normal precipitation, at places above the 90th percentile of annual rainfall, occurred in north and east Africa, the Arabian Peninsula, central and southeast Asia, and southwest Australia, New Zealand, and the eastern part of the USA. On the other hand, drought and lower rainfall than usual, even below the 10th percentile, were registered on the north and east coasts of the Arabian Sea, the northeast of the Caspian Sea, and in the central and eastern part of Australia. Rainfall deficits were also observed in central and northern Europe, Argentina and in the south of the African continent.

The development of temperature and precipitation conditions in 2018 was characterized by considerable **extremity**. Extraordinary heat and drought was registered in central and southern Scandinavia, where Norway and Finland experienced the hottest July ever, the rainfall in southern Sweden in the months of May–July was the lowest since 1748. In Denmark, too, the months of May to July were historically the hottest and driest. A significant heat wave affected central and western Europe at the turn of July and August. In France, this heat wave caused up to 1,500 premature deaths, in Germany in the Frankfurt am Main region, a continuous period of 18 days with the maximum temperature above 30 °C was recorded.

Atmospheric greenhouse gas concentrations continue to rise, with CO_2 concentrations of 405.5 ppm, CH_4 reaching 1,859 ppb and N_2O 330 ppb in 2017[4], representing respectively 146%, 257% and 122% of the pre-industrial concentration levels. Global anthropogenic greenhouse gas emissions reached 53.5 Gt CO_2 eq. in 2017 and grew by 0.7 Gt (1.3%) year-on-year. The largest share of global anthropogenic emissions consisted of CO_2 emissions from fuel combustion, which in 2017 amounted to 36.1 Gt CO_2.

Total **aggregate greenhouse gas emissions** in the EU28 (without LULUCF and including indirect CO_2) decreased in the period 1990–2017 by 24% (1,354.8 Mt CO_2 eq.) to 4,291.3 Mt CO_2 eq. Germany and the United Kingdom contributed the most to the emission reduction during this period, accounting for approximately one third of the total EU28 emissions, which together reduced emissions by 656.0 Mt, which is almost half of the emission reduction across the EU28. In relative terms, however, the largest emission reductions in the period 1990–2017 (over 50%) were recorded by the new EU Member States (Latvia, Lithuania, Romania). In a year-on-year comparison, total emissions in the EU28 increased slightly by 0.5%; the evolution of emissions was affected by their growth in transport, which has continued for 4 years in a row.

Greenhouse gas emissions per capita in the Czech Republic (12.2 t CO_2 eq.capita^{-1}) were 47.1% above the average of the entire EU28 in 2017. The **emission intensity of the economy** of the Czech Republic was in 2017 the fourth highest in the EU28 (Chart 1), it exceeded the European average by 61.2%. The emission intensity of individual countries depends on the share of emission-intensive sectors (industry and its material and energy-intensive sectors), on GDP generation and on the energy mix. Countries with high extraction and consumption of fossil fuels have a very high intensity of GDP generation (Estonia, Poland), economically strong countries whose energy is based on non-fossil sources such as France and Austria have lower emission intensity.

[4] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*


2
Air quality

Air quality

The air quality is one of the fundamental components of the environment, the quality of which affects human health, natural ecosystems, and also the other components of the environment.

The concentrations of air pollutants are affected in particular by local combustion heaters, transportation and industrial and energy production, but are also dependent on the weather conditions. Local factors are also of significant influence, in particular, the topography of the territory and cross-border transport of pollution.

The main air pollutants in the Czech Republic include total suspended particles (TSP), distinguished as suspended particulate matter (PM) at the size fraction of PM_{10}, $PM_{2.5}$ and PM_1, sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and ammonia (NH_3).

Suspended particulate matter with fraction PM_{10}, $PM_{2.5}$ and PM_1 belong among the most serious pollutants in relation to human health in the long term. The suspended particulates are bound to polycyclic aromatic hydrocarbons, expressed by benzo(a)pyrene. The severity of the exposure of the population to a mixture of suspended particulates depends on the concentration of suspended particles, their size, shape, and chemical composition. The effects of short-term increased daily concentrations of suspended particulate matter in all PM fractions include an increase in overall morbidity and mortality, particularly cardiovascular diseases, an increase in respiratory diseases, infant mortality and in problems of asthmatics. Ultra-fine particles (size of 1–100 nm) can penetrate even into the blood stream, from where they can further get into all the organs. Moreover, carcinogenic effects have been proven for benzo(a)pyrene. Ground-level ozone is another substance that negatively affects human health and ecosystems. In humans, it harms the respiratory system and in particular irritates the respiratory tract, in the case of vegetation, the ground-level ozone negatively affects the assimilation organs of plants and affects their production capability. The high concentrations of NO_x and SO_2, VOCs and CO cause breathing problems, worsen asthma, and are associated with an increase in the overall, cardiovascular and respiratory mortality, they also negatively affect the nervous system. The impact of heavy metal emissions consists in their toxic, mutagenic, and carcinogenic properties and in their ability to accumulate in the individual environmental media and in living organisms.

References to current conceptual, strategic and legislative documents

7th Environmental Action Programme until 2020
- the achievement of a level of air quality that does not have significant negative impacts or poses a risk to human health and environment

European Commission's package with the title "A Clean Air Programme for Europe"
- the achievement of the air quality in accordance with valid European legislation no later than before 2020 throughout the EU territory
- a significant reduction in emissions by 2030 from sources of pollution and thus achieving a decrease in the values of the background concentrations towards values recommended by the WHO

Directive of the European Parliament and of the Council (EU) 2016/2284 to reduce national emissions of some air pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
- commitments of Member States to reduce anthropogenic emissions of SO_2, NO_x, VOCs, NH_3 and $PM_{2.5}$ and the requirement for the preparation, adoption and implementation of national programmes for reducing air pollution, as well as the monitoring of emissions of the above substances and of emissions of other pollutants

Directive of the European Parliament and of the Council (EU) 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plants
- establishment of rules for the reduction of emissions of SO_2, NO_x and dust into the air from medium-sized combustion sources with the objective to reduce the amount of emissions into the air and reduce the possible risks arising from these emissions to human health and the environment

Directive of the European Parliament and of the Council 2010/75/EU on industrial emissions (integrated pollution prevention and control)
- reducing industrial emissions of the EU on the basis of an integrated authorisation

Directive of the European Parliament and of the Council 2008/50/EC on ambient air quality and cleaner air for Europe
- demarcating zones and agglomerations for the purpose of assessing air quality
- assessment of ambient air quality in the specified zones and agglomerations for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particles (PM_{10} and $PM_{2.5}$), lead, benzene and carbon monoxide
- taking measures to reduce $PM_{2.5}$ exposure
- ensuring public information on air quality

Directive of the European Parliament and of the Council 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
- introducing a target value for the concentration of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air in order to avoid, prevent or reduce the harmful effects of arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons on human health and the environment in general
- providing information to the public on the concentration and deposition of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons

Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- prevention of the spread of transboundary air pollution on long distances

Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (the Gothenburg Protocol)
- reduction of the number of days with high ozone concentrations to a half and a subsequent reduction of the effects of ground-level ozone on human health
- establishment of new emission ceilings for the year 2020 set as a percentage reduction in emissions compared to the state in 2005: for VOCs the emissions should be reduced by 18%, for NO_x by 35%, for SO_2 by 45%, for NH_3 by 7% and for $PM_{2.5}$ emissions by 17%

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- compliance with the national emission ceilings in force since 2010, and the reduction of the total emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH_3) and fine suspended particulate matter ($PM_{2.5}$) and volatile organic compounds (VOCs) by 2020 in line with the commitments of the Czech Republic
- improving air quality in areas where limit values are exceeded, while maintaining quality in areas where limit values are not exceeded

Strategy on Adaptation to Climate Change in the Czech Republic (2015)
- reducing the risk of rising temperatures due to photochemical smog formation, deteriorating air quality

National Action Plan on Adaptation to Climate Change in the Czech Republic (2017)
- strengthening environmental stability and reducing the risks associated with temperature and air quality in urbanized landscapes

Mid-term Strategy (up to 2020) to Improve Air Quality in the Czech Republic (2015)
- the achievement of socially acceptable extent of the risks arising from air pollution to human health, ecosystems, and cultural and historical heritage in the whole territory of the Czech Republic
- from 2020 no exceedance of the values of the national emission ceilings laid down on the basis of National Emission Reduction Programme of the Czech Republic scenario with additional measures
- progressive creation of conditions for fulfilling future national commitments to reduce emissions as of 2025 and 2030
- not exceeding the limit values throughout the territory of the Czech Republic by 2020 and at the same time maintaining and improving the air quality where concentrations of pollutants are currently below the limit values

National Emission Reduction Programme of the Czech Republic (2015)
- fulfilling the set not-to-exceed limits of national emissions as of 2020 for SO_2 (92 $kt.year^{-1}$), NO_x (143 $kt.year^{-1}$), NH_3 (64 $kt.year^{-1}$) and $PM_{2.5}$ (19 $kt.year^{-1}$) and VOCs (129 $kt.year^{-1}$)
- reduction of the negative impact on ecosystems and vegetation and on the materials by way of compliance with the national emission reduction obligations and compliance with applicable limit values

© Petr Šmídek/CENIA

- the achievement of socially acceptable extent of the risks arising from air pollution on human health
- reaching of the national exposure reduction target for suspended particulate matter $PM_{2.5}$
- the achievement and maintaining of limit values in the period 2016–2020, and further reduction of the concentrations of pollutants
- the compliance with the target values of the burden by ground-level ozone to protect human health

Air quality improvement programmes for the individual zones and agglomerations (2016)
- the achievement of limit values throughout the territory of all zones and agglomerations for the polluting substances referred to in point 1 to 3 of annex 1 of the Act on the Air Protection by 2020
- measures to reduce emissions and to improve air quality at the national level

National Programme Environment
- reducing the negative impacts of air pollution on human health and ecosystems by reducing emissions and other measures, e.g. by implementing measures identified in air quality improvement programmes
- collection and disposal of ozone-depleting substances
- improving the environment and quality of life in cities and municipalities
- support for sustainable development of cities and municipalities
- increasing the resilience of cities and municipalities to climate change
- contribution to the achievement of the 2030 climate and energy goals

Act No. 201/2012 Coll., on air protection
- full transposition of limit values laid down in Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe and by Directive 2004/107/EC of the European Parliament and of the Council relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

Decree No. 330/2012 Coll., on the method to assess and evaluate the level of pollution, the extent of information provided to the public about the level of pollution and smog situations
- determination of the lower and upper limits for each pollutant for the assessment of pollution levels

Decree 415/2012 Coll., on the permissible level of pollution and its identification and on implementation of some other provisions of the Act on air protection
- setting the general emission limits, specific emission limits, methods of calculating the emission ceilings and the technical conditions of operation of stationary sources
- determination of the requirements on the quality of fuels

Operational Programme Environment 2014–2020
- reducing emissions from residential heating of households involved in the exposure of the population concentrations of pollutants (supports Exchange of non organic heat sources, the so-called pot subsidies)
- reducing emissions from stationary sources contributing to the population's exposure to excessive concentrations of pollutants
- improving the system of monitoring, evaluation and forecasting of air quality trends and the related meteorological aspects

4 | Emissions of main air pollutants

Key question

Have we succeeded in reducing air pollution that adversely affect human health and ecosystems?

Key messages

The emissions of air pollutants significantly decreased in the period 1990–2000. Emission reduction continued also after 2000, in the period 2005–2018, the greatest decline was in SO_2 emissions by 53.0%, NO_x by 42.1%, and VOC emissions by 21.0%.
In 2018, the decrease continued, the most markedly in the case of SO_2 emissions by 10.9%.
Total emissions of the individual pollutants are approximating the not-to-exceed limits of national emissions for 2020.

Overall assessment of the trend

Change since 1990

Change since 2000

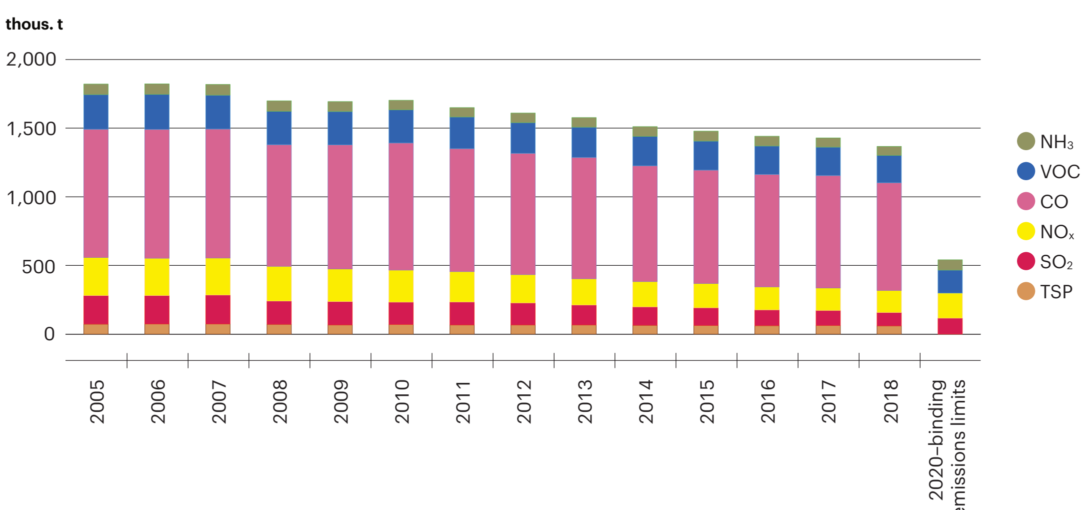
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Trends in total emissions of selected pollutants in the Czech Republic and not-to-exceed limits of emissions from 2020 [thous. t], 2005–2018

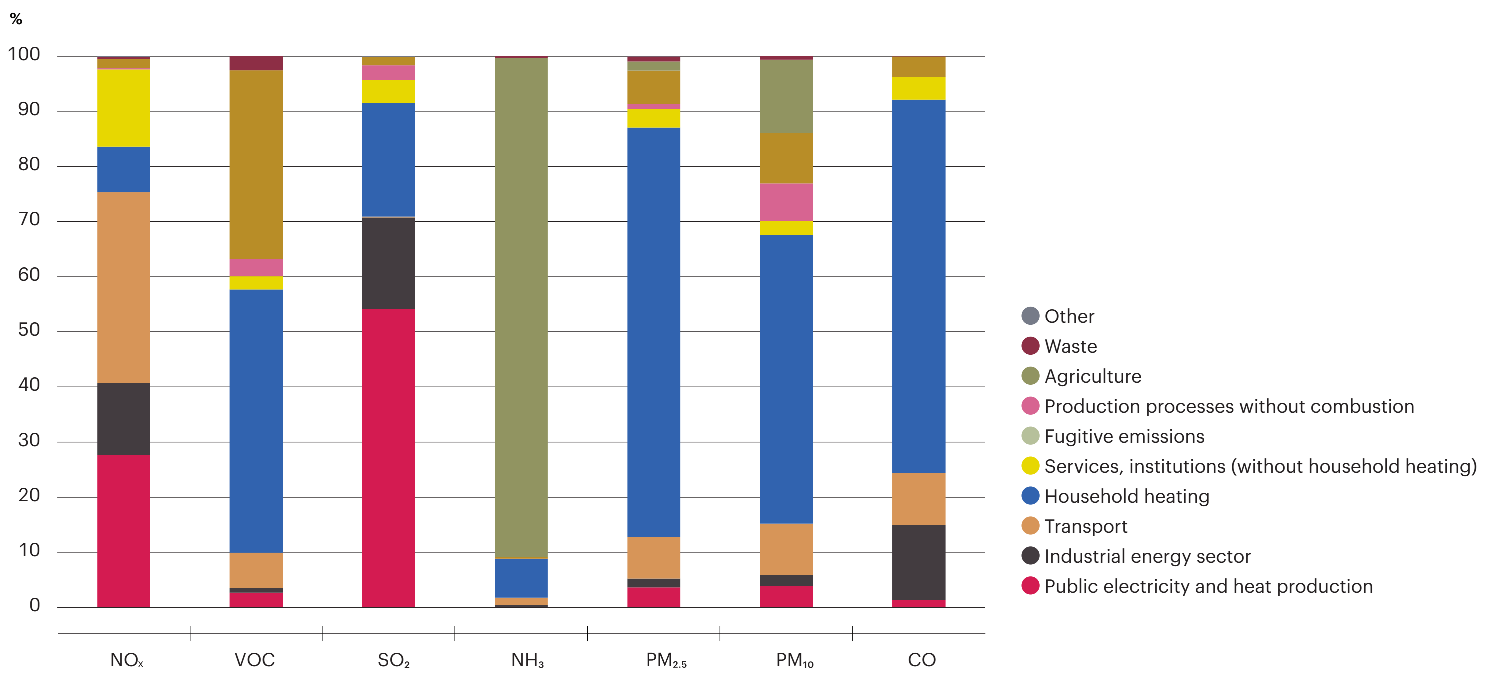


The not-to-exceed limits for the emissions of TSP and CO have not been established.

Data source: Czech Hydrometeorological Institute

Chart 2

Sources of selected emissions of pollutants in the Czech Republic [%], 2017



The data for the year 2017 were reported on 9 May 2019.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

The **emissions of air pollutants** have been declining over the long term, year-on-year fluctuations are caused primarily by the weather conditions and economic activity including mainly transport performance and industrial production.

The largest decrease in pollutants was recorded in the period between 1990 and 2000, mainly at its beginning, as a result of structural changes in the national economy.

In the period **2005–2018**, the trend of declining emissions of air pollutants continued (Chart 1), the largest overall decreases were reported for SO_2 emissions by 53.0% to 97.9 thous. t, NO_x emissions by 42.1% to 160.1 thous. t, and also for VOC emissions by 21.0% to a total of 199.4 thous. t. Less prominent decrease was reported for emissions of total suspended particles, which decreased by 17.6% to a total of 59.8 thous. t, CO emissions decreased by 16.1% to 784.3 thous. t and emissions of NH_3 decreased by 14.8% to 65.8 thous. t.

In 2018, overall positive developments continued. Significant year-on-year decreases were recorded especially for SO_2 emissions (by 10.9%), CO emissions (by 4.2%), and also for total suspended particles and VOC emissions (by 3.9% and 3.8% respectively). NO_x emissions decreased by only 1.9% and NH_3 emissions by 1.8%.

SO_2 and NO_x emissions are steadily decreasing as a result of the introduction of technologies and production processes in line with the requirements for applying best available techniques, changed fuels and reducing energy intensity of the economy. A significant role is currently played by the diversification of electricity production, i.e., the decrease in production of electricity in solid-fuel steam power plants and, on the contrary, its increase in nuclear power plants and also the production of electricity from renewable energy sources. A great influence is also the obligation to meet the legislative requirements arising from the transposition of Directive of the European Parliament and of the Council 2010/75/EU on industrial emissions into Czech legislation. However, the negative factor in the production of SO_2 and NO_x emissions is the export character of the production of a part of electricity from solid fuels, together with the need to maintain the systemic and production adequacy of the electricity system. The long-term reduction of NO_x emissions is also associated with a decrease in these emissions from the transport sector, in particular as a result of a gradual modernisation and replacement of the vehicle fleet, leading to a decline in transportation emissions.

The trend in the emissions of NH_3 is associated in particular with the set agricultural policy of the Czech Republic and with the implementation of the Common Agricultural Policy of the EU. However, the reduction of emissions of NH_3 in the long term is due to the diminishing numbers of livestock.

The development of VOC and CO emissions is associated with trends in industrial production, the most CO emissions from industrial sources come from iron and steel plants in Ostrava and Třinec and their development thus corresponds to the volume of production of those plants. Developments in PM_{10}, $PM_{2.5}$, VOC and CO emissions also reflect the development of the meteorological conditions in the heating season in that year and, moreover, are significantly influenced by the type of fuel used in household combustion heaters. The decrease in total suspended particles presented also as PM_{10} and $PM_{2.5}$, was caused in the early 1990s by the application of end technology in solid-fuel steam power plants, in the last reporting period, the dust emission trend is influenced by growth of industrial production and construction.

The remaining reductions necessary to achieve the not-to-exceed emission values as of 2020, calculated on the basis of emission monitoring data, are 6.5% for SO_2 emissions, 3% for NO_x emissions and 11.2% for $PM_{2.5}$ emissions (these emissions increased). In the case of VOC and NH_3 emissions, the emission ceiling is already met (Chart 1).

The main **sources** of emissions vary for each pollutant (Chart 2). As regards NO_x emissions, the main source in 2017[1] was transport (32.3%) and also the public electricity and heat generation sector (25.7%). In the case of SO_2 emissions, the majority producer was the public electricity and heat generation sector (51.7%). VOC emissions came from both household heating (48.8%) and non-combustion production processes where solvent use predominates (33.2%). NH_3 emissions were mainly generated by the agriculture sector (90.5%). In the case of $PM_{2.5}$, total suspended particles and CO emissions, the main source is local household heating (74.9%, 59.7% and 53.0%, respectively).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[1] *The data for the year 2017 were reported on 9 May 2019. Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

5 | Emissions of heavy metals

Key question

Is there success in reducing emissions of heavy metals that are toxic and dangerous for living organisms and the environment?

Key messages[2]

Emissions of monitored heavy metals fluctuated and declined overall between 2010 and 2017, the most significant decline was observed in the emissions of nickel by 32.9% and zinc by 27.9%.

Between 2010 and 2017, copper emissions increased by 7.7%.

Overall assessment of the trend

Change since 1990

Change since 2000

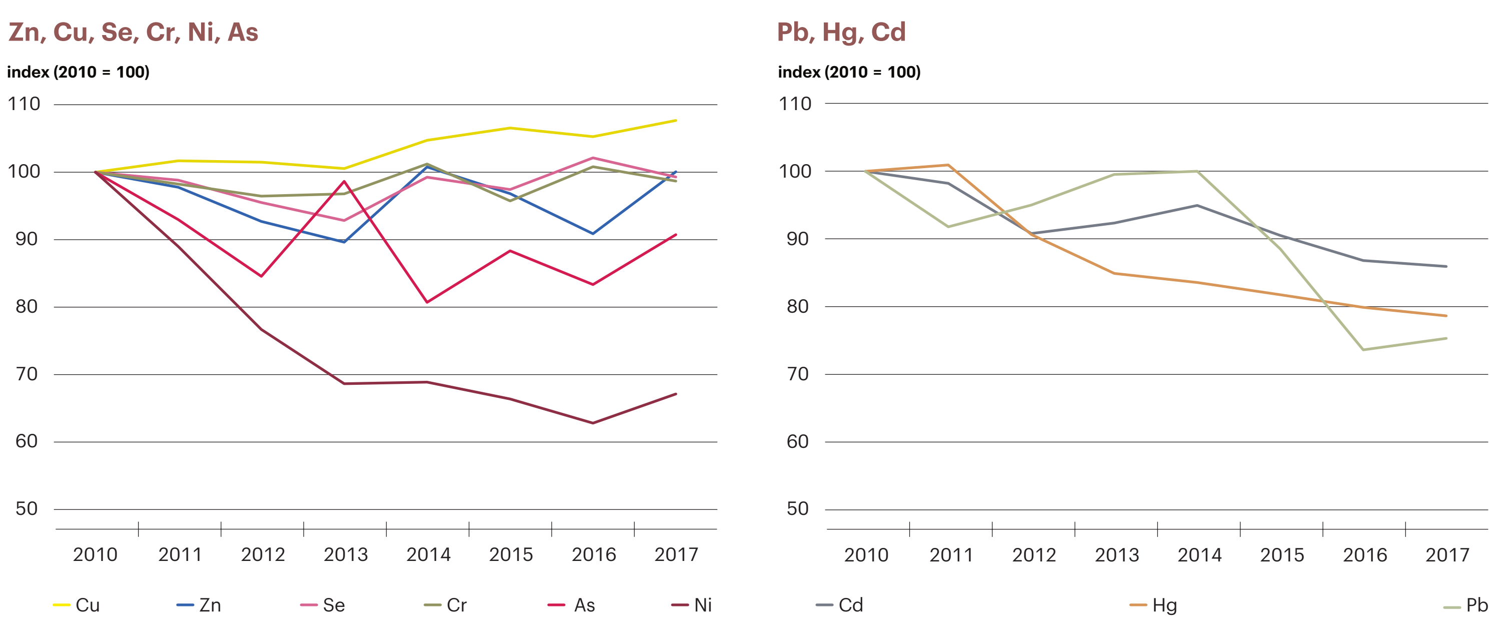
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Trend in heavy metal emissions [index, 2010 = 100], 2010–2017



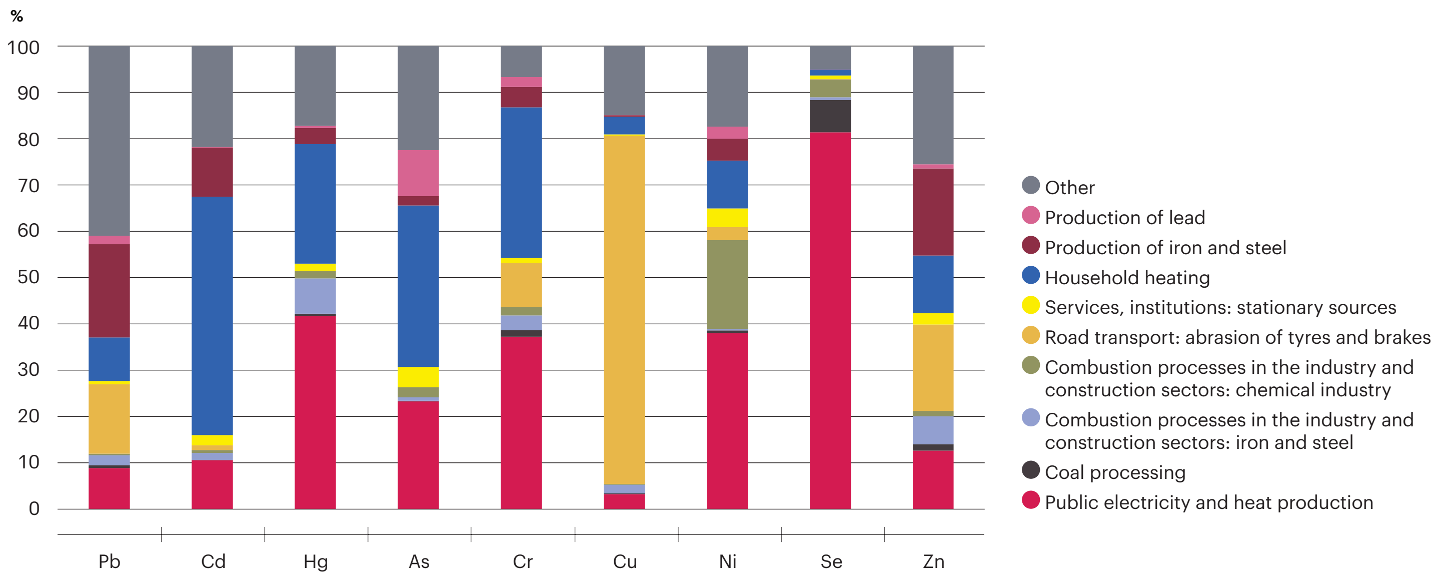
The data for the year 2017 were reported on 9 May 2019. Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

[2] *The data for the year 2017 were reported on 9 May 2019. Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Sources of selected emissions of heavy metals [%], 2017



The data for the year 2017 were reported on 9 May 2019. Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

Heavy metals are metals with a specific weight greater than 4.5 $g.cm^{-3}$. They are bound in most fossil fuels from which they are released during the combustion process, they are also generated in technological processes of processing primary raw materials, in which they are naturally contained, and are produced by abrasions of tyres and brakes.

Emissions of heavy metals have been falling since 2010 (Chart 1), in spite of the very unstable trend between the individual years both due to the development of the economy (with an impact on the iron and steel production, or the intensity of transport), and to the characteristics of the heating season and the quality of the processed material containing heavy metals.

Between the years **2010–2017**, the greatest reductions were seen in emissions of nickel by 32.9% to a total of 5.3 $t.year^{-1}$, zinc emissions by 27.9% to 41.2 $t.year^{-1}$, and also emissions of lead by 24.6% to 17 $t.year^{-1}$. On the contrary, copper emissions increased by 7.7%.

Between **2016–2017**, individual heavy metal emissions also declined in most cases, cadmium and mercury emissions declined (by 1.0% and 1.6% respectively), while arsenic emissions grew by 8.8%, and lead emissions by 2.3%.

The main sources of heavy metal emissions in the Czech Republic in 2017 were public electricity and heat production, tyre and brake wear from road transport, and household heating. The sources differ for the individual emissions (Chart 2). The public electricity and heat generation sector produced 82.7% of selenium emitted and 40.6% of mercury produced, 75.3% of copper emissions were resulted from tyre and brake wear, and 51.1% of cadmium emissions were produced by household heating. Lead emissions in 2017 came mainly from iron and steel production (20.1%) and also from tyre and brake wear (15.0%).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

6 | Air quality in terms of human health protection

Key question

Are limit values of air pollutants laid down for the protection of human health complied with?

Key messages

In 2018, the limit values for arsenic, cadmium, lead, nickel, sulphur dioxide and carbon monoxide were not exceeded.
In 2018, the share of stations at which the annual limit value for benzo(a)pyrene was exceeded in 2018 decreased year-on-year and the area and share of the population affected by the exceedance of the limit value for benzo(a)pyrene also decreased.

In 2018, 10 smog situations were declared in the Czech Republic due to high concentrations of PM_{10} and 12 smog situations were declared due to high concentrations of tropospheric ozone.
In 2018, the share of stations at which the annual average concentration for PM_{10} and $PM_{2.5}$ was exceeded increased year-on-year.
At 3 heavy traffic locations, the annual limit value for NO_2 was exceeded (in Prague and Brno).

In 2018, the annual limit value for benzene was exceeded at the station Ostrava-Přívoz.

Overall assessment of the trend

Change since 1990

Change since 2000

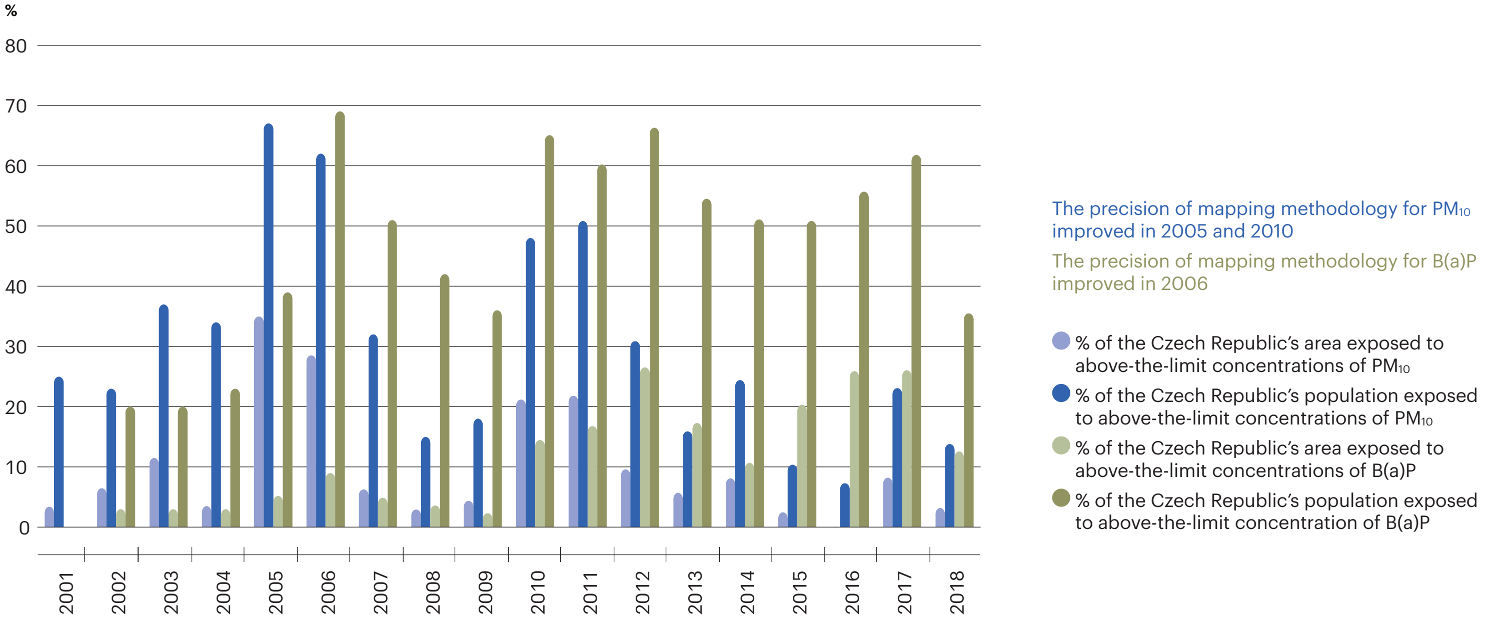
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Percentage of the Czech Republic's area and population exposed to above-the-limit 24-hour average concentrations of suspended particulate matter PM_{10} and above-the-limit annual average concentrations of B(a)P [%], 2001–2018

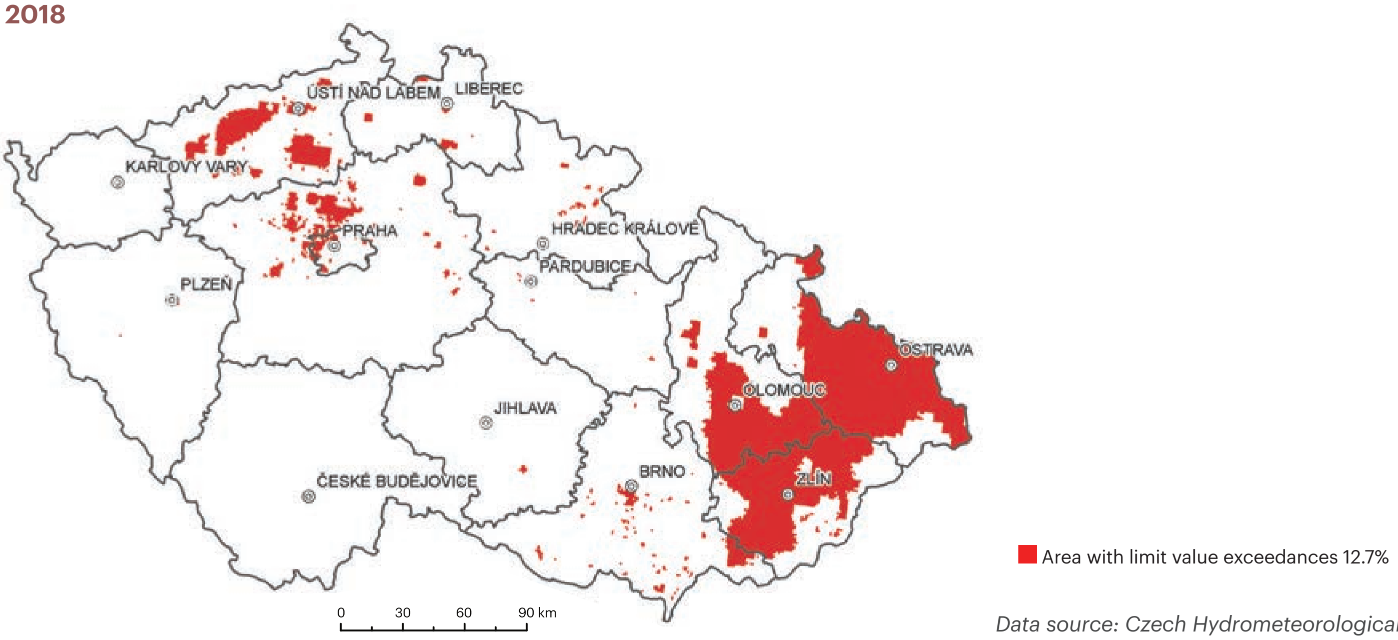


In 2005, a refinement of the mapping methodology was carried out and a model that combines the SYMOS model, the European EMEP model and the altitude data with the measured concentrations at rural background stations was first used in the construction of maps of PM_{10} concentration fields. In the year 2009, the methodology was refined again by applying the CAMx model. The SYMOS model includes emissions from primary sources. Secondary particulate matter and resuspended particulate matter that are not included in the emissions from primary sources, are taken into account within the EMEP and CAMx models. Between the years 2002–2007, the methodology for benzo(a)pyrene mapping, carried out since 2002, was gradually refined. In addition to the increase in the number of monitoring stations, a refinement in the mapping methodology was carried out in 2006. In 2006, as a result of a methodological change, a number of towns and municipalities were included in the territory with an exceeded B(a)P limit value.

Data source: Czech Hydrometeorological Institute

Figure 1

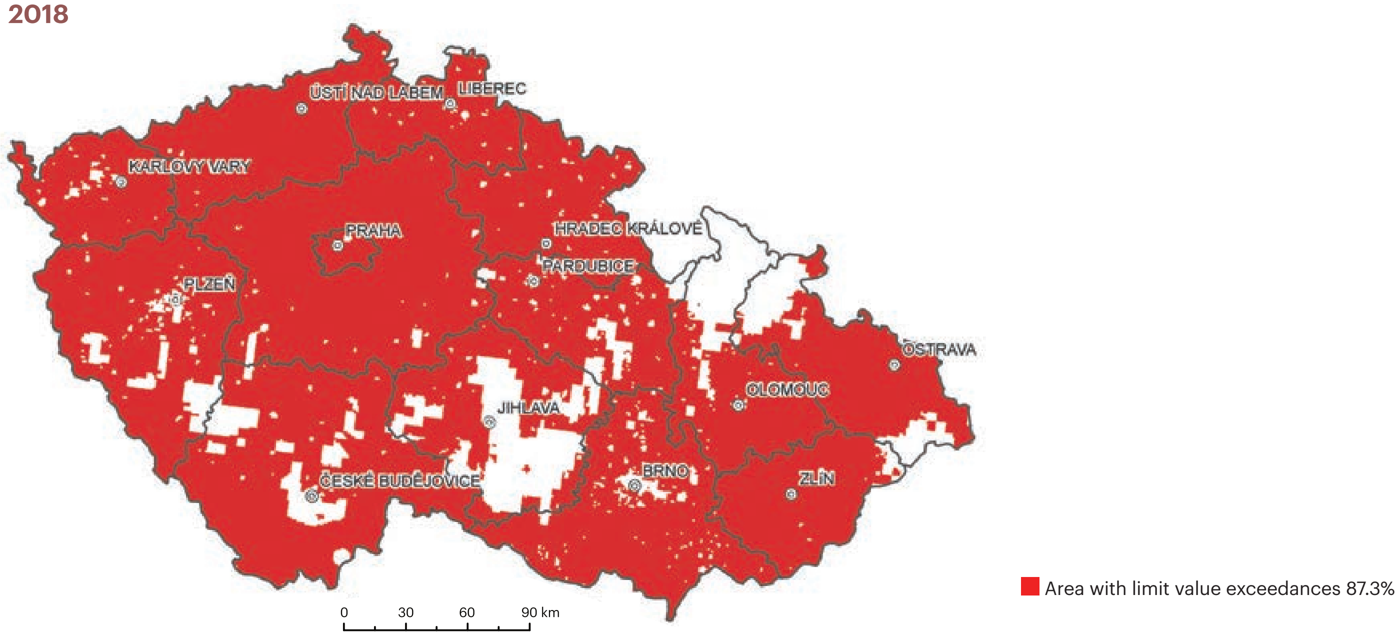
Areas within the Czech Republic with exceeding of the human health protection limit values (ground-level ozone excluded), 2018



Data source: Czech Hydrometeorological Institute

Figure 2

Areas within the Czech Republic with exceeding of the human health protection limit values (ground-level ozone included), 2018



Data source: Czech Hydrometeorological Institute

Table 1

Increase in the total annual mortality by "premature deaths" [an estimate of the number of premature deaths] – for the entire Czech Republic and the unburdened urban localities, 2010–2018

PM_{10} (75% representation of the $PM_{2.5}$ fraction)	2010	2011	2012	2013	2014	2015	2016	2017	2018
Estimated mean value for the Czech Republic	6,108	6,815	5,888	6,040	5,842	5,540	4,300	5,700	6,600
Estimated mean value for normal urban environment (*)	5,346	6,354	5,888	6,040	5,371	4,773	4,000	5,200	5,600

**Excluding stations extensively burdened by traffic and industry.*
The total mortality increase was calculated from the span of values measured in the Czech Republic and from the estimate of values in unburdened urban areas of the Czech Republic. The annual average values of $PM_{10} \leq 13.3\ \mu g.m^{-3}$ for 75% representation of the $PM_{2.5}$ fraction were evaluated as 0. The values of the total annual mortality are taken from the Czech Statistical Office and are adjusted – deaths caused by injury and deaths of people under 30 years of age were deducted. The WHO recommendations were used for the conversion of the PM_{10} effects, taking the estimated mean value of representation of $PM_{2.5}$ fraction in the PM_{10} fraction for the Czech Republic to be 75%.
Accuracy of the estimate is in the order of hundreds of inhabitants.

Data source: National Institute of Public Health

Table 2

Range of estimated values of individual carcinogenic risk (ILCR) for benzo(a)pyrene in evaluated types of localities in settlements with over 5,000 inhabitants* [number of cases per 100,000 inhabitants], 2010–2018

	2013		2014		2015		2016		2017		2018	
Number of additional cases per 100,000 inhabitants	min	max	min	max	min	max	min	max	min	max	min	max
Cities (over 5,000 to 5 mil. inhabitants)	5.7	81.7	3.3	81.1	3.1	68.1	5.1	78.3	4.5	81.4	4.1	67.0
Sites without traffic and industrial burden	5.9	39.0	5.0	31.8	3.5	30.6	5.1	29.0	5.1	36.9	4.6	34.0
Sites with traffic burden	7.0	25.7	5.7	25.0	4.8	25.3	7.0	25.4	6.1	53.0	4.1	25.0
Industrial sites	11.0	81.7	13.8	81.1	8.2	68.1	9.1	78.3	10.2	81.4	7.6	67.0

** Concerns approximately 5 mil. inhabitants.*
For the purposes of health risk assessment, the data were processed in a form of span intervals for the Czech Republic, for all urban stations (about 5 mil. inhabitants in total) and for selected types of urban sites (housing sites without transport burden and urban transport burden). Due to lack of data, this procedure cannot be used to evaluate the burden on up to about 5 mil. inhabitants in small settlements (< 5,000 inhabitants).
B(a)P, which contributes with the highest share to the burden (its ILCR moves within the range of 10^{-4} to 10^{-3}), was selected as the indicator for the assessment.

Data source: National Institute of Public Health

Despite the steady decline in air pollution over the long term, the concentrations of air pollutants (especially suspended particulate matter and benzo(a)pyrene), are not decreasing significantly year-on-year in the areas where deterioration in air quality was identified in the previous years. The trend in air quality is subject to fluctuations, mainly related to meteorological conditions and the development of anthropogenic pressures on air quality, which are, besides large sources of pollution, mainly household heating and transport. Limit values were exceeded at the measuring stations also in 2018 particularly due to the occurrence of deteriorated dispersion conditions which tend to be associated with temperature inversions in the cold part of the year.

The limit value for 24-hour PM_{10} concentration (50 μg.m^{-3}, the maximum permitted number of exceedances per calendar year is 35) was exceeded at 45 stations out of the total number of 144 in 2018, i.e. 31.2% of stations, the number of exceedances thus declined year-on-year because in 2017, this limit value was exceeded at 50 stations out of a total of 143, i.e. 35.0% of stations. In the case of automatic stations, the daily limit value for suspended PM_{10} was exceeded only at 40% of stations in 2018, compared to 46% of stations in 2017. The most exposed regions, in which stations were located that were exceeding the limit values, included mainly the Moravian-Silesian Region.

In 2018, the annual limit value for PM_{10} (40 μg.m^{-3}) was exceeded at 3 stations out of a total of 146, i.e. 2.1% of stations, an increase against 2017 when the limit value was exceeded at 2 stations out of a total of 146, i.e. 1.4% of stations.

The **limit value for the 24-hour average concentration of PM_{10}** (Chart 1) was exceeded in 2018 at 3.2% of the territory (in 2017 at 8.3% of the territory). In 2018, 13.8% of the population in the Czech Republic was exposed to above-the-limit concentrations (in 2017 it was 23.1% of the population). The limit for the annual average concentration of PM_{10} was exceeded in 2018 on 0.1% of the territory where 0.3% of the population lived.

In 2018, there was a total of 10 **smog situations** declared in the territory of the Czech Republic due to high suspended particles **PM_{10} concentrations**, with a total duration of 775 hours, and 4 regulations with a total duration of 259 hours. It was a year-on-year decrease in the smog situations against 2017 when 39 smog situations with a total duration of 3,757 hours and 17 regulations were declared throughout the Czech Republic due to high concentrations of suspended PM_{10} particles. In 2018, the smog situations were most often declared in the territory of the Ostrava/Karviná/Frýdek-Místek agglomeration, excluding the Třinec district (4 in total). Smog situations are declared during deteriorated dispersion conditions due to low air flow and inverse layering of the ground atmosphere.

In 2018, the annual limit value for $PM_{2.5}$ (25 μg.m^{-3}) was exceeded at 13 stations out of the total of 80 stations, i.e. 16.2% of stations, thus the number of exceedances increased year-on-year because in 2017, the annual limit value was exceeded at 10 stations out of a total of 79, i.e. 12.7% of stations.

No limit value has been set for the rate of air pollution in the case of suspended particulate matter PM_1, both in EU and Czech legislation. In 2014, PM_1 was measured in the Czech Republic at 9 locations, in 2015 at 11 locations, in 2016 at 13 locations, in 2017 at 14 locations and in 2018 at 23 locations. The highest annual average concentrations were reached in the suburban locality Třinec-Kanada (24.2 $\mu g.m^{-3}$) in 2018, where the maximum 24-hour concentration (187.6 $\mu g.m^{-3}$) was also reached. Data on fractions smaller than 1 µm obtained from case studies and projects point out increased and above-the-limit concentrations, especially in the Moravian-Silesian Region and Ústí nad Labem Region; the main source are, in particular, road transport and local combustion heaters.

According to the estimate carried out by the National Institute of Public Health, exposure to suspended particulate matter contributed to the **premature death rate of the population** in the range between several percent to approximately 10% in the industrially burdened areas of Ostrava-Karviná in the period 2006–2018. This risk of exposure is not evenly distributed within the population, as it concerns sensitive population groups, particularly the elderly and chronically ill people. It can be estimated from these data that in the long term (2010–2018) for the whole of the Czech Republic, the increase in overall mortality, contributed to by the exposure to PM_{10} fraction of suspended particulate matter (with estimated 75% representation of the $PM_{2.5}$ fraction), varies on average between 4 to more than 6 thous. persons per year. In 2018, it was approximately 6.6 thous. people all over the Czech Republic, or roughly 5.6 thous. people in the common urban environment. It is apparent that the long-term exposure to suspended particles leading to premature mortality is slightly decreasing (Table 1).

The **ground-level ozone concentrations** are influenced by the meteorological conditions (the intensity of sunlight, temperature, and the occurrence of rainfall). The highest concentrations are usually measured in the period from April to September. In 2018, the limit value for the protection of human health, expressed as daily 8-hour mean concentrations (120 $\mu g.m^{-3}$), was exceeded at 33 stations out of a total of 65, i.e. at 50.8% of stations. In 2017, the limit value was exceeded at 21 stations out of a total of 71, i.e. 29.6% of stations.

The limit value for ground-level ozone for the protection of human health was exceeded in 2018 on 80.0% of the Czech Republic's territory and 52.1% of the population were exposed to above-the-limit concentrations. This situation represents a significant year-on-year increase, as in 2017 the limit value was exceeded on 31.2% of the territory, for 8.6% of the population.

In 2018, 12 **smog situations for ground-level ozone** lasting 378 hours were announced, in 2017 it was only 2 smog situations for ground-level ozone with a duration of 54 hours. The highest number of smog situations was announced in the Ústí nad Labem Region and also in the Central Bohemia Zone (3 each).

Same as in 2017, in 2018 a number of towns and municipalities were classified as areas with exceeded limit values for **benzo(a)pyrene**. This concerned about 12.6% of the territory where 35.5% of the population lived (Chart 1). The situation improved year-on-year, as in 2017 it was 26.0% of the territory with 61.8% of the population.

The limit value (1 $ng.m^{-3}$) for the annual average concentration of B(a)P was exceeded at 22 out of 39 stations in 2018, i.e. 56.4% of stations, and the number of exceedances decreased year-on-year because in 2017, annual average concentrations were exceeded at 25 stations out of a total of 38, i.e. at 65.8% of stations.

The total increase in the **individual lifetime risk of new cancer diseases** in urban localities of the Czech Republic with over 5 thous. inhabitants due to B(a)P has been stagnating in the long term; in 2018 it ranged from 4.1 to 7.6 occurrences of the disease per 100,000 inhabitants according to the type of urban localities. In localities with traffic load, the impact of B(a)P emissions could lead to an increase in health risks by about 1 case per 100,000 inhabitants compared to the values measured in urban areas without major traffic and industrial pollution. In localities affected by large industrial sources, the value of the individual risk was higher than in other urban localities and in theory could represent an increase by up to 5 additional cases per 100,000 inhabitants (Table 2).

In 2018, the annual limit value for NO_2 was exceeded at 3 heavy-traffic locations (in Prague and Brno) out of a total of 95 stations, i.e. at 3.2% of the stations. This means a year-on-year decrease, as in 2017 the limit value was exceeded at 4 traffic-loaded stations. The annual limit values for nickel, cadmium, arsenic and lead were not exceeded in 2018 at any station. However, the annual limit value for benzene was exceeded at the station Ostrava-Přívoz. The limit values were not exceeded for hourly concentrations of SO_2 and NO_2, for 24-hour concentrations of SO_2 and for 8-hour mean concentrations of CO.

The **map of areas** with exceedance of at least one limit value, excluding ground-level ozone[3] provides comprehensive

[3] *Limit values according to Annex 1, points 1 to 3 of Act No. 201/2012 Coll., on air protection, as amended.*

information on ambient air quality in the territory of the Czech Republic in 2018. In the reporting year, 12.7% of the territory of the Czech Republic (Figure 1) was marked that way, covering 36.3% of the population.

After the inclusion of ground-level ozone, the limit value of at least 1 pollutant was exceeded in 2018 on 87.3% of the area of the Czech Republic (Figure 2) with 75.6% of the population.

Nearly half of the population lives in settlements of less than 10,000 inhabitants. Therefore, air quality in the most affected small settlements can be comparable with the burden in large urban agglomerations. The reason behind the poor air quality in small settlements is a combination of several basic factors, which are the morphology of the territory, particularly valleys where temperature inversion occurs, the traffic burden associated with transit transport especially in places without bypasses and with congestions, and heating of households with solid fuels. Local combustion heaters for household heating were in 2017 the source of 59.1% of all emissions of PM_{10} and 98.3% of B(a)P emissions. Moreover, where the local combustion heaters burn waste or other unauthorised fuel, they emit higher amounts of hazardous dioxins.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

7 | Air quality in terms of the protection of ecosystems and vegetation

Key question

Are the limit values for the protection of ecosystems and vegetation exceeded?

Key messages

The limit values for neither annual nor winter average SO_2 concentration were exceeded at any rural locality in 2018, and the annual limit value for annual average concentration of NO_x for the protection of ecosystems and vegetation was not exceeded either.
The total atmospheric deposition of sulphur, nitrogen and hydrogen ions decreased year-on-year.

In 2018, the limit value for ozone for the protection of ecosystems and vegetation was exceeded at 23 stations classified as rural or suburban, and compared to 2017 the number of stations with an exceeded limit value increased.

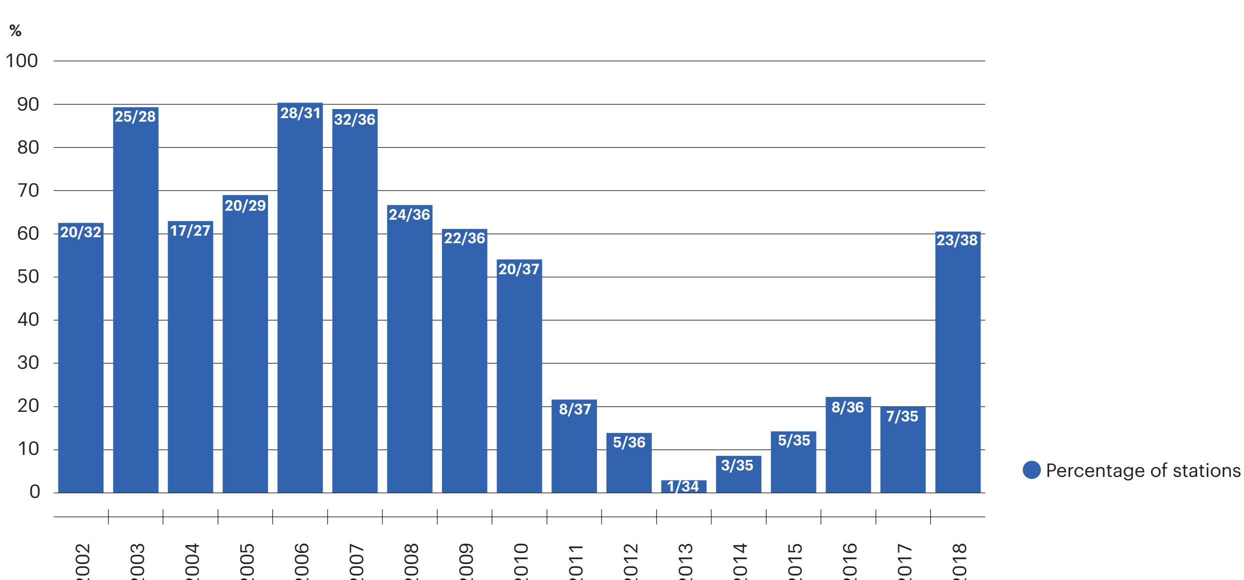
Overall assessment of the trend

Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
N/A			

Indicator assessment

Chart 1

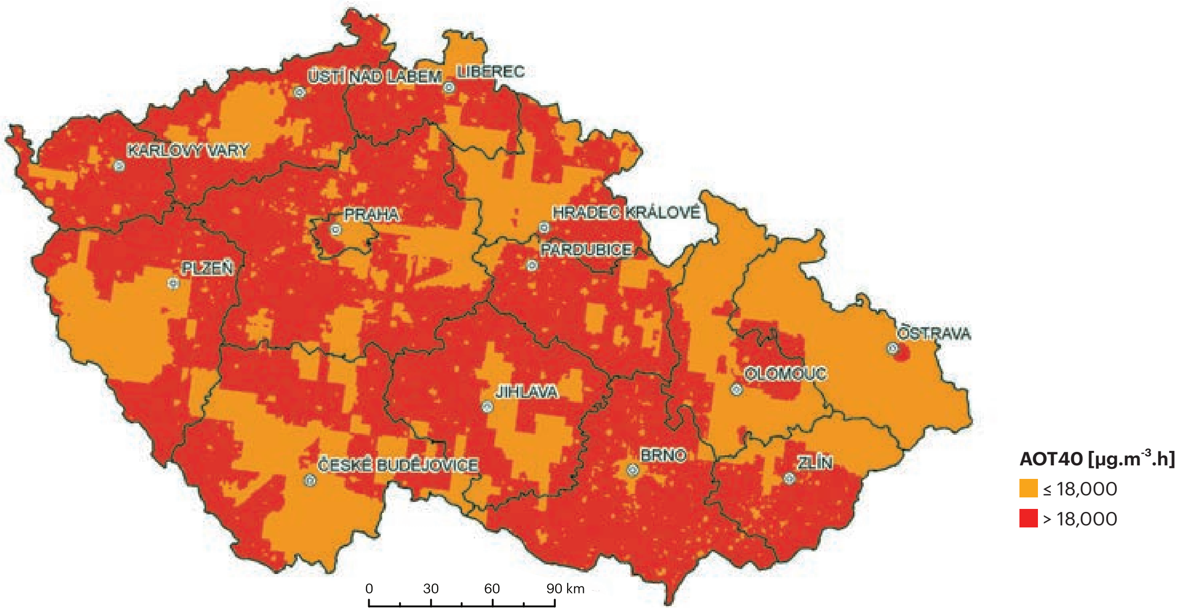
Percentage of stations at which the limit values, expressed as AOT40 (5-year average) for the protection of vegetation, were exceeded [%], 2002–2018



Data source: Czech Hydrometeorological Institute

Figure 1

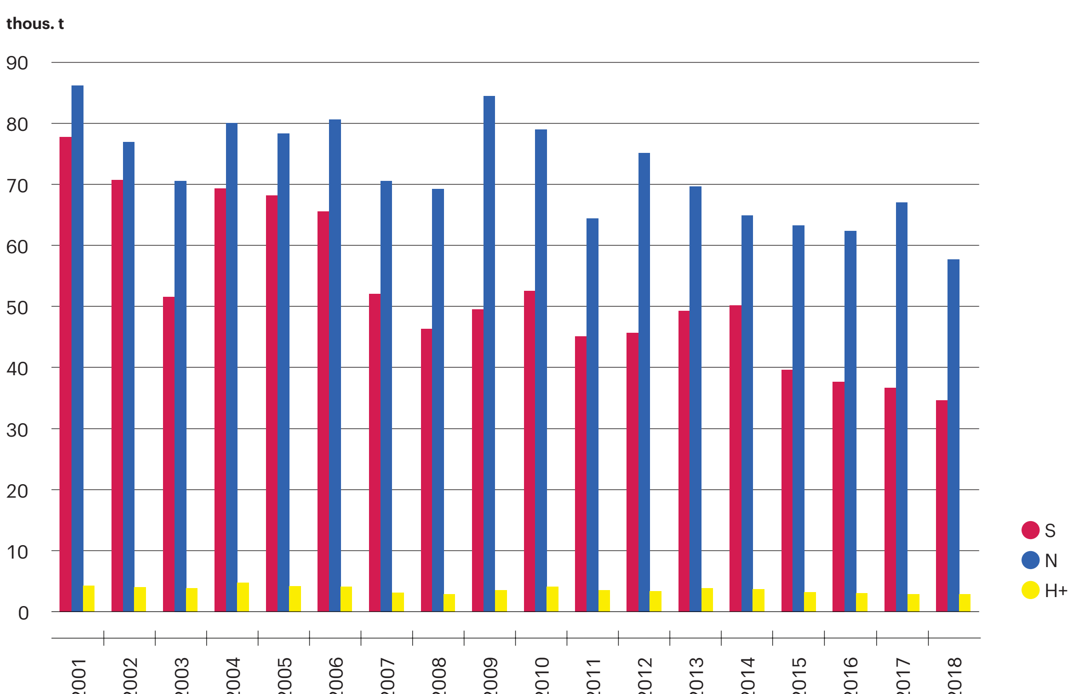
Field of AOT40 index values, 5-year average [μg.m^{-3}.h], 2014–2018



Data source: Czech Hydrometeorological Institute

Chart 2

Trends in the total atmospheric deposition of sulphur, nitrogen and hydrogen ions in the Czech Republic [thous. t], 2001–2018



Data source: Czech Hydrometeorological Institute

The **limit value for ozone for the protection of ecosystems and vegetation** (18,000 μg.m^{-3}.h) was exceeded in 2018 (2014–2018 average) at 23 stations out of a total of 38 rural and suburban stations (i.e. at 60.5% of stations). The highest values were measured at the station Kuchařovice (22,900.2 μg.m^{-3}.h). Compared to 2017 (2013–2017 average), the number of locations where exceedance was recorded grew, because in 2017 the ozone limit value for the protection of ecosystems and vegetation was exceeded at 20.0% of stations (i.e. at 7 out of a total of 35 stations monitored), Chart 1. At the same time, the area of the territory with the occurrence of above-the-limit AOT40 values increased (Figure 1).

Interannual changes in the values of the AOT40 exposure index are affected not only by ozone precursor emissions, but more particularly by the meteorological conditions (temperature, precipitation, solar radiation) in the period from May to July for which the indicator is calculated. Also for that reason, the highest concentrations of ozone and the most exceedances of the limit value were achieved in the years 2003, 2006, 2007 and 2018, which were characterised by favourable conditions for the formation of ground-level ozone.

The limit value for the **annual average concentration of SO_2** (20 μg.m^{-3}) for the protection of ecosystems and vegetation was not exceeded in 2018 at any one of the 18 stations classified as rural. Similarly, none of the 17 stations classified as rural reported exceeded limit values for the winter (i.e. the period October–March) average concentration of SO_2 (20 μg.m^{-3}) for the protection of ecosystems and vegetation in 2018. The highest annual average SO_2 concentration was measured in 2018 at the Věřňovice station (7.8 μg.m^{-3}), the highest winter average concentration of SO_2 was measured at the station of Krupka (10.4 μg.m^{-3}).

The limit value for the **annual average concentration of NO_x** (30 μg.m^{-3}) for the protection of ecosystems and vegetation was not exceeded in 2017 as well as in 2018 at any one of the 19 stations classified as rural. The highest annual average concentrations of NO_x were achieved at the Sivice locality (27.9 μg.m^{-3}).

The **total atmospheric deposition (**Chart 2) consists of wet and dry components and represents a direct input of pollutants into other environmental compartments. Despite the long-term decline of pollutants there remains a high burden of ecosystems caused by the atmospheric deposition in many areas of the Czech Republic. It is mainly caused by transport emissions (NO_x) and emissions from industrial and energy sources (NO_x and SO_2). A significant proportion is also represented by the long-range transport of pollution from neighbouring countries of Central Europe.

In 2018, the total atmospheric deposition of **sulphur** amounted to a total of 34.6 thous. t of sulphur for the total area of the Czech Republic and thus reached the lowest value since 2001. The total deposition of sulphur is the highest in the Ore Mountains (Krušné hory) where the maximum values of the throughfall deposition of sulphur are also achieved. The value of total **nitrogen** deposition (oxidized + reduced forms) has remained high in the last decade, i.e. above 60 thous. t per year, due to the production of NO_x emissions. In 2018, total deposition of nitrogen amounted to 57.7 thous. t.year^{-1} in the Czech Republic, which represents a significant year-on-year decrease. In the case of total **hydrogen ion** deposition, the value reported in 2018 was 2.9 thous. t.year^{-1} for the area of the Czech Republic, which is the lowest since 2001.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

Air quality in the global context

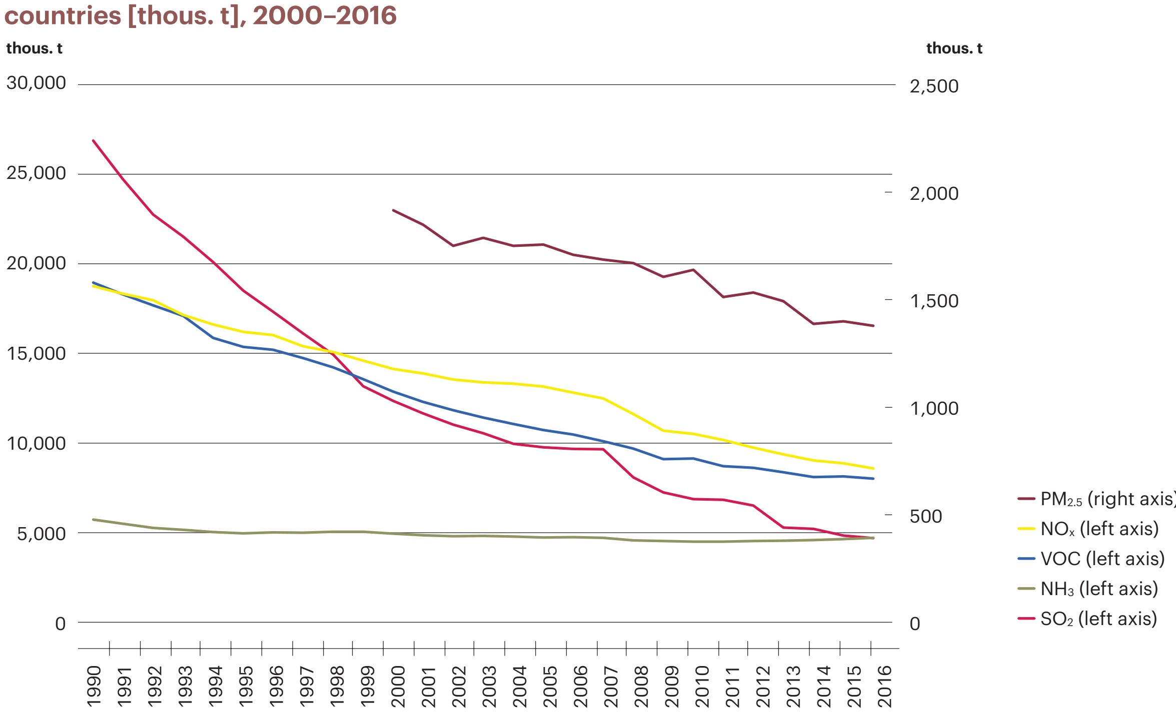
Key messages[4]

- Emissions of air pollutants in the EEA33 countries have been decreasing since 1990, in the period 1990–2016 SO_2 emissions decreased by 82.5%, VOC emissions decreased by 57.7%, NO_x emissions by 54.2%, NH_3 emissions by 17.6% and emissions of $PM_{2.5}$ decreased by 28.0% since 2000.
- Lead emissions decreased between 1990 and 2016 by 93.9%, mercury emissions by 71.5% and cadmium emissions by 64.6%.
- Air quality is improving slightly in Europe.
- The limit value for the protection of ecosystems and vegetation for ground-level ozone in 2015 was exceeded in approximately 30% of the territory of European countries, especially in southern Europe.

Indicator assessment

Chart 1

Emissions of the main air pollutants SO_2, NO_x, VOCs, NH_3 in the EEA33 countries [thous. t], 1990–2016, and $PM_{2.5}$ in the EEA countries [thous. t], 2000–2016



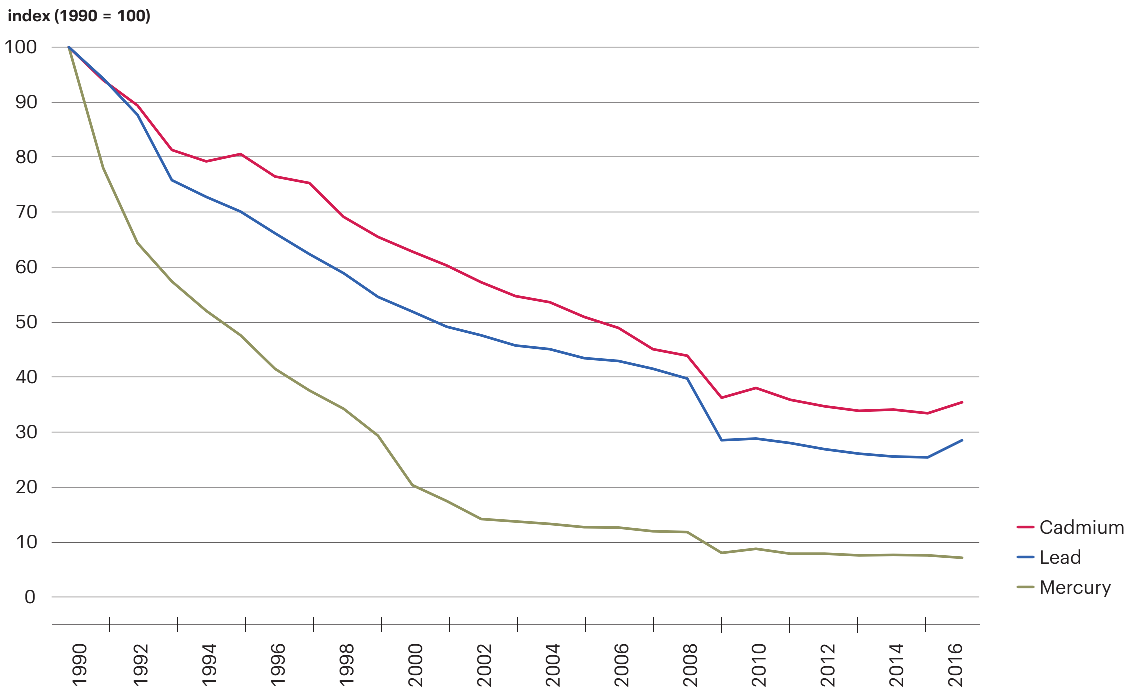
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

[4] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Trend in heavy metal emissions in EEA33 countries [index, 1990 = 100], 1990–2016

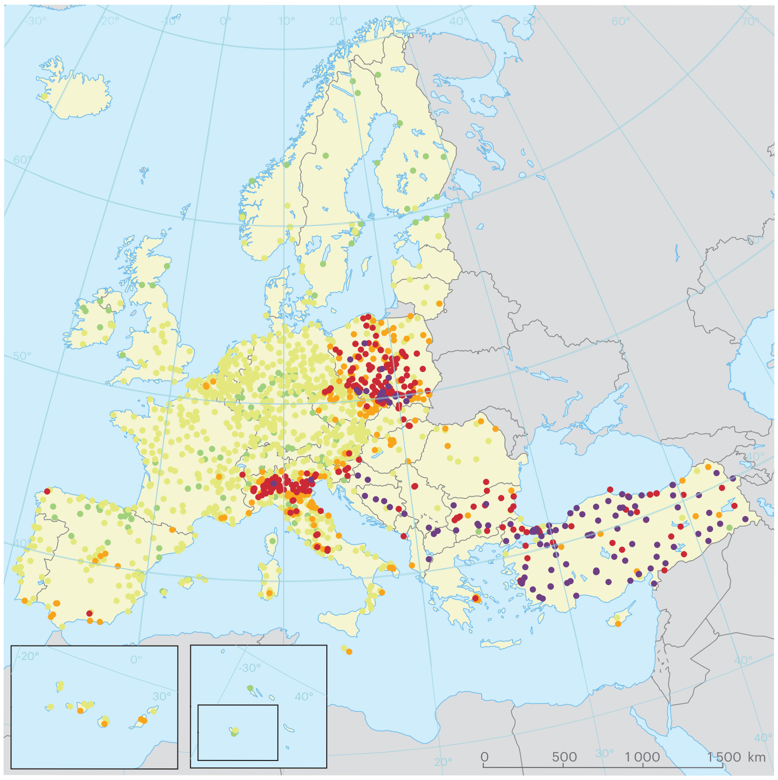


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Figure 1

Percentile 90.4 of daily mean PM_{10} concentrations at background stations [mg.m^{-3}], 2016

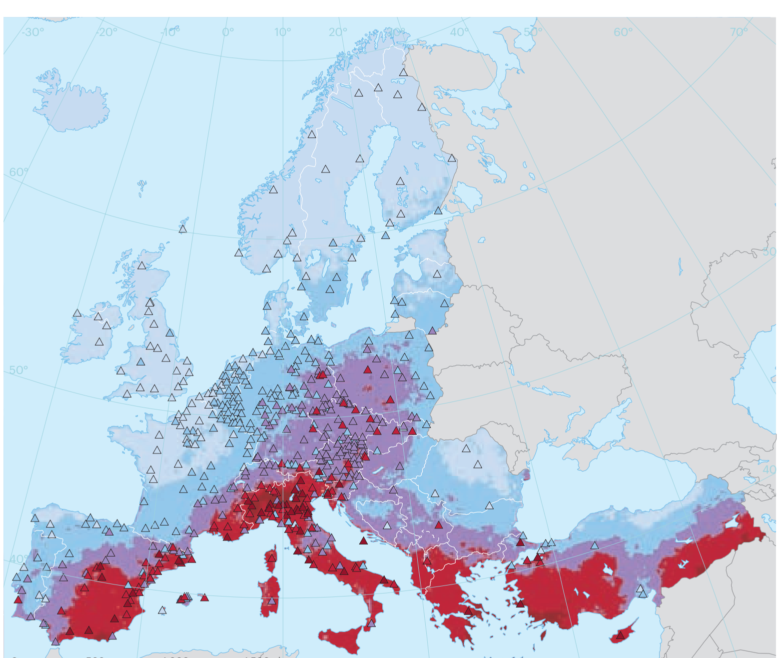


90.4 percentile of 24-hour average concentrations of PM_{10}, representing the 36th highest value of the exceedance. Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Figure 2

Rural concentration of the AOT40 for vegetation in Europe [µg.m^{-3}.h], 2016



Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Air pollutant in Europe are declining (Chart 1), and all countries of the EU28 and EEA33 are approximating the emission ceilings specified in the NEC Directive and the Gothenburg Protocol. Emissions of SO_2 in 2016 in the EEA reached, with 4.7 mil. t, nearly 17% of the 1990 level and so represent the most significant decrease out of all observed emissions of pollutants. NO_x emissions are also falling, and in 2016 they were, with 8.6 mil. t, at approximately 50% of the 1990 level. VOC emissions in 2016 amounted to 8.0 mil. t and compared to 1990 they decreased by 57.7%. NH_3 emissions were reduced between 1990 and 2014 only by 17.6%, however, their production is the lowest overall, with 4.7 mil. t. $PM_{2.5}$ emissions also decreased and in 2016 they were, with 1.4 mil. t, at about one quarter of the 2000 level. It appears, however, that 8 of the EEA33 countries will not be able to meet the set emission ceilings for $PM_{2.5}$ by 2020.

The emission ceilings for **heavy metals** are exceeded in Europe only locally, in areas with specific industrial production. Emissions of cadmium and mercury in 2016 fell to one third and one quarter respectively of the emission levels of 1990, lead emissions even to one tenth. The sharp reduction of emitted substances is mainly the result of a combination of introducing the best available techniques on the individual installations and implementing environmental legislation.

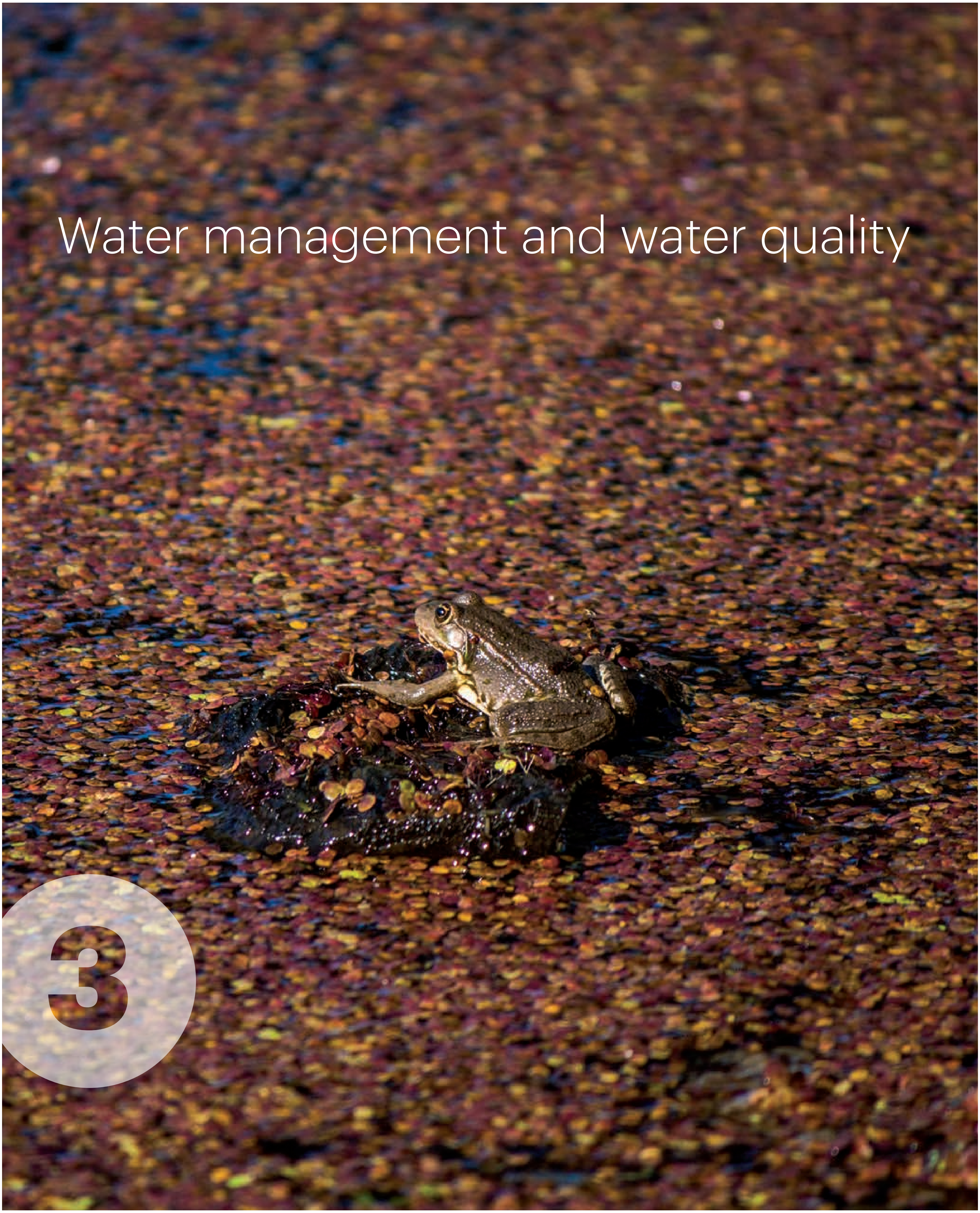
Air quality in Europe is gradually improving slightly also due to the decrease of air pollutants. The most risky substances include immissions of particulate matter of PM_{10} and $PM_{2.5}$ fraction, ground-level ozone O_3 and polycyclic aromatic hydrocarbons expressed by benzo(a)pyrene. The level of exceeding the limit values changes between years, and is influenced by the developments of meteorological conditions, and by the current economic activity in the individual countries, especially industrial activities and transport outputs.

The exceedance of **PM_{10}** concentrations continued also in 2016, when 19% of stations in 19 EU28 countries reported exceeded concentrations (Figure 1). Approximately 13% of the urban population in EU28 countries in 2016 was exposed to exceeded 24-hour PM_{10} concentrations (50 $\mu g.m^{-3}$, 35-day exceedance), approximately 6% of the EU28 population was exposed to excess concentration of **$PM_{2.5}$** (25 $\mu g.m^{-3}$). The important factors influencing the exceedance of the limit values were the dispersion conditions in 2016, the occurrence of smog situations and the duration of the heating season.

In 2016, approximately 12% of the urban population was exposed to above-the-limit concentrations of **ground-level ozone O_3**, which represents a significant year-on-year decrease (30% of the population in 2015), however, only 7% of the population was exposed in 2014. In the case of O_3 concentrations, the most important role is played by the development of meteorological conditions in the warm part of the year.

A total of 13 Member States reported above-the-limit concentrations of **benzo(a)pyrene** in 2016. As in the past, the highest concentrations were measured in the countries of Central and Eastern Europe. Approximately 31% of the urban population of EU28 were exposed in 2016 to above-limit annual concentrations of benzo(a)pyrene (1 $ng.m^{-3}$).

A serious damage to vegetation in the long term presents the ground-level ozone, expressed as AOT40. The limit value for the **protection of vegetation for ground-level ozone** (18,000 $\mu g.m^{-3}.h$) has been exceeded since 2000 in a significant part of Europe. In 2016, this limit value was exceeded on roughly 19% of the area of farmed land in all European countries and on about 15% of the area of the EU28. The limit value was exceeded especially in southern and south-eastern Europe (Figure 2). The development of concentrations of ground-level ozone reported a significant year-to-year variability caused particularly by meteorological conditions during the growing season (May to July). In 2015, concentrations were higher than in 2014.



© Jiří Přech/CENIA

Water management and water quality

Water is the basis of life on Earth, it is necessary for the functioning of ecosystems, for the life of plants, animals and humans, and is also a key input for a number of industrial sectors and agriculture. It is important to preserve the natural resources of surface and groundwater and monitor their quality. In order to maintain an adequate amount of water for living organisms in aquatic ecosystems, it is particularly important to monitor water abstraction for human needs, be it for using the water drinking or for agriculture, the energy sector, etc., especially in the current period of climate change, where lack of precipitation, high temperatures and evaporation lead to droughts and local torrential rains to floods. Increasing water retention in the landscape is essential to prevent or at least mitigate the course and consequences of such hydrological extremes. The amount of abstracted water and rainwater drained into the sewerage system affects the amount of discharged wastewater – here, both the amount of discharged wastewater and the concentration of pollutants are important. Pollution of discharged water is intertwined with the availability of wastewater treatment and its effectiveness. The problem is, in particular, the still incomplete sewerage in smaller municipalities (under 2,000 population equivalent). Moreover, only a part of the wastewater treatment plants is equipped with the tertiary degree of treatment, and even that is not capable of 100-percent capture of all substances present in the wastewater (e.g. residues of medicinal products, microplastics). The water quality is particularly important for the healthy functioning of ecosystems and the use of water as drinking, less so for its industrial or agricultural use. Water quality in watercourses is important not only for the organisms living in those ecosystems, but it affects also the surrounding ecosystems. A problem may be the content of substances that are toxic in themselves (e.g. heavy metals), they can accumulate in sediments and organic tissues, and then enter the food chain. At the same time, however, a big issue to address is the content of nutrients (nitrogen, phosphorus, etc.), the increased amount of which leads to eutrophication of waters.

References to current conceptual, strategic and legislative documents

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (Water Framework Directive)
- measures for targeted decrease in the discharge, emissions and releases of priority pollutants
- achieving at least good water status and non-deterioration of the status until 2015, with exceptions until 2027

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive)
- reduce and prevent water pollution by nitrates originating from agricultural sources

Directive 2006/11/EC of the European Parliament and of the Council on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
- reduce and prevent water pollution by hazardous substances provided in the Annex to the Directive

Directive 2006/7/EC of the European Parliament and of the Council concerning the management of bathing water quality
- definition of the methods of monitoring and classification of bathing water quality

Directive of the European Parliament and of the Council 2013/39/EU, amending Directive 2000/60/EC and 2008/105/EC in respect of priority substances in the field of water policy
- protection of water against priority hazardous substances – achieving the obligation standards by the end of 2021 for the revised environmental quality standards of the existing priority substances and by the end of 2027 for the newly designated priority substances

Council Directive 91/271/EEC concerning urban wastewater treatment
- obligation to connect communities over 2,000 PE to a WWTP

Development Plan for Water Supply and Sewerage systems of the Czech Republic
- presents the drinking water supply concept, including the definition of drinking water sources
- supports the construction and reconstruction of WWTPs in municipalities, increasing the proportion of inhabitants connected to public sewerage systems and to sewerage systems terminated in a WWTP

Development Plans for Water Supply and Sewerage on the territory of Czech Republic regions
• construction of the water infrastructure

International plans of the river basin districts of the Elbe, Oder, Danube rivers
• define the framework for the individual National river basin management plans

National River Basin Management Plans
• protection of water as an environmental component
• reducing the adverse effects of floods and drought
• sustainable use of water resources, in particular for drinking water supply purposes
• gradually achieving good water status and not deteriorating the current water status

Plans for river sub-basins
• proposals for concrete measures through programmes for the gradual elimination of important water management issues

Concept of protection against the effects of drought in the Czech Republic
• summary of measures to increase the available amount of water in each part of the hydrological cycle, measures to reduce water consumption and measures to influence its quality by the society
• aimed at creating a strategic framework for the adoption of effective legislative, organizational, technical and economic measures to minimize the impacts of drought and water scarcity on the lives and health of the population, the economy, the environment and the overall quality of life in the Czech Republic

Strategic Framework Czech Republic 2030
• ensuring the availability and sustainable management of water for all and sanitation facilities for all
• ensuring a healthy life and improving its quality for all in any age (by 2030 a substantial reduction in the number of deaths and diseases due to hazardous chemicals and polluted water)

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
• ensure prudent management of water in residential areas by supporting measures leading to the capture and subsequent use of rain water and non-drinking quality water on site
• completion of the construction and reconstruction of missing WWTPs in municipalities with over 2,000 PE, ensuring support for the construction and reconstruction of sewerage systems terminated in WWTPs in municipalities up to 2,000 PE
• achieving at least good ecological status or potential and good chemical status of surface water bodies, achieving good chemical and quantitative status of groundwater bodies

Strategy of the Ministry of Agriculture of the Czech Republic with an outlook till 2030
• improving flood prevention
• mitigating drought effects related to climate change
• sustainable management of water resources
• support and regulation of water supply and sewerage systems to provide water services to the population
• improving the status of aquatic ecosystems by implementing measures from River Basin Management Plans

Strategy on Adaptation to Climate Change in the Czech Republic (2015)
• support for integrated planning in the field of water
• conceptual and legislative solutions to the management of long-term water shortages
• modifying the system of permitting the discharge of wastewater so that it puts maximum emphasis on the application of BAT (best available techniques)
• reducing the consumption of high-quality drinking water for purposes that do not require such a high quality

National Action Plan for Adaptation to Climate Change (2017)
• it sets targets for efficient water management

Operational Programme Environment 2014–2020
• ensure supply of drinking water in adequate quantity and quality (increase share of the population supplied by water from the public water supply systems to 94% by 2023)
• decrease the quantity of discharged pollution from municipal sources and decrease the introduction of pollutants to surface

water and groundwater (for indicator P_{total} to 1,100 t by the year 2023 and for indicator COD_{Cr} to 39,100 t by the year 2023)
- increase the quantity of treated wastewater to 321 mil. m^3 by the year 2023

Act No. 254/2001 Coll. on waters and on changes of some Acts
- defining the conditions for the efficient use of water resources and for preserving and improving the quality of surface water and groundwater
- creating conditions for reducing the adverse effects of floods and droughts and conditions for ensuring the safety of hydraulic structures
- ensuring the supply of drinking water to the population
- contributing to ensuring the supply of drinking water to the population
- contributing to the protection of aquatic ecosystems and terrestrial ecosystems directly dependent on them

Act No. 274/2001 Coll. on water supply and sewerage systems for public use and amending some laws (Water Supply and Sewerage Act)
- regulates some relationships arising from the development, construction and operation of water supply and sewerage systems serving public needs

8 | Water abstraction

Key question

Is water use in the Czech Republic sustainable, with regard to maintaining the availability of water sources in the future?

Key messages

Year-on-year, the total water abstraction declined by 2.4% to 1,591.1 mil. m^3.
There was a year-on-year decrease in water losses in the water supply network, the share of losses in the total volume of water produced and intended for implementation decreased from 16.4% in 2017 to 15.8% in 2018.

Specific consumption of water per capita supplied by public water supply increased slightly by 0.6% to 166.0 $l.inhabitant^{-1}.day^{-1}$. In households, water consumption increased by 0.7%, in 2018 households consumed 89.2 $l.inhabitant^{-1}.day^{-1}$.

Overall assessment of the trend

Change since 1990

Change since 2000

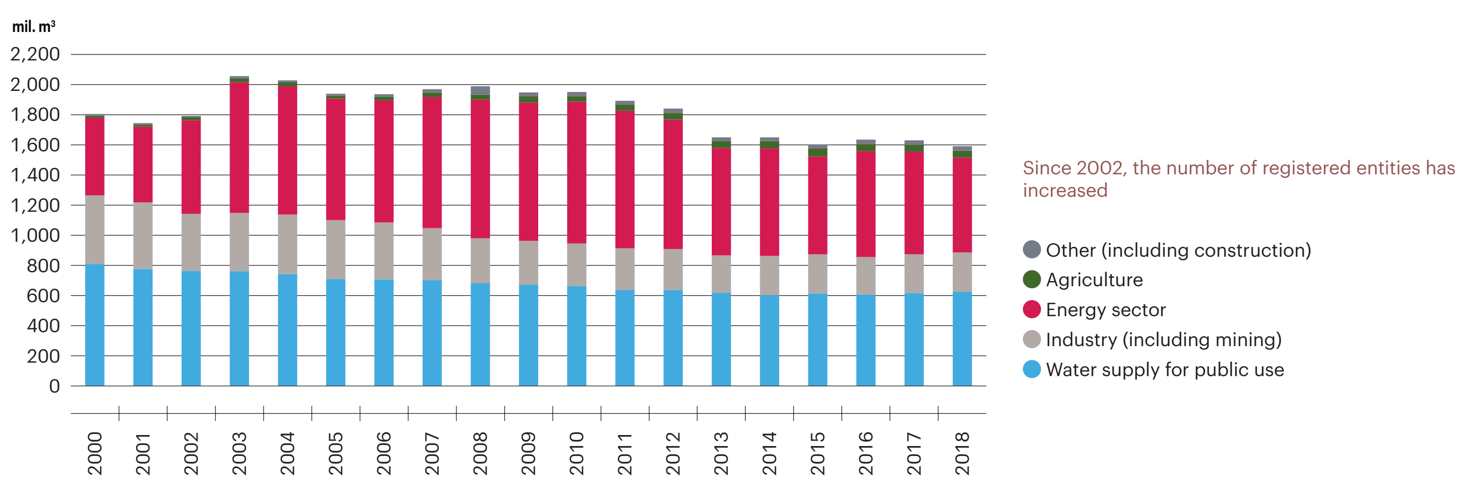
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Total water abstraction by individual sectors in the Czech Republic [mil. m^3], 2000–2018

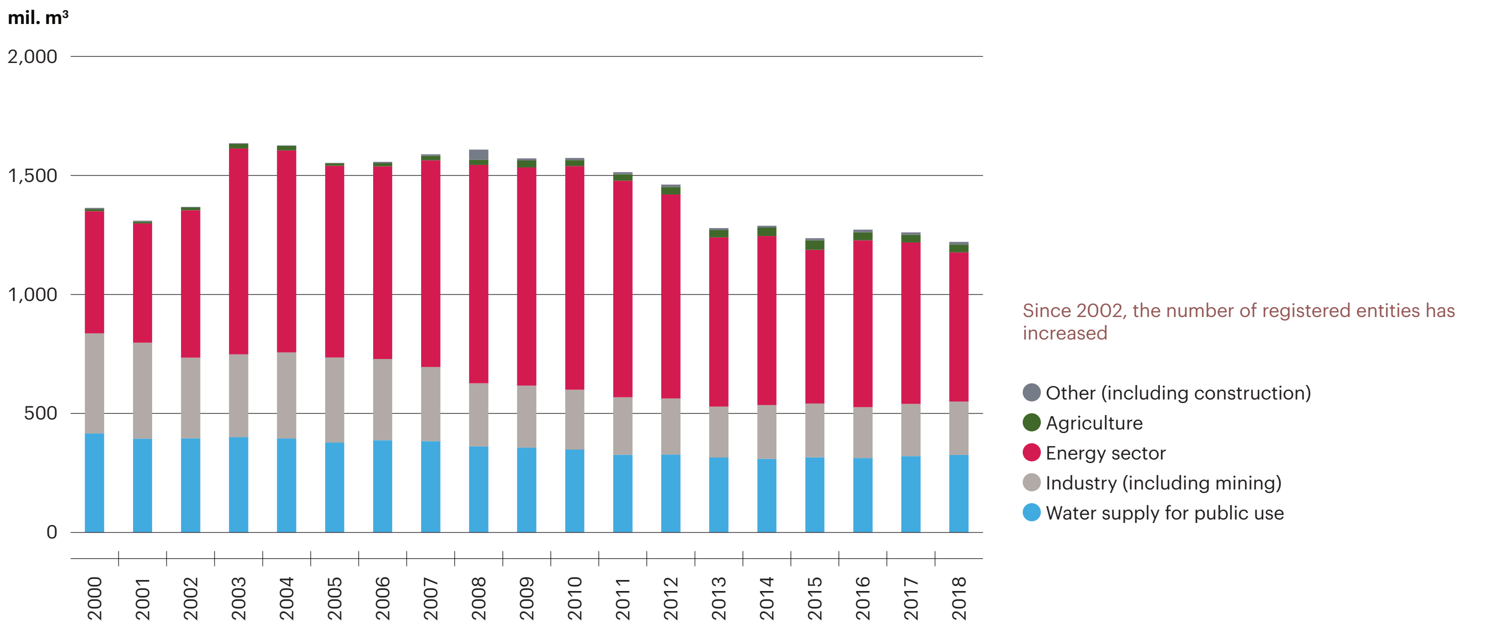


Until 2001, water abstraction exceeding 15,000 m^3 per year or 1,250 m^3 per month was registered. Since 2002, abstraction by users at over 6,000 m^3 per year or 500 m^3 per month has been registered – pursuant to Section 10 of Decree of the Ministry of Agriculture No. 431/2001 Coll.

Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 2

Surface water abstraction by sector in the Czech Republic [mil. m^3], 2000–2018

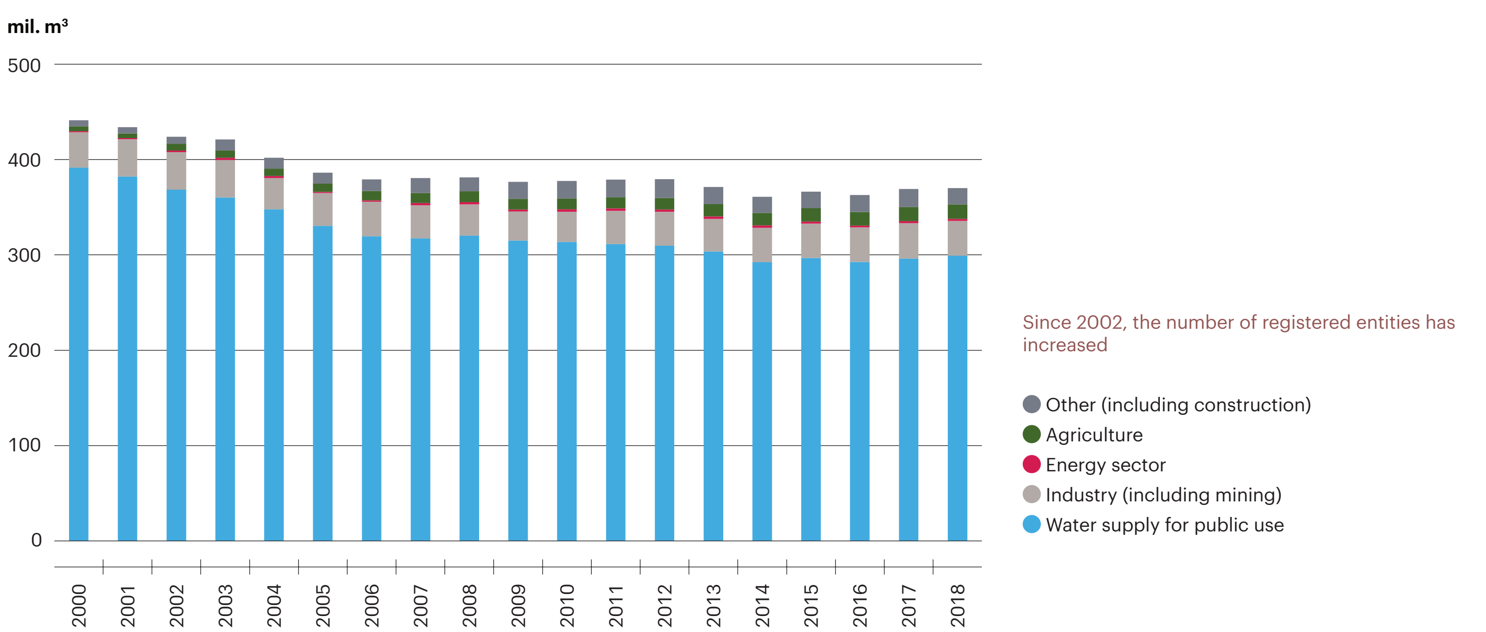


Until 2001, water abstraction exceeding 15,000 m^3 per year or 1,250 m^3 per month was registered. Since 2002, abstraction by users at over 6,000 m^3 per year or 500 m^3 per month has been registered – pursuant to Section 10 of Decree of the Ministry of Agriculture No. 431/2001 Coll.

Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 3

Groundwater abstraction by sector in the Czech Republic [mil. m^3], 2000–2018

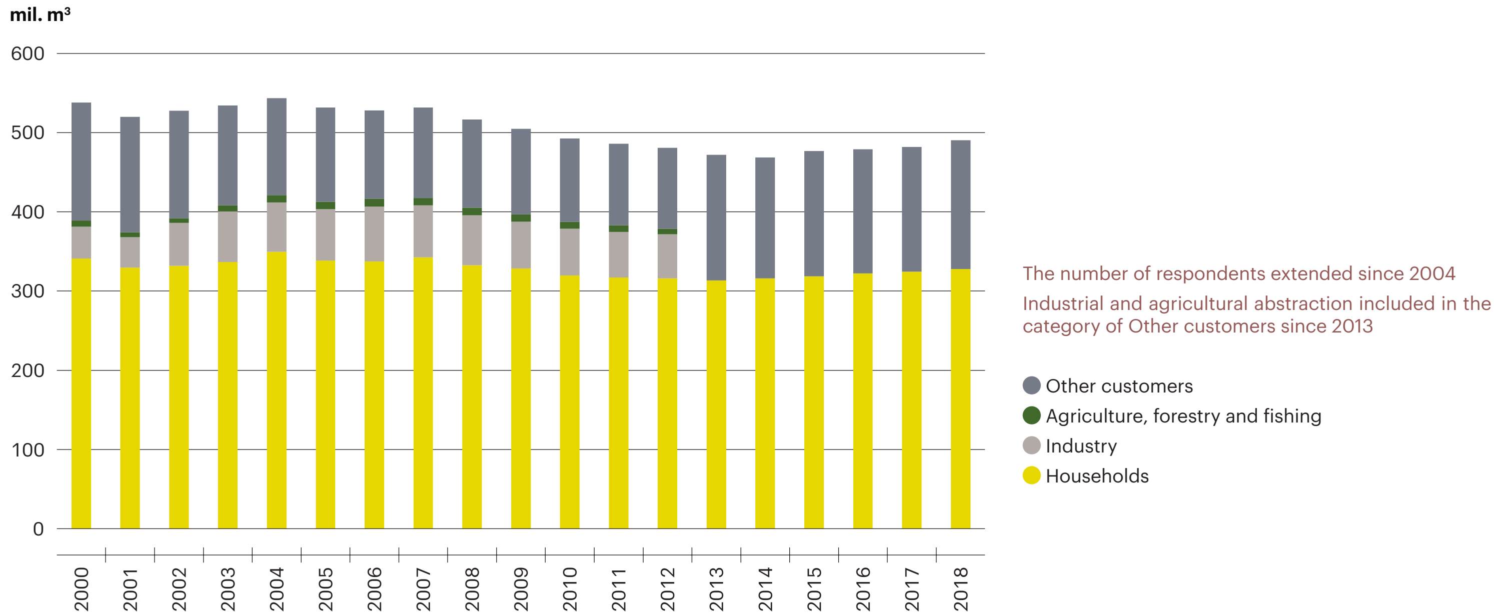


Until 2001, water abstraction exceeding 15,000 m^3 per year or 1,250 m^3 per month was registered. Since 2002, abstraction by users at over 6,000 m^3 per year or 500 m^3 per month has been registered – pursuant to Section 10 of Decree of the Ministry of Agriculture No. 431/2001 Coll.

Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 4

Use of drinking water from water supply systems for public use by individual consumer groups in the Czech Republic [mil. m³], 2000–2018

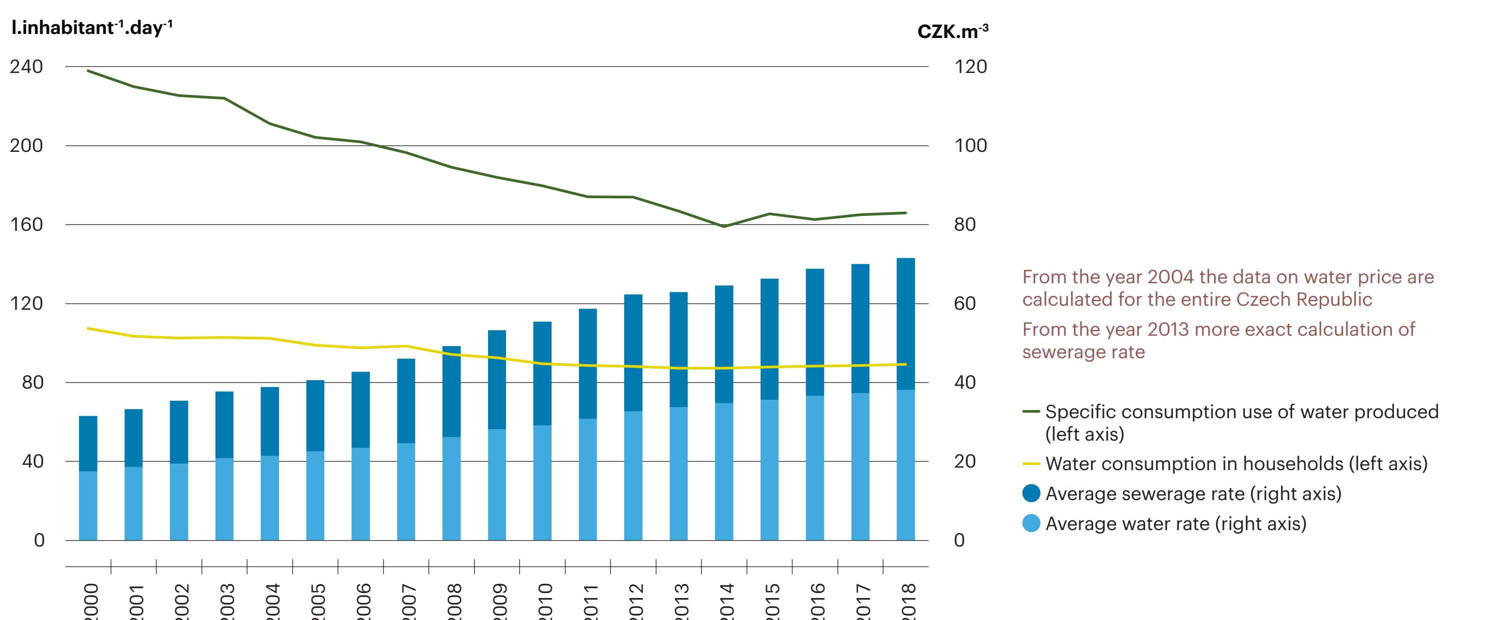


Until 2003, only data for the main operators are provided. In 2013, reporting of invoiced water was simplified (industrial and agricultural abstraction is included in the category "Other" which includes construction, services and other users connected to the public water supply systems).

Data source: Czech Statistical Office

Chart 5

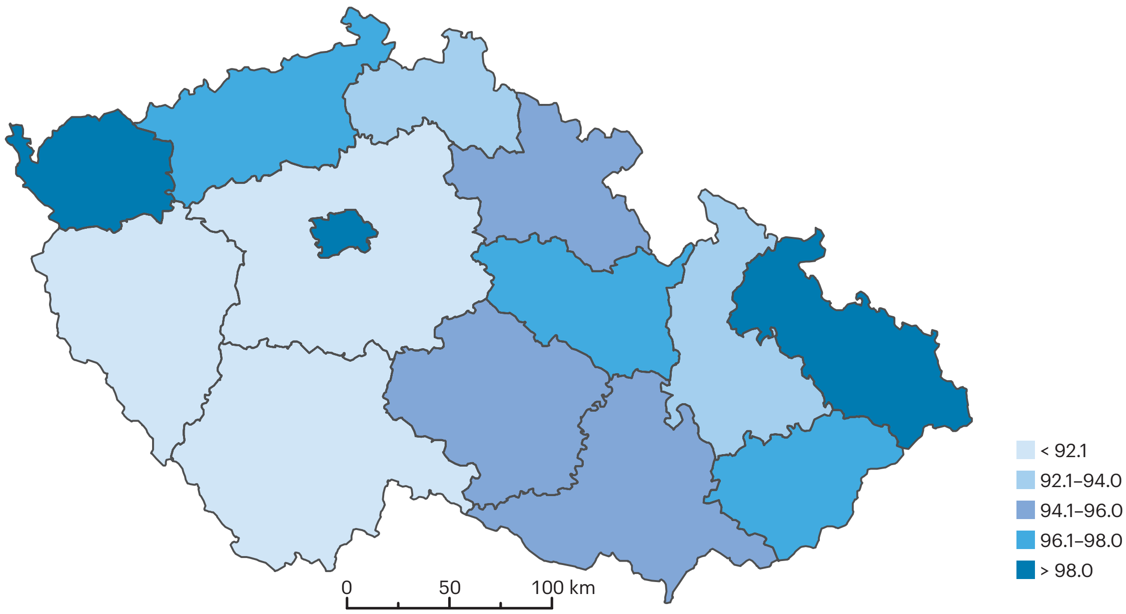
Water consumption in the Czech Republic [l.inhabitant⁻¹.day⁻¹] and the price of water [CZK.m⁻³], 2000–2018



Until 2003, the water prices are provided for the main operators only. From the year 2004, the water prices are calculated for the entire Czech Republic. Water prices are stated in current prices without VAT. In 2013, the calculation of the sewerage rate was made more precise by including rain water discharges in the rate and also due to cooperation of the respondents. The resulting sewerage rate per m³ from 2013 on is not fully comparable with the previous years.

Data source: Czech Statistical Office

Figure 1
Share of population connected to public water supply systems in Regions of the Czech Republic [%], 2018



Data source: Czech Statistical Office

Abstraction of surface and groundwater reflects the development of the economy, the hydrometeorological conditions of the given year and the behaviour of households. The total amount of abstracted water (i.e. sum of surface and ground water abstractions) has decreased by 11.8% since 2000. In 2018, the total water abstraction amounted to 1,591.1 mil. m^3, compared to 2017 it decreased by 2.4%. In the long term, the highest abstractions have been made for the energy sector; their share in the total water abstraction in 2018 was 39.5% (629.0 mil. m^3). Another important consumer are the water supply systems for public use. In 2018, 625.0 mil. m^3 (39.3% of total abstraction) was taken for public water supply systems. The third most important consumer of water is industry which abstracted 260.7 mil. m^3 in 2018, i.e. 16.4% of the total abstractions. Abstraction of water for agriculture (47.7 mil. m^3) and the other sectors including construction (28.7 mil. m^3) forms in sum 4.8% of the total water abstraction in 2018 (Chart 1).

Most of the abstractions are made from surface water (1,220.7 mil. m^3, i.e. 76.7% of the total abstractions), a smaller part from the groundwater (370.4 mil. m^3, 23.3%). When dividing the total abstractions into abstractions of surface and ground water (Chart 2, Chart 3), differences are noticeable in the sources of abstracted water used by the particular economic sectors.

Water for the energy sector is abstracted in 99.7% from surface water. That water is used mainly for once-through cooling of steam turbines. Of the total surface water abstraction, 51.4% is taken for the energy sector. Compared to 2017, water abstraction for the energy sector decreased by 7.5% to 629.0 mil. m^3. The decrease in abstraction for the energy sector was recorded in the Elbe river basin where a new technology was introduced (transition from once-through cooling to circulation cooling) and in one case electricity production was gradually reduced.

For the **water supply for public use** a total of 625.0 mil. m^3 was drawn in 2018. 47.9% (299.1 mil. m^3) was abstracted from groundwater. Public water supply systems are the greatest abstractors of groundwater, due to the higher quality of groundwater and thus less treatment needed for drinking water production, in 2018 they accounted for 80.8% of groundwater abstraction.

Water abstraction **for the industry** accounted for 18.4% of the abstraction from surface sources and 9.9% from groundwater sources. Water abstraction for industry from underground sources decreased by 2.0% year-on-year to 36.6 mil. m^3, while abstraction from surface water increased by 1.9% to 224.1 mil. m^3. Water abstraction for industry is generally influenced by economic development in individual sectors and the introduction of new more environmentally friendly production technologies.

Water for **agriculture** is taken in 68.0% from surface water and makes up 3.0% of total water abstraction. Surface water abstraction grew year-on-year by 1.7% to 32.4 mil. m^3, and groundwater abstraction also increased by 4.0% to 15.3 mil. m^3. The year-on-year fluctuations in abstraction for crop production depend on the temperatures and amount of precipitation during the growing season. The severe drought of 2018 caused higher water abstracted for agriculture.

A significant part of the abstracted water is intended for the production of drinking water. In 2018, 601.5 mil. m^3 of water was produced and intended for implementation, which represents 37.8% of the total water abstraction. **Drinking water** invoiced to households and other customers accounted for 490.4 mil. m^3 of which 66.8% was invoiced to households (Chart 4). Year-on-year, invoiced water increased by 1.8%. In 2018, 94.7% of the population of the Czech Republic were supplied with water from public water supply systems, the rate of connection of the population to the public water supply system differs by region, it has long been the highest in Prague and in the Moravian-Silesian Region (Figure 1).

There was a year-on-year decrease in **water losses in the water supply network**, both in absolute terms (from 97,793 thous. m^3 to 94,955 thous. m^3) and in relation to the total volume of water produced and intended for implementation (16.4% in 2017 vs 15.8% in 2018). Drinking water losses in the water supply network are caused by accidents and leaks from water mains. The share of drinking water losses in the water supply network has decreased significantly since 2000, when it was 25.2%.

Specific water consumption per inhabitant supplied with water from the public water supply system, out of the total quantity of produced water, was 166.0 $l.inhabitant^{-1}.day^{-1}$, which is 0.6% more than in 2017 (Chart 5). Water consumption in households (the amount of water invoiced to households per capita per day) in 2018 was 89.2 $l.inhabitant^{-1}.day^{-1}$, there was a slight year-on-year increase of 0.7%. Since 2013, when the lowest value to date was recorded in the reference period (87.2 $l.inhabitant^{-1}.day^{-1}$), the trend of an insignificant increase in consumption has continued.

In the long-term, **water and sewerage rates** continue to increase (Chart 5). In 2018, the average water rate was CZK 38.1 per m^3 excl. VAT and the sewerage rate was CZK 33.4 per m^3 excl. VAT.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

9 | Wastewater discharge

Key question

Are we successful in reducing the quantity of pollution discharged from point sources into surface waters?

Key messages

The volume of wastewater discharged decreased year-on-year by 9.5% to 1,540.8 mil. m^3. Compared to 2000 it decreased by 14.5%. The volume of nitrogen ($N_{inorg.}$) decreased year-on-year by 5.2% in discharged wastewater.

Overall assessment of the trend

Change since 1990

Change since 2000

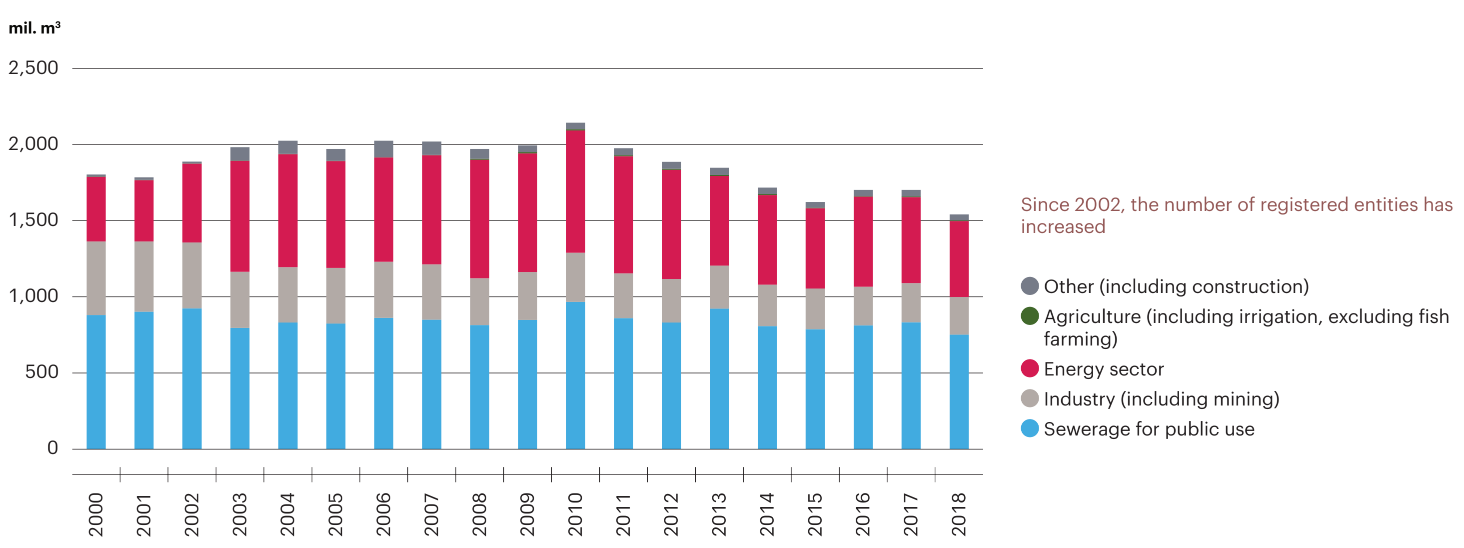
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Quantity of wastewater discharged into surface water in the Czech Republic [mil. m^3], 2000–2018

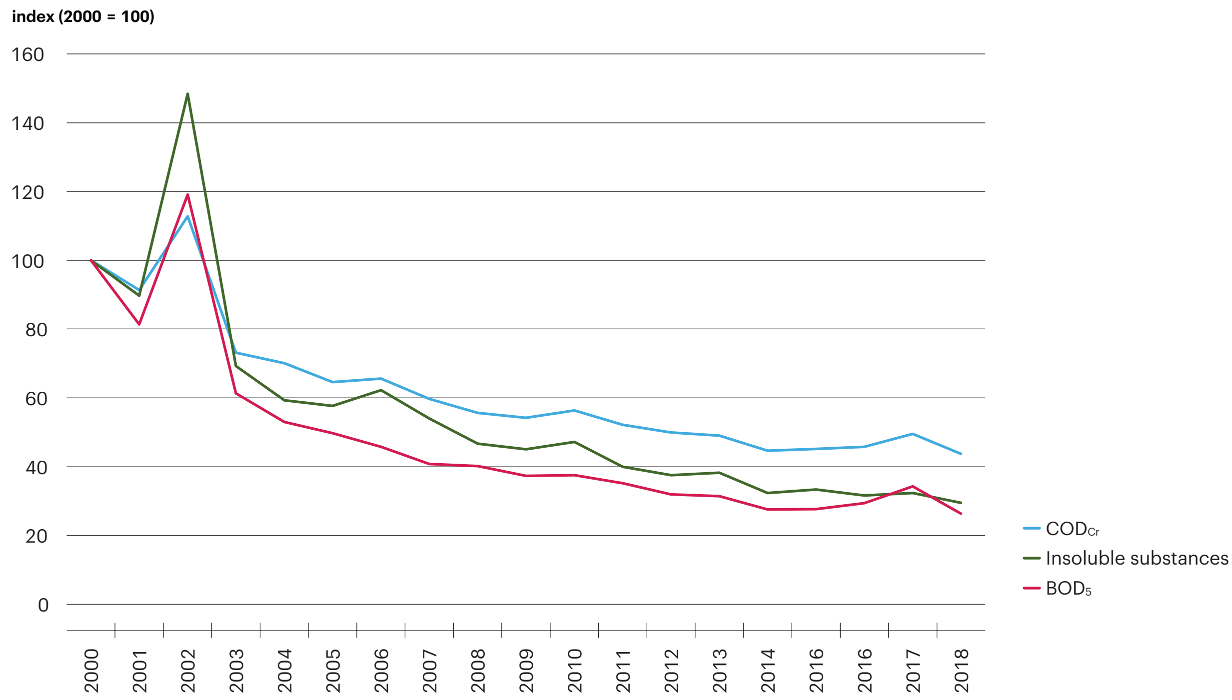


Until 2001, wastewater and mine drainage water discharges exceeded 15,000 m^3 per year or 1,250 m^3 per month. Since 2002, discharges of wastewater and mine drainage water have exceeded 6,000 m^3 per year or 500 m^3 per month – pursuant to Section 10 of Decree No. 431/2001 Coll.

Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 2

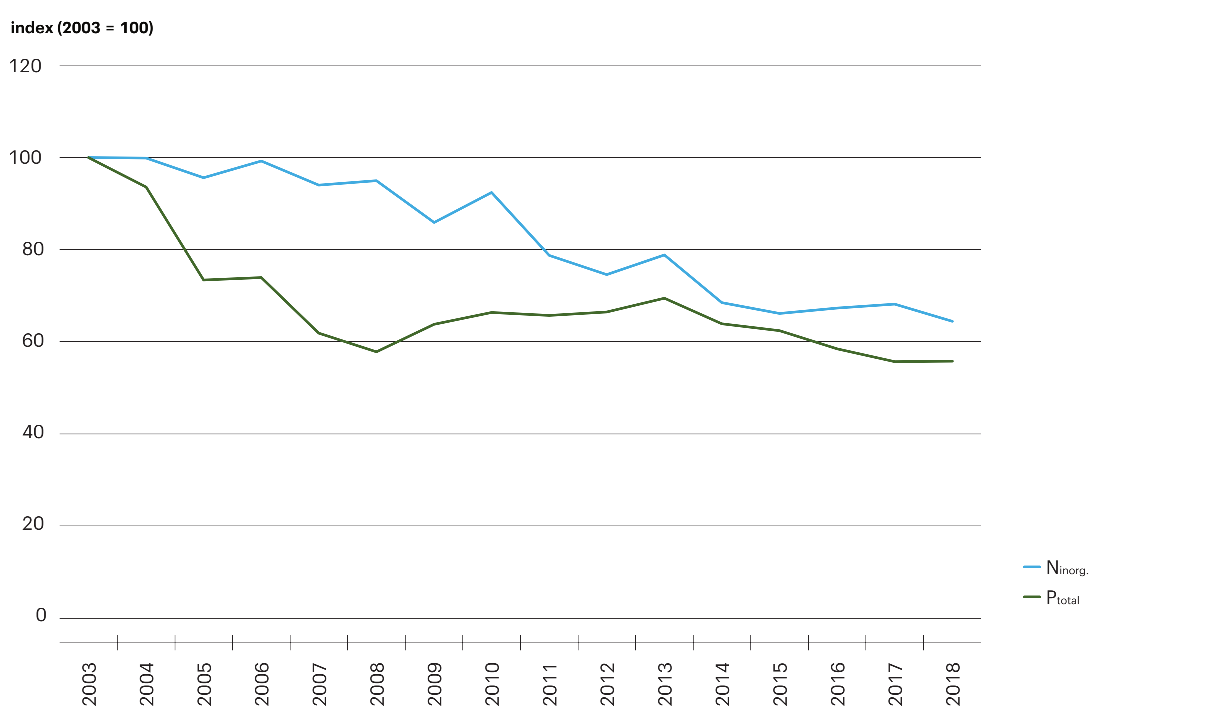
Relative representation of pollution discharged from point sources expressed in BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 2000 = 100], 2000–2018



Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Chart 3

Relative representation of pollution discharged from point sources expressed in $N_{inorg.}$ and P_{total} indicators in the Czech Republic [index, 2003 = 100], 2003–2018



Data source: Ministry of Agriculture, Povodí state enterprises, T. G. Masaryk Water Research Institute, public research institution, Czech Statistical Office

Since 2000, the **total volume of wastewater discharged** has decreased by 14.5% to 1,540.8 mil. m^3, but a long-term trend is not evident (Chart 1). The increase in 2002 and the two subsequent years was connected with a change in the limits of the registered quantity of discharged water and with the increase in discharges of wastewater from the energy sector, which was due to the start of abstractions of cooling water for the Temelín nuclear power plant and the renewed increase in abstractions for the Mělník power plant. In 2010, discharge grew sharply due to higher rainfall, which increased the volume of disposed rainwater. From 2010, the volume of discharged water decreased each year until 2015. In 2016, there was a slight increase in the total volume of wastewater discharged from point sources, and the slight increase continued in 2017. The low volume of wastewater discharged from 2015 to 2018 is influenced by the development of climatic conditions.

The **structure of the wastewater discharge** reflects the structure of customers. The largest share in 2018 was represented by public sewerage systems, namely 48.8% (i.e. 752.1 mil. m^3) and the energy sector with 32.4% (i.e. 498.7 mil. m^3). Wastewater from industry represented 16.0% (246.8 mil. m^3), other categories 2.5% (38.6 mil. m^3) and wastewater from agriculture accounted for only 0.3% (4.5 mil. m^3). The amount of wastewater discharged decreased year-on-year in all sectors. Significant decreases were recorded in wastewater discharges from agriculture (by 12.7%) and the energy sector (by 11.7%). Agriculture is an important source of non-point pollution, as substances used in agricultural activities (fertilizers, pesticides) are rinsed into watercourses, but this type of pollution is not registered. Wastewater discharged by the energy sector consists almost exclusively of wastewater from once-through cooling, which influences the temperature and oxygen regime of water. The discharge of municipal wastewater (sewerage for public use), which represents significant point sources of pollution (mainly organic), decreased year-on-year by 9.6%. Discharges of industrial wastewater, which is the source of not only organic pollution, but also pollution such as heavy metals, decreased by 3.9% year-on-year.

Monitoring the **amount of pollution discharged in wastewater** is especially important because it greatly affects the quality of surface and underground water. Since 2000, the amount of discharged pollution has been decreasing with slight fluctuations (a significant deviation was in 2002, which was caused by the extreme flood situation), Chart 2. Year-on-year, BOD_5 decreased by 23.1%, COD_{Cr} decreased by 11.8% and suspended solids by 9.0% compared to 2017.

Year-on-year, nitrogen ($N_{inorg.}$) decreased by 5.2%, while phosphorus (P_{total}) grew slightly by 0.2% (Chart 3). In the long-term perspective, since 2003, the quantity of $N_{inorg.}$ has decreased by 35.6% and P_{total} even by 44.2%. The long-term decrease is influenced especially by the fact that the wastewater treatment technology in the new and intensified WWTPs applies biological nitrogen removal and biological or chemical phosphorus removal, but also by reduction of phosphates used in detergents.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

10 | Wastewater treatment

Key question

How many Czech inhabitants are connected to the public sewerage systems and wastewater treatment plants and what is the proportion of treated wastewater?

Key messages

The number of WWTPs is growing steadily, the proportion of tertiary treatment is increasing and the number of WWTPs with only mechanical treatment is shrinking. In 2018, a total of 2,677 WWTPs were operated in the Czech Republic, of which 1,497 with the tertiary phase of treatment.

The share of inhabitants connected to the sewerage network did not change in comparison with 2017, and in 2018 it was 85.5%.
17.6% of the population is not yet connected to a sewerage system terminated with a WWTP. Although part of their wastewater may be treated in a decentralised way, still it is a significant potential source of pollution of watercourses.

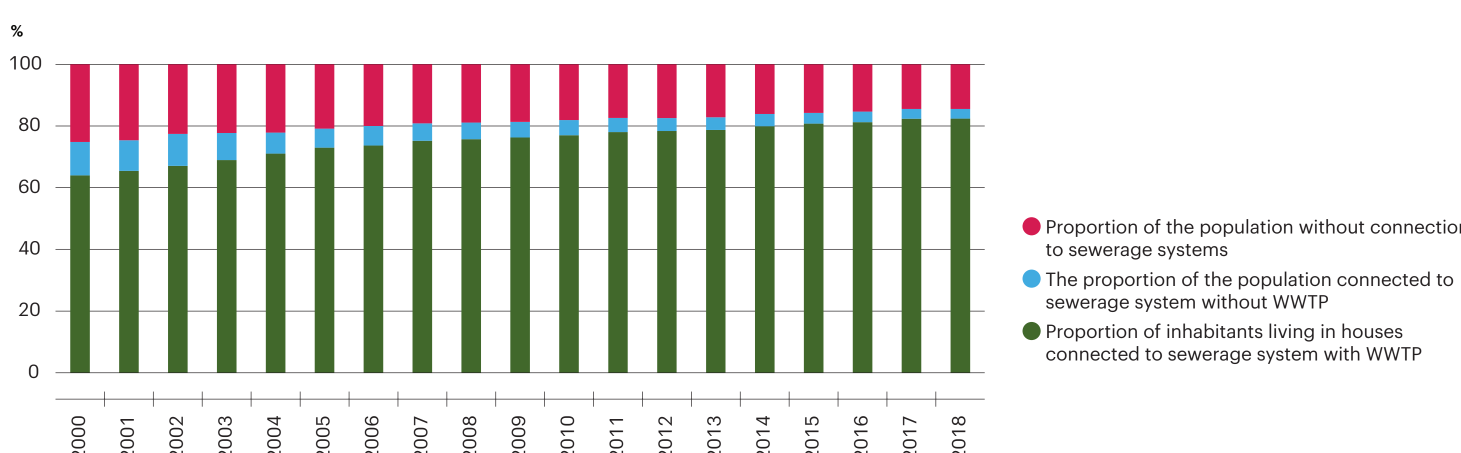
Overall assessment of the trend

Change since 1990	Change since 2000	Change since 2010	Last year-on-year change

Indicator assessment

Chart 1

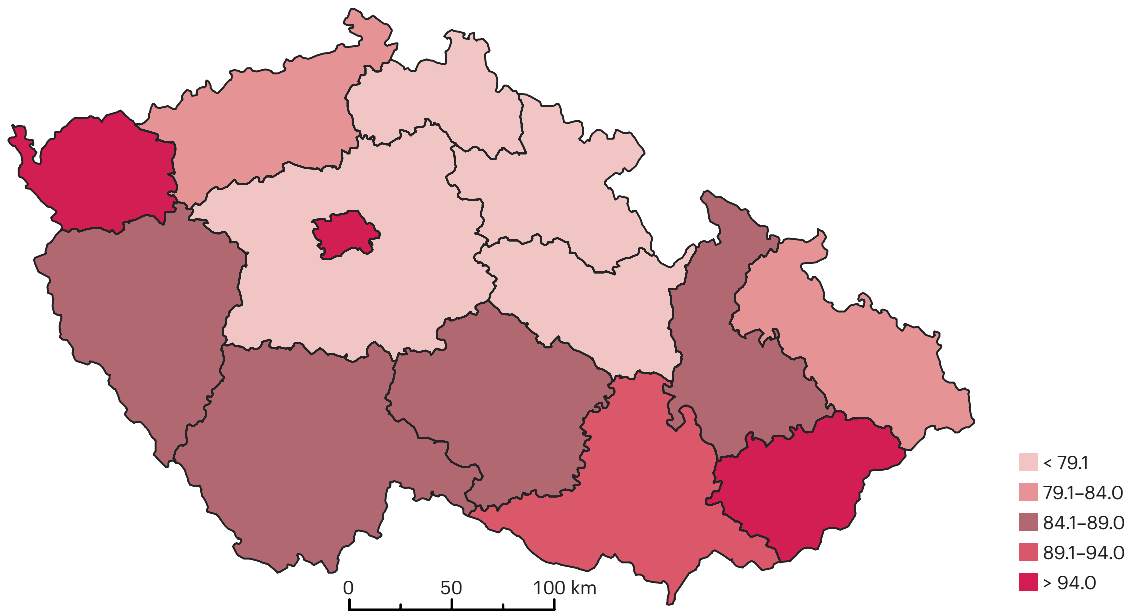
Proportion of the population connected to sewerage systems and to sewerage systems terminated in WWTPs in the Czech Republic [%], 2000–2018



Data source: Czech Statistical Office

Figure 1

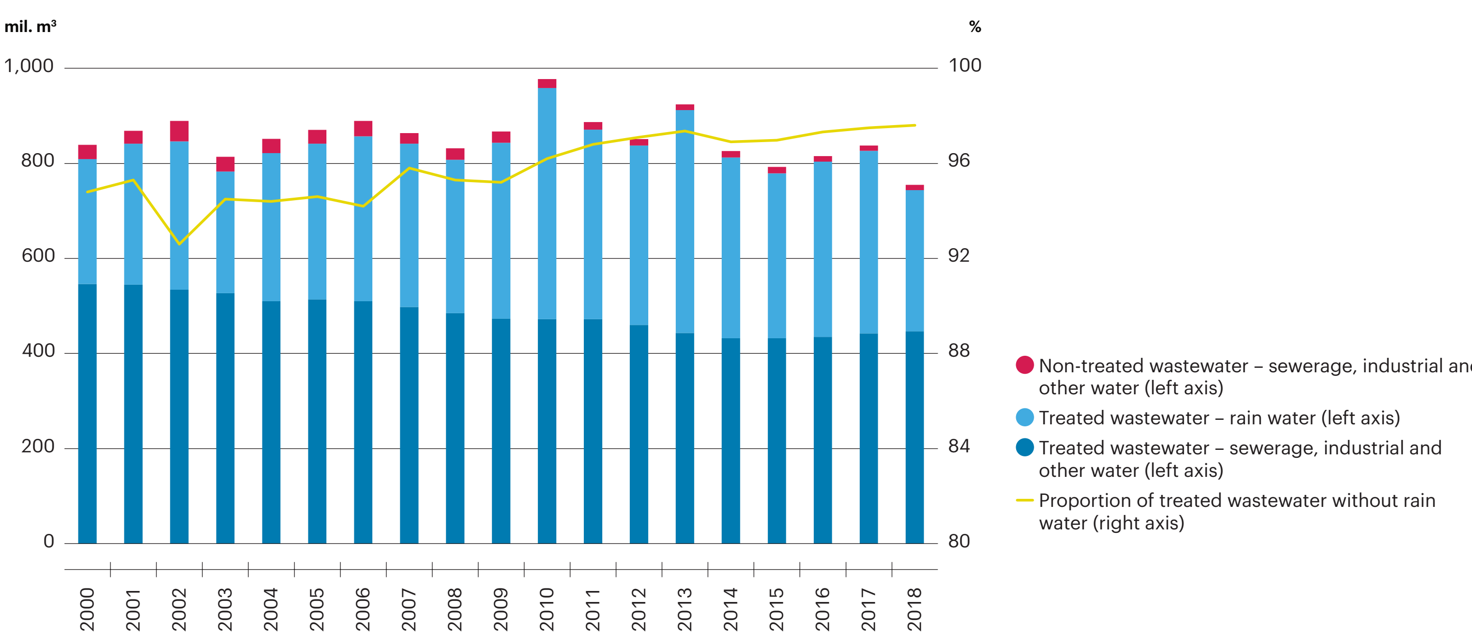
Proportion of the population connected to sewerage system in Regions of the Czech Republic [%], 2018



Data source: Czech Statistical Office

Chart 2

Treatment of wastewater discharged into sewerage systems in the Czech Republic [mil. m³, %], 2000–2018

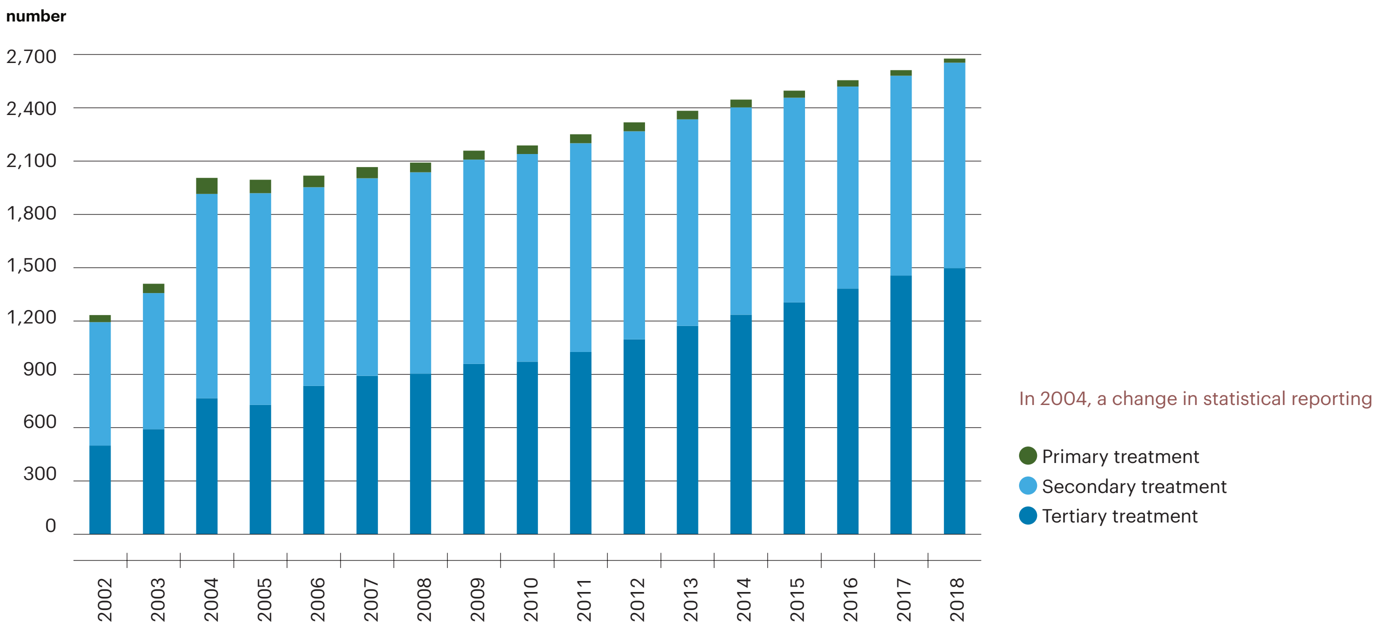


Until 2003 data are provided for the main operators of sewerage systems only. The number of respondents extended since 2004. The data series shown is impacted by changes in statistical reporting and by the gradual transformation of the former water supply and sewerage companies (sewerage systems are transferred into the ownership of towns and communities).

Data source: Czech Statistical Office

Chart 3

Wastewater treatment plants according to treatment stages in the Czech Republic [number], 2002–2018



Primary treatment – mechanical WWTPs, secondary treatment – mechanical-biological WWTPs without nitrogen and phosphorus removal, tertiary treatment – mechanical/biological WWTPs with additional removal of nitrogen and/or phosphorus.

Data source: Czech Statistical Office

The **share of the Czech population connected to the sewerage network** in 2018 was 85.5% (Chart 1) and remained unchanged compared to 2017. The proportion of the population connected to sewerage varies by Region (Chart 1). The share of the population connected to a sewerage system with a wastewater treatment plant (WWTP) in the same period increased slightly from 82.3% to 82.4%. Compared to 2000, the proportion of inhabitants connected to sewerage systems with a WWTP increased by 18.4 p.p. Despite the initial intensive development of the water infrastructure after 2000, which was influenced in particular by the entry of the Czech Republic into the EU and the subsequent implementation of European legislation and absorption of European subsidies, this development is gradually reaching the limits given by the necessity to cover the smaller municipalities where less population is concentrated and where funding is lacking in the budget. Wastewater produced by 17.6% of the population in 2018 was not directly discharged to sewerage systems with a WWTP, but was collected in sewerage systems without treatment plants, in sumps, septic tanks and other facilities, from where it was then transported for treatment or discharged without proper treatment directly into watercourses.

The **total volume of water discharged into the public sewerage systems**, which includes also rain water subject to discharge fees, was 529.1 mil. m^3 in 2018, with a year-on-year increase of only 0.9%. Of this, the volume of water discharged into the public sewerage system without rainwater in 2018 was 457.3 mil. m^3 (of which 446.3 mil. m^3 were treated and 11.0 mil. m^3 were untreated, Chart 2). The **share of treated wastewater in water discharged into sewerage systems** has been high in the long term (since 2000 it has been in the range of 94 to 98%, Chart 2). In 2018, it reached 97.6%, compared to only 75.0% in 1990. A variation in 2002 was caused by limited operation of WWTPs affected by the flood. The WWTPs also treat a part of rain water not subject to discharge fees. Its quantity shows large annual fluctuations which correspond to the precipitation conditions of the given year. In 2018, the volume of treated rainwater decreased by 86.7 mil. m^3 of compared to 2017, i.e. 297.3 mil. m^3. It was the lowest value since 2000.

The **total number of WWTPs** for public use in the Czech Republic has more than doubled since 2002 to 2,677 WWTP. The number of WWTPs grew year-on-year by 2.5% (Chart 3). Due to the construction and reconstruction of WWTPs, the total number of WWTPs with removal of nitrogen and/or phosphorus (tertiary treatment) increased by 41 compared to 2018, reaching 1,497 WWTPs in all agglomerations. There were only 25 WWTPs with only mechanical treatment in 2018.

EU Member States are obligated to ensure (pursuant to Article 3 of Council Directive 91/271/EEC on municipal wastewater treatment) that all agglomerations above 2000 population equivalent are equipped with sewerage systems for urban wastewater. The latest international evaluation is available as of 2014, where the EU achieved an average rate of 94.7% compliance with Article 3, while the Czech Republic achieved a 100% compliance rate. The Directive lays down criteria for specific types of treatment, and Article 4 requires that municipal wastewater drained by sewerage systems undergo secondary treatment or other equivalent treatment before discharge. The Czech Republic had 90.5% compliance in 2014. The rate of compliance with the requirements for tertiary treatment and more stringent treatment (Article 5) reached 62.7% in the Czech Republic in 2014. At present, all agglomerations in the Czech Republic over 10,000 PE have tertiary treatment.

The **average efficiency of WWTPs** (the amount of degraded pollution) in the Czech Republic is very high due to the modernization and reconstruction of WWTPs, which reduced the number of WWTPs with only mechanical treatment. For BOD_5, efficiency reached 98.5% in 2018. For some indicators, there was a slight year-on-year deterioration, for P_{total} to 86.7% (from 87.2%) and for COD_{Cr} to 95.1% (from 94.8%). The values improved for N_{total} to 79.4%.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

11 | Water quality

Key question

Is the quality of surface water and groundwater, which has an impact on aquatic organisms and the use of water, improving?

Key messages

According to summary assessment of the basic indicators monitored pursuant to CSN 75 7221, the quality of water in watercourses of the Czech Republic is satisfactory, but still a large part of watercourses is assessed as class III (polluted water) and worse.
A number of groundwater samples were found to be contaminated, in particular, as in 2017, by ammonium ions (11.0% of the samples were above limit) and nitrates (10.6% of the samples were above limit). Among the organic substances, pesticides and their metabolites are particularly problematic. The limit for the pesticide sum indicator was exceeded by 22.6% of samples.

Compared to 2017, the quality of bathing water deteriorated. Total share of sites falling under category I and II in 2018 was 63.4%, while in 2017 it was 68.9%. In 2018, a ban on bathing was imposed on 29 localities (10.8% of localities) based on laboratory analyses, while in 2017 the ban was imposed on 14 localities (5.6% of localities).

Overall assessment of the trend

Change since 1990

Change since 2000

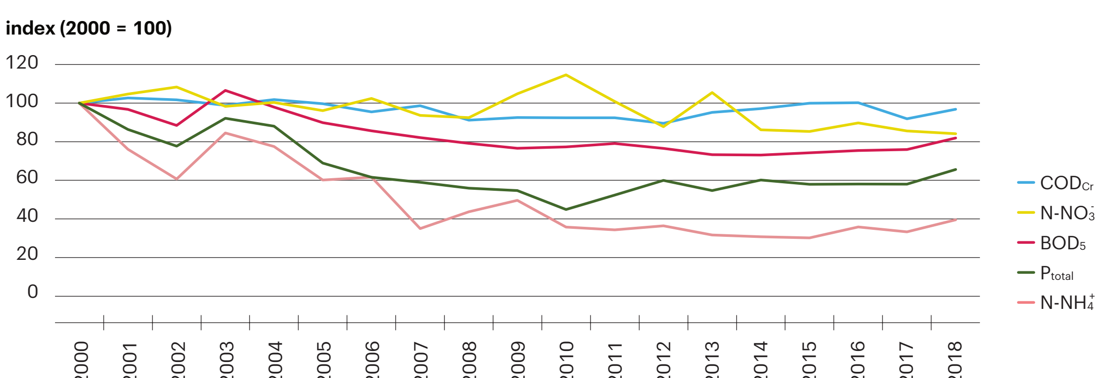
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Development of concentrations of pollution indicators in watercourses [index, 2000 = 100], 2000–2018



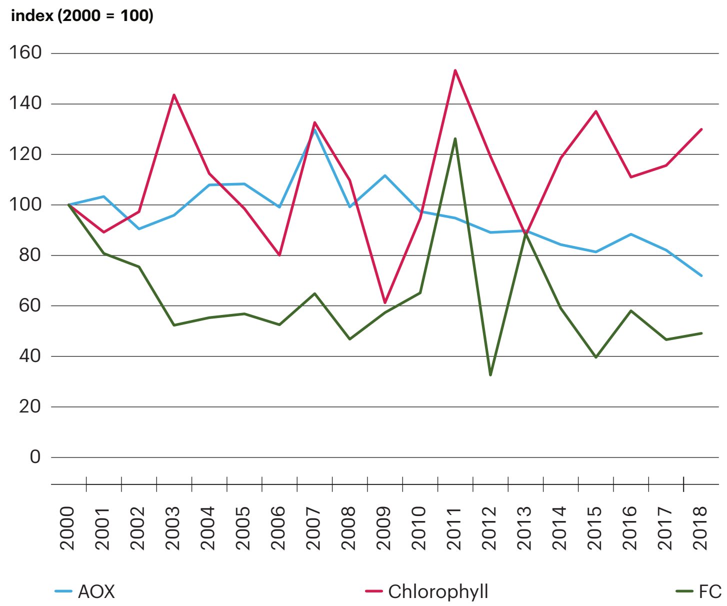
Indices for the different parameters as of the selected baseline year were calculated on the basis of arithmetic averages for each year from the average annual values for 124 representative river profiles of category 5 and 6, i.e. the two most important categories. The number of stations varies for each year and each indicator depending on the availability of data. The quality of water in indicators BOD_5, COD_{Cr}, $N\text{-}NO_3^-$, $N\text{-}NH_4^+$, and P_{total} was evaluated at 107–126 stations, in 2018 at 124 stations.

Data source: Czech Hydrometeorological Institute, based on data of Povodí state enterprises

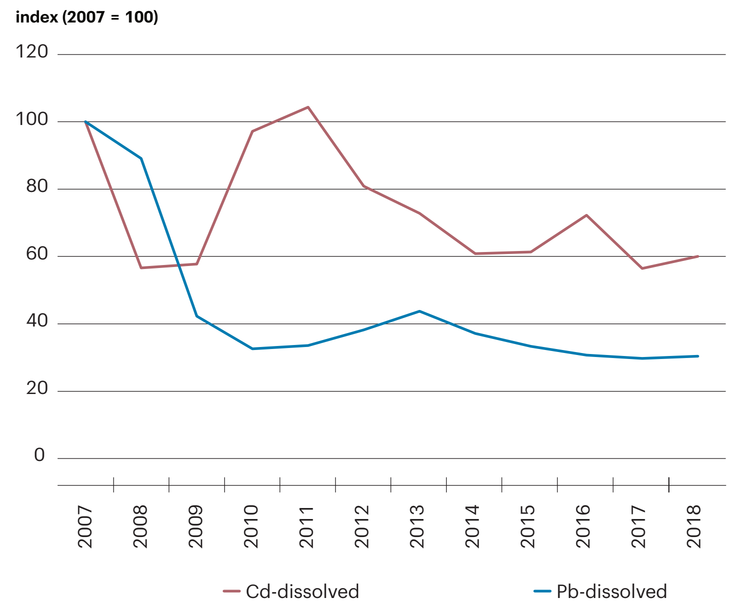
Chart 2

Development of concentrations of pollution indicators in watercourses, 2000–2018

AOX, chlorophyll, FC [index, 2000 = 100]



Cd, Pb [index, 2007 = 100]

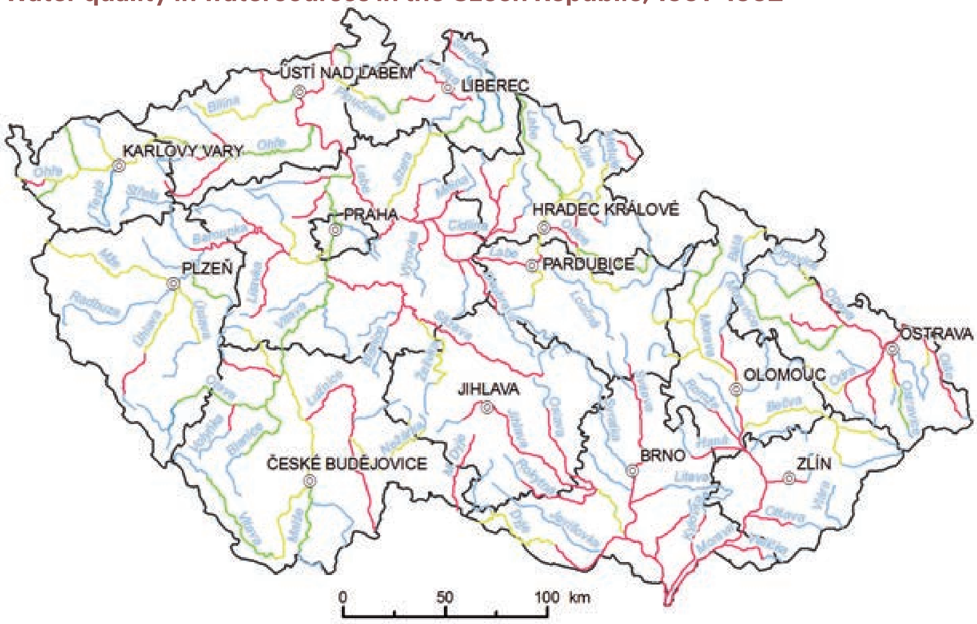


Indices for the different parameters as of the selected baseline year were calculated on the basis of arithmetic averages for each year from the average annual values for 124 representative river profiles of category 5 and 6, i.e. the two most important categories. The number of stations varies for each year and each indicator depending on the availability of data. The quality of water in indicators AOX, FC and chlorophyll was evaluated in the period 2000–2018, dissolved Cd and Pb started to be measured in 2007. AOX was measured at 79–126 stations, in 2018 at 124 stations. Chlorophyll was measured at 40–124 stations, in 2018 at 124 stations. FC at 35–126 stations, in 2018 at 125 stations. Cd at 7–86 stations, in 2018 at 86 stations. Pb at 7–89 stations, in 2018 at 86 stations.

Data source: Czech Hydrometeorological Institute, based on data of Povodí state enterprises

Figure 1

Water quality in watercourses in the Czech Republic, 1991–1992



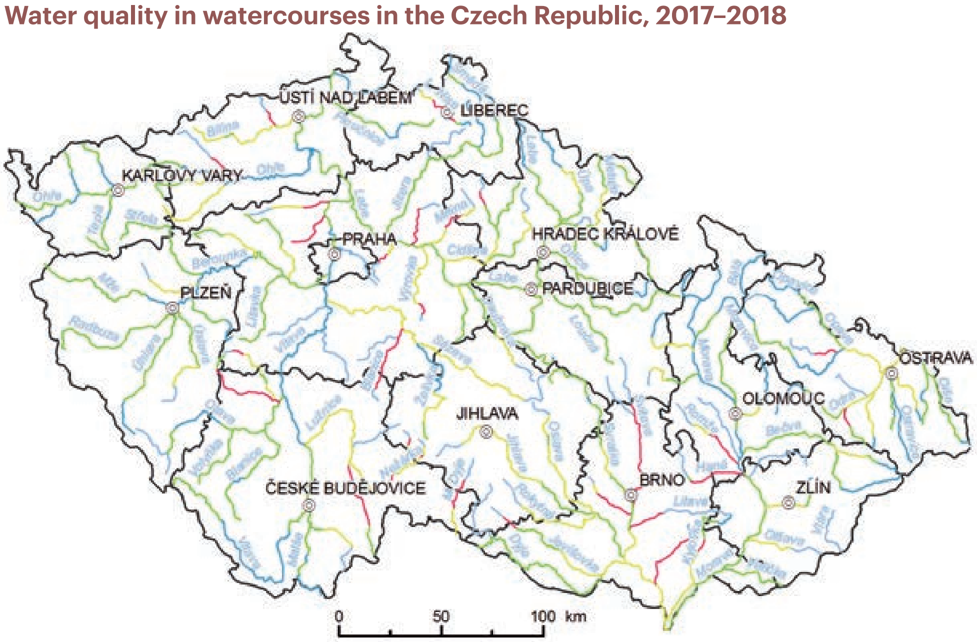
- Class I and II unpolluted and slightly polluted water
- Class III polluted water
- Class IV heavily polluted water
- Class V very heavily polluted water

A summary evaluation of indicators BOD_5, COD_{Cr}, $N\text{-}NO_3^-$, $N\text{-}NH_4^+$, P_{total}.
As of 1 December 2017, the amended standard CSN 75 7221 Water Quality – Classification of Surface Water Quality came into force, replacing the previous standard (CSN 75 7221 Water Quality – Classification of Surface Water Quality) valid for 19 years. The subject of the amendment was to take into account the requirements for the current level of surface water protection, both in terms of pollution indicators and permissible pollution levels. Both the range of indicators and the limits of the quality classes have been revised.

Data source: T. G. Masaryk Water Research Institute, public research institution

Figure 2

Water quality in watercourses in the Czech Republic, 2017–2018



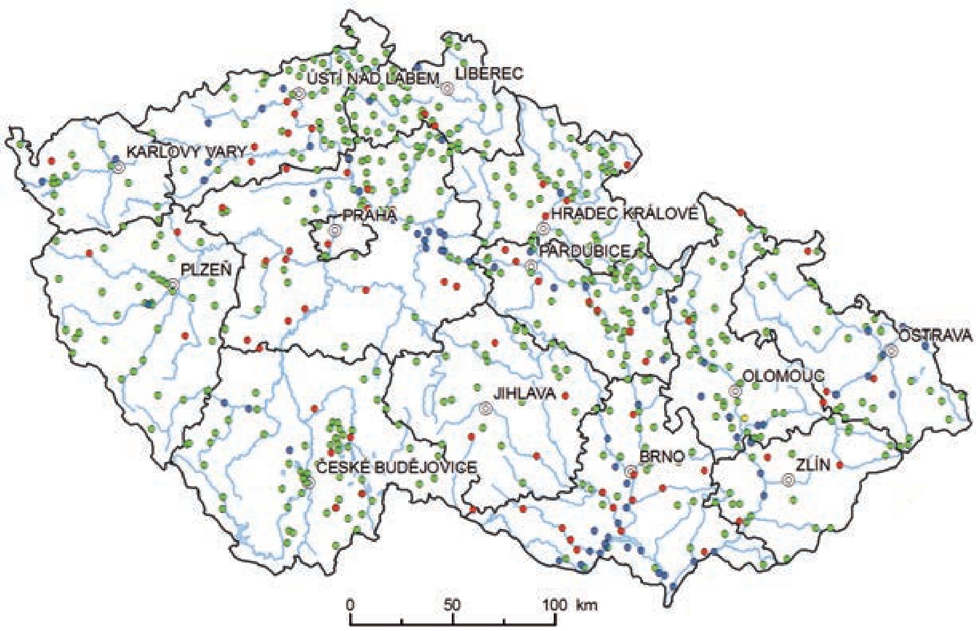
- Class I and II unpolluted and slightly polluted water
- Class III polluted water
- Class IV heavily polluted water
- Class V very heavily polluted water

A summary evaluation of indicators BOD_5, COD_{Cr}, $N\text{-}NO_3^-$, $N\text{-}NH_4^+$, P_{total}.
As of 1 December 2017, the amended standard CSN 75 7221 Water Quality – Classification of Surface Water Quality came into force, replacing the previous standard (CSN 75 7221 Water Quality – Classification of Surface Water Quality) valid for 19 years. The subject of the amendment was to take into account the requirements for the current level of surface water protection, both in terms of pollution indicators and permissible pollution levels. Both the range of indicators and the limits of the quality classes have been revised.

Data source: T. G. Masaryk Water Research Institute, public research institution

Figure 3

Concentration of nitrogen compounds in groundwater [mg.l-1], 2018

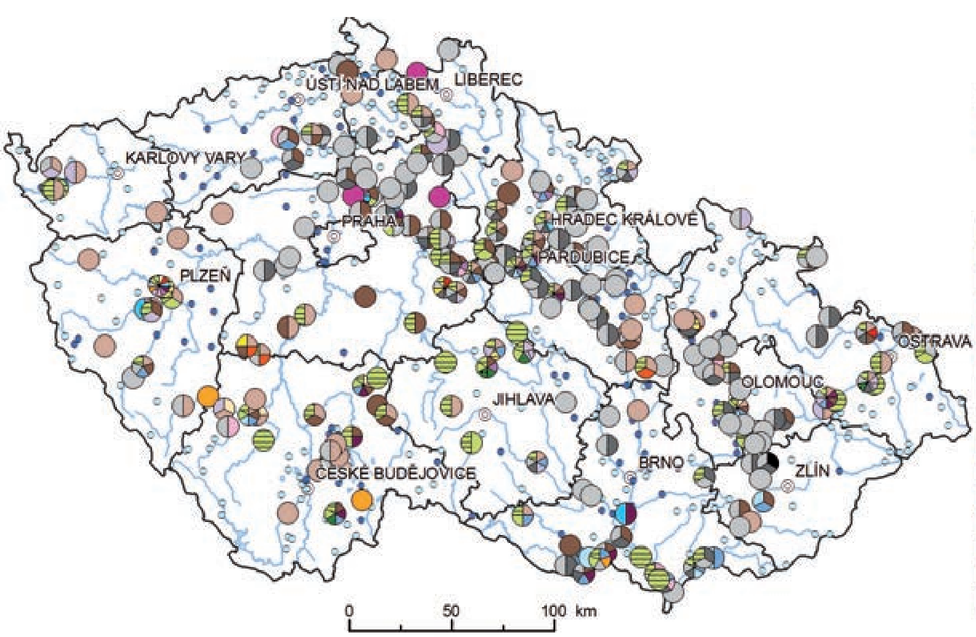


Reference value of 0.5 mg.l-1 for nitrites exceeded
Reference value of 0.5 mg.l-1 for ammonium ions exceeded
Reference value of 0.5 mg.l-1 for nitrates exceeded
Concentration under the reference value

Data source: Czech Hydrometeorological Institute

Figure 4

Concentration of pesticides in groundwater [µg.l-1], 2018



Reference value exceeded
Concentration above the limit of determination
Concentration below the limit of determination

2,6-dichlorbenzamid
Atrazin desethyldesisopropyl
Atrazin 2-hydroxy
Atrazin desethyl
Atrazin
Chloridazon
Chloridazon methyl desphenyl
Chloridazon desphenyl
Prometryn
Clopyralid
Acetochlor ESA
Acetochlor OA
Metribuzin desamino diketo
Dimethenamid ESA
Pethoxamid ESA
Alachlor OA
Alachlor ESA
Metolachlor ESA
Metolachlor
Metolachlor OA
Hexazinon
Chlortoturon
Bentazon
Dimethachlor ESA
Dimethachlor ESA
Metazachlor OA
Metazachlor ESA
MCPP
Hexazinon

This shows the occurrence of pesticides in the Czech Republic that exceeded the reference values established for groundwater by Decree of Ministry of Environment and Ministry of Agriculture No. 5/2011 Coll. at more than 1 monitoring object.

Data source: Czech Hydrometeorological Institute

The quality of groundwater and surface water is influenced by pollution produced from point, diffuse and non-point sources. The modernization and construction of wastewater treatment plants, industrial restructuring and, last but not least, the socio-economic and political developments have had a positive impact on improving water quality since the 1990s.

The **quality of surface water** has long been evaluated on the basis of COD_{Cr}, BOD_5, $N\text{-}NH_4^+$, $N\text{-}NO_3^-$ and P_{total}. The quality of watercourses is divided into 5 classes. When comparing the situation in 2017–2018 (Figure 2), the status of watercourses in most sections is obviously improved compared to 1991–1992 (Figure 1). Most of the watercourses fall into class III according to the classification, i.e. polluted water. Gradually, more sections of the streams fall into class I and II, but still some sections fall into quality class V. Although watercourse quality improved significantly since 1991, the persistent problem is eutrophication, which is caused by the increased amount of nutrients that are washed away from soils excessively fertilized by mineral fertilizers, and by wastewater discharges. Water quality is monitored in the Czech Republic at 1,024 representative river profiles, the evaluation was made on 124 profiles from categories 5 and 6, i.e. the two most important categories (Chart 1). In the period 2000–2018, the Czech Republic managed to successfully reduce watercourse pollution by $N\text{-}NH_4^+$ (decrease in average concentration by 70.2%) and P_{total} (decrease by 34.4%). The average concentration of **ammoniacal nitrogen**, which is the primary product of the decomposition of organic nitrogen compounds, and is present in sewage and waste from agricultural production, reached in 2018 the value of 0.196 $mg.l^{-1}$. The cause of the decline is especially the more effective wastewater treatment and a decrease in livestock production. The concentration of total phosphorus in 2018 reached the average value of 0.188 $mg.l^{-1}$. The reason for this positive long-term development is the fact that part of the phosphorus pollution originates from point sources where it undergoes thorough treatment and the volume of such pollution decreases. The decline in phosphorus input was enhanced by restrictions in the use of phosphates in detergents[1].

The $\mathbf{BOD_5}$ indicator decreased since 2000 by 18.0% to 3.133 $mg.l^{-1}$. The value of $\mathbf{N\text{-}NO_3^-}$ decreased by 15.9% in comparison with 2000 and reached the level of 2.841 $mg.l^{-1}$ in 2018. Significant sources of nitrogen in surface water are sewage, whose treatment is gradually improving, and mineral nitrogen fertilizers, whose consumption has increased in recent years on the contrary. $\mathbf{COD_{Cr}}$ decreased by 3.2% during the period 2000–2018 to 19.512 $mg.l^{-1}$.

Other evaluated indicators in the period 2000–2018 were chlorophyll, faecal contamination and halogenated organic contaminants and since 2007 also dissolved toxic metals lead and cadmium (Chart 2). The values of those indicators varied considerably over the monitored period. **Lead (Pb)**, which has negative effects on the nervous system, decreased the most: by 70.2% to 0.264 $\mu g.l^{-1}$ between 2007–2018. In the years 2007–2011, however, a relatively low number of samples (7–27) was evaluated; the decline between the years 2012–2018, when 66–86 samples were monitored, was 20.6%. The concentration of **cadmium (Cd)**, which shows toxic effects, is associated with carcinogenicity and accumulates in the food chain; compared to 2012, it decreased by 25.8% to 0.033 $\mu g.l^{-1}$. The indicator value of **AOX**, difficult to degrade pollution originating e.g. from the paper and chemical industry, such as chloroform or dioxins, dropped by 28.1% compared to the year 2000 to 17.941 $\mu g.l^{-1}$.

The very dry year 2018 resulted in a 12.3% year-on-year increase in average **chlorophyll** concentration to 21.353 $\mu g.l^{-1}$. The concentration of chlorophyll reflects the level of primary production of the aquatic environment (or eutrophication) and is influenced by temperature and precipitation during the year. The average concentration of thermotolerant **coliform bacteria (FC)**, which reflects the level of faecal contamination and is also influenced by meteorological conditions of the year, reached 45.848 $KTJ.ml^{-1}$ in 2018, an increase of 5.5% year-on-year.

In addition to the quality of surface water, the **quality of groundwater** is also monitored every year. In the Czech Republic, it is evaluated according to Decree No. 5/2011 Coll. of Ministry of Environment and Ministry of Agriculture. In 2018, 691 objects were observed in the national groundwater quality monitoring network, of that 223 shallow wells, 199 springs and 269 deep wells. Groundwater quality is evaluated on the basis of 353 indicators. Deeper aquifers are represented by springs that are regularly distributed throughout the Czech Republic, as well as by deep wells in important water management areas of the Czech Republic (North Bohemian Cretaceous, Moravian ravines, South Bohemian basins and East Bohemian synclines). Shallow wells monitor groundwater in predominantly quaternary, usually very permeable sediments which, however, allow for a very quick spread of pollution mostly from industrial, agricultural or other anthropogenic activities. The number of shallow wells where the limits for groundwater were exceeded in at least one indicator is 177, the limit was also exceeded in 120 deep wells and in 79 springs in 2018[2]. Significant pollution by the sum of pesticides was found in total in 165 monitoring sites (the limit was exceeded in 104 shallow wells, in 32 deep wells and in 29 springs, while in 2017 the limit was exceeded in total in 173 sites).

[1] *Detergents with higher phosphorus concentration than 0.5% of their weight were prohibited by Decree No. 78/2006 Coll.*

[2] *The assessment on the basis of selected basic indicators of pollution (NH_4^+, NO_2^-, NO_3^-, Cl^-, SO_4^{2-}, As, Cd, Co, Ni, Pb, Hg, $CHSK_{Mn}$, DOC and pesticides).*

The dominant indicators of groundwater pollution, by comparison with the threshold values of Decree of the Ministry of Environment and Ministry of Agriculture No. 5/2011 Coll. as amended, are ammonium ions (11.0% of samples were above the limit) and nitrates (10.6% of samples were above the limit), Figure 3. Out of the organic substances it is pesticides (Figure 4). In line with the previous years, the substances that were also in 2018 most often above the limit for underground water (quality standard 0.1 $\mu g.l^{-1}$) were mainly the metabolites of the herbicide chloridazon (herbicide used to treat sugar beet and fodder beet): chloridazon desphenyl (22.9% of samples over the limit) and chloridazon methyl desphenyl (11.0% of samples above the limit), and metabolites of herbicides from the chloracetanilid group: alachlor ESA (12.4% of samples above the limit), metazachlor ESA (12.4% of samples above the limit), metolachlor ESA (9.7% of samples above the limit), acetochlor ESA (4.3% of samples above the limit), metazachlor OA (4.2% of samples above the limit), metolachlor OA (2.5% of samples above the limit), dimethachlor ESA (2.4% of samples above the limit), acetochlor OA (1.4% of samples above the limit), and alachlor OA (0.7% of samples above the limit). Other frequently occurring ones are triazine pesticides, in particular metabolites of the herbicide atrazine such as 2-hydroxy, atrazine desethyl and atrazine desethyl desisopropyl (1.2%, 0.7% and 0.4% of samples above the limit). Out of other pesticides it is bentazone (1.3%), hexazinon (0.7%), 2.6-dichlorbenzamid-metabolite of the herbicide dichlobenil (0.6%), and clopyralid (0.4% of samples above the limit). Excess concentrations of the various pesticides are reflected also in the increased number of 22.6% of samples above the limit for indicator "sum of pesticides" with quality standard at 0.5 $\mu g.l^{-1}$. Other pesticides occur in concentrations above the limit only sporadically. Samples of groundwater with concentrations above the limit of pesticides were largely taken from shallow wells. The main reason for contamination of groundwater with pesticides and especially their metabolites is the trend of growing energy crops such as rape and maize. They are treated with herbicides such as metazachlor, alachlor, metolachlor, acetochlor and atrazine that contaminate groundwater to a much higher extent than herbicides used to treat cereals (chlorotoluron, isoproturon, MCPP). The overall results of the evaluation of groundwater quality in 2018 did not change significantly compared to the previous three years 2015 to 2017 due to the slow dynamics of changes in groundwater chemistry.

Every year, the **bathing water quality in open countryside** is monitored in the Czech Republic. A total of 268 bathing sites were monitored in 2018, of which 48.5% were ranked in the highest quality category I, which was an increase compared to 2017 when the share of the sites was 46.6%. The share of sites included in quality category II decreased against 2017 from 22.3% to 14.9%. A ban on bathing was imposed on 29 localities (10.8% of localities) based on laboratory analyses, while in 2017 the ban was imposed on 14 localities (5.6% of localities). The number of localities with unsuitable bathing water (quality category IV) also increased year-on-year, in 2018 it was 33 localities (12.3%), while in 2017 it was 23 localities (9.2%).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

Water management and water quality in the global context

Key messages[3]

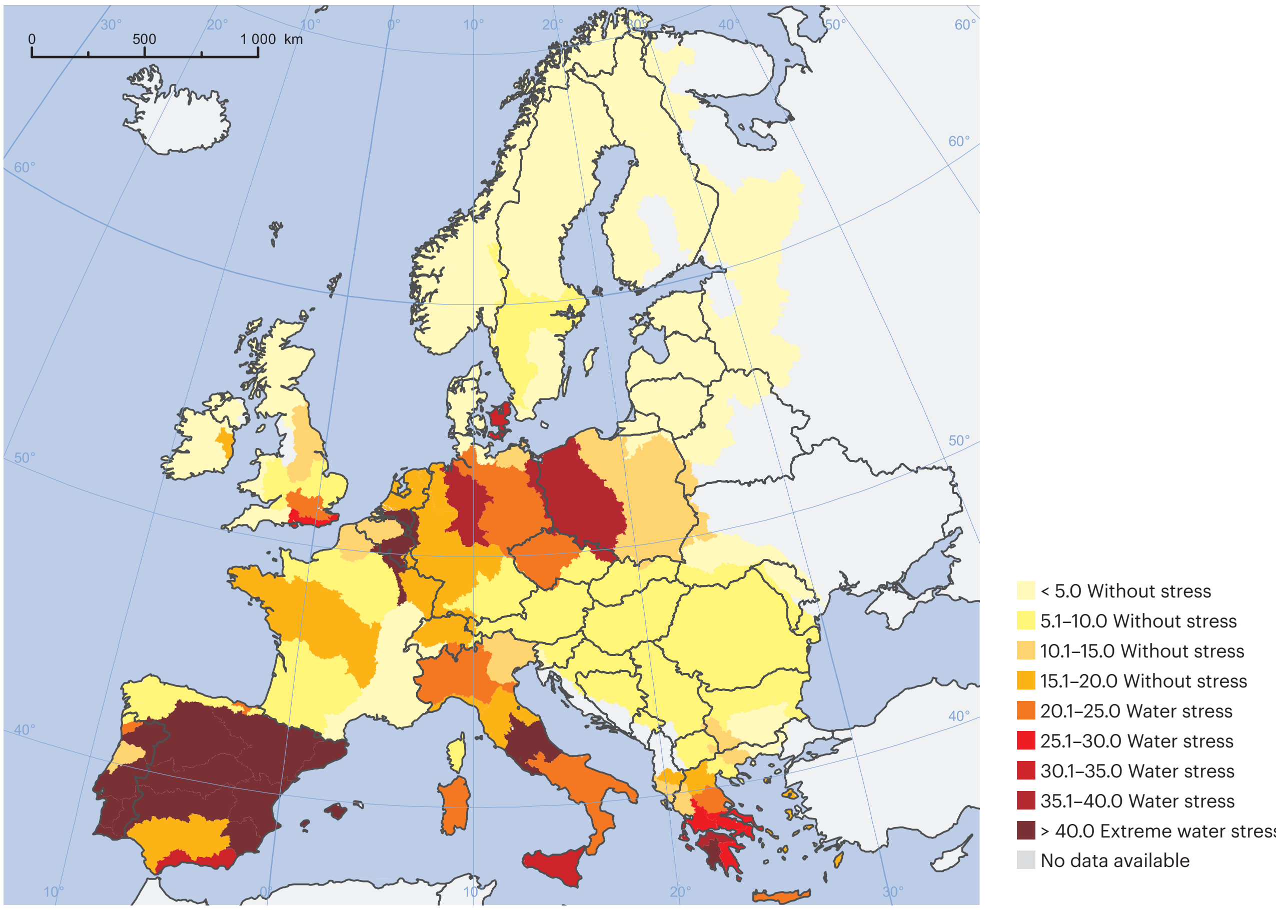
- Climate change is deteriorating the availability of water for countries. The most favourable situation is in northern Europe. The reduced water availability and the increased pressure on water resources in the most vulnerable countries in Europe (mainly Spain, Portugal, Italy, Belgium and the Netherlands) occurs as a result of both unfavourable natural conditions and inefficient utilisation and increase in abstractions, primarily for agricultural production.
- Most European countries achieved in 2014 a high degree of compliance with Article 3 of Council Directive 91/271/EEC on urban wastewater treatment, which relates to the availability of sewerage systems for urban wastewater in agglomerations over 2,000 population equivalent. An average of 88.7% of wastewater within the European Union and 90.5% in the Czech Republic was subject to the secondary treatment according to the Directive. The tertiary treatment of wastewater in the so-called sensitive areas in the EU is greatly varied and depends both on the degree of technical development of WWTP as well as on the proportion of the sensitive areas of each country. The rate of compliance with the requirements for tertiary treatment and more stringent treatment (Article 5) reaches 84.5% in the EU, and 62.7% in the Czech Republic.
- In the assessment of inland bathing water quality in the 2018 bathing season, 80.8% of the monitored sites in the EU achieved excellent water quality, 8.5% achieved good quality, 2.3% acceptable quality and 1.9% poor quality (6.5% of sites was not rated). The best results were achieved by bathing water in Austria (97.3% of the sites had excellent water quality). In the Czech Republic, 81.7% of localities had excellent water quality.

[3] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Figure 1

Water scarcity in Europe expressed using the WEI index [%], July 2015

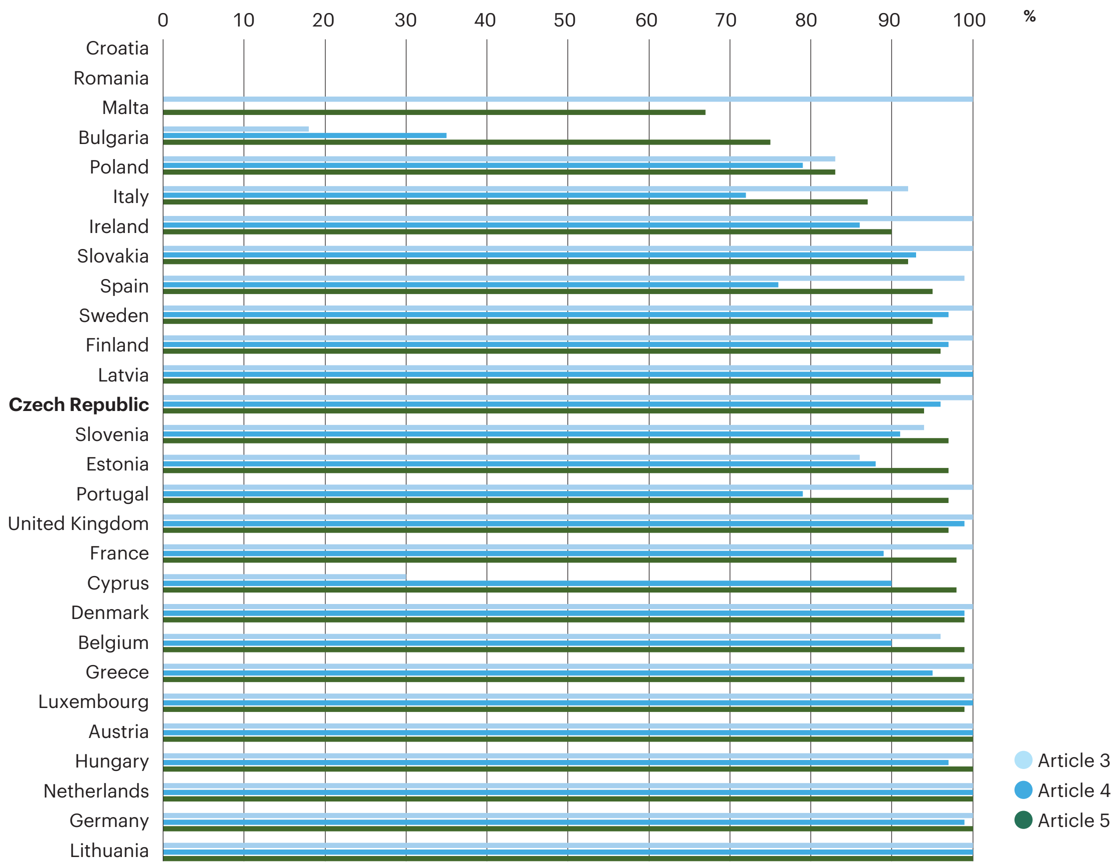


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Chart 1

Compliance of EU countries with Article 3 (collecting), Article 4 (secondary treatment) and Article 5 (more stringent treatment) of Council Directive 91/271/EEC on urban wastewater treatment [%], 2014

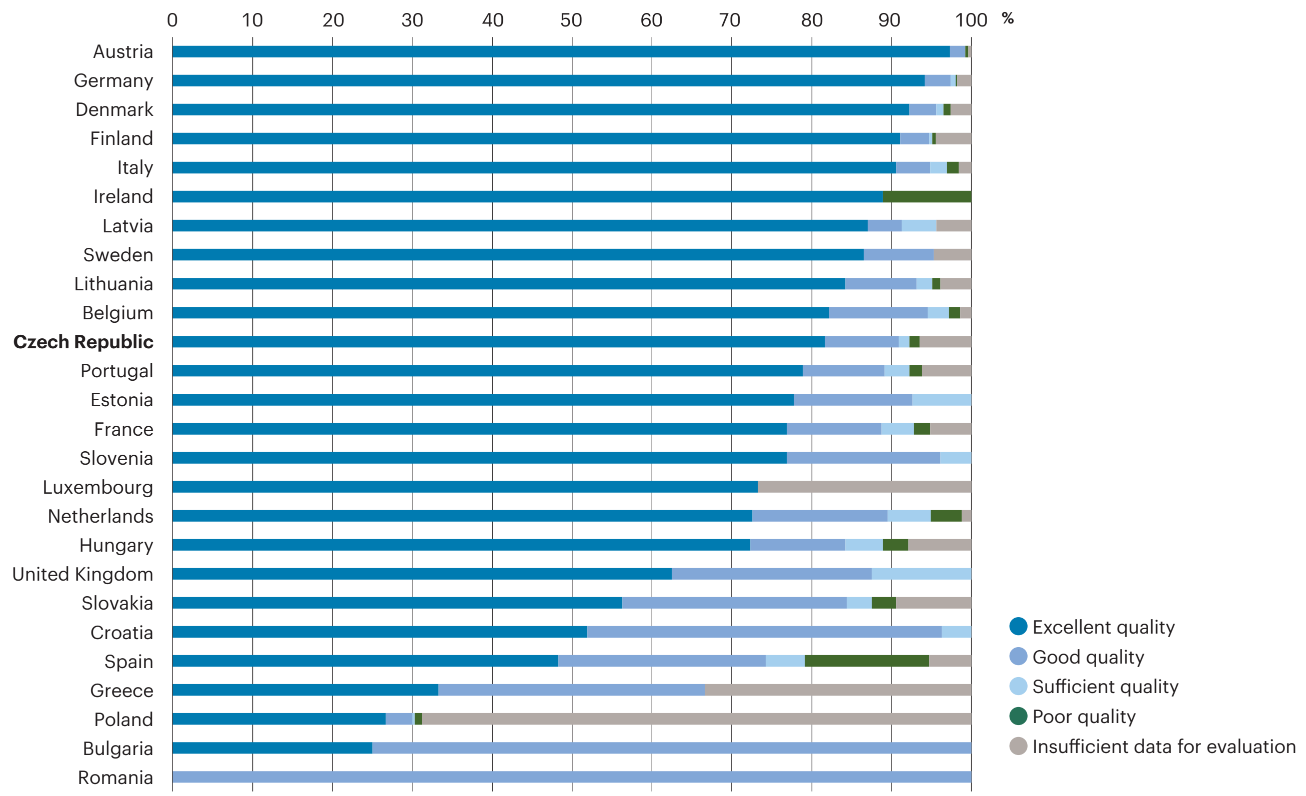


The results shown represent compliance of each Member State for the year 2014, as regards Article 3 (collecting), Article 4 (secondary treatment) and 5 (more stringent treatment) of Council Directive 91/271/EEC on urban wastewater treatment. The classification of the Member States is such that the first mentioned are the countries with the lowest rates of compliance with Article 5 and the countries are sorted by increasing rates of compliance. A lower level of compliance referred to in Article 4 in comparison with the level of compliance in accordance with article 5 is possible, since article 5 refers only to sensitive areas.
Croatia and Romania did not provide data.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Urban Waste Water Treatment Directive

Chart 2

Inland bathing water quality in EU Member States, in each category according to the EU evaluation [%], 2018



Data source: European Environment Agency

The **access to water sources** is heavily dependent on the geographical location and physical geographic conditions in the different countries. The most endangered states of Europe, i.e. states with the highest WEI index[4] (Figure 1), were mainly Spain, Portugal, Italy, Belgium and the Netherlands during July 2015[5]. The water shortage in these areas occurs as a result of unfavourable natural conditions (climate, the character of the river network, geological conditions, etc.) as well as due to anthropogenic interventions in the water regime to the economy of the given state.

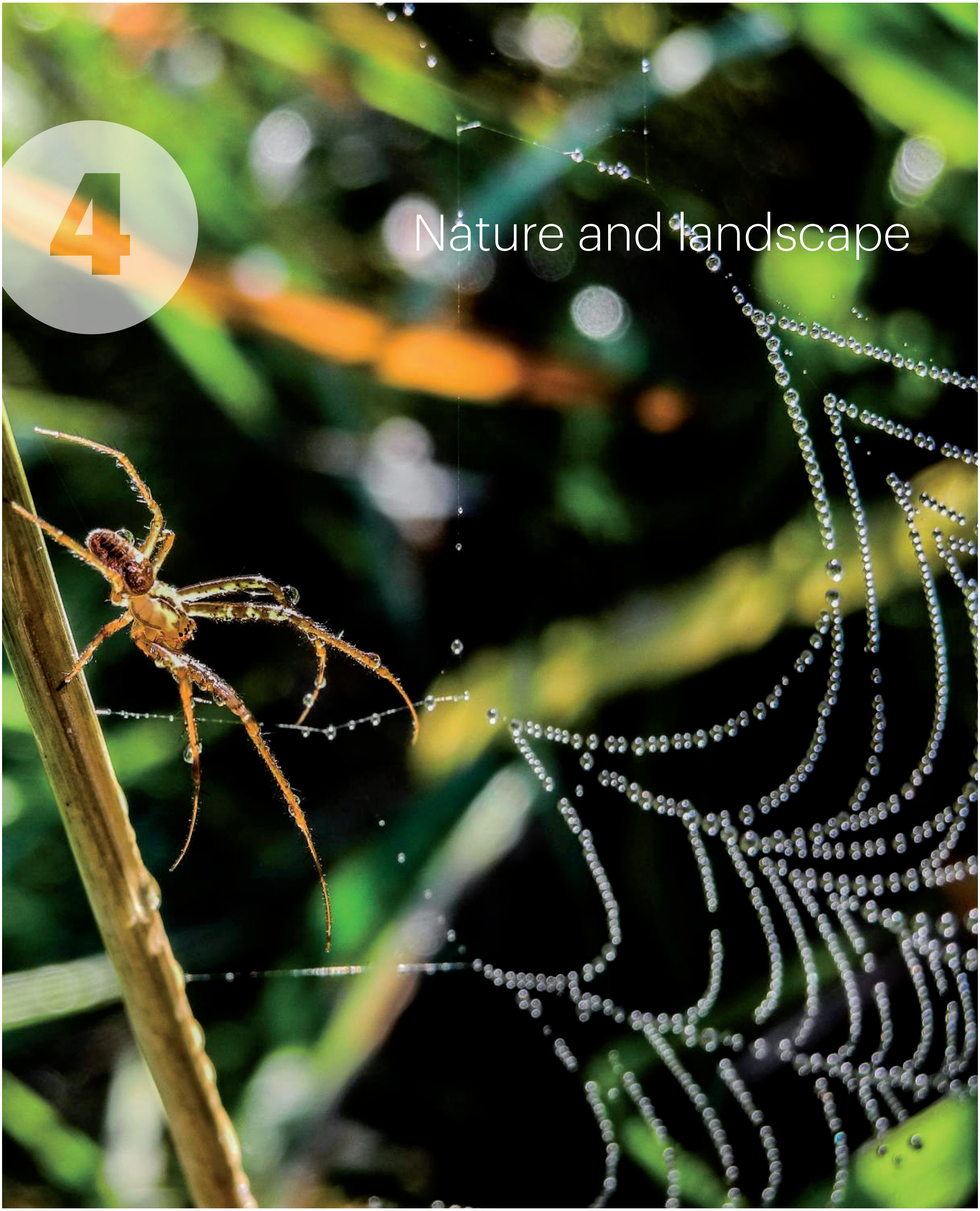
Article 3 of **Council Directive 91/271/EEC on municipal wastewater treatment** provides for Member States the obligation to ensure that all agglomerations above 2,000 population equivalent are equipped with sewerage systems for urban wastewater. In 2014, the EU achieved an average rate of 94.7% of compliance with Article 3, while the Czech Republic achieved a 100% compliance rate. The Directive lays down criteria for specific types of treatment, and Article 4 requires that municipal wastewaters drained by sewerage systems undergo secondary treatment or other equivalent treatment before discharge. Within the EU, that degree of treatment was applied to 88.7% of wastewater, in the Czech Republic, the rate of compliance was 90.5%. As of 2014, the rate of compliance with the requirements for tertiary treatment and more stringent treatment (Article 5) reached 84.5% in the EU, and 62.7% in the Czech Republic.

In European countries, the **bathing water quality**[6] is monitored each year. In the 2018 season, inland bathing sites in 26 EU countries were assessed under this Directive (Chart 2). In total, 6,822 bathing water areas were monitored in the EU in the 2018 bathing season. Of that, 80.8% of the areas had excellent water quality and only 1.9% were found to be unsuitable for bathing. The best water quality was found in Austria, 97.3% of the sites had excellent water quality. The Czech Republic was evaluated slightly above average (81.7% of the sites had excellent water quality). The highest proportion of sites with water unsuitable for bathing was found in Spain (15.6%). Based on the assessment according to the Directive, the proportion of sites with water unsuitable for bathing in the Czech Republic was only 1.3%.

[4] The WEI Index expresses water shortage and describes what pressure is exerted by the total water abstraction on water sources (calculated as a ratio of total water abstraction to the quantity of renewable water reserves). It thus specifies countries that have, given their resources, high abstraction and are therefore prone to water shortage (water stress). The WEI warning threshold that separates regions with sufficient water resources and regions lacking them is the value of approximately 20%. Severe water shortage may occur when the value of the WEI exceeds 40%.

[5] Current data are not, due to the methodology of their reporting, available at the time of publication.

[6] Based on Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality.


4
Nature and landscape

Nature and landscape

The state of nature and landscape is the result of natural factors and human activity, whereas the way we use land significantly affects the state of its individual components. Along with this, the manifestations of climate change with impacts on the landscape are increasingly decisive for landscape development. The resulting states of landscape and biodiversity significantly influence the ability of ecosystems to provide ecosystem services.

These ecosystem services mitigate natural disasters, create more stable natural conditions, affect a number of pathogens and diseases, as well as the effectiveness of pollinators, which are key to pollinating of the most crops used by humans.

Stable landscape and human society are thus directly dependent on high biodiversity which, through its mutual interactions, shapes and influences the whole environment and the functions of individual ecosystems. Only sufficiently rich and varied biodiversity creates functional and stable ecosystems that can provide all the necessary ecosystem services in the long term.

Among the most important problems of the present landscape are above-average sizes of single crop fields and their management, the deficit of "green skeleton" in agricultural landscape, in many places unsuitable condition and composition of forest stands, and the overall high rate of landscape fragmentation. Individual fragmented parts of the landscape, or on the other hand, large homogeneous areas, lose their ecological properties and ecosystem links, and they are also less resistant to increasing weather extremes and spreading of alien species.

References to current conceptual, strategic and legislative documents

Convention on Biological Diversity
- the protection of biodiversity at all levels and the sustainable use of its components

European Landscape Convention
- support of landscape protection, management and planning, including the organization of a single European cooperation in this field
- education and participation of public in the individual states

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- protection of vagile (migratory) animal species, therefore not only birds, but also mammals, fish and invertebrates throughout the entire area of their distribution, including support for joint research projects on migratory species

Convention on Wetlands of International Importance especially as Waterfowl Habitats (Ramsar Convention)
- selecting suitable wetlands for the "List of Wetlands of International Importance" and ensuring their adequate protection and rational use

Convention on Conservation of European Wildlife and Natural Habitats (Berne Convention)
- the protection of animals and plants of European importance and their habitats, and in particular the protection of endangered and migratory species and species the protection of which requires international cooperation

Council Directive No. 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive)
- establishing European network of Natura 2000 protected areas, consisting of sites of Community importance and Special Protection Areas
- biodiversity protection by protecting natural habitats, wild fauna and flora in the territory of EU Member States
- an obligation to ensure the protection of the most valuable species and habitat types in the EU, with particular emphasis on priority habitat types and priority species
- the establishment of an adequate system of strict protection for specified species of plants and animals

Directive No. 2009/147/EC on the conservation of wild birds
- the designation of Special Protection Areas, which, together with sites of Community importance, form the European Natura 2000 network
- the protection of populations of all species of birds naturally occurring in the wild in the territory of EU Member States and the prevention of destruction, pollution and disturbance of bird habitats
- priority protection of species threatened with extinction, species threatened by specific changes in their habitats, rare and other species requiring special attention due to the specific nature of their habitats

Directive No. 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
- gradual adjustment of transverse barriers on watercourses limiting migration of aquatic organisms

EU Biodiversity Strategy to 2020
- stopping the loss of biodiversity and degradation of ecosystem services in the EU by 2020
- determining the proportion of habitats and species, for which a favourable or at least improving state must be achieved as a priority

Regulation (EU) No. 1143/2014 of the European Parliament and of the Council on the prevention and control of the introduction and spread of invasive alien species
- establishing basic rules for the most problematic invasive species from the EU point of view, developing criteria, risk assessment, establishing the list of invasive species, restrictions and potential exemption scheme, obligation to monitor, eradicate or regulate

Strategic Framework Czech Republic 2030
- setting targets with the ambition to significantly improve the resilience of ecosystems in the Czech Republic (gathered under the key areas: Landscape and Ecosystem Services, Biodiversity, Water in the Landscape and Land Care)

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- protecting and enhancing the ecological stability of the landscape and sustainable management of the landscape (restoring the water regime, reducing and mitigating the effects of fragmentation, preserving and enhancing the non-productive functions of the agricultural landscape and forests), maintaining the natural and landscape valuables (ensuring the protection and care for the most valuable parts of nature and landscape, protecting indigenous species and habitats, reducing the negative impact of invasive species), and improving the quality of the environment in settlements (improving the functional state of greenery, improving rainwater management and enhancing brownfield regeneration)

National Biodiversity Strategy of the Czech Republic for the period 2016–2025
- defining a comprehensive biological protection strategy in the Czech Republic, defining priorities in the field of conservation and sustainable use of biodiversity in the Czech Republic, based on the assumption that a favourable state of biodiversity is the cornerstone of effective ecosystems providing basic goods and services to human society

Strategy on Adaptation to Climate Change in the Czech Republic
- ensuring thorough and coherent land-use planning with a long-term perspective taking into account biodiversity conservation and ensuring key ecosystem services, including water retention in the landscape

National Action Plan for Adaptation to Climate Change
- enhancement of ecological-stabilizing functions and permeability of the landscape, conceptual extension of nature protection with the perspective to climate change, reduction of the spread of invasive species

Spatial Development Policy of the Czech Republic, as amended by Update No. 1
- economical use of built-up areas, ensuring the protection of undeveloped areas (especially agricultural and forest land) and preserving public greenery
- placement of development plans that could significantly affect the character of the landscape in the least conflicting localities, together with subsequent support for compensatory measures

Concept of Clearing the River Network of the Czech Republic, 2014 update
- setting transnational and national priorities for making watercourses permeable across transversal barriers in both directions
- establishing principles of protection of existing migration permeability of watercourses and improvement of living conditions for running water organisms

• delimitation of watercourses or sections of watercourses important for migration on two levels (Trans-regional priority wildlife corridors with international significance and National priority sections of watercourses in terms of species and territorial protection)

© Jarmila Cikánková/CENIA

Rural Development Programme 2014–2020
• restoration, conservation and improvement of agriculture-dependent ecosystems through appropriate agri-environmental measures

State Nature Conservation and Landscape Protection Programme of the Czech Republic
• maintaining sufficiently large populations of native flora and fauna and minimizing the risk of introducing new invasive and alien species
• ensuring the protection of soil as an irreplaceable and non-renewable natural resource
• conservation or restoration of grassland

Operational Programme Environment 2014–2020
• measures to protect endangered plant and animal species and regulation of populations of invasive plant and animal species
• measures for the conservation and overall improvement of natural conditions in forests in specially protected areas and areas of the Natura 2000 network, as well as in defined regional and trans-regional biocentres of territorial systems of ecological stability
• support of natural floods in floodplain areas, revitalization of watercourses and wetlands, building and restoration of water retention spaces in the landscape

Act No. 114/1992 Coll., on Nature and Landscape Protection
• definition of general principles of nature and landscape protection, definition of specially protected areas, their protection and duties of natural and legal persons in nature protection, definition of nature protection authorities and their powers, definition and protection of the Natura 2000 network, species protection

Act No. 334/1992 Coll., on Protection of the Agricultural Land Resources
• protection of the agricultural land resources as an irreplaceable component of the environment
• establishing principles of land protection, fines and the process of withdrawal of land from the resources

12 | Land use

Key question

What is the state and development of land use in the Czech Republic?

Key messages

Since 2000, the area of permanent grassland has grown by 5.2% and the forested area by 1.4%.
The size of "other" areas decreased in 2018 year-on-year for the first time since 2000. This decrease is mainly due to a significant reduction of mining areas by 11.9 thous. ha year-on-year, i.e. 40.2%.

The total area of the agricultural land in the Czech Republic decreased by 1.8% in the period 2000–2018. Agricultural land is diminishing especially in favour of built-up and "other" areas. The size of these areas increased by 4.1% between 2000 and 2018.

Overall assessment of the trend

Change since 1990

Change since 2000

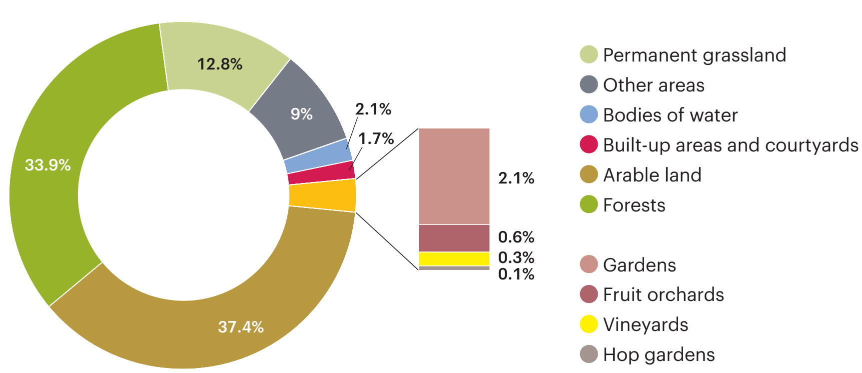
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

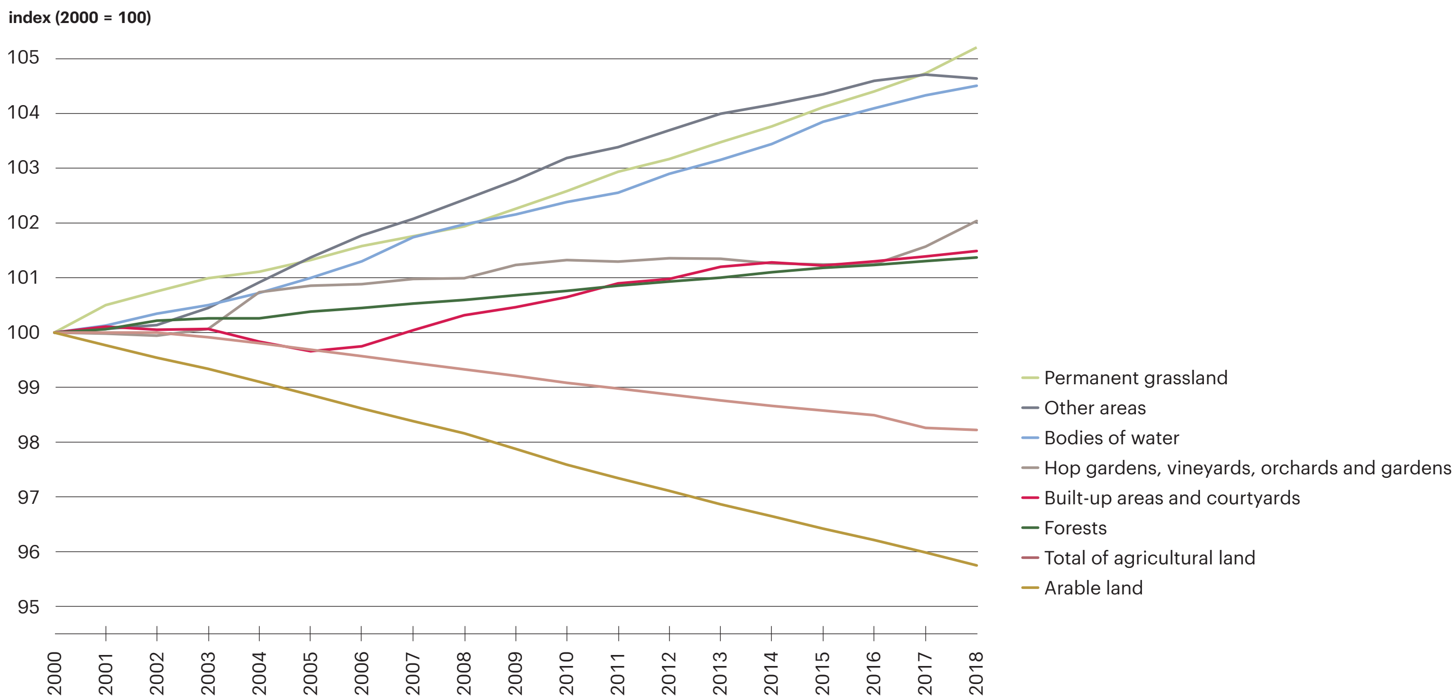
Land use in the Czech Republic [%], 2018



Data source: Czech Office for Surveying, Mapping and Cadastre

Chart 2

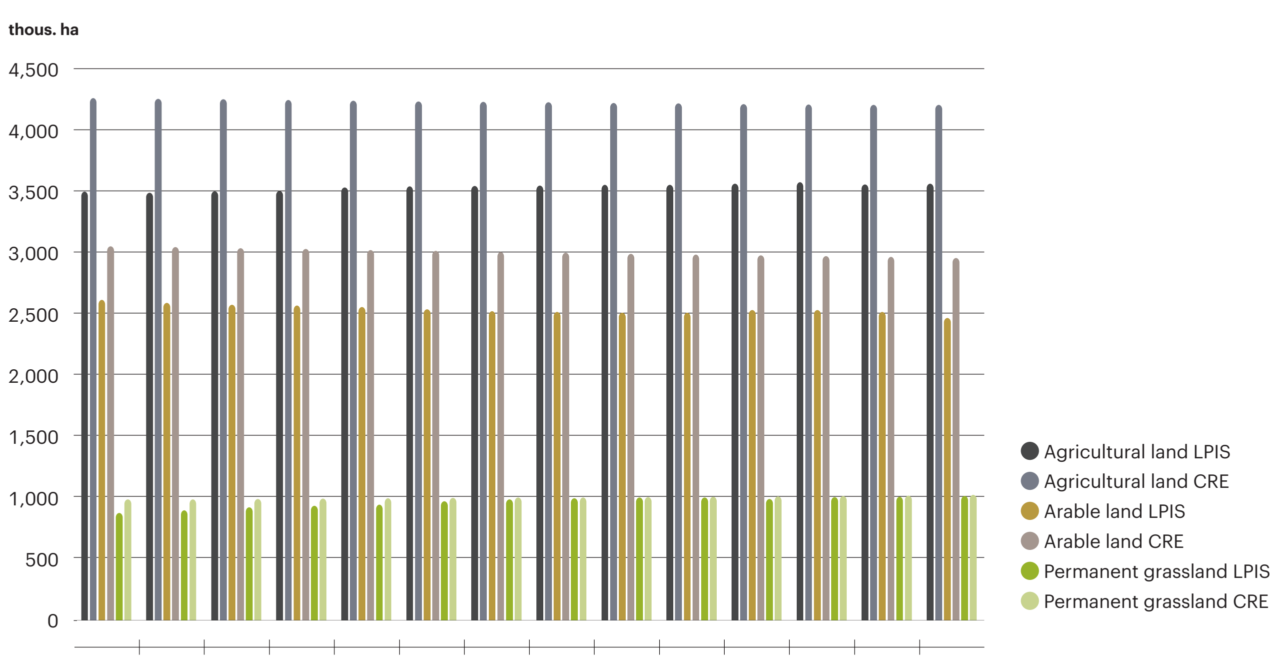
Land use in the Czech Republic [index, 2000 = 100], 2000–2018



Data source: Czech Office for Surveying, Mapping and Cadastre

Chart 3

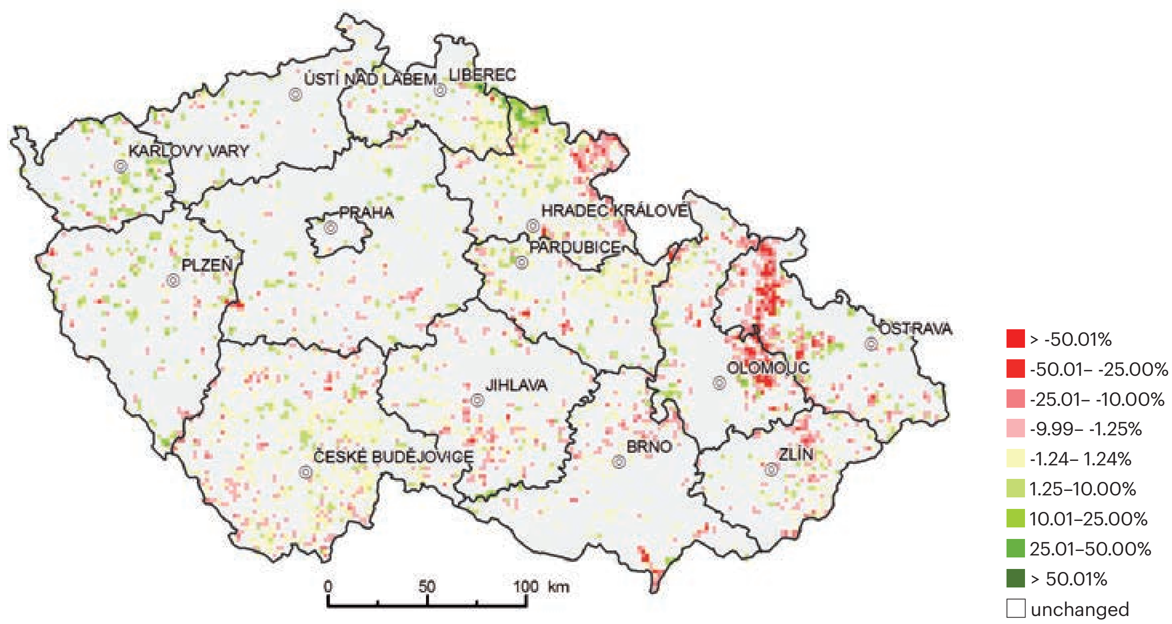
Area of agricultural land and its main categories recorded in the LPIS land register database (Land Parcel Identification System) and the Cadastre of Real Estate (CRE) [thous. ha], 2005–2018



Data source: Czech Office for Surveying, Mapping and Cadastre, The Ministry of Agriculture of the Czech Republic

Figure 1

Percentage change of forested area between 2012 and 2018 according to CORINE Land Cover database [%], 2018



Data source: CENIA, European Environment Agency

The structure of land use in the Czech Republic is characterized by high percentage of forests (33.9% in 2018) and high proportion of arable land in total agricultural land, which reached 70.2% in 2018 (Chart 1). The proportion of the agricultural land resources in the land resources of the Czech Republic in 2018 was 53.3%.

A clear long-term trend in land use since 2000 has been a decline in the area of agricultural land and an increase in built-up, water and other areas. Within agricultural land, there is a decrease in arable land and an increase in the area of permanent grassland, forests and permanent crops (hop gardens, vineyards, orchards and gardens, Chart 2).

The total area of **agricultural land** according to the data from the Cadastre of Real Estate Register in the period 2000–2018 decreased by 76.2 thous. ha (1.8%) to 4,203.7 thous. ha, and in the year-on-year comparison of 2017–2018 by 1.6 thous. ha (0.04%). The decrease of agricultural land was caused by the conversion of agricultural land into built-up and other areas, in the period 2000–2018 it was an increase of 40.6 thous. ha, i.e. by 4.1%, and due to the gradual growth of water bodies. The growth rate of water bodies increased after 2010; in the period 2000–2018, water bodies increased by 7.2 thous. ha (4.5%) and in 2018 occupied 2.1% of the Czech Republic territory. The growth of water bodies was caused, among other things, by flooding former mining areas in the Karlovy Vary and Ústí nad Labem Regions.

The area of **arable land** decreased by 131.0 thous. ha (4.3%) in the period 2000–2018. The most important process causing the loss of arable land in 2018 was its conversion to permanent grassland, which in the period 2000–2018 increased by 50.0 thous. ha (5.2%) and in 2018 occupied 12.8% of the Czech Republic territory. Of the total decline in arable land in 2018 (8.2 thous. ha), 4.2 thous. ha was converted to permanent grassland. The expansion of built-up and other areas caused a decrease in arable land by another 2.1 thous. ha. The decline in arable land in 2018 was also caused by its transformation into forested land (442.4 ha) and water bodies (177.4 ha). Most arable land decreased in the Central Bohemian Region (1.4 thous. ha). In 2018, 1.0 thous. ha of new arable land was created mostly on the original permanent grassland (291.0 ha), other areas (222.1 ha) and orchards (199.6 ha). As a result of the aforementioned changes, the total arable land area in 2018 decreased year-on-year by 7.2 thous. ha (0.2%) and the area of permanent grassland grew by 4.5 thous. ha (0.5%).

The total area of **forested land** increased by 36.1 thous. ha (1.4%) in the period 2000–2018.

The area of **other and built-up areas** decreased by 0.4 thous. ha (0.1%) year-on-year (2017–2018) and in 2018 represented 843.5 thous. ha (10.7%) of the Czech Republic territory. This decrease is due to a decrease in other areas by 0.5 thous. ha (0.1%). The built-up area increased year-on-year by 0.1 thous. ha (0.1%). The growth rate of built-up and other areas, which has been gradually decreasing since 2010, stopped for the first time since 2000. This change was caused mainly by a significant reduction of mining areas (year-on-year by 11.9 thous. ha, i.e. by 40.2%). On the other hand, the area built-up by roads is increasing (by 0.9 thous. ha, i.e. 0.4% in 2018) as well as the area of public greenery (by 0.5 thous. ha, i.e. 1.3%). The growth of public greenery areas is positive, especially regarding the quality of life in cities and their adaptation to climate change.

According to data from the **LPIS public register of agricultural land use** (Land Parcel Identification System), 45.1% of the Czech Republic territory was agriculturally used in 2018, which is by 664.1 thous. ha less than the area of agricultural land recorded in the Cadastre of Real Estate (Chart 3). The categories of agricultural land with the largest share in LPIS are arable land (69.1% in 2018) and permanent grassland (28.1%). All other categories together account for 2.8% of the total agricultural land in LPIS. In the period 2005–2018, the total area of land registered in LPIS was gradually increasing (by 63.4 thous. ha, i.e. 1.8%) as opposed to data from the Cadastre of Real Estate Register, mainly due to the growth of registered grassland areas by 138.8 thous. ha (16.1%), while the area of registered arable land decreased by 149.5 thous. ha (5.7%).

According to data from the CORINE Land Cover remote sensing, between 2012 and 2018[1], the **land cover** changed on 99.3 thous, ha (1.6%) of the Czech Republic territory. Of these changes, most (72.1%) concerned forested land, with a total decline of 48.2 thous, ha and an increase of 20.5 thous. ha forests over that period. The decrease in forests was caused by their logging and conversion to transitional woodland/shrub, the greatest decrease was in coniferous forests (41.6 thous. ha). Most of the forests were cut down in the Jeseníky range and around Broumov, while new forest stands grew the most in the Krkonoše Mountains (Figure 1). According to CORINE Land Cover data, arable land was transformed primarily into meadows (6.5 thous. ha), construction sites (1.6 thous. ha) and incoherent urban development (1.2 thous. ha), and on the other hand 8.2 thous. ha of meadows was converted to arable land. Altogether, there was an increase in arable land by 1.7 thous. ha at the expense of meadows.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[1] Images for the 2018 evaluation were taken in 2017.

13 | Landscape fragmentation

Key question

Is the process of landscape fragmentation slowing down?

Key messages

The process of landscape fragmentation in the Czech Republic continues. In the period 2000–2010[2], the area of unfragmented landscape decreased by 5.2% and in 2010 it represented 63.4% of the total area of the Czech Republic. Moreover, there is no effective system for monitoring the functionality of animal crossings in the Czech Republic.
The share of natural habitats in the cadastral area is also decreasing; in 2018 it was 13.2%.
On watercourses in the Czech Republic there are more than 6 600 transverse structures higher than 1 m, and in 2018 there were 758 weirs registered that may adversely affect aquatic ecosystems.

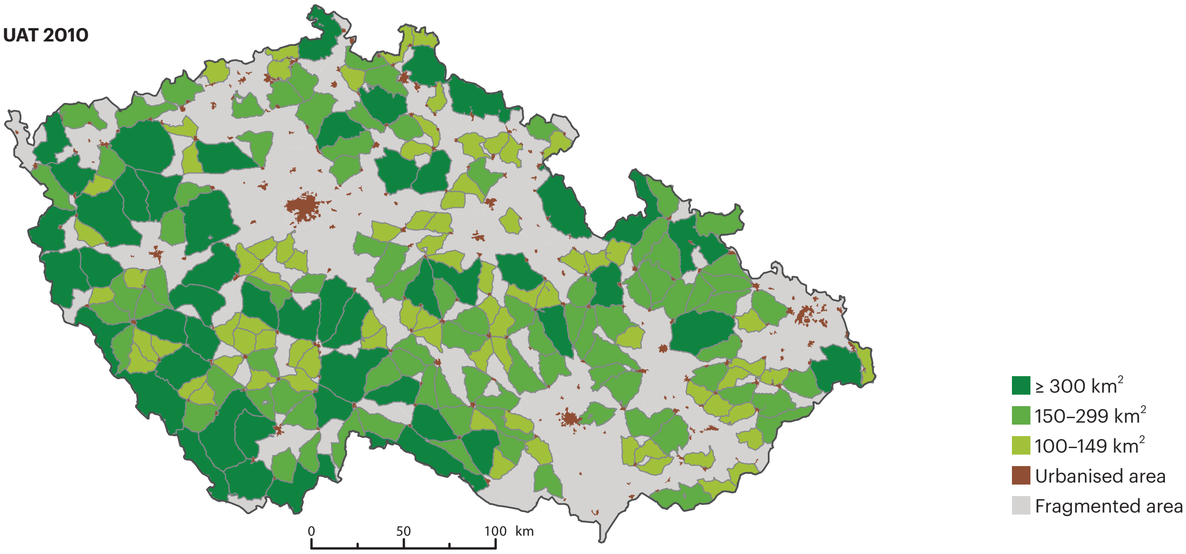
Overall assessment of the trend

Change since 1990 | Change since 2000 | Change since 2010 | Last year-on-year change

Indicator assessment

Figure 1

Landscape fragmentation due to transport in the Czech Republic, 2010



Assessed using UAT (Unfragmented Areas by Traffic) polygons. UAT is a method of determining of areas not fragmented by traffic, i.e. areas that are delimited by roads with a traffic intensity greater than 1,000 vehicles per 24 hours, or by multi-rail railways. UAT is determined in areas greater than 100 km².
Current data are not, due to the methodology of their reporting, available at the time of publication.

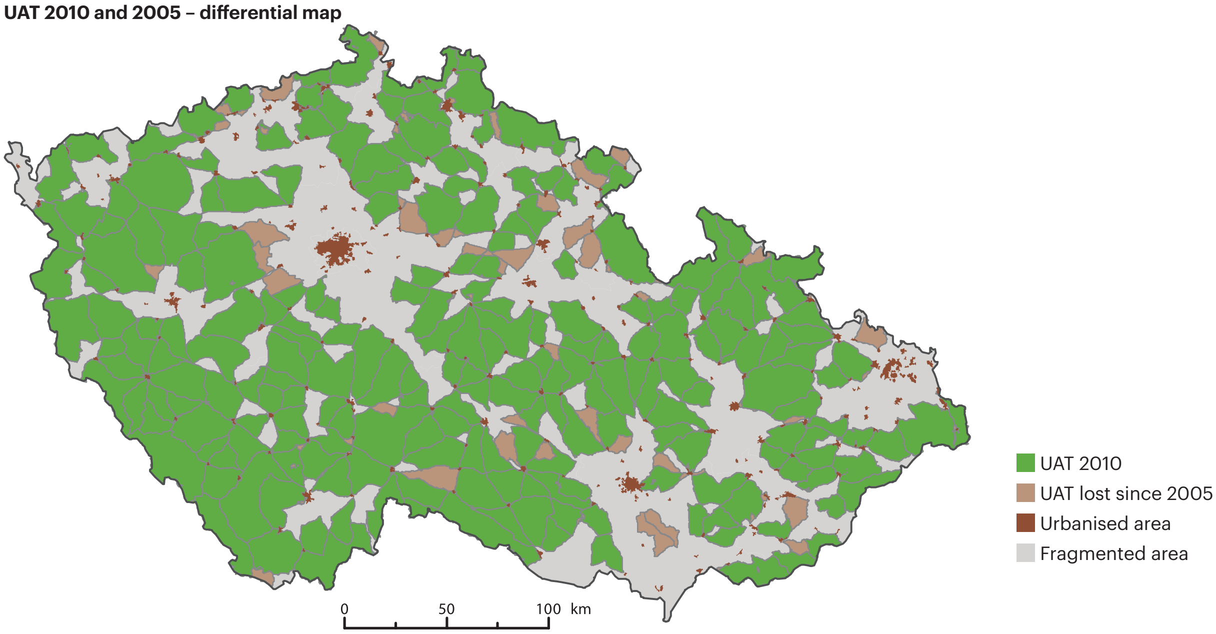
Data source: Evernia

[2] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Figure 2

Landscape fragmentation by transport in the Czech Republic between 2005 and 2010

UAT 2010 and 2005 – differential map

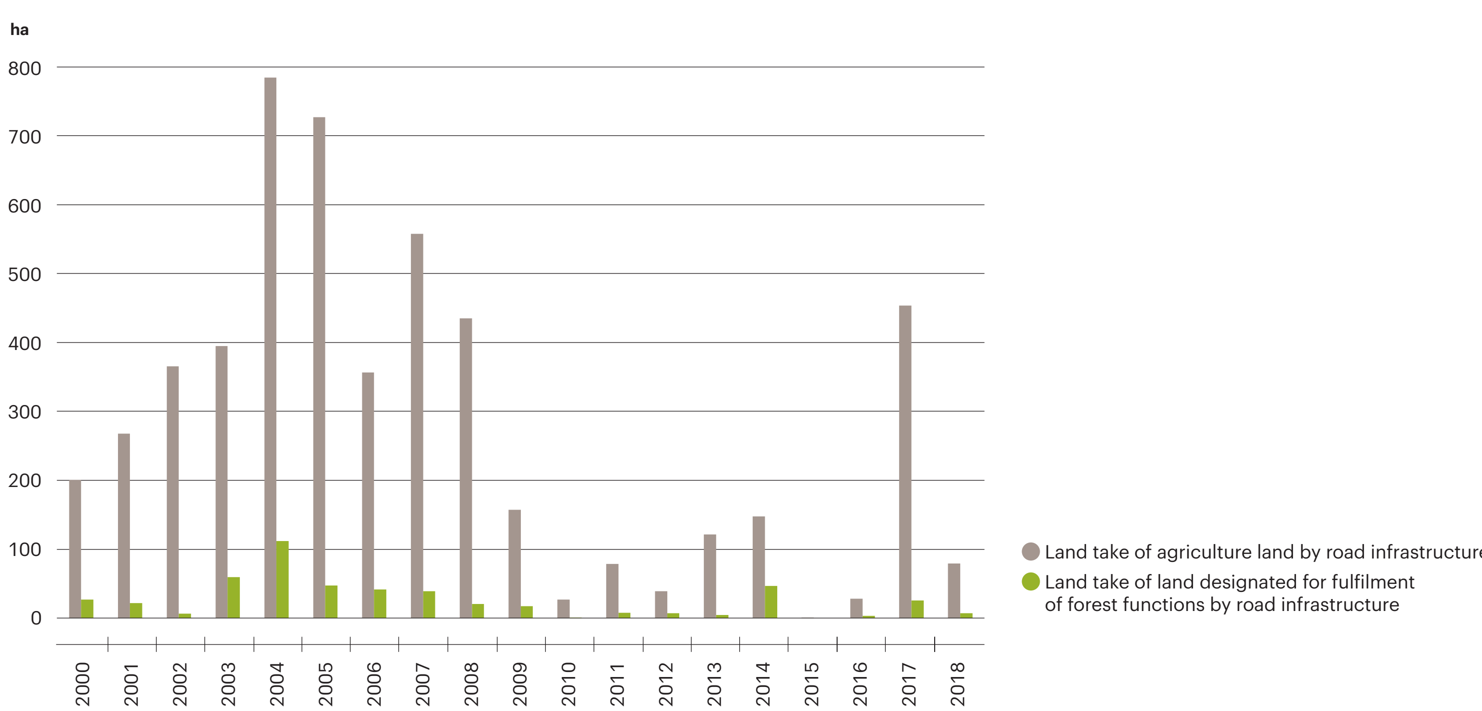


Assessed using UAT (Unfragmented Areas by Traffic) polygons. UAT is a method of determining of areas not fragmented by traffic, i.e. areas that are delimited by roads with a traffic intensity greater than 1,000 vehicles per 24 hours, or by multi-rail railways. UAT is determined in areas greater than 100 km^2.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Evernia

Chart 1

Take of the agriculture land and of land designated for fulfilment of forest functions due to road infrastructure in the Czech Republic [ha], 2000–2018

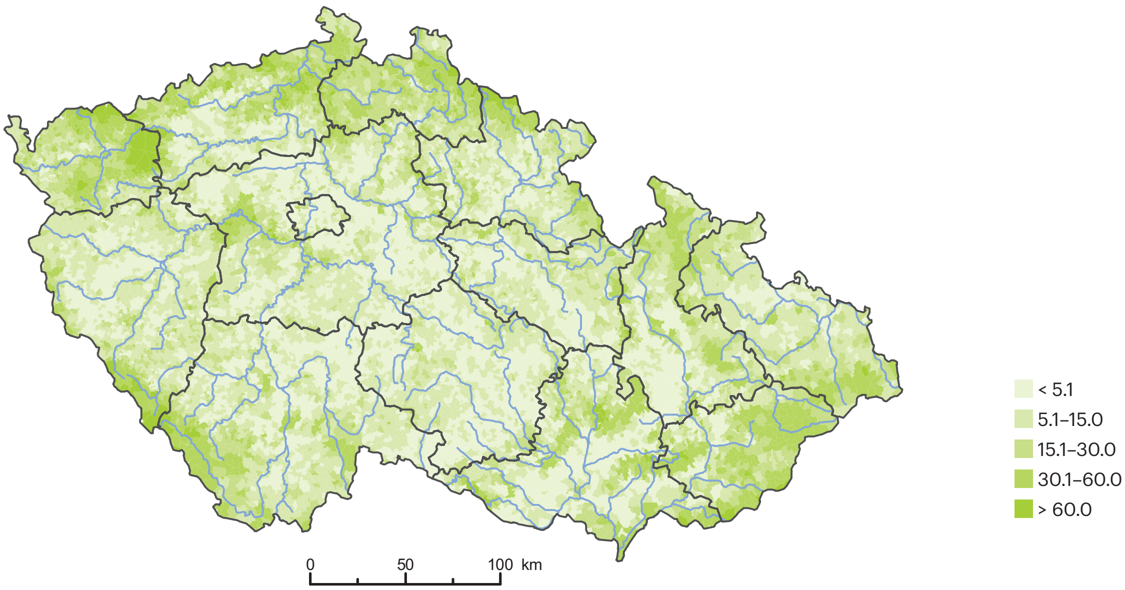


The methodology of reporting the take-overs of agriculture land and of land designated for fulfilment of forest functions is annually affected by temporary take-ups of such land which are associated with the construction of transport infrastructure.

Data source: Transport Research Centre

Figure 3

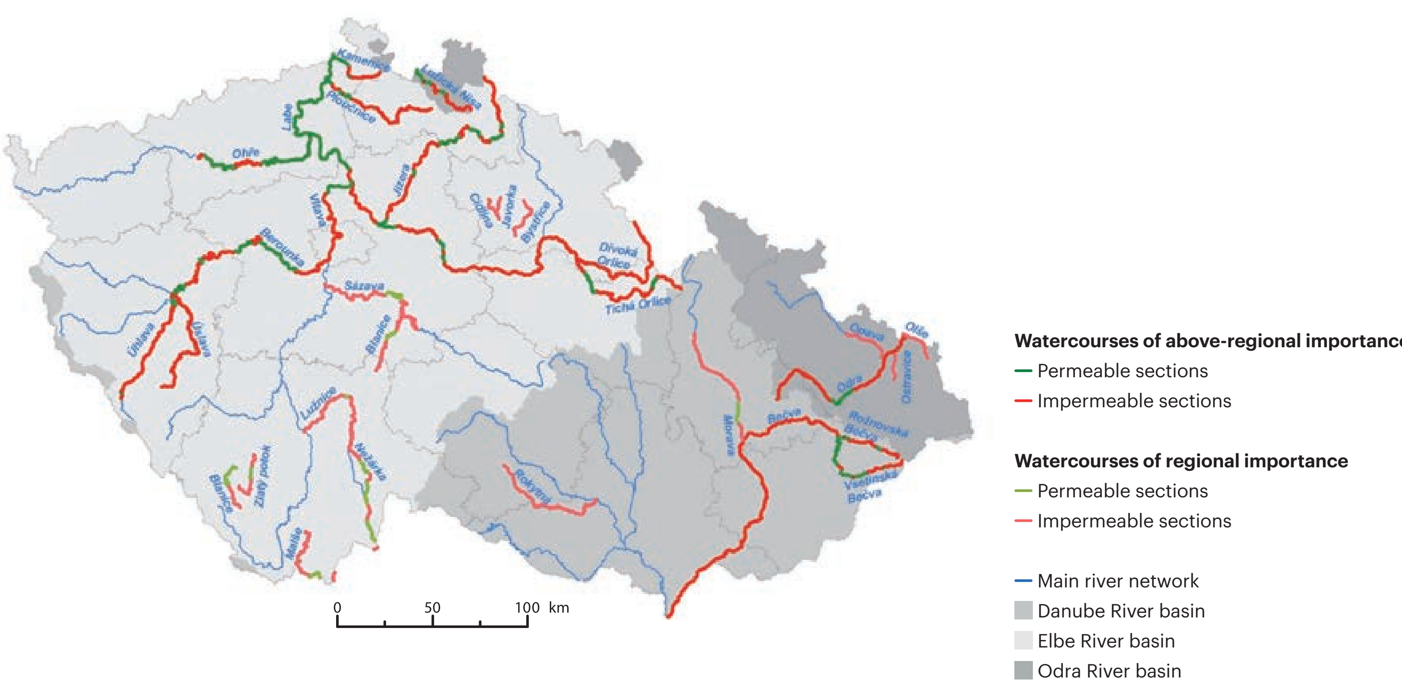
Proportion of natural biotopes in the cadastral areas in the Czech Republic [%], 2018



Data source: Nature Conservation Agency of the Czech Republic

Figure 4

Status of migration permeability of defined migration-significant watercourses in the Czech Republic, 2014



Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Nature Conservation Agency of the Czech Republic

During 2000–2010 the area of unfragmented landscape decreased from 54 thous. km^2 (68.6% of the total area of the Czech Republic) to 50 thous. km^2 in 2010 and thus covered 63.4% of total area of the Czech Republic (Figure 1, Figure 2). The rate of decline has decreased to 2.4% in the last 5 assessed years compared to the previous five-year period (2000–2005), but the fragmentation rate in the Czech Republic continues to grow and, according to forecasts, the share of unfragmented landscape is expected to reach only 53% in 2040.

The highest **landscape fragmentation** in the Czech Republic is recorded in the Central Bohemian, South Moravian and Moravian-Silesian Regions (Figure 1), which were also among the Regions with the highest decline in unfragmented areas in the period 2005–2010 (Figure 2). The high increase in fragmentation is caused by the expansion of built-up areas as a result of the ongoing urbanization of the territory, in particular urban agglomerations, and as a result of the development of transport infrastructure, including in particular the construction of city bypasses, expressways and motorways. On the other hand, the regions with the highest area of unfragmented areas include the Pilsen Region and the South Bohemian Region, where, due to the more rugged relief and larger areas of large-scale protected areas, the population density is lower and thus the need for transport services is lower.

In the years 2000–2018, approximately 5,221 ha of **agricultural land** and approximately 495 ha of **forested land** were taken in the Czech Republic for the construction of transportation infasturture (Chart 1). The most significant decrease of agricultural land in this period occurred in the Central Bohemian (1,171.1 ha) and Karlovy Vary (875.8 ha) Regions. In the Central Bohemian Region, the take of agricultural land was closely linked to the construction of the Prague ring road connecting the D1 and D5 motorways. In 2018, agricultural land was taken mainly in the Central Bohemian (39.9 ha) and South Moravian (38.6 ha) Regions, at a total of approximately 79 ha. The largest area of forested land was taken in 2015–2018 in the Central Bohemian Region (137.7 ha).

For many animal species, **linear transport structures** represent serious and often insurmountable obstacle. The solution is a suitable construction of animal crossing structures, underpasses and overpasses for animal migration. However, continuous monitoring of their functionality is not performed.

Ecological stability of the landscape can be evaluated based on the area of natural biotopes. The average share of natural biotopes on the area of the cadastral territory in the Czech Republic is 13.2% (13.3% in 2017 and 13.4% in 2016). Regions with maximum disruption of natural structures are located in the most agriculturally used areas of the Czech Republic and in urban agglomerations, while the **natural and near-natural landscape** is mainly located along the border mountain ranges and is related to defined specially protected areas (Figure 3).

Watercourses and their floodplains represent a specific migration route, to which different species of animals and plants are bound. More than 6,600 transverse structures higher than 1 m are built on watercourses of various orders in the Czech Republic, while the number of lower migration barriers is not known precisely and will be significantly higher. Other influences that cause the fragmentation of watercourses are the backwater and accumulation of water, improperly performed watercourse adaptations (flood control measures), water abstraction and pollution (Figure 4).

In 2018, a total of 838 weirs were registered on important watercourses managed by the river basin authorities (the state enterprises Povodí), of which 196 were managed by the enterprise Povodí Labe, 345 managed by the enterprise Povodí Vltavy, 44 by the enterprise Povodí Ohře, 171 by the enterprise Povodí Moravy, and 82 by the enterprise Povodí Odry. In order to maintain and strengthen populations bound to the need of **migration**, and to implement the Concept of Making the Czech River Network Passable, the number of planned constructions of fish passages has been increasing since 2010. In 2018, 24[3] new projects were prepared, and 4 projects were in progress. Since 2010, a total of 62 projects have been constructed.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[3] *These are projects that are consulted with the Nature Conservation Agency of the Czech Republic. However, the Nature Conservation Agency of the Czech Republic does not have information whether these projects are ready for implementation or whether they are being implemented.*

14 | Nature protection

Key question

What is the area of protected areas in the Czech Republic and what is the state of endangered and invasive species?

Key messages

In 2018, 16.7% of the Czech Republic territory was protected through specially protected areas, and 14.1% of the territory was protected through the Natura 2000 network. There was a slight year-on-year increase in the area of small specially protected areas.
Although according to the red lists from 2017, the number of endangered species in the Czech Republic has decreased overall, in the case of amphibians the situation has worsened.
In 2018, eight rescue programmes were implemented for selected endangered species.
In the Czech Republic, 61 plant species and 113 animal species are considered to be invasive. A total of 49 species are included on the list of invasive alien species with a significant impact on the EU (also valid for the Czech Republic).

Overall assessment of the trend

Change since 1990

Change since 2000

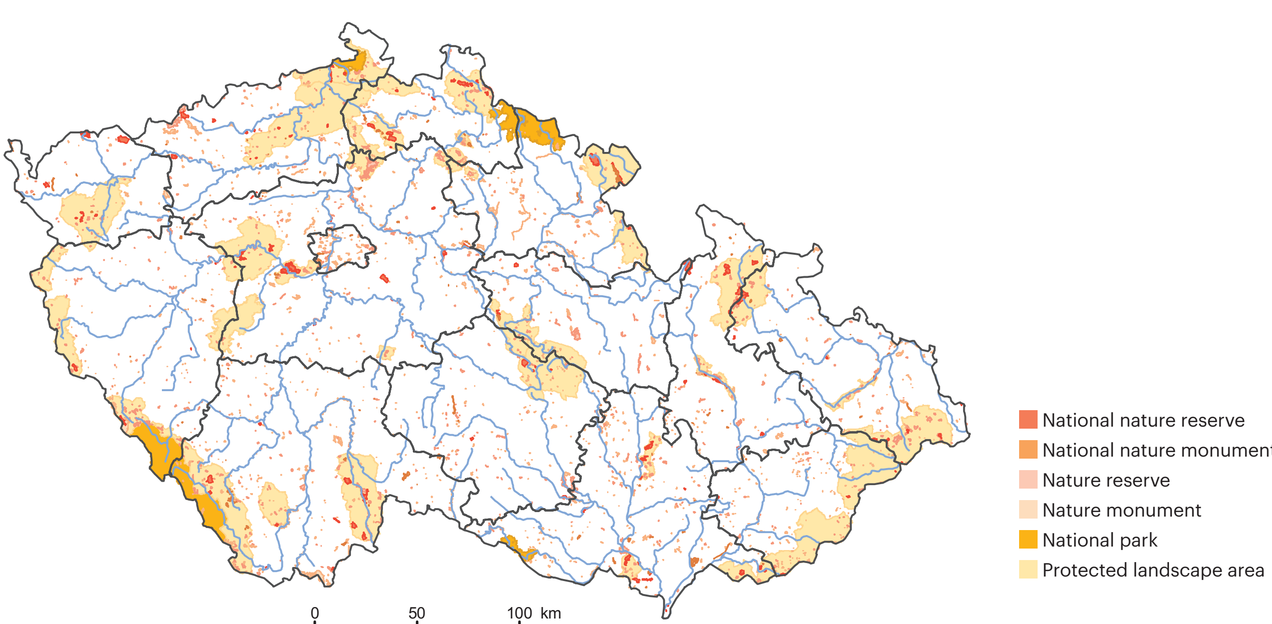
Change since 2010

Last year-on-year change

Indicator assessment

Figure 1

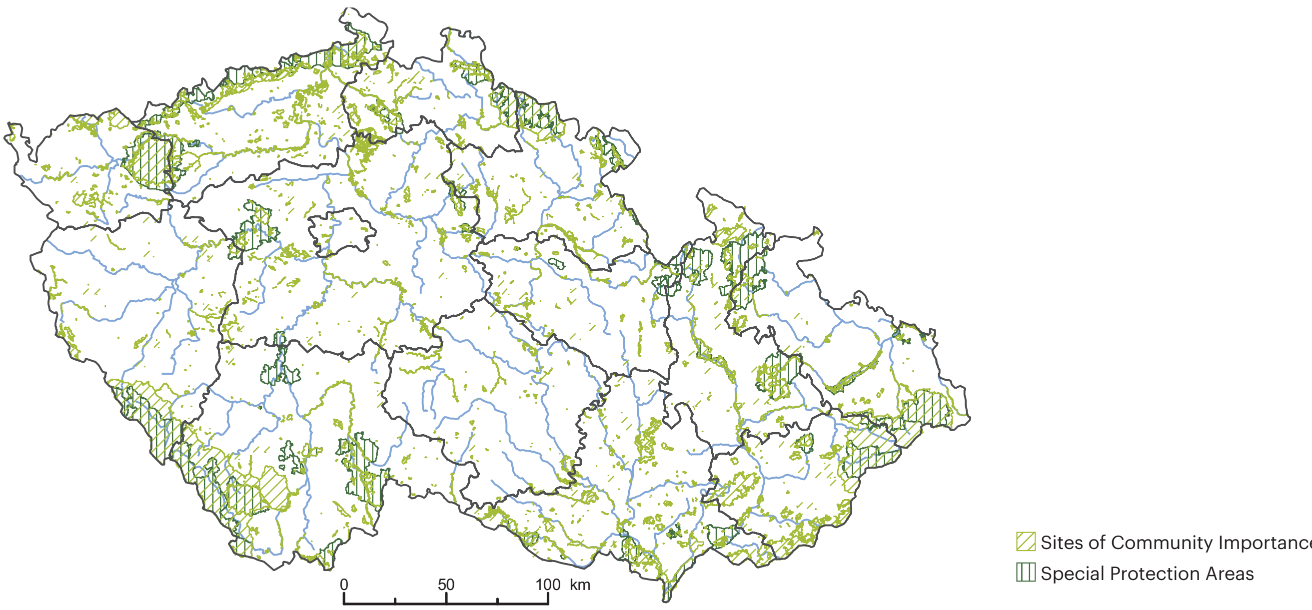
Large-size and small-size specially protected areas in the Czech Republic, 2018



Data source: Nature Conservation Agency of the Czech Republic

Figure 2

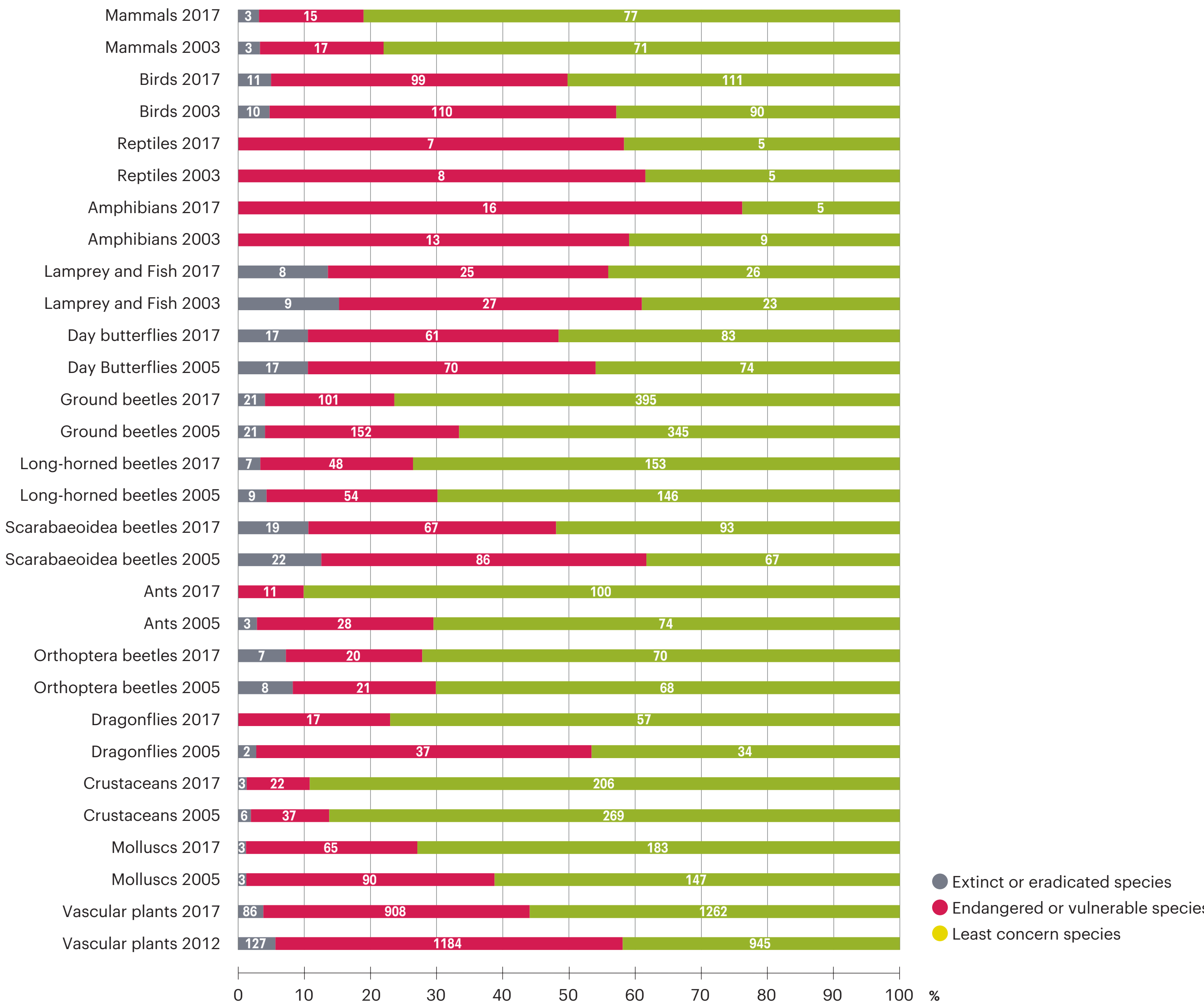
Natura 2000 sites in the Czech Republic, 2018



Data source: Nature Conservation Agency of the Czech Republic

Chart 1

Evaluation of selected groups of indigenous endangered plant and animal species in the Czech Republic according to Red Lists [number of species, %], 2003, 2005, 2012, 2017

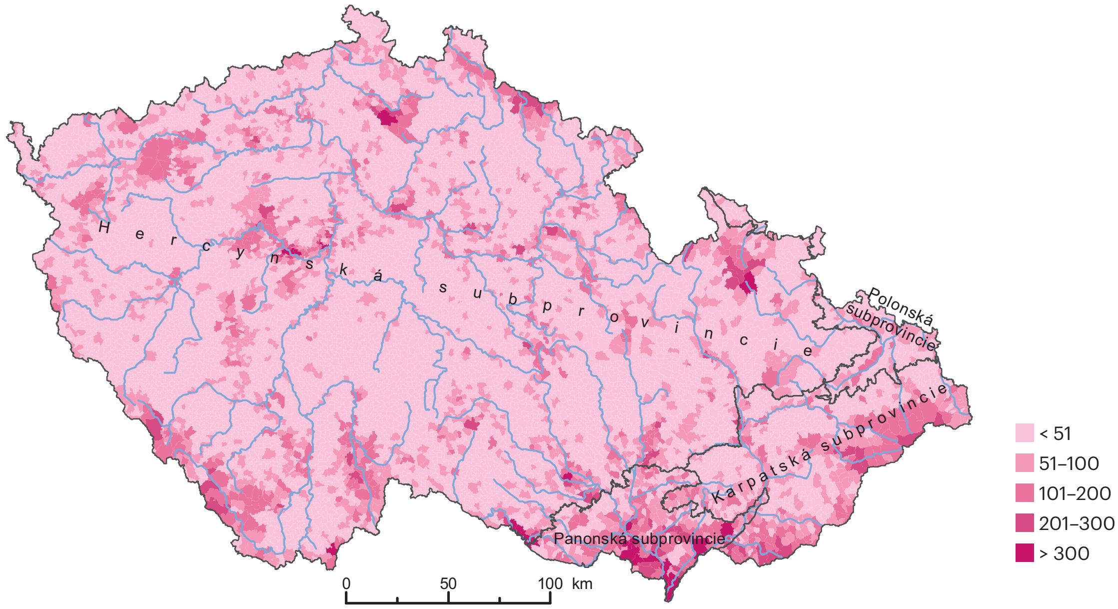


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Nature Conservation Agency of the Czech Republic

Figure 3

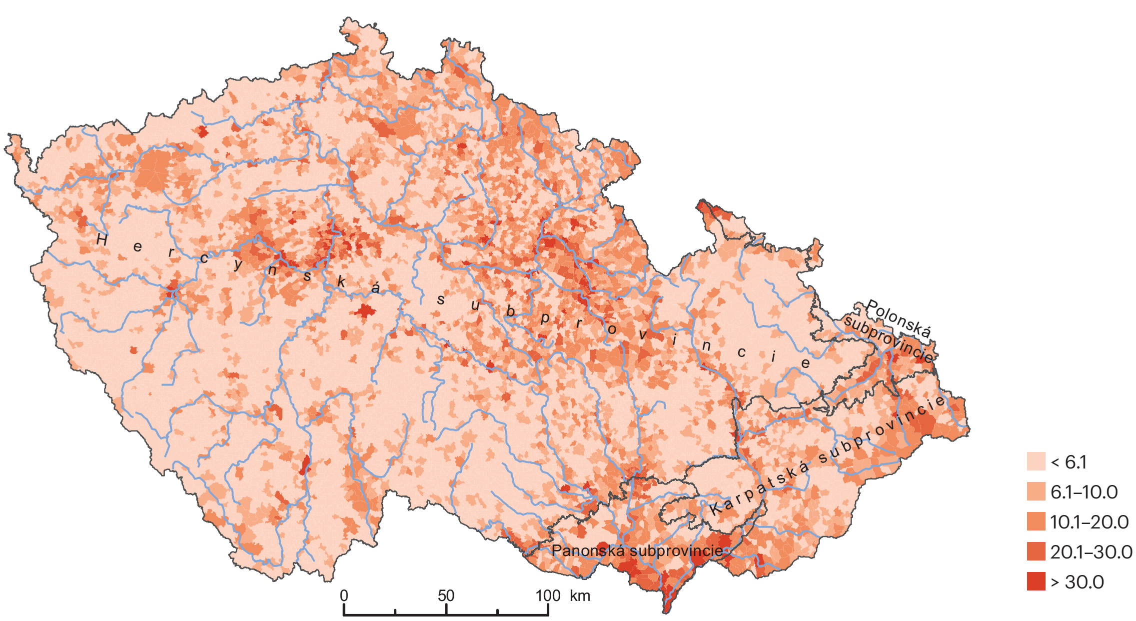
Occurrence of endangered plant and animal species according to red lists by the cadastral areas of the Czech Republic [number of species], 2018



Data source: Nature Conservation Agency of the Czech Republic

Figure 4

Occurrence of invasive plant and animal species by the cadastral areas of the Czech Republic [number of species], 2018



Data source: Nature Conservation Agency of the Czech Republic

© Petr Šmídek/CENIA

Total area of **specially protected areas** in the Czech Republic (Figure 1), comprising both small-size and large-size specially protected areas, amounted to 1,320.2 thous. ha in 2018 (16.7% of the territory of the Czech Republic). Compared to 2017, there has been a small increase (847.1 ha) in the total area of small-size specially protected areas.

The **Natura 2000** system (Figure 2) is a list of protected areas of Community importance, created in the territory of EU member states. It consists of two types of protected areas, namely **Special Protection Areas (bird areas)**, which in 2018 with a total of 41 areas occupied a total area of 703.4 thous. ha (8.9% of the Czech Republic territory), and **Sites of Community importance**, which, with a total of 1,112 localities in 2018, spread over a total area of 795.1 thous. ha (10.1% of the Czech Republic territory). Both these types of protected areas overlap in several places and the total area of Natura 2000 in the Czech Republic thus amounts to 1,114.8 thous. ha (i.e. 14.1% of the Czech Republic territory). The number of Natura 2000 sites has not changed since 2016.

The total area of **all protected areas in the Czech Republic** (large-size and small-size specially protected areas, Special Protection Areas and Sites of Community importance) is, with respect to their mutual overlaps, 1,737.2 thous. ha (22.0% of the Czech Republic territory).

General nature conservation is ensured by different types of tools. One of them is the Territorial System of Ecological Stability, the purpose of which is to interconnect individual natural and altered but near-natural ecosystems in the Czech Republic. However, they do not become binding through an administrative act of the nature conservation authority, but by issuing the appropriate spatial planning documentation. Another instrument of general nature protection is the protection through significant landscape elements (by law – forests, floodplains, wetlands and other water bodies or declared by the relevant nature conservation authorities) or protection of the landscape character.

In order to stabilize selected endangered species, **conservation programmes** containing active conservation measures are adopted. In 2018, there were rescue programmes for 8 critically endangered species of organisms[4]. Specifically for 4 types of plants, namely Marsh Angelica (*Angelica palustris*), Bohemian Pink (*Dianthus arenarius subsp. Bohemicus*), Pondweed (*Potamogeton praelongus*), Common Mustard (*Gentianella praecox subsp. Bohemica*), and 4 species of animals, Aspen (*Euphydryas maturna*), Grass snake (*Zamenis longissimus*), European ground squirrel (*Spermophilus citellus*) and freshwater pearl mussel (*Margaritifera margaritifera*). In total, an amount of CZK 3,856 thous. was spent on these rescue programmes in 2018. Mainly for the stabilization of species of freshwater pearl mussel (CZK 1,205 thous.) and ground squirrel (CZK 1,188 thous.).

According to Annexes 2 and 3 of Decree No. 395/1992 Coll. a total of 487 **specially protected species** of higher vascular plants (2,550 species in the Czech Republic), 108 specially protected species of fungi (6,000 species in the Czech Republic), 26 specially protected species/taxa of mammals[5] (81 species in the Czech Republic), 123 specially protected bird species (389 reliably identified species in the Czech Republic), 11 specially protected reptile species (11 species in the Czech Republic), 19 specially protected amphibian species (21 species in the Czech Republic), 20 specially protected fish and crustaceans (62 species in the Czech

[4] *More information at www.zachranneprogramy.cz.*

[5] *Of which one or more whole genera.*

Republic) and 116 specially protected invertebrate species/taxa[6] (40,000 species in the Czech Republic).

Detailed information on endangered species can be found in the **Czech Republic's Red Lists**. The widest range of organisms (macromycetes, lichens, bryophytes, vascular plants, invertebrates and vertebrates) was registered in 2010, but the first Red Lists based on the strict application of the International Union for Conservation (IUCN) methodology were published in 2017, namely for vascular plants, invertebrates and vertebrates. Due to the methodological modification, the numbers of endangered species in the Red Lists from 2017 are quite different from the previous red lists for the given group (Chart 1).

In the 2017 Red Lists, 908 vascular plants, 162 vertebrate species (16 amphibian species, 7 reptile species, 25 species of lamprey and fish species, 99 bird species and 15 mammal species) were classified as critically endangered, endangered or vulnerable species, as well as over 3,300 invertebrate species, with the exception of smaller groups, namely spiders who have their own 2015 Red List with 363 species. However, in 2017 among vertebrates and some groups of invertebrates (Chart 1) a high number of endangered species was detected and in the case of amphibians the trend even worsened. A large proportion of endangered species can be found among reptiles, fish and lamprey, birds, day butterflies and Scarabaeoidea beetles, indicating the major problems in the Czech landscape, which are a large number of improperly treated watercourses, in many places insufficient, albeit still improving water quality, and also the overall uniformity of many places in the Czech landscape. A large number of endangered plant and animal species (Figure 3) occurs in border areas, where a number of protected areas are located, and in the Pannonian area (South Moravia).

The populations of indigenous plant and animal species and individual valuable communities in the Czech Republic are threatened by the spread of geographically non-indigenous species, especially invasive species. Of the total number of 1,454 non-indigenous plant species which occur or have been recorded in the Czech Republic, 61 are considered to be invasive[7]. Among the widespread invasive plant species in the Czech Republic there is, among others, giant hogweed (*Heracleum mantegazzianum*), Japanese knotweed (*Reynoutria japonica*), giant knotweed (*Reynoutria sachalinensis*), Czech knotweed (*Reynoutria x bohemica*), Himalayan balsam (*Impatiens glandulifera*), many-leaved lupin (*Lupinus polyphyllus*) or varnish tree (*Ailanthus altissima*)[8]. Out of a total of 595 non-native animal species, 113 are considered to be invasive[9]. The widespread invasive animal species include American mink (*Neovison vison*), raccoon (*Procyon lotor*), sika deer (*Cervus nippon*), topmouth gudgeon (*Pseudorasbora parva*), rucian carp (*Carassius gibelio*), spinycheek crayfish (*Orconectes limosus*)) and signal crayfish (*Pacifastacus leniusculus*). The highest number of invasive species occurs in the Czech Republic along watercourses and various roads that facilitate their spread. An increased number of invasive species is also recorded in human settlements and their surroundings. Geographically, a high number of invasive species occurs in the Northern Pannonian sub-province (territory of South Moravia), where higher numbers of endangered plant and animal species occur. The occurrence and spread of invasive species has not been systematically monitored and regularly evaluated in the Czech Republic. Data on the occurrence of alien species are collected primarily in the Nature Conservation Agency of the Czech Republic database of discoveries. Priority species are included in the list of invasive alien species with a significant impact on the EU, the number of which may change continuously (in total 49 species in 2018).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[6] *Of which one or more whole genera.*

[7] *Pyšek P., Danihelka J., Sádlo J., Chrtek J. Jr., Chytrý M., Jarošík V., Kaplan Z., Krahulec F., Moravcová L., Pergl J., Štajerová K. & Tichý L. (2012): Catalogue of alien plants of the Czech Republic (2nd edition): checklist update, taxonomic diversity and invasion patterns. Preslia 84: 155–255.*

[8] *Pyšek P., Chytrý M., Pergl J., Sádlo J. & Wild J. (2012): Plant invasions in the Czech Republic: current state, introduction dynamics, invasive species and invaded habitats. Preslia 84: 575–629.*

[9] *Šefrová H., Laštůvka Z. (2005): Catalogue of alien animal species in the Czech Republic. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis. 53: 151–170.*

15 | State of animal and plant species of Community importance in 2006, 2012 and 2018

Key question

What is the development and current state of animal and plant species of Community importance[10] in the Czech Republic?

Key messages

Between 2007–2012 and 2013–2018, the number of animals of Community importance assessed in a favourable state increased from 27.4% to 31.5%. At the same time, the total number of species in unfavourable-poor state decreased from 34.0% to 27.4% between the mentioned periods.

The state of plant species of Community importance deteriorated slightly between 2007–2012 and 2013–2018, specifically the number of plant species in unfavourable-poor state increased from 23% to 24.6% between those periods.

Unfavourable-inadequate or unfavourable-poor state is found in 60.3% of animal species of Community importance and 75.4% of plant species of Community importance.

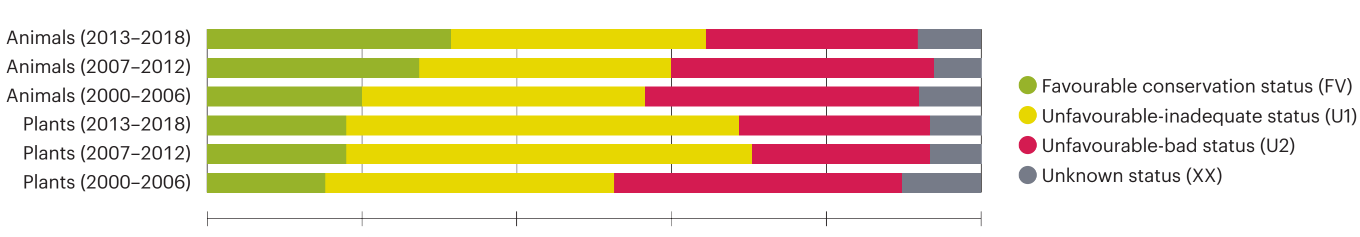
Overall assessment of the trend

Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
N/A	N/A	(neutral)	N/A

Indicator assessment

Chart 1

Overall evaluation of the state of animals and plants of Community importance in the Czech Republic [%], 2000–2006, 2007–2012, 2013–2018

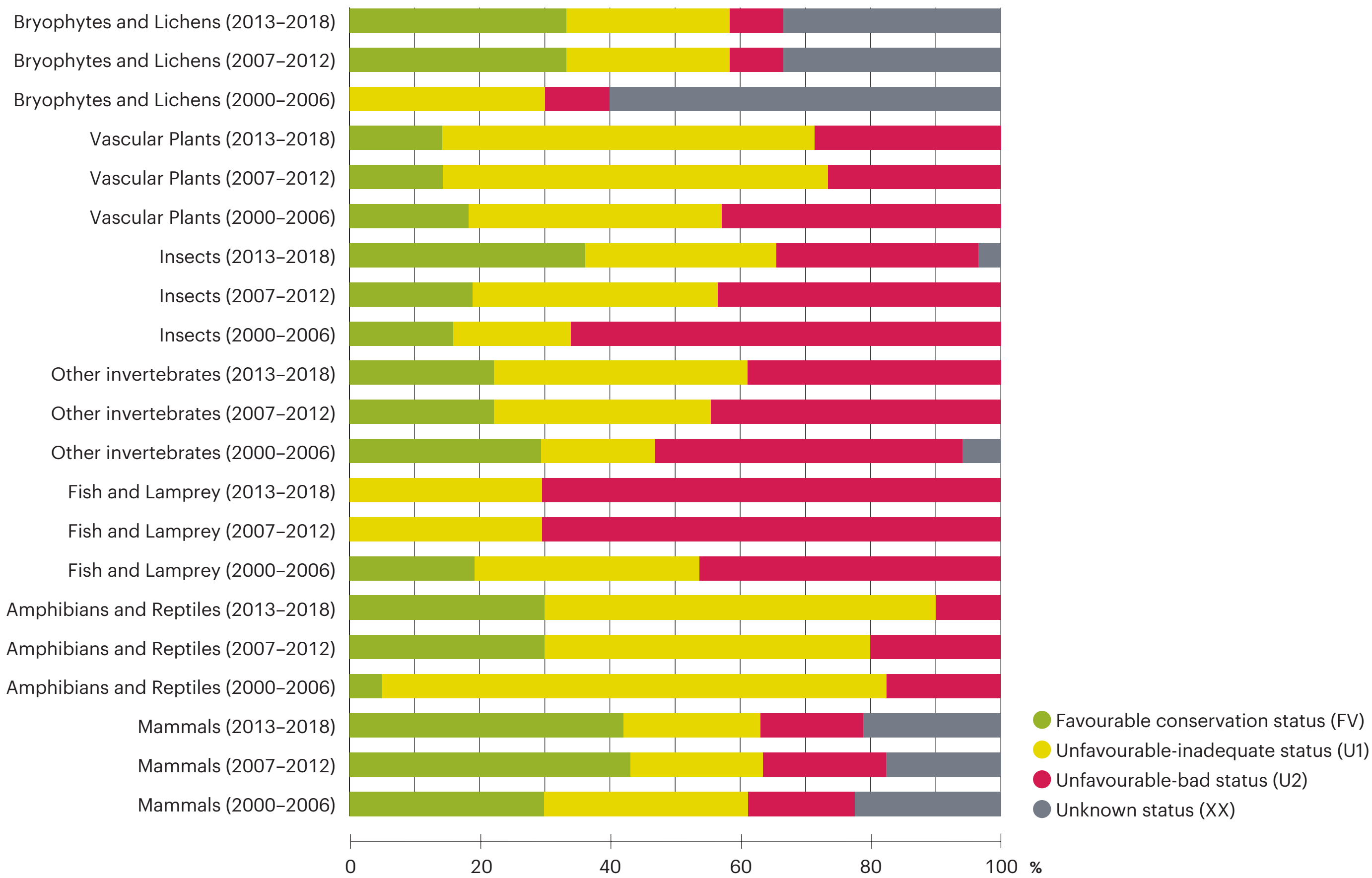


Data source: Nature Conservation Agency of the Czech Republic

[10] *Species of European Community interest (species of Community importance) include species found in territories of European member states which are endangered, vulnerable, rare or endemic and which are defined in relevant legislation of the European Community. The indicator does not assess all species, but only those stipulated in the Council Directive No. 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. This Directive obliges EU Member States to submit relevant assessment reports every 6 years. So far, the state of animal and plant species of Community importance in the period 2000–2006, 2007–2012 and 2013–2018 has been evaluated. From the viewpoint of the Habitat Directive, bird species are not considered species of Community importance, as they have, in accordance with the Directive No. 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds, a very specific position and an independent assessment system. The state of animal and plant species of Community importance is also suitable for assessing the state of biodiversity in the Czech Republic, given that no other groups of plants and animals are monitored in this way in the Czech Republic in a comprehensive or long-term manner.*

Chart 2

Evaluation of animal and plant species of Community importance according to defined groups [%], 2000–2006, 2007–2012, 2013–2018



Data source: Nature Conservation Agency of the Czech Republic

The **overall status of each** plant or animal **species evaluated** consists of 4 sub-parameters, namely area, population, habitat and prospects. If any of these parameters are assessed as unfavourable, the overall state of the species is also considered unfavourable. The status of species is evaluated separately for the Pannonian (south-eastern Moravia) and Continental (most of the Czech Republic) biogeographical regions.

The **results of the evaluation of all three previous periods** (2000–2006, 2007–2012, 2013–2018) show that there has been a significant slowdown in the trend of improvement in the state of animal and plant species of Community importance as seen **in between the evaluations in 2000–2006 and 2007–2012, although this improvement was due to methodological rather than factual** causes and the improvement was rarely due to active interventions. Overall, there has been a slight improvement between 2007–2012 and 2013–2018 in animals, especially insects. Conversely, the state of plants worsened slightly.

Between 2007–2012 and 2013–2018, there was an overall increase in the number of **species of Community importance**, which were in favourable state (from 27.4% to 31.5%, see Chart 1). At the same time, the proportion of species in unfavourable-bad state decreased from 34.0% to 27.4% compared to 2007–2012. Based on the results from 2013–2018, 60.3% of animal species are in unfavourable or unfavourable-bad state, which shows a gradual improvement (66.5% in 2007–2012). Despite this improvement, however, the overall state of species of Community importance is not good and largely reflects the state of endangered species in the Czech Republic, the overall state of biodiversity in the Czech Republic and the overall state of the Czech landscape. The main negative impact on biodiversity and important species had the overall homogenization of the Czech landscape due to agricultural and forestry management, as well as a number of artificial interventions in the landscape, especially the regulation of natural watercourses, which in many places had a very negative impact on a number of natural habitats. Increased endangerment rate can also be observed in species bound to old and decaying wood, which was in a long-term shortage in the Czech Republic due to the forest management methods.

The **overall state of plant species of Community importance** (Chart 1) deteriorated slightly in the period 2013–2018 compared to the previous period. Between 2000–2006 and 2007–2012, there was an improvement in the "Favourable status" category from 15.3% to 18%, and this status remained at the same level in the period 2013–2018, but in the category of unfavourable-bad status there was a deterioration between 2007–2012 and 2013–2018 from 23% to 24.6%.

Indicator assessment according to defined groups

The individual sub-indicators of animal species of Community importance for the particular defined groups of (Chart 2), i.e. mammals, amphibians and reptiles, fish and lampreys, other invertebrates and insect, have been defined in a way similar to the overall indicator.

In the last two evaluations, **fish and lamprey** had the worst state, for which no species were found to be in favourable status in the monitored periods of 2007–2012 and 2013–2018 (19.2% in the first evaluation period 2000–2006), and 70.4% of species were classified as unfavourable-bad. This negative state corresponds in many places to the changed water regime in the Czech Republic, many different regulations of watercourses and mechanical barriers, as well as the quality of water and intensive management of water bodies. The situation in the water sector is gradually improving, but fish and lamprey species of Community importance will, according to the results to date, respond to this improvement with a longer delay. Compared to the evaluated period 2000–2006, the condition of the **amphibian and reptile** group has improved (in the period 2000–2006, 5.0% of species were evaluated in a favourable status, in the following two periods it was 30.0%), Chart 2. Overall, the state of **insect** species of Community importance has improved significantly (36.2% in a favourable status compared to 18.9% in 2007–2012 and 16.0% in 2000–2006). At the same time, the number of species assessed as unfavourable decreased significantly (from 66.0% in the period 2000–2006 to 31.0% in the period 2013–2018). Overall, **mammals** account for the highest proportion in a favourable state, with 42.1% for the period 2013–2018. Compared to the previous period 2007–2012, there was a slight decrease in the proportion of mammals in this category (from 43.2% to 42.1%), but there was also a positive decline in the category of unfavourable state, from 18.9% to 15.8%.

Similarly, sub-indicators of plant species for vascular plants and non-vascular plants (bryophytes and lichens) have been defined as well (Chart 2). The **bryophytes and lichens** are most influenced by their insufficient exploration at the national level. Although the proportion of bryophytes and lichens in the unknown status category decreased from 60.0% to 33.3% compared to the first assessment period in 2000–2006, this value remains unchanged for the next two periods. Likewise, over the last two evaluation periods 33.3% for bryophytes and lichen species assessed in a favourable state remained stable. **Vascular plants**, the occurrence of which has been monitored intensively for a long time, showed a significant decline in the number of species in unfavourable-bad status in the period between 2000–2006 and 2007–2012 (from 42.9% to 26.5%), but in the period 2013–2018 the proportion of species assessed in unfavourable-bad status increased again, albeit slightly, to 28.6%.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

16 | State of natural habitats of Community importance in 2006, 2012 and 2018

Key question

What is the development and current state of European habitat types[11] in the Czech Republic?

Key messages

The comparison of all 3 evaluated periods shows a very slight improvement of the overall state of habitats of Community importance in the Czech Republic. In the period 2013–2018, 19.4% of habitats of Community importance were evaluated to be in a favourable state, compared to 16.1% in the period 2007–2012.

Despite a long-term positive trend, 79.6% of habitats of Community importance still have an inadequate or unfavourable state.

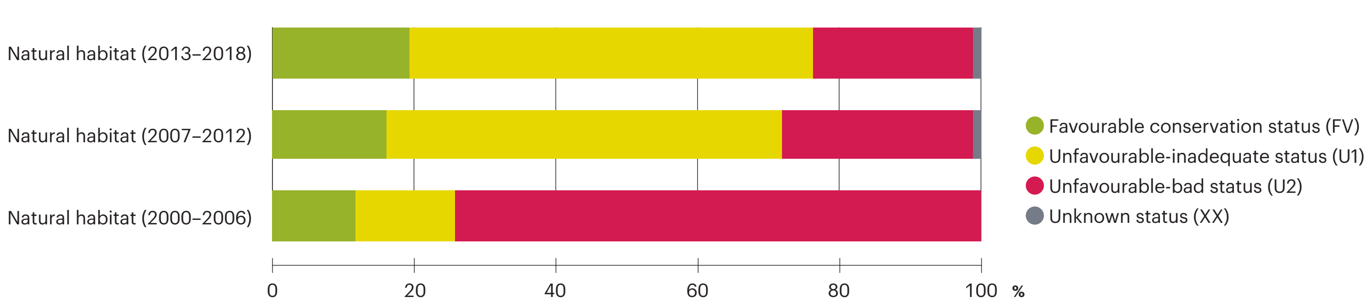
Overall assessment of the trend

Change since 1990	Change since 2000	Change since 2010	Last year-on-year change
N/A	N/A		N/A

Indicator assessment

Chart 1

Evaluation of the state of natural habitats of Community importance in the Czech Republic [%], 2000–2006, 2007–2012, 2013–2018

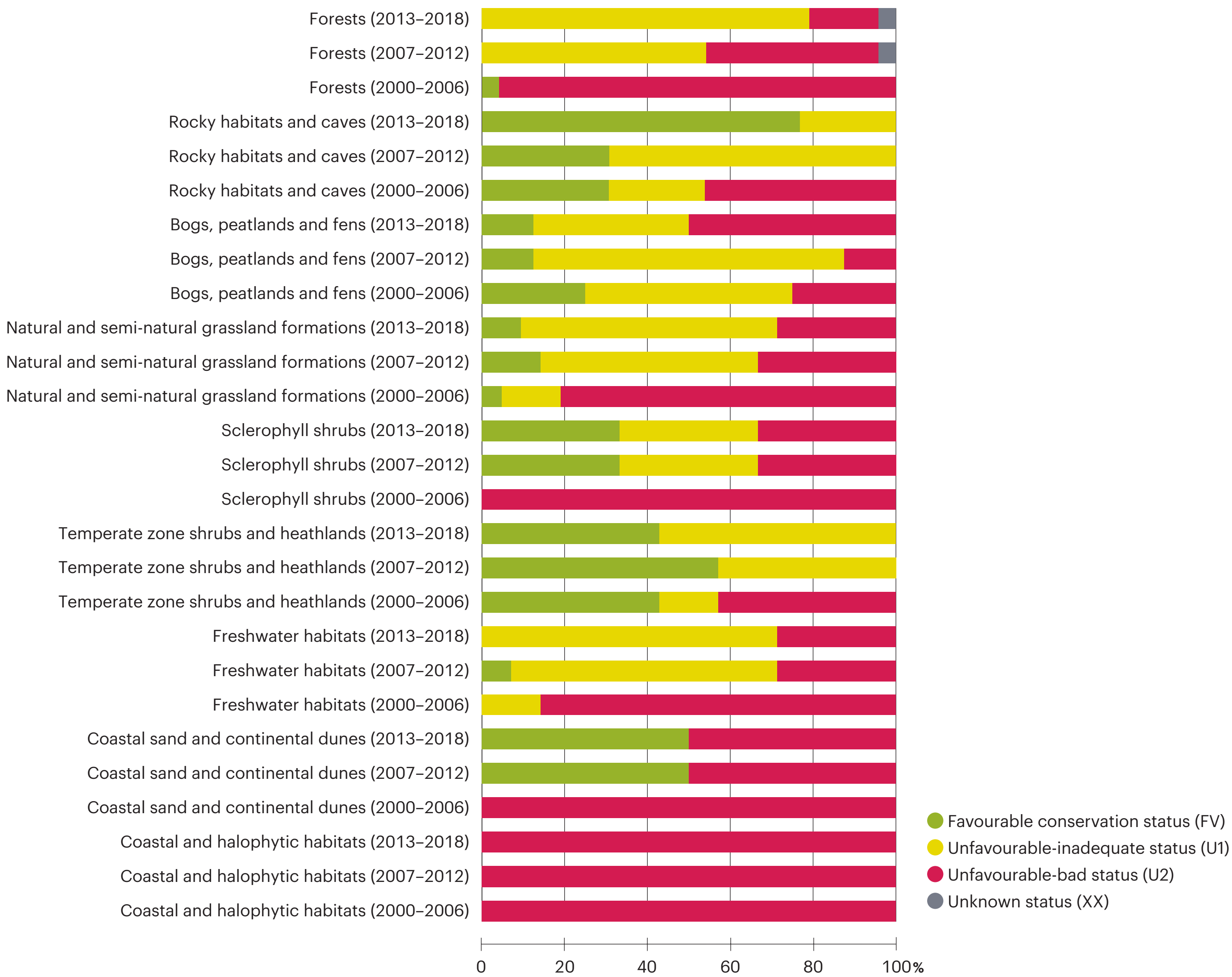


Data source: Nature Conservation Agency of the Czech Republic

[11] Natural habitat types of European Community interest (European habitats) are natural habitats found in territories of European Community member states that are in danger of disappearance in their natural range, have a small natural range due to their regression or their intrinsically restricted area, or present special examples of typical characteristics of one or more biogeographical regions. These habitats are defined by the European Community legislation. The evaluation of the status of habitats of Community importance is based on Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora and, within the Czech Republic, their status is evaluated based on biotope state. This Directive obliges EU Member States to submit relevant evaluation reports every 6 years. So far, the state of habitat types of Community importance in the period 2000–2006, 2007–2012 and 2013–2018 has been evaluated.

Chart 2

Evaluation of the state of natural habitat types of Community importance in the Czech Republic by the individual formation group [%], 2000–2006, 2007–2012, 2013–2018



Data source: Nature Conservation Agency of the Czech Republic

The **overall state of each habitat type** evaluated consists of 4 sub-parameters, namely the existing area, potential site, structure and function, and future prospects; if any of the parameters is evaluated as unfavourable, the overall state of the given habitat is evaluated as unfavourable. Generally, site area and its development is evaluated more positively than the structure and function, which are based on biological value of the habitat and its ability to withstand external pressures. Each habitat type is evaluated separately for the Continental (most of the Czech Republic) and for the Pannonian (southeast Moravia) biogeographical region. On a long-term basis, 93 types of natural habitats are evaluated in the Czech Republic.

A comparison of all 3 evaluations carried out so far (2000–2006, 2007–2012, 2013–2018) shows a moderate improvement in the overall state of natural habitats in the Czech Republic. However, it should be emphasized that careful interpretation of results is necessary, especially when evaluating trends, as the improvement of the situation is often given methodically and not by active intervention. As in the case of species, the methodological effect is predominant in the first two periods of 2000–2006 and 2007–2012, when the methodology was partially modified. The improvement in the assessment of 2007–2012 and 2013–2018 periods is more reliable, although even in this case methodological limits need to be considered.

In **favourable** conservation status 19.4% of habitats were evaluated in 2013–2018, compared to 16.1% in 2007–2012 (11.8% in 2000–2006). In the latest evaluation, 25.8% of habitat types of Community importance are classified in this category (26.9% in 2007–2012 and 74.2% in 2000–2006).

Despite the gradual improvement in the state of habitats of Community importance, 79.6% of habitats are still classified as **unfavourable-inadequate or unfavourable-bad** (57.0% and 22.6% respectively); in the period 2007–2012 it was 82.8% and in the period 2000–2006 it was 88.2%.

In all three periods (2000–2006, 2007–2012, 2013–2018), the taxonomy group **Coastal and halophytic habitats** was evaluated to be in unfavourable-bad status, and all habitat types in this group were classified to be in unfavourable-bad status. The **Freshwater habitat** taxonomy group is also in a poor condition in the long term. Currently, no habitat type within this group is classified as favourable, 71.4% of habitat types are classified as unfavourable-inadequate. There was a deterioration compared to the previous period, during which 7.1% of the habitats of this taxonomy group were classified to be in favourable conservation status. The evaluation results indicated an improvement within the **Forests** taxonomy group, although this improvement regarded only category of unfavourable-inadequate status (from 54.2% in 2007–2012 to 79.2% in 2013–2018) and unfavourable-bad status (down from 41.7% to 16.7% in the period 2013–2018), as no habitat from the Forests taxonomy group was included in the favourable conservation status. The taxonomy group of **Bogs, peatlands and fens** was evaluated to be in a significantly worse state in the period 2013–2018 than in the previous period. 50% of natural habitat types have been evaluated to be in the worst category of unfavourable-bad status (Chart 2). Furthermore, the evaluation results indicate a significant improvement in the taxonomy group **Rock habitats and caves**, in which during the last evaluation 76.9% of habitat types were classified in favourable conservation status and only 23.1% in unfavourable-inadequate status. One of the most favourably evaluated groups in each period is the taxonomy group **Temperate zone shrubs and heathlands,** although between the last two evaluation periods the number of habitat types in the favourable conservation status category decreased from 57.1% to 42.9%. **Other taxonomy groups** are on a long-term basis in similar overall state (Chart 2).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

17 | Indicator of common bird species

Key question

Is it possible to reverse the decline in the number of bird populations in the Czech Republic?

Key messages

The population size of common bird species has stagnated since 1982, in 2018 it was 0.4% higher than in 1982. The population size of woodland bird species had long been decreasing with a gradual reversal of the trend in recent years, it was 9.9% lower in 2018 than in 1982. The population size of farmland birds has decreased by 33.5% since 1982, while the slowing of downward trend in recent years is caused by the depletion of remaining population rather than by improvement in the state of the landscape.

Overall assessment of the trend

Change since 1990

Change since 2000

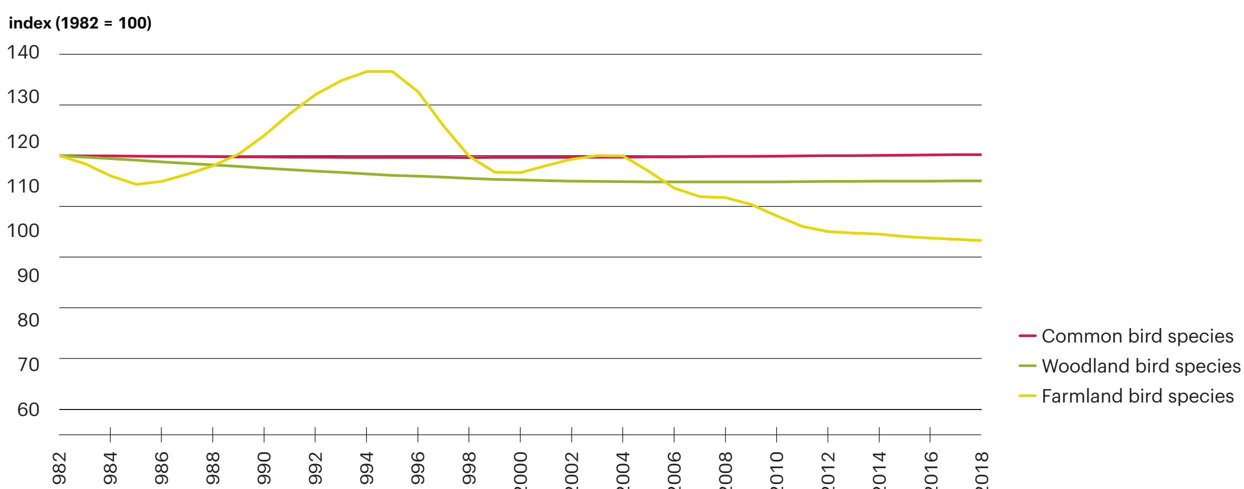
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Indicator of common, woodland and farmland bird species in the Czech Republic [index, 1982 = 100], 1982–2018



Data source: Unified Bird Census Programme (Czech Society for Ornithology/ORNIS)

Trends in development of bird populations[12] reflect changes in the landscape and its use, as well as overall changes in ecosystems. To a lesser but increasing extent, the effects of climate change are evident[13].

The **population size of common bird species** has stagnated since 1982, in 2018 it was 0.4% higher than in 1982.

The **population size of woodland bird species** has been gradually decreasing since 1982, around 2000 the decline trend started to slow down and gradually reversed. The population size of woodland bird species has been gradually increasing over the last decade, with a value of 9.9% lower in 2018 than in 1982. In the case of woodland species, the unification of bird communities is a major problem, reducing the number of forest habitat specialists (such as the flycatcher (*Ficedula parva*), willow warbler (*Phylloscopus sibilatrix*), goldcrest (*Regulus regulus*)), who are substituted by common species with a wide ecological valency such as blackbird (*Turdus merula*), song thrush (*Turdus philomelos*), robin (*Erithacus rubecula*), blackcap (*Sylvia atricapilla*) or great tit (*Parus major*) and blue tit (*Cyanistes caeruleus*). Rare and narrowly specialized species are becoming even rarer and generally biodiversity at the local and regional level is reduced. The causes of this negative development in the forests of the Czech Republic have not been adequately studied.

The **population size of farmland birds** fell by 33.5% in 2018 compared to the beginning of the census in 1982, with a decrease in their population already before 1982. The main reasons for this significant decline are the ever-increasing intensity of agriculture. A temporary improvement occurred after 1989, when the intensity of agricultural production temporarily decreased, to which the farmland birds responded immediately by increasing their populations[14]. The economic consolidation of agriculture was again followed by a sharp decline in the number of farmland birds, which was further intensified with the application of the EU Common Agricultural Policy[15]. Since 2012, further decline has been slowing down, but this is due to the depletion of species populations rather than to a real improvement in the environment. Some of the known species (the grey partridge (*Perdix perdix*), northern lapwing (*Vanellus vanellus*), meadow pipit (*Anthus pratensis*) or yellow wagtail (*Motacilla flava*) decreased to a fraction of the initial state. The non-improving situation indicates the lack of effectiveness of existing financial instruments to limit the negative impact of agriculture.

The factor that is increasingly more affecting the composition of bird species in the Czech Republic is climate change. Due to the influence of climate change, Nordic species of birds (the winchat (*Saxicola rubetra*), green cricket (*Locustella naevia*), icterine warbler (*Hippolais icterina*)) are retreating from Central Europe and the thermophilous species (the turtle dove (*Streptopelia decaocto*), nightingale (*Luscinia megarhynchos*), golden oriole (*Oriolus oriolus*)), which have been so far occurring in southern Europe are more common. At the same time, we can expect a gradual decline of birds in the Czech Republic, as the area with the greatest species diversity, which we are currently part of, will move north-east[16].

Based on the assessment of population trends of common bird species, a fundamental problem persists especially for farmland birds. Unless strong measures are taken, especially in the agricultural subsidy policy, a further decline in biodiversity can be expected in the near future[17]. The conservation measures applied so far in the agricultural landscape (agro-environment-climate measures in the framework of agricultural subsidies, general protection of nature and birds) seem to contribute to slowing down the negative trend in the decline in the populations of Czech farmland birds, but do not lead to its cessation.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[12] *For the purpose of calculation of the indicator of common bird species, 42 species were selected whose population (together with the population of the feral pigeon (Columba livia f. Fera), which was excluded from the analysis) together represent 95% of all birds nesting in the Czech Republic. 17 species were included in the calculation of the woodland bird species indicator and the farmland bird indicator contains data from 20 species of field and meadow birds. The input data come from the Single Bird Census Programme (JPSP). The selection of species has been different since 2014 in order to improve the classification of individual species than in previous years and compared to the previous calculations the indicator is smoothed by the TrendSpotter algorithm, which reduces seasonal fluctuations. Thus, the entire time series is recalculated every year after the addition of new data, which refines the trend estimate, and this smoothing affects the numerical value of the index in individual years.*

[13] *Reif J., Škorpilová J., Vermouzek Z. & Šťastný K. (2014) Population changes of common breeding birds in the Czech Republic for the period 1982–2013: an analysis using multispecies indicators. Sylvia 50: 41–65.*

[14] *Reif J., Voříšek P., Šťastný K., Bejček V. & Petr J. (2008a) Agricultural intensification and farmland birds: new insights from a central European country. Ibis 150: 596–605.*

[15] *Reif J. & Vermouzek Z. (2018) Collapse of farmland bird populations in an Eastern European country following its EU accession. Conservation Letters 2018, doi: 10.1111/conl.12585.*

[16] *Huntley B., Green R. E., Collingham Y. C. & Willis S. G. (2007) A Climatic Atlas of European Breeding Birds. Lynx Edicions, Barcelona.*

[17] *Voříšek P., Klvaňová A., Brinke T., Cepák J., Flousek J., Hora J., Reif J., Šťastný K. & Vermouzek Z. (2009) State of Birds of the Czech Republic 2009. Sylvia 45: 1–38.*

Nature and landscape in the global context

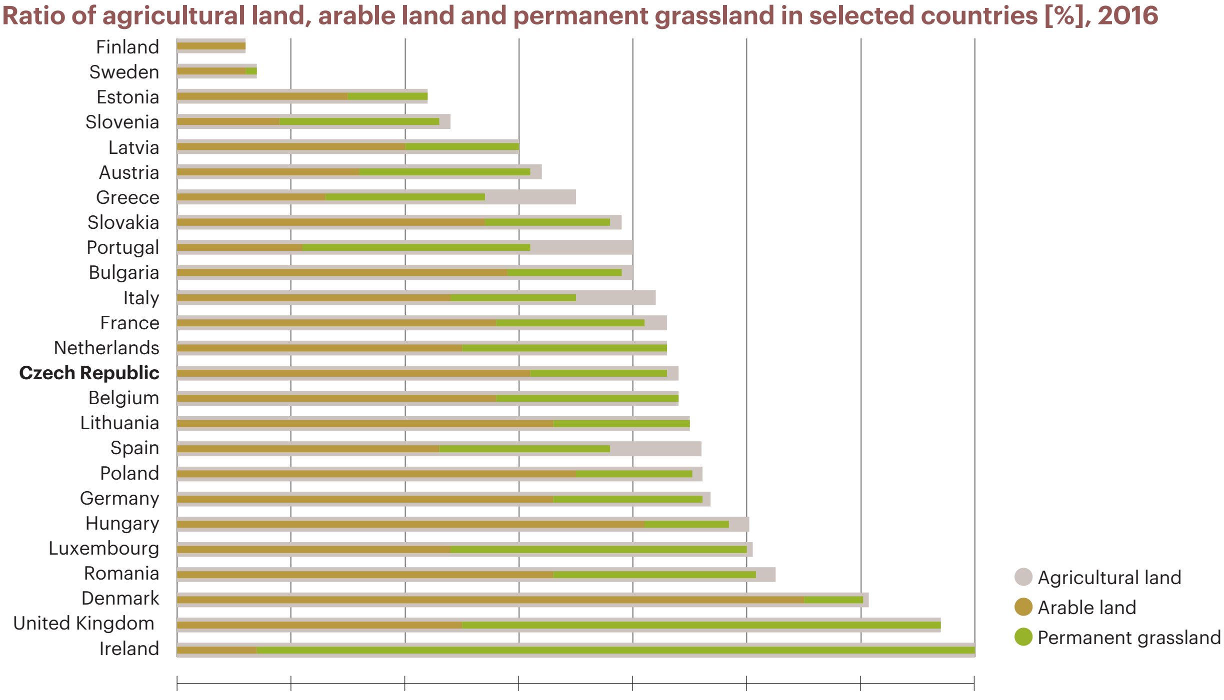
Key messages[18]

- In 2016, agricultural land accounted for 38.6% of the whole EU28 territory. The character of farming along with urbanization and transport infrastructure significantly causes to maintain the homogeneity and fragmentation of the landscape at high level.
- The share of the mainland part of the Natura 2000 territorial system in the EU has not increased significantly in the long term (it increased from 17.9% to 18.2% of the total EU area from 2011 till May 2018), mainly due to the fact that the mainland part of the Natura 2000 network is almost complete. The total proportion of marine habitats included in the Natura 2000 network increased from 5.1% to 12.2% over the same period.
- Only 23.1% of all animal and plant species of Community importance and around 16.4% of habitat types of Community importance were assessed as favourable in the most recent pan-European assessment period (2007–2012). In the Czech Republic, this value was 25.3% for animals and plants and 16.1% for sites of Community importance over the same period.
- Between 1990 and 2016, the number of populations of common bird species decreased by 11.2%, woodland bird species by 5.3% and farmland bird species by 34.9% in Europe (EU, Norway, Switzerland). The situation in the Czech Republic is similar in case of birds of agricultural land and farmland species, but the population of common bird species in the Czech Republic slightly increased between the years mentioned above.
- Between 1990 and 2017 there was a dramatic decrease in the population of meadow butterflies in the monitored European countries by 39.3%.

Indicator assessment

Chart 1

Ratio of agricultural land, arable land and permanent grassland in selected countries [%], 2016



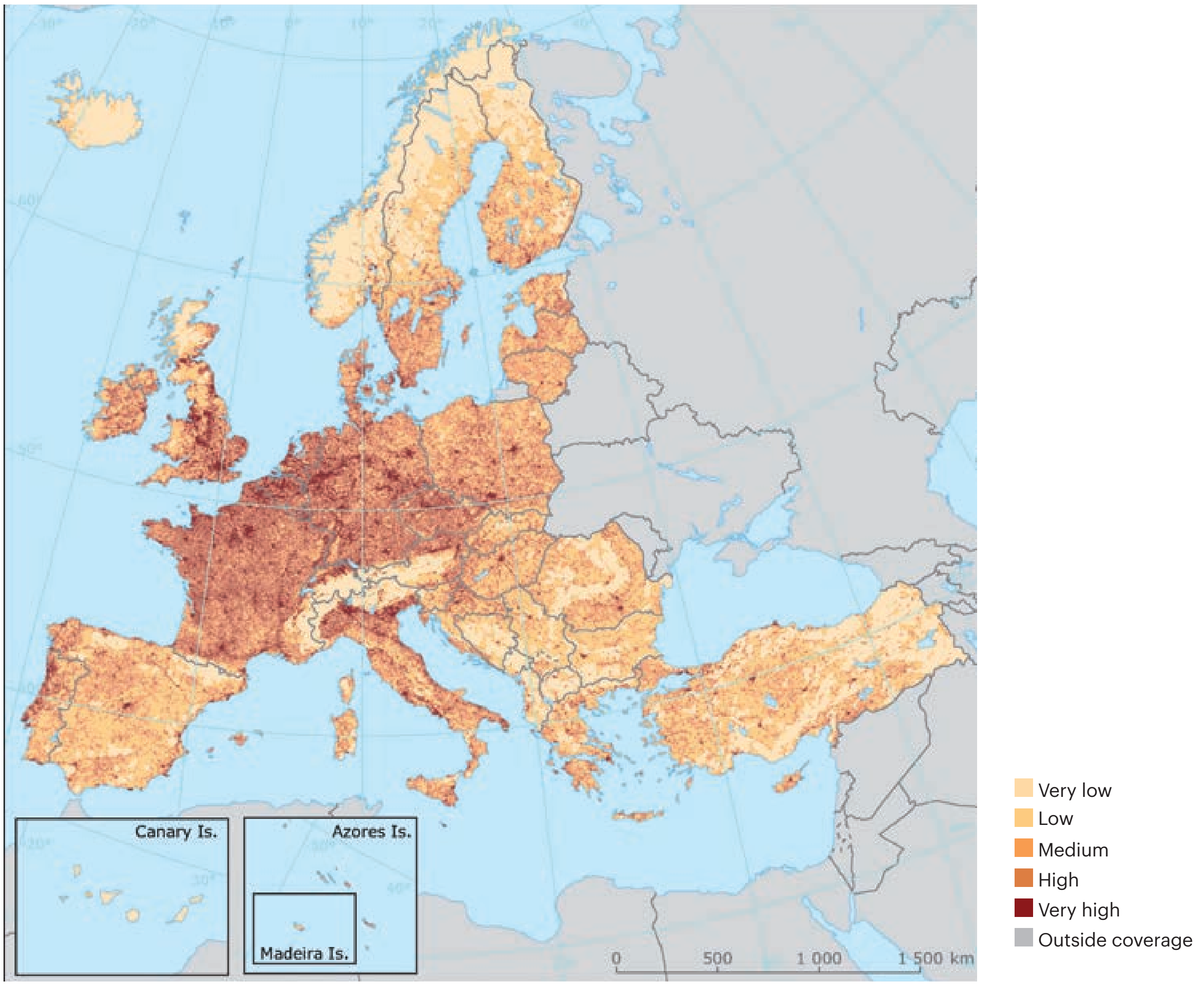
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

[18] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Figure 1

Landscape fragmentation in Europe [Effective mesh density index], 2016

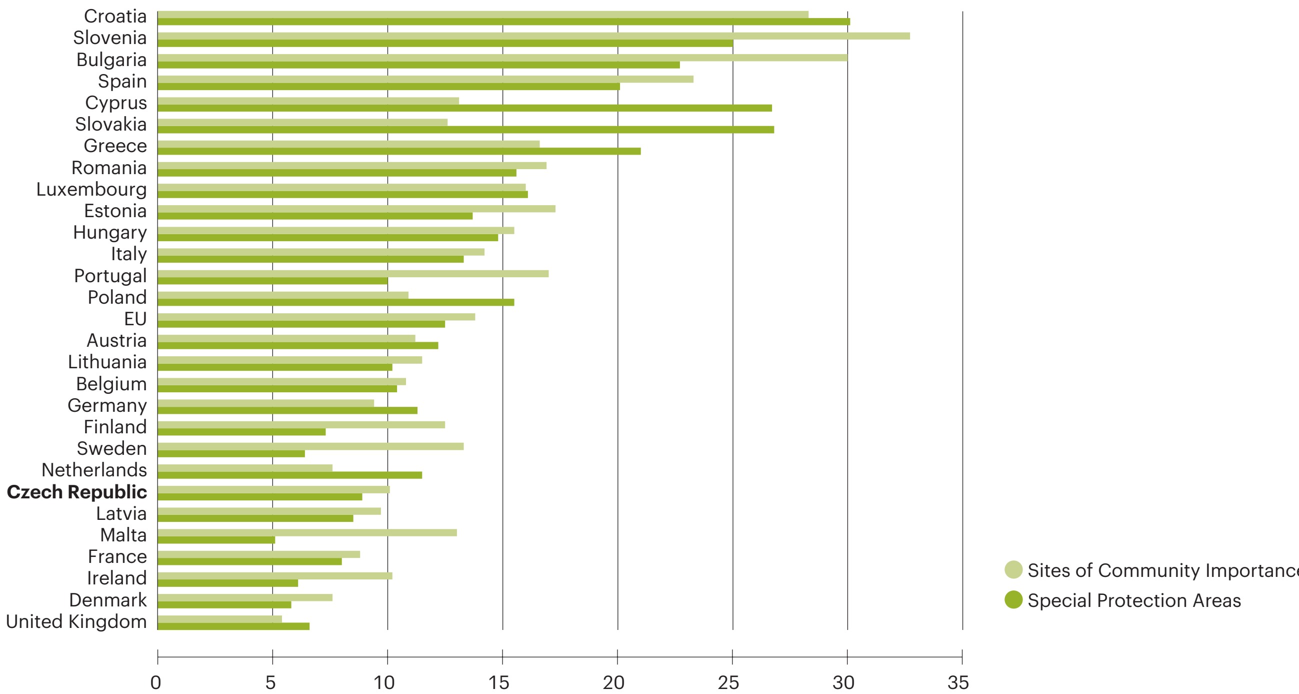


Current data are not, due to the methodology of their reporting, available at the time of publication.
The "Effective mesh density" method is based on the number of meshes per 1,000 km^2. The smaller the size of meshes (i.e. greater number per 1,000 km^2), the higher the landscape fragmentation. In urbanized regions, the number of meshes is higher than 100 per 1,000 km^2 and they are in average 40 times more fragmented than the extra-urban regions.

Data source: European Environment Agency

Chart 2

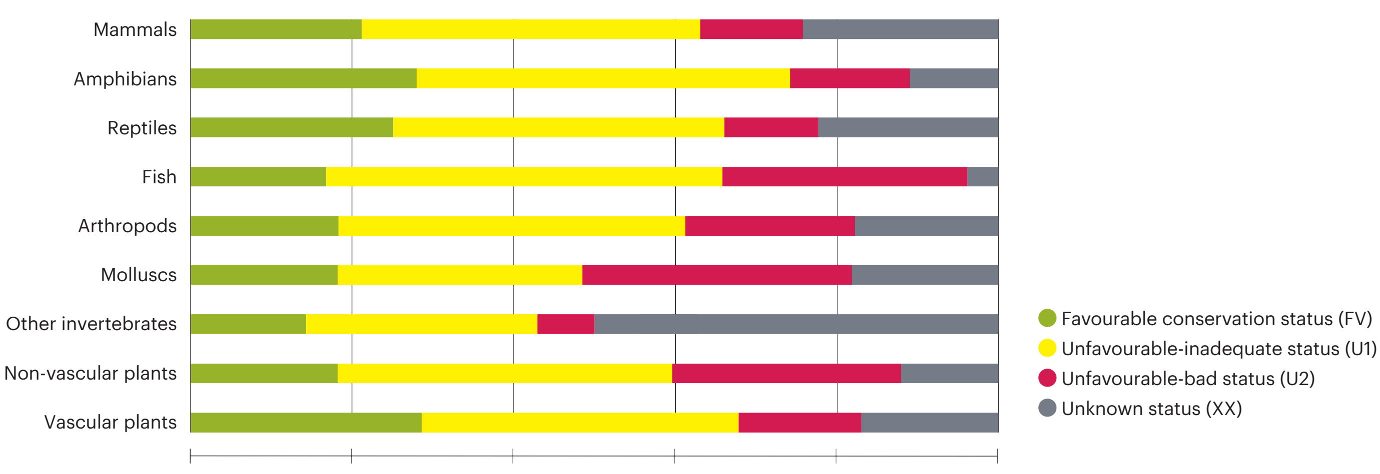
Share of Sites of Community Importance and Special Protection Areas on the area of the EU28 countries [%], 2018



Data source: European Environment Agency

Chart 3

State of animal and plant species of Community importance in EU25 by taxonomic groups [%], 2007–2012

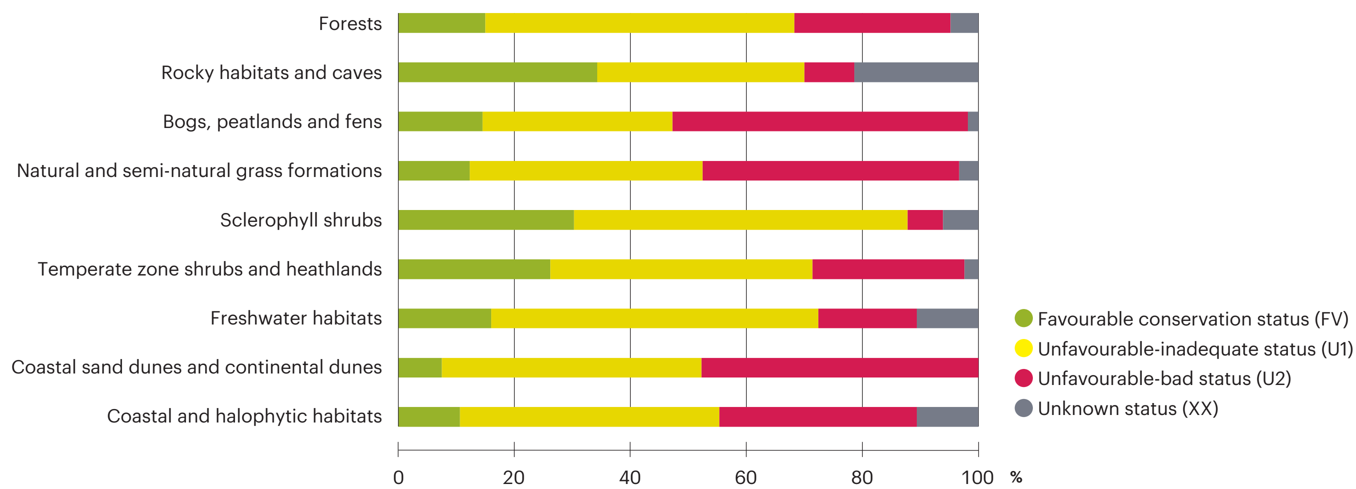


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Topic Centre on Biological Diversity

Chart 4

State of natural habitats of Community importance in EU25 by taxonomic groups [%], 2007–2012

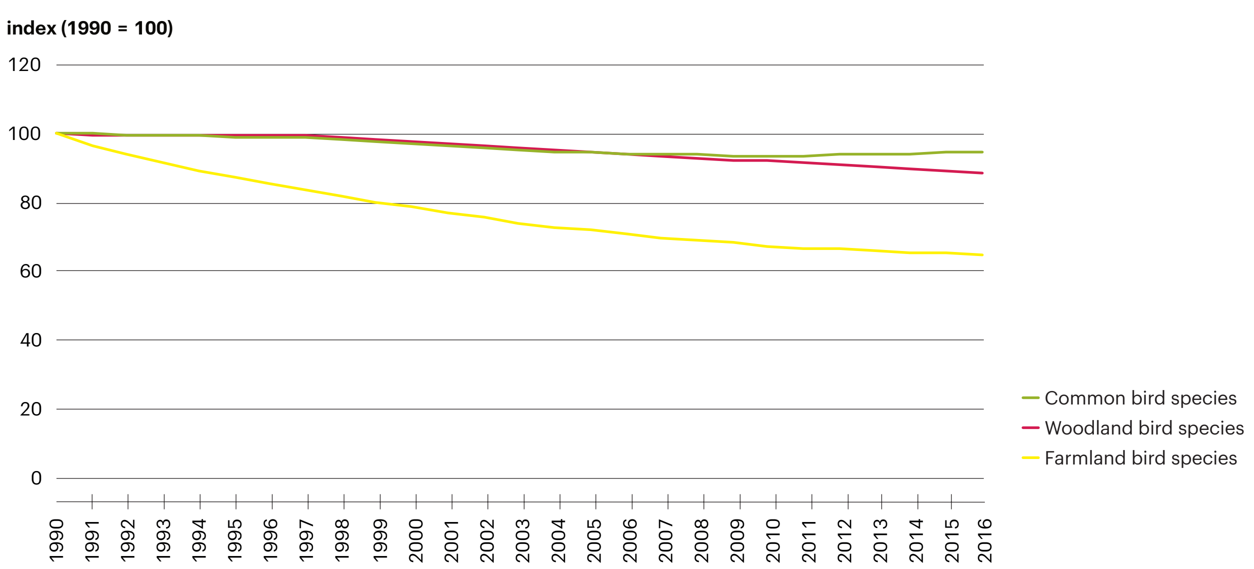


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Topic Centre on Biological Diversity

Chart 5

Indicators of common bird species, woodland bird species and farmland bird species in the Czech Republic [index, 1990 = 100], 1990–2016

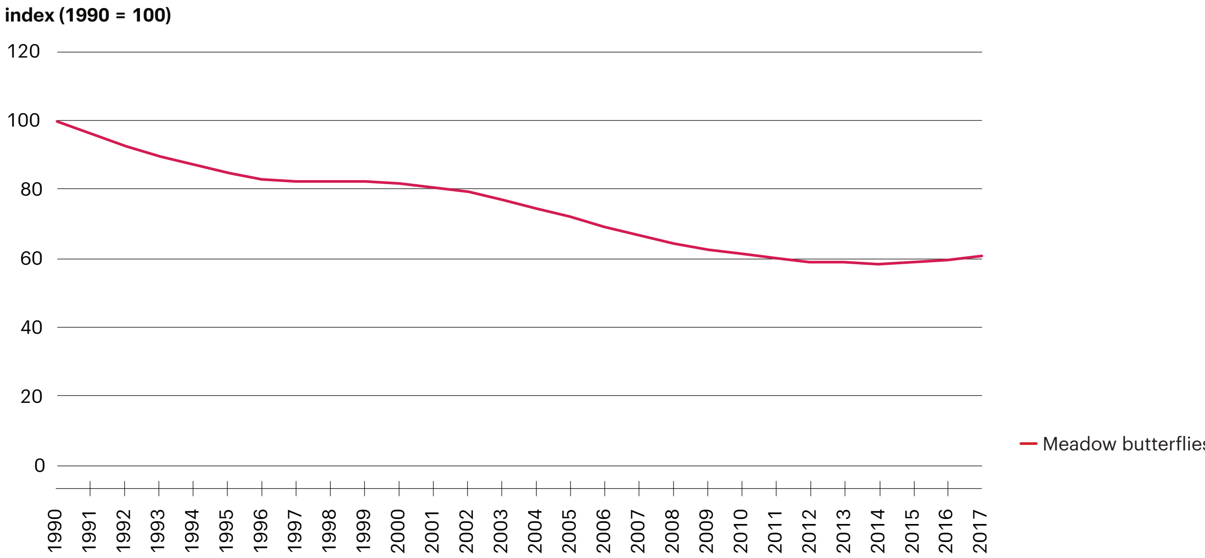


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Chart 6

Indicator of grassland butterflies (17 species) in Europe [index, 1990 = 100], 1990–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

The state of European landscape is mainly the result of human **land use**, e.g. for agriculture or development. In 2016[19], agricultural land occupied a total of 38.6% of the whole EU28 territory. The share of agricultural land on the total territory of individual countries varies considerably, which is caused by a wide range of natural and socio-economic conditions within the European region. The highest shares of agricultural land are in the Ireland (69.5%) and United Kingdom (67,0%, Chart 1), where most of the agricultural land is covered by permanent grassland. On the contrary, Finland and Sweden have a very small share of agricultural land on total area (6.5%, respectively 6.7%), with respect to the fact that most of the territory of the country is covered by forests. The share of agricultural land on total territory in the Czech Republic is slightly above average compared to EU28 (43.8% in 2016). Most of the agricultural land in the Czech Republic is occupied by arable land (71.6%) which is intensively cultivated causing heavier environmental pressure than farming on permanent grassland. As in the Czech Republic, agricultural land is decreasing in other EU28 countries, especially at the expense of built-up areas.

Human land use almost always results in the division of large landscape areas into smaller areas, fragments that disrupt ecosystem bonds and limit the dispersion and migration capabilities of organisms. **Landscape fragmentation** in Europe is mainly influenced by transport infrastructure, the degree of urbanization and by agriculture. Given the above factors, Luxembourg, Belgium and the Netherlands belong among the most fragmented countries, followed by the Czech Republic with a slightly lower share (Figure 1). On the other hand, Norway, Sweden and Romania are countries with the lowest fragmentation level in Europe (Figure 1).

The total area of the **Natura 2000** territorial system in May 2018 amounted to 1,322.6 thous. km^2 (18.2% of the EU28), of which 12.2% are marine areas and 18.2% are land areas. The share of the mainland part of the Natura 2000 territorial system in the EU has not increased significantly in the long term (it increased from 17.9% to 18.2% of the total EU area from 2011 till May 2018), mainly due to the fact that the mainland part of the Natura 2000 network is almost complete. The total proportion of marine habitats included in the Natura 2000 network increased from 5.1% to 12.2% over the same period.

The countries with the highest proportion of land areas included in the Natura 2000 network include Slovenia (37.8%), Croatia (36.6%) and Bulgaria (34.5%). The Czech Republic ranks at the 17th place with 14.1% share. Countries with the lowest share of

[19] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Natura 2000 areas are United Kingdom (8.6%) and Denmark (8.4%).

Only 23.1% of all **animal and plant species** of Community importance in the EU25 were evaluated to be in a favourable conservation status in 2007–2012. In the same period 18.2% was evaluated to be in unfavourable-inadequate and 41.7% in unfavourable-bad status. The most endangered groups were arthropods, molluscs, fish and non-vascular plants. In the Czech Republic, 25.3% of animal and plant species of Community importance were evaluated in this period to be in favourable conservation status, and this percentage increased to 28.6% during the last evaluated period 2013–2018. At the same time, the number of species evaluated to be in unfavourable-bad status decreased from 31.5% to 26.8%. Of the **habitats of Community importance**, 16.4% were evaluated to be in favourable conservation status within EU25 in the last evaluation period 2007–2012. 46.8% of habitats were evaluated to be in unfavourable-inadequate status and 30.1% in unfavourable-bad status. According to the results, coastal sand and continental dunes were the most endangered, with only 7.5% in favourable conversation status. Coastal and halophytic habitats were only slightly better (see Chart 4). In the Czech Republic, forests, coastal and halophytic habitats (both types with 0.0% in favourable conversation status) and freshwater habitats (only 7.1% were evaluated to be in favourable conversation status) were found in an unfavourable state. The new evaluation for the period 2013–2018 in the Czech Republic shows a slight improvement in the overall state of habitats, but the negative state of forests, coastal and halophyte habitats persists, and the state of freshwater habitats deteriorated (newly 0.0% in favourable conservation status). On the other hand, there was a significant improvement in the state of rock habitats and caves (from 30.8% to 76.9% in favourable conservation status).

Between 1990 and 2016, the number of populations of **common bird species** decreased by 11.2% and **woodland bird species** by 5.3% in the monitored Europe territory (EU, Norway, Switzerland), Chart 5. The trend in European woodland bird species is like one in the Czech Republic. Very similar downward trends were observed between 1990 and 2016 in both Europe and in the Czech Republic in **farmland bird** species populations. In the case of Europe, the numbers went down by 34.9%. This negative trend continues.

As in the case of farmland birds, there has been a dramatic decrease in the **population of meadow butterflies** observed in the territory of 15 European countries within Europe. The number of butterflies dropped by 39.3% between 1990 and 2017 (Chart 6). Between 2014 and 2017, the trend reversed slightly (an increase by 2.1%). As in the case of the Czech Republic, this decrease is related to a large decline in biodiversity of grassland, which was given by extensive intensification of agricultural production and the overall unification of the landscape and methods of its management.


5
Forests

Forests

The importance of forest stands lies not only in their ability to fulfil their production function, but also several important non-production functions. These include enhancing biodiversity, regulating water regime of the landscape, protecting against soil erosion, improving air quality, sanitary and recreational and aesthetic functions. To fulfil all these functions, it is essential for the forest to be in a good ecological state. Therefore, it is necessary to ensure good health of the forest not only in order to maintain their value, but also in the interest of human society which is influenced by forest ecosystems. In the past, the non-production functions of forests were completely neglected and there were interventions that negatively affect the state of forests to this day. The even-aged monocultures, as a result from the planting of homogeneous (mainly spruce and pine) stands, have poor long-term resilience to abiotic and biotic factors, are often in poor ecological state and therefore are not able to perform all their functions. At present, the state of forests is negatively affected mainly by the manifestations of climate change, the spread of pests and unbearable populations of cloven-hoofed game. At the same time, however, measures to improve the ecological stability of forests are being implemented to a small extent.

The ability of the forest to perform its non-production functions can be primarily strengthened by applying near-nature methods of forest management (selection cutting, planting of ameliorating and reinforcing trees, increasing the species, age and spatial diversity of forest stands, etc.). The result of responsible forest management is in particular the strengthened ecological stability, which is important, for example, in reducing the impact of extreme weather events and climate change.

References to current conceptual, strategic and legislative documents

EU Forest Strategy for the period 2013–2020
- promoting the balance of various forest functions, meeting the demand and delivering essential ecosystem services
- promoting forestry and the entire forestry-based value chain as a competitive and viable contributor to the bioeconomy

Council Directive 1999/105/EC of 22 December 1999 on the marketing of forest reproductive material
- ensuring high quality of reproductive material of forestry species and artificial hybrids of forest tree species that must, from a genetic point of view, correspond to the different habitat conditions
- maintaining and enhancing the biodiversity of forests, including genetic diversity of trees, is essential for sustainable forest management

7. EU Environment Action Programme
- implementing the renewed Union Forestry Strategy that addresses the multiple demands on, and benefits of, forests and contributes to a more strategic approach to protecting and enhancing forests, including through sustainable forest management

Strategy of the Ministry of Agriculture of the Czech Republic with a 2030 perspective
- increasing the competitiveness and sustainability of Czech forestry

Concept of Research, Development and Innovation of the Ministry of Agriculture for the years 2016–2022
- increasing the efficiency of the use of public funds invested in research and thus contributing to the development of Czech forestry in the context of European and world trends regarding climate change

Applied Research Programme of the Ministry of Agriculture for years 2017–2025, EARTH
- supporting applied forestry research projects applicable to new products, technologies and production processes

State forest policy principles
- preserving forests and forest land for future generations
- increasing biodiversity in forest ecosystems, their integrity and ecological stability
- increasing the species diversity of forest stands towards a natural species composition

• increasing the structural diversity of forests and the share of natural regeneration of genetically suitable stands
• enhancing the non-production functions of forest ecosystems

National Forest Programme for the period until 2013[1]
• improving the health and protection of forests by reducing clear-cuts, supporting and introducing near-natural management methods, promoting natural regeneration and more nature-like tree species composition
• developing of forest monitoring

National programme on protection and reproduction of the gene pool of forest tree species
• preserving and reproducing a high-quality forest gene pool as part of national wealth

Strategic Framework Czech Republic 2030
• conceiving the landscape of the Czech Republic as a complex ecosystem and ecosystem services provide a suitable framework for the development of human society
• adapting the landscape to climate change and its structure helps to retain water

State Environmental Policy of the Czech Republic 2012–2020
• promoting sustainable and environmentally friendly forestry practices
• taking measures to adaptation to the negative impacts of climate change in forestry
• improving the species and spatial composition of forests – supporting an increase in the share of ameliorating and reinforcing trees in forest regeneration and forestation
• updating the National Forest Programme after 2013
• maintaining the current share of forests owned by the State, with preference for more natural forms of forestry, while respecting competitiveness

Strategy on Adaptation to Climate Change in the Czech Republic
• utilization of natural processes and cultivation of spatially varied and species-rich forest stands
• changing the preference of species and ecotypes of forest tree species

National Action Plan for adaptation to climate change
• supporting the natural adaptation capacity of forests and strengthening their resilience to climate change
• protecting and restoring the natural water regime in forests

National Biodiversity Strategy of the Czech Republic
• specifying the current problems of forest ecosystem restoration in areas that have been exposed to increased air pollution especially in the past
• drawing up a concept of further steps to mitigate the impacts of adverse processes on forest biodiversity

State Nature Conservation and Landscape Protection Programme of the Czech Republic
• increasing the species diversity of forest stands towards natural species composition
• increasing the structural heterogeneity of forests and the share of natural regeneration and genetically suitable stands
• strengthening the non-productive functions of forest ecosystems

ICP Forests Programme
• assessing and monitoring the impact of air pollution on forests

Operational Programme Environment 2014–2020
• improving the species, age and spatial structure of forests

[1] *This programme is valid until its update.*

18 | Defoliation of forest stands

Key question

Is the health condition of forest stands in the Czech Republic improving?

Key messages

The unsatisfactory and worsening health condition of forest stands in the Czech Republic is currently caused mainly by long-lasting drought and subsequent spread of insect pests, but also by historical exposure of forest ecosystems to air pollution. Unsuitable species composition of forest stands and the compartment felling method create a prerequisite for high defoliation. In the context of drought, the pressure of climate change is also increasing.

Damage to forest stands in the Czech Republic expressed as a percentage of defoliation[2] remains high. In the category of older stands (60 years and over), the sum of defoliation classes 2–4 in conifers was 76.6% and in deciduous trees 42.8%. In younger stands (up to 59 years), the situation is more favourable, in the case of conifers, classes 2–4 covered 29.4% of stands and for the deciduous trees 34.0%. After the improvement in the second half of the 1990s, a deterioration can be observed after 2000 in all categories.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

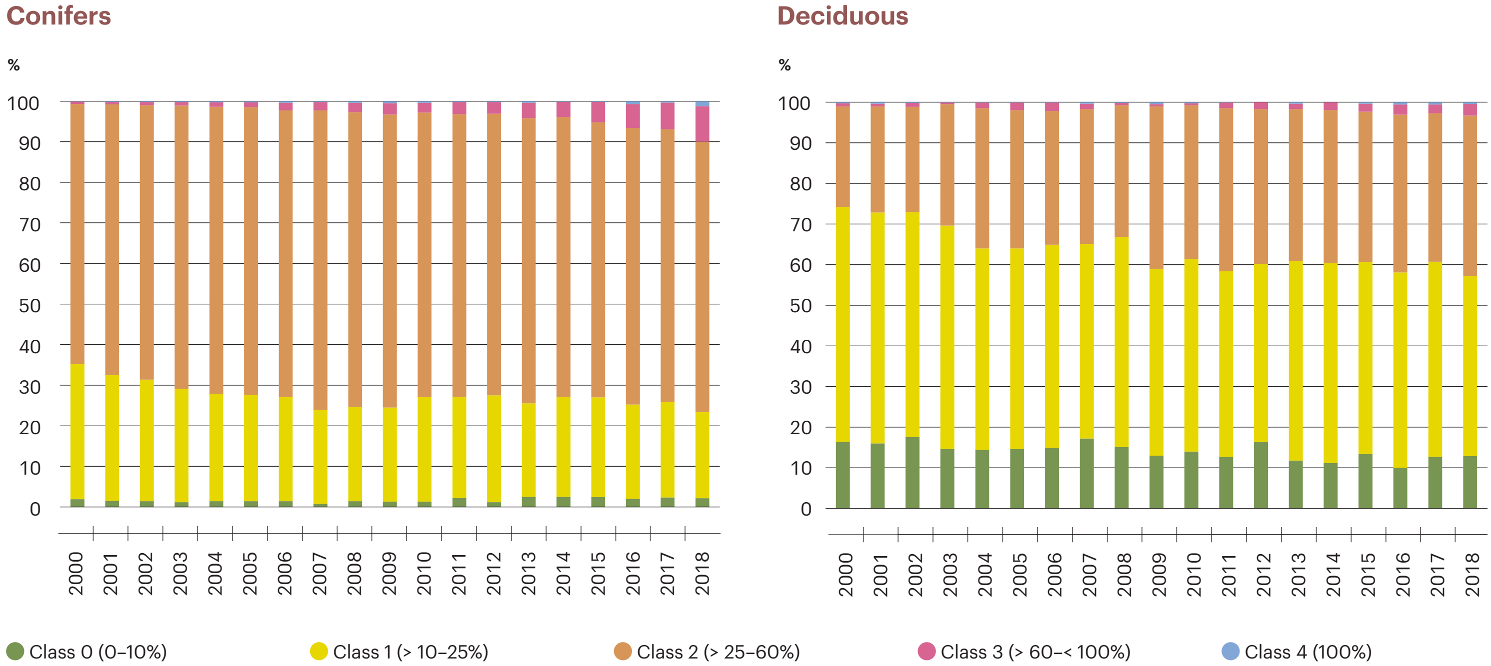
Last year-on-year change

[2] *Defoliation values are divided into five basic classes, the last three of which the last three characterize significantly damaged trees: 0 – none (0–10%); 1 – moderate (> 10–25%); 2 – medium (> 25–60%); 3 – strong (> 60–< 100%); 4 – dead trees (100%).*

Indicator assessment

Chart 1

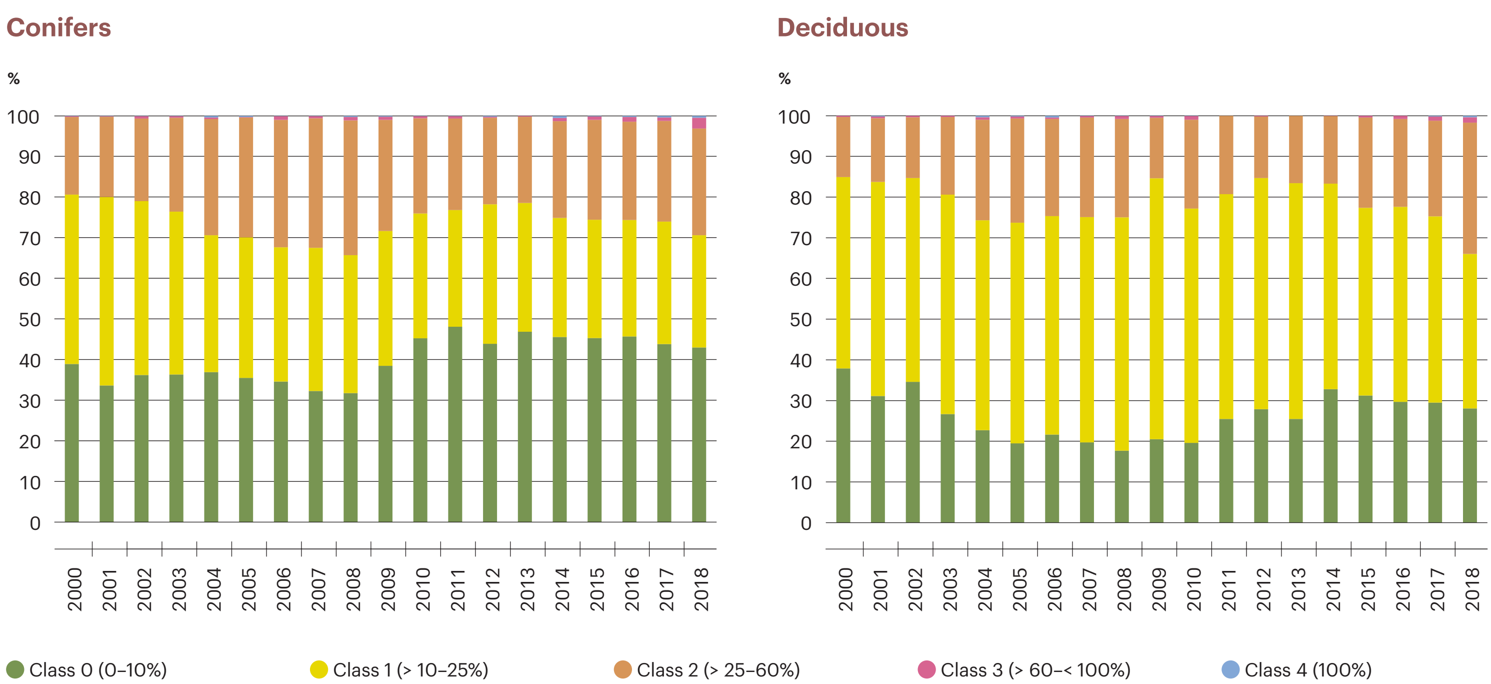
Defoliation of older conifers and deciduous trees (60 years of age and older) in the Czech Republic by classes [%], 2000–2018



Data source: Forestry and Game Management Research Institute, public research institution

Chart 2

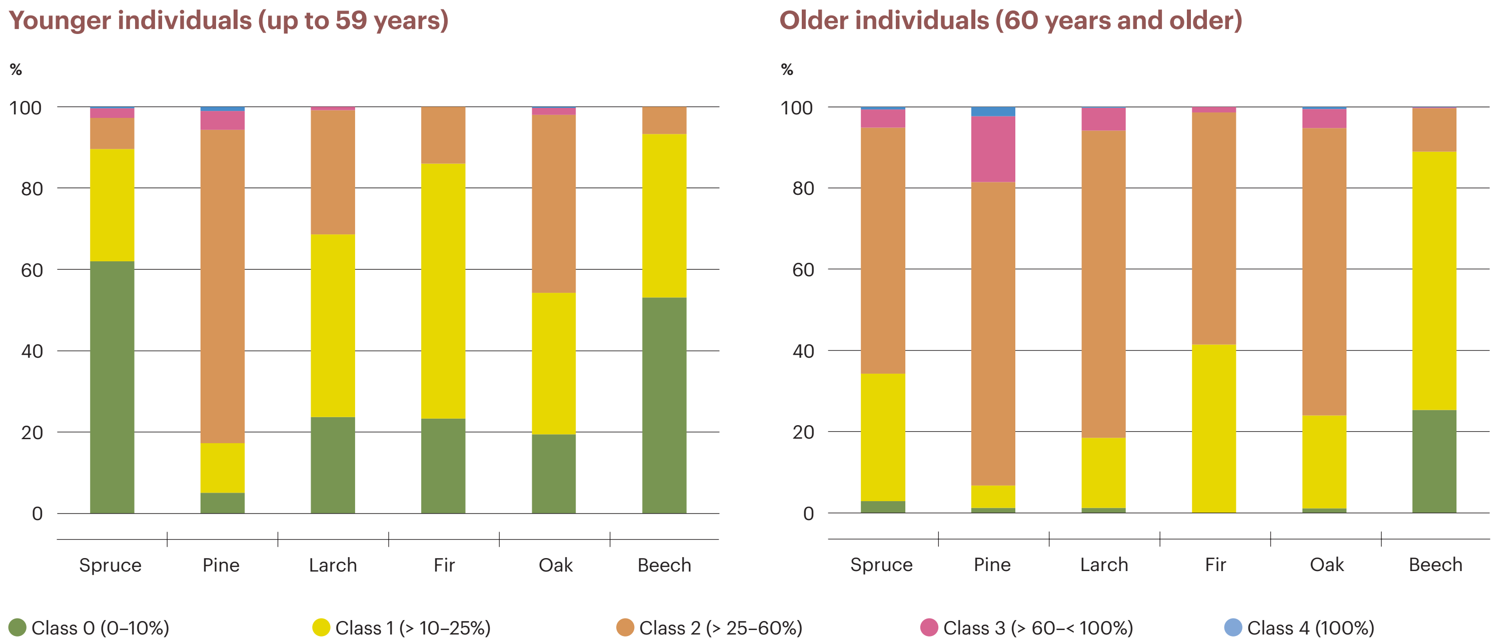
Defoliation of younger conifers and deciduous trees (up to 59 years of age) in the Czech Republic by classes [%], 2000–2018



Data source: Forestry and Game Management Research Institute, public research institution

Chart 3

Defoliation of basic tree species in the Czech Republic by classes [%], 2018



Data source: Forestry and Game Management Research Institute, public research institution

The **percentage of defoliation**, which is defined as a relative loss of the assimilation apparatus in the tree crown compared to an undamaged tree growing under the same stand and habitat conditions, can be used to express the health condition of forest stands. Defoliation is influenced by many biotic (insects, fungi) and abiotic (drought, frost, wind) factors, in terms of human activity it is primarily caused by the exposure of forest ecosystems to immissions of sulphur (SO_2) and nitrogen (NO_x). The effects of anthropogenic immissions are divided into primary, caused by direct damage to the surface of assimilation organs, and secondary, caused by leaching of alkaline nutrients due to soil acidification. In addition to habitat conditions and the amount of acid deposition, the acidification and overall nutrient balance of forest ecosystems is also influenced by the method of forest management, including tree species composition and logging intensity.

Assessment of the health of coniferous and deciduous stands using the defoliation level is divided according to age into two categories – older (60 and more years) and younger (up to 59 years). The defoliation values are divided into five basic classes (0–4), of which classes 2–4 characterise significantly damaged trees.

In the case of **older stands**, a significant increase in defoliation in response to air pollution was observed during the 1970s and 1980s. The subsequent stabilization was attributed to the reaction of forest stands to the reduced immission load. However, since the beginning of the 21st century, the condition of both coniferous and deciduous trees has deteriorated again (Chart 1). For conifers, class 2–4 defoliation increased from 64.8% in 2000 to 76.6% in 2018 (74.1% in 2017). The largest increase (by 8.2 p.p.) since 2000 was in the category of 60–100% damage (class 3) and the proportion of already dead trees in class 4 increased (from 0.1% to 1.2%). In the case of deciduous trees, the trend of an increasing share of classes 2–4 also prevails. In 2000, a total of 25.8% of the stands belonged to these classes and between 2017 and 2018 this share increased from 39.3% to 42.8%. Coniferous stands are more vulnerable to acidification due to the slow decomposition of their litterfall, which is associated with the production of low molecular weight organic acids, and due to higher concentrations of immissions in throughfall precipitation due to dry deposition on needles.

In the **assessment of individual wood species** aged 60 years and over, the value of defoliation in the sum of classes 2 to 4 is the highest for pine from among conifers – in 2018 it was 93.3%, for larch (81.5%) and spruce (65.8%). Among deciduous trees, a significant degree of defoliation in classes 2–4 is shown for oak – on 76.0% of the evaluated trees in 2018 (Chart 3).

In **younger stands (up to 59 years)**, the level of defoliation is lower (Chart 2) because younger forests have better vitality and ability to withstand adverse environmental conditions. A significant reason is also the lower immission load in the past. After

2000, however, the progress of defoliation of the younger stands can be characterised by an increasing proportion of trees in class 2 to 4 at the expense of classes 0 and 1 (conifers in the period 2000–2008 from 19.4% to 34.3%, deciduous trees from 15.1% to 25.0%). The change in trend can be observed after 2008, when in both categories of tree species, the proportion of class 2 to 4 decreases. Between 2013 and 2018, however, a re-increase from 21.5% to 29.4% for conifers and from 16.6% to 34.0% for deciduous trees is observed.

In the **evaluation of individual tree species** up to 59 years, in the case of conifers, the least favourable situation is repeatedly for pine, which is sensitive to drought, temperature extremes and sudden weather changes. In 2018, in the sum of classes 2–4, the total defoliation was 82.7%. A more favourable situation, compared to older stands, is observed in the case of spruce (only 10.4% in classes 2 to 4). In the deciduous stands of the younger age category, the higher degree of defoliation applies mainly to oak, with 45.8% (Chart 3).

The **poor health of forest stands** is a consequence of the intensive immission load on forest ecosystems in recent decades, when older stands were significantly influenced by deteriorated air quality since their early growth stage. Since 1989, the immission situation has improved significantly thanks to the installation of devices, the change of the fuel base and the application of emission limits on air pollution sources. Forest stands, however, respond to changes with a considerable delay, moreover, the immission load continues, even though its intensity is demonstrably lower. At present, the health condition of forest stands is negatively influenced by the spruce bark beetle gradation and by individual manifestations of climate change such as drought, strong wind and subsequent prolonged vegetation period. In addition, many of the forest stands are characterized by an unsuitable species composition, with the prevailing use of compartment felling, which do not create the prerequisites for improving forest health. Therefore, the state of forest health remains unsatisfactory.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

19 | Logging

Key question

Is the volume of harvested wood stable?

Key messages

In 2018, the volume of salvage logging reached the highest level in history and was almost double that of the previous year. Most of the salvage logging was insect logging, which has risen sharply since 2014 (11.5 times higher in 2018 than in 2014), and in 2018 it was higher than the total volume of insect logging over the past decade.

Despite the high volume of logging, the total standing stock of wood has been increasing in the long term. That development is due to the increasing normal increment, the growing share of older stands and the modest growth in stocking level in the stands. However, the standing stock is expected to decrease in the coming years, after the present coniferous logging will be reflected in it's calculation.

Overall assessment of the trend

Change since 1990

Change since 2000

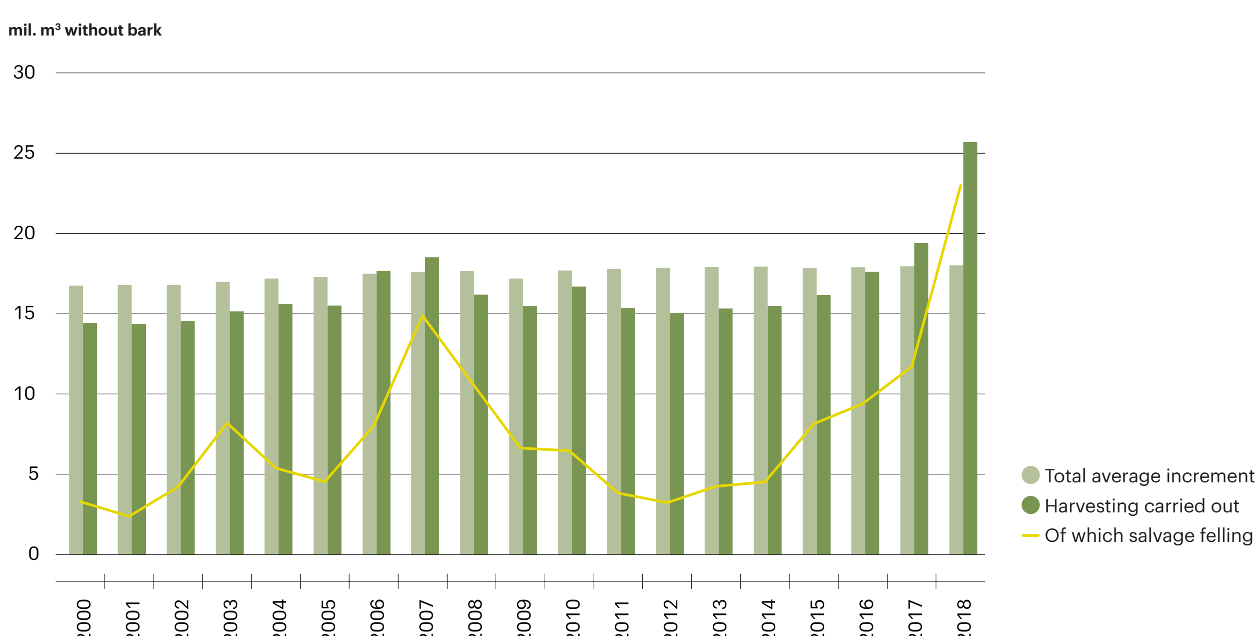
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

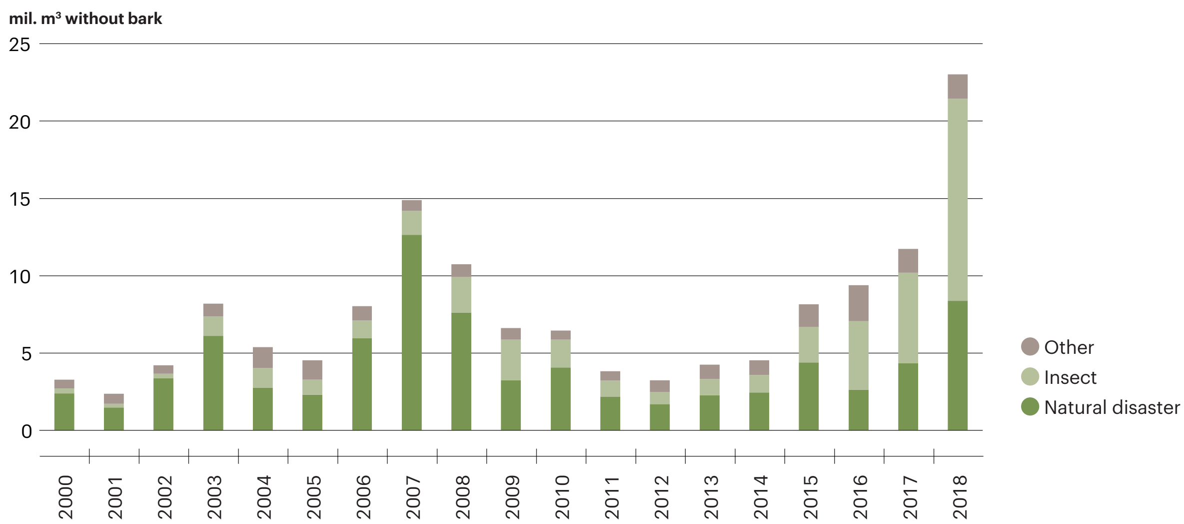
Comparison of wood felling and total average increment in the Czech Republic [mil. m³ without bark], 2000–2018



Data source: Czech Statistical Office

Chart 2

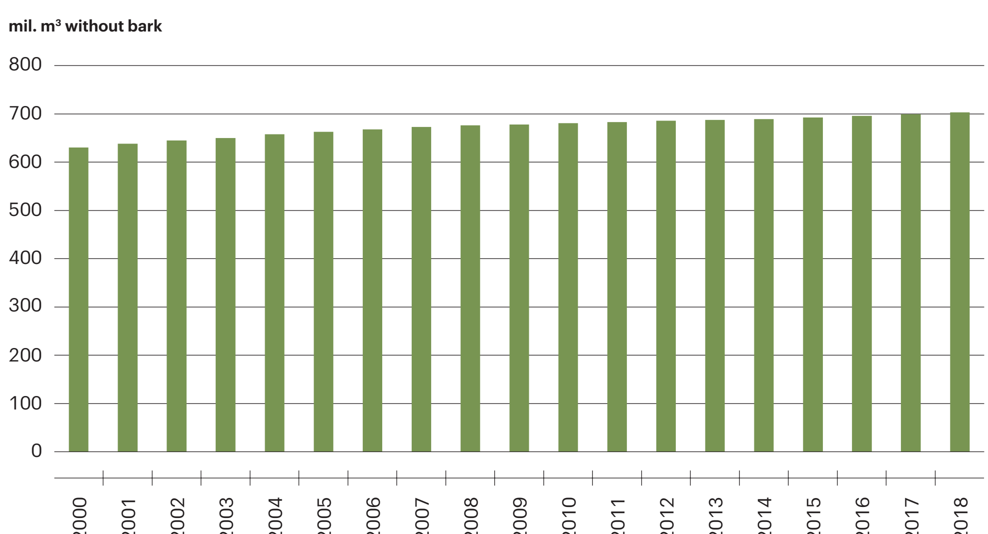
Salvage logging by cause in the Czech Republic [mil. m^3 without bark], 2000–2018



Data source: Czech Statistical Office

Chart 3

Standing tree volumes development in the Czech Republic [mil. m^3 without bark], 2000–2018



Data source: Forest Management Institute

The **volume of felling** has been growing significantly since 2015 and reached the highest value ever recorded in 2018, namely 25.7 mil. m^3 (Chart 1). The share of salvage (calamity) logging on total felling in 2018 was 89.6%, a significant increase against the previous period since 2000, when it ranged between 20–30%, except for 2007 due to the consequences of the Kyrill hurricane (in 2007, salvage logging accounted for 80.4% of total felling). The main causes of that change include the impact of drought, especially on trees planted outside their ecologically optimal sites (dominantly Norway spruce in the lower vegetation zones) and subsequent infestation by insect pests.

The total volume of felling in 2017 and subsequently in 2018 significantly exceeded the **total average increment**, which has been steadily ranging between 17–18 mil. m^3 without bark since 2003 (18.0 mil. m^3 without bark in 2018, Chart 1). The total average increment, which expresses the production capacity of forest habitats, is a crucial indicator in assessing the principle of equilibrium and sustainability of felling. Since 2000, except for the last two years, the total felling has exceeded the total average increment only twice, in 2006 and 2007, mainly as a result of processing the wood damaged by the Kyrill hurricane and the subsequent bark beetle calamity.

In 2018, the **volume of salvage logging**, which amounted to 23 mil. m^3 without bark, was the highest in history and roughly doubled compared to previous years (11.7 mil. m^3 without bark in 2017 and 9.4 mil. m^3 without bark in 2016, Chart 2). Most of the salvage logging was insect logging (13 mil. m^3 without bark). Insect logging has been rising since 2015 and in 2018 it was higher than the total volume of insect logging over the past decade. This increase is mainly due to logging after bark beetle calamities caused by climatic conditions and the concurrent low ecological stability of forest stands, which are largely made up of spruce monocultures. Drought and prolonged vegetation season improve conditions for bark beetle spread and at the same time reduces the ability of spruce stands to resist this pest. Moreover, an attack by insects as well as fungal diseases is a greater threat for stands damaged by abiotic agents such as wind. In 2018, natural disaster logging also increased compared to previous years, amounting to 8.4 mil. m^3 of bark-free wood (4.3 mil. m^3 without bark in 2017).

The **total standing stock of wood** has been increasing for a long time (Chart 3). In 2018, the total standing stock amounted to 702.9 mil. m^3. In addition to the increasing normal increment, that development is due to the growing share of older stands and the slight growth in stocking level in the stands. However, in the coming years, the standing stock is expected to decrease as its calculated level will reflect unprecedented logging of coniferous stands in the present.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

20 | Species composition and age structure of forests

Key question

Is the unsatisfactory species composition and age structure of forests in the Czech Republic changing?

Key messages

The proportion of deciduous trees in the total forest area of the Czech Republic gradually increases, in 2018 it accounted for 27.3% of the total forest area. In the long term, a trend of approximating a more natural (and stable) structure of forest stands can be observed. However, this process is very slow and requires many years of intense effort.

In the Czech Republic, the age structure of forests is not evenly distributed. In the long term, the area of old forest stands (over 120 years) increases. This phenomenon is positive in the context of biodiversity conservation.

Overall assessment of the trend

Change since 1990

Change since 2000

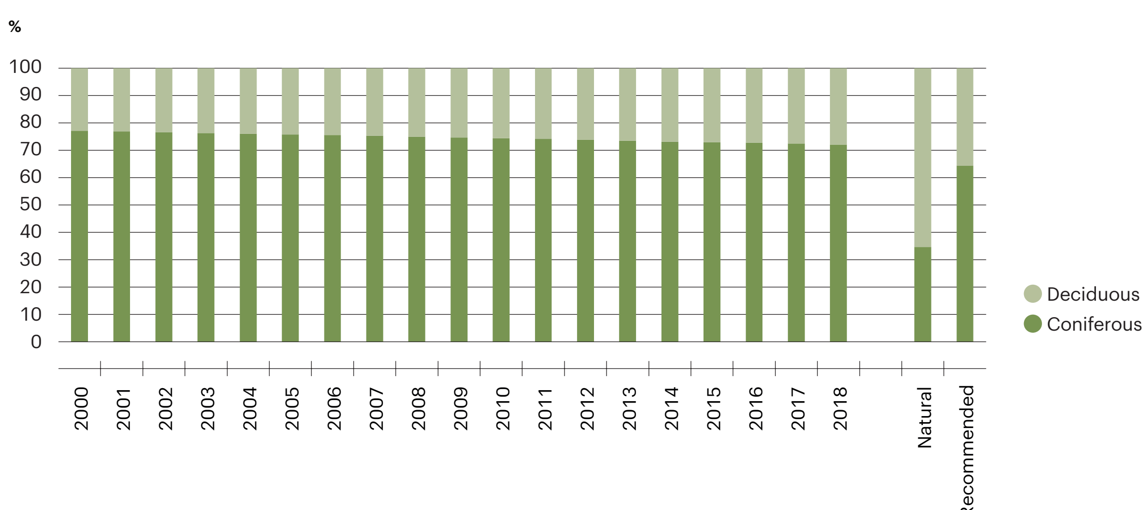
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Development of the proportions of coniferous and deciduous stands in total forest area of the Czech Republic, reconstructed natural and recommended species composition [%], 2000–2018

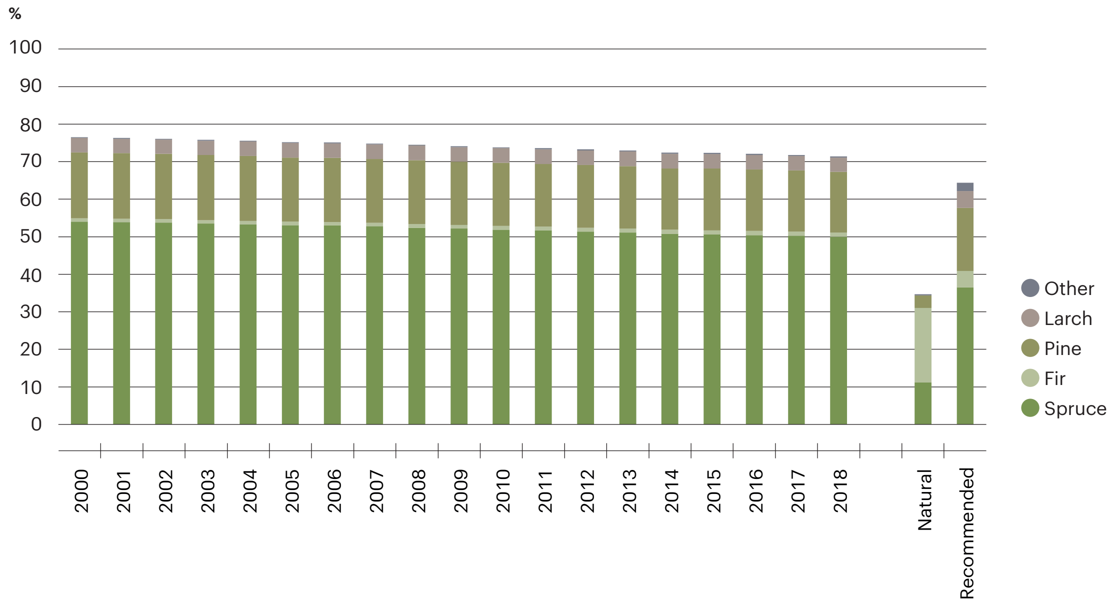


Reconstructed natural species composition is close to the climax composition at the time before forests were influenced by humans. Recommended forest composition is a universally optimized compromise between natural composition and composition ensuring maximum production, considering current climate conditions.

Data source: Forest Management Institute

Chart 2

Development of species composition of coniferous stands in the Czech Republic, reconstructed natural and recommended species composition [%], 2000–2018

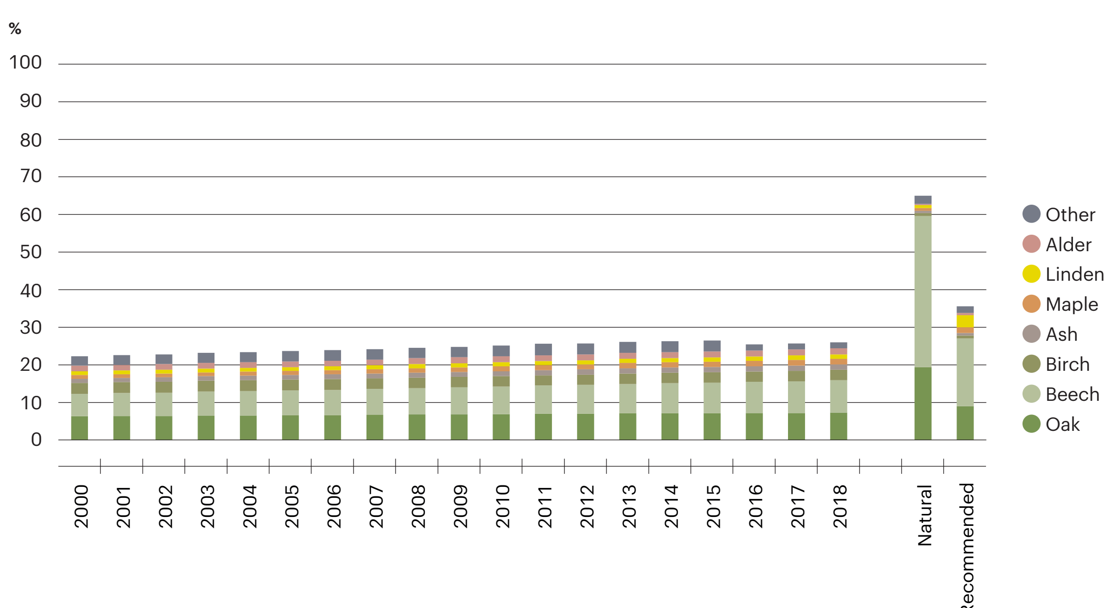


Larch occurs naturally only on a very limited area in the Czech Republic, east of the Hrubý Jeseník range, therefore, it is not included in natural forest composition. It naturally occurs in mountain ranges of Central Europe – Alps and Carpathian Mountains and their foothills.

Data source: Forest Management Institute

Chart 3

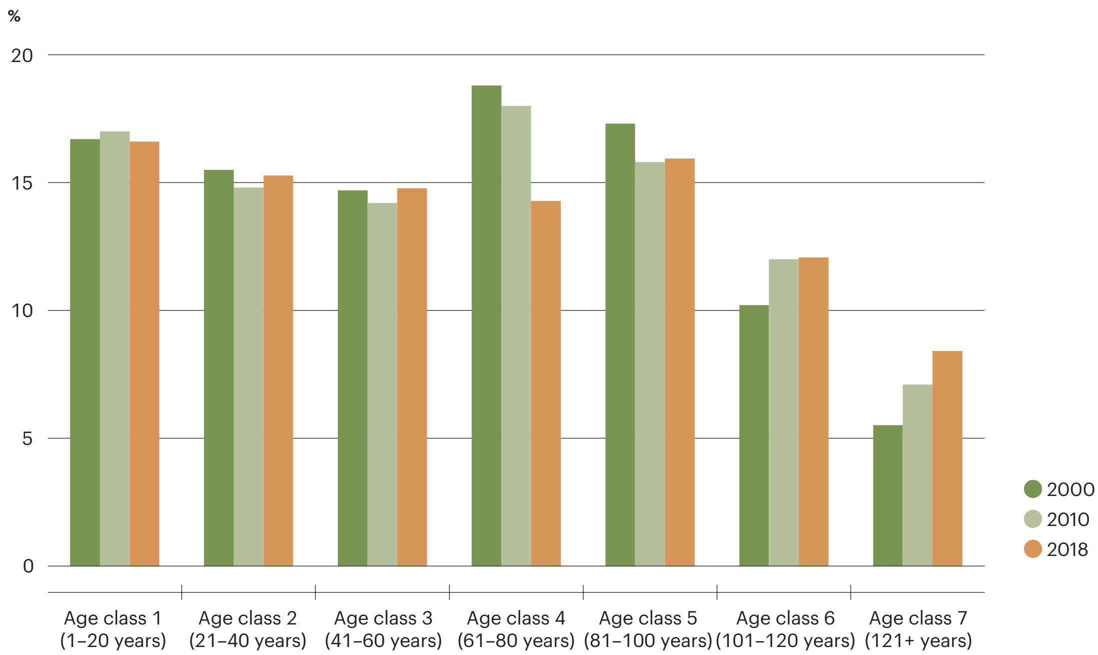
Development of species composition of deciduous stands in the Czech Republic, reconstructed natural and recommended species composition [%], 2000–2018



Data source: Forest Management Institute

Chart 4

Age structure of forest stands in the Czech Republic [%], 2000, 2010, 2018



Data source: Forest Management Institute

Current tree species composition of forests in the Czech Republic significantly differs from the reconstructed natural and recommended composition (Charts 1–3), due to across-the-board planting of spruce and pine monocultures in the past. These even-aged monocultures of conifers, often of unsuitable ecotype, decrease biodiversity and are much more susceptible to damage resulting from biotic and abiotic factors. At the same time, **natural species composition of forests** considering natural conditions of the habitat is the basis for overall stability of the forest. According to natural composition, in lower altitudes there should be oak and hornbeam forests, which would gradually, with growing altitude, transform into beech and fir, and in the highest altitudes to spruce forests.

Recommended composition is then a compromise between natural tree species compositions and economic interests, the non-productive functions of forests, and recently also the knowledge related to climate change adaptation. Recommended composition would mean the reduction in the **proportion of coniferous trees** (Chart 1) from current 71.5% to 64.4% (in the case of spruce from 50.0% to 36.5%). At the same time, it would mean an increase in the proportion of fir from current 1.1% to 4.4% (Chart 2) and a significant increase in the **proportion of deciduous trees**, especially of beech (from current 8.6% to 18.0%), oak and linden (Chart 3).

In the last decades, the species composition has been changing towards a more natural (and stable) structure of forest stands thanks to more frequent planting of deciduous tree species at the expense of conifers (Chart 1). The overall proportion of deciduous stands in the total area of forests increased from 22.3% in 2000 to 27.3% in 2018 (Chart 1). On the other hand, the proportion of coniferous stands in the total forest area of the Czech Republic decreased from 76.5% in 2000 to 71.5% in 2018.

Spruce has been the most represented tree species in the Czech Republic for a long time (Chart 2). Its proportion in the forest composition has been decreasing steadily, between years 2000 and 2018 it decreased from 54.0% to 50.0% (Chart 2). An important part of natural forest ecosystem is fir, which contributes significantly to maintaining the stability of the forest. The proportion of fir, which is considered an ameliorating and reinforcing tree species, on the total area of forests is consistently around 1% (in 2018 it formed 1.1%), even though its share in forestation steadily rises (currently about 5%). The failure of the efforts to increase the proportion of fir in stands is mainly attributed to the extensive damage caused by cloven-hoofed game.

The **share of beech** in the composition of forests is purposefully increased (Chart 3). Between 2000 and 2008, however, its share has increased only slightly, from 6.0% to 8.6% of the total forest area. A slower increase was recorded also for oak, i.e. from 6.3% in 2000 to 7.3% in 2018.

The **age structure of forests in the Czech Republic** is not evenly distributed (Chart 4). The approximation of the actual age structure to so-called normal status[3] is very slow. An area of stands under age of 60 years is below normal, in the long term it should range around 18% in each age class 1 to 3, but that is currently not reached in any of the classes. In 2018, age class 1 covered 16.6%, class 2 covered 15.3%, and class 3 covered 14.8% of the forested land area. In 2000, age classes 4 (18.8%) and 5 (17.3%) were abundantly represented, as a result of extensive planting of forest monocultures at the end of the 19th and the first half of the 20th century. Current decline in representation especially of age class 4 (14.3% in 2018) correlates with the ongoing bark beetle calamity, which affected mainly the above-mentioned monocultural stands. On the other hand, since 1990, the proportion of areas of older to overaged stands of age classes 6 and 7 has been rising continuously. In 2018, age class 6 covered 12.1% and age class 7 covered 8.4% of the forest land area. This increase may have been caused by changes in the management of some protection forests and special purpose forests, and by postponing the renewal of economically unattractive, lower-quality or poorly accessible forests. This trend, which in economic terms poses a risk of losses, is, on the other hand, very positive in terms of biodiversity conservation. Forest stands of higher age in fact represent favourable environment for species bound to ecosystems with high proportion of dead wood.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[3] *As a normal spatial arrangement of age classes in a forest is considered one that meets requirements for forest cultivation, protection and felling.*

21 | Responsible forest management

Key question

Does forest management develop in accordance with the principles of sustainable development and nature-like forestry methods?

Key messages

Since 2015, the total area of certified forests has decreased to 67.7% of the forest area due to a decrease in PEFC-certified forests. FSC-certified forest area is slightly increasing, but it is only around 2% of the total forest area.

Thanks to the reduction in share of naturally and artificially regenerated coniferous trees in favour of deciduous trees, the tree species composition of forests has been gradually approaching the recommended composition since 2000. The growing trend of natural forest regeneration seen in the period 2007–2013 has stopped in 2014 and since then, natural regeneration area and its share on the total afforestation has been decreasing.

A long-term problem is nibbling of trees by cloven-hoofed game, which causes considerable damage, especially in regenerating stands.

Overall assessment of the trend

Change since 1990

Change since 2000

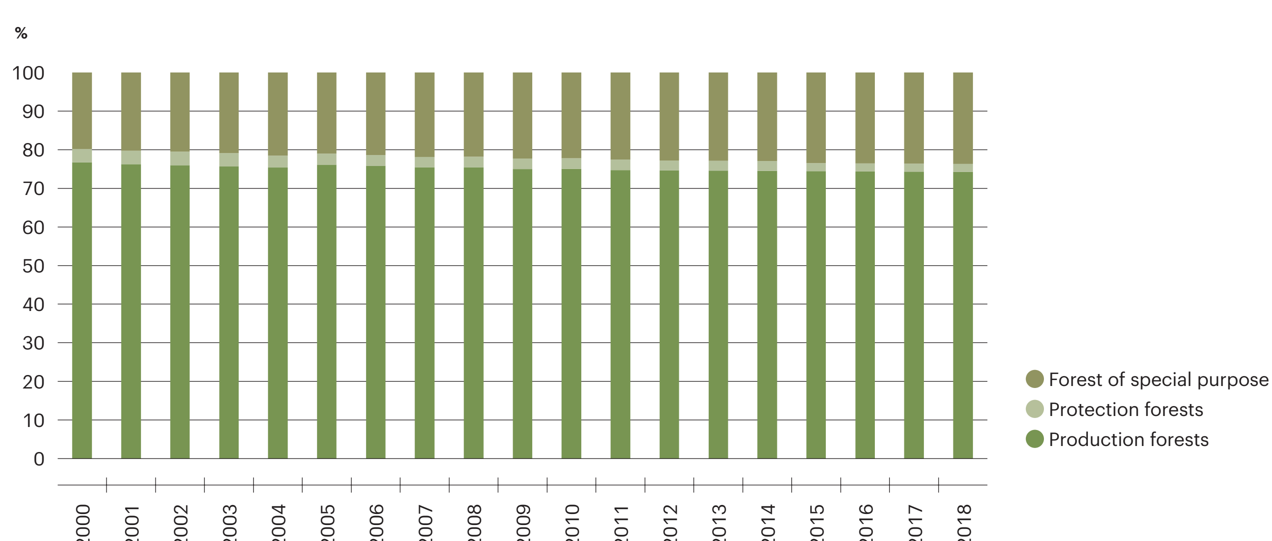
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

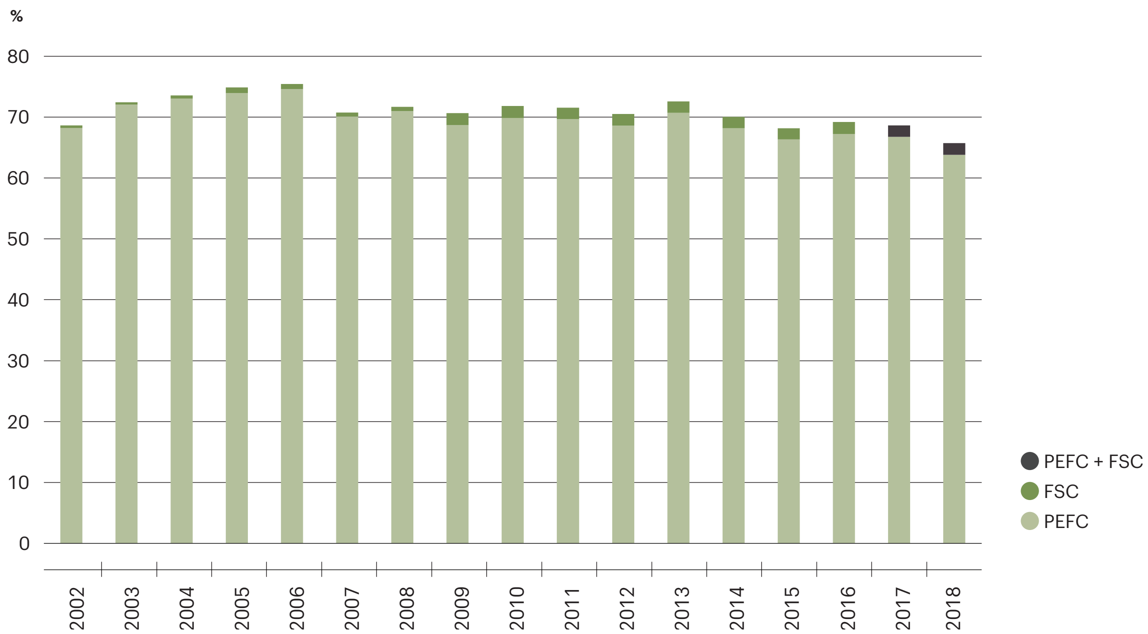
Proportions of forest categories in the Czech Republic's total forest area [%], 2000–2018



Data source: Forest Management Institute

Chart 2

Proportion of PEFC and FSC certified forests in the total forest area in Czech Republic [%], 2002–2018



Since 2017, the PEFC and FSC organisations have jointly carried out the identification of forest areas certified by both certificates (PEFC + FSC) at once.

Data source: FSC Czech Republic, PEFC Czech Republic

Chart 3

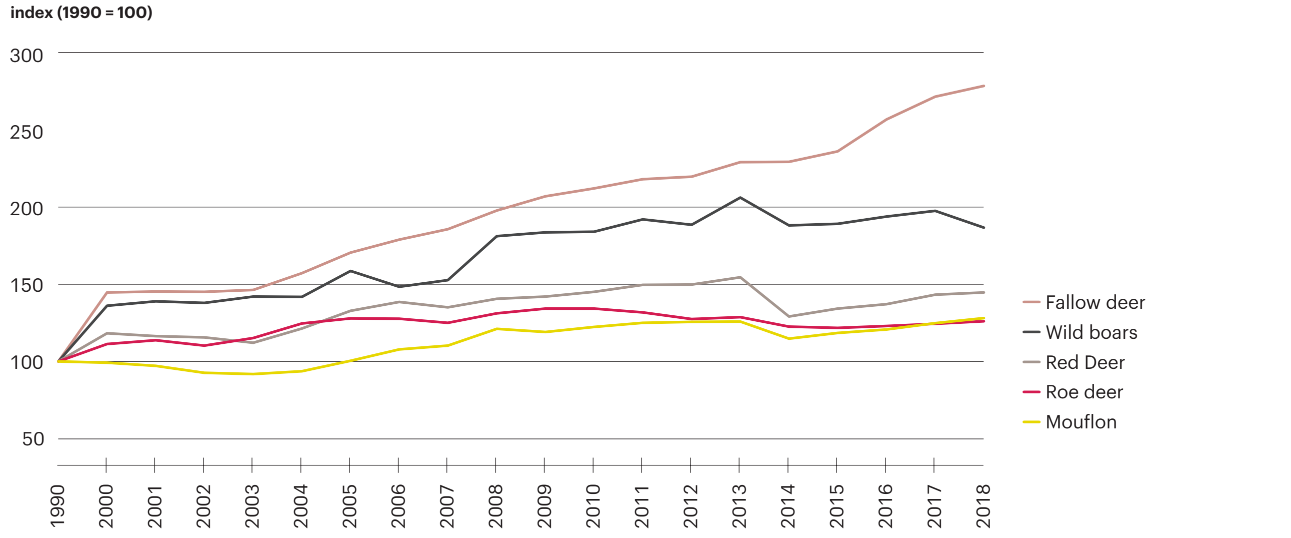
Forest regeneration in the Czech Republic [thous. ha], 2000–2018

Since 2002, due to changes in the methodology, the natural regeneration includes also regeneration under the trees (originally, only the renewal on bare areas was included).

Data source: Czech Statistical Office

Chart 4

Spring stocks of game (selected species) in the Czech Republic [index, 1990 = 100], 1990–2018



As of 31 March of a given year.

Data source: Czech Statistical Office

Chart 5

Area of forests of the Czech Republic by harvesting method according to forest management plans [%], 2005–2018

Data source: Forest Management Institute

According to their main function, forests are classified into **categories of:** production forests, protective forests, or special purpose **forests** (Chart 1). There has been a gradual decline in the proportion of production forests, from 76.7% of the total forest area in 2000 to 74.3% in 2018. At the same time, the proportion of special purpose forests increased in the same period from 19.8% to 23.7%. The area of protection forests is also steadily decreasing, which, considering the relatively unchanging natural conditions, indicates that the current possibilities of including forests in the protection category are not fully utilised. Their share in 2018 accounted for 2.0%, while in 2014 it was 2.6% and in 2000 even 3.5%.

The area of forests certified in accordance with the principles of the **PEFC** (Programme for the Endorsement of Forest Certification Schemes) and **FSC** (Forest Stewardship Council)[4], i.e. forest sustainably managed according to the parameters of those programmes, peaked in 2006 (74.6% under PEFC and 0.8% under FSC, Chart 2). In 2007, however, that area decreased to about 70%, where it remained until 2015, when, mainly due to the reduction of areas of PEFC-certified forests, there was a further decrease to 66.3%, despite the slight rise in FSC certified forests to 1.9%. In 2018, there was a further year-on-year decline in the PEFC-certified forest area to 65.7% of the total forest area and a slight increase in FSC-certified area by 402 ha. However, only 2.0% of forests are FSC-certified. Forest certification in the Czech Republic developed particularly after 2000, when in addition to promoting sustainable forest management, there was an effort to inform consumers about the origin and environmental consequences of logging. The reason for the decline in awarded certificates in recent years is that the certification process is demanding and forest owners do not see any added value in the certificates.

Since 2000, the shares of conifers and deciduous trees have been slightly approximating the recommended composition of the forest, thanks to reducing the proportion of **naturally and artificially regenerated** coniferous trees in favour of deciduous trees (Chart 3). In 2018, the share of deciduous trees was increased due to higher proportion of deciduous trees in artificial regeneration to 44.7% (in 2017 it was 42.3%) and at the same time by the dominant share of conifers in total logging (94.3%). After the increase in the area and the proportion representation of naturally regenerated stands between the years 2007–2013, there was a decline in natural regeneration in the subsequent period – its share in the total area of reforestation dropped from 23.5% in 2013 to 16.1% in 2018. In 2018, the area where **natural regeneration** takes place was 4.1 thous. ha (compared to 6,112 ha in 2013).

The priority for enabling a natural regeneration of forests is the reducing and maintaining the **populations of cloven-hoofed game**, particularly regarding the damage caused by this game on newly established forest as well as on agricultural crops and land. In addition to the nibbling of young trees, which hinders both natural and artificial regeneration, high populations of game have a negative impact on entire forest ecosystem. The reason for current high stock of game is mainly the method of farming, which creates sheltering and feeding conditions for the rapid growth of game numbers, and reduced natural regulation of the game, or its complete absence. Following a short-term improvement in the situation in 2014, the numbers of monitored game increased again in recent years, except for wild boar, whose population decreased slightly year-on-year (Chart 4). The game with the largest numbers in the long term si roe deer, counting 298 852 in the spring of 2018. In order to reduce the damage caused by wild animals on agricultural and forest property, the plans for breeding and hunting, and their supervision based on the approval by the hunting holder, must be carefully prepared every year in accordance with relevant provisions of Act No. 449/2001 Coll., on game management, so that the populations of cloven-hoofed game and wild boars range between the minimum and standardised levels. At the same time, it is necessary to change the system of farming and forestry so that it allows more efficient reduction in the numbers of wild boar and concurrently the conditions improve for small animals and other animals bound to agricultural landscape.

Individual types of forest management can be assessed by how close they are to natural processes in forest ecosystems. The method most similar to natural processes is selection cutting, where logging for the purpose of regeneration and upbringing of forest stands is not differentiated in time and space and does not create clearings (as opposed to clearcutting and border strip cutting), and which significantly helps to maintain the diverse age and spatial structure of forest ecosystems. In addition to selection cutting, it is also appropriate to use shelterwood cutting, which uses so-called regeneration felling. In shelterwood cutting, the new stand grows under the protection (shelter) of the parent stand. Clearcutting can lead to the formation of such clearings which, by their size, adversely affect the forest structure and naturally occurring processes. According to data from forest management plans[5], the most frequently used method of land management in 2018 was border strip cutting, the second most frequently used method of management is shelterwood cutting (Chart 5). Out of the compartment felling methods, clearcutting was used the least. Forests managed by selection cutting comprised the lowest share. Since 2005, forest management plans have shown the trend of decreasing the area managed by clearcutting and increasing the proportion of area managed by border strip cutting and shelterwood cutting.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[4] Forest certification under the PEFC and FSC systems is one of the forest management processes which aim at sustainable forest management in the Czech Republic and strive to improve all forest functions in favour of the environment inhabited by humans. Through the certificate, the forest owner declares a commitment to manage the forest pursuant to the given criteria. In terms of sustainability, higher demands are placed by the FSC certificate.

[5] These are data from the proposal part of forest management plans. The representation of the management methods applied may vary.

Forests in the global context

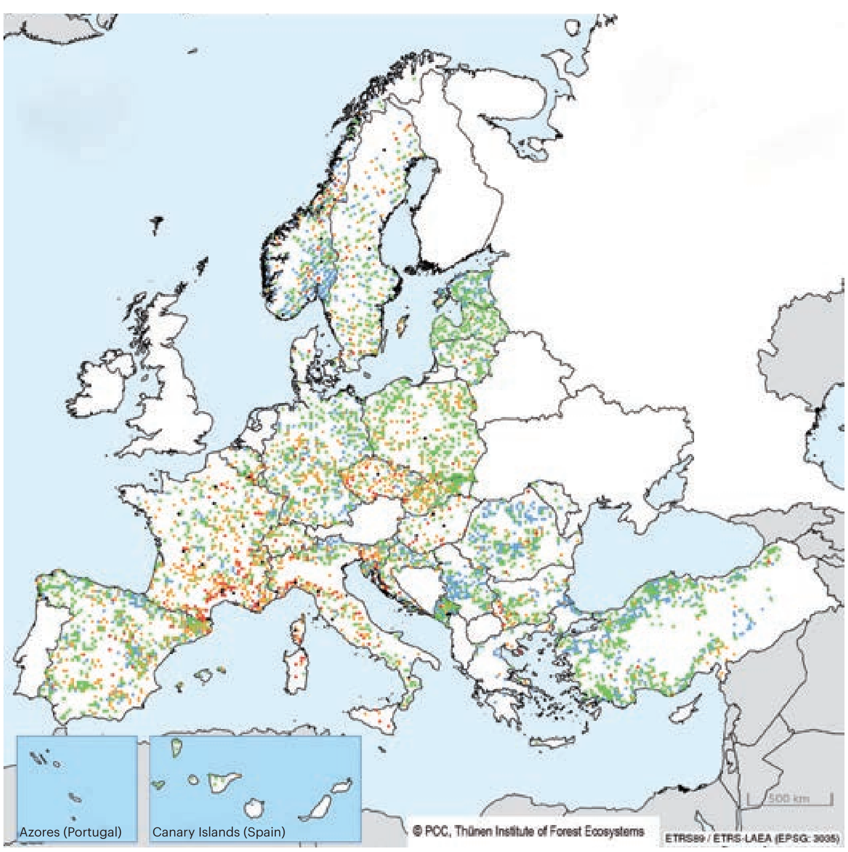
Key messages[6]

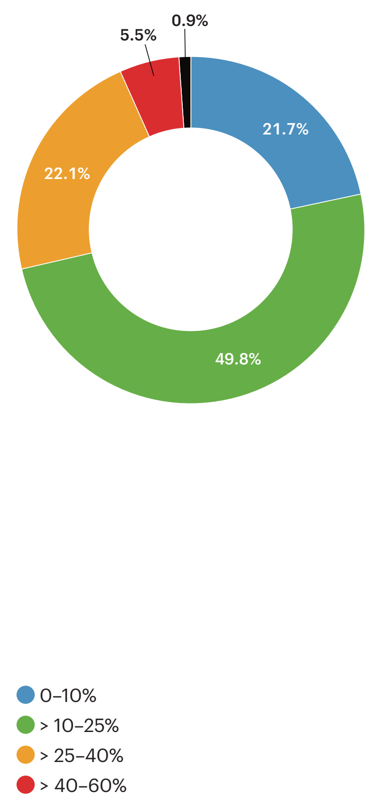
- Forests cover 40% of Europe and almost 90% of them are used for logging. The total area of forest stands as well as the total standing stock are growing. In terms of production, most forests are managed according to the principles of sustainable development.
- Europe's forests are faced with increasing pressure associated with deepening manifestations of climate change. Damage from strong winds, droughts, fires and biotic agents is increasing. Species and age composition of stands is still inappropriate in many places.
- The health condition of forest stands in Europe is also not satisfactory. In 2017, for a total of 28.5% of assessed stands, the defoliation rate exceeded 25% and the stands were thus classified as damaged or dead. Pollution with acidifying and eutrophising sulphur and nitrogen compounds remains high.

Indicator assessment

Figure 1

Defoliation on the main monitoring sites of all tree species [%], 2017





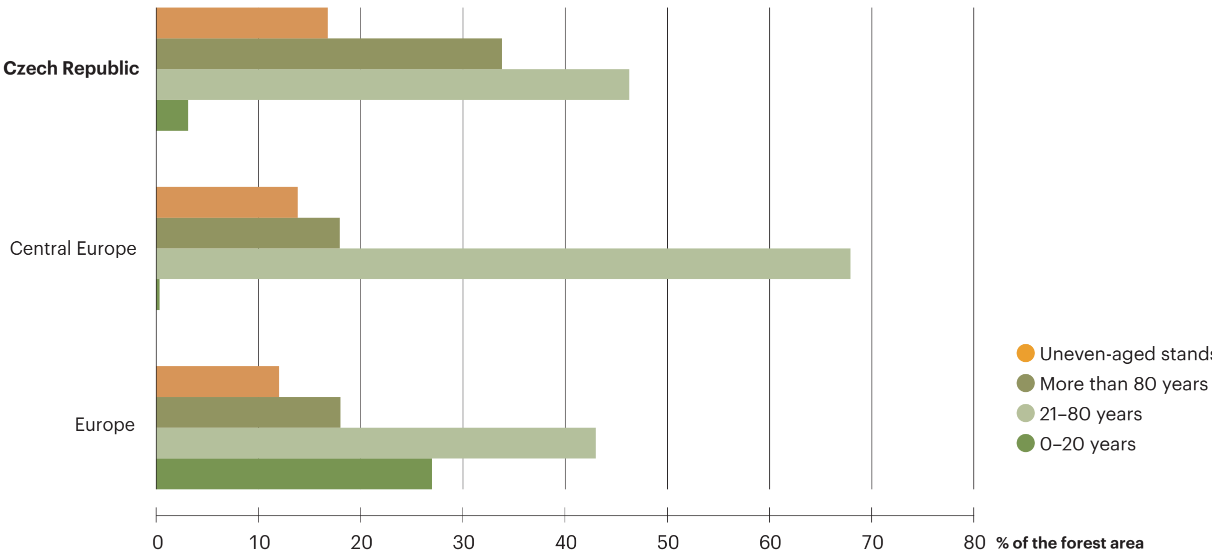
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: ICP Forests

[6] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Chart 1

Age structure of forest stands [% of the forest area], 2010

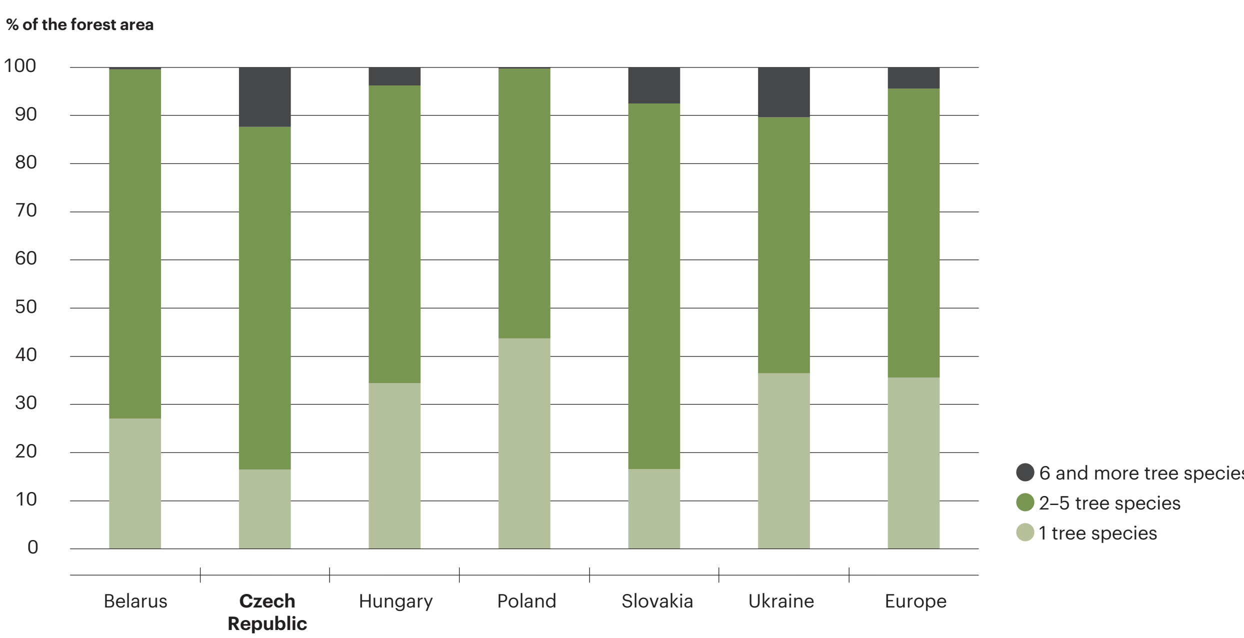


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: State of Europe's Forests 2015

Chart 2

Species composition of forest stands in selected countries [% of the forest area], 2010

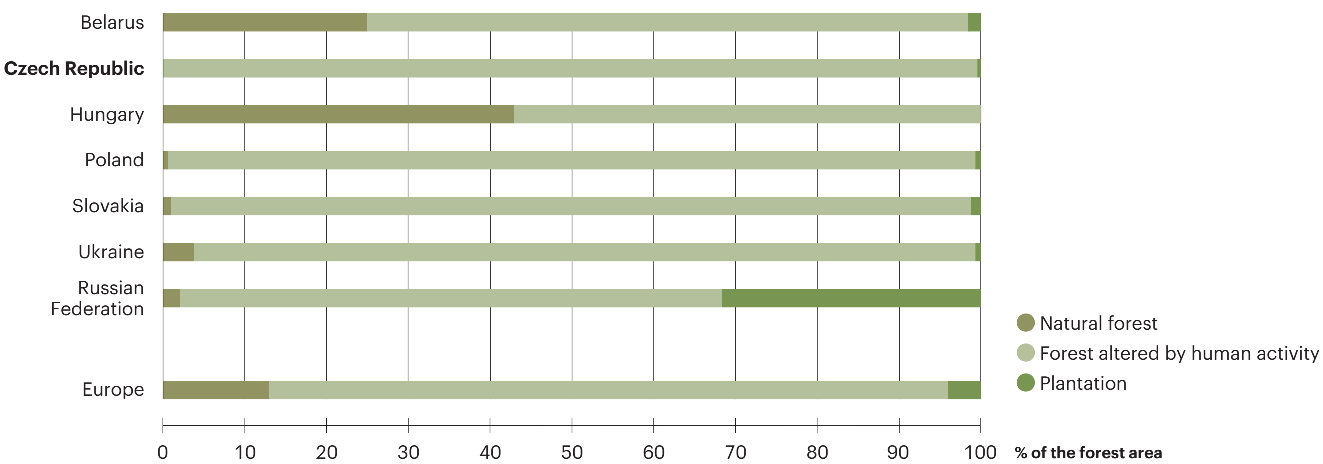


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: State of Europe's Forests 2015

Chart 3

Proportion of forests affected by humans in selected countries [% of the forest area], 2015

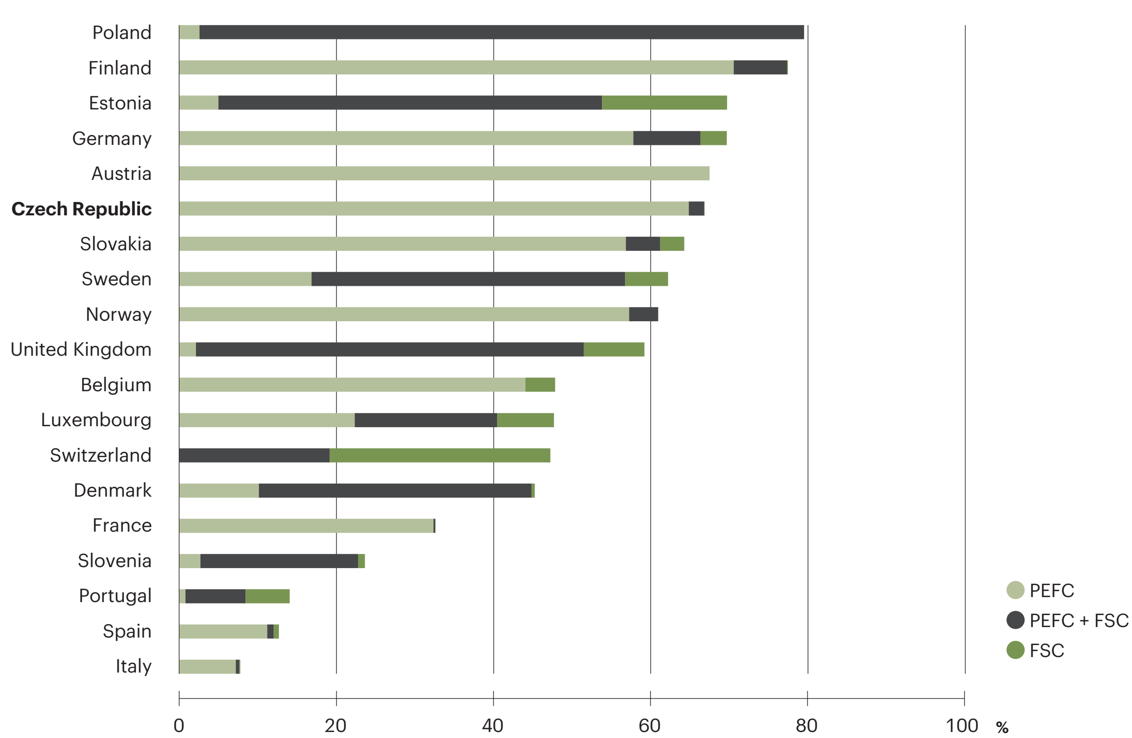


A forest modified by humans differs from a natural forest usually in its species composition, which has been affected by human activities, e.g. artificial regeneration. Plantations are forest stands established with the intention to obtain the largest possible volume of wood in a short time (10–60 years). Wood from forest plantations is most used to produce paper, cellulose, chipboard, or as firewood.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: State of Europe's Forests 2015

Chart 4

Proportion of PEFC and FSC certified forests in the total forest area in selected EU countries [%], 2018



According to the joint finding by PEFC and FSC, in 2018 more than 86 mil. ha of forests worldwide were simultaneously certified by both certificates at the same time.

Data source: PEFC Czech Republic, FSC Czech Republic

Forests in Europe are ecosystems disrupted by human activity, which are facing ever-increasing manifestations of climate change and atmospheric pollution that pose a risk to the vitality of forest soils and the health status of forest stands.

Defoliation is a result of a complex set of factors and is influenced by short-term factors (pest outbreaks, diseases, damage by frost, drought, wind and other weather conditions), along with long-term factors (inappropriate age and species composition of vegetation, soil acidification, long-term exposure to atmospheric pollution and others). The high degree of defoliation generally indicates a decrease in the resistance of forests to various environmental influences. The category of low damage by defoliation (0–25%) covers 71.5% of forests in Europe and a total of 28.5% of the assessed stands exceeded the 25% defoliation rate and thus the stands were classified as damaged or dead. The highest damage category (over 60%) includes 0.9% of forests. The forests with the significant damage are mainly located in the Central and Southern Europe, namely in southern and south-eastern France, northern Italy, Czech Republic, Slovenia, or Croatia (Figure 1). Defoliation rate in Europe is not improving. This is a worrying finding, especially in relation to climate change and the fact that the efforts to reduce nitrogen deposition have so far been unsuccessful.

An important factor for the stability and resilience of forest ecosystems to acidification and climate change is the appropriate species and age composition of forest stands reflecting natural conditions. In Europe, the share of natural forests is 4.0% of the total forest area, with less than 1% of forests considered as primary (original). In the Czech Republic, the share of **natural forests** is 0.4% (Chart 3). This low level is due to the long-term use of European forests and land for economic purposes. The highest share of natural forests can be found in the Russian Federation – around 32%.

Monoculture stands represent on average 16.5% of forests in the Czech Republic and 32.0% in the whole of Europe. Also, the area of stands composed of more than 6 tree species is significantly higher than in the European average (12.4% in the Czech Republic, 4.0% in Europe, Chart 2). The species composition of forest stands in the Czech Republic compared to the European average is not relevant, however, because the European average also includes specific forest ecosystems that naturally consist of only one or two species (e.g. Nordic pine forests, subalpine spruce forests).

In the Czech Republic, in comparison with the European **average age structure**, the percentage of stands older than 80 years is significantly higher (33.8% in the Czech Republic, 18.0% in Europe), and the area of all-aged stands is smaller (Chart 1).

Current state of forests is a result of historical development. Intensive forest management and the trend of planting monocultural stands at the end of the 19th century and in the 20th century have led to an entirely unsuitable age and species structure of forest stands. The change in the unfavourable situation, pursued by forest management in the Czech Republic, is a long-term process.

A good tool for implementing **responsible forest management** are the standards of international certification organizations. The proportion of the areas of PEFC and FSC certified forests in the total forest area in selected EU Member States is the highest in Poland (79.5%) and Finland (77.4%). In contrast, the smallest proportion is in Italy (7.8%) and Spain (12.7%). The Czech Republic belongs to the European average with 66.9%, mainly due to the high proportion of forests certified according to PEFC. On the other hand, the Czech Republic is among countries with the lowest proportion of forests certified according to the FSC standard (2.0%) which has higher environmental requirements. Only Spain (1.5%), Italy (0.6%), France (0.2%) and Austria (0.01%) have a lower share of FSC forests, Chart 4.


6
Soil and agriculture

Soil and agriculture

A prerequisite for life on land is not only water and sunlight, but also soil that serves as an environment for living for most terrestrial organisms, including humans. Land is a dynamic and ever-evolving living system which provide many ecosystem functions and services. These include mediation of circulation of substances, exchange of thermal energy in the system earth – air, infiltration, accumulation and distribution of water. But soil is most often seen as a source of livelihood and a space for farming and territorial development.

Factors that threaten the qualitative properties and the amount of the soil the most are construction and inappropriate management methods. Inappropriate crop rotation practices and the use of heavy vehicles cause an increased level of erosion and compaction of the soil. The consequence is a reduced ability to absorb water, accelerated surface run-off, siltation of water sources, reduced depth of topsoil or limitation of plant development. Also inappropriate practices in conventional farming, using mineral fertilizers and plant protection products in excessive quantities or in an unsuitable period, often lead to the pollution of groundwater and surface water, the decline in biodiversity of soil micro-organisms, and thus the quality of the soil. Similarly, this applies to other chemical substances that enter the soil from landfills, old environmental burdens, through immission deposition or discharges of wastewater into the soil, and in industrial accidents. Soil contamination may subsequently, through bioaccumulation in the food chain, have a negative impact on related ecosystems and the potential presence of contaminant residues in food.

From an environmental point of view, it is therefore important to adhere to the principles of good agricultural practice and to encourage the development of organic farming that does not burden the soil with mineral fertilizers or other chemical plant protection products. Especially, it has a positive effect on the quality of the soil as well as on the quality of produced food, on the health and welfare of livestock and indirectly also on human health. Organic farming contributes significantly to the protection of surface water and groundwater, has a beneficial effect on soil microorganisms, increases biodiversity and ecological stability of the landscape, including the anti-erosion effect. It contributes positively to the sustainable development of rural areas and maintains the character of the landscape by not applying the conventional farming approaches. However, it is necessary to support the use of arable land and permanent crops as part of organic farming. At present, organic farming is dominated by permanent grasslands, which are not sufficient for proper self-sufficiency in organic farming. Despite the development of organic farming in the Czech Republic, conventional farming still dominates and organic forms are represented only to a small extent.

References to current conceptual, strategic and legislative documents

Common Agricultural Policy 2014–2020
- measures to protect the environment – e.g. crop diversification, maintenance of permanent grassland and creation of ecologically focused regions

Directive 2009/128/EC of the European Parliament and of the Council establishing a framework for Community action to achieve the sustainable use of pesticides
- requirements for the use of plant protection products

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive)
- requirements for farming in vulnerable areas (checking compliance with farming requirements, set out in the Directive, as part of the Cross Compliance system)

Regulation (EC) No. 1305/2013 of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No. 1698/2005
- support of knowledge transfer and innovation in agriculture and in rural areas
- increasing the viability and competitiveness of agricultural holdings
- promoting the competitiveness of agriculture
- ensuring sustainable management of natural resources and climate action

Regulation (EU) No. 1306/2013 of the European Parliament and of the Council on the financing, management and monitoring of the common agricultural policy and repealing Council Regulations (EEC) No. 352/78, (EC) No. 165/94, (EC) No. 2799/98, (EC) No. 814/2000, (EC) No. 1290/2005 and (EC) No. 485/2008
• lays down rules for the financing of expenditure under the common agricultural policy, including rural development expenditure
• lays down rules for the farm advisory system, the management and control systems, the Cross compliance system, the clearance of accounts

Regulation (EU) No. 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No. 637/2008 and Council Regulation (EC) No. 73/2009
• payment of support including the additional support per hectare for observing agricultural practices which have a beneficial effect on the climate and the environment
• complying with the standards for agricultural and environmental status of the soil established by a Member State intended to prevent soil erosion, maintain soil structure and keep organic matter in the soil

European Action Plan for Organic Food and Farming
• promoting organic farming through rural development, organic food market and strengthening of research

EU Strategy on Adaptation to Climate Change
• minimizing the negative impacts of climate change on agriculture
• improving resilience of agricultural and forest ecosystems

Strategy on Adaptation to Climate Change in the Czech Republic
• halting soil degradation by excessive erosion, nutrient depletion, loss of organic matter and compaction
• support for organic agriculture

United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, particularly in Africa
• measures against desertification and to mitigate the effects of drought in the drought-affected countries

Strategic Framework Czech Republic 2030
• the landscape in the Czech Republic is conceived as a complex ecosystem and ecosystem services provide a suitable framework for the development of human society
• the landscape is adapted to climate change and its structure helps to retain water

State Environmental Policy of the Czech Republic (updated 2016)
• reduction of permanent grabs of agricultural land
• reducing the risk of agricultural land, forest land and rock erosion
• limiting and controlling contamination and other degradation of soil and rocks caused by human activities
• restoration of the landscape water regime by implementing erosion mitigation measures to the landscape

National Action Plan on Adaptation to Climate Change
• diversification of agriculture
• measures combating agricultural drought
• reducing soil erosion
• organic farming

Strategy of the Ministry of Agriculture of the Czech Republic with a 2030 perspective
• support of the competitiveness and sustainability of Czech agriculture, food industry, forestry and water management
• support of reasonable food self-sufficiency
• application of sustainable use of natural resources

National strategic Rural Development Plan of the Czech Republic for the period 2014–2020 support of environment-friendly farming methods, including organic farming
• restoration, conservation and increase in biodiversity, development of agricultural areas with high natural value and improvement of the status of European landscape
• better water management, including the management of fertilisers and pesticides
• prevention of soil erosion and improved soil management

Action Plan of the Czech Republic for the Development of Organic Farming in the years 2016–2020
- increasing the share of income from the production in the total income of organic farms against aid (improvement against the current state)
- increasing the proportion of Czech organic food to 60% in the organic food market
- achieving 3% proportion of organic food in the total food and drink consumption
- increasing the real contribution of organic farming to the environment and animal welfare = reaching 15% share of organically farmed land in the total agricultural land in the Czech Republic
- achieving at least 20% proportion of arable land in the total area of organically farmed land
- securing financing for research and consultancy in organic farming at an extent corresponding to the proportion of organic farming areas in the total farmland (15%)
- ensuring non-productive functions of organic agriculture, which contribute to the restoration and stability of natural processes in the soil

National Emission Reduction Programme of the Czech Republic
- reduction of ammonia emissions from fertiliser applications to arable land and livestock production beyond the minimum requirements of Good agricultural practice

Act No. 252/1997 Coll., on agriculture, as amended
- creating prerequisites for the support of non-productive functions of agriculture that contribute to the protection of the environment components such as soil, water and air, and to the sustaining of populated and cultural landscape
- creating conditions for the implementation of the common agricultural policy and rural development policy of the European Union
- creating conditions for the development of diverse economic activities and improving the quality of life in rural areas and for the development of villages

Government Regulation No. 75/2015 Coll., on conditions for the implementation of agri-environment-climate measures and amending Government Decree No. 79/2007 Coll., on conditions for the implementation of agri-environment measures, as amended
- the maximum limit values of the content of monitored heavy metals, which can be contained in a soil sample

National Action Plan on the Safe Use of Pesticides in the Czech Republic for 2018–2022
- establishes tasks, targets, measures and timetables to reduce risks and limit the impacts of the use of chemicals on human health and the environment, in order to support the development and implementation of integrated pest management and alternative approaches or practices to reduce dependence on use of chemicals

Act No. 156/1998 Coll., on fertilisers, soil conditioners, herbal medicines and substrates and agrochemical testing of agricultural soils (Fertilisers Act), as amended
- the use of fertilisers, auxiliary chemicals, modified sludge and sediments

Act No. 334/1992 Coll., on the protection of the agricultural land resources (as amended)
- defines ways of protecting agricultural land resources

Act No. 254/2001 Coll., on waters and amending some Acts (as amended)
- implementation of the Nitrate Directive into national legislation

Government Regulation No. 262/2012 Coll., on designation of vulnerable zones and action programme, and its amendment No. 235/2016 Coll.
- the designation of vulnerable zones and establishing an action program for these areas
- the determination of the resulting Good agricultural practice

Operational Programme Environment 2014–2020
- finalization of the inventory of old environmental burdens (the target value for the year 2023 is 10 thous. registered contaminated sites)
- implementation of remediation of the most seriously contaminated sites on the basis of risk analysis results (the target values for the year 2023 are 1.5 mil. m^3 of excavated or pumped contaminated material and 500 thous. m^2 of remediated sites in the Czech Republic)

22 | Risk of soil erosion and slope instabilities

Key question

How big is the proportion of agricultural land threatened by erosion what is the area of landslides in the Czech Republic?

Key messages

On the Czech Republic's territory[1], 56.7% of agricultural land is potentially threatened with water erosion, of which 17.8% with extreme erosion. Wind erosion is a threat for 18.4% of agricultural land. Adapted method of management to prevent further erosion is recommended for 53.8% of the evaluated area of agricultural land. The remaining area of agricultural land (46.2%) can be managed without limitations.

In 2018, a total of 276 erosion events were recorded in the Czech Republic (168 in 2017). Since 2010, when only 7 of these events were recorded, there has been a significant increase in their number. In almost 76% of cases, erosion events occurred on soils without any soil protection technologies applied. On the mapped territory[2], the area of active landslides was 4,187.8 ha.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

Last year-on-year change

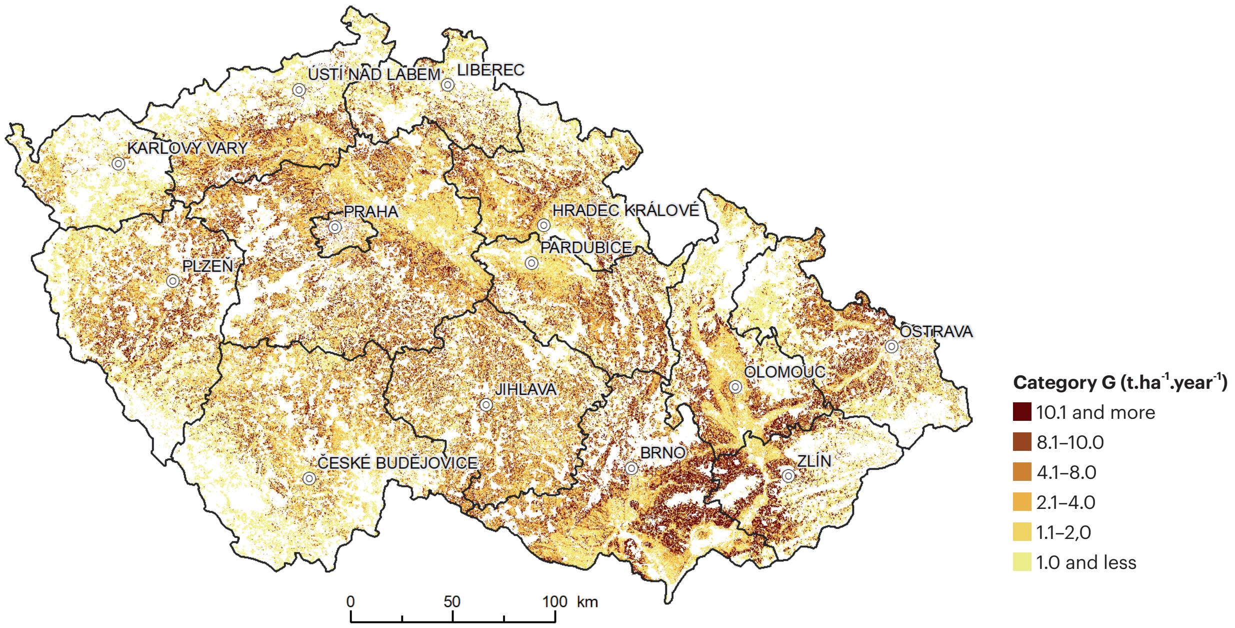
[1] Potential vulnerability of agricultural land to water erosion expressed as a long-term average soil loss G higher than 2.1 $t.ha^{-1}.year^{-1}$.

[2] Currently, 18% of the territory of the Czech Republic is mapped.

Indicator assessment

Figure 1

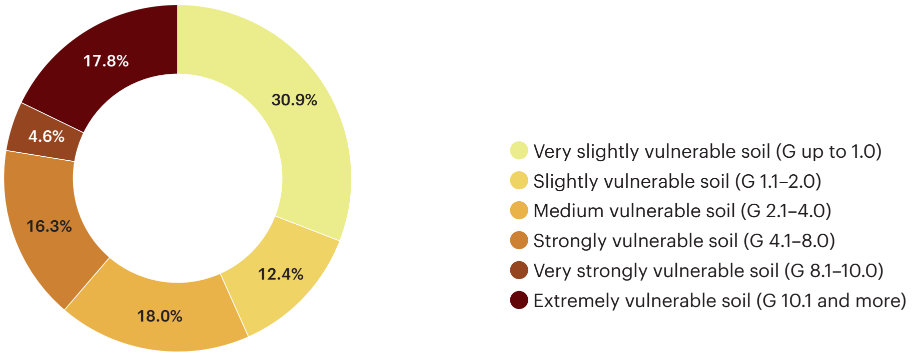
Potential vulnerability of agricultural land to water erosion expressed as a long-term average soil loss G in the Czech Republic [$t.ha^{-1}.year^{-1}$], 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Chart 1

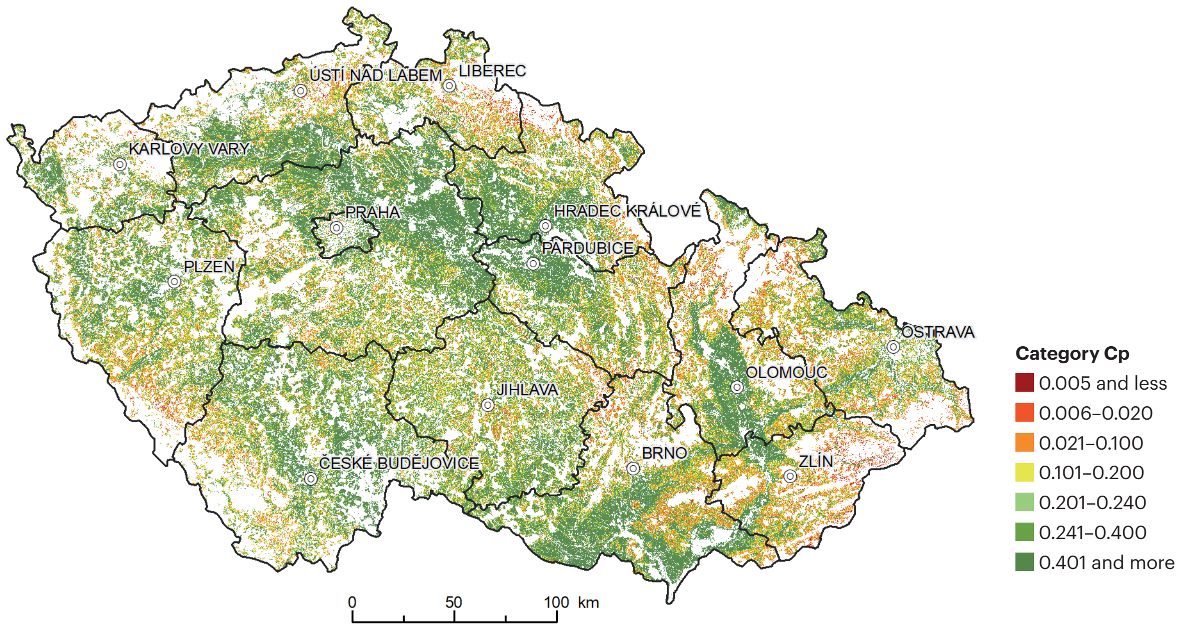
Potential vulnerability of agricultural land to water erosion expressed as a long-term average soil loss G in the Czech Republic [% of agricultural land resources], 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Figure 2

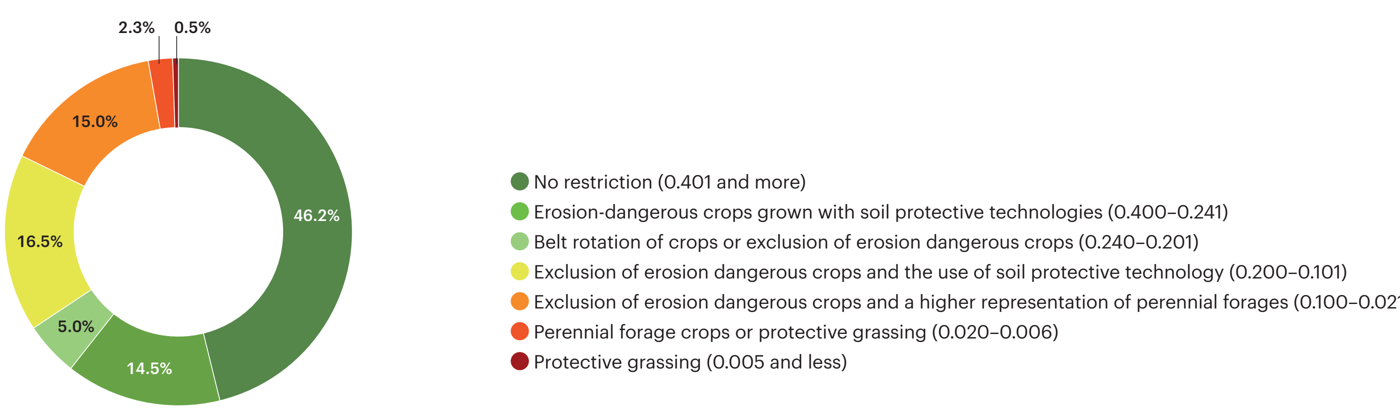
Vulnerability of agricultural land to water erosion expressed as the maximum admissible values of the protective vegetation influence factor (Cp) in the Czech Republic, 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Chart 2

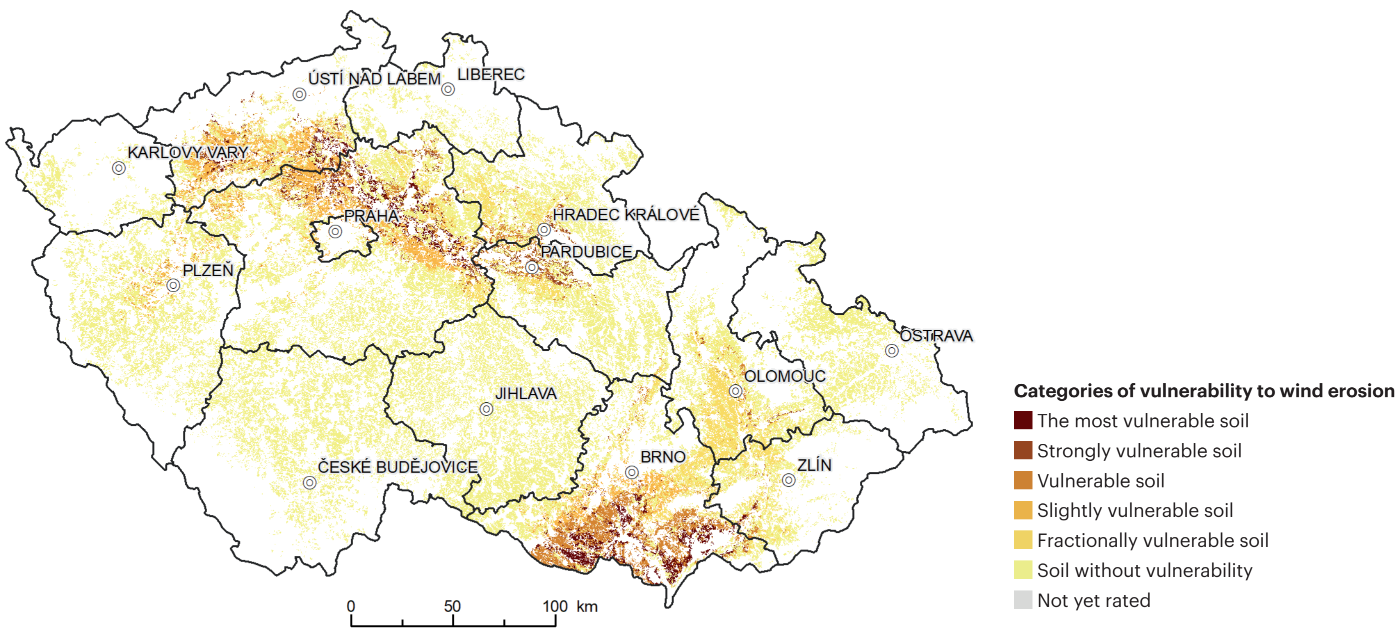
Vulnerability of agricultural land to water erosion expressed as the product of the maximum tolerable values of the protective vegetation influence factor (Cp) and the erosion control measures factor (Pp) in the Czech Republic [% of agricultural land resources], 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Figure 3

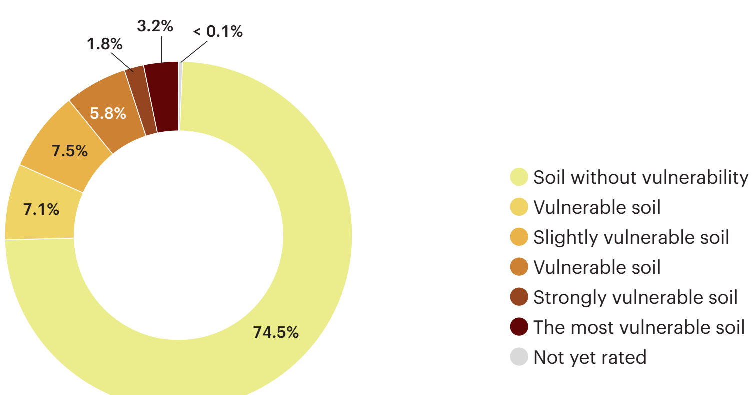
Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Chart 3

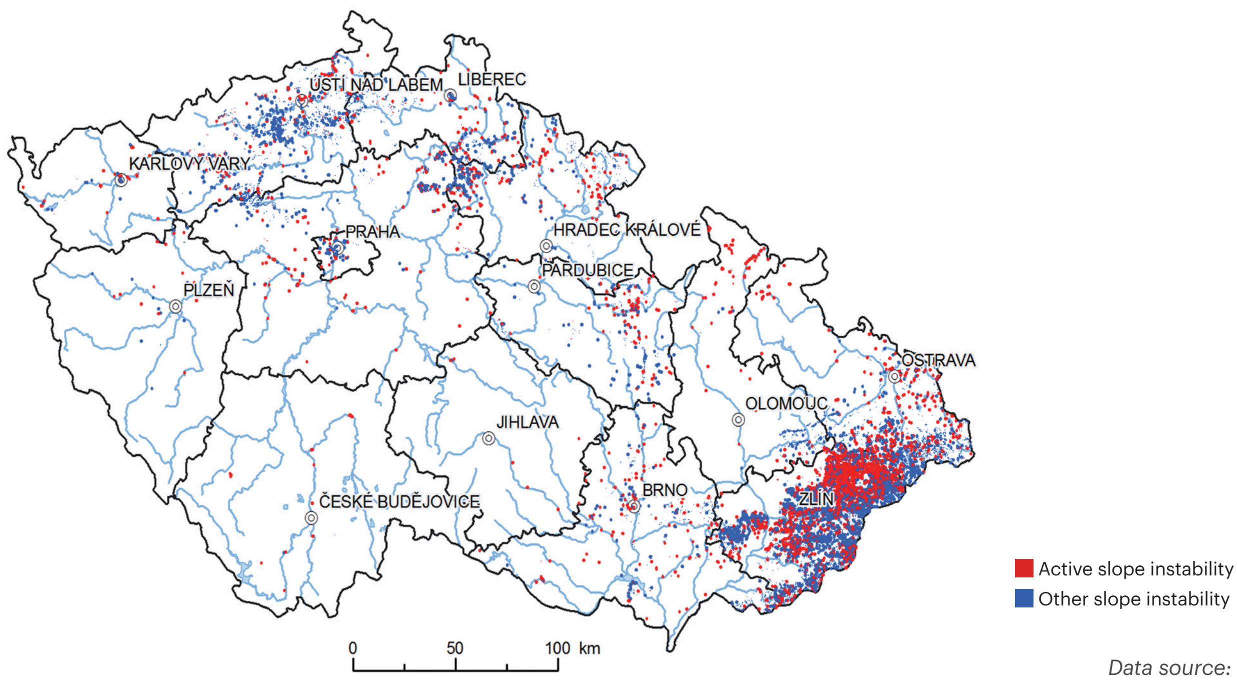
Potential vulnerability of agricultural land to wind erosion in the Czech Republic [% of agricultural land resources], 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Figure 4

Landslides and other dangerous slope instabilities on the territory of the Czech Republic, 2018



Data source: Czech Geological Survey

Soil erosion in natural conditions is a slow process, which is compensated by weathering of the substrate and formation of new soil. Human influences have accelerated this process, especially in the case of cultivation of erosion-risk crops (e.g. corn) up to thous. times. Such high erosion rate cannot be compensated by the very slow soil-forming processes (it is estimated that the period needed to form 1 cm layer of soil in the climatic conditions of the Czech Republic (and Central Europe) is around 100 years). The excessive loss of soil particles due to erosion may **reduce the depth of the topsoil**, or destroy the entire topsoil layer. On heavily eroded soils, the yields per hectare are reduced by up to 75% and land prices are reduced by up to 50%. In addition to growing erosion-risk crops, erosion is accelerated also by monoculture cultivation, small amount of organic matter in the soil, absence of landscape elements, absence of grassed strips or terraces, consolidation of parcels, farming practices regardless of the slope of the land, etc.

More than 50% of the arable land area in the Czech Republic is threatened **by water erosion**. Water erosion threatens mainly the upper (the most fertile) part of land (topsoil) by washing away soil particles and depositing them in other places, so-called soil loss. In addition to soil loss, the washed-away soil particles also cause surface water pollution and clogging of water reservoirs. The proportion of land potentially vulnerable to **long-term average soil loss (G)**[3] greater than 2.1 $t.ha^{-1}.year^{-1}$ (i.e., above the lower limit of medium threatened soil) was 56.7% of the acreage of agricultural land in 2018 (Chart 1). Extreme water erosion (G higher than 10.1 $t.ha^{-1}.year^{-1}$) affects 17.8% of agricultural land in the Czech Republic, e.g. in the areas lining the Moravian Ravines and in the uplands and highlands of the Czech Republic (Figure 1). The potential vulnerability expressed by the long-term average soil loss is calculated on the basis of regionalized factors set for the long term and therefore does not change much over the years. According to **agricultural soil erosion monitoring** performed by the National Land Authority and Research Institute for Soil and Water Conservation, a total of 276 erosion events were registered in the Czech Republic in 2018 (168 in 2017). Since 2010, when only 7 of these events were recorded, there has been a significant increase in their number. In the long term, the most (44.8% in 2018) erosion events occur in the Vysočina Region.

[3] The calculation of the average long-term soil loss (G) is based on the universal soil loss equation (USLE): $G = R \times K \times L \times S \times C \times P$ [$t.ha^{-1}.year^{-1}$]. Inputs into the equation include the following factors: rainfall and runoff erosivity factor adjusted for regional climate according to public land register database (R), soil erodibility factor (K), slope length factor (L), slope steepness factor (S), cover-management factor adjusted for regional climate (C) and the support practices factor (P).

The level of water erosion threat for a land can also be expressed using the maximum permissible value of the **protective vegetation influence factor Cp**[4] (Figure 2). This value is used as the basis for specifying the type of a suitable framework method of farming (Chart 2), in which the excess loss of soil particles is not yet manifested. In 2018, it was possible to grow erosion-risk crops on 65.7% of the area, of that on 46.2% without restriction and on 14.5% with soil-protective technology. On 5.1% of the area, the cultivation of erosion-risk plants was conditioned by strip cropping. The exclusion of erosion-risk crops was recommended on 31.3% of the territory. Of that, on 16.5% of the area, the recommendation included using soil-protection technologies and on 15.0% a higher representation of perennial forage. On the remaining 2.8% of the territory, the recommendation was to cultivate perennial forage crops or protective grassing. The types of framework management are recommended according to the standards of good agricultural and environmental condition that ensure the management is in agreement with environmental protection. The farming methods are restricted in areas with low Cp, which are delimitated mainly in mountain areas and on steeper slopes. However, the steepness influences the erosion level always in combination with other factors. Soil loss due to erosion also occurs on soils where no systematic protection is applied to prevent further losses. In 2018, nearly 76% of erosion events occurred on soils without applied soil protection technologies.

The **effect of wind erosion** on agricultural land is similar to that of water erosion, and its causes are also similar (outsize plots with one type of crop, missing windbreaks – alleys, in-field patches, etc.). Regarding current trends in land management it may be assumed that in the future the danger of wind erosion will increase. In 2018, 18.4% of agricultural land was potentially endangered by wind erosion[5], of which 3.2% were the most endangered soils, located mainly in South Moravia and in Polabí. The category of soils not at risk covered 74.5% of the agricultural land.

Serious direct and indirect damage may also be caused by some of the geodynamic processes, in particular the **slope instability**. Slope instabilities can be of natural or anthropogenic origin, but are distinguished by the speed of movement, forming 4 basic groups: a creep (movement from millimetres to centimetres per year), a slump (movement of meters per day), a flow (movement of meters per hour) and a fall (movement of meters per second). In the Czech Republic, the behavior of slopes is affected mainly by extreme situations, the type of rock, inappropriate placement of structures and by management in the landscape. Landslides most commonly affect large areas of the Czech Republic in the Outer Western Carpathians, Bohemian Central Uplands and the area around the River Ohře (Figure 4). In 2018, the registry of slope instabilities of the Czech Republic registered 20,401 sites of slope instabilities (19,319 in 2017). The area of landslides amounted to 78,923.0 ha (74,857.0 ha in 2017), of which 4,187.8 thous. ha consisted of **active landslides**, which are considered the most serious source of risk. The long-term increase in the area of slope instabilities can be evaluated in the context of increasing intensity of extreme weather events and of mapping the phenomenon in the territory of the Czech Republic[6].

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[4] The calculation of Cp is based on the Universal Soil Loss Equation (USLE), expressed in the form: Cp = Gp / (R × K × L × S × P). Inputs into the equation include the following factors: maximum permissible average annual loss of soil preserving soil functions and fertility relative to the depth of the soil (Gp), rainfall and runoff erosivity factor adjusted for regional climate according to public land register database (R), soil erodibility factor (K), slope length factor (L), slope steepness factor (S) and cover-management factor adjusted for regional climate (P). Cp are divided into 5 categories. This value is the limit and its potential exceedance should be eliminated by erosion control measures (Pp).

[5] The methodology for establishing the potential vulnerability of agricultural land to wind erosion was used. From the data on soil environmental quality units, the data on climatic regions (the sum of daily temperatures above 10° C, average rainfall certainty for the growing period, probability of dry vegetation periods, average annual temperature, annual precipitation), and information on the main soil units (genetic soil type, soil-forming substrate, grain size, skeletal characteristics, rate of hydromorfism). The final evaluation is expressed by the product of the climate region factor and the main soil unit factor.

[6] Currently, 18% of the territory of the Czech Republic is mapped.

23 | Consumption of fertilisers and plant protection products

Key question

Is the amount of agrochemicals used in agriculture reducing?

Key messages

In comparison with 2017, the consumption of mineral fertilizers decreased by 11.1% to 122.9 kg of pure nutrients.ha^{-1} in 2018.
The consumption of lime substances improving the production capacity of soils reached the highest value since 2000, in 2018 a total of 340.0 thous. t of lime substances were applied.
Compared to 2017, the consumption of plant protection products decreased by 8.0%; in 2018, farmers consumed 4,388.5 thous. kg of active substances.

The consumption of livestock manure has been stagnating since 2014, 70.0 kg.ha^{-1} of livestock manure and organic fertilizers was used in 2018.

Overall assessment of the trend

Change since 1990

Change since 2000

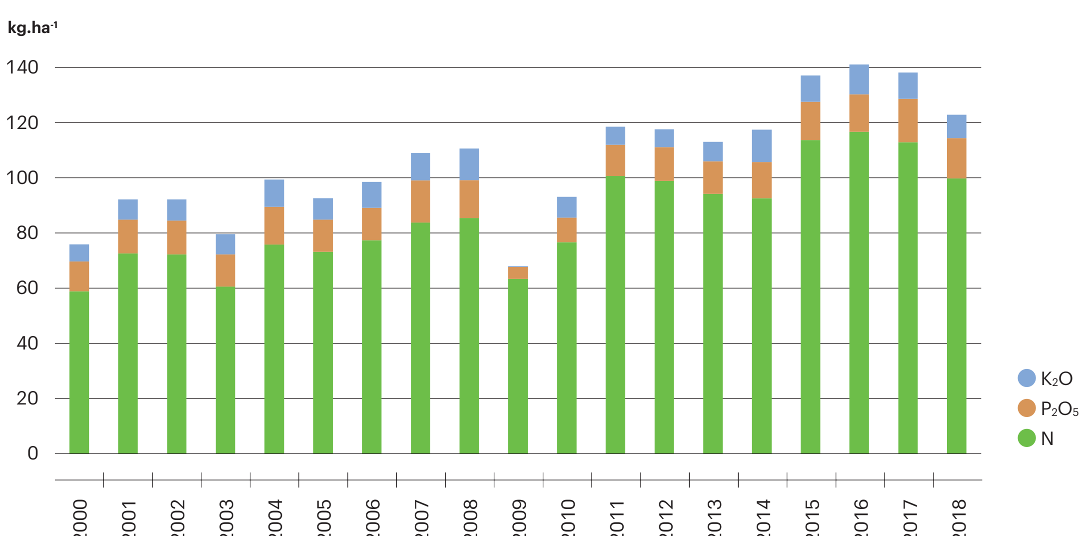
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

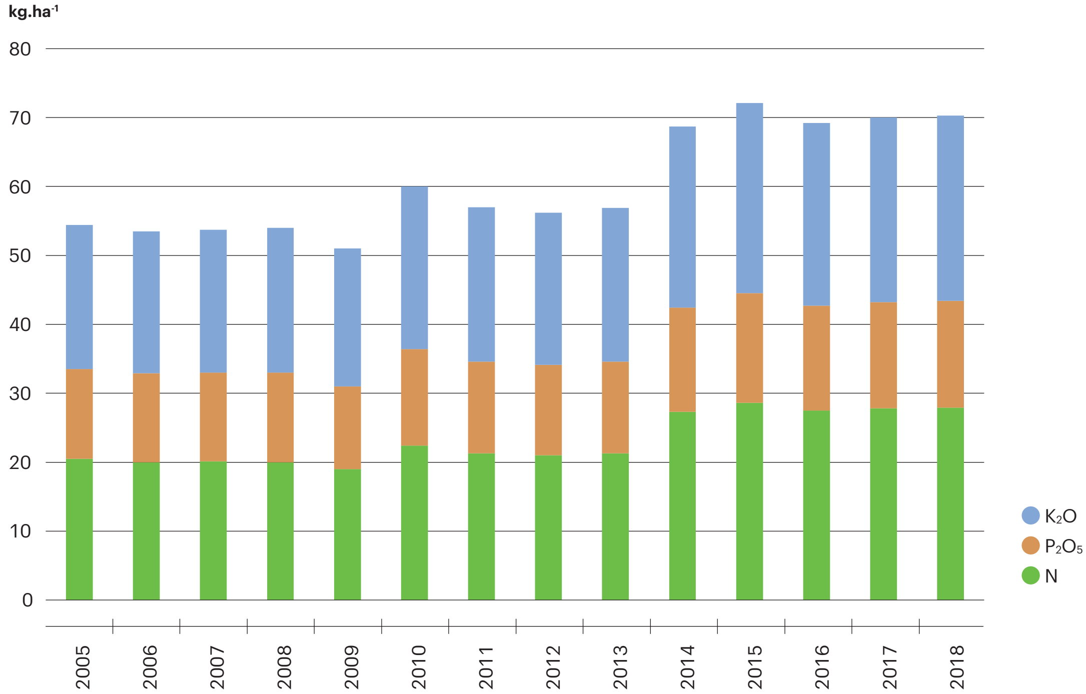
Development of the consumption of mineral fertilisers in the Czech Republic [kg of pure nutrients.ha^{-1}], 2000–2018



Data source: Ministry of Agriculture

Chart 2

Development of the consumption of manure and organic fertilisers in the Czech Republic [kg of pure nutrients.ha^{-1}], 2005–2018

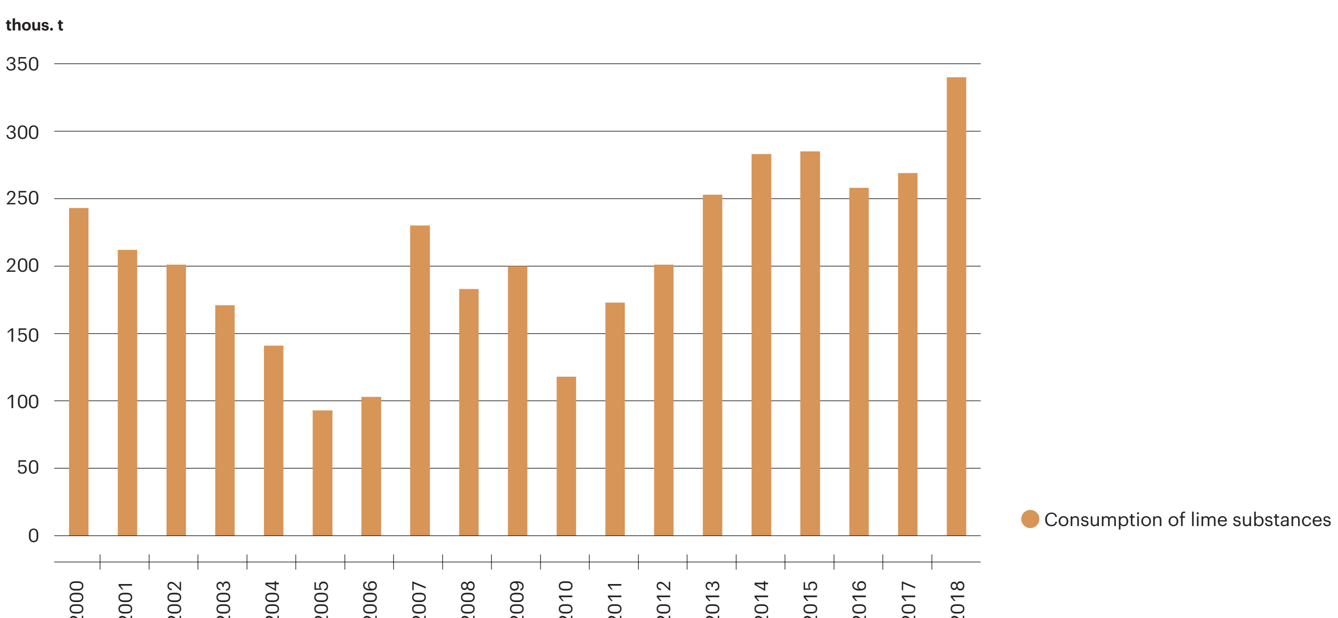


Since 2014, the nutrient input in digestate has also been included. At the same time, a part of the livestock manure (slurry, but also manure), forming the input raw material for biogas plants, is deducted.

Data source: Ministry of Agriculture

Chart 3

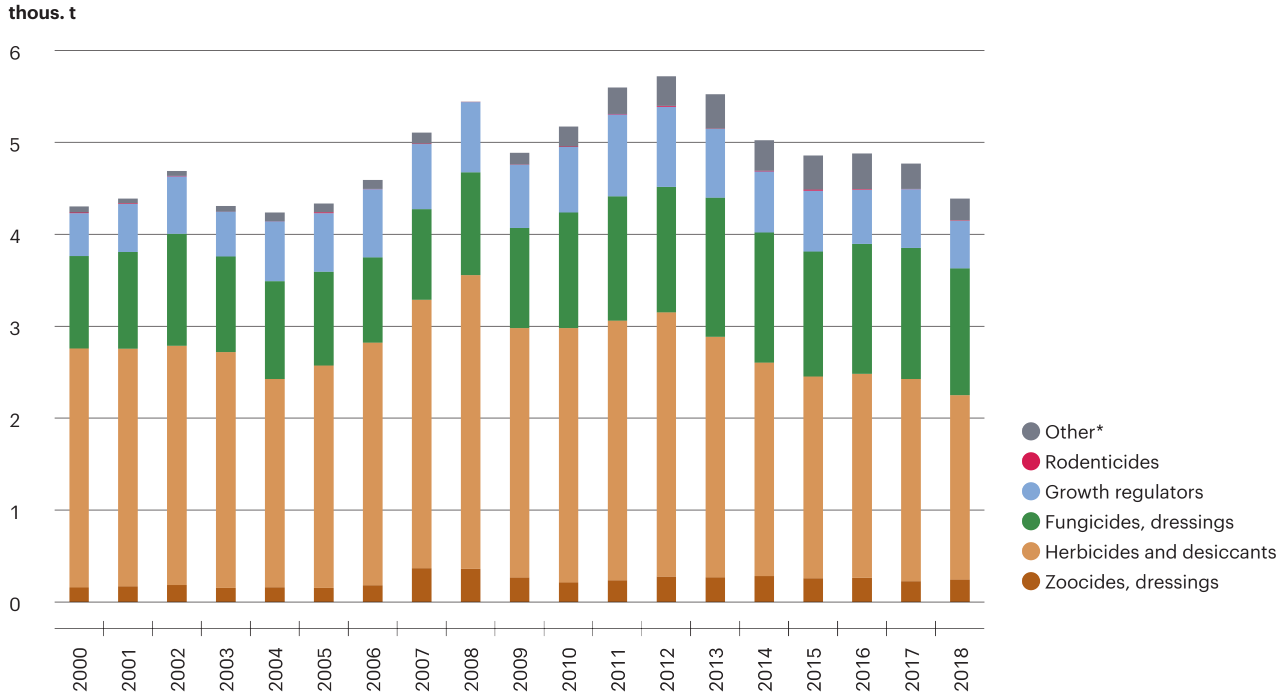
Development of the consumption of lime substances in the Czech Republic [thous. t], 2000–2018



Data source: Ministry of Agriculture

Chart 4

Consumption of active substances contained in plant protection products and other protective means by the purpose of use in the Czech Republic [thous. t of the active substance], 2000–2018



**Other – auxiliary chemicals, repellents, mineral oils, etc.*

Data source: Ministry of Agriculture

Compared to 2000, the **consumption of industrial fertilizers** has increased gradually (by 61.9%). However, their consumption decreased year-on-year by 11.1% to 122.9 kg of pure nutrients.ha^{-1} (Chart 1). Compared to 2017, the most significant decrease was recorded in the consumption of nitrogen fertilizers by 11.6% to 99.8 kg.ha^{-1}, and in consumption of potassium fertilizers (decrease by 11.1% to 8.5 kg.ha^{-1}). The consumption of phosphatic fertilizers dropped by 7.0% to 14.6 kg.ha^{-1} year-on-year. Regarding the composition of mineral fertiliser consumption, nitrogen fertilisers clearly dominate and represent 81.2% of total consumption. The high consumption of fertilisers in recent years is associated, among other things, with an effort to offset the negative effects of drought on crops. Atypical year in the entire period was 2009, with a marked decline, which was caused by high prices especially of phosphate and potassium fertilisers and low market prices of agricultural products.

The **consumption of livestock manure** has been relatively stable since 2014. In 2018, livestock manure (manure, slurry, etc.) and organic fertilizers (especially digestate from biogas plants) delivered 27.9 kg of N, 15.5 kg of P_2O_5 and 26.9 kg of K_2O into agricultural land per hectare (related to utilised agricultural land of 3,523.2 thous. ha). In 2018, the total input of pure nutrients from manure and organic fertilisers was 70.0 kg.ha^{-1}. Nutrients from the livestock manure make up an estimated half of the nutrients in the resulting digestate. The other half of the nutrients comes from biomass entering the biogas plants (mainly silage maize). The input of nutrients from organic fertilizing is in fact increased by that amount. In order to maintain the production capacity of the soil and to maintain the nutrients in the soil, it is advisable to increase the consumption of manure and to use compost for improving the soil structure.

Agricultural land in the Czech Republic has an acidic soil reaction, so it is important to lime the soil. Adjustment of the soil reaction by applying **lime substances** helps to improve the fertility and the production capacity of the soil by maintaining and improving its physical, chemical and biological properties. The consumption of lime substances reached the highest value since 2000, in 2018 a total of 340.0 thous. t of lime substances were applied. This was a year-on-year increase by 26.4% (Chart 3). Thus, 9.6 tonnes of lime substances were applied per hectare of cultivated land in 2018. Increased use of liming increases the proportion of soils with an alkaline reaction. In the Czech Republic, the average value of soil reaction of agricultural land over the period 2012–2017[7] was 6.10 pH (i.e. slightly acidic). A total of 30.0% of the area of agricultural land has an acidic soil reaction (i.e. pH up to 5.5). Given that another 40.5% of agricultural land has a slightly acidic soil reaction, it would be desirable to lime regularly 70.5% of agricultural land. The proportion of alkaline soil (pH above 7.2) was only 13.6% of the agricultural land.

The **consumption of plant protection products** is influenced by the current incidence of crop diseases and pests in the given year, which varies according to the weather conditions during the year. The consumption of active substances contained in plant protection products has been decreasing since 2012, in 2018 it was 4,388.5 thous. kg of active substances, i.e. 8.0% less than in 2017 (Chart 4). The largest proportion of the total consumption was made up by herbicides and desiccants (45.7%), followed by fungicides and bate (31.4%) and growth regulators (11.8%).

Excessive use of plant protection products as well as mineral fertilizers contributes to the deterioration of soil quality, to biodiversity loss and, last but not least, to impairing the quality of surface and groundwater. The excessive use of plant protection products also affects non-target species (especially insects and birds). Measures and objectives to reduce the adverse impact of plant protection products are defined in the National Action Plan for the Safe Use of Pesticides in the Czech Republic for 2018–2022.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[7] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

24 | Quality of agricultural land

Key question

What is the quality of soil having an effect on soil properties, water quality and the food chain?

Key messages

In monitoring the content of risk elements and substances in the soil (Basal Soil Monitoring), it was found in 2018 that the prevention values were exceeded for persistent organic pollutants PCB, PAH and DDT.
Based on the results of determining the hazardous element content in soil after aqua regia extraction, the most problematic was in the period of 1998–2018 the concentration of cadmium (9.3% of samples in excess) and arsenic (8.8%).
PAH and cadmium are the most problematic in reservoir and river sediments. In the samples for the period 1995–2018, the limit values for PAH were exceeded in 21.1% of the samples and for cadmium in 16.5% of the samples.

Overall assessment of the trend

Change since 1990

Change since 2000

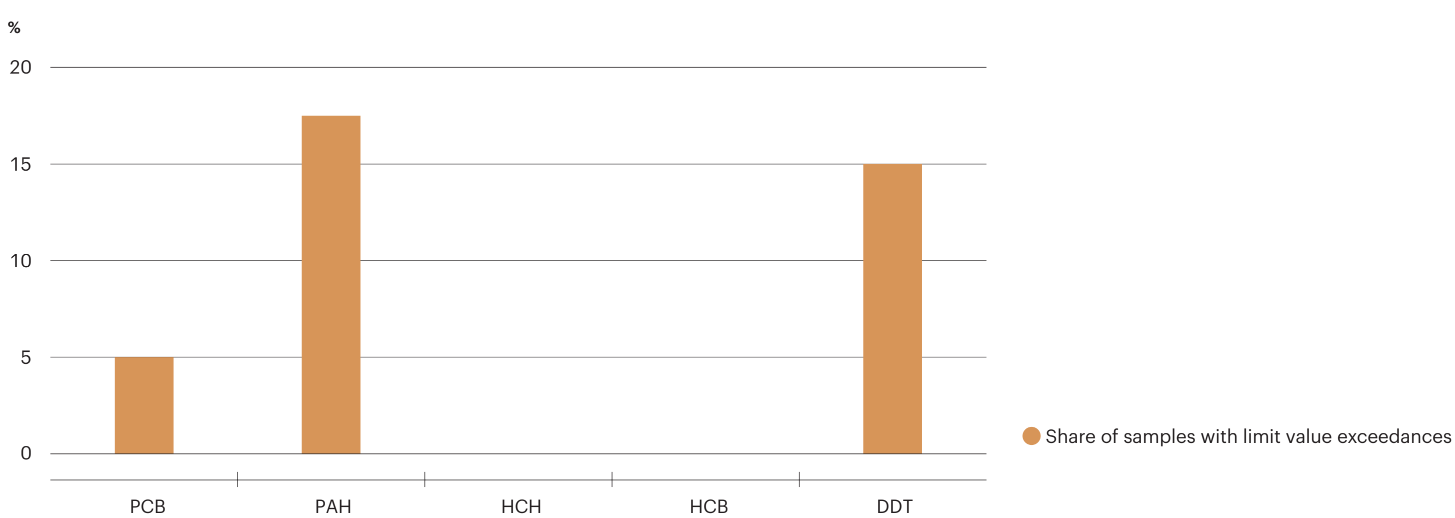
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Proportion of samples exceeding preventive values of risk substances in agricultural land in the Czech Republic [%], 2018

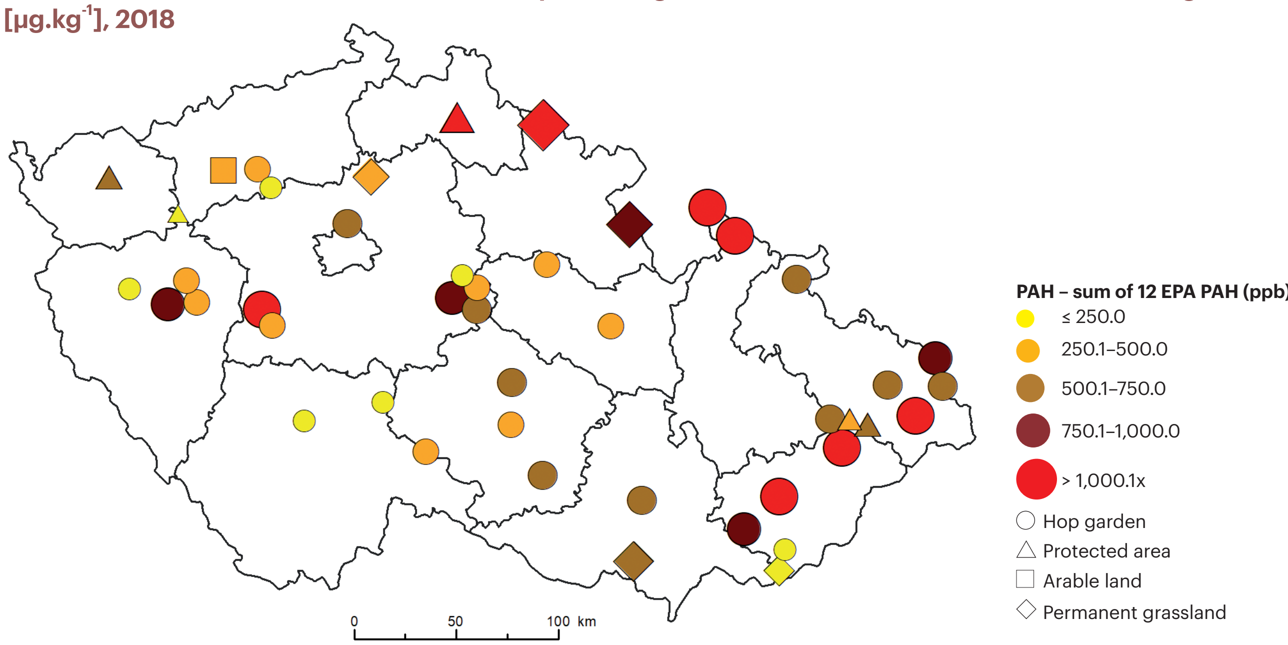


Results of Basal Soil Monitoring (BSM). Established on the basis of samples from 40 selected monitoring areas. The preventive values for the specified risk substances are established by Decree No. 153/2016 Coll.

Data source: Central Institute for Supervising and Testing in Agriculture

Figure 1

Content of the sum of 12 EPA PAH in the topsoil of agricultural land (under Basal Soil Monitoring) in the Czech Republic [μg.kg^{-1}], 2018

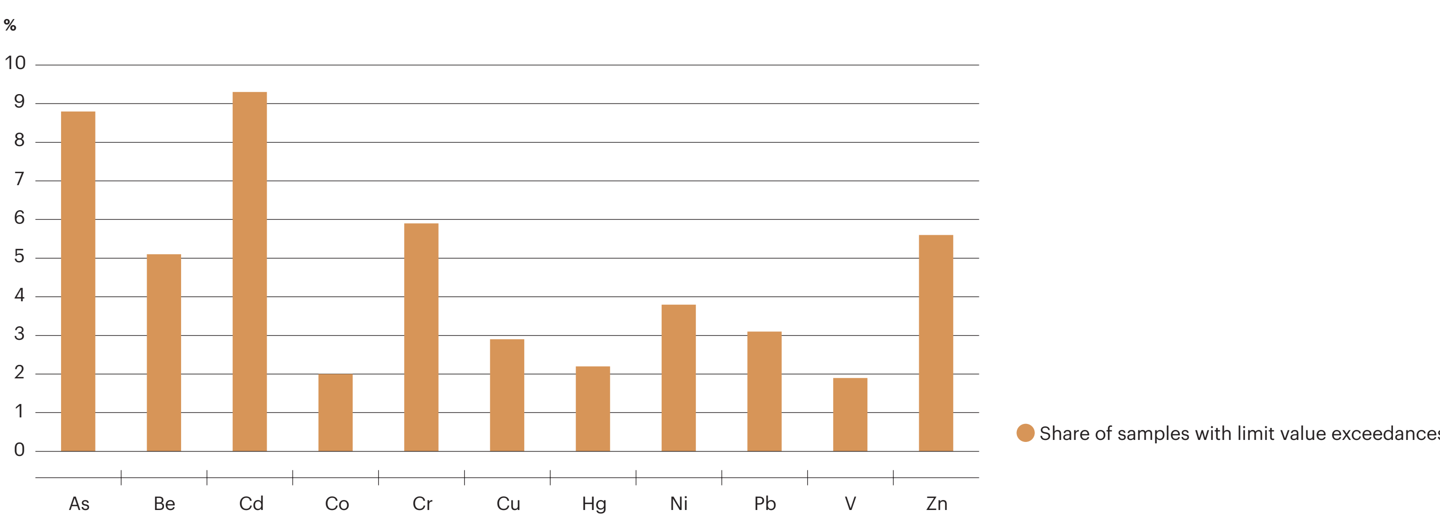


Established on the basis of samples from 40 selected monitoring areas and 5 localities in protected areas. The preventive value for the sum of 12 PAH EPA pursuant to Decree No. 153/2016 Coll. is 1,000 ppb (1.0 mg.kg^{-1} of dry mass).

Data source: Central Institute for Supervising and Testing in Agriculture

Chart 2

Proportion of soil samples exceeding the preventive values for the content of elements in the extract of aqua regia in the Czech Republic [%], 1998–2018

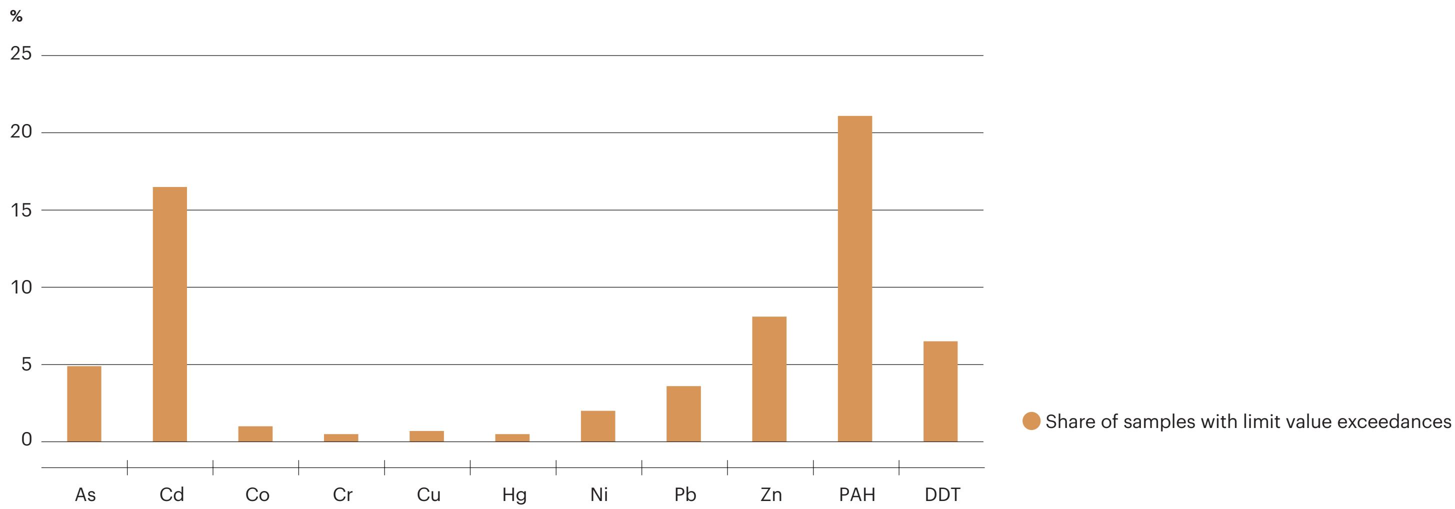


The results of the Register of Contaminated Areas, 14,281 samples evaluated, in the case of mercury 52,462 samples evaluated. The preventive values for the above risk substances are established by Decree No. 153/2016 Coll.

Data source: Central Institute for Supervising and Testing in Agriculture

Chart 3

Proportion of reservoir and river sediment samples exceeding the limit values in the Czech Republic [%], 1995–2018

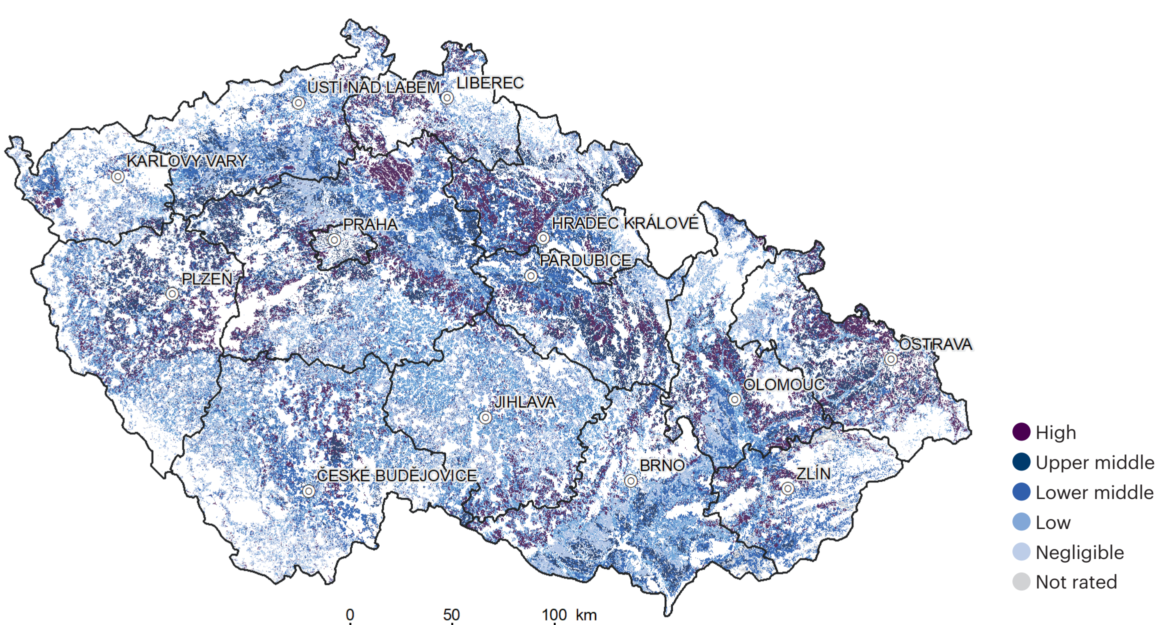


The results of the long-term monitoring of inputs into the soil (sediments). Risk elements 1995–2018, approximately 500 samples; PAH: polycyclic aromatic hydrocarbons (sum of 12 PAH), monitored 2009–2018, 57 samples; DDT: sum of DDT including metabolites, monitored 2007–2018, 57 samples.

Data source: Central Institute for Supervising and Testing in Agriculture

Figure 2

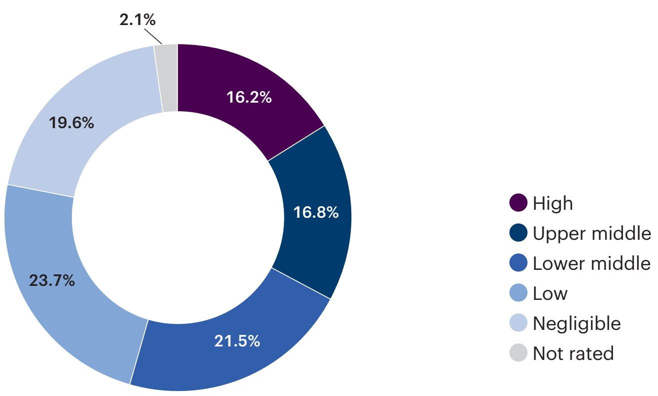
Potential vulnerability of lower soil strata to compaction in the Czech Republic, 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

Chart 4

Potential vulnerability of lower soil strata to compaction in the Czech Republic [%], 2018



Data source: Research Institute for Soil and Water Conservation, public research institution

The quality of farmland is determined by a number of properties (e.g. soil structure, soil reaction (pH), sorption capacity, humus content). The quality farmland is adversely affected by the content of hazardous substances in the soil, which get into the soil and sediments through anthropogenic activities. The **monitoring of the content of the risk elements and substances in the soil** (BSM) covers both inorganic pollutants, or risk elements (e.g. As, Cd, Ni, Pb, Zn, etc.) and persistent organic pollutants (POPs). These include in particular the 16 polycyclic aromatic hydrocarbons (16 EPA PAHs), polychlorinated biphenyls (7 PCB congeners) and organochlorine pesticides (HCB, HCH, substances of the DDT group). The core network of BSM points was founded in 1992. The system currently includes 214 monitoring plots. Sampling of soil from all monitoring plots for the purpose of determining the content of risk elements takes place in six-year cycles. The first sampling was made in 1992, three years later, in 1995, the sampling was made according to an optimised sampling method and the subsequent sampling has been carried out on a regular six-year basis. The last cycle took place in 2013. The samples from the six-year cycles[8] are used to determine, in addition to the risk elements, also the content of the accessible nutrients, of accessible microelements (B, Cu, Fe, Mn), exchangeable and active pH. On selected plots, regular sampling of plants is made every year in order to determine the content of risk elements in agricultural crops and soil sampling focused e.g. on microbiological parameters, the content of mineral nitrogen, or on monitoring selected persistent organic pollutants (POPs). The presence of hazardous elements and substances in soil is not necessarily related to agricultural activity, and if so, it is mainly due to the application of plant protection products, sludge from WWTPs or sediments from water reservoirs and watercourses.

Organic pollutants are determined in soil samples from 40 selected BSM monitoring plots and 5 plots in protected areas (KRNAP, Kokořínsko PLA, Pálava PLA, the White Carpathians, Orlické Mountains) from the topsoil horizon. In 2018, the preventive value was exceeded for PCB, PAH and DDT. The value for HCH and HCB was not exceed in the samples, their content in the soil has been negligible in the long term and preventive value was not exceeded in 2018 (Chart 1). The highest proportion of samples exceeding the preventive values was measured in the sum of 12 PAHs. PAHs are formed also in natural processes, but currently their occurrence is higher in the environment, among other things as a result of human activity, especially due the incomplete combustion of carbon-based fuels. They have a high bioaccumulation ability and depending on the structure, some of them have carcinogenic effects. The value was exceeded on eight selected BSM plots, of which one was in a protected area (Figure 1). The content of DDT was exceeded in 6 localities. In 2018, the limit for PCB content in arable land was exceeded in two monitoring plots.

The BSM is used to monitor the development of the content of risk elements in agricultural soils in the Czech Republic. More detailed information about the contents of elements in soils can be obtained from so-called **Registry of Contaminated Areas**[9]. According to the results of the determination of the contents of the risk elements in the soil after extraction by aqua regia (Chart 2), the most problematic in the period 1998–2018 were the levels of cadmium with 9.3% of samples in excess for all soils (i.e., for light and other types of soils that include sandy-loamy, loamy, clayey-loamy and clayey soil), arsenic (8.8%), chromium (5.9%), zinc (5.6%) and beryllium (5.1%).

[8] *A detailed evaluation of the contents and changes in monitored parameters can be found here: http://eagri.cz/public/web/ukzuz/portal/hnojiva-a-puda/publikace/bezpecnost-pudy-zpravy/monitoring-pud/bazalni-monitoring-zemedelskych-pud/*

[9] *Registry of Contaminated Areas. The database of the Registry contains coordinates-determined areas of sampling and the relevant values of the contents of the risk elements in the soil (mg.kg^{-1}). A basic overview of the sites with detected excess levels of risk elements in the soil is provided by the maps of the Register. The database has two parts: (1) results of determining the contents of the risk elements in the extract of 2M HNO_3 – this section is already closed; (2) results of determining the contents of risk elements after extraction by aqua regia – this part of the database is continuously replenished with the results of new investigations.*
For more detailed information see: http://eagri.cz/public/web/ukzuz/portal/hnojiva-a-puda/bezpecnost-pudy/registr-kontaminovanych-ploch/.

To improve the production properties of agricultural land, it is possible to deposit reservoir and river sediments on agricultural land. The sediments must first be analysed, and if they comply with the relevant limits under Decree No. 257/2009 Coll., they can be used on agricultural land. The content of hazardous elements and organic pollutants, as well as the granular composition, the proportion of organic matter, pH and nutrient content are monitored. Central Institute for Supervising and Testing in Agriculture has performed **quality monitoring of reservoir and river sediments** since 1995 (Chart 3). In the period 1995–2018, it evaluated 564 sediment samples. The highest percentage of samples exceeding the limit values was recorded for PAH (21.1%), and cadmium (16.5% of the samples). For arsenic, zinc and DDT, 5 to 10% samples in excess were found.

Risk inputs of substances into soil include the sludge from wastewater treatment plants. The WWTP sludge can be applied to soil only if it is treated and must comply with the limits for the content of risk elements and substances. The contents of the individual elements and organic pollutants are evaluated according to Decree No. 437/2016 Coll. A total of 82 sludge samples were tested in 2018. Out of those samples, 16 were in excess (i.e. 19.5%) and 24 were found to exceed the limit contents of the risk elements. This was an increase compared to 2017, when 15.9% of samples were above the limit. The limit values were the most frequently exceeded for cadmium (6 exceedances, corresponding to 7.3% of samples) and copper (4 exceedances, 4.9%).

Soil quality is affected by **soil compaction**, which is caused by intensive farming. Soil compaction negatively affects the production and non-production properties of the soil. Compaction reduces precipitation infiltration, speeds up surface runoff and increases the risk of erosion, and the natural soil processes are suppressed as water, air and thermal regimes of the soil are disrupted. The potential vulnerability of the lower strata soil due to compaction is partly determined by the type of soil – the so-called genetic compaction which is typical of soils with a higher clay content. Of the total land area at risk of compaction, genetic compaction accounts for only 30%, while compaction caused by intensive farming accounts for 70%. A high potential vulnerability by compaction was assessed on 16.2% of agricultural land (Chart 4). The potential risk of agricultural land compaction is high in north Moravia and central and west Bohemia (Figure 2).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

25 | Organic farming

Key question

Does the share of organically farmed land and the number of organic farms continue to increase?

Key messages

The number of organic farming entities continues to grow, in 2018 the Czech Republic had 4,596 farms, which is 197 more than in 2017 and 8 times more than in 2000.

The total area of organically farmed land has been growing very slowly since 2011; in 2018, it was 539.0 thous. ha, i.e. by 18.9 thous. ha more than in 2017. Permanent grasslands occupy a large part of the total area (80.8%).

Although there has been a year-on-year increase in the share of arable land in the total area of organically farmed land (from 13.8% to 15.1%), this value is not close to the target of 20%, which is set by the National Action Plan for the Development of Organic Farming.
The National Action Plan for the Development of Organic Farming defined the target share of organically farmed land in the agricultural land resources at 15% for the period 2011–2015. In 2018, that share was still not achieved.
The proportion of organically farmed land in agricultural land resources was only 12.8% in 2018.

Overall assessment of the trend

Change since 1990

Change since 2000

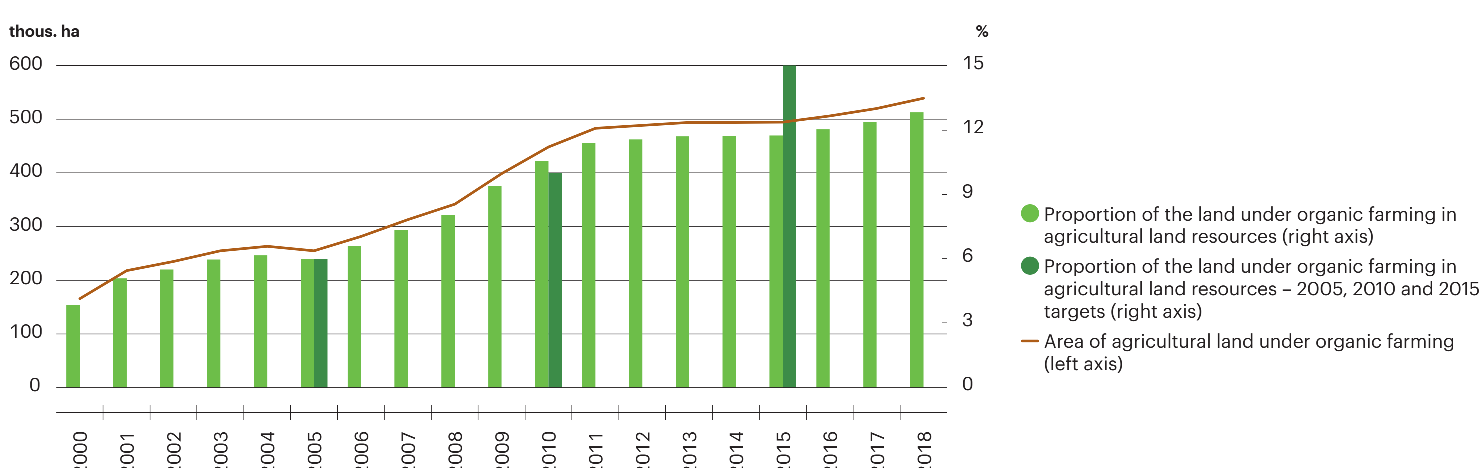
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

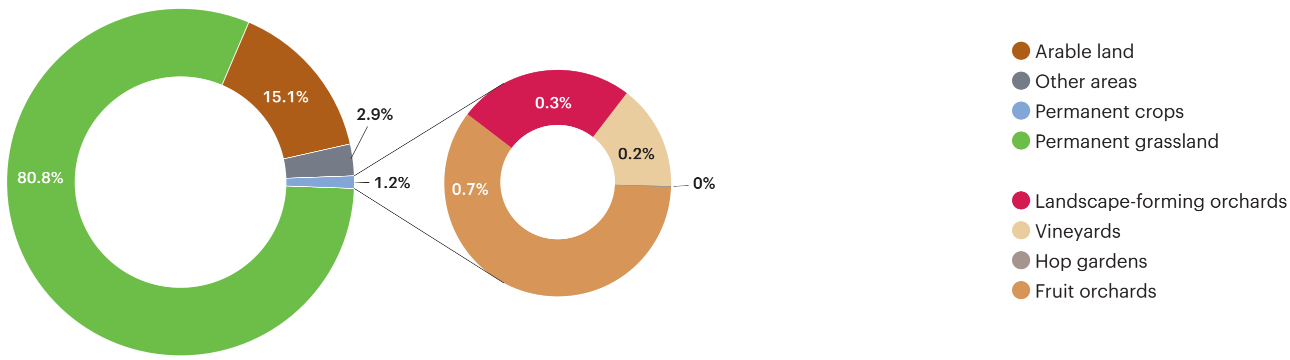
Area and proportion of the organically farmed land in agricultural land resources in the Czech Republic [thous. ha, %], 2000–2018



Data source: Ministry of Agriculture

Chart 2

Structure of the land resources in organic farming in the Czech Republic [%], 2018



The category of Other areas includes the areas of fast-growing tree species, forest-tree nurseries, forested land and other crop.

Data source: Ministry of Agriculture

Chart 3

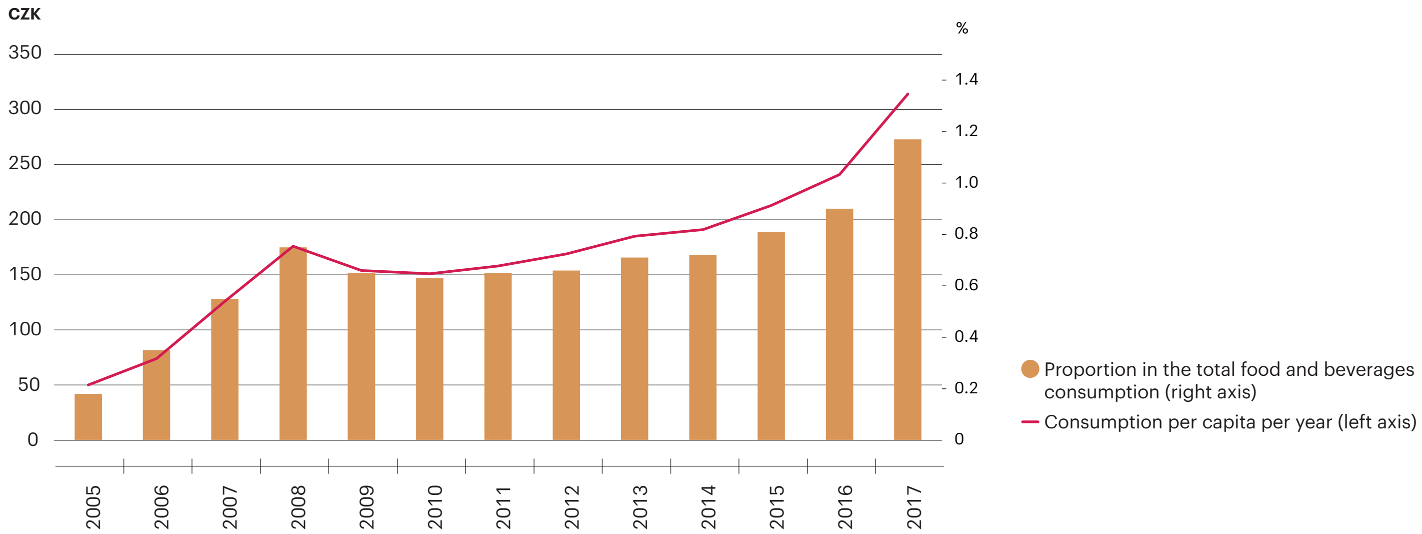
Number of organic farming entities in the Czech Republic [number], 2000–2018

The number of organic farms does not include their branches.

Data source: Ministry of Agriculture

Chart 4

Consumption of organic food in the Czech Republic [CZK, % of the total food and beverages consumption], 2005–2017

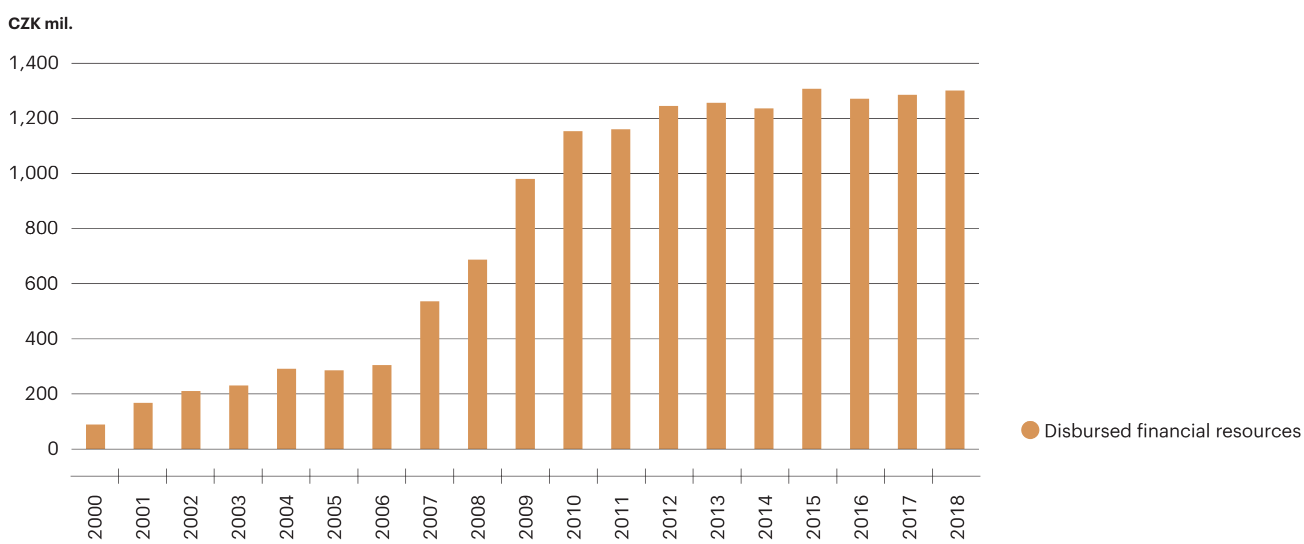


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Institute for Agricultural Economics and Information, Ministry of Agriculture

Chart 5

Financial resources disbursed within the "Organic Farming" agri-environmental measure in the Czech Republic [CZK mil.], 2000–2018



Data source: Ministry of Agriculture

Since 2000, the **area of organically farmed land** increased significantly from 165.7 thous. ha to 539.0 thous. ha in 2018. The growth was fast until 2011, but slowed down in the following years. The area of organically farmed land grew only by 3.6% (18.9 thous. ha) year-on-year. Although the area of organically farmed land is gradually increasing, the **proportion of organically farmed land** in the agricultural land resources is still low, in 2018 it was only 12.8%. Thus, the Czech Republic is still not close to meeting the target set in the Action Plan for the Development of Organic Farming for 2011–2015 (to reach 15% of the agricultural land resources). The objectives set for 2005 and 2010 by the National Action Plan for the Development of Organic Farming up to 2010 were achieved in those years. In 2015, organically farmed land made up only 11.8% of of the total agricultural land resources. The targets set out in the Action Plan for the Development of Organic Farming have been extended until 2020.

The biggest share in the **structure of organically farmed land** is held by permanent grassland, which in 2018 accounted for 80.8% (435.7 thous. ha), followed by arable land, which in 2018 occupied 15.1% (81.2 thous. ha), Chart 2. In comparison with 2017, the share of arable land in the total area of organically farmed land increased by 1.3 p.p. However, the target of achieving a 20% share of arable land set in the Action Plan for Organic Farming in 2016–2020 is still not being met. The rest of the organically farmed land area, i.e. 4.1% consists of permanent crops (vineyards, orchards, hop gardens) and other areas. Although permanent grasslands have an important function in the landscape and are used for organic livestock farming, it is necessary to increase the share of other categories in the future, especially arable land, mainly in order to increase organic food production and to ensure sustainable farming and use of agricultural land.

Since the year 2000, the **number of organic farms**, farming in accordance with the established principles of organic farming increased 8 times from 563 to 4,596 organic farms in 2018 (Chart 3). After the period of 2011–2014 when the number of organic farms stagnated due to the developments in the Rural Development Programme 2007–2013, their number started to grow again in 2015. In 2018, 197 more organic farms were registered than in 2017. The total number of organically reared animals in 2017[10] was 418.1 thous.[11], in which cattle farming dominated with 61.2% of the total number of organically reared animals.

The number of **producers of organic food** has been increasing in the long term. While in 2001 organic food was made by 75 producers, in 2018 it was already 748 producers. Despite the growing trend, that the Czech organic food market is still underdeveloped – the average annual consumption of organic food in 2017 reached CZK 314 per capita and the proportion of organic food in the total consumption of food and beverages was 1.2% (Chart 4). Apart from the still relatively high average price of organic food, the reason is in particular the insufficiently developed marketing and distribution networks ensuring the sales of organic products, and the underdeveloped processing industry for organic products. A large part of organic food is imported; in 2017, imports by distributors represented approximately 46% of turnover.

The significant development of organic farming is primarily due to **European and national support**, which, however, apart from the aid itself, also has its downsides such as increasing the dependence of organic farmers on subsidies, reducing their engagement in the economic efficiency of farming, etc.). Traditional support for agricultural entities farming in the organic farming regime is currently paid under the **Rural Development Programme 2014–2020**, measure M 11 Organic farming. The volume of funds paid out under the agri-environmental scheme "Organic farming" has been relatively stable in recent years and ranges around CZK 1.3 bil. (Chart 5). The Ministry of Agriculture also financially supports the training of organic farmers and organic food producers every year, the educational activities are implemented predominantly by non-governmental organisations.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[10] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
[11] The total number includes cattle, pigs, sheep, goats, poultry and horses.

Soil and agriculture in the global context

Key messages[12]

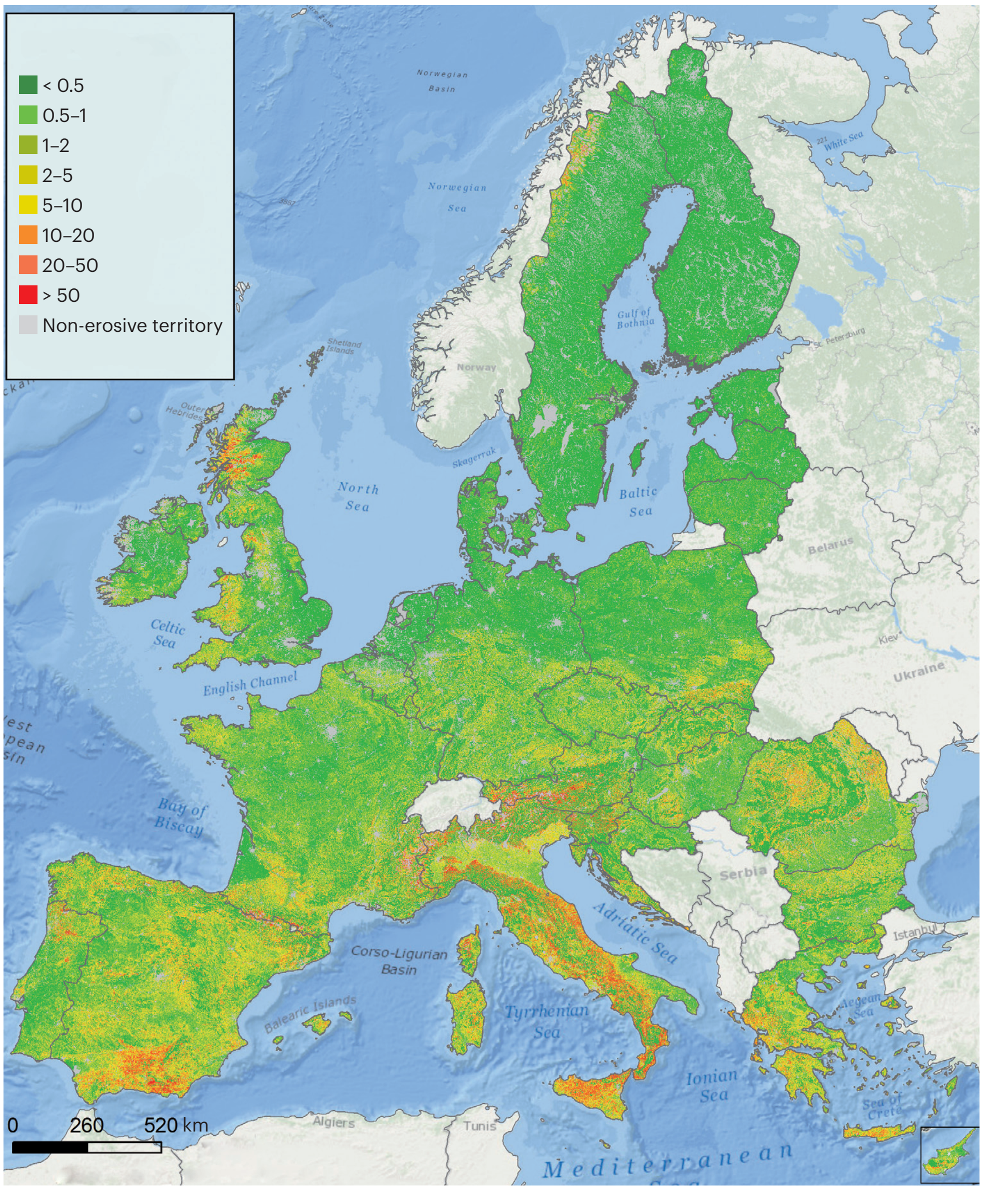
- Water erosion, according to the model data as of 2015, threatens 90.3% of the EU28 territory. The most vulnerable soils are exposed to loss exceeding 10 $t.ha^{-1}.year^{-1}$ especially in southern Europe. Wind erosion, which is estimated to threaten approximately 9.6% of EU28 territory, also represents a serious problem in many areas of Western Europe.
- The Czech Republic has a long-term high consumption of mineral fertilizers compared to the other EU28 countries. On the contrary, the consumption or sales of plant protection products in the Czech Republic are below average in the European context. Most products sold in the EU28 fall into the category of fungicides and bactericides. Malta and Cyprus show the highest sales per hectare.
- Organic farming in the EU28 and the Czech Republic has been developing positively in the long term. The total area of organically farmed land in the EU28 in 2017 was 12.6 mil. ha, which is 5.2% more than in 2016 and 25.0% more than in 2012. The largest share of agricultural land cultivated organically was reached in Austria (23.4%).

[12] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Figure 1

Water erosion of soil according to the RUSLE2015 model [$t.ha^{-1}.year^{-1}$], 2015

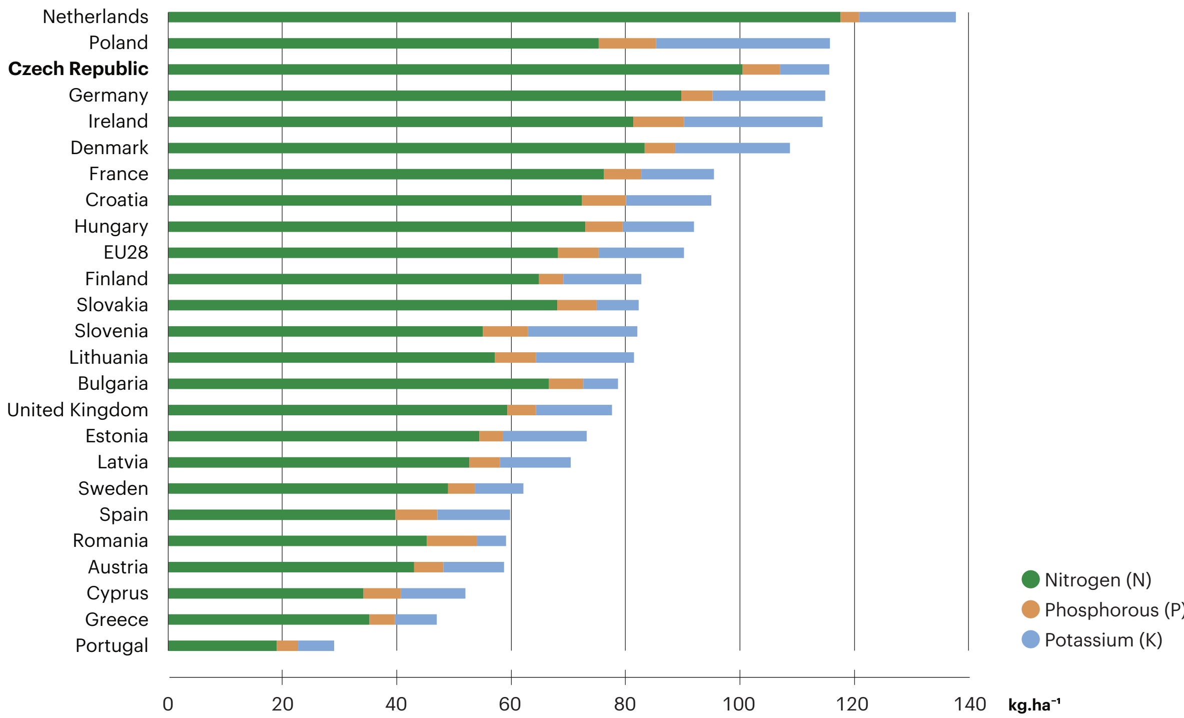


Soil erosion by water is determined by a calculation according to the RUSLE2015 model (Revised Universal Soil Loss Equation). The current model includes the slope length (L) and steepness (S) factor, the cover-management factor (C), the support practices factor (P), the rainfall-runoff erosivity factor (R) and the soil erodibility factor (K), which reflects the average precipitation characteristics. On the contrary, it does not include the impact of local precipitation extremes. The presented map therefore provides only an approximate view of soil erosion by water in Europe and specific sites cannot be evaluated in detail on its basis. Currently, data are being validated based on national data and expert assessments.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Joint Research Centre

Chart 1

Consumption of mineral fertilisers (N, P, K) [kg.ha^{-1} of farmed agricultural land], 2017

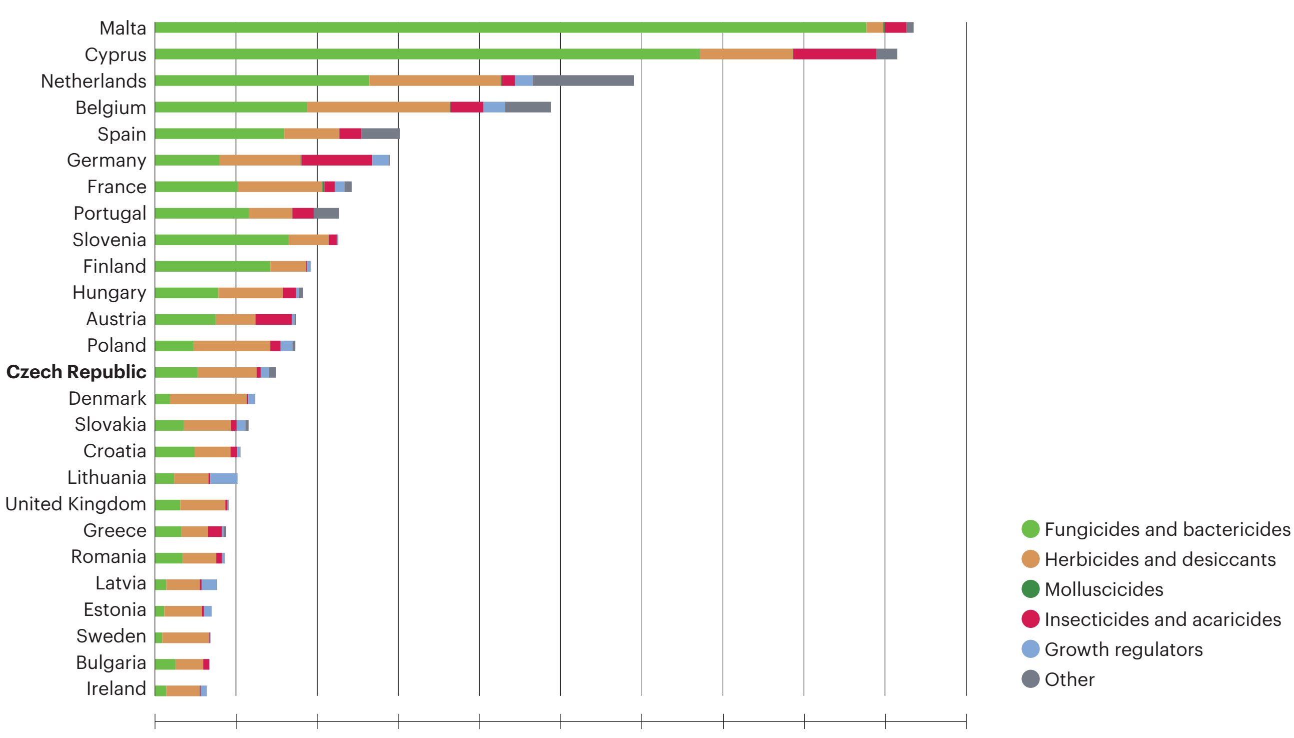


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 2

Quantity of active ingredient contained in plant protection products sold [kg.ha^{-1} of farmed agricultural land], 2017

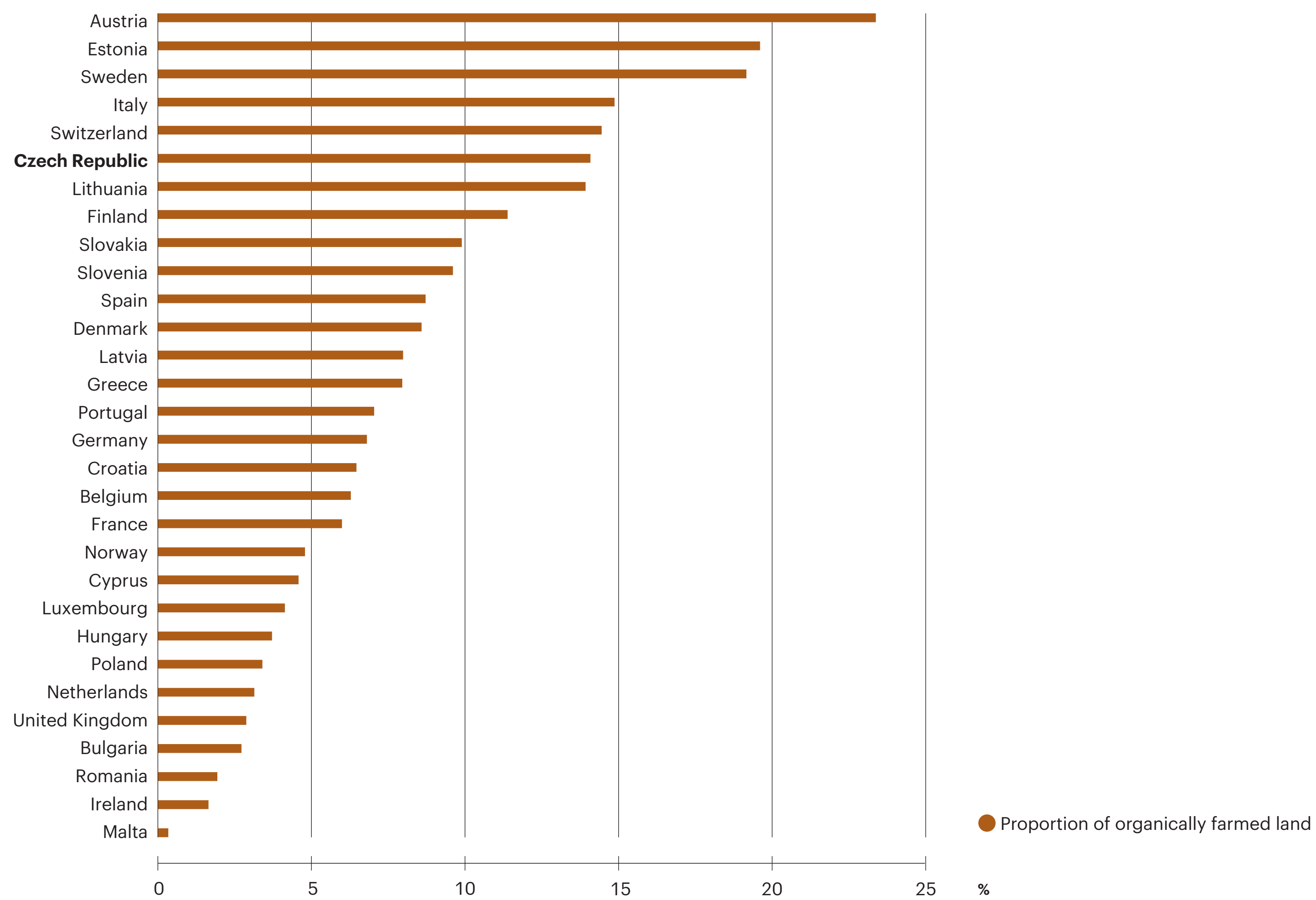


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 3

Proportion of organically farmed land in the total area of farmed agricultural land [%], 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

According to the latest available model data (Figure 1), 90.3% of the EU28 territory is at risk of **water erosion** (roughly 394.1 mil. ha out of the total area of 436.6 mil. ha). The most vulnerable soils are exposed to loss exceeding 10 $t.ha^{-1}.year^{-1}$ especially in the south of Europe. Losses in excess of 10 $t.ha^{-1}.year^{-1}$ contribute to the overall erosion in 50%. Moreover, in connection with climate change, an increase in the exposure of soil to water erosion due to increased extremities of rainfall and due to changes in land use is expected in the future. **Wind erosion** (especially in many areas of Denmark, eastern England, north-west France, northern Germany and the eastern Netherlands) also represents a serious problem which is estimated to threaten approximately 42 mil. ha of land (around 9.6% of the EU28 territory) of which 1 mil. ha of land is threatened seriously. In the case of wind erosion, an increase in erosion vulnerability due to more frequent occurrences of droughts are also expected. Although in the European context, the Czech Republic does not rank among the states most threatened by erosion, it has also areas that are heavily threatended by erosion. In overall assessment, it is necessary to take into account the uncertainties stemming from the inaccuracies in the input data of the model and the fact that there were no specific measurements of soil erosion, but erosion vulnerability given by the individual factors.

Conventional agricultural practices may represent a significant source of pollution for surface water and groundwater, due to the excessive application of mineral fertilisers to agricultural land and the use of plant protection products. The potential environmental burden caused by agriculture, especially in water pollution, is high in the Czech Republic. The reason is the high proportion of arable land in the total land resources and above average **consumption of mineral fertilisers** compared to the EU28 countries (Chart 1). When comparing the composition of sold fertilizers in the EU28, nitrogen fertilizers clearly prevail (68.2 $kg.ha^{-1}$ in 2017[13] in the EU28). The consumption of fertilizers and plant protection products in each State depends mainly on the crops being grown, temperature and rainfall conditions, farming methods and, in the case of plant protection products, the current occurrence of crop diseases and pests. Comprehensive international data on **plant protection products** are available for the quantity sold. Compared to other EU28 countries, the Czech Republic is below the European average in terms of the consumption of plant protection products (Chart 2). Most products sold in the EU28 belong to the category of fungicides and bactericides. The most sold products per hectare are reported in Malta and Cyprus, therefore the States with a very small acreage of cultivated agricultural land.

Organic farming in the EU28 has been developing in the long term. In 2017, organically farmed agricultural land accounted for 7.03% of the total cultivated land within the EU28. The total area of organically farmed land within the EU28 was 12.6 mil. ha, an increase of 5.2% compared to 2016, and an increase of 25.0% compared to 2012. In terms of the land use, the largest share is taken by arable land, within the EU28 it accounts for 44.5% (5.5 mil. ha) of the total area of organically farmed land, closely followed by permanent grasslands that accounted for 44.4%, and permanent crops 11.1%. However, this trend is not evident in the Czech Republic where permanent grasslands predominate (80.8%). With the share of 14.1%[14] of organically farmed agricultural land, the Czech Republic ranks among the leading EU28 countries. The highest share is reached in Austria, 23.4% (Chart 3). The number of organic farming producers in the EU28 in 2017 was 305,394, in the whole of Europe 397,509. Most of the producers are in Turkey (75,067), followed by Italy (66,773) and Spain (37,712).

[13] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

[14] *The value used is based on a comparison of Eurostat.*

7 Industry and energy

Industry and energy

The Czech Republic’s economy has a strong industrial base linked to the extraction of mineral resources, which represents a significant burden on the environment. Mining results in the grab of agricultural land, changes in groundwater levels, degradation of soil profiles, and pollution of surface and groundwater. In the vicinity of the mined deposits, dust and noise emissions often increase, not only due to the mining itself, but also as an impact of transporting large quantities of material. The negative consequences of industrial and energy production are also contaminated sites.

Industrial production is a source of noise, vibration, waste, thermal and light pollution as well as a number of pollutants that have not only a local impact but also a regional impact due to long-range transmission. This applies in particular to areas where industrial production is concentrated. The proven results of deteriorated air quality are: increased morbidity, allergies, asthma, respiratory and heart problems, cancer, reduced immunity etc.

Although energy production in the Czech Republic is gradually shifting to more environmentally friendly sources, it is still heavily dependent on coal, which leads to the production of pollutant emissions into the air and, in particular, the production of greenhouse gases. Due to the production of greenhouse gas emissions, consumption and the related energy production contribute to the deepening of the manifestations of climate change. This phenomenon is associated with a more frequent occurrence of hydrometeorological extremes – heat waves and episodes of drought, floods or extreme temperatures, and thus causes an overall disturbance of the environment.

The topic of household heating has been current for a long time. In the case of local combustion heaters, the choice of fuel and the way the boiler is operated are relevant for the environment. The choice of low-quality fuel and the often incomplete combustion of solid fuels produce a considerable amount of substances, especially particulate matter and polycyclic aromatic hydrocarbons, which have carcinogenic effects. Due to the low height of chimneys, the emitted pollutants from the local combustion heaters do not have enough time to be dispersed in the air, and thus reach the respiratory system of organisms in high concentrations.

References to current conceptual, strategic and legislative documents

Decision 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community’s greenhouse gas emission reduction commitments up to 2020
- reducing greenhouse gas emissions by at least 20% by 2020, compared to 1990

Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources
- setting the targets for the share of renewables in final energy consumption: to ensure 13% share of RES in gross domestic final consumption in 2020

Regulation of the European Parliament and of the Council (EU) 2017/1369, laying down the framework for energy labelling and repealing Directive 2010/30/EU
- marking energy-related products with labels, and providing information on energy consumption and energy efficiency of such products so that end users have the option to choose products with higher efficiency

European Parliament and Council Directive 2010/31/EU on energy performance of buildings
- decreasing the energy demand of buildings

Directive 2012/27/EC of the European Parliament and of the Council on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
- fulfilling the main objective of 20% energy efficiency by the year 2020 and further energy efficiency improvements beyond this date

- meeting the national indicative target established for the Czech Republic at 51.1 PJ (14.19 TWh) of new savings in final energy consumption by 2020

Action Plan for Energy Efficiency: Realising the Potential COM/2006/545
- framework of policies and measures designed to strengthen the utilisation of possibilities related to the estimated savings potential of 20% of the EU's annual primary energy consumption by 2020

European Parliament and Council Regulation (EC) 1907/2006, concerning the registration, evaluation, authorisation and restriction of chemicals, establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) 793/93, Commission Regulation (EC) 1488/94, Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC
- exclusion of substances with the worst impact on human health and the environment from circulation and replacing them with less harmful substances

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- reducing the environmental impact of the industry, in particular emissions of pollutants and greenhouse gases, reducing energy and material intensity of industry
- removing and preventing the consequences of mining activities and minerals extraction
- securing 13% proportion of energy from renewable sources in gross final energy consumption by the year 2020
- securing a 10% share of renewable energy in transportation by the year 2020
- ensuring commitment to energy efficiency by 2020 (for the EU as a whole it is 20%)
- limiting and controlling contamination and other degradation of soil and rocks caused by human activities
- remediation of contaminated sites, including old environmental burdens

Strategy on Adaptation to Climate Change in the Czech Republic 2015
- ensuring the functioning of critical infrastructure
- ensuring the safety of industrial installations

National Action Plan for Adaptation to Climate Change (2017)
- ensuring the safety of industrial installations in view of the expected impacts of climate change
- securing strategic reserves of the Czech Republic
- ensuring the possibility of island operation
- ensuring high resilience of the Czech transmission network, diversification of transport routes and source territories
- renewable energy sources resilient to the impacts of climate change

New Raw material policy in the area of minerals and mineral resources (2017)
- ensuring the necessary minerals for the Czech economy while enabling the necessary development of the raw material industry

State Energy Concept of the Czech Republic (2015)
- import dependence shall not exceed 65% by 2030 and 70% by 2040
- diversified mix of primary sources with the target structure in the corridors: nuclear fuel 25–33%, solid fuels 11–17%, gas fuels 18–25%, liquid fuels 14–17%, renewable and secondary sources 17–22%
- the target structure of electricity production by 2040 in the corridors: nuclear fuel 46–58%, brown and black coal 11–17%, natural gas 5–15%, renewable and secondary sources 18–25%
- net final energy consumption in 2020 will be 1,060 PJ (according to Eurostat methodology) or 1,020 PJ (according to IEA methodology)
- to ensure self-sufficiency in the production of electricity, with an increasing share of RES sources and secondary sources, the gradual replacement of nuclear energy production with coal-fired energy as a pillar of electricity production
- gradual decline in exports of electricity and maintaining the balance in the range of +/-10% of domestic consumption

Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants in the Czech Republic for the period 2018–2023
- protection of human health and the environment from the harmful effects of persistent organic pollutants (POPs), i.e. toxic substances capable of long-term persistence in the environment, transmission over long distances and accumulation in living organisms
- prioritization in dealing with old environmental burdens, improvement of the public database
- regulates production, use, import and export of the above-mentioned POPs

National Action Plan for Nuclear Energy Development in the Czech Republic (2015)
• nuclear safety regulation
• ensuring long-term sustainable infrastructure needed for the construction
• long-term safe operation of nuclear installations and their decommissioning
• disposal of nuclear waste of all categories

National Action Plan of the Czech Republic for Energy from Renewable Sources (2015)
• achieve a 15.3% share of energy from renewable sources in gross final consumption of energy in the year 2020
• achieve a 10.0% share of energy from renewable sources in gross final consumption in transport in the year 2020

Action Plan for Biomass in the Czech Republic for the period 2012–2020
• determining of the potential of various types of biomass in the Czech Republic for efficient energy use while respecting food self-sufficiency of the Czech Republic

Secondary Raw Materials Policy of the Czech Republic (2014)
• increasing self-sufficiency in raw material resources of the Czech Republic by substituting primary sources by secondary raw materials
• promoting innovation securing the extraction of raw materials in a quality suitable for further use in industry
• promoting the use of secondary raw materials as an instrument to reduce energy and material demands of the industrial production while eliminating of negative impacts on the environment and human health

5th National Energy Efficiency Action Plan (2017)
• the national target expressed in primary energy consumption was set at 1,855 PJ by 2020
• the national indicative target of final energy consumption in the Czech Republic is set at 1,060 PJ by 2020

Act No. 44/1988 Coll., on the protection and utilisation of mineral resources (Mining Act)
• obligation of the reclamation of the territories affected by mining and the creation of financial reserves for this reclamation
• protecting the deposit area
• economical utilisation of deposits

Act No. 201/2012 Coll., on air protection
• minimum emission requirements for combustion sources using solid fuels with a rated thermal input up to and including 300 kW, serving as a heat source for hot water central heating systems

Act No. 114/1992 Coll., on nature and landscape protection
• the demarcation and limitation of mining in specially protected areas

Act No. 406/2000 Coll., on energy management
• improving energy performance of buildings, certificate on the energy performance of buildings
• the obligation to provide buildings with energy performance certificates for buildings and energy-using products with energy labels

Operational Programme Environment 2014–2020
• improving energy performance of public buildings and increasing the use of renewable energy sources
• reducing emissions from domestic heating contributing to the population's exposure to excessive concentrations of pollutants
• reducing emissions from stationary sources contributing to the population's exposure to excessive concentrations of pollutants
• finalization of the inventory of old environmental burdens (the target value for the year 2023 is 10 thous. registered contaminated sites)
• on the basis of risk analysis results, remediating the most seriously contaminated sites (the target values for the year 2023 are 1.5 mil. m^3 of excavated or pumped contaminated material and 500 thous. m^2 of total remediated sites in the Czech Republic)

Operational Programme Enterprise and Innovation for Competitiveness 2014–2020
• ensuring efficient energy management
• development of energy infrastructure and renewable energy sources
• support for the introduction of new technologies in the management of energy and secondary raw materials

26 | Extraction of raw materials

Key question

What is the development of the extraction of mineral resources and how does mining affect the state of the environment?

Key messages

Mining in the Czech Republic fluctuates with a generally decreasing tendency and is mainly influenced by industrial production and construction.
The area affected by mining is decreasing, while the area of reclaimed areas is growing.

Overall assessment of the trend

Change since 1990

Change since 2000

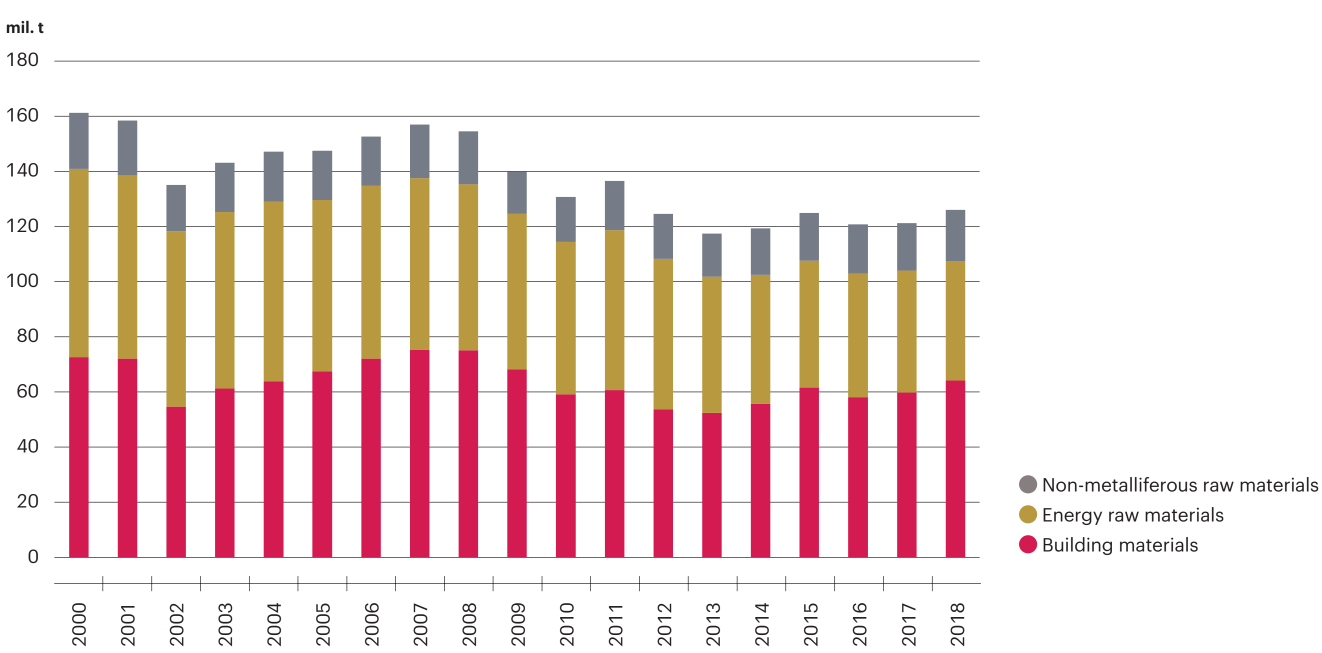
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

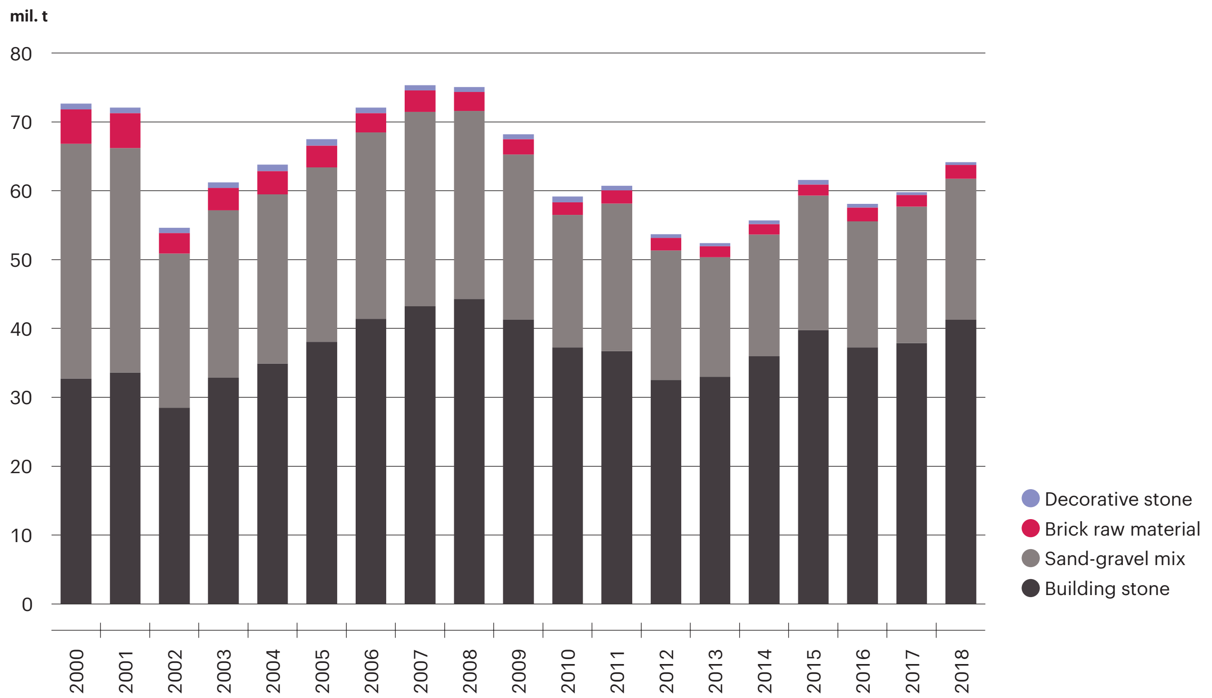
Extraction of mineral resources in the Czech Republic [mil. t], 2000–2018



Data source: Czech Geological Survey

Chart 2

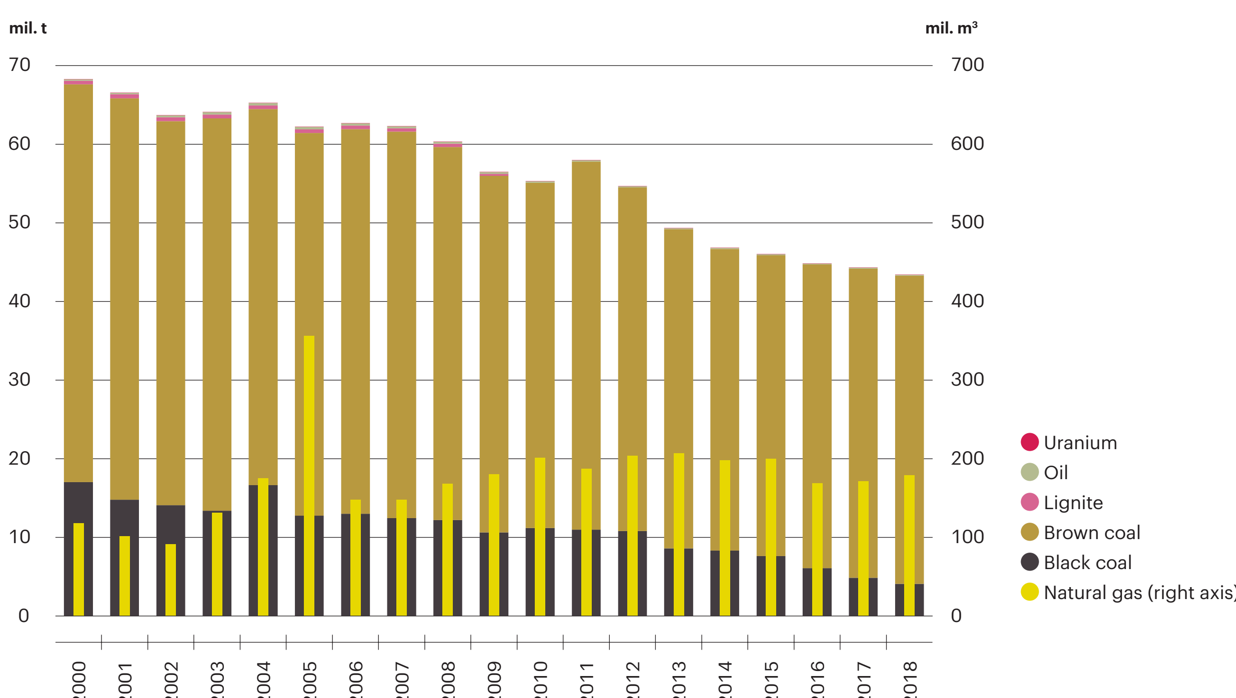
Mining of construction minerals in the Czech Republic [mil. t], 2000–2018



Data source: Czech Geological Survey

Chart 3

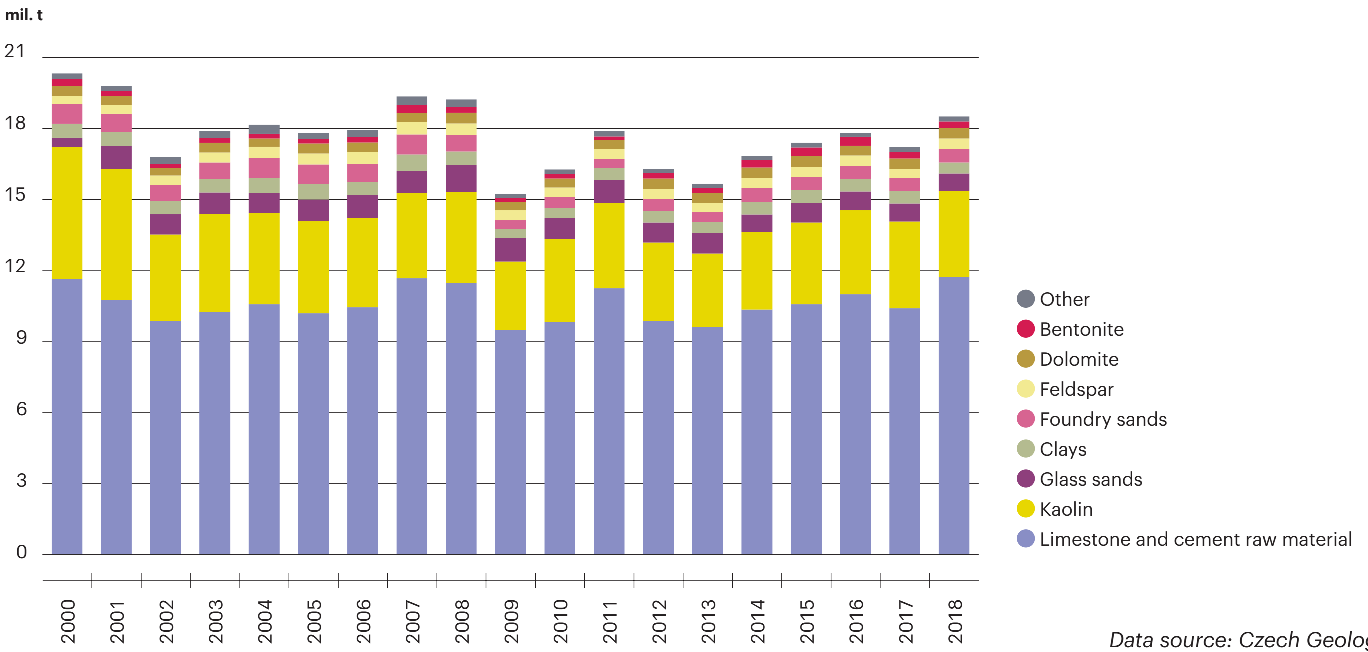
Extraction of energy raw materials in the Czech Republic [mil. t, mil. m³], 2000–2018



Data source: Czech Geological Survey

Chart 4

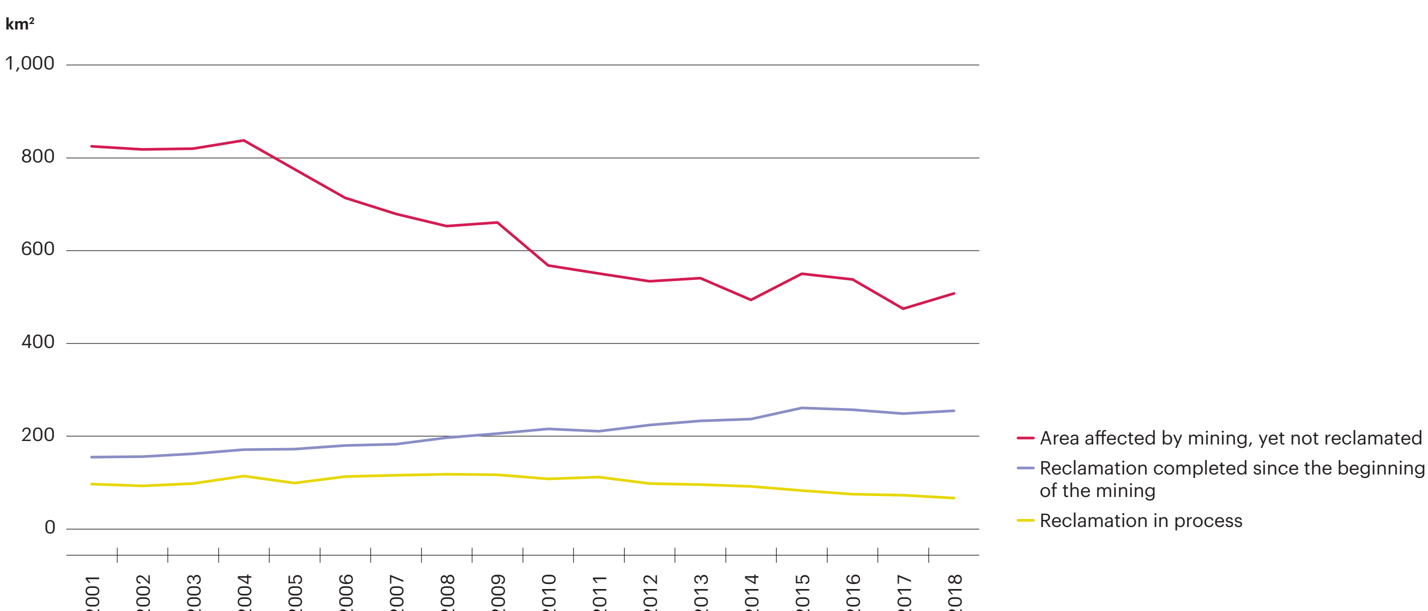
Mining of non-metallic minerals in the Czech Republic [mil. t], 2000–2018



Data source: Czech Geological Survey

Chart 5

Advancement of reclamation after mineral extraction in the Czech Republic [km²], 2001–2018



Data source: Czech Geological Survey

The **mining of raw materials** in the Czech Republic has a long tradition dating back to the Middle Ages and predetermines the industrial focus of the country, as industrial production is directly linked to the extraction of raw materials. All mining can be divided into four basic groups: energy raw materials, construction minerals, non-metallic minerals and metallic minerals. In the Czech Republic, the construction and energy raw materials are mined in the largest volumes, and non-ore raw materials in smaller volumes (Chart 1). Ores are no longer mined in the Czech Republic; their extraction was terminated for economic reasons in the 1990s. These were the iron ore and non-ferrous metal ores.

The mined **construction minerals** include mainly building stone and gravel (Chart 2). In 2018, the volume of mining and quarrying of construction minerals amounted to 64.1 mil. t, which represents a year-on-year increase of 7.3%, but compared to 2000 it is 11.7% less. Mining of construction minerals is closely related to the construction industry and the performance of the national economy, so the intensity of mining corresponds to the intensity of construction production.

Out of **energy raw materials** (Chart 3), mainly coal is mined in the Czech Republic. Brown coal is extracted from the surface in the Czech Republic, in the North Bohemian and Sokolov basins. Black coal is currently extracted in the Czech Republic in the Upper Silesian coal basin by excavation. The mining of brown and black coal covers their consumption in the Czech Republic. The amount of extracted energy raw materials gradually decreased in the reporting period 2000–2018, except for natural gas. The mining of brown coal decreased in that period by 22.6%, between 2017 and 2018 it decreased by 0.3% to 39.2 mil. t. The mining of black coal decreased since 2000 by 75.9%, year-on-year by 15.6% to 4.1 mil. t. The mining of lignite in 2000 amounted to 453 thous. t, however, its production declined gradually, and since 2010 this material has not been extracted in the Czech Republic.

After closing the last **uranium** mine in Rožná in 2016, uranium is obtained only as a by-product of treating underground and mine waters as part of the clean-up works and reclamation after mining, in particular in the deposits in Příbram and Stráž pod Ralskem. The extracted uranium must be processed into nuclear fuel before use, but this is not done in the Czech Republic. Therefore, the Czech Republic is dependent on imports of nuclear fuel from abroad, despite its own uranium reserves. Mining of uranium between 2000 and 2018 decreased from 498 t to 34 t (decrease by 93.2%), the year-to-year decrease in 2018 was 39.3%.

Natural gas is extracted in the Czech Republic in south and north Moravia, its extraction only covers approximately 3% of domestic consumption. In 2018, 179 mil. m^3 of natural gas were extracted in the Czech Republic, which is 51.7% more than in 2000 and 4.7% more than in 2017.

The **crude oil** is extracted in the Czech Republic in Southern Moravia in the Vienna basin, and on a smaller scale in the Moravian-Silesian region in the deposit area of the Carpathian Foredeep. Oil production in the Czech Republic makes approximately 2% of domestic consumption. In the period 2000–2018, the oil production dropped by 35.1%, between 2017 and 2018 increased by 1.9% to 109 thous. t.

The **non-ore minerals** that are mined in the Czech Republic include mainly **limestone and cement raw materials**, which are used in construction. Their production fluctuates year-on-year; in 2018, 11,727 thous. t were mined, which represents a year-on-year increase by 12.8%. **Kaolin** is another important raw material, even on a global scale. Karlovy Vary kaolin even sets the international standard for the quality of this mineral in industrial use (porcelain production). In the global kaolin extraction, the Czech Republic holds the 4th rank, its share in the world production is approximately 9.5%. In 2018, the extraction of kaolin in the Czech Republic amounted to 3.6 mil. t.

The mining of **non-ore raw materials** fluctuated in the period 2000–2018, its development reflected the gradual reduction of the material intensity of industrial production and the decline in industrial production after 2008. With the economic revival and development of industrial production, there has been a noticeable growth in extraction of these raw materials since 2014. The extraction of non-ore raw materials increased year-on-year (2017–2018) by 7.5%, but compared to 2000 this represents a decrease by 8.9% (Chart 4).

However, the extraction has a significant **impact on the environment** as it disrupts the landscape character, changes the natural habitats of plants and animals and deteriorates the quality surface water and groundwater. It is therefore important to minimize such negative impacts. Act No. 44/1988 Coll., on the protection and utilisation of mineral wealth (the Mining Act) requires the mining companies to reclaim the territory affected by extraction and to create financial reserves for such reclamation. The area affected by mining has been gradually decreasing since 2001 and, on the contrary, the amount of reclaimed areas is increasing (Chart 5). In 2018, there were 508 km^2 of not yet reclaimed areas in the Czech Republic (in 2001 they occupied 825 km^2). In 2018, by contrast, there were 255 km^2 of reclaimed areas (in 2001 only 155 km^2).

After the mining is terminated, the new arrangement of natural conditions and relationships in its space is not immediately apparent. Where there has been a reclamation by way of natural succession, ecosystems are developed, which are subsequently often declared as specially protected areas of nature and also as Natura 2000 sites. A positive effect on the environment also comes from the hydric reclamation of the mining area, which retains water in the landscape, creating sources of drinking water or welcomed landscape forming elements to which wetland habitats are connected.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

27 | Industrial production

Key question

What is the environmental impact of industrial production development and of its structural changes?

Key messages

In 2018, the industrial production index increased by 3.0% year-on-year.
Emissions of the monitored substances from industry have been declining for a long time.
The energy intensity of industry decreases.

Overall assessment of the trend

Change since 1990

Change since 2000

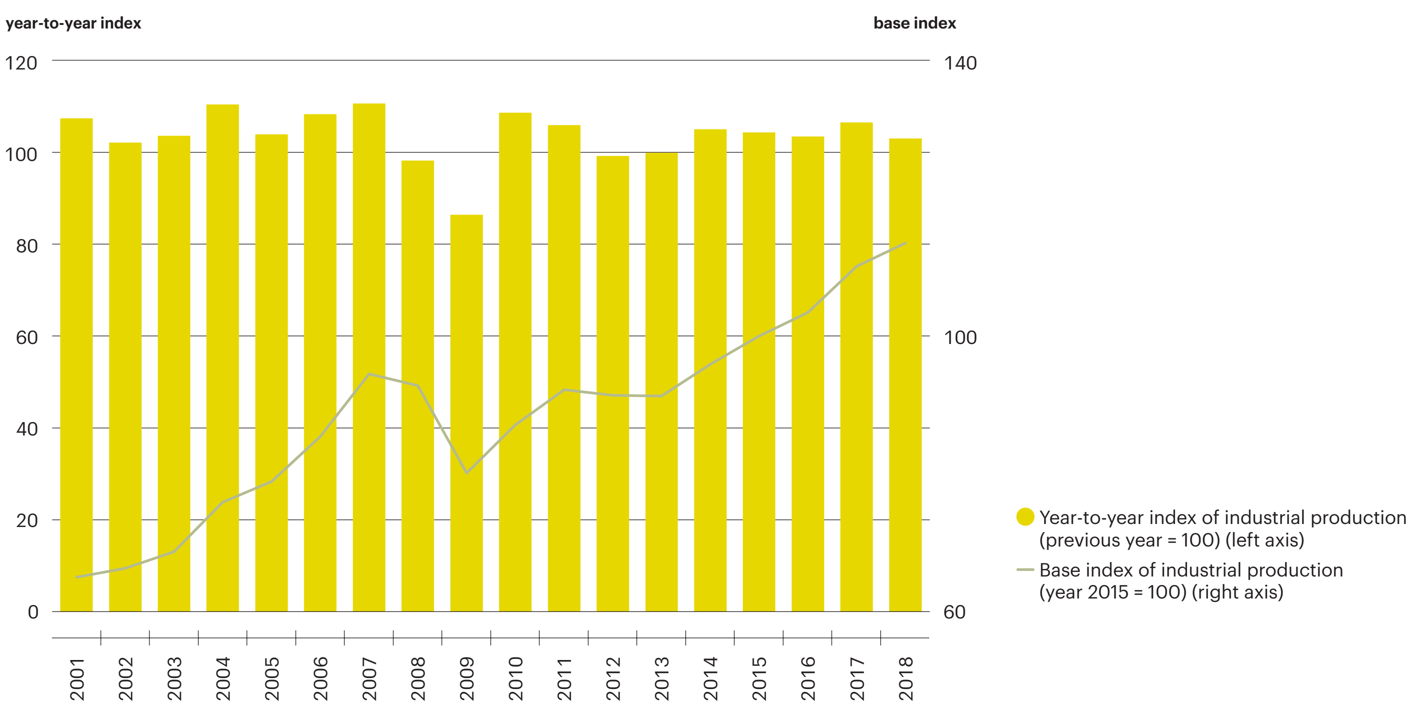
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

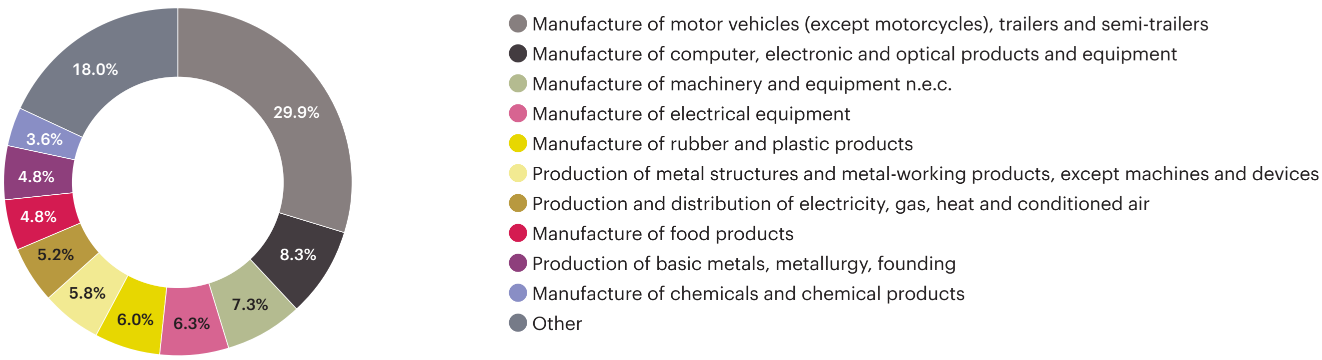
Year-on-year and basic industrial production index in the Czech Republic [index, previous year = 100, 2015 = 100], 2001–2018



Data source: Czech Statistical Office

Chart 2

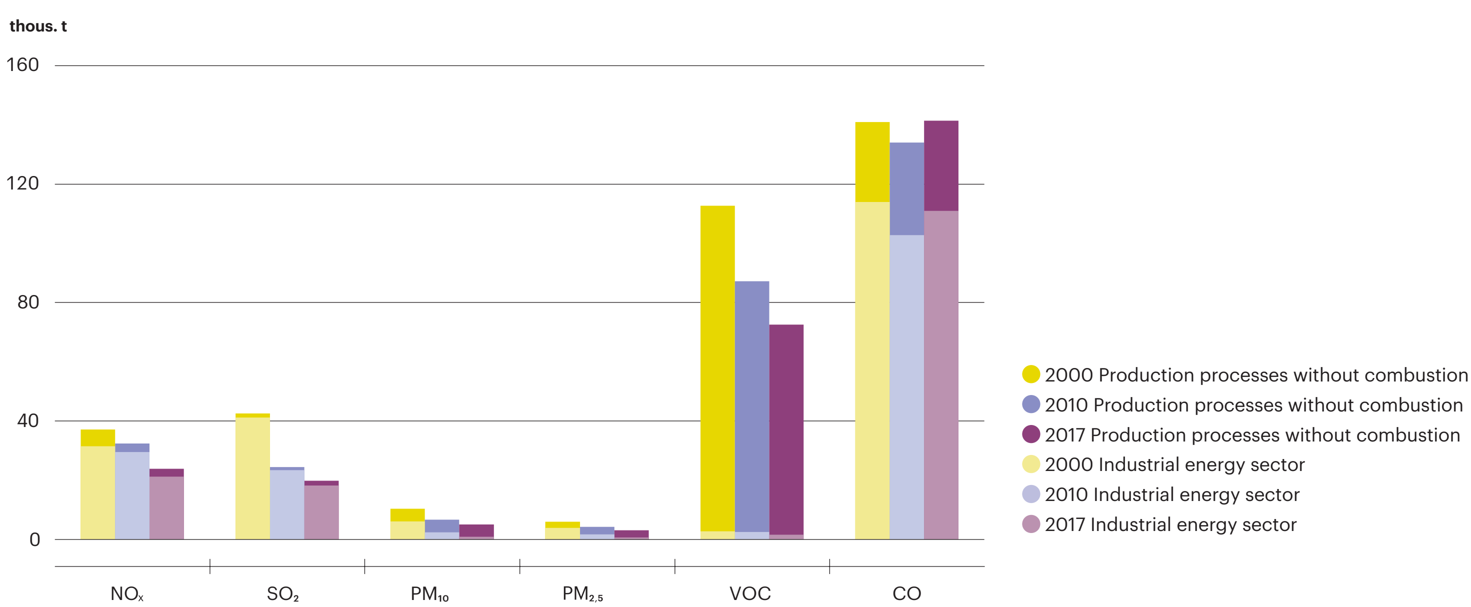
Structure of industrial production in the Czech Republic [%], 2018



Data source: Czech Statistical Office, Ministry of Industry and Trade

Chart 3

Pollutant emissions from industry in the Czech Republic [thous. t], 2000, 2010, 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication. The data are valid as of 10. 05. 2019.

Data source: Czech Hydrometeorological Institute

The Czech Republic has been historically characterized by its **industrial focus**, as it has significant mineral resources in its territory. Industry is an important part of the Czech economy, accounting for approximately 30% of GDP. However, this sector also represents a significant environmental burden because industrial production generates a wide range of pollutant emissions and waste products while consuming a significant amount of non-renewable natural resources and energy resources. Industry has a notable environmental impact especially in the localities where the large industrial enterprises are concentrated (Moravian-Silesian Region, Ústí nad Labem Region, Central Bohemian Region).

Industrial production continued to grow in 2018 (Chart 1), with the year-to-year industrial production index reaching 103.0%. A decisive factor in the economic growth was domestic demand; the higher consumption was associated with growth in employment and wages.

The decisive branch of the **manufacturing industry** is the manufacture of motor vehicles (Chart 2), which generated 29.9% of sales. Other important industrial sectors include the manufacture of computer, electronic and optical products and equipment (8.3%), manufacture of machinery and equipment (7.3%), or manufacture of electrical equipment (6.3%).

The **emissions from the industrial sector** (Chart 3) can be divided into two groups – emissions from industrial energy (production processes involving fuel combustion) and emissions from industrial processes (production processes without fuel combustion). The emissions from industrial energy include in particular NO_x and SO_2 from fuel combustion, as well as CO emissions from iron and steel production. The second group, industrial production processes without combustion of fuel, is highly specific depending on the type of production. These sources emit a wide range of emissions that affect the environment in different ways. That group includes the category of solvents which are a significant source of VOC emissions.

Emissions of main monitored substances from industry have been declining for a long time (Chart 3), both from industrial power generation and from combustion manufacturing processes. An exception is CO which fluctuates according to the current production in iron and steel mills,where most of emissions of this gas are generated. In 2017[1], SO_2 emissions decreased Year-on-year by 11.1%, CO by 5.2%, VOC by 1.4% and NO_x emissions by 0.7%. On the contrary, $PM_{2.5}$ emissions grew slightly by 1.8% and PM_{10} by 1.7%. As the industrial production grew by a significant 6.5% year-on-year in 2017, this trend in emissions from industry is positive.

The **energy intensity of industry** in 2010–2017[2] decreased with slight fluctuations. While in 2010 the energy intensity of the industrial sector was 269.6 MJ.thous. CZK^{-1}, in 2017 it amounted to only 215.6 MJ.thous. CZK^{-1}, which means a decline by 20.1%. Year-on-year, the energy intensity of the industry in 2017 went down by 1.6%. This trend was favourable for the environment, because lower energy consumption in production means a lower burden for the environment.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[1] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

[2] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

28 | Final energy consumption

Key question

Is the final energy consumption in the Czech Republic, and thus the burden on the environment from the production of energy, decreasing?

Key messages[3]

Since 2015, the total energy consumption has grown every year. In 2017, consumption amounted to 1,028.1 PJ. The target of the State Energy Concept not to exceed the value of 1,060 PJ of final energy consumption by 2020 (calculated according to the methodology Europe 2020–2030) was exceeded in 2017 as 1,067.0 PJ were consumed.

Households, transport and industry account for the largest share of energy consumption. Energy consumption in industry is steadily decreasing, while in the transport sector it is increasing.

Overall assessment of the trend

Change since 1990

Change since 2000

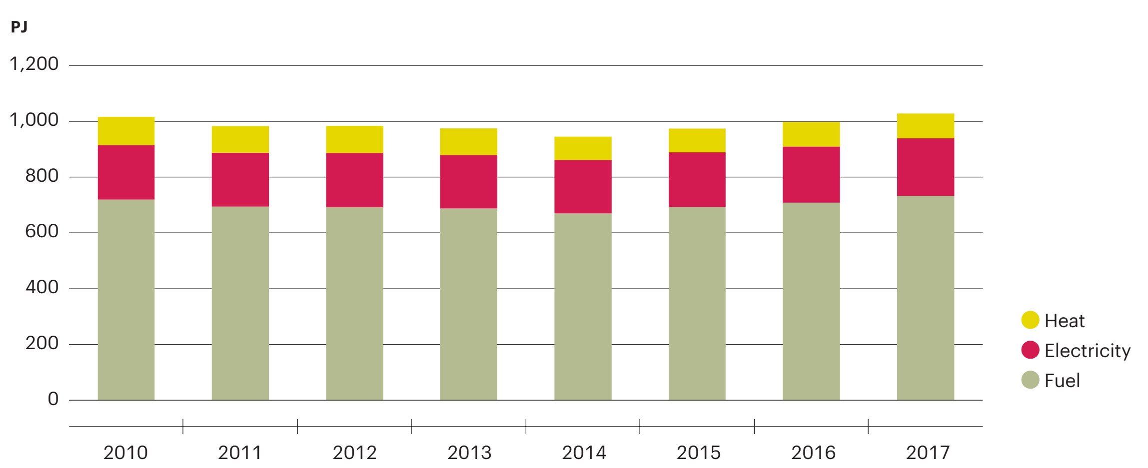
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Development of final energy consumption by source in the Czech Republic [PJ], 2010–2017



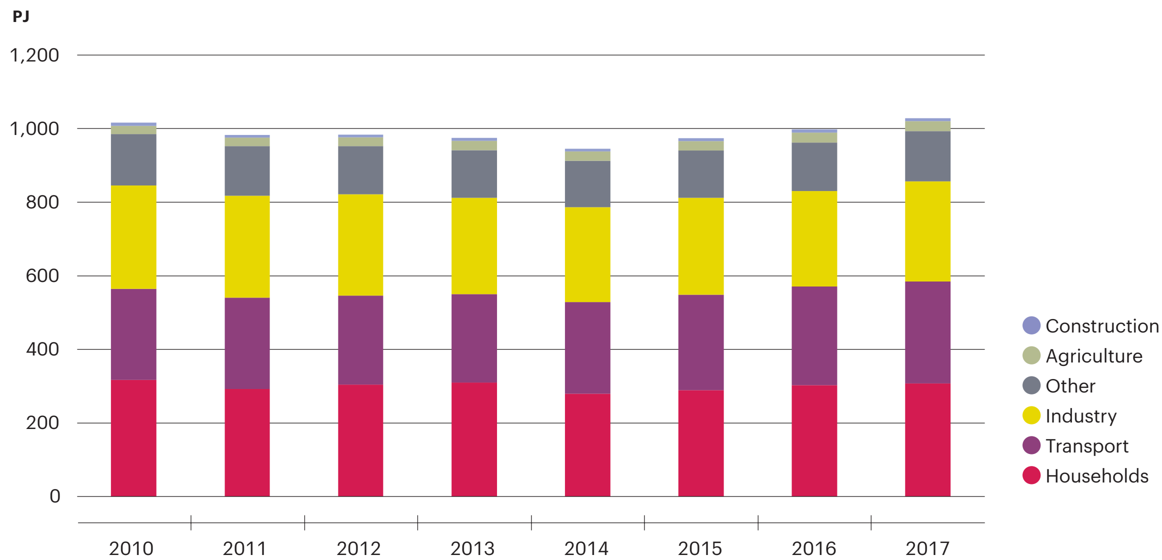
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Industry and Trade

[3] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Development of final energy consumption by sector in the Czech Republic [PJ], 2010–2017

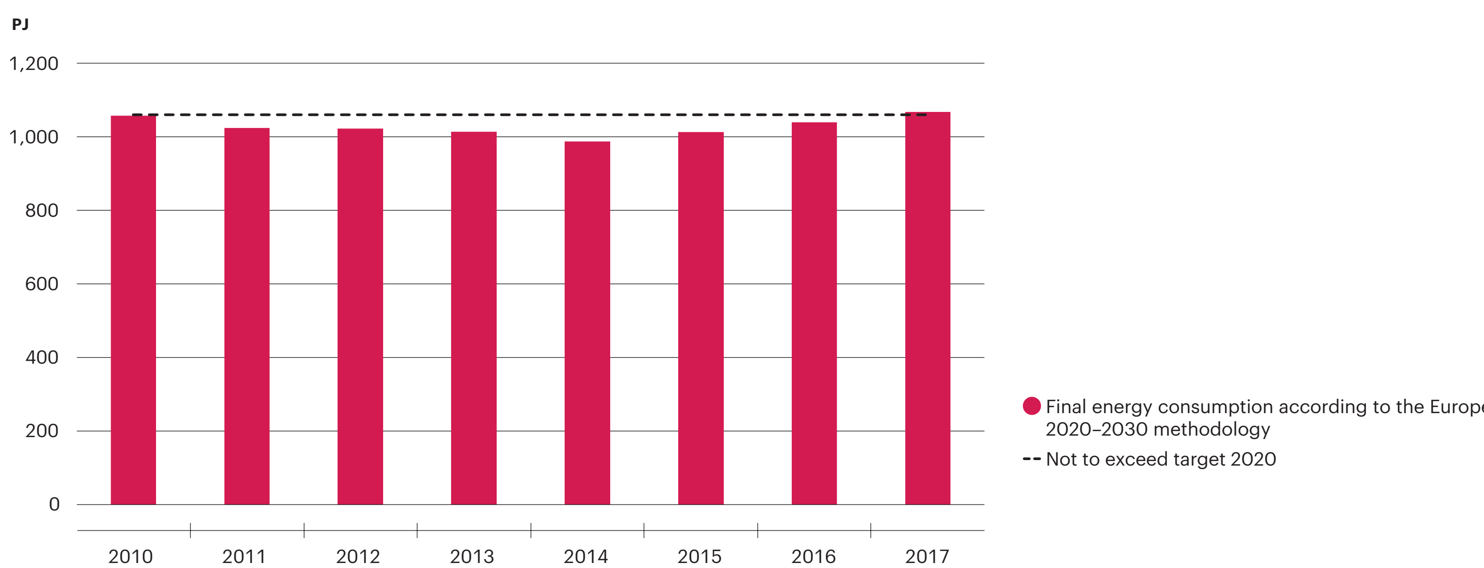


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Industry and Trade

Chart 3

Final energy consumption in the Czech Republic according to the Europe 2020–2030 methodology and its target, 2010–2017



Data source: Ministry of Industry and Trade

Energy consumption reflects the state of the national economy, it responds to the situation in industry, transport and other sectors. **Final energy consumption** developed in the period 2010–2017[4] in two opposite trends. Until 2014, it declined slightly or stagnated year-on-year, which was a consequence of the waning economic crisis and also of efforts to make energy and economic savings. In 2015, however, there was a turnaround and the consumption started to grow every year by several percent. In 2017, final energy consumption grew by 3.1% year-on-year to 1,028.1 PJ.

The highest share of consumption in the Czech Republic's energy balance (Chart 1) is held by **fuels** (71.2% in 2017). This category includes fuel for industrial production, fuel for transportation and home heating fuel. It also includes renewable sources and energy recovered from waste. Less **electricity** is consumed (20.1% in 2017) in heavy industry, services and households. The lowest share of energy consumption is in the form of **heat** (8.7%). Most of the heat is consumed for heating households as a system of thermal energy supply, but is also used in industry for heating in manufacturing and in services.

In each sector of activity, energy consumption is influenced by many factors; in terms of sectors, the largest consumers are households, transport and industry (Chart 2). Households, where consumption reached 307.4 PJ in 2017, account for 29.9% of total consumption. Developments in household energy consumption are significantly affected by the character of the heating seasons, because heating consumes the majority of the overall energy consumed in households. The curve of their energy consumption copies the character of the heating season in that year. This was also reflected in 2017, when the heating season was colder compared to the previous year and energy consumption in households rose by 1.7% year-on-year.

Energy consumption in transport has been steadily growing since 2014, mainly due to growth in motorised private transport and also in air transport. In 2017, the share of energy consumption in this sector was 26.9%. This represents a year-on-year increase of 3.1% to 277.0 PJ. The main consumer of energy in transport was road transport (93.3% in 2017), the share of motorised private transport in 2017 was 56.2% and road freight transport 27.1%.

In 2017, **industry** consumed 272.1 PJ of energy, it ranks third with its share of 26.5%. The character of industrial production in the Czech Republic is energy intensive, but in this sector, as the only sector, energy consumption is permanently decreasing due to legislative and economic pressures on operators of industrial facilities. The year-on-year decline in energy consumption in industry was 4.8% in 2017.

Energy consumption in **agriculture** in 2017 was 26.9 PJ. The category **Other** includes services, schools, health care, public administration and other fields of activity. In those sectors, energy consumption is the result of the balancing of conflicting interests: on the one hand, it is the quest for efficient use of energy, but the increasing demands for comfort work against the reduction of consumption. Higher energy consumption is caused mainly by the installation of air conditioning and the trend of increased use of information and communications technologies. On the contrary, the factors leading to reducing the energy intensity of services include thermal insulation of buildings and the installation of more efficient equipment for heating, air conditioning and lighting.

Final energy consumption is subject to a national indicative target resulting from a common European framework for the promotion of energy efficiency. The EU has set itself a target that by 2020 its energy consumption will be 20% lower compared to the 2007 energy consumption reference scenario. The level of the national indicative energy efficiency target for the Czech Republic is set at 1,060 PJ. In order to compare the achievement of that target, the final energy consumption is calculated according to the Europe 2020–2030 methodology which is decisive for these purposes, and its value therefore does not correspond to the above-mentioned values from the energy balance of the Czech Republic. According to that methodology, the final energy consumption in the Czech Republic in 2017 was 1,067.0 PJ and the set target was thus slightly exceeded (Chart 3).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[4] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

29 | Fuel consumption in households

Key question

What progress has been made in reducing the negative impacts of local heating units on air quality and public health?

Key messages[5]

14.9% of households were heating with solid fuels in 2017, and their share decreases only very slowly.

Household heating accounted for 59.1% of total PM_{10} emissions in 2017 and for 98.3% of B(a)P.

Overall assessment of the trend

Change since 1990

Change since 2000

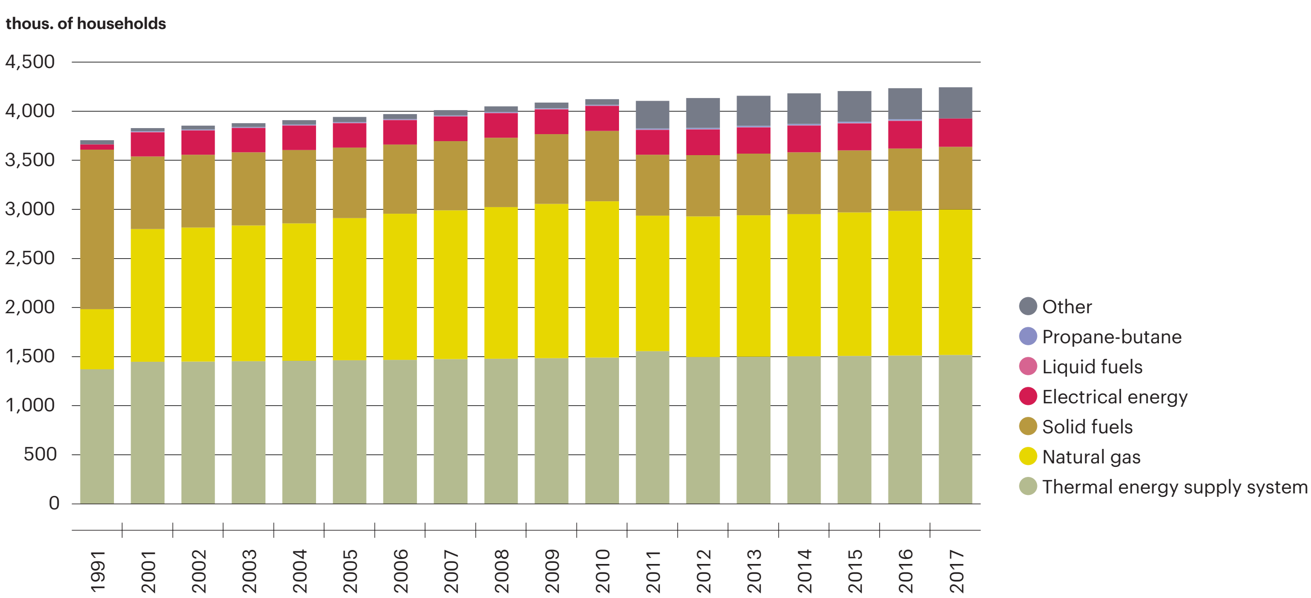
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Prevailing heating methods used in permanently inhabited households in the Czech Republic [thous. of households], 1991, 2001–2017



Data from the population and housing censuses in 1991, 2001 and 2011 have been included in the calculation.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

[5] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

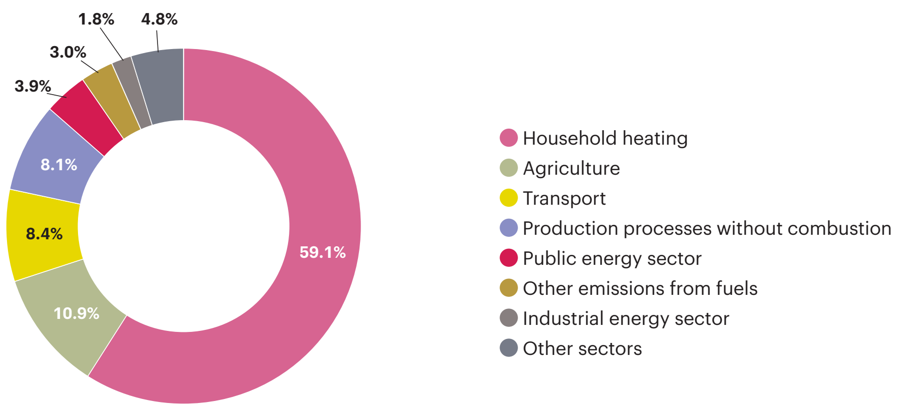
Characteristics of the heating season in the Czech Republic [number of day-degrees], 2000–2017

Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Hydrometeorological Institute

Chart 3

PM_{10} emissions from the different economic sectors in the Czech Republic [%], 2017

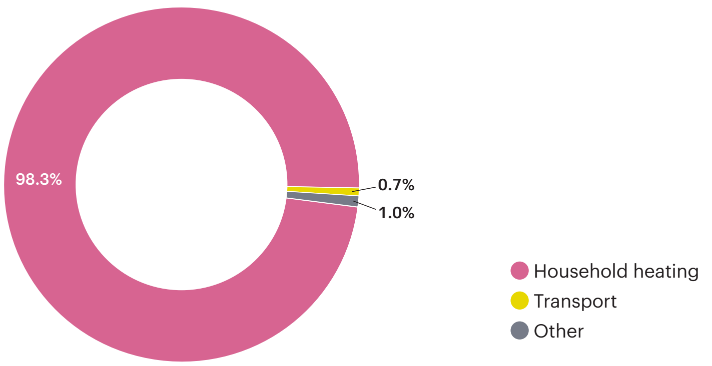


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
The data are valid as of 09.05.2019.

Data source: Czech Hydrometeorological Institute

Chart 4

B(a)P emissions from the different economic sectors in the Czech Republic [%], 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
The data are valid as of 09.05.2019.

Data source: Czech Hydrometeorological Institute

Fuel consumption in households is influenced by many factors. The heating intensity of buildings is fundamentally influenced by the current meteorological conditions, but also by the individual needs of their inhabitants. The feeling of thermal comfort or the need for ventilation are quite subjective perceptions, but they significantly affect the consumption of heat. Another factor is the permanent growth of energy prices and as that the vast majority of energy in homes is consumed for heating and hot water, the households gradually replace their appliances with more economical ones. In addition, the thermal insulation of houses and apartments continues. The method of heating also has a significant impact on the environment. The choice of fuel type and boiler type, especially in individual heating, greatly influences the emissions and subsequently the state of the atmosphere. The type of fuel used for the heating of households is driven particularly by its availability, price, and practices used by individuals.

The structure of household heating has changed only slowly since 2001 (Chart 1). In 2017, the largest use was made of the **system of heat supply** (35.6% of households) and **natural gas** (34.8% of households). 14.9% of households were heating with **solid fuels**, and their share decreases only very slowly (in 2001, that share was 19.3%). The category of solid fuels includes mainly coal and wood. However, their exact proportion cannot be specified because households with a boiler that can burn multiple types of fuel often burn wood and coal together and their proportion depends upon their current availability and price. The predominant type of heating then cannot be precisely quantified.

Meteorological conditions are a crucial determinant of the heating intensity and consequently of the amount of emissions from households. In 2017, the heating season[6] was colder than in the previous year 2016, which caused higher demands on fuel consumption and the amount of heat produced. That development also reflected in the production of pollutant emissions. Household heating generates significant emissions of suspended particulate matter – PM_{10} and benzo(a)pyrene – B(a)P. PM_{10} emissions increased by 3.2% year-on-year in 2017 and B(a)P by 1.7%. Emissions from households amounted to 30.3 thous. t of PM_{10} and 16.0 t of B(a)P.

The share of households in total PM_{10} and B(a)P emissions is substantial. In the case of PM_{10}, households accounted for 59.1% of the total emissions of this substance in 2017 and for even 98.3% of B(a)P. This is why household heating and fuels related to this heating are given great attention including subsidy programmes, as there is potential for further reductions in emissions of those substances.

By the end of 2018, the New Green Savings subsidy programme for family houses, apartment buildings and public sector buildings received in total 39,371 grant applications, and 24,566 applications were reimbursed with around CZK 4.8 bil. During 2018, a total of 9,309 new applications for approximately CZK 3.5 bil. were submitted, and 7,689 applications for approximately CZK 1.8 bil. were paid.

Another subsidy programme, the Boiler Subsidies, was announced under the Operational Programme Environment. Owners of family houses can apply for a financial contribution for the replacement of old, inefficient solid fuel boilers. The aim of the programme is to reduce pollutant emissions into the air from local combustion heaters by replacing at least 85,000 old boilers. As of 31 December 2018, a total of 34,316 boilers were replaced.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[6] The heating season is characterized by the unit day-degree, which is the product of the number of heating days and the average difference between indoor and outdoor temperature. The day-degree thus illustrates how cold or warm it was during a certain period of time and the quantity of energy needed to heat the buildings.

30 | Energy intensity of the economy

Key question

Are the efforts to reduce energy intensity of the Czech Republic economy successful?

Key messages[7]

The energy intensity of the economy has been gradually decreasing, since 2010 it declined by 17.7%. It decreased by 0.1% year-on-year.

The structure of primary energy sources is dominated by the consumption of solid fuels.
The transportation, agriculture and industry sectors represent the most significant proportion in the economy energy intensity by sectors.
The goals of the State Energy Concept for 2040 on the structure of the energy mix have not yet been met; the solid and liquid fuels have a higher share in the current energy mix than the other sources.

Overall assessment of the trend

Change since 1990

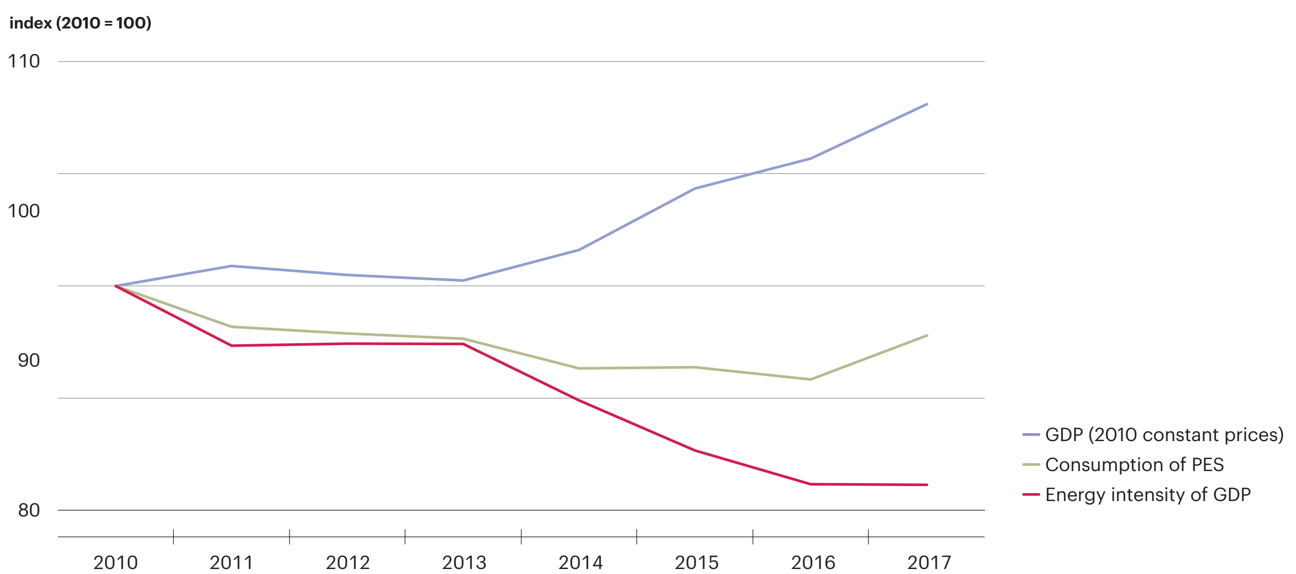
Change since 2000

Change since 2010

Last year-on-year change

Chart 1

Energy intensity of GDP in the Czech Republic [index, 2010 = 100], 2010–2017



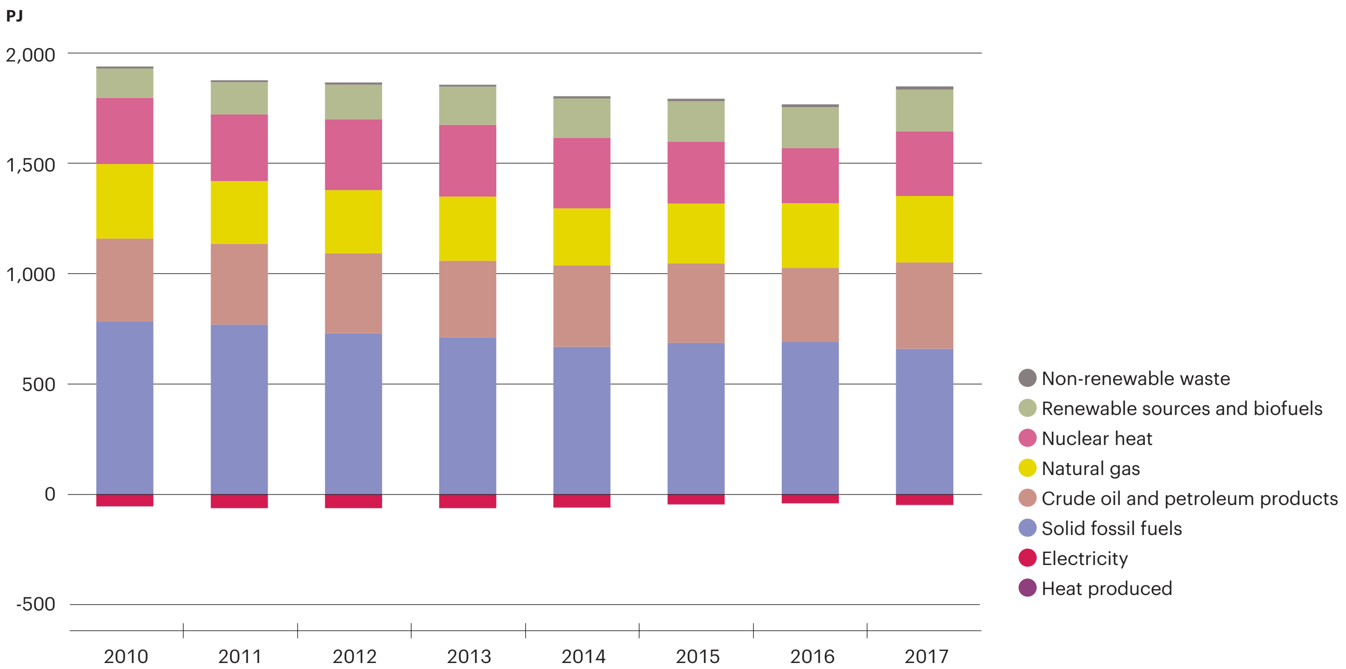
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office, Ministry of Industry and Trade

[7] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Trend in the consumption of primary energy sources in the Czech Republic [PJ], 2010–2017

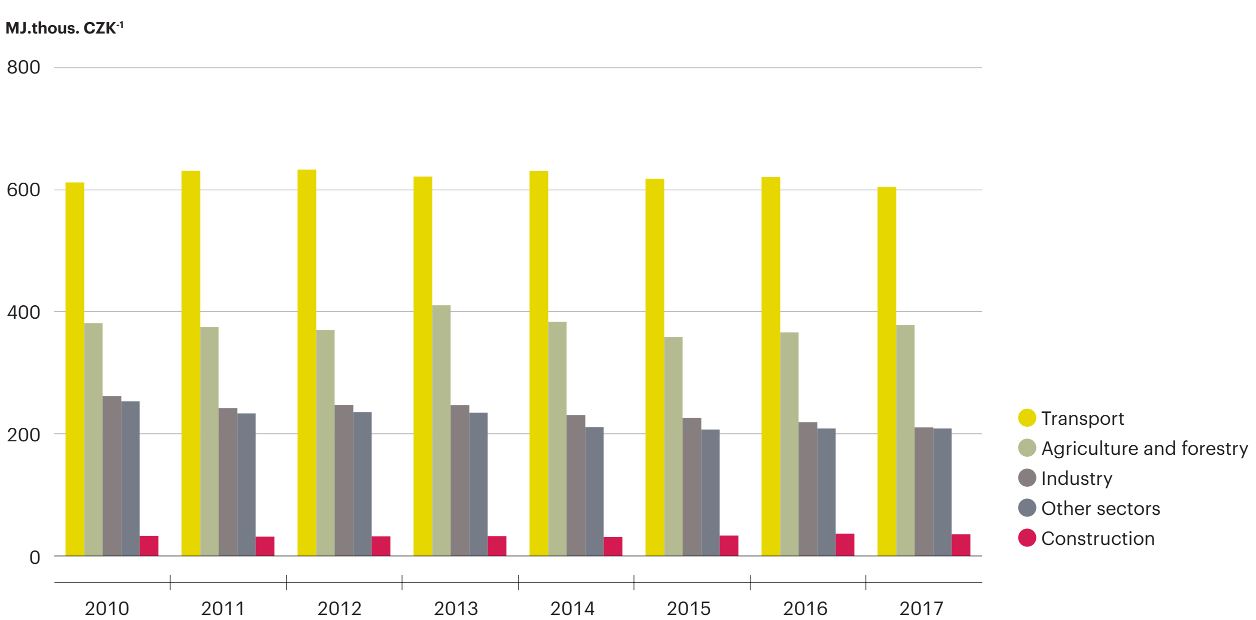


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Industry and Trade

Chart 3

Development of energy intensity by sector in the Czech Republic [MJ.thous. CZK^{-1}], 2010–2017



The energy intensity of sectors is expressed by the ratio of final energy consumption in the sector to the gross value added of the sector.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office, Ministry of Industry and Trade

The **energy intensity of an economy** is the amount of energy consumed per unit of gross domestic product. It measures the energy consumption of the national economy. A long-term effort is to reduce energy intensity in all areas of human activity by increasing the energy efficiency of appliances, introducing energy-saving technologies or reducing wasting. This in turn leads to increased energy security, self-sufficiency and sustainability.

In the monitored period 2010–2017, the **energy intensity of GDP** is decreasing (Chart 1), in 2017 it reached 391.2 MJ.thous. CZK^{-1}. This development is mainly due to GDP growth, primary energy sources (PES) consumption declined more moderately and even increased by 4.3% in 2017. Thus, the year-on-year energy intensity of the national economy decreased slightly due to higher economic performance in 2017, but only by 0.1%. In longer term, i.e. since 2010 (when the energy intensity of the Czech economy was 475.5 MJ.thous. CZK^{-1}) there was a total decline in energy intensity by 17.7%.

The aim of the **State Energy Concept** of the Czech Republic 2015 for 2040 is a diversified mix of primary sources with the target structure in the corridors: nuclear fuel 25–33%, solid fuels 11–17%, gas fuels 18–25%, liquid fuels 14–17%, renewable and secondary sources 17–22%. Currently, PES are not within these values, solid and liquid fuels have a higher proportion and other sources a lower one.

Solid fossil fuels are the most important item in **the PES structure**, thanks to domestic coal mining. In 2017, they represented 36.7% of the total amount of PES. Crude oil and petroleum products accounted for 21.7%, natural gas 16.7%, nuclear energy 16.3% and renewables and biofuels accounted for 10.5%. The categories Heat produced and Electricity have negative values in the final balance, because electricity is exported abroad and in the Czech Republic it is produced from the above mentioned sources. There is no primary heat source in the Czech Republic, potentially it could be e.g. geothermal energy. Its 0.002% share in the PES structure is the result of foreign trade.

When comparing the **energy intensity of individual sectors** of the national economy (Chart 3), transport, agriculture and forestry and also industry achieve the highest values. The high energy intensity of transport is due to the inclusion of motorised private transport which does not contribute to economic performance in any way. Over the reference period 2010–2017, the energy intensity of industry decreased by 13.6%, agriculture and forestry by 5.9% and it also decreased in the category Other sectors by 18.2%. On the contrary, the intensity of construction increased by 1.5% and transport by 1.0%. The energy intensity of all sectors except construction decreased year on year. Efforts to reduce energy intensity are driven by social, economic and legislative pressures in all areas of human activity.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

31 | Electricity and heat generation

Key question

What is the structure and quantity of generated energy and what impacts does the electricity and heat generation have on the environment in the Czech Republic?

Key messages

Heat production from solid fossil fuels and natural gas has been decreasing slightly in the long term, while the share of renewable sources and biofuels is growing. In 2017[8], the gross heat production was 121.6 PJ. Emissions of the monitored substances from the energy industry have been declining for a long time.

Electricity production is growing, reaching 88,001.8 GWh in 2018. Its largest share was produced from brown coal and also from nuclear fuel.

The total energy dependency of the Czech Republic on imports from abroad is increasing; in 2017[9] it increased year-on-year from 33.0% to 37.3%.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

Last year-on-year change

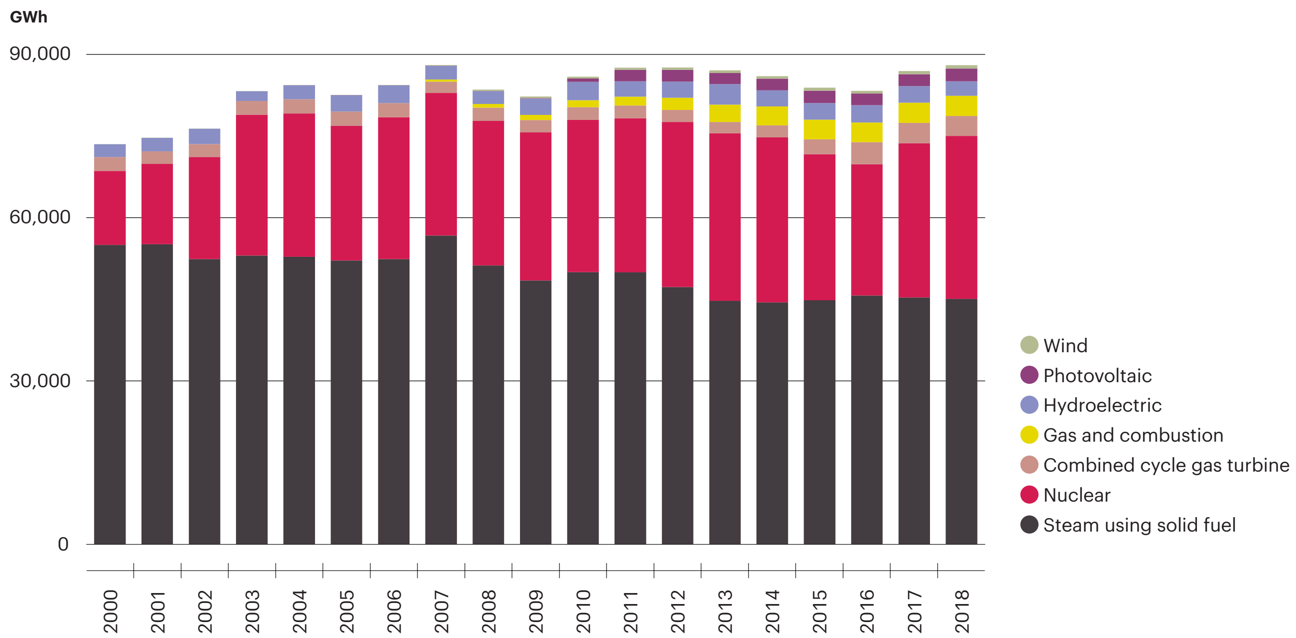
[8] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

[9] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Indicator assessment

Chart 1

Electricity generation by the type of power plants in the Czech Republic [GWh], 2000–2018

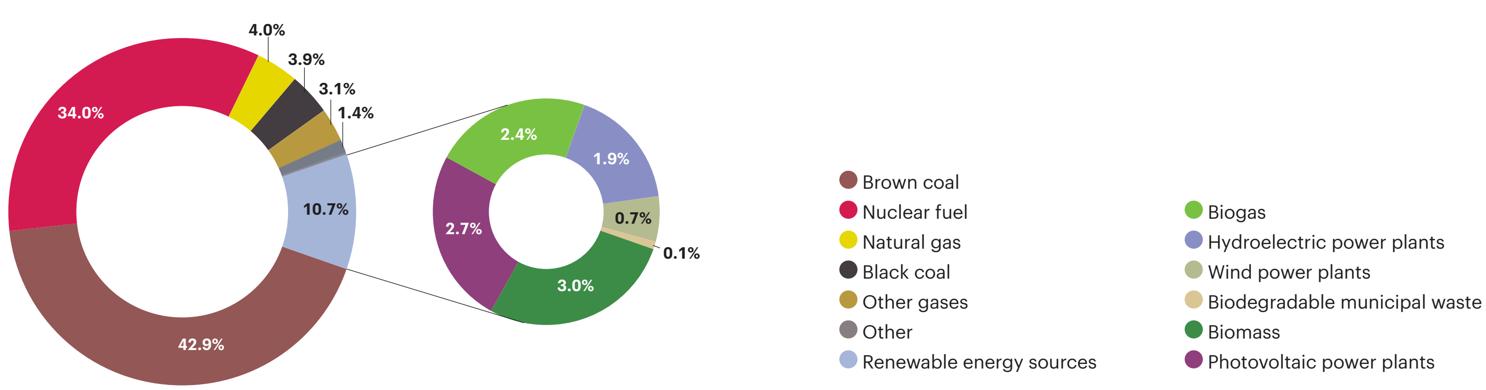


Wind power stations: The wind drives the propeller through an electric generator that produces electricity.
Photovoltaic power plants: Gaining energy from the solar radiation transformation on the principle of the photoelectric effect.
Hydroelectric power stations: The electric energy is produced by converting the potential energy of water so that the water turns a water turbine that drives an electric generator.
Gas and combustion power plants: Energy is produced by the gas combustion in a gas turbine. Combustion gases directly drive a gas turbine. Combined cycle gas turbine power plant: The gas is first burnt in a gas combustion turbine where the first part of the electricity is produced. The formed hot flue gas produces steam in the boiler, and it is led into a steam turbine that produces the second part of the electricity. This double production greatly increases the energy efficiency of the equipment.
Nuclear power plants: This is in principle a steam power plant which has a nuclear reactor in place of a steam boiler and the energy is gained by conversion of binding energy from the nuclei of heavy elements (uranium 235 or plutonium 239).
Steam power plant for solid fuel: Energy is obtained by the combustion of fossil fuels (coal) or biomass. The resulting heat is heated by steam, which powers a steam turbine generator.

Data source: Energy Regulatory Office

Chart 2

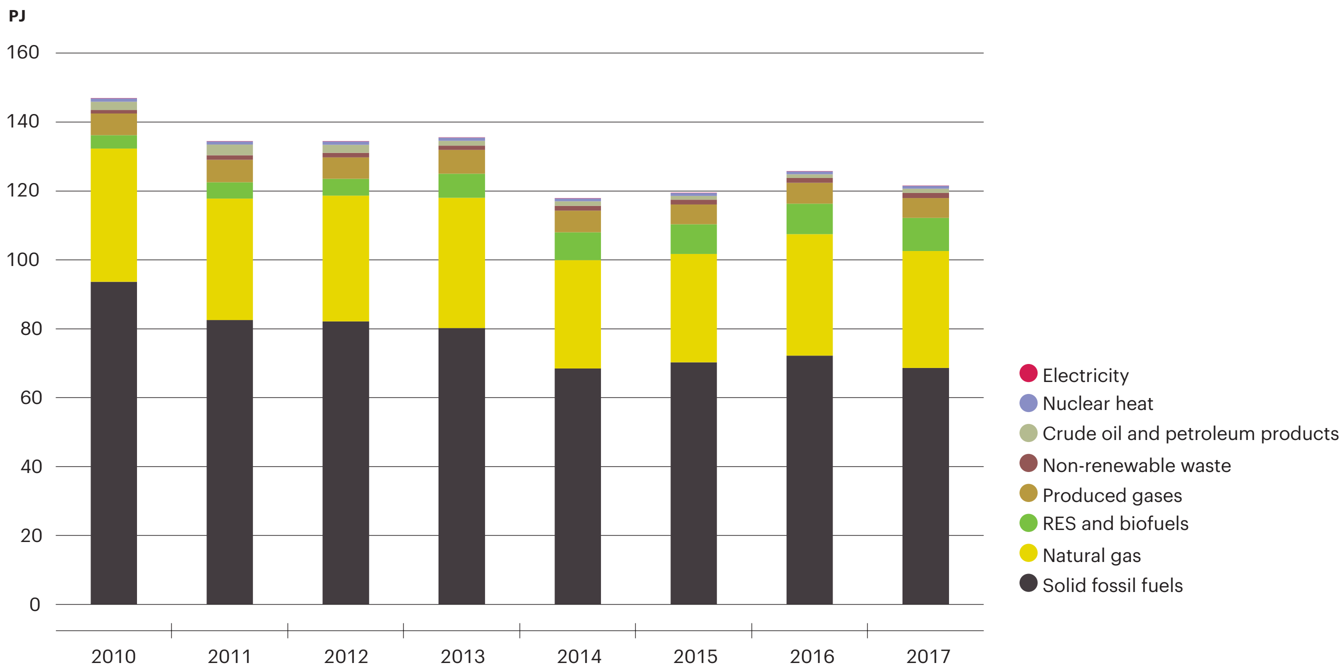
Electricity generation by fuel type in the Czech Republic [%], 2018



Data source: Energy Regulatory Office

Chart 3

Gross heat production by fuel type in the Czech Republic [PJ], 2010–2017

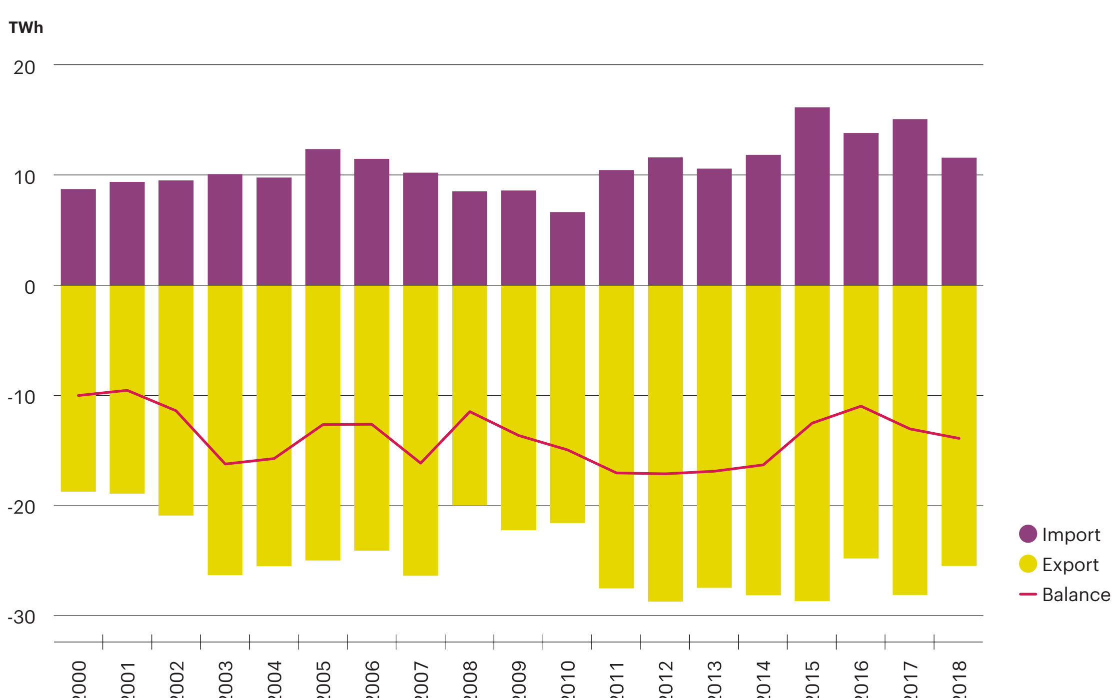


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Industry and Trade

Chart 4

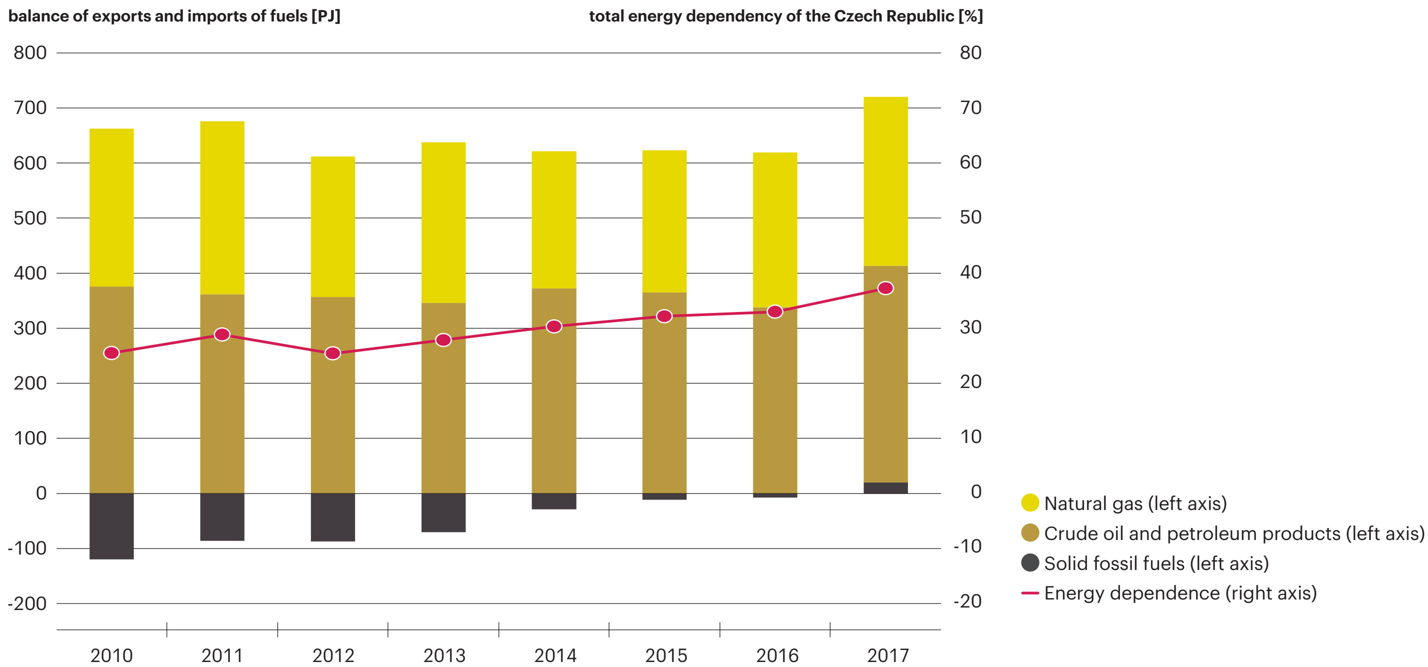
Electricity imports and exports in/from the Czech Republic [TWh], 2000–2018



Data source: Energy Regulatory Office

Chart 5

Export/import balance by fuel, overall energy dependence of the Czech Republic [PJ, %], 2000–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

Electricity and heat production in the Czech Republic is determined by the current situation on the domestic market (demand and current consumption) and also by foreign trade. The energy mix, i.e. the sources from which electricity and heat is produced, is influenced by domestic energy sources, foreign trade, and also by the current energy policy that regulates the conditions for their use.

In 2018, **gross electricity production** in the Czech Republic reached 88,001.8 GWh, which is the second highest value for the period under review since 2000, and was higher only in 2007, i.e. the year preceding the economic crisis (Chart 1). This represents a year-on-year increase by 1.1% and compared to 2000 the electricity production increased by 19.8%. In terms of the individual types of power plants, the largest share of electricity (51.2%) was produced in solid-fuel steam power plants[10]. The second important category is nuclear power plants, which generated 34.0% of electricity. The other sources are less important, they are combined cycle power plants (4.2%), gas and combustion plants (4.2%), hydro (3.0%), photovoltaic (2.7%) and wind power (0.7%).

In terms of fuels, most electricity in the Czech Republic in 2018 was produced from brown coal (42.9%) and from nuclear fuel (34.0%). Renewables generated 10.7% of electricity, while other fuels accounted for only a few percent (Chart 2).

In 2017[11], **heat** (Chart 3) was mainly **generated** by burning solid fossil fuels (56.5%, mainly brown and black steam coal) and natural gas (27.9%). This is the production of heat for sale, i.e. for heat supply systems, as well as production in house boiler rooms, housing cooperatives, etc. The total amount of heat produced decreased by 3.3% year-on-year to 121.6 PJ. Heat production from solid fossil fuels decreased by 4.9% year-on-year, production from natural gas decreased by 3.9% year-on-year.

[10] *Steam power stations are generally those that use steam to drive the generator of electricity, whereas water vapour is extracted by heating the water that occurs by burning fuels or nuclear reactions. In this document, however, the category of steam power plants is taken from the statistics of the Energy Regulation Office and includes thermal power plants that burn, in the conditions of the CR, particularly brown coal. Nuclear power plants are listed in a separate category.*

[11] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Heat production from solid fossil fuels and natural gas has been decreasing slightly in the long term, while the share of renewable sources and biofuels increased from 2.6% to 8.0% in 2010–2017.

The public and industrial energy sector[12] is a major producer of **emissions of pollutants** into the atmosphere and **greenhouse gases**. In 2017[13], its share in total SO_2 emissions was 70.7% (77.8 thous. t), in NO_x emissions 40.7% (66.4 thous. t), in CO_2 emissions 59.8% (61 813.1 thous. t) and in PM_{10} emissions 5.8% (3.0 thous. t). Compared to 2016, all of the main monitored emissions decreased in this sector. PM_{10} decreased by 5.5%, NO_x by 4.2%, SO_2 by 3.8% and CO_2 by 2.7%. Emissions of the main monitored substances from the energy industry have been declining in the long term. In the period 2000–2017, there was a significant decrease in emissions of all pollutants from this sector by tens of percent.

Exports are constantly outweighing imports in **foreign electricity trade** (Chart 4). In 2018, 11,573 GWh of electricity was purchased, but 25,481 GWh was sold. The balance of exports and imports was thus 13,907 GWh. In total electricity production of 88,002 GWh, the share of exports in the electricity produced is 15.8%. The balance is up by 6.7% year-on-year. The export of electricity is negative with regard to the environment because the emissions and other environmental burdens generated by electricity production remain in the Czech Republic while the electricity is consumed abroad.

The country's **energy dependence** is an indicator of how much the economy is forced to rely on imports of energy or its sources to meet its energy needs. In general, maximum self-sufficiency is advantageous, as this guarantees the energy security of the state. The total energy dependency of the Czech Republic is rising, it rose from 33.0% to 37.3% in 2017, the highest figure since 2010 (Chart 5). In the past years, the Czech Republic was self-sufficient in the consumption of solid fossil fuels thanks to domestic mining of brown and black coal. In 2017[14], however, their consumption outweighed mining and 3.1% of the solid fossil fuels consumed was imported from abroad. In the case of oil and natural gas, the Czech Republic is almost exclusively dependent on supplies from foreign trade. Nuclear fuel for nuclear power plants is also imported.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[12] *The categories 1A1 and 1A2 of the Nomenclature for Reporting (NFR) are included in the Public and Industrial Power Generation; they are the generation of electricity and heat to the public grid and for industrial purposes and combustion processes in industry and construction.*

[13] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

[14] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

32 | Renewable energy sources

Key question

What is the structure and the share of renewable energy sources in the total energy sources?

Key messages

The production of heat from RES has increased significantly, in the period 2010–2017[15] it increased 2.5 times.
The target of the share of RES in gross final energy consumption of 13% by 2020, set out in the State Environmental Policy of the Czech Republic 2012–2020, has been met since 2012, in 2017[16] it was 14.8%.

Renewable electricity generation is stagnating with only slight year-on-year fluctuations.
The RES share in the electricity production was 10.7% in 2018, the target of the State Energy Concept is to achieve the proportion in the range of 18%–25% by 2040.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

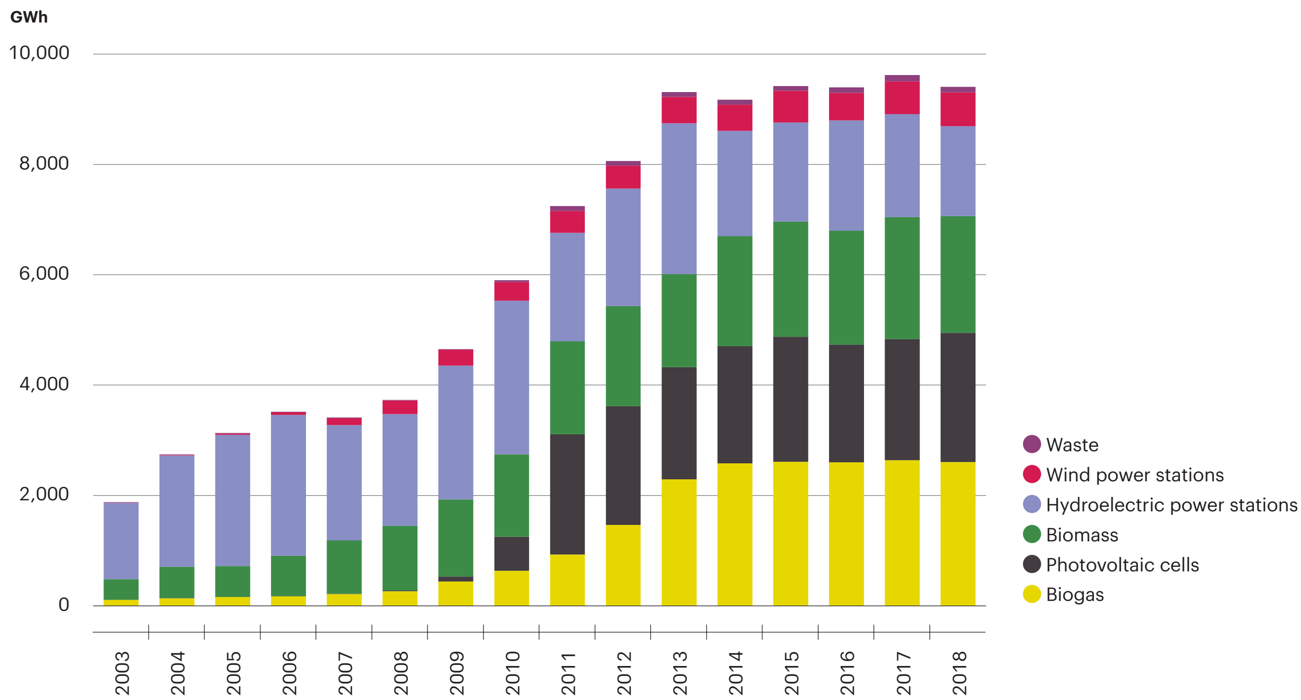
Last year-on-year change

[15] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
[16] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Indicator assessment

Chart 1

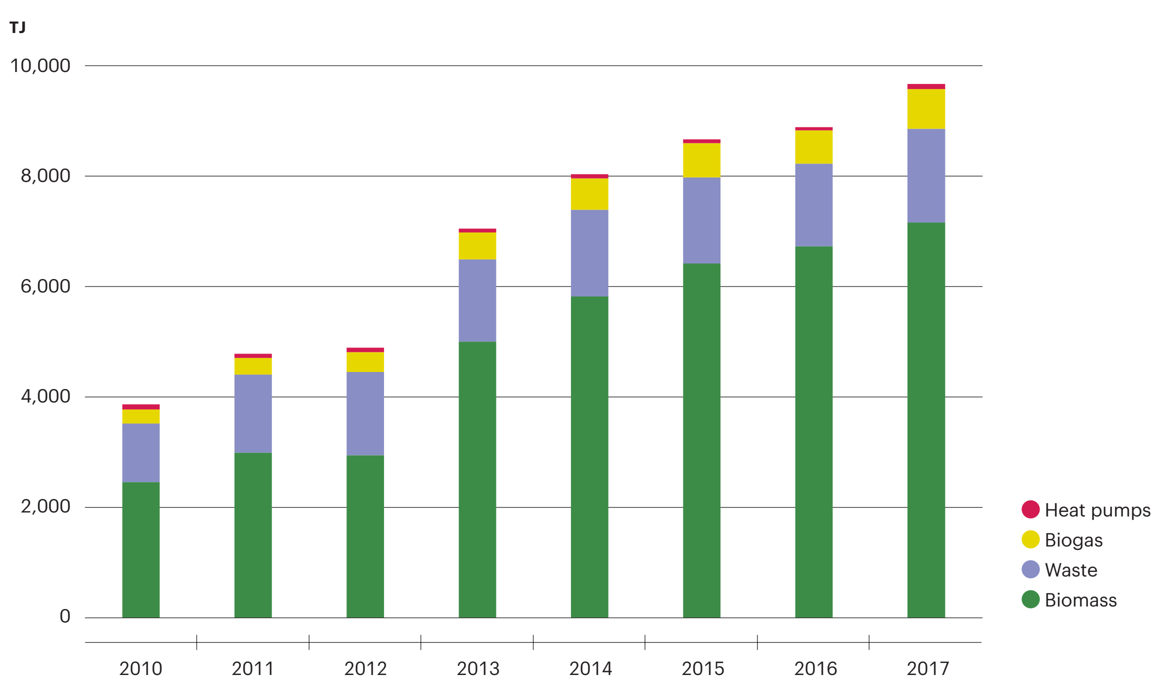
Electricity generation from RES in the Czech Republic [GWh], 2003–2018



Data source: Energy Regulatory Office

Chart 2

Gross heat production from RES and biofuels in the Czech Republic [TJ], 2010–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Industry and Trade

Chart 3

Targets for RES and their implementation in the Czech Republic [%], 2004–2018

The aim of the State Energy Concept of the Czech Republic is to ensure by 2040 the share of annual electricity generation from RES and secondary sources in the range of 18–25%, in the Chart only the lower limit is marked, i.e. 18%.
Data for the RES share in the final energy consumption in 2018 were not available at the time of publication due to the methodology of their reporting.

Data source: Energy regulatory Office, Ministry of Industry and Trade

Renewable sources include wind energy, solar energy, potential water energy, geothermal energy and biomass energy. Despite the fact that these resources are inexhaustible, their availability is limited in time and space due to their dependence on climatic, meteorological and geographical conditions. Production of electricity and heat from these sources is limited by those factors, and at the same time it is difficult to adjust to the current market demand. Nevertheless, RES are beneficial in terms of energy security and sustainable development.

Electricity generation from renewable sources has stabilized after a period of steep growth in 2008–2013, when RES were widely supported as a result of translating policy decisions into international and national strategies and targets (Chart 1). Since 2014, the amount of electricity produced from RES has stagnated with only slight year-on-year fluctuations. In 2018, 9,404.0 GWh of electricity was produced from renewable sources, which means a year-on-year decrease by 2.2%.

The RES for electricity production are quite diverse and their share is relatively balanced. In 2018, most electricity was produced from biogas (27.7%, 2,607.2 GWh), followed by photovoltaic power plants (24.9%, 2,339.7 GWh), biomass (22.5%, 2,118.7 GWh) and hydropower (17.3%, 1,628.8 GWh, excluding pumped storage). On the contrary, the least electricity was produced from wind power plants (6.5%, 609.3 GWh) and waste (1.1%, 100.2 GWh).

The **production of heat from RES** grew significantly in the reporting period in the Czech Republic (Chart 2). In 2017[17], 9,666 TJ was produced, i.e. a year-on-year increase of 8.8%, and in 2010–2017 the production of heat from RES grew even 2.5 times. This category is clearly dominated by biomass, which made up 74.1% in 2017. The largest share is represented by combustion of wood for local heating of households. Other sources of heat are waste (17.6%), biogas (7.4%) and heat pumps (0.9%).

There are two **strategic goals** for renewables in the Czech Republic. The State Environmental Policy of the Czech Republic has taken over the target arising from Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable sources, i.e. to ensure 13% share of RES in gross final energy consumption by 2020. In 2017[18], the value for the Czech Republic was 14.8%, and the indicative target was reached already in 2013. The second target, arising from the State Energy Concept, is to achieve the proportion of RES in electricity production in the range of 18%–25% by 2040. In 2018, that share amounted to 10.7% (Chart 3).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[17] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

[18] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

33 | Contaminated sites

Key question

How may contaminated sites are registered in the Czech Republic and what is the progress in their remediation?

Key messages

Remedial actions recorded in the Evidence System of Contaminated Sites over the period 2010–2018 include finalized remediation of 369 localities of old environmental burdens, another 62 remedial actions were terminated in an unsatisfactory state.

The incremental Evidence System of Contaminated Sites database contained 4,967 sites in 2018.
The territorial analysis materials used for spatial planning registered 9,347 contaminated and potentially contaminated sites in 2018.

Despite the clear benefits and the amount of works already completed, the Czech Republic still has a large number of old environmental burdens where the extent of risks to the environment and human health is not known.

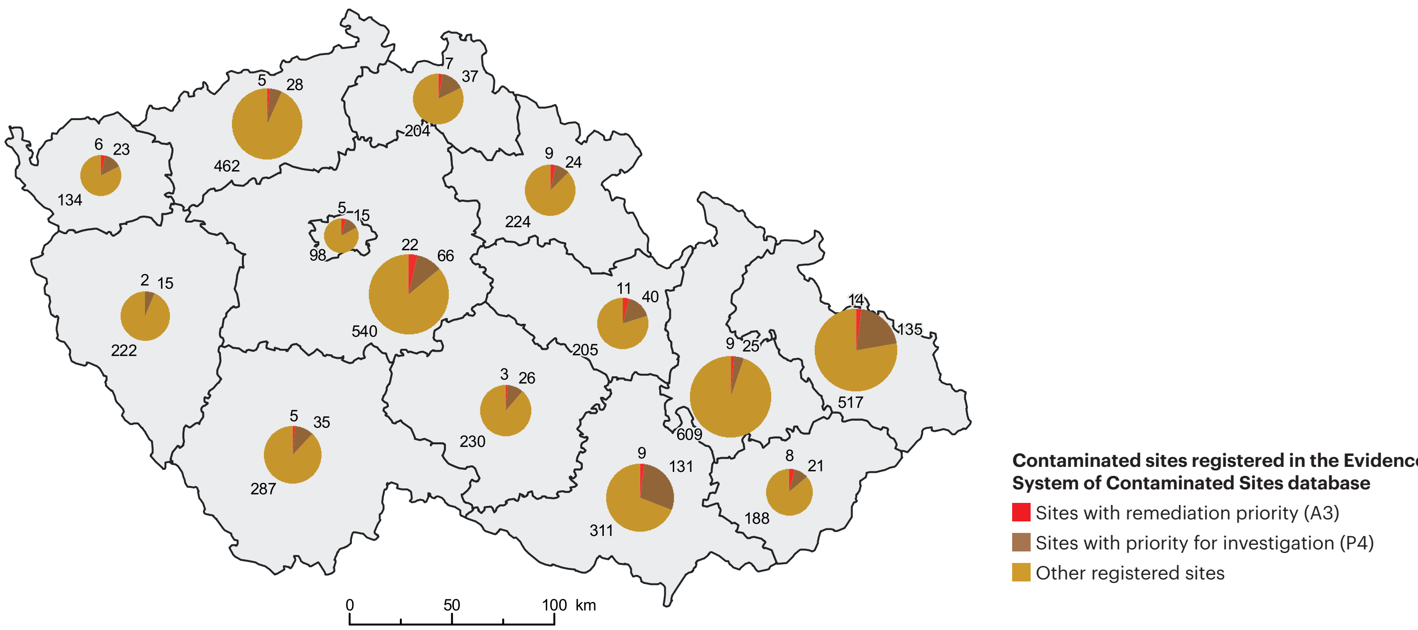
Overall assessment of the trend

Change since 1990	N/A
Change since 2000	positive
Change since 2010	positive
Last year-on-year change	positive

Indicator assessment

Figure 1

Number of contaminated sites registered in Evidence System of Contaminated Sites in the Czech Republic, 2018

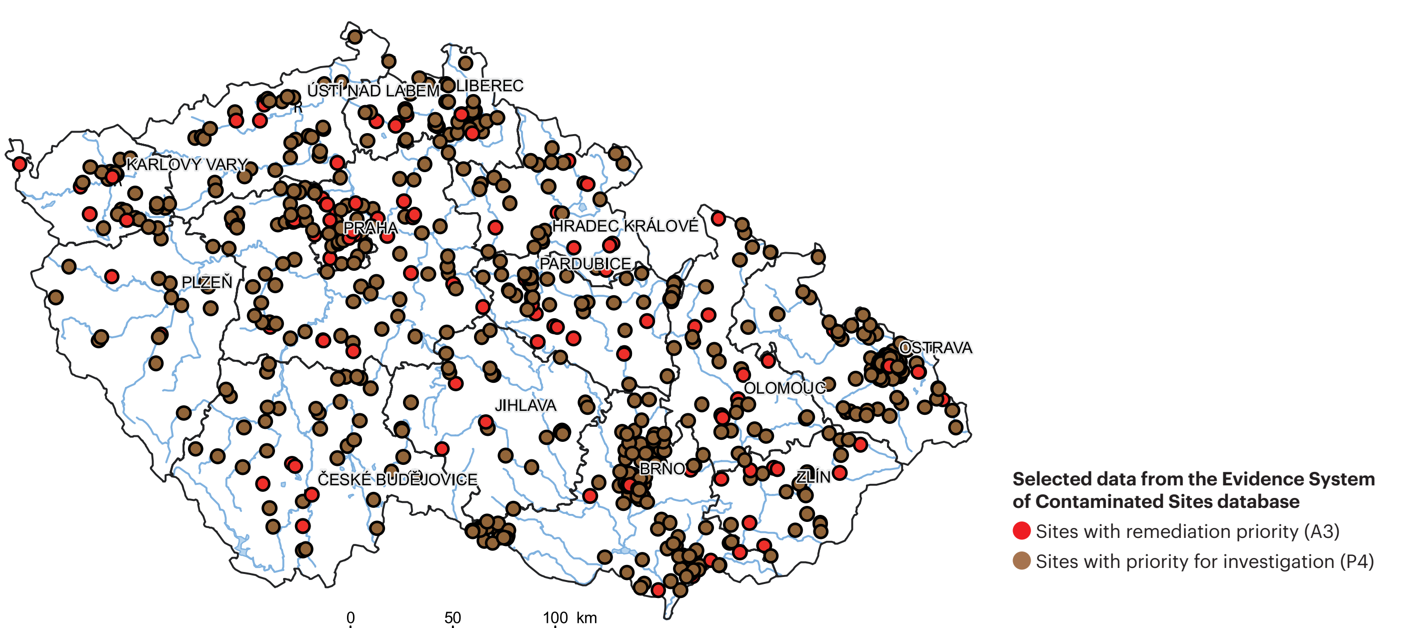


Sites with remediation priority (A3) and priority for investigation (P4) have been determined according to the valid Methodological Guideline of the Ministry of the Environment No. 1/2011.

Data source: Ministry of the Environment

Figure 2

Locations of contaminated sites with priority for remediation and for investigation, registered in Evidence System of Contaminated Sites in the Czech Republic, 2018

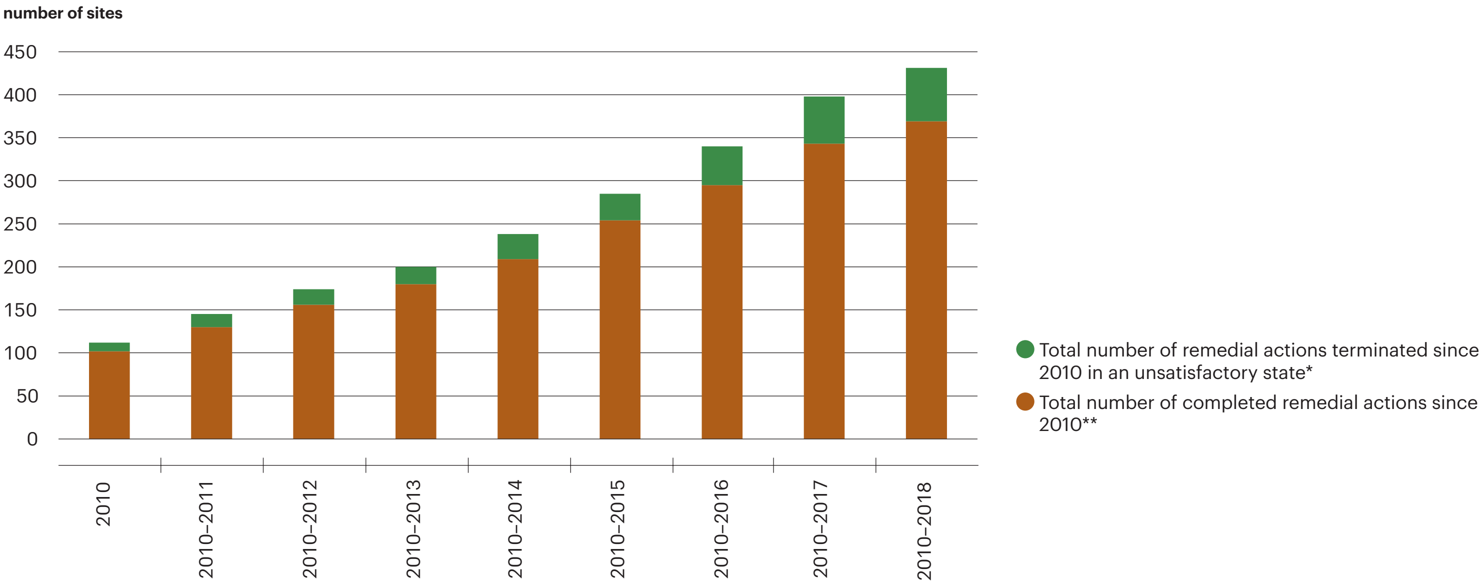


Sites with remediation priority (A3) and priority for investigation (P4) have been determined according to the valid Methodological Guideline of the Ministry of the Environment No. 1/2011.

Data source: Ministry of the Environment

Chart 1

Number of contaminated sites with completed remediation registered in Evidence System of Contaminated Sites in the Czech Republic, cumulatively for the period 2010–2018



** Remediation was terminated for other reasons (e.g. lack of financial resources, unanticipated extent of contamination, newly identified circumstances, etc.).*
*** Remediation may be registered as completed even if the post-remediation monitoring is still underway.*

Data source: Ministry of the Environment

Contaminated sites are the manifestation of the negative effects of economic activities, not only of industry and energy. They represent a severe contamination of the rock environment, groundwater or surface water, soil or building structures, which occurred due to negligent handling of hazardous substances in the past (before 1989) and which endangers the health of humans and the environment. The extensive occurrence of old environmental burdens in the Czech Republic is one of the remnants of the long governance of the previous regimes, when environmental protection and the use of harmful substances in industrial and other production were not paid much attention. Contaminated sites are those where contamination has been verified, at least indicatively. Potentially contaminated sites are those where contamination can reasonably be expected.

To record information about contaminated and potentially contaminated sites, the Czech Republic has operated since 2005 a database called **Evidence System of Contaminated Sites**, originally it was Evidence System of Old Environmental Burdens formed in 1996. This is an incremental database recording the existence of contaminated sites and their status, which is publicly accessible. The Evidence System of Contaminated Sites database has not been filled through systematic inventory but is formed by incrementally adding sites, because the issue of old environmental burdens remediation is not regulated by any law and there is no unified approach to this issue. For those reasons, the Evidence System of Contaminated Sites database does not provide an overview of the total number of contaminated or potentially contaminated sites in the Czech Republic. Therefore, in the years 2009–2012 the first phase of the National Inventory of Contaminated Sites was implemented. Within its framework, the methodology tools for inventorying maximum number of contaminated or potentially contaminated sites were developed. A pilot survey using new methodologies on 10% of the territory of the Czech Republic has registered nearly 1,000 sites, of which a third turned out to have been already registered in the Evidence System of Contaminated Sites. With the help of the second stage of the National Inventory of Contaminated Sites (2018–2021), the Evidence System of Contaminated Sites database will be supplemented with up-to-date information and will provide comprehensive information on the number and risk level of old environmental burdens in the Czech Republic.

Total **number of contaminated sites** in the Czech Republic is not known but is estimated approximately at 10,000 contaminated sites. The territorial analysis materials used for spatial planning registered 9,347 localities in 2018, including those registered in Evidence System of Contaminated Sites. The Evidence System of Contaminated Sites database contained 4,967 sites in 2018.

Most of the localities of old environmental burdens registered in Evidence System of Contaminated Sites are located in the Moravian-Silesian, Olomouc and Central Bohemian regions. These are mostly former industrial facilities, landfills, fuel stations, etc. (Figure 1, Figure 2).

Remediation of the contaminated and risk sites should contribute to reducing health risks by removing the most hazardous contaminants from groundwater and rock environment and also has benefits for the revitalization of the landscape as a whole, for the restoration of the state of the environment and regeneration of natural relationships in the ecosystems. Remedial interventions started before 1989 or immediately after were mostly carried out randomly without deeper economic priority analysis of the interventions, and that as a result of the economic interests of investors on the sites or in response to an acute threat to water resources, environment or public health. The systematic removal of the old environmental burdens started on a larger scale after 1990. For some of them, especially within the framework of the privatization, the state accepted the liability.

At present, the need for remedial action (e.g. remediation, decontamination) of old environmental burdens is evaluated on the basis of a risk analysis carried out according to the relevant Ministry of the Environment Methodological Guideline No. 1/2011[19], which proves the potential of an adverse effect on the health of people or sensitive ecosystems near the contaminated site. The remediation of old environmental burdens in the Czech Republic is predominantly **financed from three main sources**. The first source are the so-called "Environmental Agreements"[20], which provide Ministry of Finance of the Czech Republic funding towards old environmental burdens created before privatization of the former state enterprises, where the state assumed the liabilities associated with their existence in the 2nd privatization wave. The second major source of funding are the financial sources of the individual ministries, state enterprises, etc. The third source of funds are European funds withdrawn through operational programmes, in particular the Operational Programme Environment. In that programme, it is possible to apply for financing in the case of an old environmental burden where the pollution originator or successor in title is not known, or the originator has ceased without a successor. Under call 5th for intervention area 3.4, or call 75th of the Operational Programme Environment 2014–2020 (November 2017–January 2018), there were 8 projects on investigation work and risk analysis approved for financing, with total costs of CZK 1,111 mil. and the requested subsidy from the Cohesion Fund at CZK 944 mil. A complementary programme to the Operational Programme Environment is the National Programme Environment, which supports projects and activities contributing to the protection of the environment in the Czech Republic, including in the area of old environmental burdens.

The number of localities of old environmental burdens with **completed remediation** in the Czech Republic can be assessed, at least partially, on the basis of data recorded in the Evidence System of Contaminated Sites database (Chart 1). The Evidence System of Contaminated Sites database does not include information on remedial actions implemented by the regions, the State Environmental Fund of the Czech Republic and other ministries and does not register any private investments and so it is not complete. In the period 2010–2018, remediation of 369 localities of old environmental burdens was completed, and another 62 remedial actions were terminated in an unsatisfactory state (e.g. because of lack of financial resources, unanticipated extent of contamination, newly identified circumstances, etc.). The state is unsatisfactory if the administrative decision, which is usually issued by the respective Czech Environmental Inspectorate branch and which is a crucial measure for the satisfactory state, is not implemented. Remediation of these sites may continue in the future if, for example, additional financial resources are found, a newly identified contamination is investigated and another method of remedial measures is proposed, the risks arising from the contamination are reassessed, etc. The largest number of completed remediation of localities with old environmental burdens was recorded in 2010. In 2018, remediation was completed on 26 sites and another 7 remedial actions were terminated in an unsatisfactory state. Despite the undoubted benefits and the substantial extent of already implemented remedial actions, still a large number (in the order of thous.) of old environmental burdens remain in the Czech Republic, where the extent of the risks to the environment and human health is not known, or the risks are so serious that it is essential to pay increased attention to them and to try to direct more funding in their remediation. Only by doing so, the number of old environmental burdens in the Czech Republic can be reduced, thus limiting any further potential contamination of the sites.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[19] *Ministry of the Environment (2011): Methodical guidance Risk analysis of contaminated territories*

[20] *In cases of national enterprises where the "Environmental Agreement" was not concluded as part of the privatization project, the buyer received a discount on the purchase price to cover the elimination of contamination. Thereby the originator became the successor in the case of old environmental burdens.*

Industry and energy in the global context

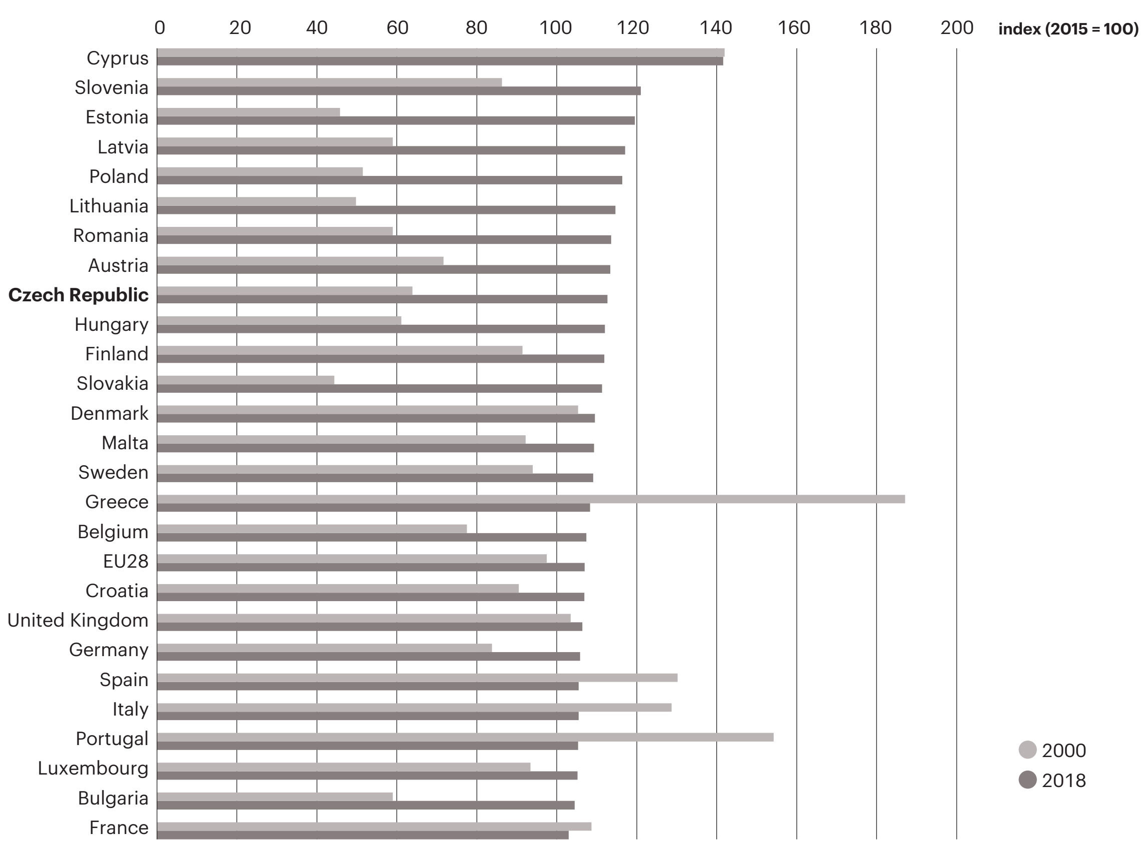
Key messages[21]

- Industrial production develops differently in each of the EU28 countries. The differences are influenced by natural, economic, political or demographic factors.
- The average energy consumption per capita in the EU28 was 91.9 GJ.capita^{-1}, which represents a decrease of 5.6% compared to 2000.
- The energy intensity of the EU28 economies decreased from 6.6 to 4.6 TJ.(EUR mil.)$^{-1}$, i.e. by 31.2%, in the period 2005–2017.
- Dependence on energy imports rages in the European countries from 4.1% up to full dependence and gradually increases. In 2017, energy dependency of the EU28 reached 55.1%.
- The share of renewable energy sources in final consumption in the EU28 countries is growing, in 2017 the share was 17.5%, while the target for the EU28 as a whole by the year 2020 is 20%. Their national objectives were already achieved by 10 countries of EU28, including the Czech Republic.
- In 2011, 2.5 mil. of potentially contaminated sites were estimated to exist in selected European countries, of which 45% (around 1.1 mil. of the sites) have been identified to date.

Indicator assessment

Chart 1

Index of industrial production [index, 2015 = 100], 2000, 2018

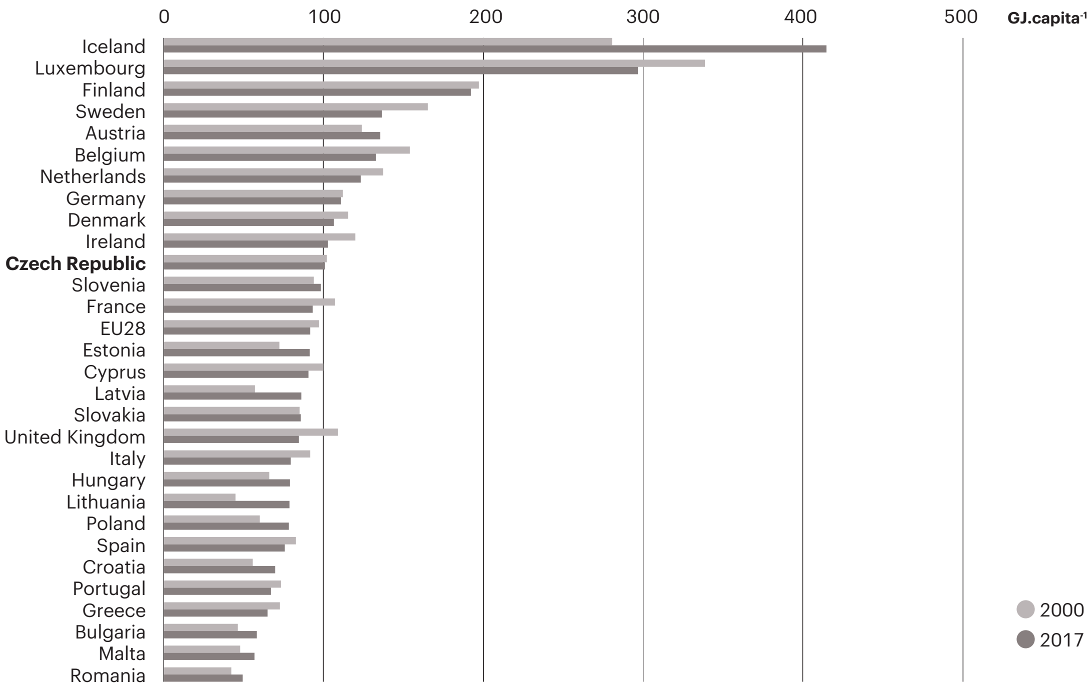


Data source: Eurostat

[21] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Final energy consumption per capita [GJ.capita⁻¹], 2000, 2017

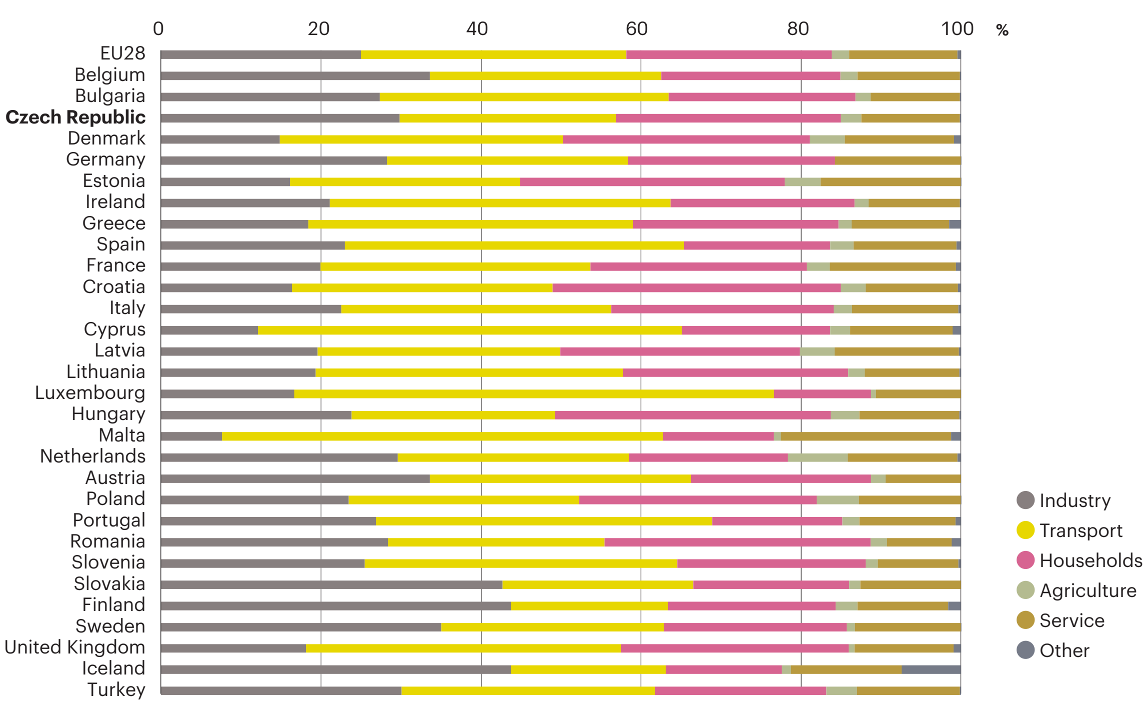


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 3

Final energy consumption by sector [%], 2016

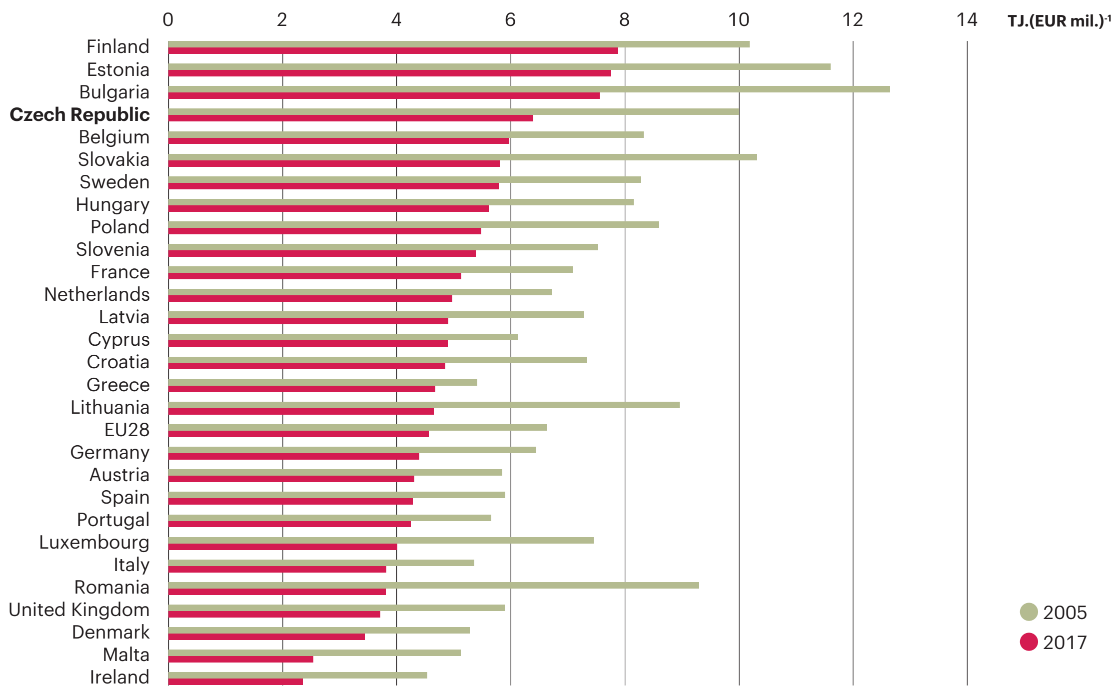


Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 4

Energy intensity of the economy [TJ.(EUR mil.)$^{-1}$], 2005, 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 5

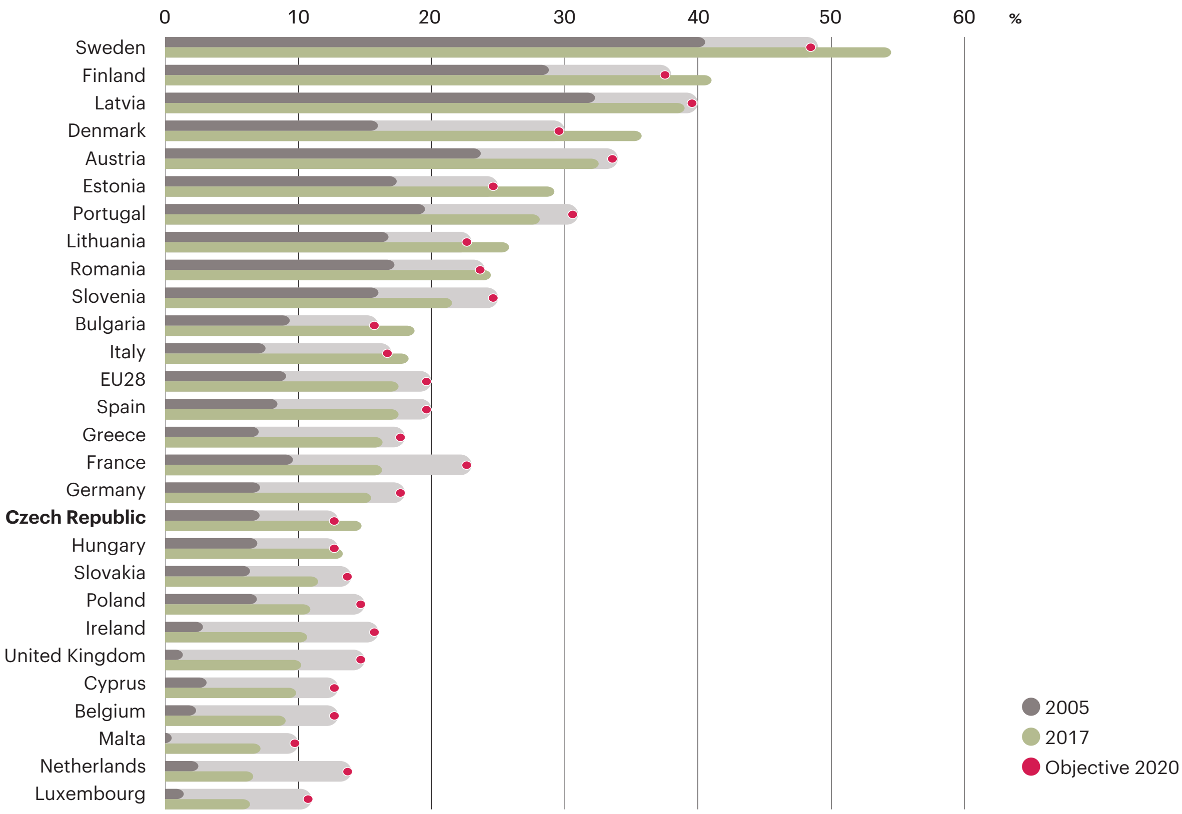
Energy dependence [%], 2000, 2017

Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 6

Proportion of renewable energy sources in final energy consumption and target value as of 2020 [%], 2005, 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Industrial production develops differently in each of the European countries (Chart 1). While some countries are increasing their production, often at a significant rate (e.g. Estonia, Slovakia), others are experiencing a decline (e.g. Greece, Portugal). These changes are influenced by the orientation of the individual national economies, the stability of the national economy, inter-connectivity of the national economies with other countries, openness to foreign trade, domestic markets and other economic, political and demographic factors. The current situation is also given by the economic boom which has occurred practically throughout Europe since 2014.

The value of the **industrial production index** in the EU28 as a whole increased over the period 2000 to 2018 from 97.5 to 107.0 (index for 2015 = 100). In the Czech Republic, this change was much more pronounced, the industrial production index in the same period increased from 63.9 to 112.7. The greater or smaller **orientation** of the individual States **on industrial production** is significantly determined by the natural conditions, or the presence of mineral and energy resources. The Czech Republic is historically focused on industrial production, in particular thanks to its deposits of precious metals and coal, and this heritage still persists despite a long-term gradual slow-down in extracting.

Final energy consumption per capita in 2017[22] in European countries ranged broadly from 49.5 GJ.capita^{-1} (Romania) to 414.9 GJ.capita^{-1} (Iceland). The EU28 average was 91.9 GJ.capita^{-1}, which represents a decrease of 5.6% compared to 2000. That decline is in line with the general efforts to reduce energy intensity of the economy. It reflects the structural changes in the economy and higher energy efficiency. The per capita final energy consumption is related also to the country location and climatic conditions, because a significant portion of the energy is consumed for heating homes. Therefore, the higher per capita consumption is in the Nordic countries, and on the contrary lower in the countries in southern Europe with warmer climates. In the Czech Republic, energy consumption per capita in 2017 was 100.9 GJ.capita^{-1}, which is 9.7% more than the EU28 average (Chart 2).

[22] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Total **final energy consumption** in the EU28 countries reached in 2016 the value of 46,382.1 PJ. In the sectoral breakdown, the largest share is held by transport (33.2%), households (25.7%) and industry (25.0%), followed by services (13.5%) and agriculture (2.2%). The shares of the various sectors in the energy consumption vary across the EU28 (Chart 3). This is influenced by many factors, such as the type of economy, standard of living, climatic conditions, etc. Within the EU28, however, these shares are relatively stable in the long term.

The **energy intensity of the economies** in EU28 countries (Chart 4) is decreasing significantly. In the period 2005–2017, its value decreased from 6.6 to 4.6 TJ.(EUR mil.)$^{-1}$, i.e. by 31.2%. This trend is influenced by the improving energy efficiency both in energy production and at end users. In the national economies of the individual states, the changes are ongoing, including, for example, shift from energy-intensive industries towards less demanding industries, or increasing the share of services in GDP. The decline in the energy intensity of the economy in the period 2005–2017 is reported in all EU28 countries without exception. The energy intensity of the economy in the Czech Republic dropped during that period from 10.0 to 6.4 TJ.(EUR mil.)$^{-1}$, that is by 36.1%, however it is still 40.3% higher compared to the EU28 average. The reason for that is the significant role of industry in the Czech Republic on the creation of GDP.

Energy dependence of EU28 countries increases. In the 1980s, its value amounted to less than 40%, in 2000 it went up to 46.6% and in 2017 it reached 55.1%. This is because of the higher consumption of energy raw materials that must be imported from outside the EU, in particular oil and natural gas. However, energy dependency varies significantly among EU28 Member States (Chart 5), ranging from 4.1% (Estonia) to 102.9% (Malta, where the above 100% energy dependence is due to the use of energy reserves). The above notable differences in energy dependency among the countries are caused by the different availability of domestic fossil resources and the differences in the potential of renewable energy sources. In the Czech Republic in 2017, the total energy dependency was 37.3%, which is the sixth least dependent position among the EU28 countries. This position is determined by its own resources of solid fuels (brown and black coal), which are also exported abroad, both in the form of extracted materials as well as products – most of them in the form of coke or electrical energy. However, gaseous and liquid fuels and fuel for nuclear power plants have to be imported to the Czech Republic. In EU28 at present, none of the countries is energy independent any longer (i.e. with higher exports than imports), in 2000 it was still two countries: the United Kingdom and Denmark (Chart 5).

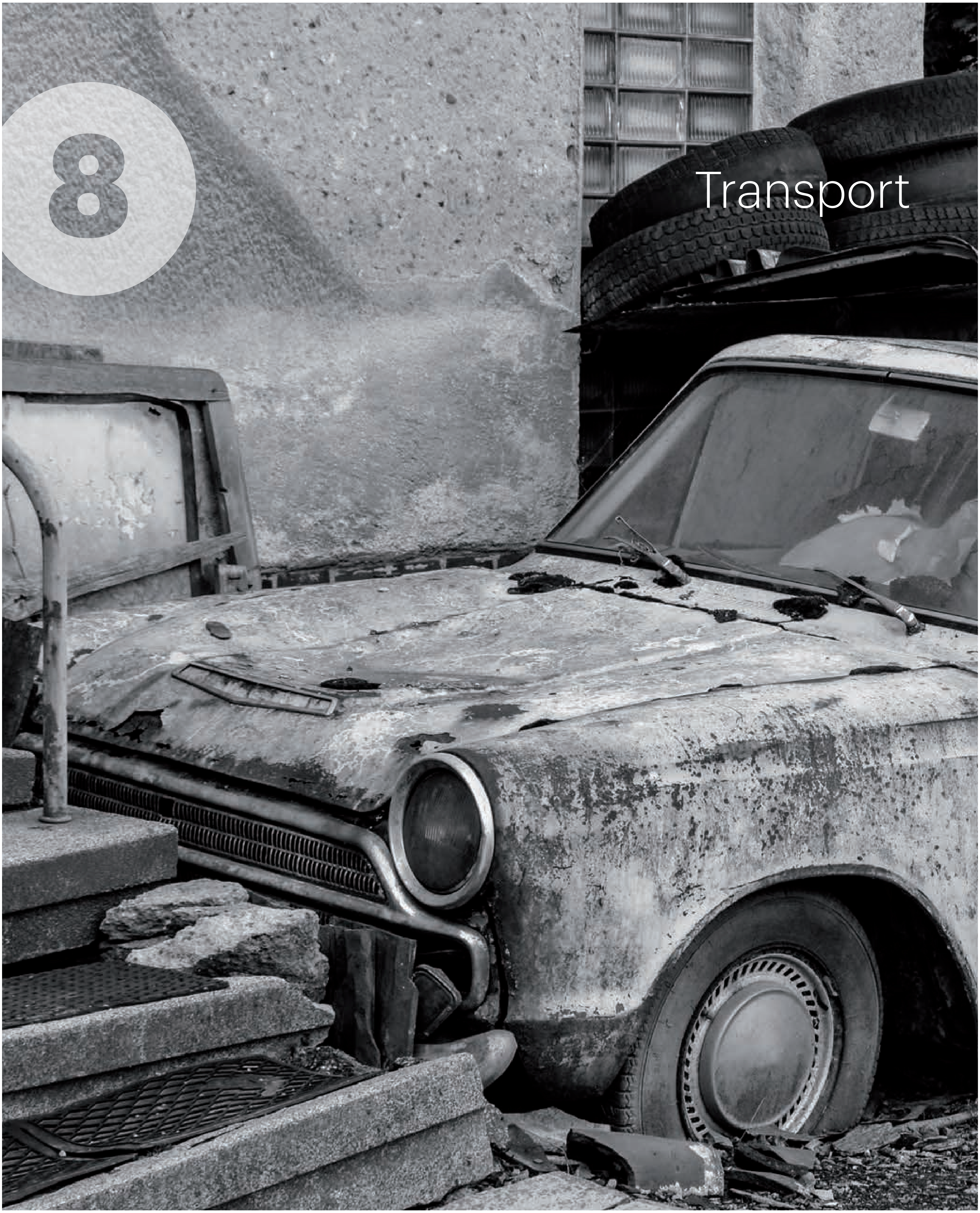
The **share of renewable energy sources (RES)** in the EU28 final consumption grew year-to-year from 17.0% to 17.5% in 2017, while in 2005 this value was only 9.1% (Chart 6). EU Member States have set a target by 2020, that the share of electricity production from renewable sources in final energy consumption will reach 20%. However, due to the varying potential of renewable energy sources, the individual countries have set their national targets, for which national action plans were drawn up, stating measures to achieve these objectives. For example, Denmark, Finland or Estonia make extensive use of wind power plants installed both at sea and on land to generate electricity. After the Fukushima nuclear accident, Germany is shutting down its nuclear sources and trying to replace them with renewable ones – developing photovoltaics and wanting to complement its energy mix with offshore wind installations. With regard to its morphological conditions, Austria bets on water energy and by using pumped-storage power plants it can well regulate renewable energy production with greater fluctuations (photovoltaic and wind). In 2017, the national target for renewable sources was reached by 10 of the EU28 countries including the Czech Republic (Chart 6). The value of the share of renewable sources in final consumption in the compared year of 2017 in the Czech Republic reached 14.8%, while the target national for 2020 is 13%.

The negative consequences of industrial and energy production are old environmental burdens. The most common source of contamination in European countries is mining, metal-working industry and out of the service sector it is petrol stations, the main contaminants include mineral oils and heavy metals. In selected European countries, the number of potentially **contaminated sites**[23] as of 2011 was estimated at 2.5 mil. Inappropriate manipulation with hazardous substances occurred on those sites in the past, and therefore they pose a significant risk of soil, groundwater or surface water contamination. Out of that number of potentially contaminated sites, 45% (1.1 mil. sites) have been identified[24]. Of those identified sites, 30% (342.0 thous.) were found to need remediation and 15% of those (51.3 thous.) have already been remediated. In 2011, the average national expenditure of selected European countries on removal of old environmental burdens amounted to EUR 10.7 per capita, which represents on average 0.04% of national GDPs. Approximately 81% of the national expenditure was spent on remediation works and 15% on site investigations[25].

[23] The definition of the term in the individual countries is based on national regulations. In the Czech terminology it is referred to as old environmental burdens.

[24] The identification of the site was carried out, where appropriate, preliminary study has been carried out.

[25] The stated data reflect the situation of only 27 of the total polled 39 member states of the EEA. Moreover, the source data are not complete for all states and in selected cases, the set definitions and interpretations for the identification of sites differ. Although most European countries have adopted national, or where relevant, regional legislation governing the exploration and remediation activities at localities of old environmental burdens, no European framework strategy has been created so far.



8 Transport

Transport

Transport is an economic sector with a significant impact on the environment. Production of greenhouse gases from combustion of fossil fuels burdens the climate system, it is a source of pollutant emissions that worsen air quality and last but not least it is the main source of noise exposure of the population in the urban environment. Furthermore, transport infrastructure is causing land take and fragmentation of the landscape. The greatest negative impacts on human health and ecosystems are caused by road transport.

The effect of transport on air quality is most pronounced in settlements and other densely populated areas, which increases the impacts of air pollution on the health of the population, which include reduced immunity, deteriorated condition of asthmatics and people with allergies and more frequent occurrence of diseases of the respiratory and cardiovascular system. The air pollution caused by transport also burdens ecosystems, namely through secondary pollutants, mainly ground-level ozone which is produced from precursors emitted by transport and damages the green parts of plants with consequent effects on forest stands and agricultural production.

The effects of transport on the environment can be reduced by changing the composition of the transport performance of both passenger and freight transport towards environmentally more friendly types (e.g. rail transport), in passenger transport by a higher use of public transport instead of passenger car transport. Furthermore, measures focus on reducing energy and emission intensity of vehicles and developing the use of alternative fuels and drives, including RES, in order to achieve a gradual reduction of the dependence of transport on oil products.

References to current conceptual, strategic and legislative documents

White Paper – Roadmap to a Single European Transport Area
- reducing (and gradually eliminating) dependence of the EU transport system on oil
- shifting 50% of medium and long-distance freight transport from road to railway and water transport, completing the European high-speed railway network by 2050
- reducing greenhouse gas emissions from transport by 60% compared to 1990 levels by 2050

Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources
- achieve a 10% share of energy from renewable sources in gross final energy consumption by the year 2020

Directive 2018/2001/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (amendment of Directive 2009/28/EC)
- achieve a 14% share of energy from renewable sources in gross final energy consumption by the year 2030

Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (Environmental Noise Directive – END)
- determining exposure to environmental noise, through noise mapping and by using assessment methods common to the Member States
- adopting action plans by the Member States, based upon noise-mapping results, with a view to preventing and reducing environmental noise
- drawing up strategic noise maps by 30 June 2012 and then every five years

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- reduction of emissions of NO_x, VOC and $PM_{2.5}$ from transportation, implementation of measures to protect air quality and compliance with limit values, for example construction of bypasses and the establishment of low emission zones
- ensuring a 10% share of energy from renewable sources in transport by 2020, increasing the proportion of vehicles with alternative drive in the sector of public and individual transport

National Emission Reduction Programme of the Czech Republic
- reducing emissions from transport, implementing measures to reduce the impact of transport on air quality in settlements

- shifting the freight transport from roads to railways
- accelerating the renewal of the passenger car fleet; increasing the use of alternative drives in transport

Air quality improvement programmes
- improving the quality of the public transport system, supporting integrated transport systems and ensuring the preference of public transport in the organization of transport in cities
- construction and reconstruction of transport infrastructure for road and rail transport, construction of commuter parking lots
- improving air quality in the settlements by setting emission ceilings for road transport for municipalities with a population of over 5,000

Transport Policy of the Czech Republic for 2014–2020, with the prospect of 2050
- promoting energy efficient public transport and non-motorized transport in the transport service system
- reducing NO_x, VOC and $PM_{2.5}$ emissions from the road transport sector by renewing the car fleet in the Czech Republic and increasing the share of alternative fuels
- increasing the proportion of renewable sources in total energy consumption in transport to 10% by 2020

National Renewable Energy Action Plan for the Czech Republic
- achieving a 10% share of energy from RES in the final consumption of energy in transport by the year 2020

National Action Plan for Clean Mobility
- creating favourable conditions for a wider application of alternative fuels and drives in the transport sector in the Czech Republic

Act No. 267/2015 Coll., amending Act No. 258/2000 Coll., on the protection of public health and amending some related laws, as amended, and other related laws
- procuring strategic noise maps for all agglomerations with a population exceeding 100 thous. and for main roads and railways by 30 June 2012
- drawing up action plans to reduce noise pollution in areas identified by noise mapping

34 | Transport performance and infrastructure

Key question

What is the development of transport and the related environmental burden?

Key messages

Within passenger transport the transport performance and the number of passengers transported by rail are increasing, in comparison of 2017–2018 it increased by 6.5 bil. persons. Railway use in integrated transport systems is increasing. The share of public transport in the overall performance of passenger transport (without air transport) in 2018 reached 33.4% and does not change significantly over time.
In freight transport, the transport performance of the railway, which in 2018 accounted for more than a quarter (27.5%) of the total freight transport, is increasing.

Passenger transport performance has been steadily increasing in connection with economic growth, increasing by 28.2% in the period 2000–2018.
In road freight transport, the transit of vehicles registered in other EU Member States through the Czech Republic is increasing, which compensates for the decrease in international road transport of carriers registered in the Czech Republic and causes a significant burden on the environment and the road network through freight transport.

Overall assessment of the trend

Change since 1990

Change since 2000

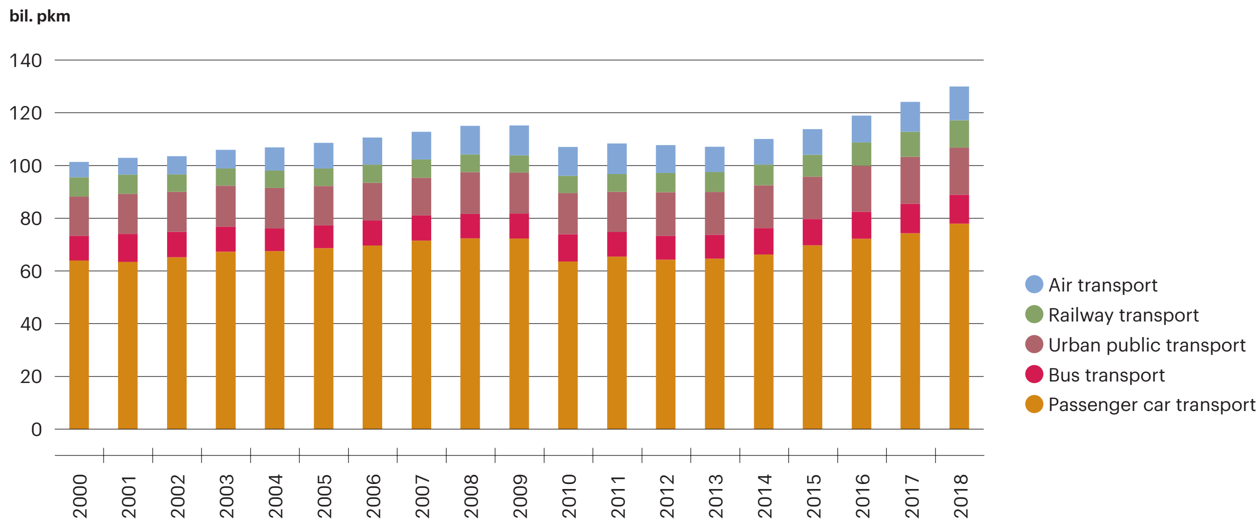
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Development of the transport performance of passenger transport in the Czech Republic by mode of transport [bil. pkm], 2000–2018

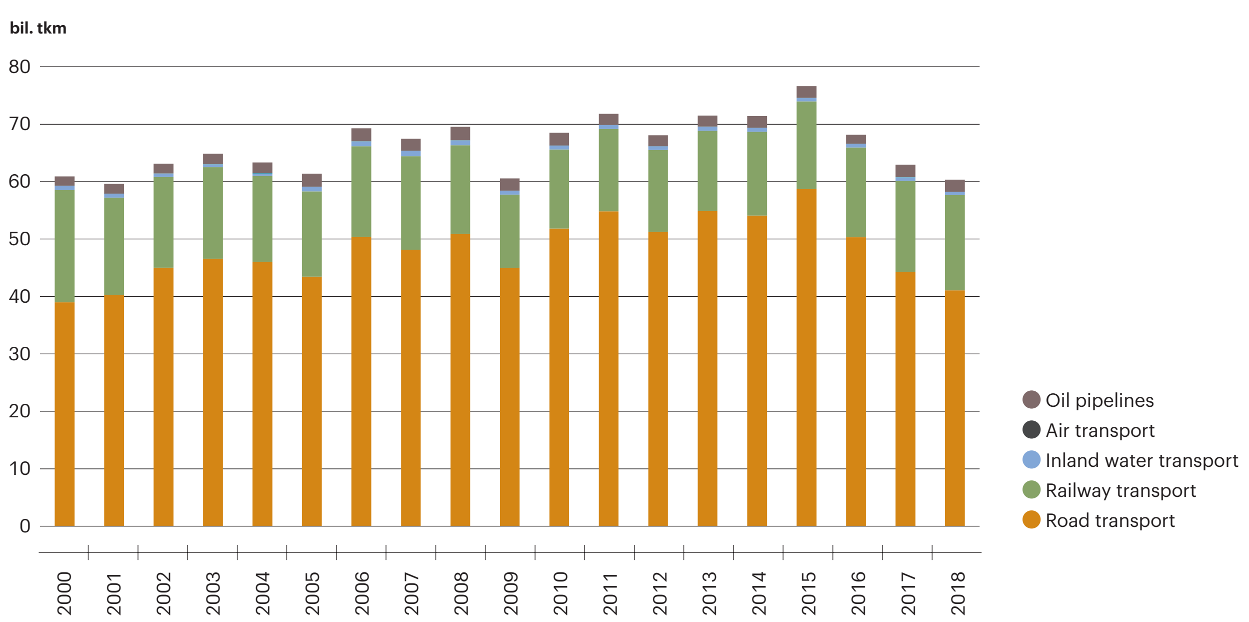


The decline in the performance of passenger car transport in the years 2009 and 2010 was influenced by a change in the methodology of road traffic census. It is therefore impossible to interpret the variation as a drop in passenger car transport or in passenger transport as a whole.

Data source: Ministry of Transport

Chart 2

Development of the transport performance of freight transport in the Czech Republic by mode of transport [bil. tkm], 2000–2018

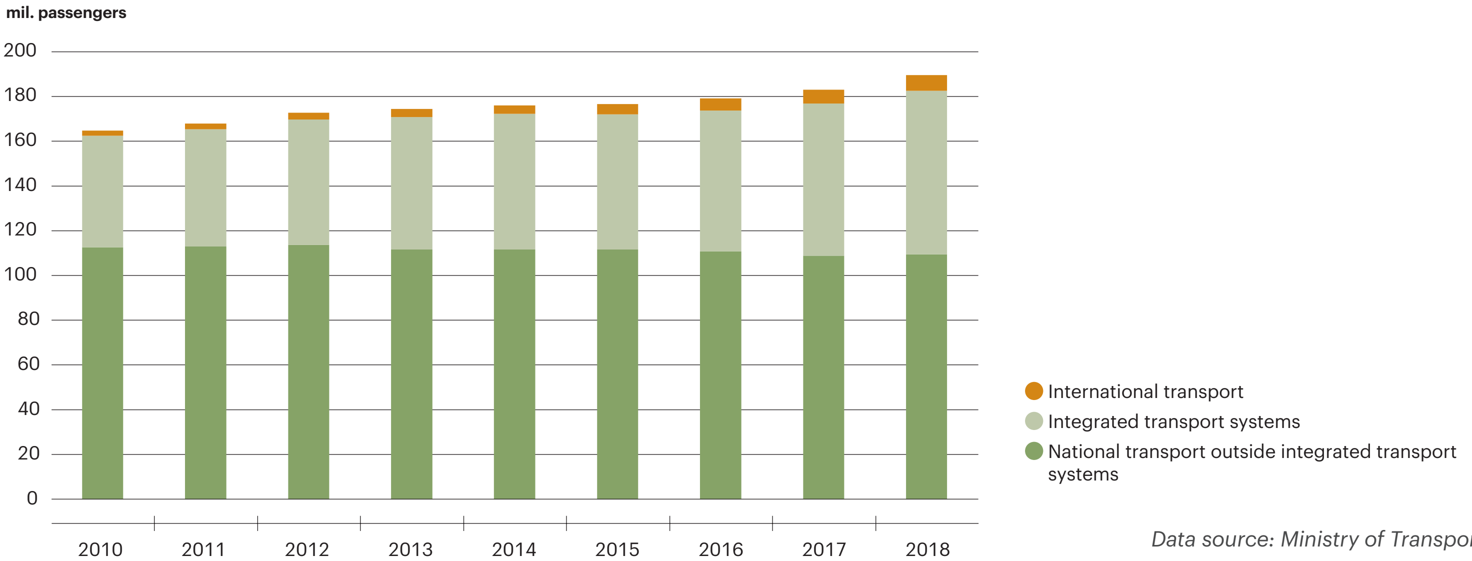


The data on the road freight transport include only the volumes of carriers registered in the Czech Republic, including the volumes carried out abroad as part of international transport.

Data source: Ministry of Transport

Chart 3

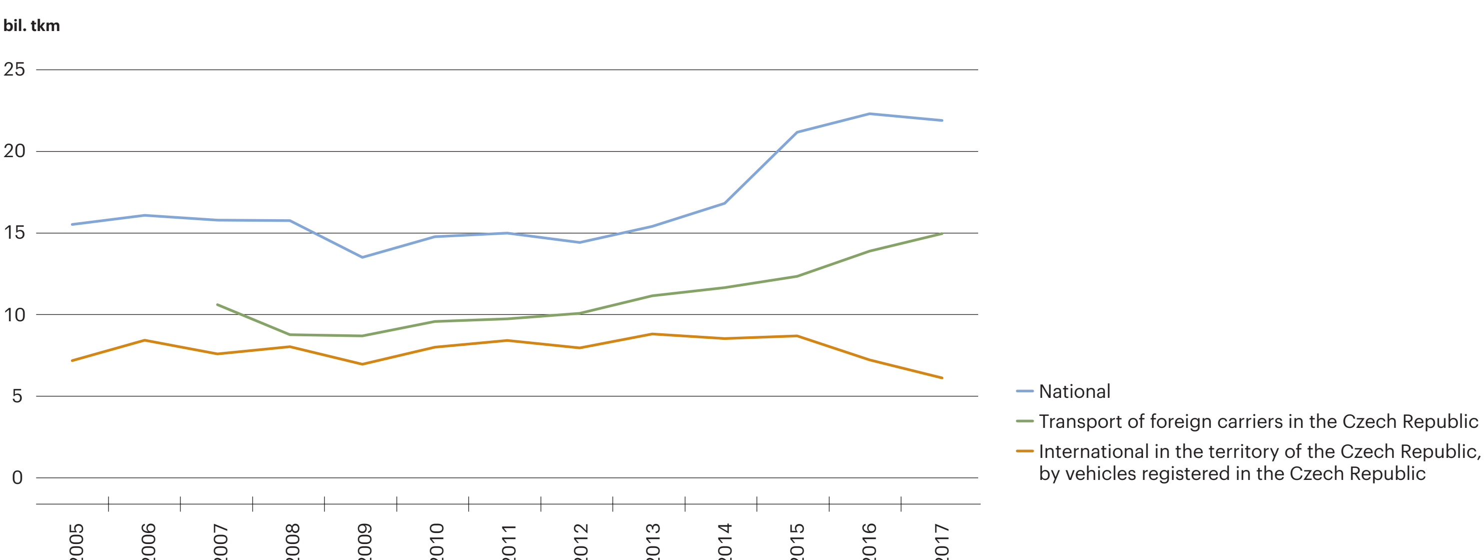
Number of passengers transported in domestic rail transport (of which in the framework of integrated transport systems) and international rail transport in the Czech Republic [mil. passengers], 2010–2018



Data source: Ministry of Transport

Chart 4

Performance of road freight transport in the territory of the Czech Republic [bil. tkm], 2005–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Transport, Eurostat

The total passenger transport performance in the Czech Republic increased by 28.2% to 130.0 bil. pkm in the period 2000–2018, and compared to the year-on-year comparison to 2018 the growth of passenger transport reached 4.7% (Chart 1).

This development of passenger transport increases the environmental pressures of transport, which need to be addressed by measures of a technological nature on vehicles and measures on transport infrastructure. From the environmental point of view, however, it is positive that there is not only the growth of individual transport, but also **public passenger transport** is growing and that the individualisation of transport is not deepened. The performance of public passenger transport as a whole (excluding air transport) increased by 23.8% in the period 2000–2018, the performance of passenger car transport increased by 21.9%. The share of public transport in the overall performance of passenger transport (without air transport) in 2018 reached 33.4% and is significantly above average in the European context.

The most significant factor of the growth of **public passenger transport** in the period 2000–2018 was railway, with passenger transport performance increasing by 40.9% and by 8.3% in year-on-year comparison between 2017 and 2018. In 2018, the railway transported a total of 189.5 mil. passengers, which is 6.5 mil. more than in the previous year. The **development of integrated transport systems** in cities and international transport (Chart 3) had the greatest impact on the growth of the number of passengers transported by railway, due to increased competition and quality of transport. A total of 73.1 mil. passengers were transported by railway under the integrated transport systems in 2018, which was 40.0% of domestic railway passengers. The number of integrated transport systems passengers has risen by 46.5% since 2010. In international transport, the number of passengers almost tripled (by 194.1%) to 7.0 mil. passengers in 2018 during the period 2010–2018.

The performance of **bus transport** (regular and irregular) stagnated in 2018 compared to 2017, it increased by 17.1% in the period 2000–2018. In 2018, the number of passengers transported increased by 10.4 mil. to 340.2 mil. passengers. A comparison of the development of bus transport performance and the number of passengers transported shows a shortening of the average transport distance (32 km in 2018), which corresponds to the growth of short-distance suburban bus transport. Within the urban public transport, there is a slow but steady increase in transport performance, in the period 2000–2018 the performance of public transport within the whole Czech Republic increased by about one fifth (by 19.6%), in 2018 the urban public transport transported 2.2 bil. people.

Air transport performance in the Czech Republic (only air carriers registered in the Czech Republic) increased by 13.4% in 2018, more than doubled (by 119.5%) in the period 2000–2018, air transport was the most dynamically growing type of passenger transport in this period. In 2018, airports in the Czech Republic handled a total of 17.8 mil. passengers (a year-on-year increase of 1.5 mil. passengers).

The overall performance of **freight transport in the Czech Republic** fluctuates over time, and in 2018 it was approximately at the level of 2000 (Chart 2). Since 2015, a significant decrease in the performance of road freight transport has been registered (by 30.0% in the period 2015–2018 and by 7.2% in the year-on-year comparison), while freight rail transport increased by 8.5% in this period. There is thus a positive change in the structure of freight transport in favour of rail transport, which accounted for 27.5% of total freight transport in 2018. However, when evaluating the environmental impacts of this development of freight transport, it is necessary to take into account the methodology of freight transport statistics, which takes into account only carriers registered in the Czech Republic, including their performance abroad. In the case of road freight transport, there is a situation (Chart 4) when after 2015 mainly international transport decreases with the performance mostly outside the Czech Republic, while domestic transport is stagnating. In addition, road freight transport performed by foreign carriers in the territory of the Czech Republic is also increasing; in 2015–2017, the growth in transport performance was 21.2%. This implies that the burden on the road network and the environment in the Czech Republic by road freight transport does not decrease and remains high despite the positive growth in freight transport by railway.

Inland water freight transport in the Czech Republic remains insignificant (0.9% of the total freight transport performance), and in 2018 due to drought and worse navigability of watercourses its performance decreased by 11.0% year-on-year.

Due to the development of road infrastructure, 79.0 ha of agricultural land and 7.2 ha of forest land were taken in 2018. In the period 2000–2018 the total land take amounted to 5.2 thous. ha of agricultural land and 0.5 thous. ha of forest land. In 2018, the motorway network was extended by 1 newly opened section of the D7 motorway (Postoloprty–Bítozeves) in the length of 3.8 km to a total of 1,252 km. The sections of the D3, D1, D6 and D48 motorways totalling 54.4 km were under construction with a total investment cost of CZK 13.7 bil. On the 1st class roads, 5 bypasses in the total length of 11.1 km were put into operation in 2018 with investment costs of CZK 1.8 bil., including the bypass of Strakonice on road I/22 and relaying of road I/62 in the section Děčín–Vilsnice.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

35 | Energy and fuel consumption in transport

Key question

Is energy consumption in the transport sector decreasing and are the objectives of the share of renewable energy sources in overall energy consumption in the transport sector being met?

Key messages

CNG consumption has an upward trend, over the past 10 evaluated years (2009–2018) it increased ten times. The number of registered passenger cars and buses on CNG is increasing, and the CNG infrastructure is developing.
The number of registered new electric vehicles and hybrids doubled in year-on-year comparison in 2018, despite this dynamic development, electromobility remains a marginal issue in the Czech Republic.

Energy consumption in transport is increasing; in 2018 it increased by 4.8% year-on-year and compared to the beginning of the 21st century it grew by 71.8%. Transport in the Czech Republic is almost entirely dependent on fossil energy sources, from which in 2018 originated 95.5% of the energy consumed in transport. Diesel consumption is growing, which is the least favourable fuel in terms of environmental impacts.
The share of renewable sources in total energy consumption in transport reached 6.6% in 2017[1]. The target of the National Renewable Energy Action Plan and the target of the State Environmental Policy 2012–2020 of 10% of renewable energy in transport by 2020 is not currently met.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

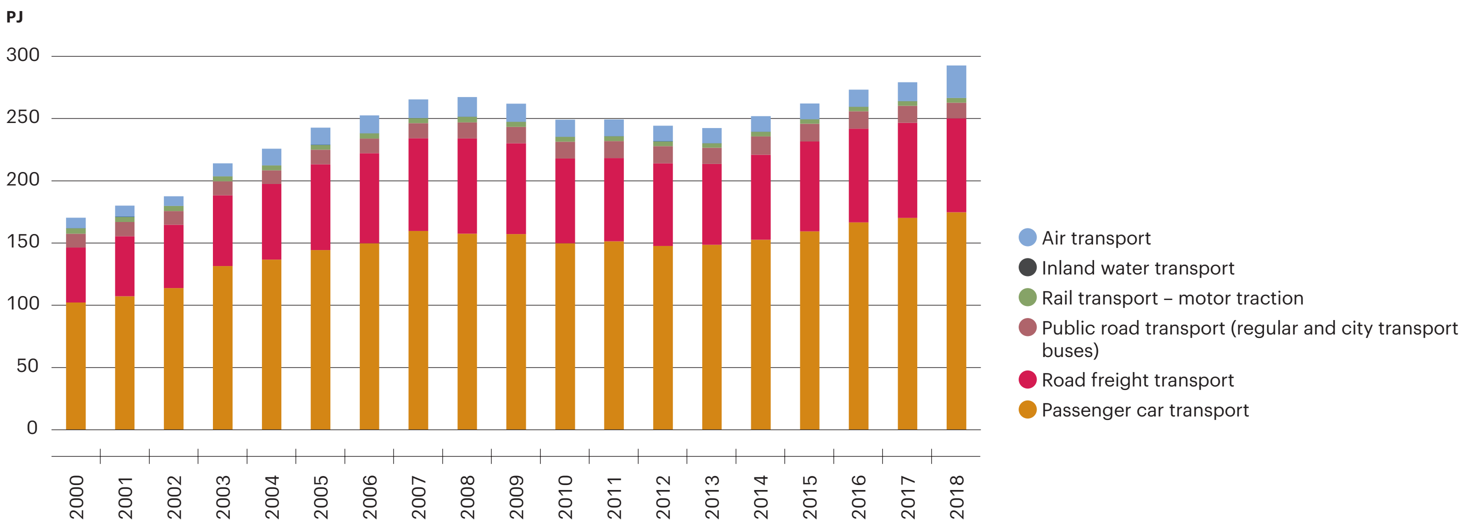
Last year-on-year change

[1] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Indicator assessment

Chart 1

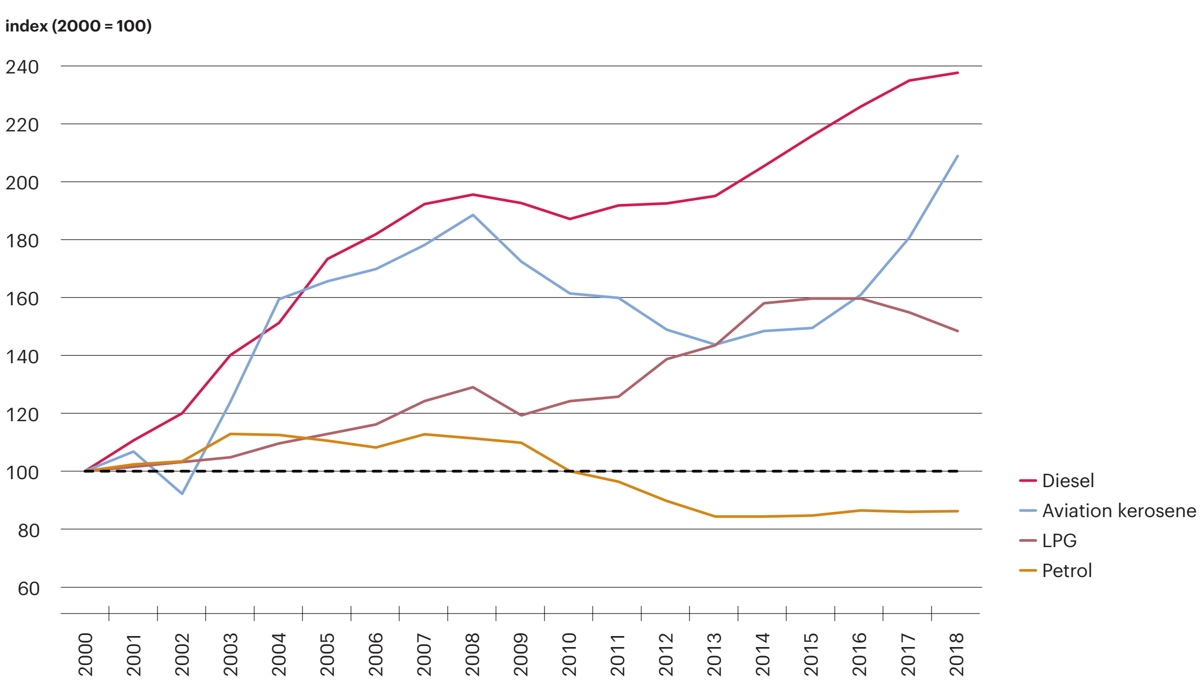
Energy consumption in transport by mode of transport in the Czech Republic [PJ], 2000–2018



Data source: Transport Research Centre

Chart 2

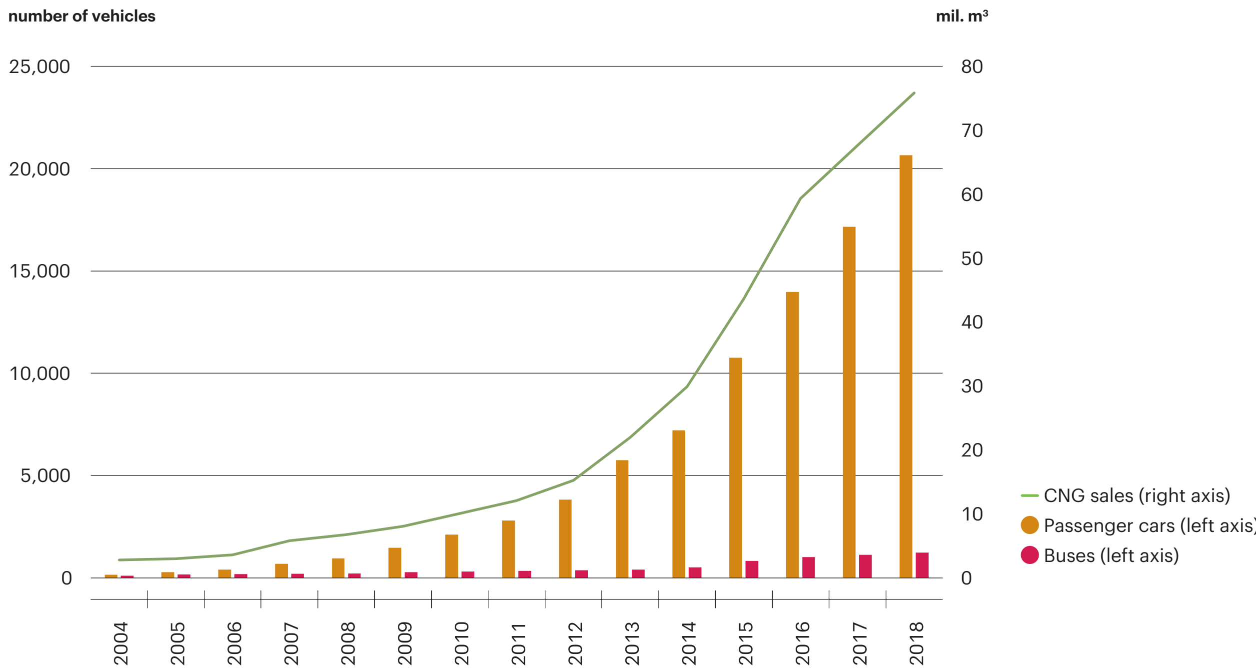
Development of fuel consumption of petroleum origin in transport in the Czech Republic [index, 2000 = 100], 2000–2018



Data source: Czech Statistical Office

Chart 3

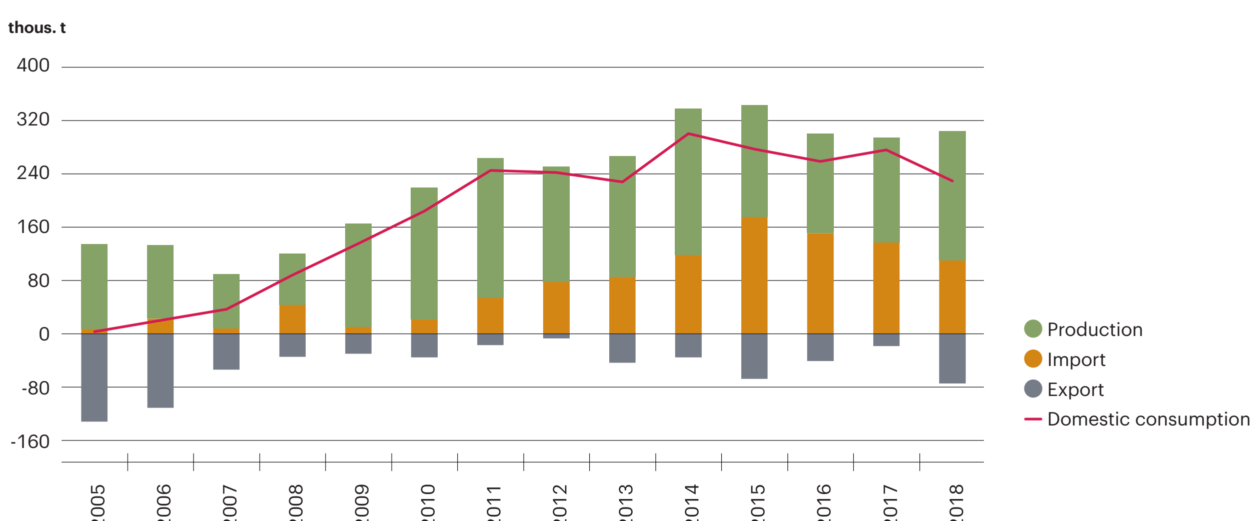
Number of registered passenger cars on CNG (including a combination of CNG and petrol) and CNG buses (left axis), CNG sales in the Czech Republic (right axis) [number of vehicles, mil. m³], 2004–2018



Data source: Czech Gas Association

Chart 4

Production, import, export and domestic consumption of FAME in the Czech Republic [thous. t], 2005–2018



Data source: Ministry of Industry and Trade

Chart 5

Energy consumption from RES in transport in the Czech Republic (left axis) and the share of RES in final energy consumption in transport (right axis) [PJ, %], 2005–2017

Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Ministry of Transport, Eurostat

Energy consumption in transport increased by 71.8% in the period 2000–2018, and by 4.8% year-on-year between 2017 and 2018 to 292.7 PJ (Chart 1). The development of energy consumption is influenced by the growth of the Czech economy and it results in an increase in transport pressures on the environment, especially in terms of carbon and emission intensity of transport. In 2018, most of the energy consumption in transport came from **fossil sources**, 95.5% excluding electricity consumed by rail and electric traction of urban public transport.

Road transport was the largest energy consumer in 2018, accounting for 89.8% of total energy consumption in 2018. Passenger cars accounted for more than a half (59.7%) of energy consumption in transport and road freight transport about a quarter (25.7%). According to the data of Energy Regulatory Office, electricity consumption in transport amounted to 671.6 GWh (2.4 PJ) in 2018 and decreased by 2.3% year-on-year. Thus, in 2018, electricity represented less than a hundredth of energy consumption in transport from fuel combustion.

The **development of fuel consumption** is characterized by a steady increase in **diesel fuel** consumption, which increased more than double to 4.6 mil. t in the period 2000–2018 (Chart 2), and diesel consumption was roughly threefold in 2018 compared to gasoline consumption. The growth of diesel consumption during the period under review was influenced by the growth of road freight transport and an increase in the share of diesel drive in the passenger car fleet. At the end of the period, however, the fleet structure is developing in the opposite direction (the share of diesel drive decreases in favour of petrol) and freight transport by domestic carriers also slightly decreases (however, it is compensated by the growth of transport of foreign companies in the Czech Republic). As a result of these factors, the growth in diesel consumption slowed down and, compared to the year 2018, consumption increased only by 1.1%.

Petrol consumption stagnated, reaching 1.6 mil. t in 2018, which was 13.7% lower than in 2000. At the end of the reporting period, a recovery in petrol demand is evident (petrol consumption grew by 2.5% year-on-year in 2018), driven by growth in registrations of new petrol passenger cars, which in 2018 had a market share of 67.0% in new passenger vehicle registrations, while diesel drive only 30.2%. Consumption of aviation kerosene has been developing according to the development of air transport and has been rising significantly after 2015. **CNG consumption**, a more environmentally friendly alternative to petrol and diesel, is rising sharply (Chart 3). Year-on-year, it grew by 12.2% to 75.8 mil. m^3 in 2018, with CNG consumption more than tenfold over the past 10 years (2008–2018). In 2018, 20.7 thous. passenger cars on CNG (and on a combination of CNG and petrol) and 1,234 buses were registered. The share of passenger cars on CNG in the fleet is negligible (0.4%), but in the case of buses it reached 5.8%. In 2018, 185 CNG filling stations were available in the Czech Republic, and 21 new filling stations were added year-on-year.

Although the use of electric cars and hybrids in the Czech Republic is dynamically increasing, the development of **electric** mobility has taken a short time (more importantly since 2016), and so the use of this alternative drive in the Czech Republic remains marginal. The number of new electric vehicles registered approximately doubled to 618 vehicles in 2018 compared to the previous year, which is only 0.2% of the number of new passenger cars registered this year. Number of hybrids registered in 2018 was 4,831, which is also roughly double that of the previous year, with a market share of hybrids reaching 1.8%.

Biofuels are an essential renewable energy source in transport. The consumption of FAME, a bio-component of diesel, decreased in 2018 by 16.9% year-on-year to 229.4 thous. t (Chart 4). After a dynamic growth and reaching the maximum consumption in 2014 (300.4 thous. t), FAME consumption fluctuates and decreased by 23.6% in 2014–2018. This development, which occurs despite the increase in diesel consumption, indicates low and declining demand for high-percentage biodiesel. The reasons for this are operational problems associated with its use and, despite tax advantages, a small price difference compared to conventional diesel. Despite a decline in domestic demand, FAME production grew by 23.4% year-on-year to 194.3 thous. t, as a result of which the FAME exports grew roughly four times to 74.5 thous. t. **Bioethanol** consumption is stagnating, only bio-ETBE, which is an additive of high-octane petrol produced from bioethanol, is increasing, which makes it possible to meet the mandatory bio-component content of these fuels.

The **share of renewable energy sources** in final energy consumption in transport according to the internationally used SHARES methodology[2] reached 6.6% in 2017[3] (Chart 5). Compared to 2016, when the share of RES was 6.4%, there was a slight year-on-year increase. In 2017, in the energy consumption from RES in transport there was the largest share of biofuels of 74.5%, the share of electricity from RES consumed in rail transport was 23.2%, electricity from RES in road transport accounted for only 2.0%.

The **target of the National Renewable Energy Action Plan and the State Environmental Policy of the Czech Republic 2012–2020**, which is set in accordance with European legislation at 10% of energy from RES in transport by 2020, is currently not met. Moreover, the share of RES in total energy consumption in transport has been stagnating since 2011. Although the consumption of RES in transport during the period of validity of the State Environmental Policy of the Czech Republic 2012–2020 increased by 21.9% (3.2 PJ), at the same time, due to economic growth, there was an overall increase in energy consumption in transport. The share of RES in energy consumption in transport therefore increased by only 0.4 p.p. during this period.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[2] The Eurostat methodology (http://ec.europa.eu/eurostat/web/energy/data/shares) used for the calculation of the RES share in final energy consumption.

[3] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

36 | Emissions from transport

Key question

Is the emission intensity of transport, together with the impact of transport on the environment and public health, declining?

Key messages[4]

NO_x emissions from transport decreased by 30.0% in the period 2000–2018, VOC emissions decreased by 71.0%, CO emissions by 79.8% and suspended particulate emissions by 9.2%.

CO_2 emissions from transport are increasing, they increased by 65.8% in the period 2000–2018. Transport is the second largest source of greenhouse gas emissions in the Czech Republic.
Growth is also registered for PAH emissions from transport, which increased by 131.0% between 2000–2008.
In 2018, NO_x emissions from diesel passenger cars accounted for 85.1% of NO_x emissions from passenger car transport. In addition, most of the emissions from diesel passenger cars are produced by newer vehicles meeting the higher EURO 4–6 emission standards due to the high transport performance of these vehicles. The situation is similar for heavy trucks.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

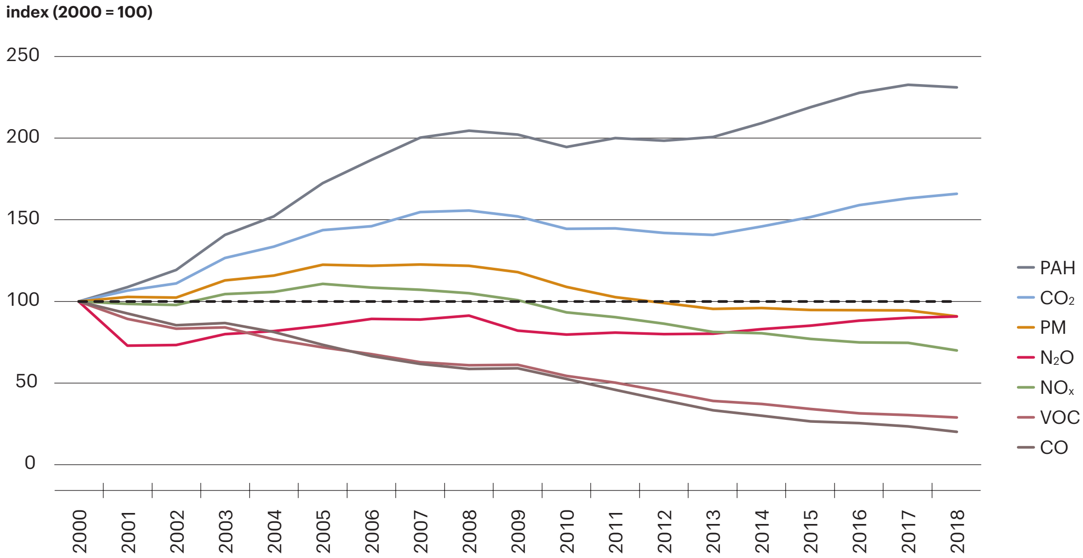
Last year-on-year change

[4] *Since 2019, emissions from road transport have been newly calculated according to the "EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016" methodology for the calculation of emissions from road transport, updated in 2018, and the "IPCC Guidelines for National Greenhouse Gas Inventories". These methodologies are implemented in the COPERT 5 software tool supported by the European Environment Agency. COPERT calculates fuel consumption from traffic performance based on data pairing from the Central Vehicle Register and Database of Technical Inspection Stations calibrated for the results of the National Traffic Census. Finally, the emissions calculated in the COPERT programme are normalized to the statistical fuel consumption reported by the Czech Statistical Office, which ensures logical coherence of emissions with consumption data transmitted by the Czech Statistical Office to the European authorities.*

Indicator assessment

Chart 1

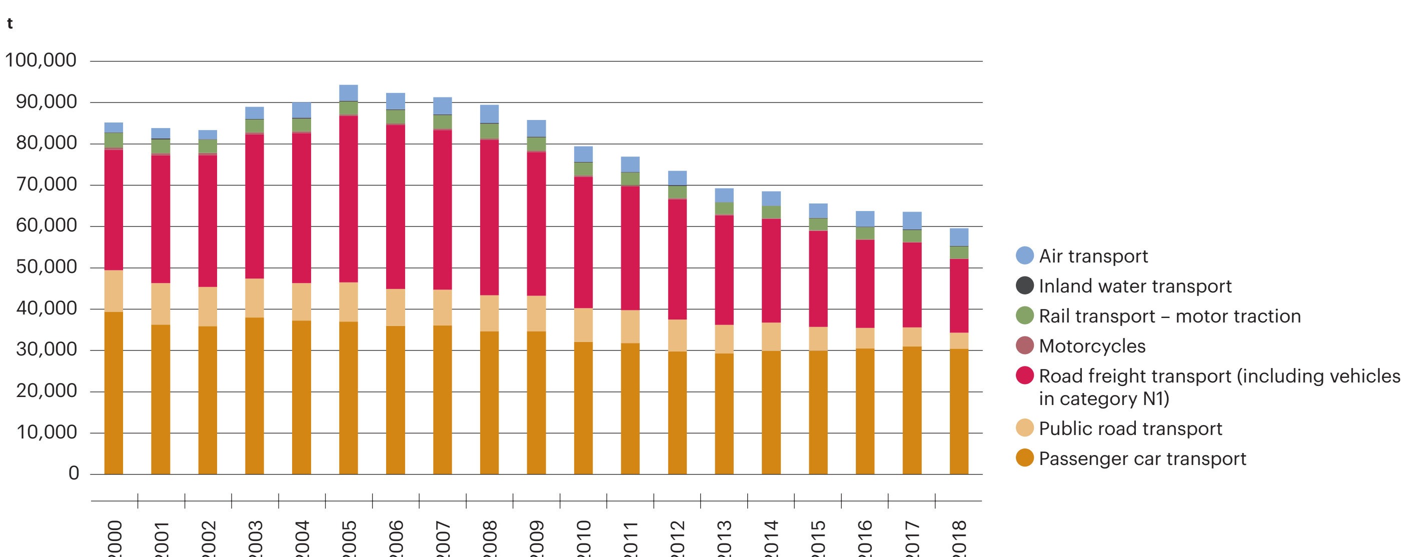
Development of emissions of air pollutants and greenhouse gases from transport in the Czech Republic [index, 2000 = 100], 2000–2018



Data source: Transport Research Centre

Chart 2

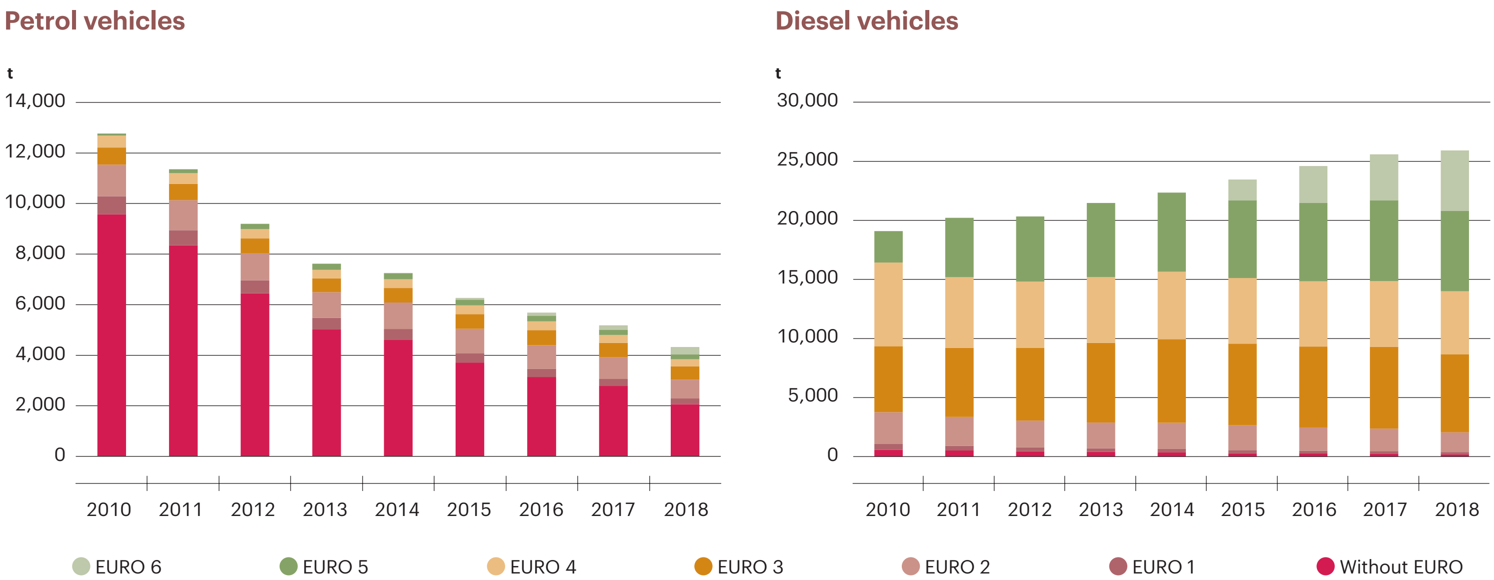
Decomposition of NO_x emissions from transport by mode of transport [t], 2000–2018



Data source: Transport Research Centre

Chart 3

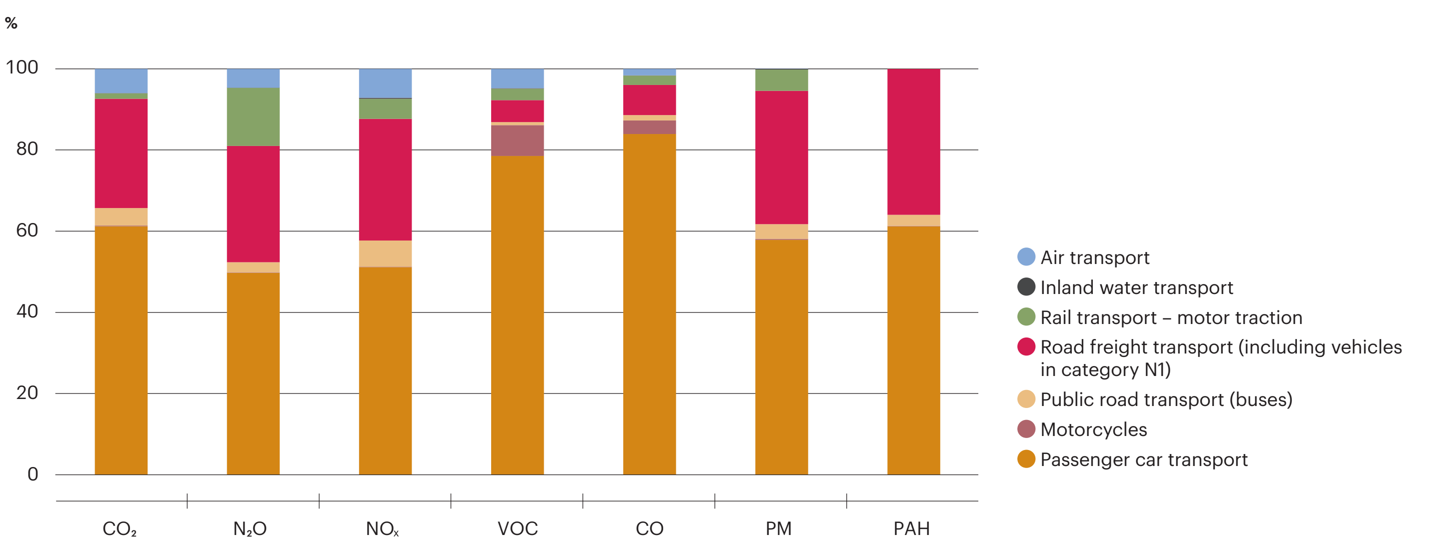
Development of NO_x emissions from petrol passenger cars and diesel passenger cars according to EURO emission standards [t], 2010–2018



Data source: Transport Research Centre

Chart 4

Emissions of air pollutants and greenhouse gases from transport in the Czech Republic [%], 2018



Data source: Transport Research Centre

Emissions of pollutants and greenhouse gases from transport are a major environmental burden with impacts on human health, ecosystems and the climate system. Emissions of NO_x, VOC, CO and suspended particulate matter (PM) from transport decreased over the period 2000–2018 (Chart 1). However, a significant and sustained decrease was registered only for CO emissions, which decreased by 79.8% during the reporting period, and for VOC emissions – the decrease was 71.0%. Between 2000 and 2018, NO_x emissions, the main pollutant from transport, decreased by 30.0%, while they also had an increasing trend at the beginning of the period under review. A similar situation was observed for PM emissions, the decline of which was the least significant (by 9.2%) in this period. On the other hand, carcinogenic PAH emissions showed a markedly increasing trend due to the growth of fuel consumption and more than doubled (by 131.0%) in the period 2000–2018.

In 2018, in the year-on-year comparison, NO_x emissions decreased by 6.3%, VOC emissions by 4.8%, CO by 14.2% and PM by 3.8%. It can thus be stated that in the last monitored year the decrease of pollutant emissions from transport accelerated and was one of the most significant since 2000.

Within the decomposition of the development of NO_x and PM emissions by mode of transport, the decreasing trend of emissions from road freight transport and public road transport after 2010 is evident (Chart 2), which occurs after the period of growth of emissions at the beginning of the 21st century. NO_x emissions from road freight transport (including the N1 commercial vehicle category) decreased by 43.8% and 13.0% year-on-year between 2010 and 2018 in the period 2017 and 2018. By contrast, emissions from passenger car transport have been stagnating after 2010, with NO_x emissions dropping by only 1.8% year-on-year. The trend in emissions from passenger car transport was influenced, besides the increase in that transport performance, by the increased share of diesel powered vehicles in the fleet (except for the period after 2016 when diesel powered vehicle registrations were declining) and by the growth of transport performance of diesel powered vehicles which are a common part of company car fleets and are thus intensively used.

While NO_x emissions from gasoline passenger cars in the period 2010–2018 decreased by 66.1%, NO_x emissions from diesel vehicles increased in this period by 35.8% (Chart 3). In 2018, diesel passenger cars produced 85.1% of total NO_x emissions from passenger car transport and 43.5% of total NO_x emissions from transport. This indicates a significantly higher emission intensity of the diesel drive compared to the petrol drive. Emission production differs for petrol and diesel drive, also in terms of vehicle age, respectively the fulfilment of EURO emission standards.

In the case of petrol passenger cars, the decisive share of NO_x emissions (70.2%) was produced in 2018 by older vehicles fulfilling the maximum emission standard EURO 2. However, for diesel cars, the highest share of NO_x emissions comes from newer vehicles meeting higher emission standards (EURO 4–6), which accounted for 66.5% of total diesel emissions in 2018. In the case of heavy trucks, the newest vehicles meeting the highest emission standards EURO 5 and 6 participated in 2018 on NO_x emissions from heavy trucks by 44.4% and on PM emissions even by 70.3%. PM emissions from vehicles complying with the EURO 6 emission standard have almost doubled since 2015. Thus, even in the case of trucks, a major proportion of the pollution comes from the newest vehicles with the highest traffic performance, not from the oldest vehicles.

CO_2 emissions from transport increased by 65.8% in the period 2000–2018 and by 1.7% year-on-year in 2018. The evolution of CO_2 emissions reflected the growth in transport energy consumption and the dependence of transport on fossil fuels. N_2O emissions decreased by 9.2% during the period under review, but after 2010 the trend of N_2O emissions is also increasing due to transport growth, in 2018 N_2O emissions increased by 1.0% year-on-year. Transport accounted for 14.5% of total greenhouse gas emissions in 2017[5], making it the second largest source of greenhouse gas emissions after the energy industry.

The largest air pollutant from transport and the source of greenhouse gas emissions in 2018 was passenger car transport (Chart 4). In 2018, the largest share of total transport emissions was attributed to passenger car transport for CO (84.5%) and VOC (79.5%) emissions. Road freight transport (including commercial vehicles of the category N1) was responsible for 36.2% of PAH emissions from transport and 32.8% of PM emissions. Of the non-road modes, only air transport had a significant share of NO_x (7.1%) and CO_2 emissions (6.0%); the motor traction of rail transport produced 5.3% of PM emissions.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[5] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

37 | Noise pollution burden of the population

Key question

What is the state and development of noise pollution in the Czech Republic?

Key messages[6]

The numbers of inhabitants exposed to high noise pollution from road transport exceeding the limit value between 2012 and 2017 decreased. The decrease was registered both in the areas outside agglomerations and in the majority of urban agglomerations. In the Plzeň agglomeration the population exposure to noise levels above the limit value dropped down to approximately one quarter. Expenditure on the implementation of noise reduction measures on the road infrastructure is growing, reaching CZK 232.8 mil. in 2018 and increasing by 8.7% year-on-year.

In the agglomeration of Prague, between 2012 and 2017, the proportion of inhabitants exposed to noise pollution from roads exceeding the limit value increased to 8.4% of the population of the agglomeration all-day and 10.1% of the population at night hours.

Overall assessment of the trend

Change since 1990 N/A

Change since 2012[7]

Situation in 2017

Table 1

Limit values for noise indicators in the Czech Republic [dB]

Source of noise	L_{dvn} [dB]	L_n [dB]
Road transport	70	60
Rail transport	70	65
Air Transport	60	50
Integrated devices	50	40

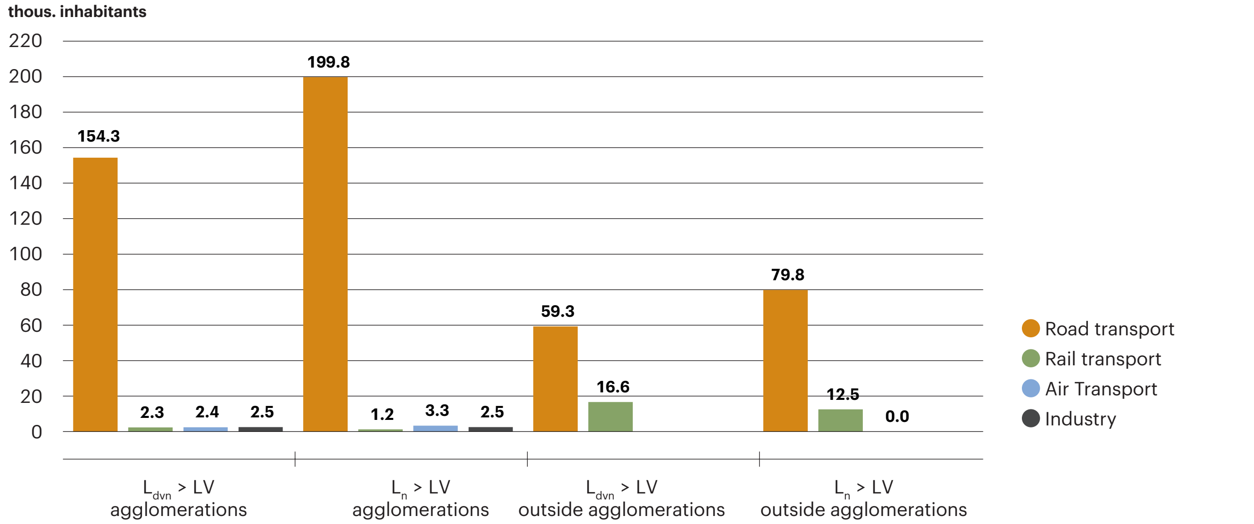
L_{dvn} – noise indicator for day, evening, and night to characterise the all-day noise disturbance
L_n – the noise indicator for night hours (10 pm–06 am) characterising the sleep disturbance

Data source: Decree No. 523/2006 Coll., on noise mapping

[6] *Due to the methodology for collecting and processing noise mapping data, data for the year 2018 are not available at the time of publication.*
[7] *Overall assessment of the trend shifted due to data collection and processing.*

Chart 1

Total number of population exposed to noise exceeding the limit values laid down for each category of sources of noise burden in agglomerations and outside agglomerations, indicators L_{dvn} and L_n [thous. inhabitants], 2017

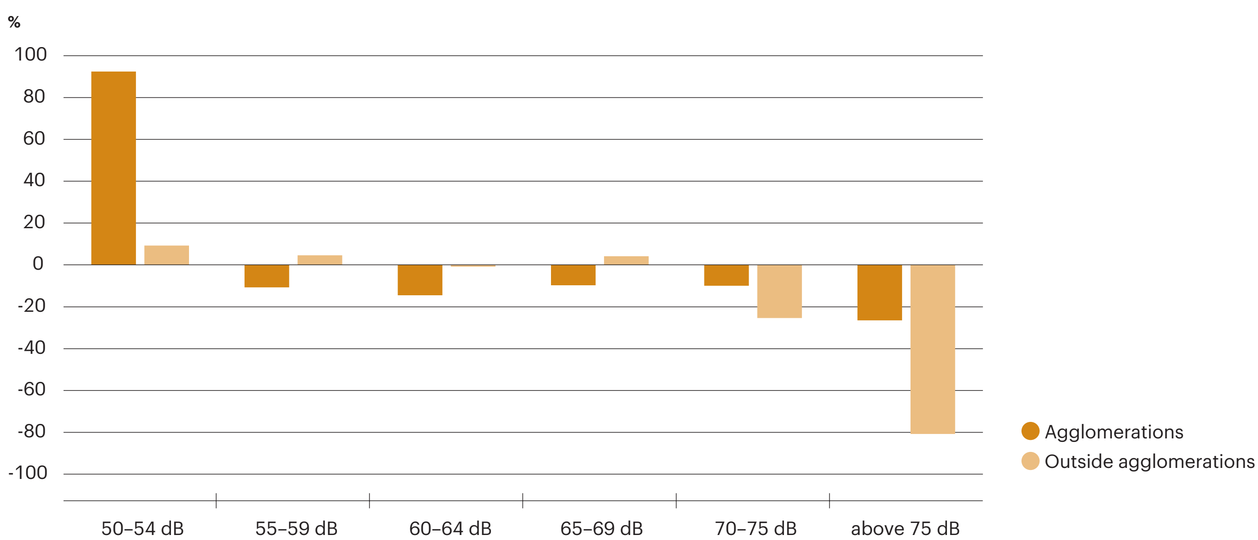


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
Outside agglomerations, noise pollution from road transport is only evaluated for major roads with traffic intensity above 3 mil. vehicles per year.
Noise mapping for industry is only performed in agglomerations. Noise pollution from airports was evaluated only for the main airport of Václav Havel in Prague.

Data source: National Reference Laboratory for Environmental Noise

Chart 2

Comparison of the population exposed to individual categories of noise pollution from road transport between the 2nd round of Strategic Noise Mapping (2012) and the 3rd round (2017) for the indicator of all-day noise disturbance (L_{dvn}), inside and outside agglomerations [%]

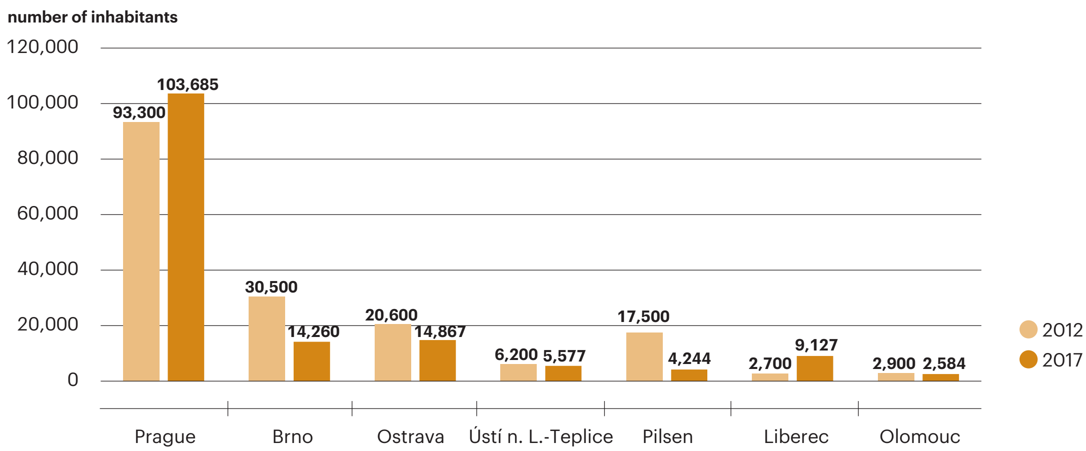


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: National Reference Laboratory for Environmental Noise

Chart 3

Number of inhabitants of urban agglomerations of the Czech Republic exposed to all-day noise pollution (L_{dvn} indicator) from road transport exceeding the limit value, comparison of the results of the 2nd round (2012) and the 3rd round (2017) of the Strategic Noise Mapping [number of inhabitants]

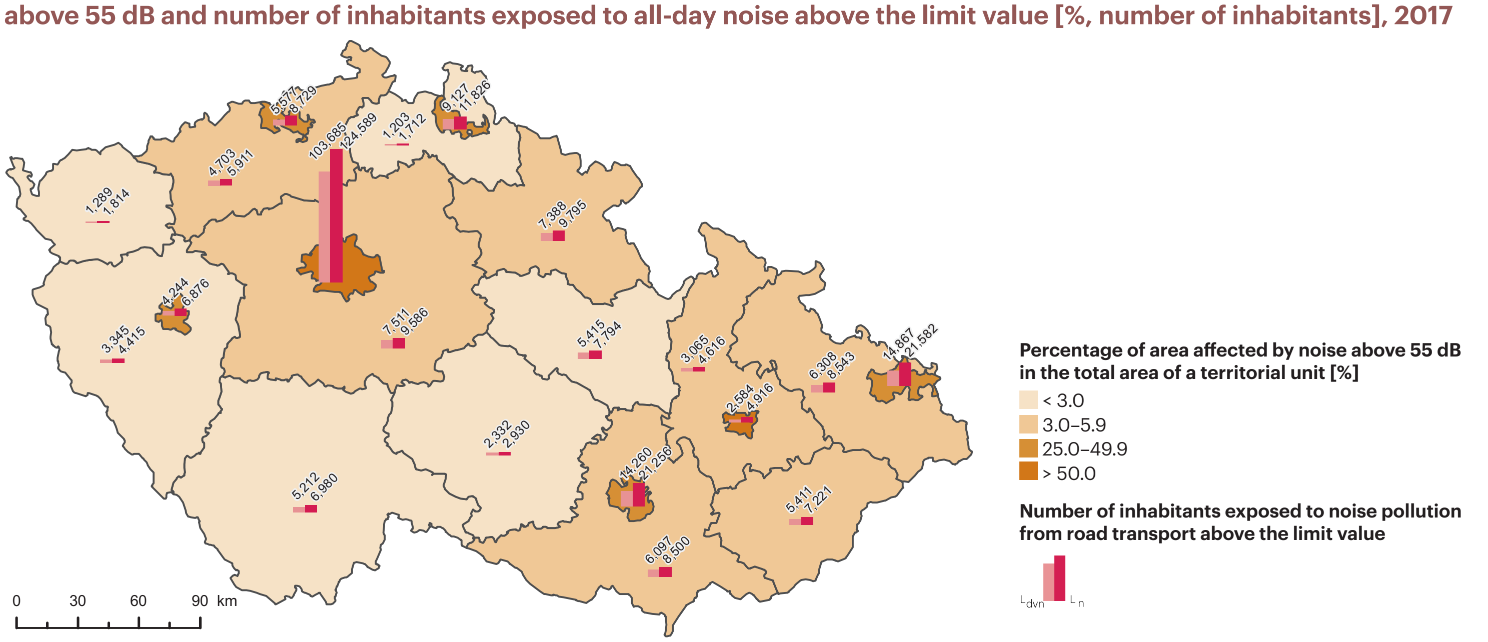


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: National Reference Laboratory for Environmental Noise

Figure 1

Percentage of the areas of regions of the Czech Republic and agglomerations affected by all-day noise (indicator L_{dvn}) above 55 dB and number of inhabitants exposed to all-day noise above the limit value [%, number of inhabitants], 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.
Outside agglomerations, noise pollution is only assessed on major roads with traffic intensity above 3 mil. vehicles per year.

Data source: National Reference Laboratory for Environmental Noise

Noise pollution is an important factor in the Czech Republic affecting the quality of the environment and the health of the population. The most significant source of noise pollution in the Czech Republic is **road transport**. In areas with exceeded limit value[8] for the indicator of all-day road traffic noise (L_{dvn}), which is set at 70 dB (Table 1), in 2017 according to the results of the 3rd round of Strategic Noise Mapping there were 213.6 thous. inhabitants (approx. 2% of the Czech population). In the night hours (10 pm–06 am, indicator L_n), when the lower limit value of 60 dB applies, it was 279.6 thous. inhabitants (Chart 1).

[8] The limit values of noise indicators are set for individual categories of noise sources by Decree No. 523/2006, on noise mapping. These are limit values, above which an action plan for noise reduction is prepared for the given locality.

The noise pollution from road transport is highest in **urban agglomerations**[9], where lived 72.3% of the total population exposed to all-day noise pollution above the limit value (indicator L_{dvn}) in 2017. Overall, about 2.5 mil. inhabitants in the Czech Republic were exposed to all-day noise pollution from road traffic above 55 dB (in and outside the agglomerations), which corresponds to 23.5% of the Czech population.

Comparison of the results of noise mapping in 2012 (2nd round of Strategic Noise Mapping) and in 2017 (3rd round) shows that the L_{dvn} indicator increased the number of inhabitants exposed to road traffic noise at the lowest monitored exposure interval (especially in agglomerations). However, for higher noise levels, in particular for the highest noise exposure, the number of exposed inhabitants has decreased (Chart 2). The noise sleep disturbance indicator (L_n) showed a slight decrease in the number of exposed persons in the whole observed range of noise exposure. Although this favourable trend must be seen in the context of methodological changes in noise mapping, the impact of these changes is more significant only in more distant objects, i.e. affected by lower noise load. The decrease in the number of exposed persons to the highest noise pollution can thus be considered as proven and the effectiveness of the adopted noise reduction measures can be positively evaluated.

In most **urban agglomerations**, the number of inhabitants exposed to noise pollution from road transport exceeding the limit value decreased between 2012 and 2017, with the exception of the Prague agglomeration and the Liberec agglomeration (Chart 3). In 2017, the Prague agglomeration exposed to all-day noise exceeding the limit of 8.4% of the population, and at night even 10.1% of the population. The situation in the Prague agglomeration is influenced by the increasing intensity of road traffic and the yet unfinished bypass for transit traffic. On the other hand, in the agglomeration of Pilsen, noise exposure above the limit value decreased by 75.7% (L_{dvn} indicator), which is a consequence of the diversion of most transit traffic outside the city area. A similar trend in noise exposure can be observed in the agglomerations of Ostrava and Olomouc, where the proportion of the population exposed to above the limit value (2.5% for the L_{dvn} indicator) is the lowest of all agglomerations in the Czech Republic.

In 2017, the agglomerations of the Czech Republic were exposed to all-day noise pollution from road traffic exceeding the limit value of 70 dB in total of 11.5 thous. **residential buildings**, of which 6.2 thous. were in Prague and 1.6 thous. in Brno. Regarding school facilities with noise exposure above the limit value, a total of 164 were registered, of which 101 were in Prague and 26 in Brno. The location of inpatient health care facilities in locations with high noise pollution is exceptional in the Czech Republic, in total there were 5 health care facilities, of which 3 in the Prague agglomeration.

Outside the agglomerations, in 2017 the biggest **noise pollution was from the main roads** of the Central Bohemian and Hradec Králové regions (Figure 1) through which the main roads and motorways pass. The Liberecký Region has the lowest noise pollution outside the agglomeration (1.2 thous. inhabitants are exposed all day to above the limit value), where road traffic is intensive and the associated noise pollution is concentrated mainly in the Liberec agglomeration. In the period 2012–2017, exposure to road traffic noise above the limit value decreased in most regions, most notably in the Karlovy Vary region (by 64.9%). The increase of high noise exposure was registered only in the Moravian-Silesian (by 23.8%) and South-Moravian (by 23.4%) regions; in these regions the road transport intensity is significantly growing, in Moravian-Silesian region it is related to the improvement of transport availability due to the D1 motorway.

Expenditure on implementation of **noise reduction measures** on road infrastructure is growing; in 2018 it was CZK 232.8 mil. expended, which is by 8.7% more than in the previous year and more than twice as much as in 2015. The length of noise barriers at the end of 2018 reached 412.4 km, 6.7 km of new noise barriers on motorways and 1st class roads were put into operation in 2018.

Traffic on the **main railway lines**, where at least 30 thous. trains per year pass, was a source of noise pollution (indicator L_{dvn}) above the limit value of 70 dB in 2017 for a total of 19.0 thous. inhabitants. Noise from rail transport mainly affects areas outside urban agglomerations. In regional breakdown, the noise pollution from rail transport is the biggest in the Central Bohemia, Ústí nad Labem and Pardubice regions, through which corridor lines of international importance pass. **Václav Havel Airport in Prague**, which was the only airport in the Czech Republic to be evaluated in the 3rd round of Strategic Noise Mapping, is a source of noise pollution above the limit value for a total of 2.4 thous. inhabitants all day and 3.3 thous. inhabitants at night, mostly living in the Prague agglomeration.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[9] Agglomerations are defined by Decree No. 561/2006 Coll., stipulating a list of agglomerations for the purpose of assessing and reducing noise.

Transport in the global context

Key messages[10]

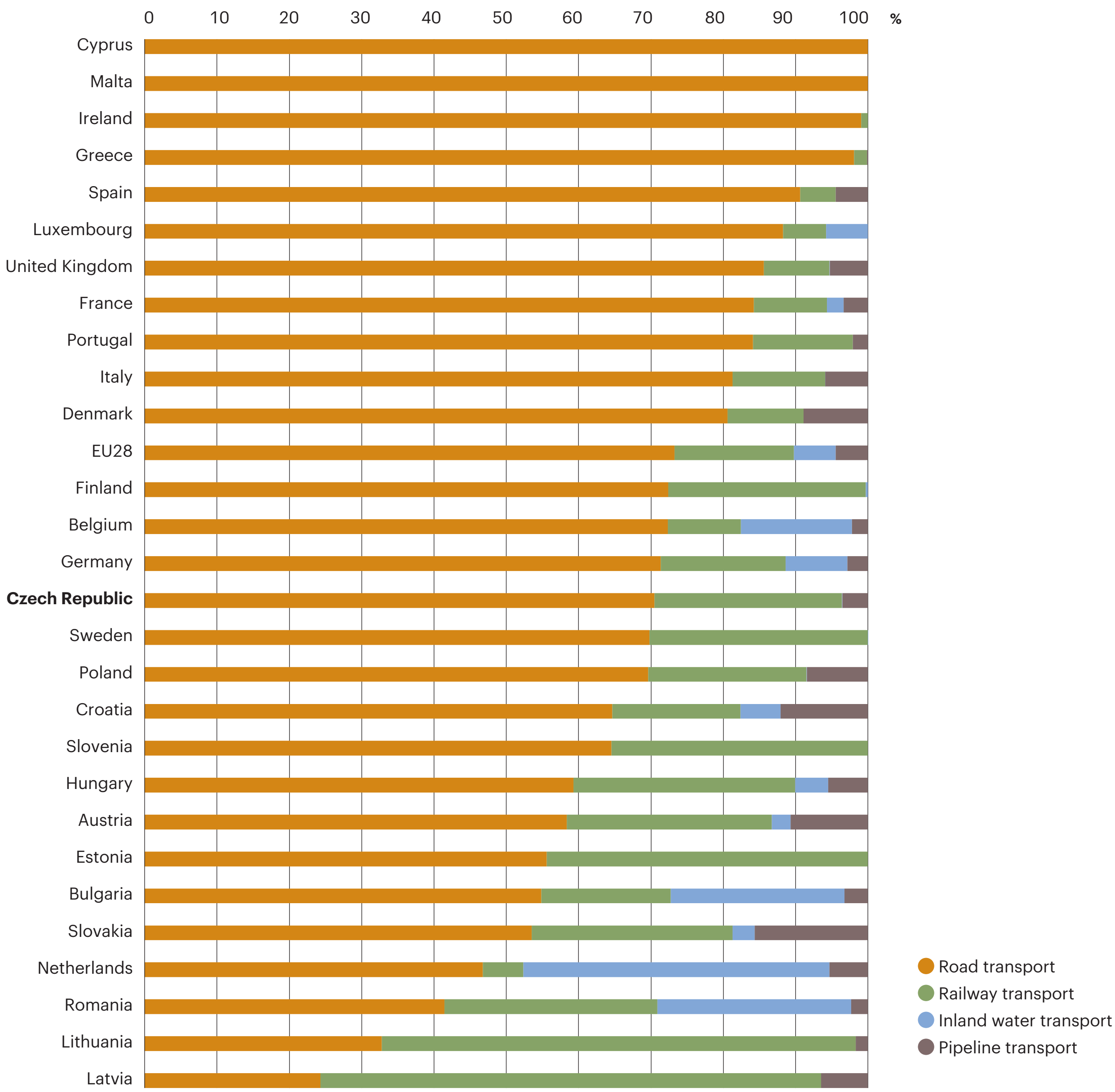
- In the structure of the transport performance of inland freight transport in the EU28, the environmentally least friendly road transport prevails, with the share of 73.3% in 2017.
- Greenhouse gas emissions from transport in the EU28 have been slowly increasing since 2000, and transport accounted for 21.9% of the total EU28 emissions in 2017. A significant increase in greenhouse gas emissions from transport is registered in the countries of Central and Eastern Europe, including the Czech Republic.
- Share of inhabitants of urban agglomerations with over 100 thous. inhabitants affected by high noise pollution from road transport above 70 dB in the Czech Republic reached 6.4% in 2017 and is above average compared to other EU28 countries.

[10] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Chart 1

Structure of freight transport performance (excluding maritime shipping) [%], 2017

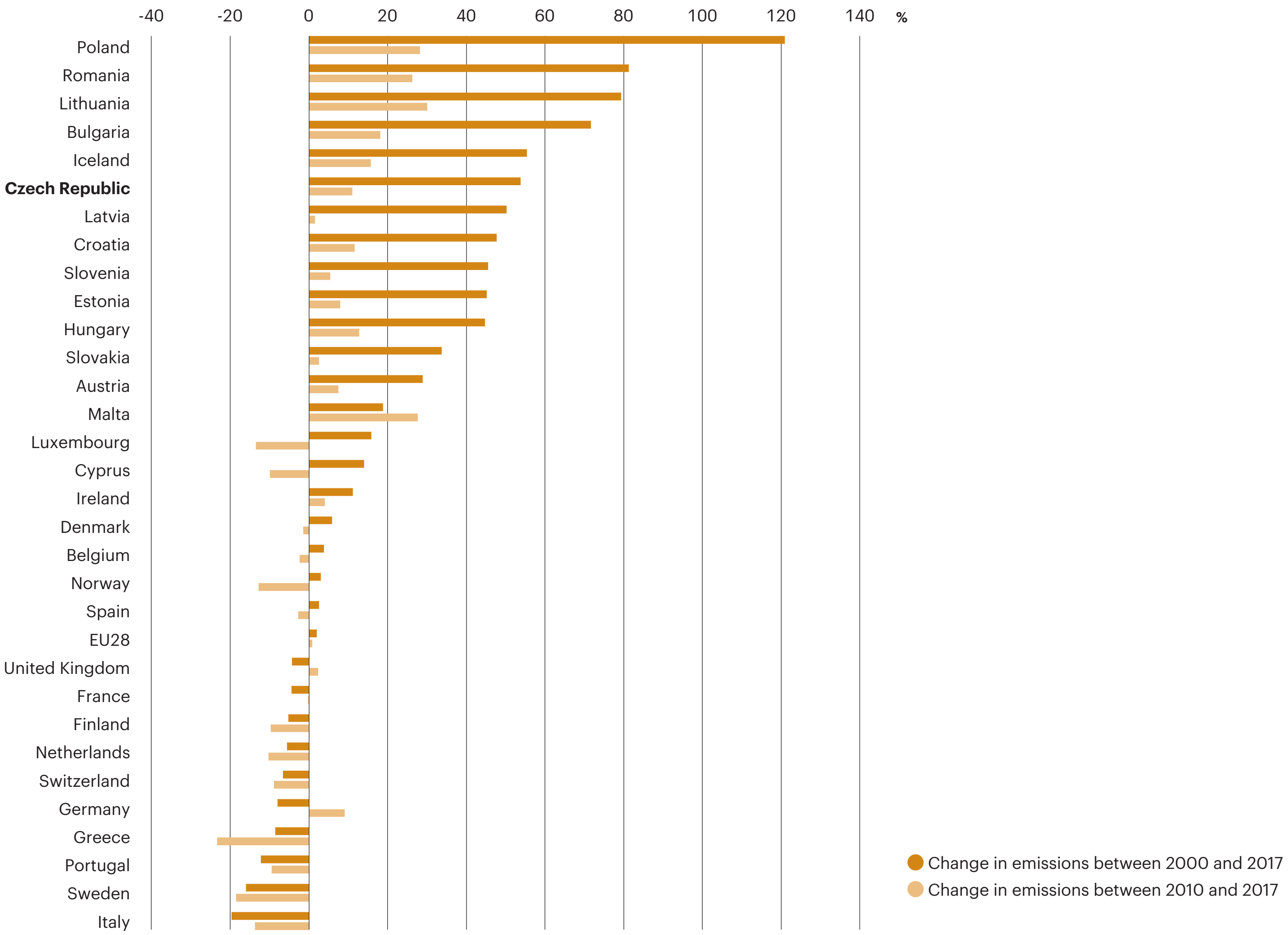


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Commission, DG Mobility and Transport

Chart 2

Relative change in greenhouse gas emissions from transport between 2000 and 2017 and between 2010 and 2017, excluding LULUCF [%]

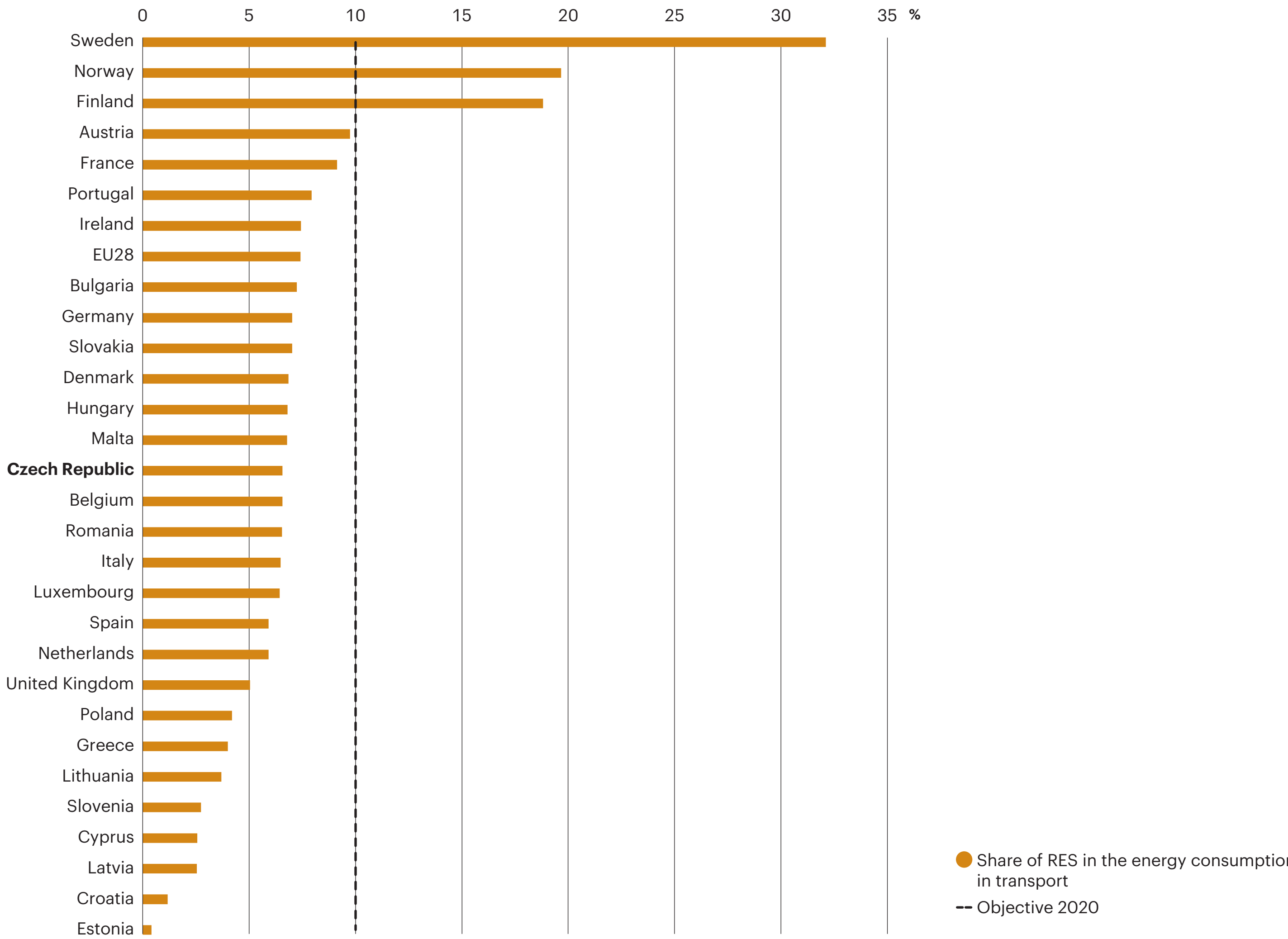


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency

Chart 3

Share of RES in the final energy consumption in transport [%], 2017

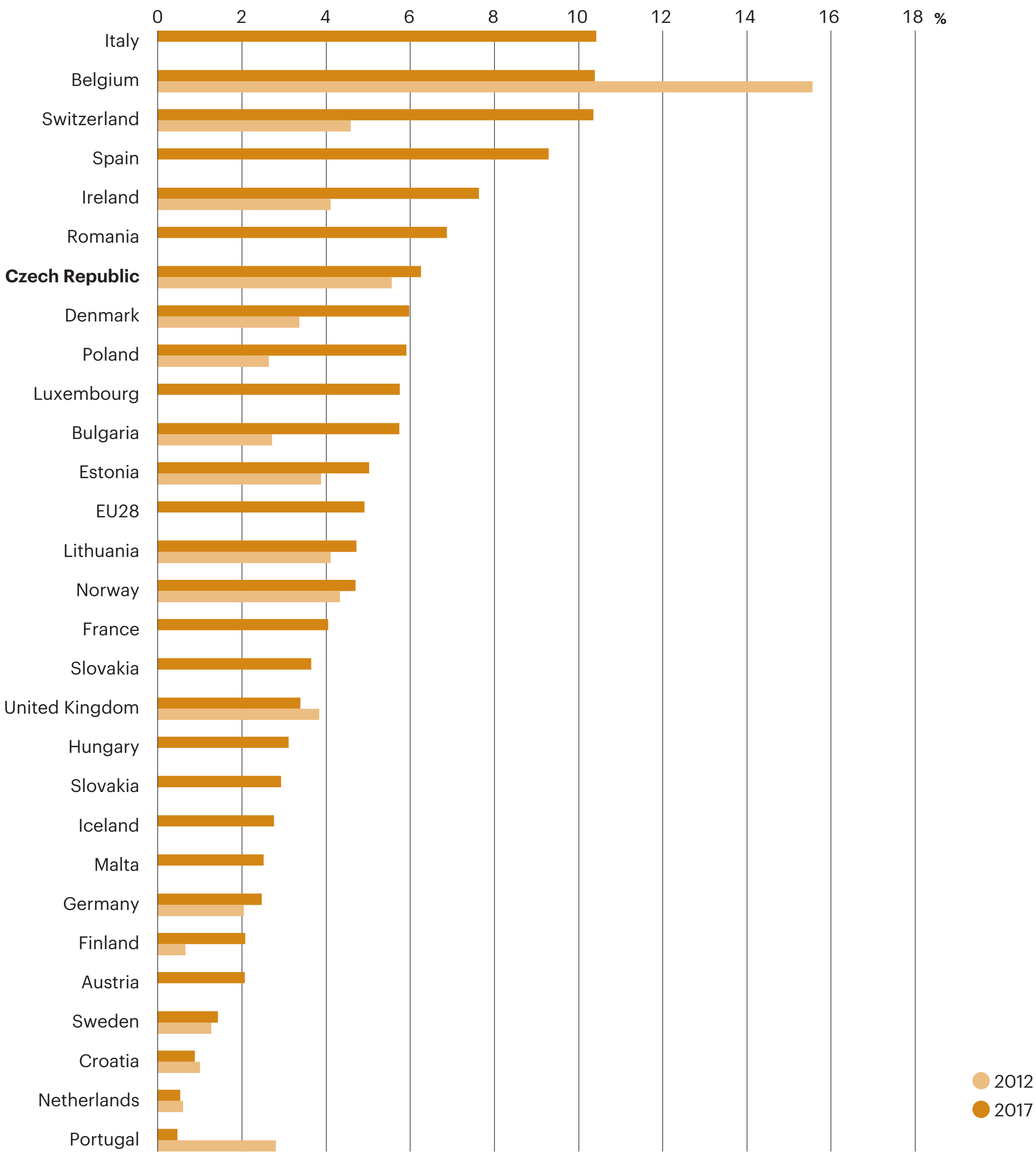


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 4

Share of inhabitants exposed to noise pollution from road transport over 70 dB (indicator L_{dvn}) in agglomerations with over 100 thous. inhabitants [% of exposed population of agglomerations], 2012, 2017



Data for the year 2017 are only available for some countries (agglomerations), for other countries data is not available, or the number of agglomerations with available data is too low.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: European Environment Agency, Eurostat

Transport is a dynamically developing sector in the EU28 with a growing environmental impact. In the period 2000–2017,[11] the EU28 economy as a whole grew by 27.1%, the total passenger transport performance in the EU28 increased by 17.3% and the freight transport performance by 15.0%.

Passenger transport in the EU28 is greatly individualized, most of the performance of land modes of passenger transport is delivered by passenger cars (81.8% in 2017). The share of public passenger transport in total passenger transport (excluding air transport) was the highest in the Czech Republic in 2017 (33.8%) out of the entire EU28. This is due to the above-average use of urban public rail transport (trams, metro) and bus transport in the European context. The proportion of railways in the total passenger transport performance in the Czech Republic (8.4%) is around the European average, it is higher e.g. in Austria, Netherlands and France.

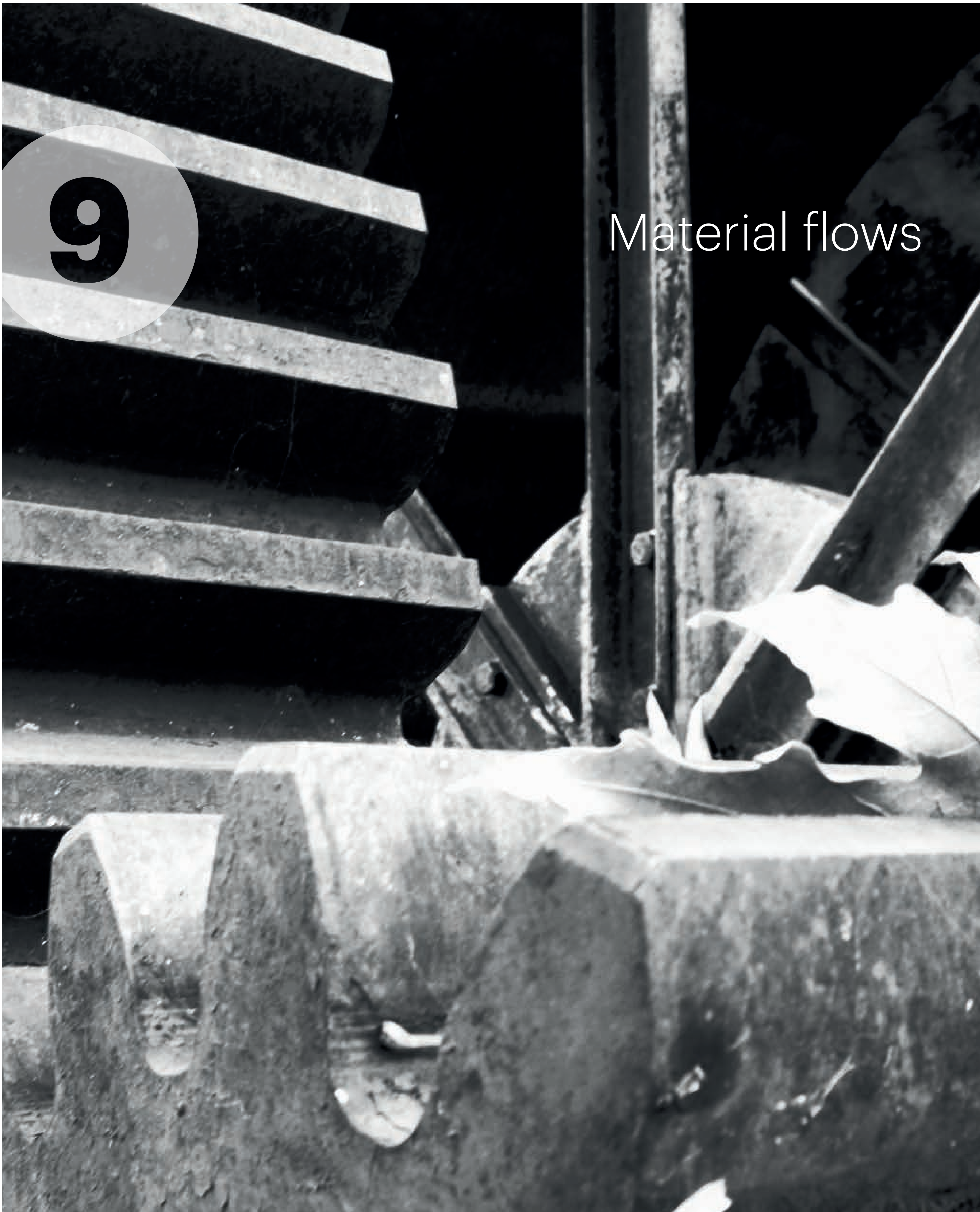
The structure of the inland freight transport performance (i.e. without maritime and air freight transportation) is dominated in the EU28 in 2017 by road transport with 73.3% share in 2017 (Chart 1). Apart from the small island States, road transport is the prevailing mode of freight transport also for example in Greece, Ireland and Luxembourg. In contrast, a relatively lower proportion of road transport in the total performance of freight transport is in countries with developed railway freight transportation (Baltic countries, Austria) and inland waterway transport (the Netherlands, Romania). Globally, the whole EU28 is one of the regions with above-average use of road transport for freight transport. In non-European countries such as the USA, Australia, China and Russia, rail freight transport has a more prominent role than the EU28.

Transport in EU28 is a significant **source of greenhouse gas emissions**, the share of transport in total aggregate greenhouse gas emissions (without LULUCF) in 2017 throughout the EU28 reached 21.9%, in the Czech Republic it was 14.5%, which is the third lowest proportion of transport in EU28 after Estonia and Poland. Greenhouse gas emissions from transport in the EU28 as a whole increased by 2.0% in the period 2000–2017. The highest increases in emissions were recorded in the countries of Central and Eastern Europe (Chart 2). In Poland, transport emissions more than doubled during this period, and in the Czech Republic they increased by 53.7%. Emissions growth in these countries was caused by the dynamic growth of the transport sector and its high emission intensity, due to slower fleet renewal and only marginal use of alternative fuels and drives. In contrast, in some Western European countries, such as Italy, Germany or France, transport emissions declined during this period. The development has been reflected in the implementation of environmental measures in transport and technological innovation, considering the higher economic performance of these countries. After 2010, emission trends in both groups of countries are beginning to converge, in Western Europe the decline in emissions is more moderate, and in some countries (e.g. Germany) it is moving into moderate growth. The intensity of the growing trend in emissions in the new member states has decreased, and even here the impact of measures on emission reduction is beginning to show, e.g. in the Czech Republic, transport emissions increased by 11.0% in the period 2010–2017.

In the EU28, the **share of RES in energy consumption in transport** was 7.4% in 2017, so the Czech Republic is slightly below the European average in the use of RES in transport, with a share of 6.6% (Chart 3). As of 2017, only 3 European countries (Sweden, Norway, Finland) achieved the 10% renewable energy target. Scandinavian countries have the highest share of RES in energy consumption, followed by Austria and France. By contrast, Slovenia, Latvia, Croatia and Estonia have less than half the share of RES in energy consumption compared to the Czech Republic.

Urban agglomerations in the EU28 with the population over 100 thous. inhabitants have, according to the reporting results under Directive 2002/49/EC on the assessment and management of environmental noise have a considerable noise pollution from road traffic. More than 10% of the population of some agglomerations is affected by high all-day noise pollution from road traffic above 70 dB (which is the limit value for the Czech Republic, Chart 4). This indicator varies considerably between countries and within regions, depending on traffic intensity and the routing of road transit routes. Between 2012–2017, i.e. between 2nd and 3rd rounds of noise mapping, noise pollution decreased in most countries with available data, but there were exceptions, e.g. in Belgium, the United Kingdom and Portugal, the proportion of the population in agglomerations impacted by noise from road traffic increased.

[11] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*



9 Material flows

Material flows

Evaluation of material flow allows us to comprehensively assess the demands of the economy on natural resources and the degree of environmental burden associated with consumption and processing of raw materials and materials. With regard to the structure of GDP formation with a high proportion of industry and energy based on fossil sources, the Czech Republic is characterized by higher values of specific indicators of material consumption and therefore higher environmental burdens, which are related to the sourcing and consumption of materials.

This means interventions in the landscape and ecosystems, associated with the extraction of minerals and the cultivation of biomass, which may cause a decrease in biodiversity. Processing and consumption of materials is also associated with a direct environmental burden, in particular in the form of emissions into the air, water pollution and waste generation. Emissions into air and water have a negative effect on human health and ecosystems, combustion of fossil fuels is a significant source of anthropogenic greenhouse gas emissions and therefore of a burden on the climatic system.

References to current conceptual, strategic and legislative documents

Europe 2020 – a strategy for smart, sustainable and inclusive growth
• resource efficiency, creating a knowledge base and analytical apparatus for monitoring the efficiency of resource utilisation
• creation of a circular economy based on the use of secondary raw materials as resources
• reduction of material intensity of economy

Renewed EU Sustainable Development Strategy
• improving the effectiveness of resources in order to reduce the overall use of non renewable natural resources and reducing the impact of the use of raw materials on the environment
• transition to low-carbon economy and economy with low material inputs based on resource-efficient technologies effectively using resources, and sustainable consumer behaviour

7th Environmental Action Programme until 2020
• protection and development of natural capital of the EU
• creating a sustainable, low-carbon, competitive and resource-efficient economy

EU action plan for the circular economy
• transition to a circular economy in which the value of products, materials, and resources in the economy is maintained as long as possible, and in which the waste is minimized

Strategic Framework Czech Republic 2030
• efficient use of natural resources
• reducing the environmental impact of material flows
• preference for the use of domestic material resources
• increasing material efficiency of the economy

Secondary Raw Materials Policy of the Czech Republic
• increase of the self-sufficiency of the Czech Republic on raw material resources by resorting to the use of secondary resources
• inclusion of secondary raw materials in the statistical surveys in the area of material flow accounts

National Reform Programme of the Czech Republic
• streamlining of the life cycle of natural resources and reduction of material and energy intensity of the Czech economy

38 | Domestic material consumption

Key question

Is the environmental burden associated with the sourcing and consumption of materials decreasing in the Czech Republic?

Key messages[1]

The domestic material consumption of the Czech Republic decreased by 7.7% in the period 2000–2017, since 1990 by 43.9%.

In 2012–2017, domestic material consumption (DMC) grew by 5.3% as a result of economic growth. The share of renewables in the DMC structure in 2017 was only 14.4% and decreased year-on-year.
The share of imports in DMC in 2017 reached 47.3%, which is the maximum for the whole period since 2000. The Czech Republic is almost entirely dependent on imports in the case of liquid and gaseous fossil fuels and metal ores.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Development of domestic material consumption and its components in the Czech Republic [mil. t], 1990, 2000–2017

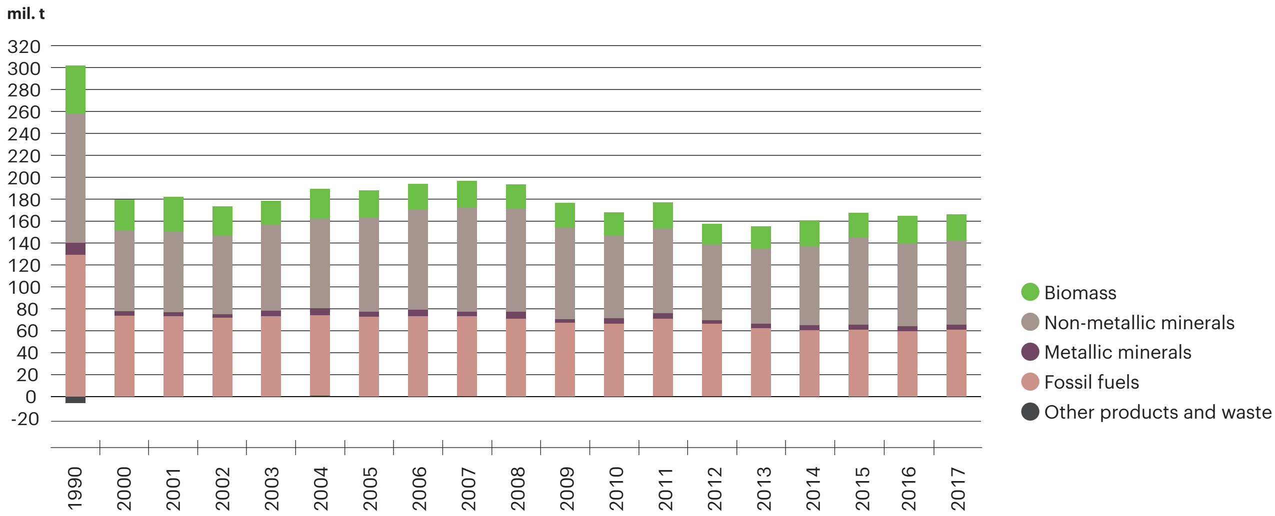
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

[1] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Development of the structure of domestic material consumption in the Czech Republic by material group [mil. t], 1990, 2000–2017

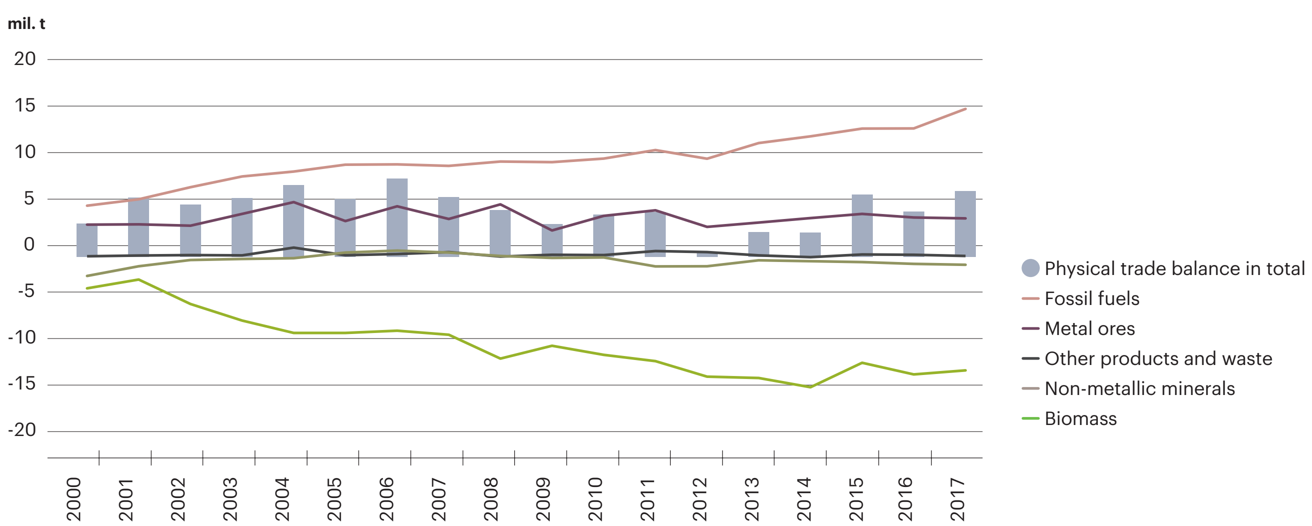


Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

Chart 3

Physical foreign trade balance in the Czech Republic by material group [mil. t], 2000–2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

Domestic material consumption (DMC) in the Czech Republic in 2017[2] increased slightly by 0.6% (1.1 mil. t) to 166.0 mil. t (Chart 1). The development of DMC in 2012–2017 was influenced by economic growth, GDP for this period increased in total by 15.1% and material consumption by 5.3%. However, in the longer-term trend since 2000, material consumption and the related environmental burden have been decreasing. DMC fell by 7.7% in the period 2000–2017, and in 2017 it was at approximately half the level (43.9% decrease) of the early 1990s. From the environmental point of view, the positive long-term development of DMC is linked to a decrease in the material and energy intensity of the Czech economy.

[2] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

After 2000, the **development of DMC components** was characterized by an increase in **physical imports**, which grew by 76.0% in the period 2000–2017 and by 17.3% in the last 5 evaluated years (2012–2017). The upward trend of imports was affected mainly by the growth of the manufacturing industry and its more material-intensive branches using imported raw materials, especially at the end of the period under review. According to the basis index of 2015, industrial production in manufacturing increased in 2012–2017 by 23.1 p.p., the largest growth was recorded in the manufacture of motor vehicles, by 41.3 p.p. Another factor of growth in imports was the development in the transport sector, which is almost entirely dependent on oil imports. Energy consumption in transport increased by 14.6% in the period 2012–2017, oil imports increased by 20.6% in that period and in 2017 by 14.0% (1.4 mil. t) year-on-year. In 2017, imports accounted for 47.3% of the total DMC, the highest since 2000; material dependency on foreign countries is thus increasing.

Physical exports are also increasing, albeit at a lower pace than imports at the end of the period under review, rising by 6.8% in 2012–2017. **Domestic used extraction**, which is a direct measure of environmental burden from mineral extraction and biomass production, increased by only 0.9% in the period 2012–2017, since 2000 it has fallen by 10.0%. The development of domestic used extraction is influenced by a decrease in domestic extraction of solid fossil fuels (by 18.9% in the period 2012–2017); black coal extraction decreased by 54.9% (by about 6 mil. t per year) during that five-year period, since 2000 to less than a third. The fact that DMC growth was saturated mainly by imports at the end of the period under review is a positive finding from the environmental point of view, as the environmental burden from the extraction of imported raw materials occurred outside the Czech Republic.

The structure of the DMC by material group has long been dominated by non-metallic minerals (46.1% in 2017) and fossil fuels (36.9%), Chart 2. The share of biomass (i.e. renewable sources) in the DMC, whose consumption causes lower environmental burden than the consumption of non-renewable resources, was 14.4% and ranks are among the lowest in the EU28.

DMC of fossil fuels decreased in the period 2000–2017 by 17.5%. While solid fossil fuel consumption has fallen by 25.4% during that period, reflecting a gradual change in the energy mix for electricity and heat production, the consumption of liquid and gaseous fuels increased by 9.8% and in 2017 accounted for about a quarter of total DMC of fossil fuels. DMC development of non-metallic minerals fluctuated after 2000 according to the development of industrial and construction production, after reaching its maximum in 2006–2008 exceeding 90 mil. t and the subsequent decline, the trend of consumption of **non-metallic minerals** is slightly increasing, the growth in 2012–2017 was 11.1% (7.6 mil. t). The consumption of metallic ores fluctuates, it increased by 16.6% in the period 2000–2017.

The development of **DMC of renewable sources** (biomass) has been fluctuating after 2000. Biomass consumption decreased by 16.1% in the period 2000–2017 and 4.4% year-on-year. That decrease was caused by a year-on-year decline in the production of biomass from agriculture due to drought by 9.4%, the most significant decrease was seen in cereal harvest – by 13.2% (1.2 mil. t). In the longer-term development, biomass production from agriculture slightly increases (by 7.2% in the period 2000–2017), a more significant growth, especially at the end of the period under review, was registered for forest biomass production which grew by 26.9% in the period 2012–2017. Timber is an important export commodity, in 2017, 9.1 mil. t of timber and wood products were exported, with domestic wood harvesting amounting to 11.4 mil. t.

Physical foreign trade balance in the Czech Republic was positive in 2017 overall (import exceeded export) and year-on-year it soared by 45.7% to 7.4 mil. t (Chart 3). The material groups of fossil fuels (due to the dependence on import of oil and natural gas) and metal minerals have a positive balance. For this material group, the Czech Republic mostly imports raw materials and semi-finished products and exports products that weigh less than primary raw materials. The opposite situation and negative foreign trade balance is in biomass where the Czech Republic exports the surplus of domestic production.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

39 | Material intensity of GDP

Key question

Is the material intensity of GDP generation decreasing in the Czech Republic?

Key messages[3]

The material intensity of the Czech economy has been decreasing in the long term, in the period 2000–2017 it decreased by 41.9%. Decreasing material intensity means lower consumption of materials per unit of GDP generated and hence a lower environmental burden.

In the long term, an absolute decrease in the environmental burden has not been achieved yet, i.e. a decrease in material consumption while the economy grows. In 2017, the growing economy led to a slight increase in material consumption.

Overall assessment of the trend

Change since 1990

Change since 2000

Change since 2010

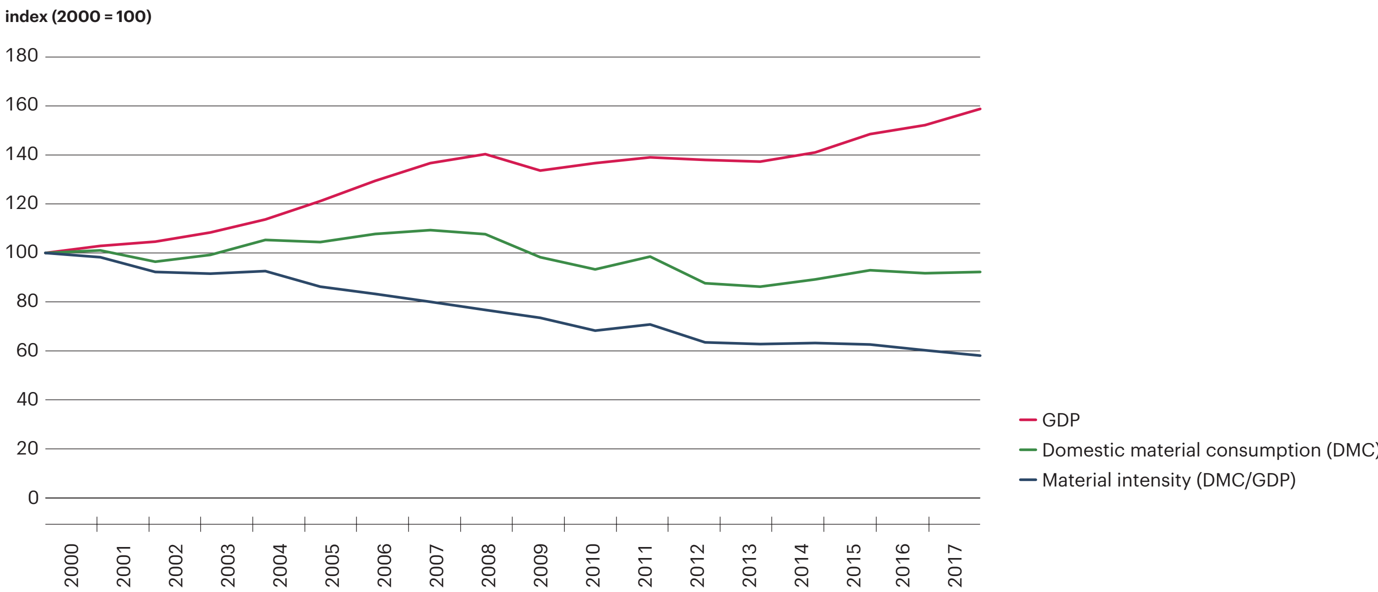
Last year-on-year change

[3] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Chart 1

Material intensity, domestic material consumption and GDP in the Czech Republic [index, 2000 = 100], 2000–2017

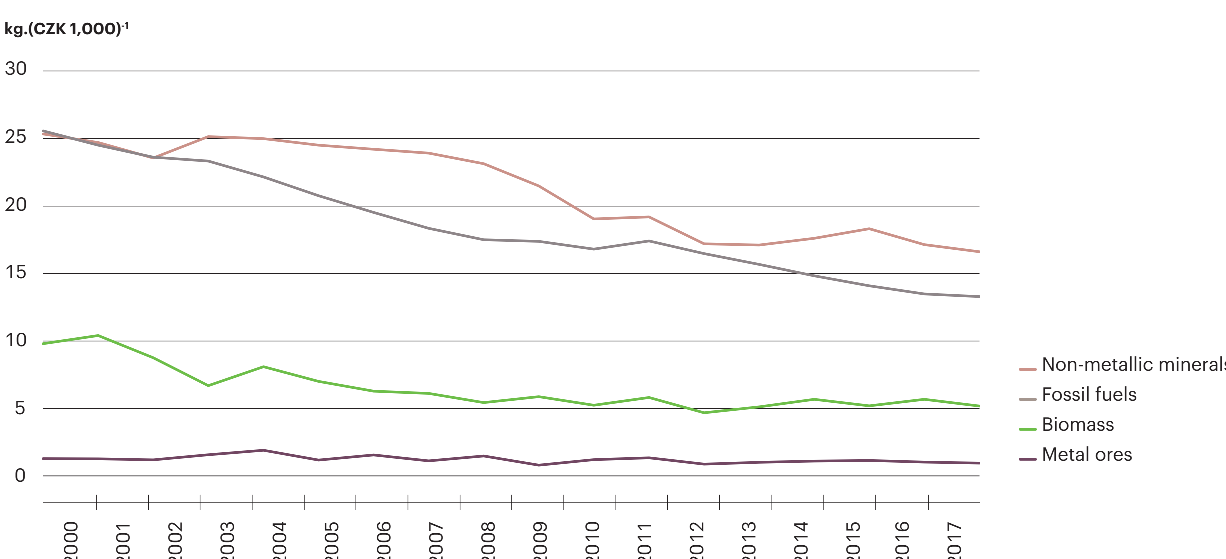


GDP figures in constant prices in 2010.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

Chart 2

Development of the material intensity of selected material groups in the Czech Republic [kg.(CZK 1,000)$^{-1}$], 2000–2017



GDP figures in constant prices in 2010.
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Czech Statistical Office

The material intensity of the Czech economy is declining, which indicates an increasing efficiency of the conversion of material inputs into economic output and a decrease in the environmental burden caused by the extraction of raw materials and consumption of materials per unit of GDP produced. Material intensity decreased by 41.9% in the period 2000–2017 (Chart 1), in year-on-year comparison by 3.6% to 36.0 kg.(CZK 1,000 of GDP)$^{-1}$, which is approximately one third of compared to the early 1990s. The situation in 2017 represents a relative decoupling, the year-on-year GDP growth by 4.4% was accompanied by only a slight increase in material consumption by 0.6%.

The factors underlying the decline in material intensity after 2000 include reducing the share of solid fuels in the energy mix of the Czech Republic for electricity and heat production, the growing use of renewable energy sources and other non-fossil energy sources and reducing the energy and material intensity of the industry. Decreasing material intensity makes it possible to reduce the landscape impacts associated with the extraction of mineral resources and reduce the waste streams of the economy related to the use of materials and raw materials, which include emissions into the air and waste production. Increasing efficiency of biomass use reduces the environmental burden from agriculture, affecting mainly water quality and ecosystems.

During the period 2000–2017 in the Czech Republic, the development of the environmental burden caused by material consumption was separated from the economic performance, such separation is called **decoupling**. In most years of that period, the **decoupling was relative**, with the environmental burden represented by material consumption per unit of GDP decreasing, but in absolute terms, the DMC trend follows that of the economy (i.e. it goes up as the economy grows and decreases as the economy declines). During the period under review, this was due to a significant share of manufacturing and its more material-intensive industries in economic growth. **Absolute decoupling**, in which the environmental burden in absolute terms decreases despite the growth of the economy, which is an optimal development from the environmental point of view, was rather unique during the period under consideration due to the high share of industry in GDP formation in the Czech economy. It occurred in five years of the period under review, most recently in 2016.

The decline in material intensity of the Czech Republic in the period 2000–2017 was most notably driven by the category of **fossil fuels**, in which the material intensity decreased by 48.0%, in the year-on-year comparison of 2016 and 2017 by 1.4% (Chart 2). Fossil fuels accounted for almost 50% of the overall decline in the material intensity of the economy in that period, reflecting a reduction in the consumption of solid fossil fuels and their gradual substitution by liquid and gaseous fuels. In the case of **non-metallic minerals**, the drop in material intensity was less pronounced (by 34.5% in the period 2000–2017). Material intensity in the group of metallic minerals has a fluctuating character and contributes little to the overall decline in material intensity of the economy. The material intensity of the use of **renewable resources** (biomass) fell by 47.1% in the period 2000–2017. After 2010, however, the development of material intensity in this material group fluctuates without a clear trend, the year-on-year decrease in 2017 by 8.6% was affected by drought, which caused a decrease in biomass production from agriculture by 9.4%.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

Material flows in the global context

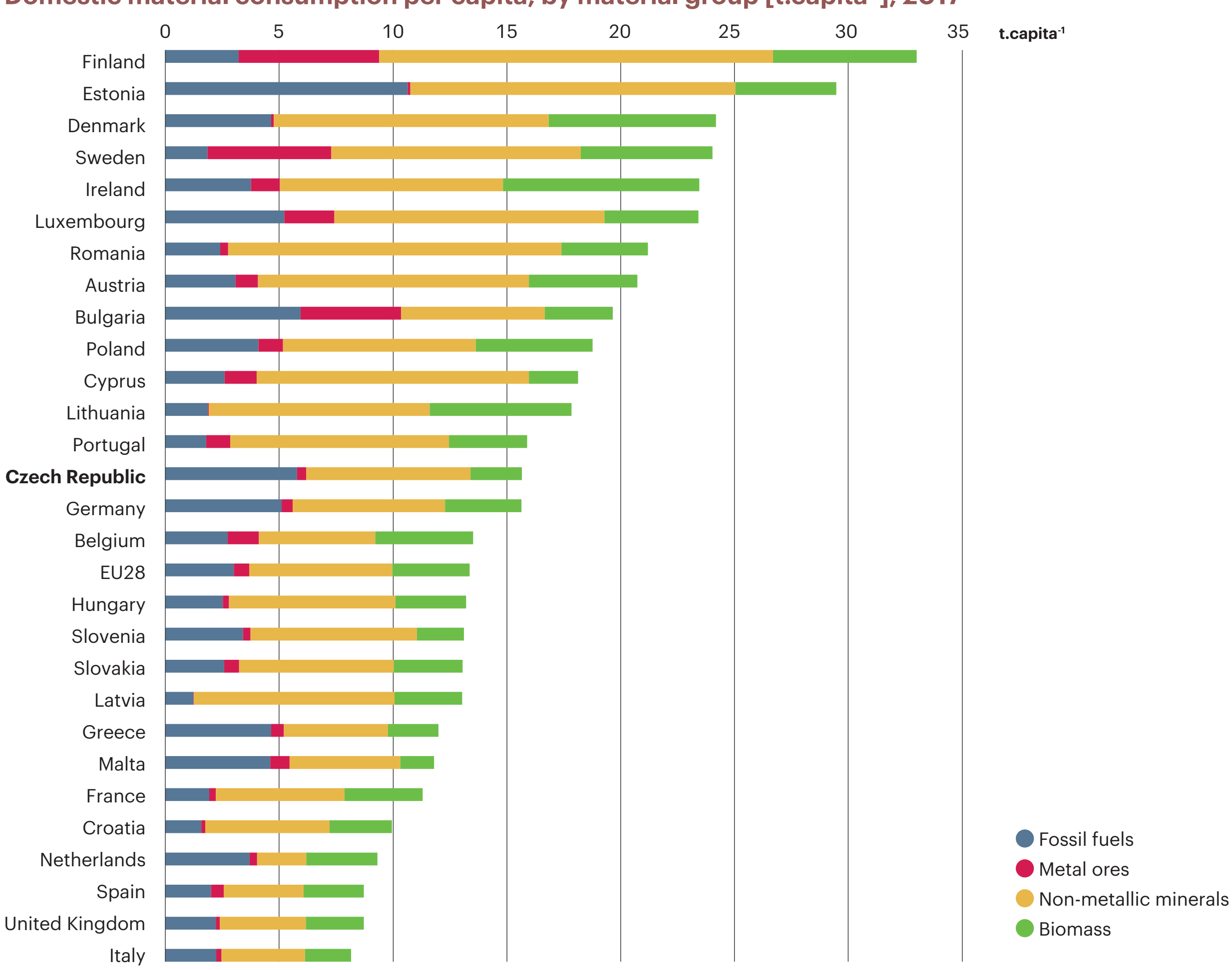
Key messages[4]

- Both the domestic material consumption (DMC) per capita and material intensity of the Czech economy were above the average of EU28 countries in 2017. That is related to higher environmental burden per capita and unit of GDP in the Czech Republic, associated with the sourcing and consumption of materials.
- In the structure of DMC, the Czech Republic has a high proportion of fossil fuels compared to the EU28 average. On the contrary, the Czech Republic's share of renewable sources in the DMC, whose consumption causes lower environmental burden than the consumption of non-renewable resources, ranks among the lowest in the EU28.

Indicator assessment

Chart 1

Domestic material consumption per capita, by material group [t.capita^{-1}], 2017



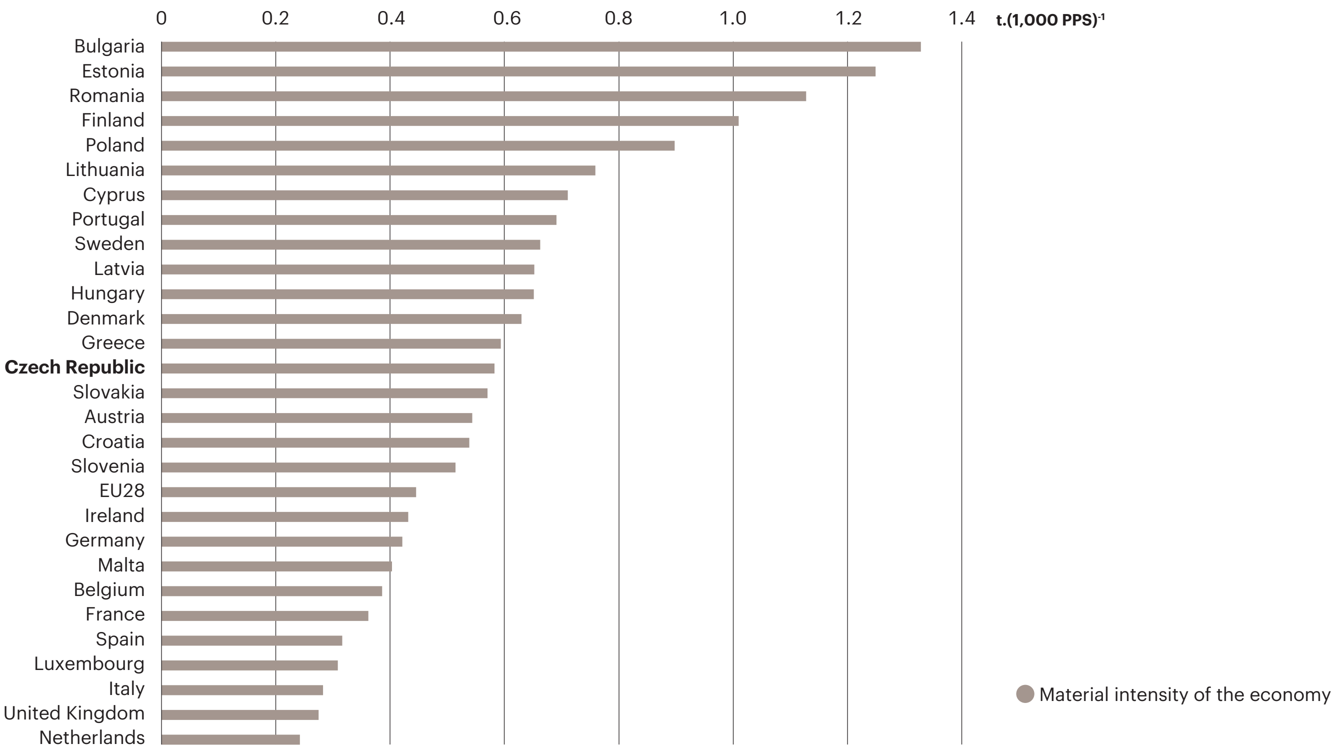
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

[4] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.*

Chart 2

Material intensity of the economy [t.(1,000 PPS)$^{-1}$], 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

The values of **intensity indicators of material flows**, and thus the specific environmental burden per capita and unit of GDP associated with sourcing and consumption of materials are above average in the Czech Republic compared with the other EU28 countries. In particular, this is due to a higher proportion of industry in the GDP formation and to the fossil-based energy sector.

Domestic material consumption per capita in the Czech Republic in 2017[5] reached 15.7 t.capita^{-1}, which is 17.3% above the average of EU28 countries (Chart 1). The highest per capita consumption of materials in the EU28 is in the Scandinavian countries with a small population density (Finland, Sweden) and countries with high extraction and consumption of non-metallic minerals (Romania) and fossil fuels (Estonia). In the global comparison, domestic material consumption per capita in the Czech Republic is at the OECD average (15.7 t.capita^{-1} in 2016), but above the global average, which is around 12 t.capita^{-1}. Worldwide, the countries with the highest domestic material consumption per inhabitant are Chile (41.6 t.capita^{-1} in 2016) and Australia (38.3 t.capita^{-1}), i.e. countries with rich mineral reserves and mineral extraction, in particular metal ores and fossil fuels.

In the structure of DMC by material group, the Czech Republic has its share of fossil fuels in the total DMC above the EU28 average (36.9%, the EU28 average is 22.5%). In absolute terms, a higher DMC of fossil fuels per capita than in the Czech Republic is only in Estonia (10.6 t.capita^{-1}) and Bulgaria (5.9 t.capita^{-1}). The share of biomass, i.e. renewable sources, in DMC (14.4%) in the Czech Republic is the third lowest in the EU28 after Cyprus and Malta.

The **material intensity of the Czech economy** in 2017 was 0.58 t.(1,000 PPS)$^{-1}$ (a year-on-year decrease by 4.5%) and was therefore 30.8% higher than the average material intensity of the whole EU28 (Chart 2). In a year-on-year comparison, the distance between the Czech Republic and the EU28 average decreased by 3.4 p.p. Western European countries with high GDP per capita have the lowest material intensity of the economy. On the contrary, higher material intensity than in the Czech Republic is typical for countries with high material consumption per capita in combination with lower economic performance, such as Romania, Estonia and Bulgaria. The highest material intensity globally (more than three times higher than the OECD average) and thus low efficiency of transforming material into economic output is in the fast growing economies of the BRICS countries, especially China and Brazil, and Chile, where a large part of the GDP is generated by the mining and export of minerals.

[5] *Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication. The most recent OECD data for non-european countries are for the year 2016.*


10
Waste

Waste

The waste and packaging generated by consumer in large quantities may present a risk factor both for human health and ecosystems. During the generation as well as treatment of waste, alien substances may leak into the environment, and therefore subsequently pollute its individual components. In addition, generation and treatment of waste, in particular landfilling, causes land take. That may affect the landscape character and functions of the landscape and consequently influence the development of biotopes and the various species of plants and animals. The odour and noise produced by waste treatment facilities pose a problem as well. The substances contained in waste (mainly in the waste from selected products) and in packaging can get into the human body through the food chain and negatively affect human health.

In line with the hierarchy of waste treatment in force, it is important to limit the negative impact of all types of waste on the environment and human health by treating the waste and packaging correctly, and, ideally, prevent their generation.

At present, the crucial trend in waste management is the effort to move towards a circular economy where material flows are closed in long time cycles and the emphasis is put on waste prevention, reuse of products, recycling and conversion to energy instead of extraction of raw materials and increasing landfills. Attention at the national and European level is also devoted to the issue of food waste.

Special attention is paid to municipal waste, the generation of which is closely related to the place of residence and lifestyle of each individual, and so it also immediately affects the individual's surroundings. The mixed municipal waste, where sorting is absent, can also contain hazardous components such as batteries and accumulators, paints, solvents, medicaments, etc.

References to current conceptual, strategic and legislative documents

Directive of the European Parliament and of the Council 2008/98/EC on waste, repealing some directives
- minimising the adverse effects of waste generation and treatment on the environment and human health
- supporting implementation of the hierarchy of waste treatment
- increasing the level of preparation for reuse and recycling of municipal waste at least by 55% of its weight by 2025 (or 60% by 2030, 65% by 2035)

Council Directive 1999/31/EC on the landfill of waste
- preventing and minimising adverse environmental impacts of municipal waste landfilling
- reducing the proportion of landfilled BMW to 35% (of weight) of the total amount of BMW (generated in 1995) by 2020 at the latest
- reducing the amount of landfilled municipal waste by 2035 to 10% (of weight) or less of the total municipal waste generated

European Parliament and Council Directive 94/62/EC on packaging and packaging waste
- minimising environmental effects of packagings and packaging waste
- preventing the generation of packaging waste through a reduction of the total volume of packagings
- supporting repeated use of packagings
- developing innovative, environment-friendly and sustainable recycling processes
- reducing the toxicity of packaging waste through preventing the use of heavy metals in packagings
- recycling at least 65% of the weight of all packaging waste by 31 December 2025 at the latest (or 70% by 31 December 2030)
- recycling of specific materials contained in packaging waste by 31 December 2025 at the latest: 50% of plastics, 25% of wood, 70% of ferrous metals, 50% of aluminium, 70% of glass, 75% of paper and cardboard (or by 31 December 2030: 55% of plastics, 30% of wood, 80% of ferrous metals, 60% of aluminium, 75% of glass, 85% of paper and cardboard)

Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE)
- preventing adverse effects of generation and treatment of WEEE on the environment and human health
- minimising the disposal of WEEE as unsorted municipal waste

Directive 2006/66/EC of the European Parliament and of the Council on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC
• supporting recycling of waste batteries and accumulators
• minimising the disposal of waste batteries and accumulators as mixed municipal waste
• prohibition of the placing of certain batteries and accumulators containing mercury and cadmium on the market

Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles
• preventing generation of waste from vehicles
• increasing rates of reuse and recycling of waste from vehicles and reducing their quantity that is disposed of

Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products
• improving the environmental impact of a product throughout its whole life cycle
• reducing the impact of energy-related products on the environment and achieving energy savings
• ensuring the functioning of the internal market by establishing appropriate environmental requirements for products

European Commission's package on the circular economy
• changing the current linear model to a circular model, i.e. returning the potential waste back into the economic process and closing the loop in a ring
• reducing dependence on primary raw materials
• emphasizing waste prevention and reducing food waste
• increasing the targets for recycling municipal waste and packaging, and setting a target for reducing landfilling
• restricting illegal transportation of waste

Strategic Framework Czech Republic 2030
• substituting natural materials by waste recycling and by secondary raw materials
• developing circular economy and increasing the proportion of recycled materials and secondary raw materials in material flows
• increasing the share of circular economy in the total volume of material flows

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
• supporting the development and generation of easily repairable, recyclable and materially usable products
• adhering to and complying with the hierarchy of waste treatment: prevention of the generation of waste, preparations for reuse, waste recycling, other waste recovery (e.g. energy) and disposal methods
• reducing the share of landfilling in the total waste disposal and increasing the material and energy recovery of waste
• minimising risks of transport of waste and its environmental impacts

Government Regulation No. 352/2014 Coll., on the Waste Management Plan of the Czech Republic for the period 2015–2024
• waste prevention and reduction of the specific waste generation, including hazardous waste
• maximum use of waste as a substitute of primary resources and transition to the circulatory economy
• sustainable development of society and approximating the European "recycling society"
• creating and maintaining a comprehensive, appropriate and effective network of waste treatment facilities in the territory of Czech Republic
• increasing recycling to 65% and overall recovery of packaging waste to 70% by 31 December 2018, or to 70% and 80% by 31 December 2020[1]
• achieving the levels of collection of waste electrical and electronic equipment higher than 50% in 2018 or 65% in 2021
• achieving at least 45% level of collection of waste portable batteries and accumulators in 2018
• achieving the following recycling efficiency of recycling processes: lead-acid batteries and accumulators 65%, nickel-cadmium batteries and accumulators 75%, other batteries and accumulators 50%
• increasing the reuse and recovery rate to at least 95% of the total weight of selected car wrecks and the reuse and recycling rate to at least 85% of the total weight of selected car wrecks
• ensuring a minimum take-back level of waste tyres at 35% in 2018, or 80% in 2020

[1] Definitions of the terms "recycling" and "overall recovery of packaging waste" are given in Table 2 of Government Regulation No. 352/2014 Coll., on the Waste Management Plan of the Czech Republic for the period 2015–2024.

Czech Republic's Waste Prevention Programme
- reducing the quantity and dangerous properties of generated waste
- prevention in the form of reuse of products and improved efficiency of manufacturing

Secondary Raw Materials Policy of the Czech Republic
- supporting innovations allowing secondary raw materials to be obtained from waste in a quality suitable for further industrial use
- supporting innovations and transfers of science and research into the industry of processing and use of secondary raw materials obtained from waste, in the framework of programmes of the Ministry of Industry and Trade (Operational Programme Enterprise and Innovation for Competitiveness)
- inclusion of technologies of processing and use of secondary raw materials obtained from waste among industries supported by investment incentives
- removing barriers to the increased use of secondary raw materials
- supporting the introduction of voluntary agreements between state authorities and the business community for the purpose of voluntarily establishing product take-back systems, and thus eliminating the generation of waste

Act No. 477/2001 Coll., on packaging and amending some acts (the Packaging Act)
- preventing the generation of packaging waste through reducing the weight, volume and harmful effects of and contents of chemical substances contained in packagings
- producing packagings that are reusable, recyclable or organically recyclable, or can be used for energy recovery
- increasing the level of recycling to 65% and the level of overall recovery of packaging waste to 70% by 31 December 2018, or 70% and 75% by 31 December 2020 (the targets are set for every year)

Act No. 185/2001 Coll., on waste and amending some acts
- ensuring a minimum take-back level of used tyres in the amount of 35% for each calendar year

Operational Programme Environment 2014–2020
- waste prevention
- increasing the share of material and energy recovery of waste
- reclamation of old landfills

40 | Total waste generation

Key question

Is total waste generation declining?

Key messages

Total waste generation increased between 2017 and 2018 by 9.5% to 37,784.8 thous. t.
Since 2009, it grew by 17.1%.

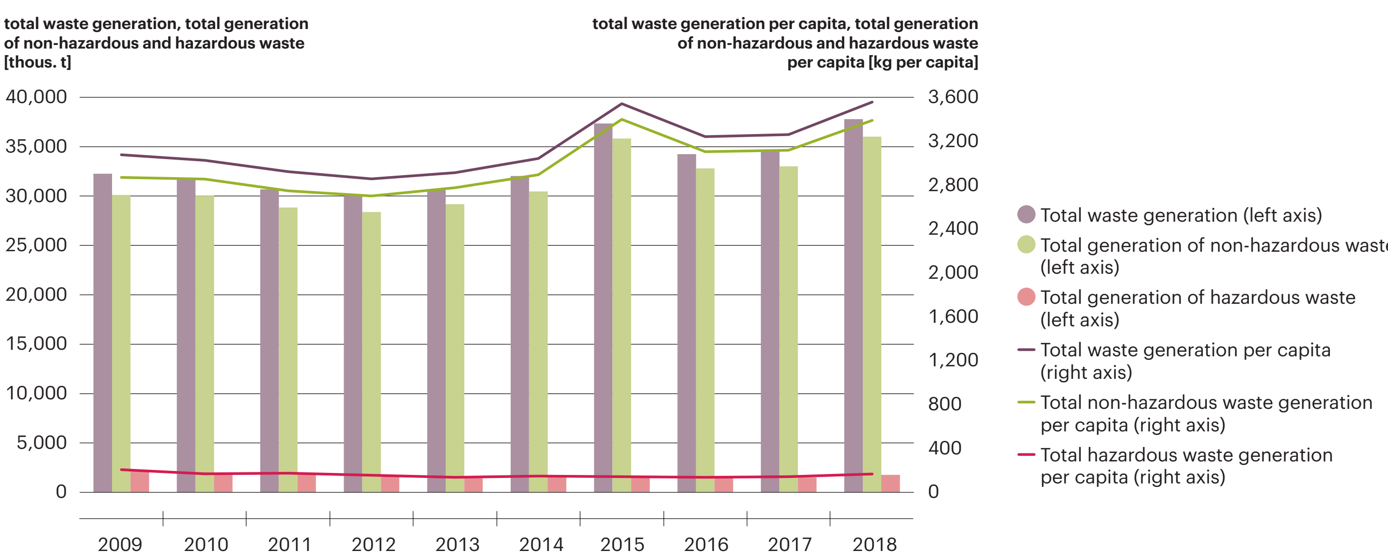
Overall assessment of the trend

Change since 1990	N/A
Change since 2009[2]	☹
Change since 2010	☹
Last year-on-year change	☹

Indicator assessment

Chart 1

Total waste generation, total generation of non-hazardous and hazardous waste in the Czech Republic [thous. t], total waste generation per capita, total generation of non-hazardous and hazardous waste per capita in the Czech Republic [kg per capita], 2009–2018



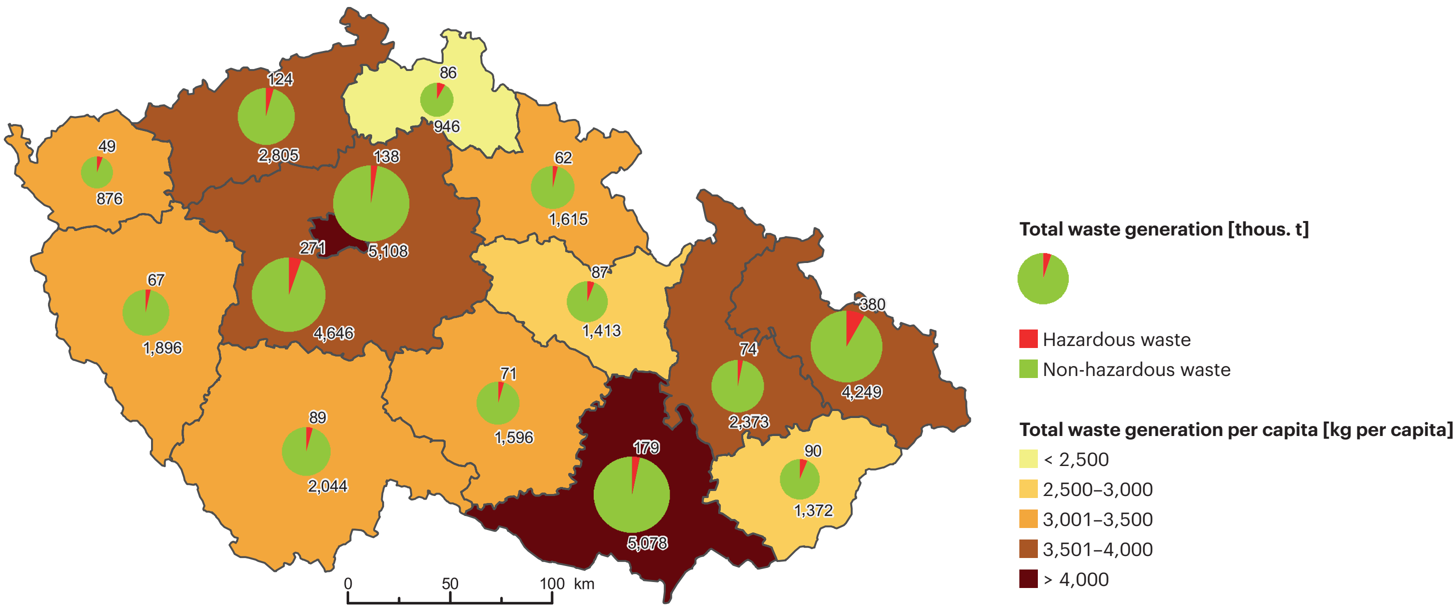
The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

Data source: CENIA, Czech Statistical Office

[2] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Figure 1

Total waste generation, total generation of non-hazardous and hazardous waste in regions of the Czech Republic [thous. t], total waste generation per capita in regions of the Czech Republic [kg per capita], 2018

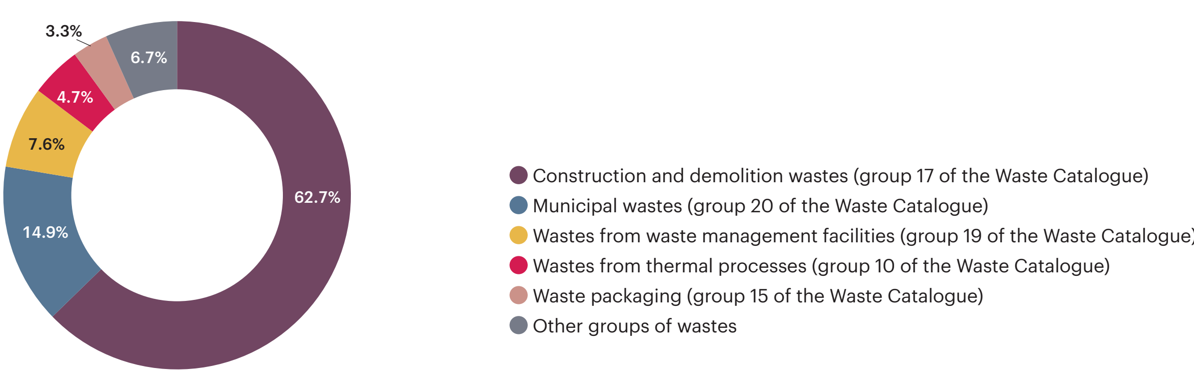


The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

Data source: CENIA, Czech Statistical Office

Chart 2

Structure of total waste generation in the Czech Republic [%], 2018



The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Data source: CENIA

Total waste generation (the sum of the total generation of non-hazardous and of hazardous waste) grew in 2017–2018 by 9.5% to 37,784.8 thous. t. Since 2009, it grew by 17.1%.

Another important indicator is the **total waste generation per capita**, which was 3,555.7 kg per capita in 2018. In the period 2009–2018, the value of this indicator rose by 480.2 kg per capita, between the years 2017 and 2018, it grew by 296.6 kg per capita (Chart 1).

The value of the indicator is influenced by several factors. It is influenced the most by construction activities resulting from government contracts (Chart 2) because 62.7% of the generated waste come from construction (group 17 of the Waste Catalogue). This waste group generation increased during 2018 especially in connection with investments in modernisation and construction of transport infrastructure (road and rail).

An important share (95.3% in 2018) in the total waste generation is held by the **total generation of non-hazardous waste** (Chart 1). It is mainly influenced by the generation of construction and demolition waste. Since 2009, the total generation of non-hazardous waste increased by 19.6% to 36,016.9 thous. t and it increased by 9.1% year-on-year (2017–2018). **Total generation of non-hazardous waste per capita** grew since 2009 by 519.3 kg per capita to 3,389.4 kg per capita in 2018. Between 2017 and 2018 it grew by 272.6 kg per capita. The high increase in the waste generation during 2015 and also in 2018 was especially connected with investments in modernisation and construction of transport infrastructure (road and rail). In accordance with the principles of circular economy, waste can be reduced by preventing its generation.

Hazardous waste represented only 4.7% of the total generation of all waste in 2018. However, because of the danger it poses, the percentage of hazardous waste in the total waste generation is an essential indicator in the monitoring of the development of waste management in the Czech Republic. That percentage decreased since 2009 (from 6.7%), despite a slight year-on-year 2017–2018 increase from 4.4%. A positive trend can also be observed in an absolute reduction of the total generation of hazardous waste. Between 2009 and 2018, the total generation of hazardous waste dropped by 18.2% to the total of 1,768.0 thous. t despite the 17.3% increase between 2017 and 2018. The **total generation of hazardous waste per capita** in 2018 amounted to 166.4 kg per capita, between 2009 and 2018 it declined by 39.6 kg per capita but in last year-on-year comparison of 2017–2018 it grew by 24.0 kg per capita (Chart 1). There are no clearly defined development trends in the generation of hazardous waste. This depends mainly on the condition of economy and industry. The increased amount of hazardous waste generated was attributable to projects of remediation of old environmental burdens which were going on during the monitored period. The generation of hazardous waste can be prevented by reducing the content of hazardous substances in products.

The total waste generation as well as the ratio between the generation of non-hazardous and hazardous waste as well as the total waste generation per capita differ among the **regions of the Czech Republic** due to the different economic focus of each region. The highest total generation of waste is in the South Moravian, the Capital City of Prague and Central Bohemian regions, the highest total waste generation per capita is in the South Moravian, Capital City of Prague and Olomouc regions (Figure 1).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

41 | Municipal waste generation and treatment

Key question

Is the municipal waste generation decreasing and the structure of the municipal waste treatment changing?

Key messages

Total generation of municipal waste between 2017 and 2018 increased by 1.6% to 5,782.1 thous. t.

Although landfilling continues to prevail among the methods of municipal waste treatment, its use has been declining since 2009 in favour of material and also energy recovery of municipal waste.

Overall assessment of the trend

Change since 1990 – N/A

Change since 2009[3]

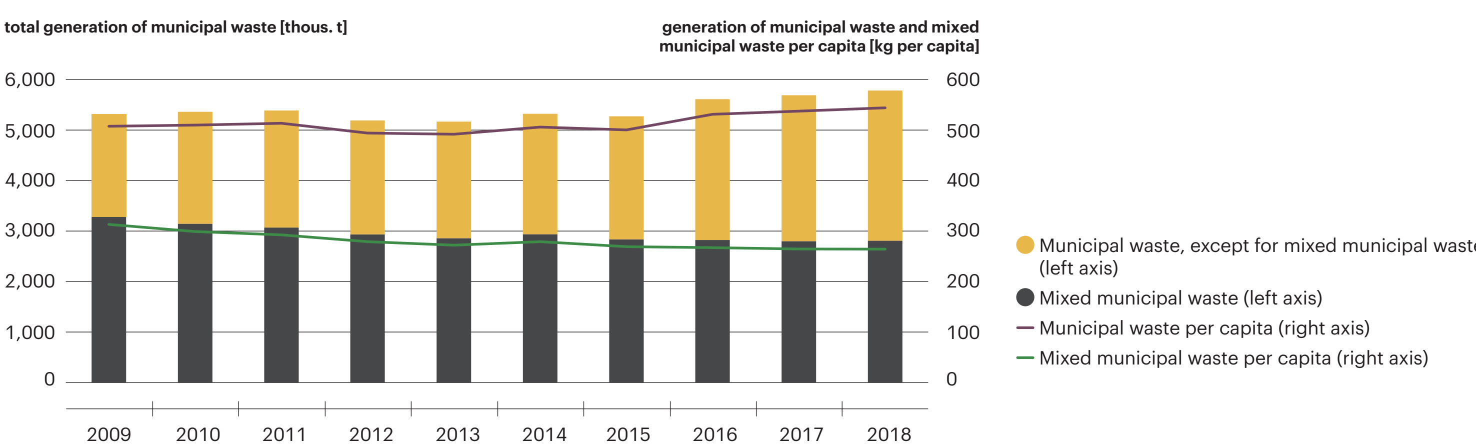
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Total generation of municipal waste in the Czech Republic [thous. t], generation of municipal and mixed municipal waste per capita in the Czech Republic [kg per capita], 2009–2018



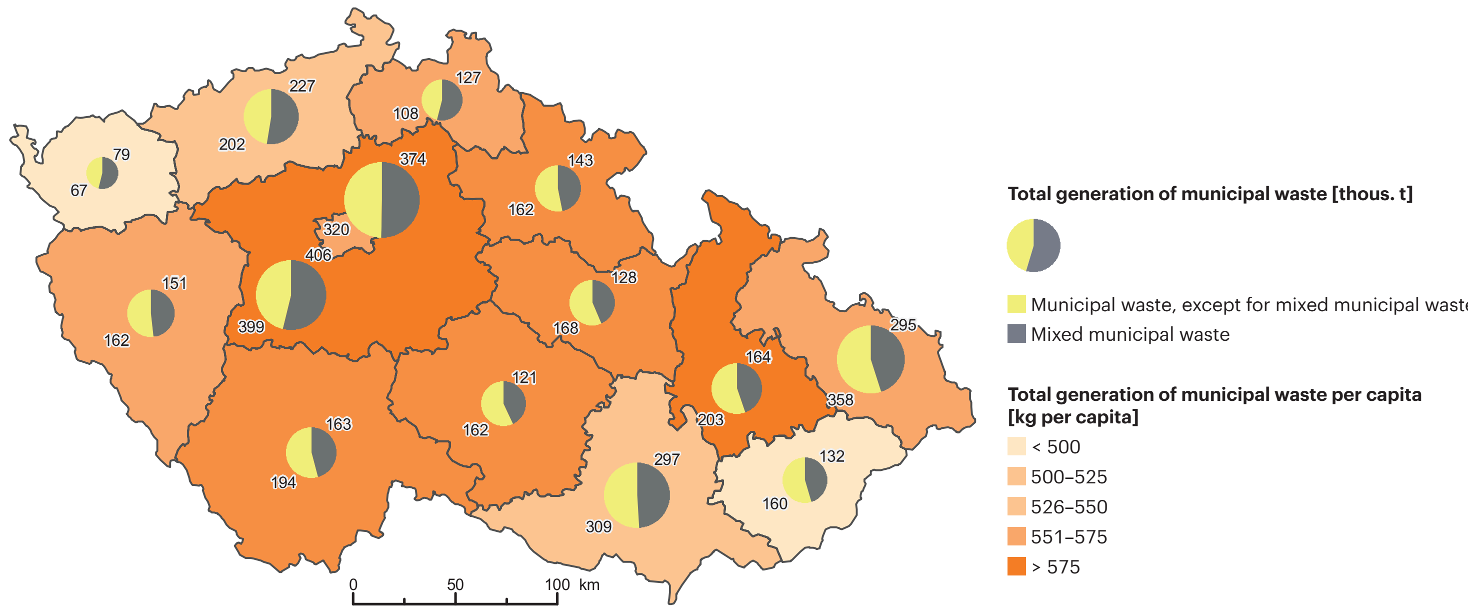
The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

Data source: CENIA, Czech Statistical Office

[3] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Figure 1

Total municipal waste generation, total generation of mixed municipal waste in regions of the Czech Republic [thous. t], total municipal waste generation per capita in regions of the Czech Republic [kg per capita], 2018

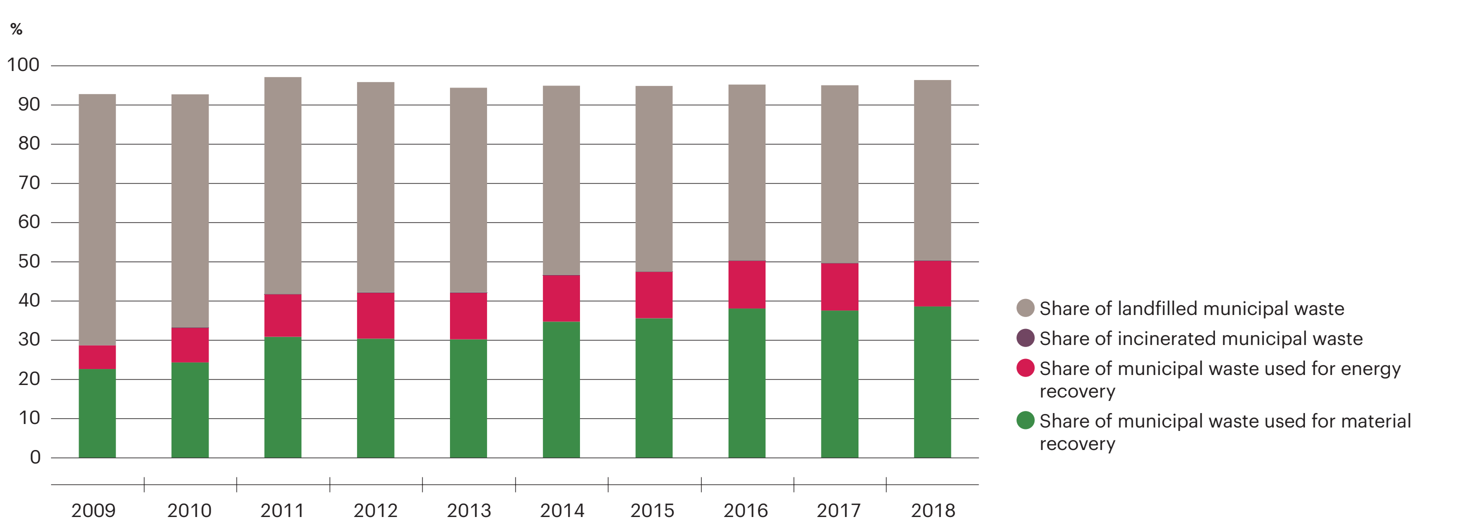


The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

Data source: CENIA, Czech Statistical Office

Chart 2

Proportion of selected methods of municipal waste treatment in the total municipal waste generation in the Czech Republic [%], 2009–2018



The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Data source: CENIA

The **municipal waste** includes, for example, mixed municipal waste, its separately collected components (paper, plastic, glass, metal), large-volume waste, but also hazardous waste.

Total generation of municipal waste between 2017 and 2018 increased by 1.6% to 5,782.1 thous. t (Chart 1). Since 2009, it grew by 8.6%.

As municipal waste is closely related to the place of residence of every individual, the development of its **per capita generation** represents an important indicator. In 2009, it reached 507.5 kg per capita and in 2018 it amounted to 544.1 kg per capita. In the period 2009–2018, the value increased by 36.6 kg per capita, which was mainly due to the increase of 6.7 kg per capita between the years 2017 and 2018 (Chart 1). Between 2009 and 2018, the average generation of municipal waste per capita was equal to 513.5 kg per capita.

The category of **mixed municipal waste** includes waste falling under catalogue number 20 03 01. It is the residual (unseparated) waste produced by households, but also by non-manufacturing activities of businesses. The fact that the generation of mixed municipal waste has been declining since 2009 can be regarded as positive. Between 2009 and 2018, the mixed municipal waste generation decreased by 14.5% and in 2018 it rose slightly year-on-year by 0.2% to a total of 2,807.4 thous. t. The proportion of mixed municipal waste in the total municipal waste generation amounted to 48.6% in 2018. Same as in the case of the total generation of municipal waste, the **per capita generation** of mixed municipal waste is an important indicator for comparisons. Between 2009 and 2018, the total generation of mixed municipal waste per capita dropped by 48.8 kg per capita; the generation decreased slightly between 2017 and 2018 by 0.3 kg per capita to 264.2 kg per capita (Chart 1).

© Stipe Surac, WasteSMART/EEA

Due to the significant concentration of the population and services, the total municipal waste generation and the total municipal waste generation per capita is higher over the long term in the Central Bohemian region and in the Capital City of Prague (Figure 1). In those **regions**, there is also high generation of mixed municipal waste.

The different **waste treatment methods** are marked by codes that are defined in Act No. 185/2001 Coll., on waste, and Decree No. 383/2001 Coll., on waste treatment details, as amended. According to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set"[4] which sets out the method for calculating the various waste management indicators including definitions and the waste treatment codes, the waste treatment methods can be divided as follows:

- material recovery of municipal waste (regeneration, recycling and others),
- energy recovery of municipal waste (using waste in a manner similar to fuels and in other ways to generate energy),
- disposal of municipal waste in landfills (landfilling),
- disposal of municipal waste in incinerators (incineration on land).

Municipal waste is a specific group of waste, which is also reflected in its **treatment methods**. Unlike in other groups of waste, the prevailing method of disposal in this case is **landfilling**. However, the share of municipal waste disposed of by landfilling has decreased since 2009 (Chart 2). Comparing 2017 and 2018, the proportion of municipal waste disposed of by landfilling in the total generation of

[4] *https://www.mzp.cz/C1257458002F0DC7/cz/odpady_podrubrika/$FILE/OODP-Matematicke_vyjadreni_rok_2018-20190909.pdf*

© Ergys Gezka, WasteSMART/EEA

municipal waste increased slightly from 45.4% to 46.0% but between 2009 and 2018 it fell from 64.0% to 46.0%. In 2018, the amount of landfilled municipal waste was 2,658.3 thous. t.

The gradual shift away from landfilling of municipal waste makes way for the development of its **material recovery**, which is another significantly represented method of treatment of municipal waste. Its share in the total generation of municipal waste increased from 22.7% in 2009 to 38.6% in 2018. Between 2017 and 2018, the quantity of municipal waste used for material recovery rose by 94.7 thous. t to 2,230.4 thous. t.

At the same time, the **energy recovery** of municipal waste is also becoming more important. Since 2009, the percentage of municipal waste used for this purpose in the total generation of municipal waste grew from 6.0% to 11.7%. Between 2017 and 2018, the quantity of municipal waste used for energy recovery decreased by 8.7 thous. t to the total of 676.6 thous. t.

As to **incineration**, the situation is dramatically different; the method is used to treat an almost negligible amount of municipal waste (its percentage is almost zero).

The situation in municipal waste treatment in the Czech Republic is not satisfactory in the long term (landfilling of municipal waste is above the EU28 average, and recycling is below the average). The goal is a more intensive reduction of the proportion of landfilling in the total municipal waste generation and, on the contrary, a growing material and energy recovery of that waste, in accordance with the principles of a circular economy and with the need to meet the European targets of circular economy.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

42 | Waste treatment structure

Key question

How is the structure of the waste treatment changing?

Key messages

Between 2009 and 2018, the proportion of waste used for material recovery rose from 72.5% to 83.4%. In line with that, the proportion of landfilled waste in the total waste generation declined in the same period.

In the long run, the use of waste for energy recovery has been more or less stagnating.

Overall assessment of the trend

Change since 1990 N/A

Change since 2009[5]

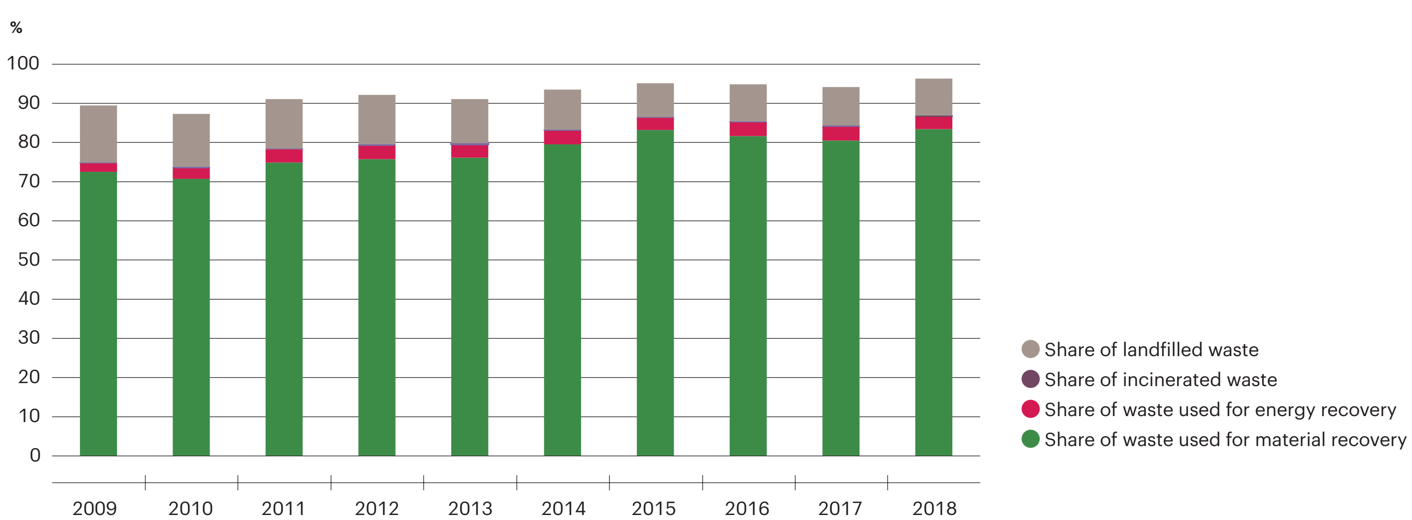
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Proportion of selected waste treatment methods in the total waste generation in the Czech Republic [%], 2009–2018



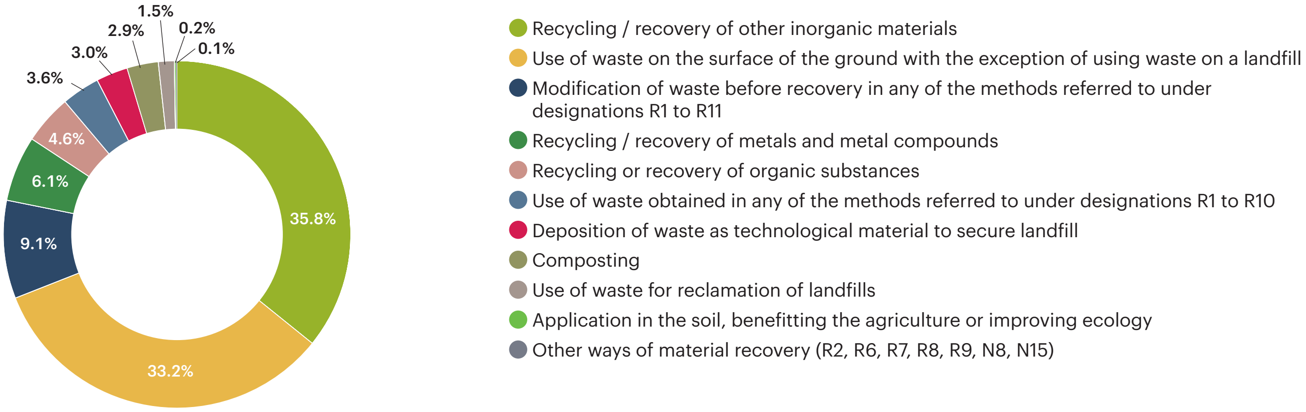
The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Data source: CENIA

[5] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Chart 2

Structure of material recovery of waste in the Czech Republic [%], 2018



The data was determined according to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set" applicable for a given year.

Data source: CENIA

In a broader sense, the term **waste treatment** includes, according to the Waste Act, trading, gathering, collection, purchase, handling, transport, storage, treatment, recovery and disposal of waste.

The different **waste treatment methods** are marked with codes that are defined in Act No. 185/2001 Coll., on waste, and in Decree No. 383/2001 Coll., on waste treatment details, as amended. According to the methodology Mathematical Expression of Calculating the "Waste Management Indicator Set"[6] which sets out the method for calculating the various waste management indicators including definitions and the waste treatment codes, the waste treatment methods can be divided into uses of waste for material recovery (regeneration, recycling and others), uses of waste for energy recovery (use of waste similarly as fuel or in another way to produce energy), disposal of waste by landfilling (deposition on landfills and others), and waste incineration (incineration on land).

Since 2009, a positive trend of a step-by-step increase in the proportion of **recovered wastes** at the expense of that of disposed wastes can be observed. The reasons include, in particular, changes in waste treatment technologies and the need to substitute primary raw materials with secondary raw materials (that can be well sourced from waste), or financial support for waste recovery facilities provided under the Operational Programme Environment. With regard to the waste treatment hierarchy, laid down in legislation, increasing the share of recovered waste is a necessity and must be emphasized.

There has been a positive trend in the **use of waste for material recovery**; between 2009 and 2018, the proportion of waste used for this purpose in the total waste generation rose from 72.5% to 83.4%. Between 2017 and 2018, the quantity of waste used for material recovery increased by 3,744.0 thous. t to 31,528.0 thous. t (Chart 1). In terms of the structure of the methods of material recovery of waste, no significant changes have been observed in the reporting period. The most frequent methods of material recovery of waste still include the recycling of other inorganic materials and use of waste on the surface of the ground with the exception of using waste on a landfill (particularly construction and demolition wastes are used this way).

Only a small proportion of the total waste generation is used for **energy recovery**. Energy recovery refers to the use of waste in a manner similar to that of fuels or to other methods to generate energy, and can therefore be used to generate thermal and electrical energy. In the long term, the trend of energy recovery of waste has been rather stagnant, which is due, among other things, to the capacity of waste recovery facilities. Between 2009 and 2018, the share of the energy recovery of waste in total waste generation increased from 2.2% to 3.2%. Between 2017 and 2018, however, the amount of waste used for energy recovery slightly increased by 36.1 thous. t to a total of 1,200.8 thous. t in 2018 (Chart 1).

[6] *https://www.mzp.cz/C1257458002F0DC7/cz/odpady_podrubrika/$FILE/OODP-Matematicke_vyjadreni_rok_2018-20190909.pdf*

The **proportion of disposed waste** in the total waste generation has been steadily declining. The reasons include a higher level of recycling, use of waste instead of primary raw materials (the support for the use of secondary raw materials and recycled materials is important), and, last but not least, also the introduction of modern waste treatment technologies.

The most frequent method of waste disposal is depositing waste onto or into land, i.e. **landfilling**. This fact represents a persistent major problem for the Czech Republic. However, the situation has been changing for the better since 2009, with the proportion of landfilled waste in the total generation of waste decreasing from 14.6% to 9.4% in 2018. The 2017–2018 year-on-year comparison indicates a slight increase in the amount of landfilled waste by 173.7 thous. t to 3,565.4 thous. t (Chart 1). The long-term aim is a further reduction of the share of landfilling in the total waste generation in favour of the material as well as energy recovery of waste, i.e. in line with the applicable waste treatment hierarchy. It is important to use the proper tools for this gradual change that can significantly help the transition to the circular economy.

Another method of waste disposal is **incineration**. In contrast to energy recovery, in this case the waste is only disposed of by incineration and, therefore, nothing is recovered of it. Together with landfilling, incineration is the last in the waste hierarchy (in both cases it is waste disposal), the above-mentioned material and energy recovery of waste has priority over them. In the long run, incineration has been stagnating. Only some 0.2% of the total waste generated is incinerated every year, which is a negligible proportion compared to landfilling (Chart 1).

Proper waste treatment and compliance with rules of operation applying to waste treatment facilities are regularly **checked** by the Czech Environmental Inspectorate. In 2018, inspectors from the waste management department in the field of waste management, packaging and chemical substances carried out 3,544 inspections, of which 1,450 were planned and 2,094 unplanned, of which 707 inspections were based on a suggestion submitted. The total amount of penalties imposed in 2018 was CZK 43,596.5 thous., i.e. CZK 481.0 thous. less than in the previous year.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

43 | Packaging waste generation and recycling

Key question

Is the amount of generated packaging waste decreasing and is the proportion of packaging waste recovery increasing?

Key messages

In the period 2009–2018, the generation of packaging waste rose by 45.0%. At the same time, however, the rate of recycled waste from packaging is growing. The most frequent uses of packaging waste include recycling and energy recovery. The legislative targets[7] of recycling and overall recovery of packaging waste were met.

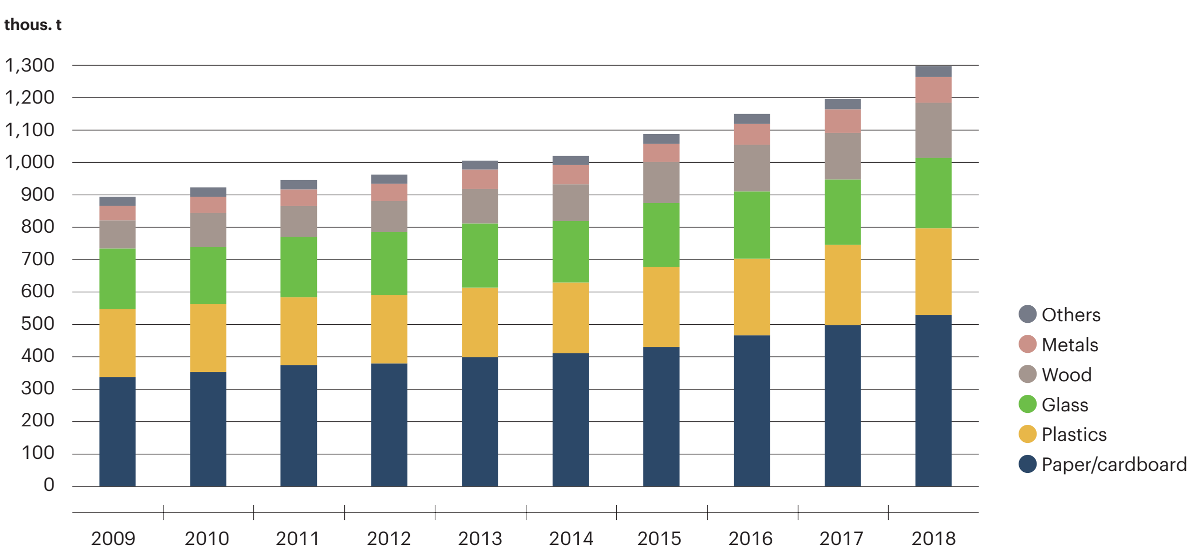
Overall assessment of the trend

Change since 1990	Change since 2009[8]	Change since 2010	Last year-on-year change
N/A			

Indicator assessment

Chart 1

Generated packaging waste and material structure of packaging waste in the Czech Republic [thous. t], 2009–2018



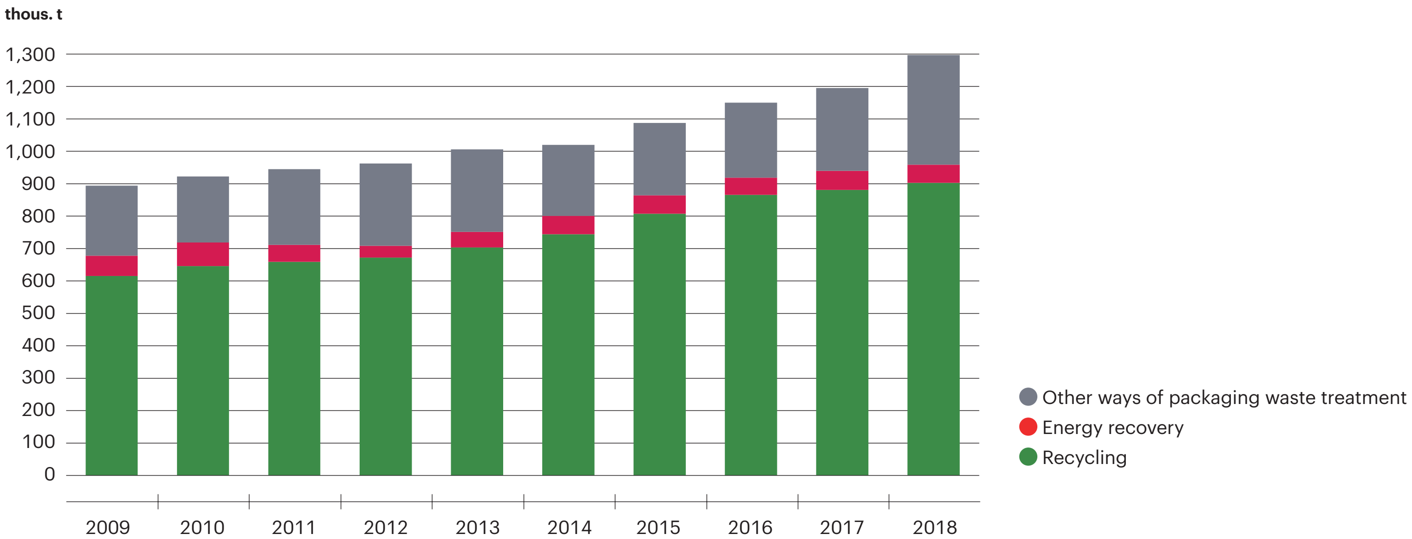
Data source: Ministry of the Environment

[7] *The targets for packaging waste are given in Government Regulation No. 352/2014 Coll., on the Waste Management Plan of the Czech Republic for the period 2015–2024, and in Annex 3 to Act No. 477/2001 Coll., on packaging and amending some laws, as amended.*

[8] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Chart 2

Recovery of packaging waste in the Czech Republic [thous. t], 2009–2018



Data source: Ministry of the Environment

Table 1

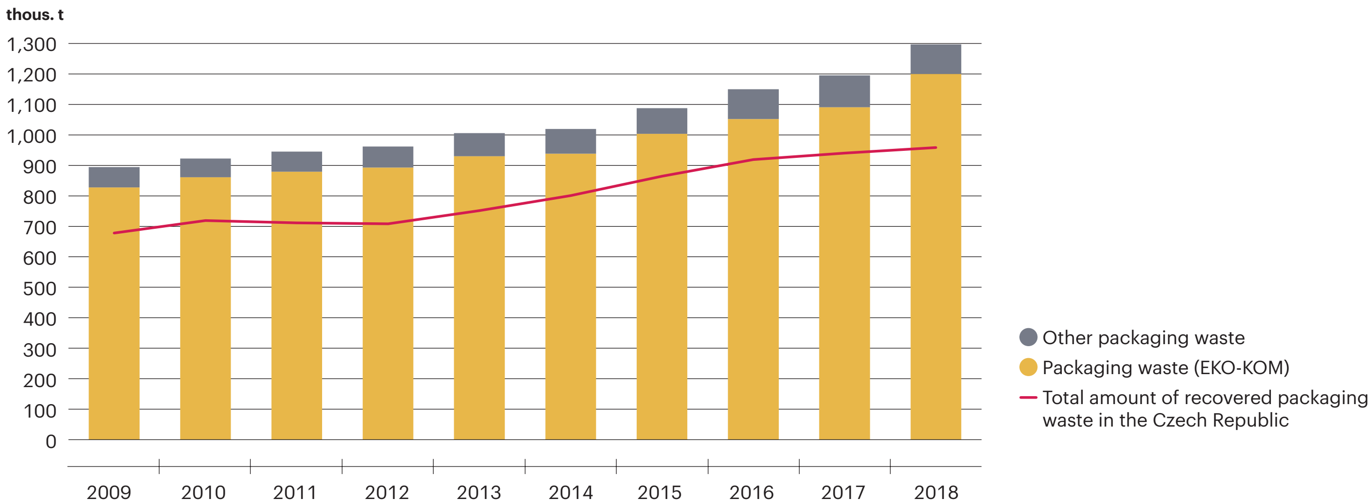
Number of entities that are obligated to recover packaging waste or to provide take-back and that participate in the EKO-KOM system, and the number of municipalities that participate in the EKO-KOM system, 2009–2018

Year	Number of clients participating in the EKO-KOM system	Number of municipalities participating in the EKO-KOM system
2009	20,573	5,861
2010	20,591	5,904
2011	20,482	5,993
2012	20,241	6,025
2013	20,233	6,057
2014	20,277	6,073
2015	20,382	6,085
2016	20,586	6,114
2017	20,778	6,123
2018	21,052	6,131

Data source: EKO-KOM, a.s.

Chart 3

Generation of packaging waste (within the EKO-KOM system and other) and its recovery in the Czech Republic [thous. t], 2009–2018



Data source: Ministry of the Environment

A growing **generation of packaging waste** is one of the most characteristic phenomena of the consumer society. This phenomenon has been present in the Czech Republic for quite some time. Between 2009 and 2018, the generation of packaging waste rose by 45.0%. In 2018, the generation of packaging waste in the Czech Republic amounted to 1,296.9 thous. t, an 8.5% increase compared to 2017. The year-on-year growth rate of the generation of packaging waste has been increasing since 2009 (Chart 1).

As to the **material structure of packaging waste**, the most frequently occurring component are paper or cardboard packagings (40.8% in 2018), a long way ahead of plastics (20.6%) and glass (16.8%). That structure is relatively stable in the course of years. The year-on-year fluctuations of percentages of the different types of packaging waste not exceeding 4% (Chart 1).

The **total amount of recovered packaging waste** in the Czech Republic in 2018 was 958.5 thous. t, i.e. 73.9% of the total generated packaging waste. The legislative target (70%) for the given year was thus met. Since 2009, the amount increased by 280.3 thous. t, i.e. 41.3%, and the year-on-year increase between 2017 and 2018 was 18.4 thous. t, i.e. 2.0% (Chart 3).

In the light of the steadily growing generation of packaging waste, the increasing **proportion of recycled packaging waste** can be viewed as a very positive phenomenon (Chart 2). Recycling is the most frequent use of packaging waste. Since 2009, there has been an increase in the amount of recycled packaging waste by 287.3 thous. t and in the year-on-year comparison of 2017–2018 by 22.0 thous. t to the total 902.9 thous. t. The proportion of recycled packaging waste in the total generation of packaging waste showed an increase between 2009 and 2018 (by 69.6%), and so it well exceeds the legislative target for the year (65%). In terms of materials contained in packaging waste, 85.6% of paper and cardboard, 57.0% of plastics, 74.8% of glass, 45.0% of wood and 67.6% of metals were recycled in 2018. Raising the targets for the recycling of packaging waste is one of the principles of the circular economy.

The second most frequent category is **energy recovery**; however, the proportion of packaging waste used for this purpose dropped from 7.0% in 2009 to 4.3% in 2018 of the total generation of packaging waste. The last year-on-year comparison between 2017 and 2018 showed a decrease of 3.6 thous. t, to 55.6 thous. t.

Issues related to packaging waste are dealt with in Act No. 477/2001 Coll., on packaging, according to which all entities introducing packagings or packaged products in the market are obliged to take back and use packaging waste. The relevant entities can meet the above obligation either on their own, or collectively, through EKO-KOM, a.s., the authorised packaging company. There were no significant changes in the number of clients meeting their obligation laid down by the Packaging

Act **through the authorised packaging company** between 2009 and 2018 (Table 1); nevertheless, when looking at each year of the reporting period, it is possible to see some dynamism in the number of clients joining or leaving the collective system. The largest number of entities involved in the EKO-KOM system was registered in 2018. The fluctuations of the number of client are caused by winding up or mergers of companies. In 2018, the number of clients involved in the system of the authorised packaging company EKO-KOM therefore reached 21,052. The number of municipalities making use of the system was gradually growing; by 2018, their number was 6,131 (out of the total number of 6,258 municipalities in the Czech Republic), with 10.590 mil. inhabitants (i.e. roughly 99% of the Czech population). The number of new entrants in 2018 was 8. All inhabitants of these municipalities have the possibility to separate their waste, in 2018 this was carried out by already 73% of the Czech population. Participation in sorting is gradually increasing, mainly due to the good accessibility of the sorting system and public awareness. In 2018, the proportion of packaging waste registered in the EKO-KOM system accounted for 92.6% of the total generated packaging waste (Chart 3).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

44 | Generation and recycling of waste from selected products

Key question

Is the amount of generated waste from selected products decreasing and is the proportion of its recovery increasing?

Key messages

Although the generation of waste from selected products increased since 2009 and it also increased year-on-year (2017 and 2018), the take-back of selected products also increased since 2009 in most cases. During the monitored period, it was the take-back of portable batteries and accumulators that showed the greatest progress. The most frequent uses of waste from selected products include material and energy recovery. The percentage of waste from selected products used for material recovery is increasing. Strategic targets[9] for selected products are continuously being met.

Overall assessment of the trend

Change since 1990 – N/A

Change since 2009[10]

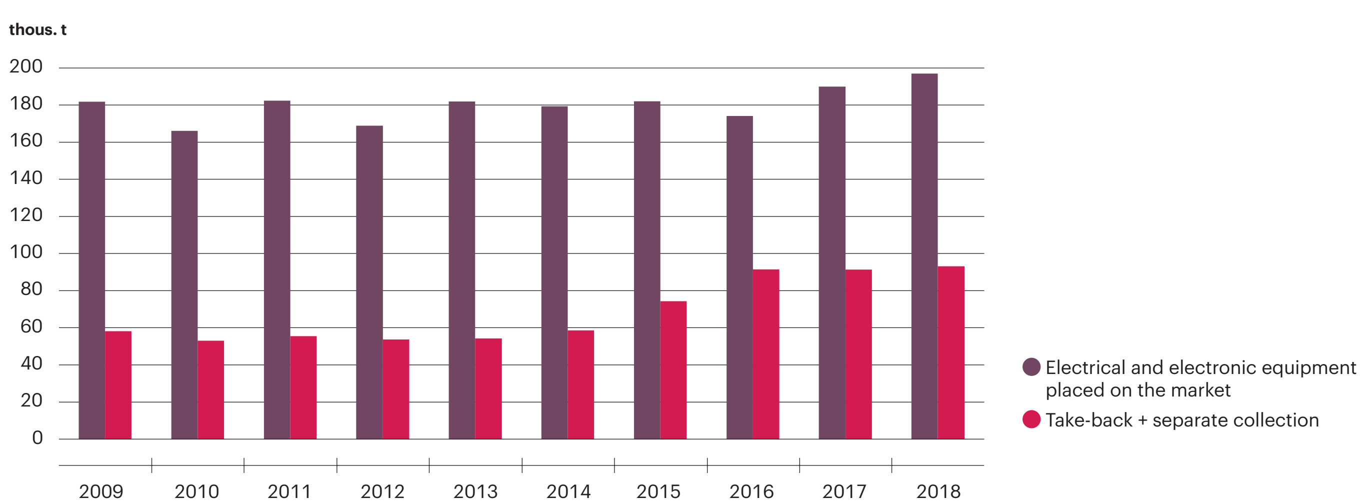
Change since 2010

Last year-on-year change

Indicator assessment

Chart 1

Quantity of electrical and electronic equipment placed on the market and the take-back rate of electrical and electronic equipment and separate collection of waste electrical and electronic equipment achieved in the Czech Republic [thous. t], 2009–2018



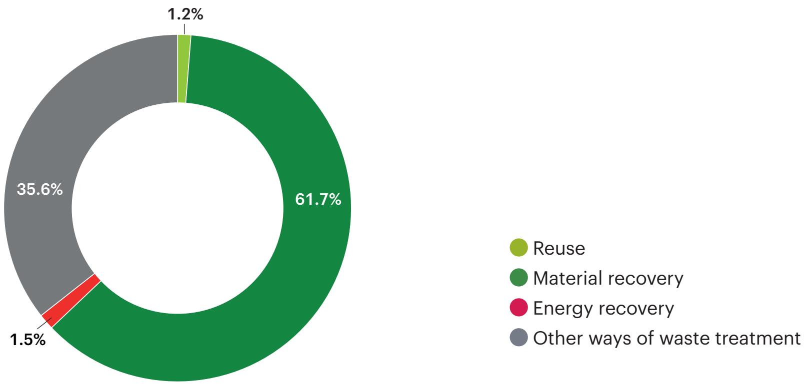
Data source: Ministry of the Environment

[9] *The targets for selected products are set out in Government Regulation No. 352/2014 Coll., on the Waste Management Plan of the Czech Republic for the period 2015–2024.*

[10] *Overall assessment of the trend is postponed because of changes in the calculation methodology.*

Chart 2

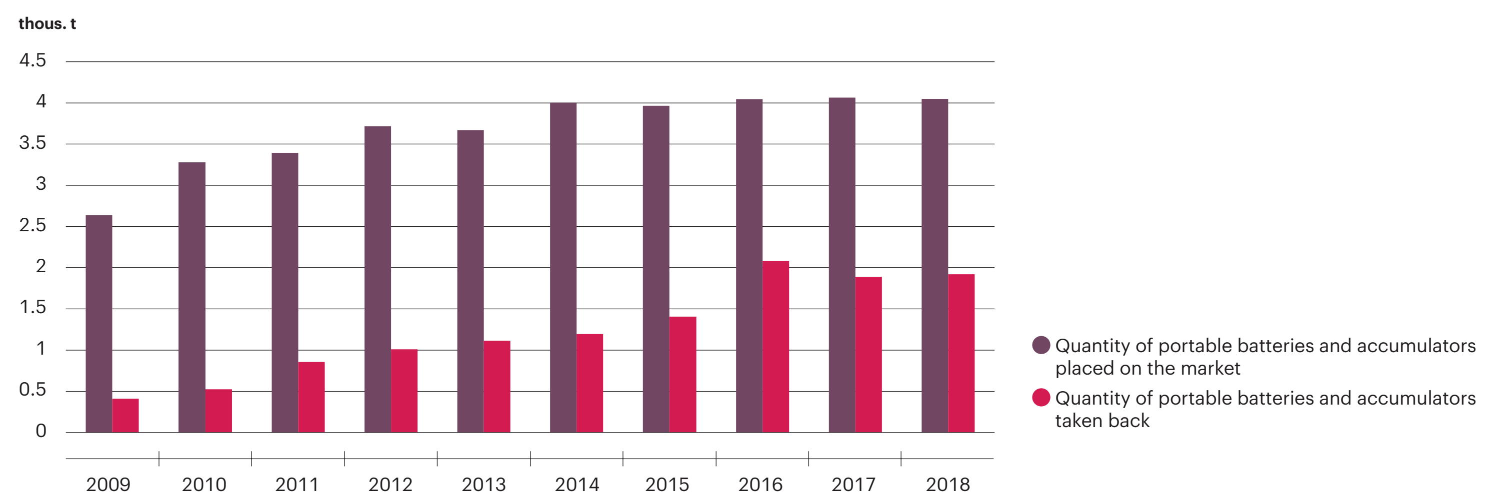
Treatment of electrical and electronic equipment and of waste electrical and electronic equipment in the Czech Republic [%], 2018



Data source: Ministry of the Environment

Chart 3

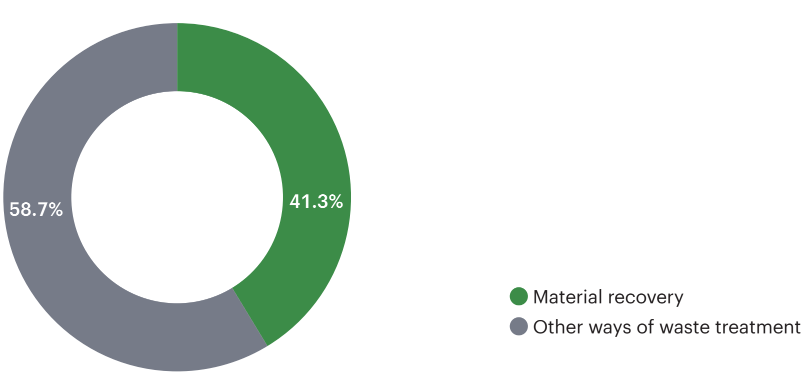
Quantity of portable batteries and accumulators placed on the market and quantity of portable batteries and accumulators taken back in the Czech Republic [thous. t], 2009–2018



Data source: Ministry of the Environment

Chart 4

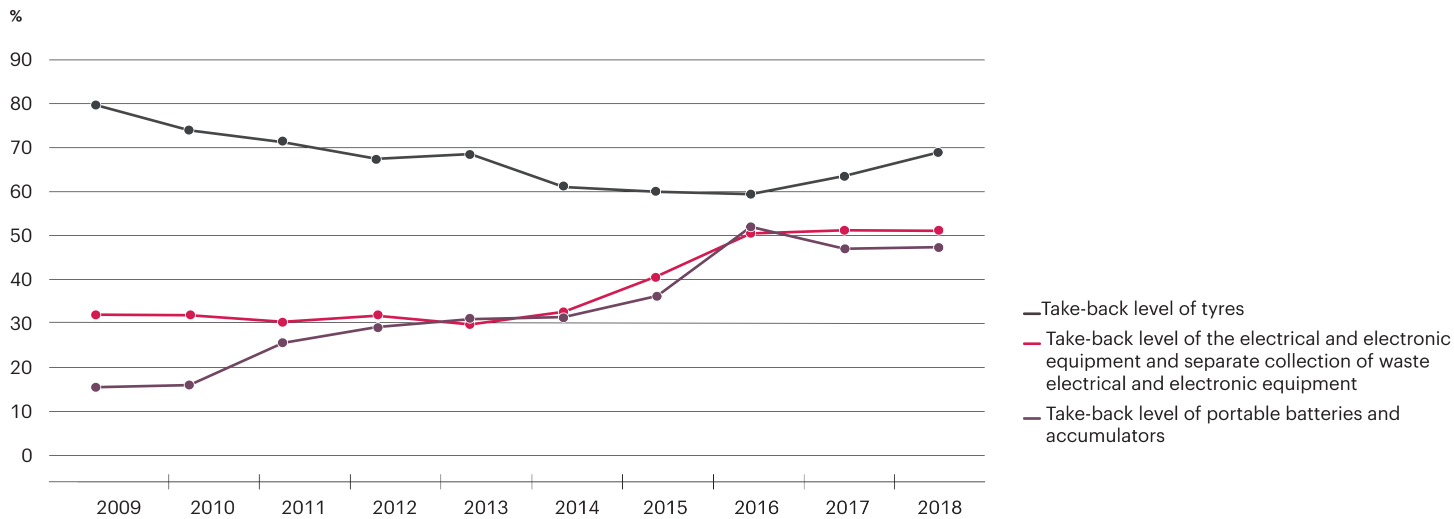
Treatment of portable batteries and accumulators taken back in the Czech Republic [%], 2018



Data source: Ministry of the Environment

Chart 5

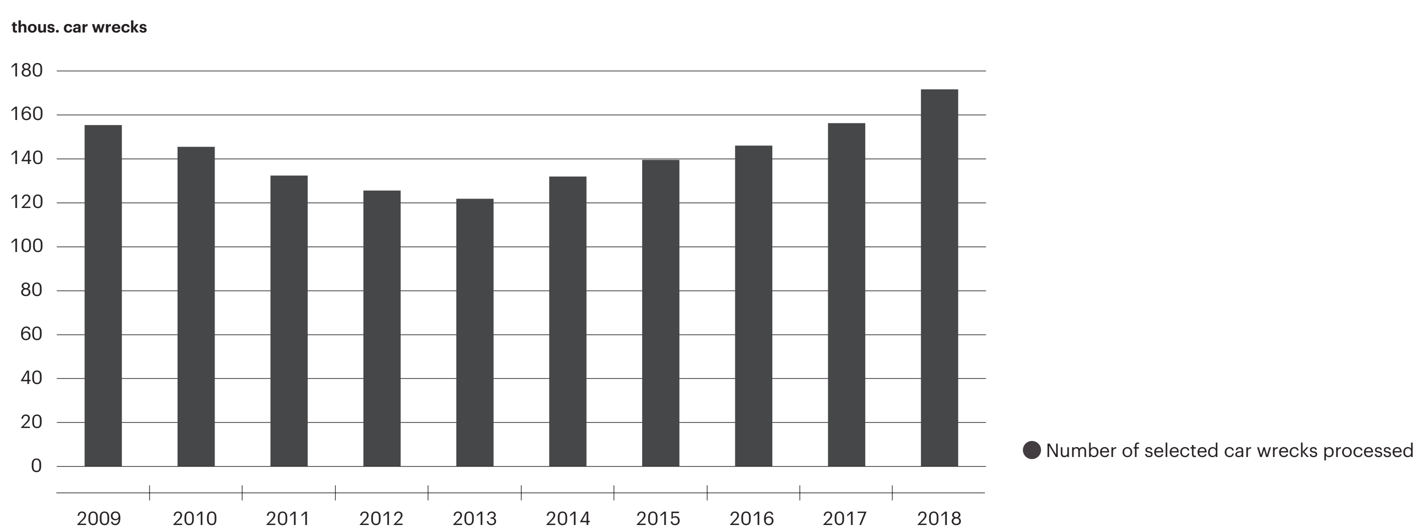
Trend in the take-back level of selected products in the Czech Republic [%], 2009–2018



Data source: Ministry of the Environment

Chart 6

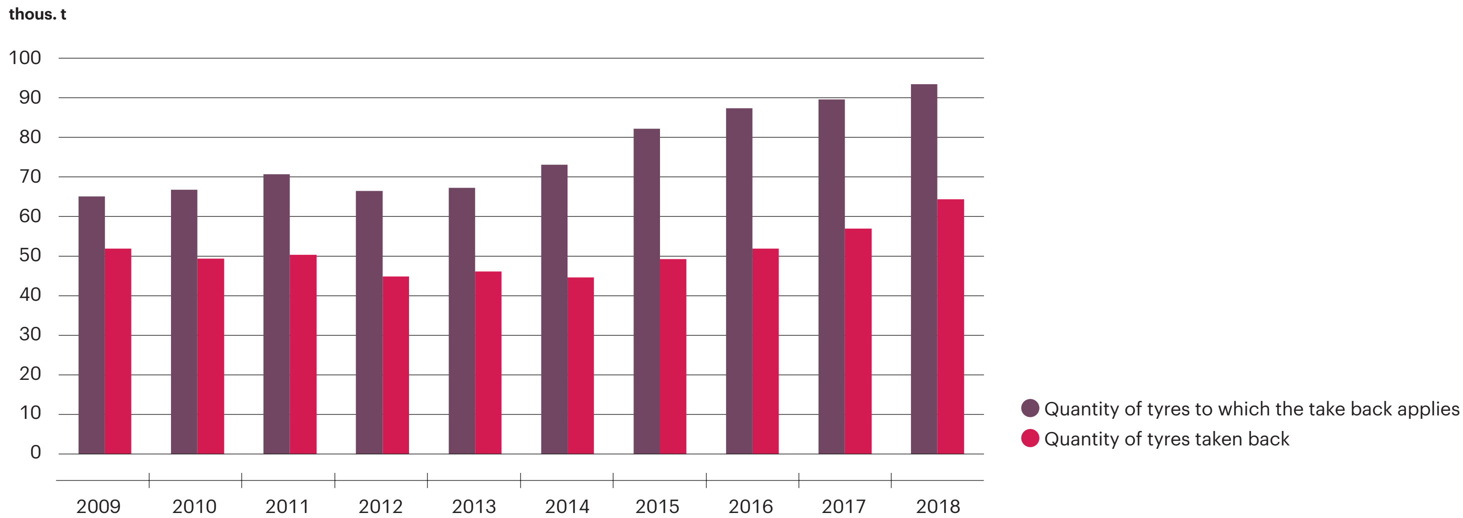
Number of selected car wrecks processed in the Czech Republic according to the MA ISOH system [thous. car wrecks], 2009–2018



Data source: Ministry of the Environment

Chart 7

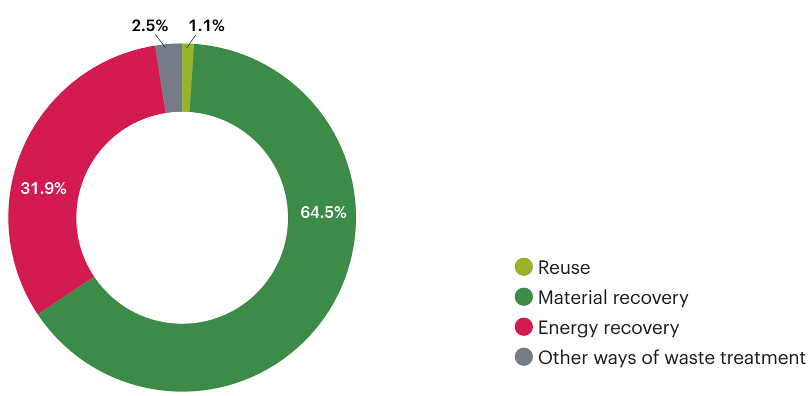
Quantity of tyres placed on the market and quantity of tyres taken back in the Czech Republic [thous. t], 2009–2018



Data source: Ministry of the Environment

Chart 8

Treatment of tyres in the Czech Republic [%], 2018



Data source: Ministry of the Environment

Waste from selected products (electrical and electronic equipment, batteries and accumulators, car wrecks, tyres) contain substances which, if treated improperly, may find their way into the environment, and pose a risk for the ecosystems and human health. In order to maintain and improve quality of the environment and to save energy, the content of such substances in products must be reduced, and waste resulting from the products must be treated properly. In the Czech Republic, this issue is regulated by Act No. 185/2001 Coll., on waste.

Between 2009 and 2018, the **quantity of electrical and electronic equipment**[11] **placed on the market** grew by 8.3%, and between 2017 and 2018 it rose by 3.7%, bringing the total to 196.9 thous. t (Chart 1).

The take-back applies to selected used household electrical and electronic equipment and appliances, which are handed back at take-back points (e.g. civic amenities, waste containers), to firms processing electrical and electronic waste, or at end sellers of such equipment and appliances. As to electrical waste not coming from households but from electrical and electronic equipment intended exclusively for professional applications, its separate collection is arranged by the manufacturer. Most manufacturers fulfil these obligations as part of the collective systems (these are specialized companies

[11] *http://www.mzp.cz/cz/odpadni_elektronicka_zarizeni_nakladani_cr*

through which manufacturers implement their legal obligations that include take-back and separate collection). Since 2009, the take-back and separate collection had a rather stagnating trend until 2015, when it rose more distinctly against 2014 and the rise continued in 2016, it again stagnated in the next years, and rose slightly in 2018 by 1.9% to the value of 93.1 thous. t (Chart 1). Between 2009 and 2018, the total increase was 59.9%.

The take-back level of electrical and electronic equipment and the separate collection of waste electrical and electronic equipment grew from 32.0% in 2009 to 51.1%, although in the year-on-year comparison of 2017–2018 it slightly decreased from 51.2% to 51.1% (Chart 5). The target for 2018 (at least 50%) was thus met. However, to meet the 2021 target (65%) it will be necessary to increase their collection.

In 2018, the most frequent **recovery of electrical and electronic equipment and waste electrical and electronic equipment** was material recovery, which accounted for a 61.7% of selected methods of treatment. The share of energy recovery was 1.5% and reuse accounted for 1.2% (Chart 2). Between 2017–2018, the share of material recovery decreased slightly from 63.9% to 61.7%. However, the amount of materially recovered electrical and electronic equipment and waste electrical and electronic equipment increased by 2.3 thous. t to a total of 63.8 thous. t. Energy recovery decreased slightly between 2017 and 2018 from 1.6% to 1.5% and the share of reuse grew from 1.0% to 1.2%.

When assessing data on **batteries and accumulators**[12] it is necessary to distinguish between their different groups, which include automotive, industrial and portable batteries and accumulators. The greatest attention is paid to portable batteries and accumulators, as they pose the highest risk that they would be, due to their small dimensions, disposed of as a component of mixed municipal waste.

Between 2009 and 2018, the generation of portable batteries and accumulators was found to grow by 53.4%. Between 2017 and 2018, the generation of portable batteries and accumulators slightly decreased by 0.4% to a total of 4.0 thous. t (Chart 3).

The growing generation was also reflected in an increased volume of portable batteries and accumulators taken back; since 2009, there was a significant increase of 369.1% to 1.9 thous. t. In year-on-year terms (2017–2018), it increased by 1.6% (Chart 3).

Between 2009 and 2018, the **take-back level** of portable batteries and accumulators increased from 15.5% to 47.4% (Chart 5). Year-on-year 2017–2018, it increased slightly from 47.0% to 47.4%. The reasons for the long-term growth of the take-back level included better awareness of take-back obligations and the expanding network of collection points. The number of manufacturers who properly meet their obligations, in particular through collective systems, is also increasing. One of the essential requirements applying to portable batteries and accumulators is achieving a minimum take-back level. The required 45% collection rate in 2018 was achieved at 47.4%.

The **methods employed to treat** of portable batteries and accumulators taken back were clearly dominated in 2018 by material recovery with a 41.3% share, as that waste is not used for energy recovery (Chart 4). Between the years 2010–2018, the proportion of material recovery decreased from 46.7% to 41.3%. In the year-on-year comparison of 2017–2018, the quantity of portable batteries and accumulators used for material recovery (1.0 thous. t) almost did not change.

The recycling processes must achieve a prescribed recycling efficiency. In 2018, the recycling efficiencies of lead-acid batteries, nickel-cadmium batteries and accumulators and other waste batteries and accumulators were 82.2%, 93.9% and 61.2%, respectively. The target figures for recycling efficiency were achieved in all the groups by a good margin.

The assessment of data on car wrecks is based on the **Car Wrecks**[13] Module of the Waste Management Information System (in Czech acronymized as MA ISOH) into which car wrecks processing entities and companies enter data directly. Based on data from the MA ISOH system, it can be stated that in 2018, 10.4% more car wrecks were processed compared to 2009, and between 2017 and 2018 there was a 9.9% increase to a total of 171.6 thous. processed car wrecks (Chart 6). In terms of implementing the objectives of recycling, reuse and recovery of selected car wrecks, the Czech Republic fulfils objectives of reuse and recovery at 95.6% and reuse and recycling at 91.9%.

The quantities of **tyres**[14] placed on the market and taken back were, to some extent, underrated because the reporting system was incomplete. For this reason, there were considerable differences between the generation of waste tyres and the quantity

[12] *http://www.mzp.cz/cz/ukazatele_odpadoveho_hospodarstvi_baterie_akumulatory*

[13] *http://www.mzp.cz/cz/modul_vraky_isoh*

[14] *http://www.mzp.cz/cz/vybrane_ukazatele_odpadoveho_hospodarstvi*

of tyres taken back. In 2014, the number of entities subject to the reporting duty, and hence the amount of collected data, increased as a result of a legal obligation of entry into the register of entities subject to the reporting duty.

Since 2009, the quantity of tyres to which the take-back applies rose by 43.6%. Between 2017 and 2018, the quantity increased by 4.3% to 93.4 thous. t (Chart 7).

As to the quantity of tyres taken back, an increase of 24.0% was registered between 2009 and 2018; 2018 saw a year-on-year increase by 13.0% to 64.3 thous. t (Chart 7).

The take-back level of tyres since 2009 decreased from 79.7% to 68.9% but in the year-on-year comparison of 2017–2018 it increased from 63.6% to 68.9% (Chart 5). The target for the year (35%) was met. To achieve the target for 2020 (80%), however, the level of their collection will have to grow notably.

The predominant method of waste tyres treatment is material recovery (64.5%). Energy is recovered of 31.9% of tyres (Chart 8). The reuse is minimal (1.1%), which indicates that retreading of tyres takes place outside the waste treatment system. Between 2009 and 2018, the share of waste tyres used for energy recovery dropped from 71.8% to 31.9%. In the year-on-year comparison, in 2018, the amount of tyres used for energy recovery decreased by 5.9 thous. t to a total of 20.8 thous. t. The material recovery of tyres in the years 2009–2018 increased from 14.5% to 64.5% and year-on-year the amount of tyres used for material recovery increased by 12.9 thous. t to a total of 42.0 thous. t in 2018. The reuse of tyres between 2009 and 2018 declined from 3.4% to 1.1% and in the year-on-year comparison the quantity of reused tyres almost did not change in 2018.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz


11
Financing

Financing

Financing of the environment is one of the decisive factors affecting the state of the individual components of the environment, and is also an expression of the public need of environmental protection at both central and regional level. This need can be quantified not only by the volume of financing spent from own resources of economic entities, but also by the amount of public financial support from local, central and international sources.

Without a reasonable amount of expenditure dedicated to the protection of the environment, it is not possible to achieve the objectives laid down in the environmental policies, or the sustainable development objectives. Their absolute amount and share in the GDP demonstrates the demands of achieving and maintaining the desired environmental state levels, but also the social consensual understanding of the need of a quality environment.

The theme of financing is divided into two chapters, the first of which focuses on investment activity of both corporate and the government sector, i.e. on investments and the related current (non-capital) costs of environmental protection. Their aim is, in particular, the reduction or elimination of environmental pollution produced by the company or a public body. An essential precondition of the success of investment activities and projects is ensuring adequate financial resources. Those may be in the form of own resources or in the form of public resources which are the subject of the second section of this theme. The public sources of expenditure on environmental protection include in particular grants and subsidies granted from the national and international public sources, i.e. in particular, from the state budget, state funds, local budgets and the related funding from European or international sources.

References to current conceptual, strategic and legislative documents

Europe 2020: Strategy for smart, sustainable and inclusive growth
- supporting research, development and innovations in combination with more effective use of resources; investment into clean low-carbon technologies to secure competitiveness and job creation (green jobs)

Strategic Framework Czech Republic 2030
- ensuring the most effective spending of public funds and sustainable public finances, which in future must be able to cope with changes in revenue structure or with new spending requirements
- adhering to the principle of additionality, in order to avoid crowding out national resources and to prevent the dependence of public policies and day-to-day State operation on EU funds whose inflow into the Czech Republic will gradually decrease
- promoting investment in research, development and innovation
- support for investment in quality infrastructure, in improving the energy performance of buildings, in more sustainable forms of mobility, in priority areas of risk prevention and protection of health, life, the environment, etc.

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- increasing investment in the use of clean technologies, renewable energy sources and in more economical management of non-renewable resources, in the protection and conservation of ecosystem services and biodiversity protection
- strengthening promotion of science, research and innovation from foreign sources for the effective implementation of environmentally friendly technologies and eco-innovation in industry
- including negative externalities into the polluters' costs, such as application of the "polluter pays" principle
- reinforcing financing support for monitoring and mitigating natural hazards and increasing funding for ensuring permeability of migration barriers, especially transport structures
- ensuring maximum use of financial resources, especially from EU funds

Strategy on Adaptation to Climate Change in the Czech Republic and the National Action Plan on Adaptation to Climate Change
- investments, for example, in the restoration of ecosystems and natural qualities of territories in the open and urbanized landscape contributing to adaptation to the impacts of climate change

© Jarmila Cikánková/CENIA

- the use of financial instruments such as: insurance against natural risks, payments for ecosystem services, carbon taxes
- supporting research into adaptation to climate change

Operational Programme Environment 2014–2020
- allocating financial assistance of EUR 3.2 bil. of total eligible expenditure from the Operational Programme Environment 2014–2020 (of which EU contribution from the Cohesion Fund and European Regional Development Fund at EUR 2.8 bil.) into the following priority axes:

PA 1 – Improvement of Water Quality and Reduction of Flood Risks: 28% of the programme allocation
PA 2 – Improvement of air quality in human settlements: 19% of the programme allocation
PA 3 – Waste and material flows, environmental burdens and risks 17% of the programme allocation
PA 4 – Conservation and care of nature and landscape 13% of the programme allocation
PA 5 – Energy savings: 20% of the programme allocation
PA 6 – Technical assistance 3% of the programme allocation

National Reform Programme of the Czech Republic 2018
- support for the implementation of measures to reduce the risk of long-term drought and water scarcity (e.g. support for water retention in the landscape, rainwater management) in the context of the impacts of climate change

45 | Investments and non-investment costs in environmental protection

Key question

What amount of funding in the form of investment expenditure or non-investment costs is spent on maintaining and improving the environment?

Key messages

In 2018, the total expenditure, i.e. investments in and non-investment costs in environmental protection, reached CZK 98.1 bil. and increased by CZK 1.3 bil., i.e. 1.4%, compared to 2017, despite a decline in investment expenditure, which was more than offset by a rise in non-investment costs. However, due to stronger economic growth, the share of investments and non-investment costs in GDP decreased slightly by 0.1 p.p. to 1.8% of GDP. In terms of the programme focus, as in previous years, the most of the resources were spent in the area of waste management, followed by the area of wastewater treatment and the protection of air quality and climate.

Overall assessment of the trend – investment expenditure

Change since 1990

Change since 2000

Change since 2010

Last year-on-year change

Overall assessment of the trend – non-investment costs

Change since 1990 N/A

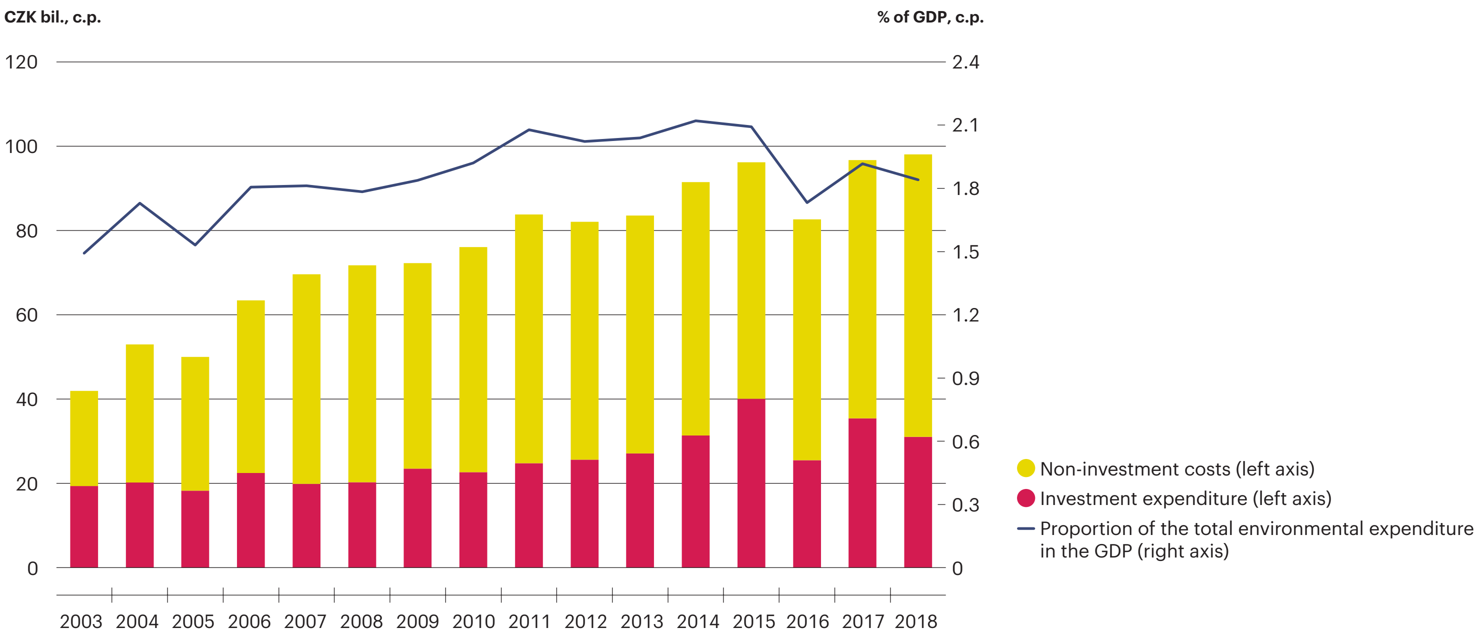
Change since 2003

Last year-on-year change

Indicator assessment

Chart 1

Total environmental protection expenditure in the Czech Republic [CZK bil., % of GDP, current prices], 2003–2018

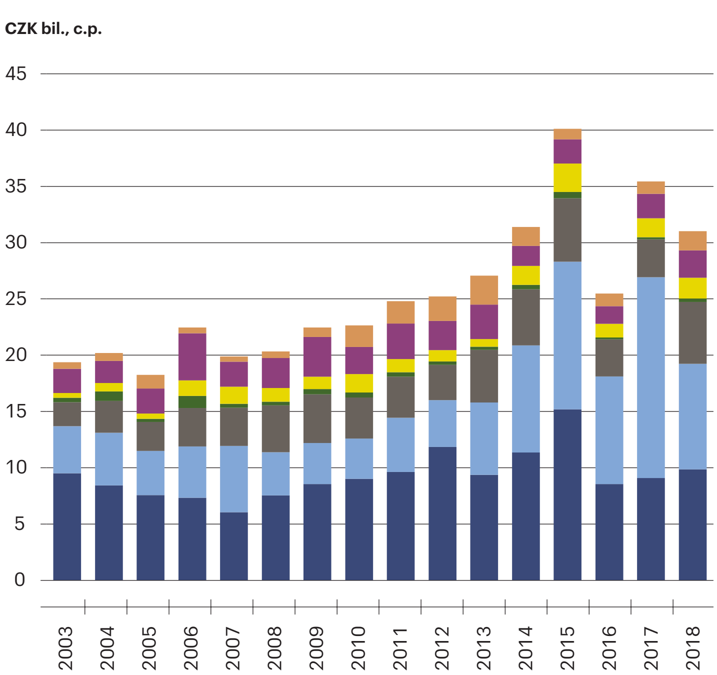


Data source: Czech Statistical Office

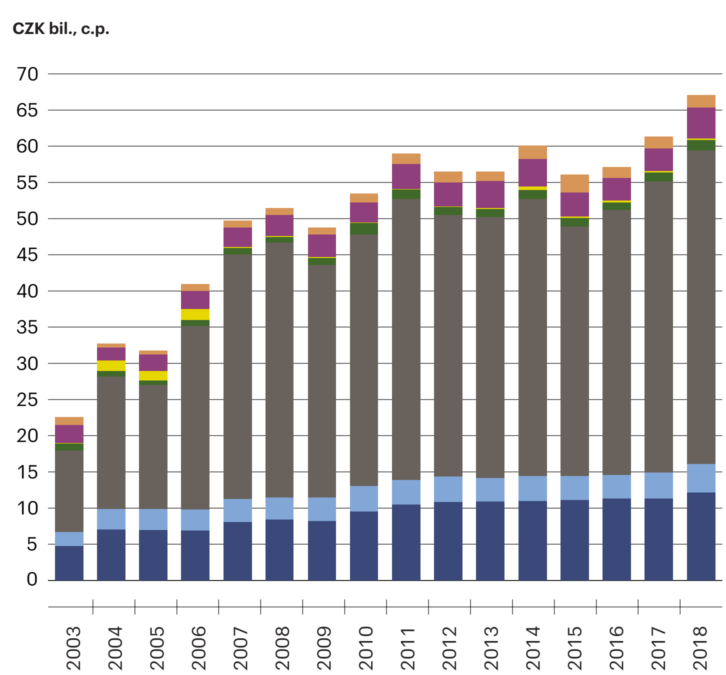
Chart 2

Investments and non-investment costs on environmental protection by programme focus in the Czech Republic [CZK bil., current prices], 2003–2018

Investments



Non-investment costs

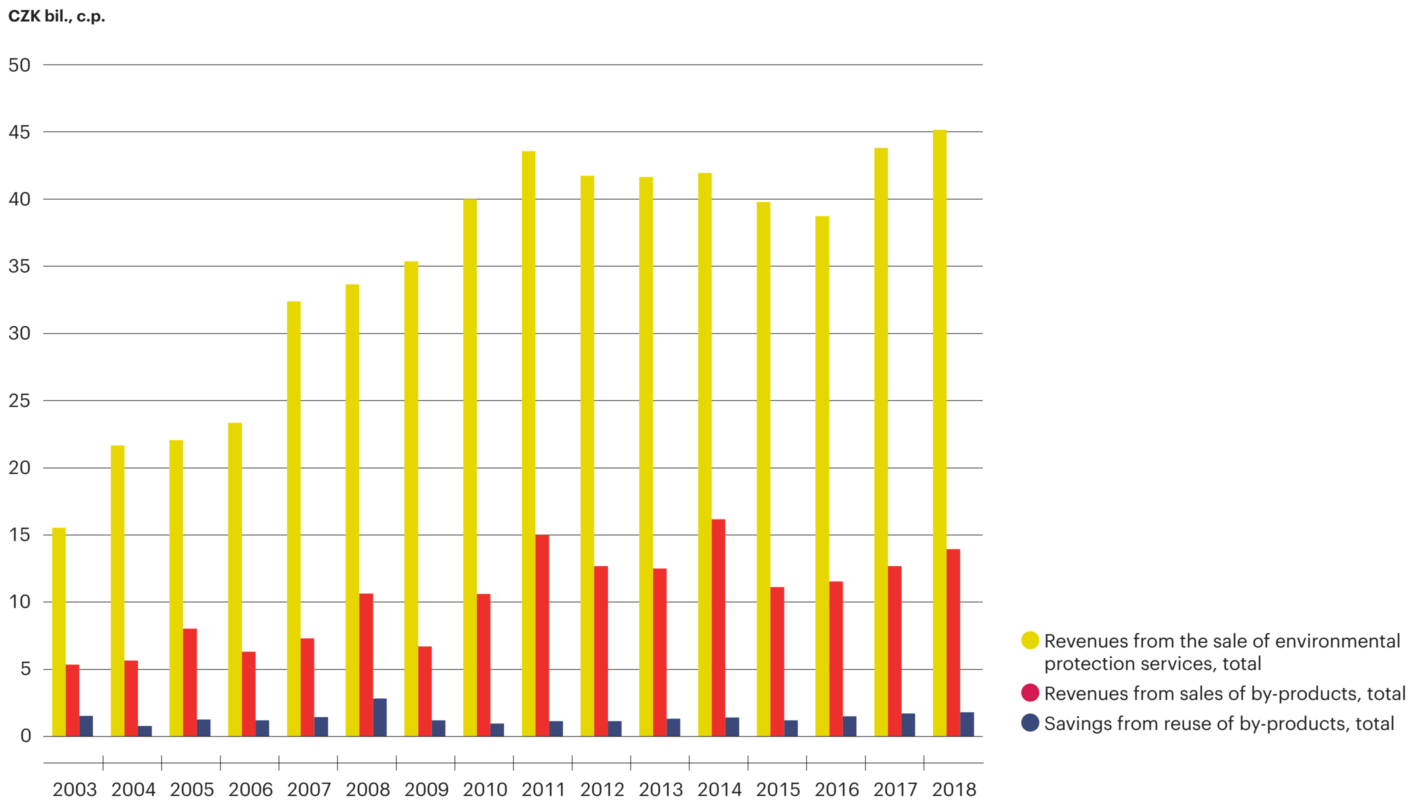


Research and development; other environmental protection activities
Protection and remediation of soil, groundwater and surface water
Reduction of noise and vibration; protection against radiation
Protection of the landscape and biodiversity
Waste management
Air and climate protection
Wastewater management

Data source: Czech Statistical Office

Chart 3

Economic benefit of environmental protection activities in the Czech Republic [CZK bil., current prices], 2003–2018



Data source: Czech Statistical Office

Total environmental protection expenditure

The total statistically monitored expenditure on environmental protection represents the sum of investments in environmental protection and non-investment costs of environmental protection that are expended by the monitored entities of the Czech economy (i.e. both private companies and the public sector). Investment expenditure includes all expenditure for tangible fixed assets, i.e. expenditure that relates to environmental protection activities, the main objective of which is to reduce the negative effects resulting from the business activity. Non-investment costs are current expenditure, especially payroll costs, payments for material consumption, energy, repairs, maintenance, etc. The statistical survey of source data has been carried out by the Czech Statistical Office, since 1986 in the case of investment expenditure on environmental protection, and since 2003 in the case of non-investment costs.

In 2018, **investments and non-investment costs of environmental protection** amounted to CZK 98.1 bil. and in comparison with 2017 rose by CZK 1.3 bil., i.e. 1.4%. However, the share of investments and non-investment costs in GDP decreased slightly by 0.1 p.p. to 1.8% of GDP (Chart 1) due to stronger economic growth.

Investments in environmental protection

In terms of **investments**, more than 60% was represented by expenditure on integrated equipment (i.e. to prevent pollution) which prevailed over expenditure on terminal equipment (i.e. to remove generated pollution). Therefore, it is possible to conclude that there was a high level of investments in the long-term, where an integrated approach to environmental protection is applied based on the principle of introducing and using BATs and other innovations. The aim of this approach is the gradual modernisation of production and operating facilities of environmental polluters, which leads particularly to a removal of the negative impacts caused by their operations.

In 2018, the investment expenditure **decreased year-on-year** by CZK 4.4 bil. (i.e. by 12.4%) to the total CZK 31.0 bil., which was CZK 9.6 bil. (45.0%) more than the volume of investments in 2000. This decrease was related mainly to lower investment activity in the area of air and climate protection. Investing entities in 2018 increased the volume of investments financed through grants and subsidies, or loans and borrowing by CZK 1.7 bil., while financing from own resources and budget funds decreased by CZK 6.1 bil.

In terms of the **programme focus**, in 2018, the most investment expenditure was spent traditionally on wastewater management (CZK 9.9 bil.), air and climate protection (CZK 9.4 bil.) and waste management (CZK 5.5 bil., Chart 2). In the protection of air and climate, funding was invested in 2018 in particular in further emission reductions, for example in connection with Directive of the European Parliament and of the Council 2010/75/EU on the industrial emissions (IED) and with the emission standards in transport. In the field of wastewater management, sewerage systems and wastewater treatment plants continued to be reconstructed and new ones were built. In the area of waste management, in 2018 the most investments went to the collection and gathering, and the recovery and disposal of municipal waste.

In terms of the **economic activity sectors of the investing entities (CZ-NACE)**, the highest shares in total investments have been contributed in the long term by the public administration and defence, compulsory social security (33.5% of total investments in 2018) and manufacturing industry (24.2% of total investments), followed by water supply including the activities related to wastewater, waste and remediation (18.2% of total investments) and the energy sector, i.e. production and distribution of electricity, gas, heat and conditioned air (12.7% of total investments).

Concerning the division into **corporate and government sectors**, in 2018 the private and public non-financial enterprises invested CZK 19.9 bil. (i.e. CZK 6.2 bil. less than in 2017) and the government sector (central and regional) CZK 11.1 bil. (i.e. CZK 1.8 bil. more than in 2017). As in previous years it was the corporate sector which contributed more on the investments in environmental protection, while the "polluter pays" principle applies: the main responsibility for protecting the environment has to be transferred onto private entities.

Environmental protection investments are closely related to economic benefits from environmental protection activities, which consist in revenue from the sale of environmental protection services, revenue from the sale of by-products and savings related to the re-use of by-products (Chart 3). Total sales or savings in 2018 grew year-on-year by 3.1% to CZK 45.2 bil., and all three groups of benefits continued to be clearly dominated by the area of waste management. While this area contributed 72.3% to revenues from the sale of services and 86.3% to savings from the use of by-products, its proportion in the sales of by-products was 96.4%.

Non-investments costs of environmental protection

The **amount of non-investment costs** has a long-term rising trend, which was confirmed in 2018, when those costs increased by CZK 5.7 bil. year-on-year (i.e. by 9.4%) to CZK 67.0 bil. and continued to form a substantial part of the total expenditure on environmental protection (70% in 2018). Compared with 2003, when they began to be tracked, the non-investment costs have increased by CZK 44.5 bil., i.e. nearly 3 times. The largest volume of non-investment costs was spent on consumption of materials and energy and on wages.

Same as in previous years, in 2018, in terms of **programme focus**, most of the current expenditure was spent on waste management (CZK 43.3 bil., which, together with investment costs in that area, comprises the biggest part of total environmental protection expenditure) and on wastewater management (CZK 12.2 bil.), Chart 2. Other high-cost areas include, in the long term, protection and remediation of soil, protection of ground water and surface water (CZK 4.3 bil. in 2018) and air and climate protection (CZK 3.9 bil.).

In terms of **economic activity sectors of the investing entities (CZ-NACE)**, in 2018, same as in the previous year, the biggest proportion in total non-investment costs on environmental protection was spent in the water supply sector and in activities related to wastewater, waste and remediation (49.4% of total non-investment costs), in the manufacturing industry (22.5% of total non-investment costs) and in the sector of public administration and defence, and compulsory social security (17.6%).

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

46 | Public expenditure on environmental protection

Key question

What is the structure and the volume of funding from national and international public resources to protect the environment?

Key messages

The volume of expenditure both from central sources (i.e. mainly from the state budget and state funds) and from territorial budgets increased slightly in 2018 year-on-year. In the case of environmental protection expenditure from central sources, the growth was 1.4% to CZK 45.4 bil. and, from territorial budgets 13.6% to CZK 40.5 bil.

In 2018, the priority areas of support included the protection of water, namely wastewater drainage and treatment, biodiversity and landscape protection, waste management and, last but not least, air protection. In this area, the implementation of programmes supporting thermal insulation, energy savings and changes in heating technologies continued in 2018 (e.g. the New Green Savings Programme or boiler subsidies).

Under the Operational Programme Environment for the 2014–2020 programming period with a total allocation of EUR 3.2 bil. (i.e. approx. CZK 86.2 bil.) of total eligible expenditure, 23 new calls offering EUR 518 mil. were announced in 2018 (i.e. CZK 13.5 bil.) of total eligible expenditure. Since the beginning of the programming period, subsidies have been approved for more than 4,900 applications totalling EUR 2.07 bil. (i.e. CZK 53.7 bil.) of total eligible expenditure.

Overall assessment of the trend

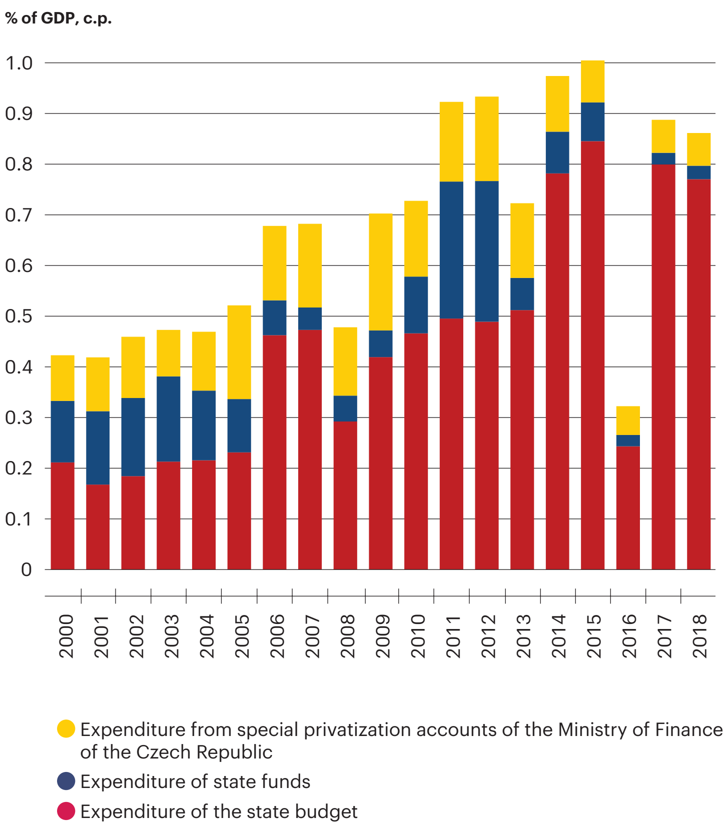
Change since 1990	Change since 2000	Change since 2010	Last year-on-year change

Indicator assessment

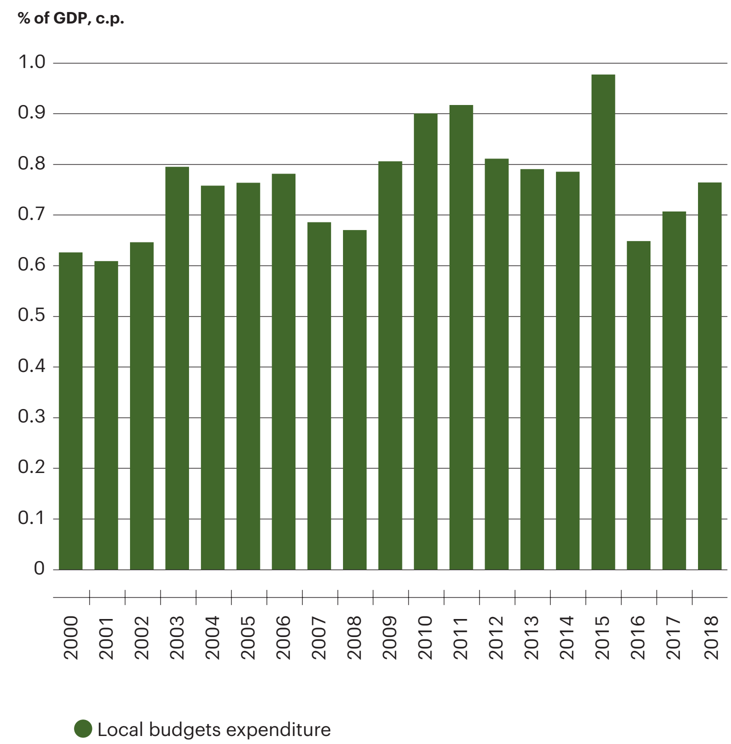
Chart 1

Share of public expenditure on the environment protection from central and local budgets in GDP in the Czech Republic [% of GDP, current prices], 2000–2018

Expenditure from central sources



Local budgets expenditure

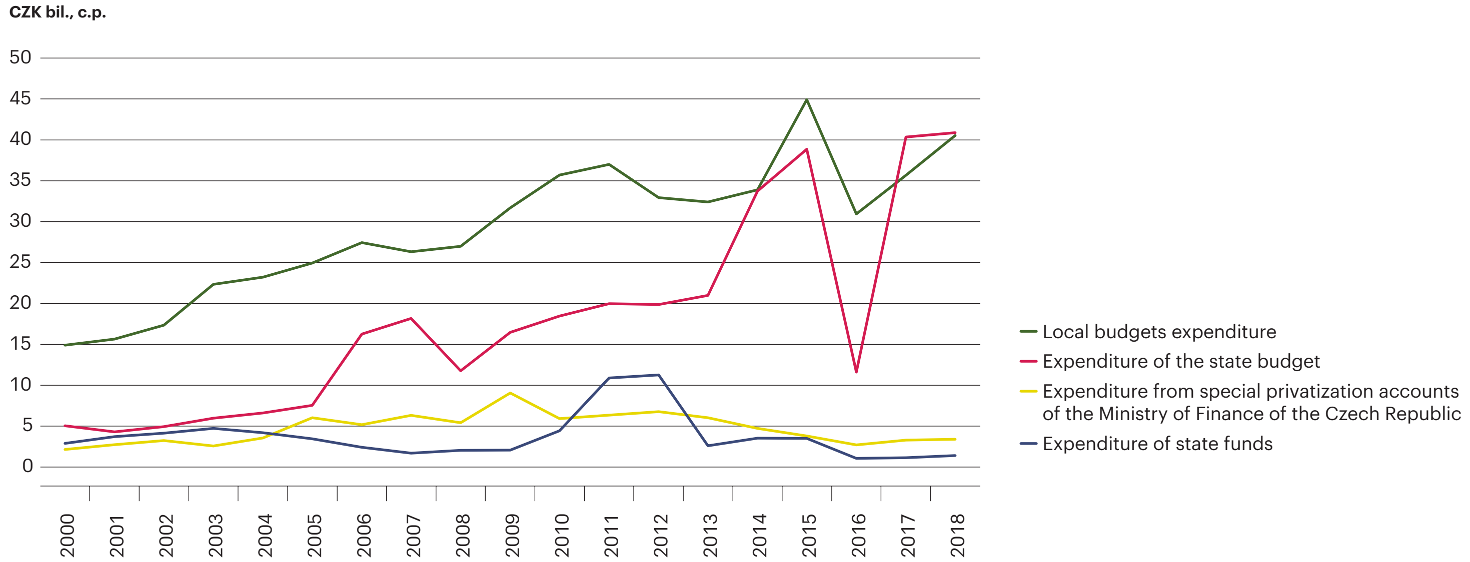


Expenditure from the special privatization accounts of the Ministry of Finance of the Czech Republic (up to 2005 the expenditure of the National Property Fund of the Czech Republic) includes resources of the former National Property Fund of the Czech Republic abolished on 1 January 2006. These expenses cover the removal of old environmental damage caused before privatization and caused by the previous activities of enterprises, or the remedying of environmental damage caused by the extraction of minerals, and the revitalization of the affected territory.
A part of public environmental expenditure of local budgets may be a duplication of expenditure from central sources.

Data source: Ministry of Finance of the Czech Republic, Czech Statistical Office

Chart 2

Public environmental protection expenditure in the Czech Republic by source type [CZK bil., current prices], 2000–2018



Expenditure from the special privatization accounts of the Ministry of Finance of the Czech Republic (up to 2005 the expenditure of the National Property Fund of the Czech Republic) includes resources of the former National Property Fund of the Czech Republic abolished on 1 January 2006. These expenses cover the removal of old environmental damage caused before privatization and caused by the previous activities of enterprises, or the remedying of environmental damage caused by the extraction of minerals, and the revitalization of the affected territory.
A part of public environmental expenditure of local budgets may be a duplication of expenditure from central sources.

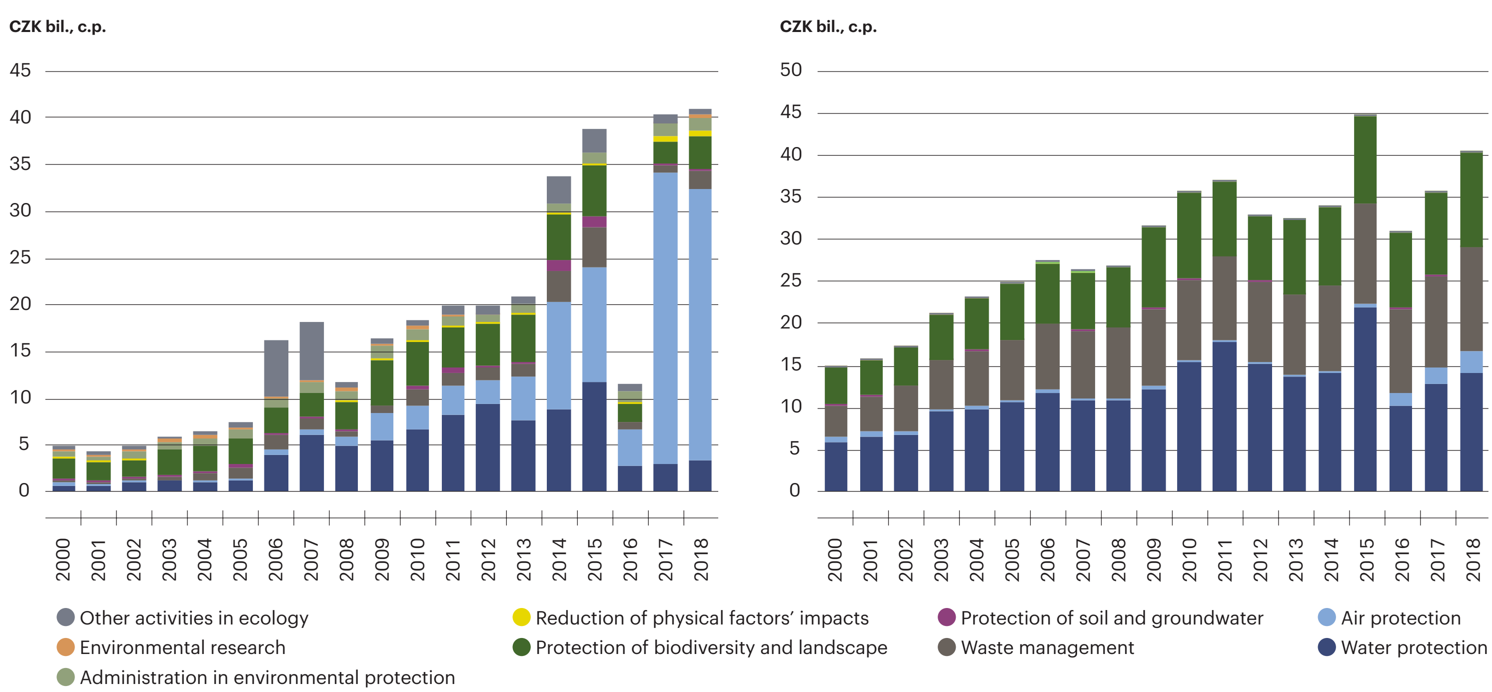
Data source: Ministry of Finance of the Czech Republic

Chart 3

Public environmental protection expenditure from the state budget and local budgets in the Czech Republic by programme orientation [CZK bil., current prices], 2000–2018

Expenditure from central sources

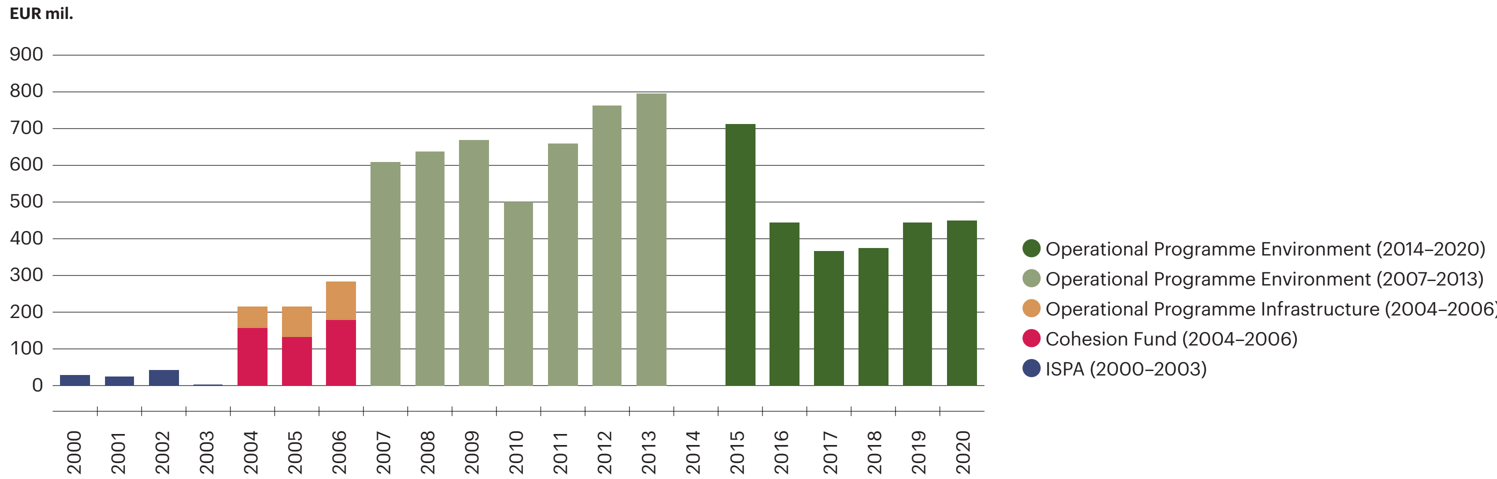
Local budgets expenditure



Data source: Ministry of Finance of the Czech Republic

Chart 4

Allocation of financial resources from the EU funds for projects in the field of the environment in the Czech Republic [EUR mil.], 2000–2020



The year 2014 is not indicated in the chart because in the Operational Programme Environment no allocation was determined in the 2007–2013 programming period for 2014 and for the 2014–2020 programming period the allocation 2014 was moved to 2015.

Data source: Ministry of Finance of the Czech Republic

Public environmental protection expenditure comprises environmental protection expenditure both from national sources, i.e. from central sources and local budgets, and from European or international sources[1]. Same as in other areas, also in the field of environmental protection it is monitored whether the expenditure incurred is adequate to the economic possibilities and performance of the Czech Republic, or to the gross domestic product. In 2018, compared to the previous year, both the volume of expenditure from central sources and the volume of expenditure from territorial budgets increased. However, given the faster growth of the economy in 2018, the **share of that expenditure in GDP** rather stagnated (Chart 1). The level and development of the volume of funding in the last three years was caused, in particular, by the final closure of the programming period of the Operational Programme Environment 2007–2013, which was successfully financially completed in 2016, and also by the gradual launch of the follow-up Operational Programme Environment 2014–2020. Resources from the operational programmes financed by the EU funds are in fact intertwined with resources from national public sources in the form of co-financing or pre-financing of the supported projects and actions to protect the environment. That interconnection had a major influence on the total volume of expenditure, including its share in the GDP. In 2018, the expenditure from central sources amounted to 0.86% of GDP (year-on-year decrease by 0.03 p.p.), and the expenses of local budgets 0.76% of GDP (year-on-year decrease by 0.05 p.p.).

Public expenditure from central sources

The state budget is the most significant central source of public funding for environmental protection, especially subsidies or repayable financial aid. Other central sources of funding are state funds (mainly the State Environmental Fund of the Czech Republic) and the dissolved National Property Fund of the Czech Republic, whose remaining competencies and resources are now in the remit of the Ministry of Finance of the Czech Republic on special privatization accounts. Expenditure on environmental protection from central sources in 2018 rose slightly year on year by 1.4% to CZK 45.4 bil. (Chart 2). In long-term comparison with 2000, when that expenditure amounted to CZK 10.1 bil., it increased 4.5 times.

Expenditure from the **state budget** increased slightly by 1.3% year-on-year to CZK 40.9 bil. in 2018 (Chart 2). The development of that expenditure is connected with the above mentioned co-financing, or pre-financing of projects implemented under operational programmes financed from EU funds. Another reason for the steep year-on-year increase in 2017 and its confirmation in 2018 was also the transfer of funds within the state budget, originally allocated in the budget chapter of

[1] Information regarding public spending is based on the budget structure of the Ministry of Finance of the Czech Republic, which has long monitored the funds provided primarily for the purpose of environmental management and protection. As the source of expenditure of local budgets can include financial transfers (e.g. from the state budget, state funds, etc.), some of that expenditure is duplicate with expenditure from central sources or European funds. For that reason, the expenditure from central sources, local budgets, and European or international sources is evaluated separately and can not therefore be summarized.

Ministry of Industry and Trade, specifically to Section 2115 Programmes on Thermal Insulation and Energy Savings which falls under expenditure on environmental protection. That transfer was made namely into the area of air protection which is also the most supported area within the state budget (CZK 28.9 bil. in 2018), and particularly in support for the above-mentioned programmes on thermal insulation and energy savings, and in support for changes in heating technologies (Chart 3). That was followed by the water protection area with CZK 3.5 bil., represented primarily by expenditure on collection and treatment of wastewater and on sludge management, and the protection of biodiversity and landscape with CZK 3.5 bil. Within this area, in addition to erosion and fire protection, the most resources were spent mainly on supporting protected areas of nature. Significant programmes in this area of support include the Landscape Management Programme, the Landscape Natural Function Restoration Programme and the sub-programme Management of Inalienable State Property in Protected Areas. Under these programmes, a total of CZK 213.2 mil. was paid out in 2018.

The largest central source of financing for environmental protection outside the budget are state funds, for example the State Agricultural Intervention Fund of Ministry of Agriculture or State Transport Infrastructure Fund of Ministry of Transport and of course the **State Environmental Fund of the Czech Republic**. In 2018, the expenditure on environmental protection from the state funds amounted to CZK 1.4 bil. and compared to 2017 they grew year on year by 22.3%. The role of the State Environmental Fund of the Czech Republic is important in the area of financing environmental protection, the importance of this Fund is currently connected with, inter alia, the provision or administration of grants under national programmes, the Operational Programme Environment (for more on this programme see the paragraph Financing from the EU and foreign sources) or the **New Green Savings Programme**[2]. This programme, which started in 2014, falls within the area of programmes on thermal insulation and energy savings, changes of heating technologies, and measures to reduce the production of greenhouse gases. In 2018, this programme reimbursed 7,689 applications with about CZK 1.8 bil. to cover measures in family houses, apartment buildings and public sector buildings. The main source of financing of the programme is the set share of the proceeds from the auctions of emission allowances EUA and EUAA under the EU ETS and the total allocation for the programme will be mainly dependent on the amount of that revenue; according to the updated estimates, the total sources of the programme could reach CZK 22.9 bil.

State Environmental Fund of the Czech Republic also administers the collection of **fees** that are used for environmental protection. The purpose of the collection of fees is direct return of the fees back to environmental protection, as opposed to environmental taxes for which such return is not a necessary precondition. The fees therefore represent a source for providing support within the Fund's competence; the support is drawn mainly in the form of loans, subsidies and payment for a part of the interests from loans and it goes mainly to the priority areas of environmental protection in the Czech Republic (i.e. protection of water, biodiversity and landscape, air protection and waste management). The main source of State Environmental Fund of the Czech Republic income from the collection of fees or dues were in 2018 in particular the abstraction of groundwater (in total CZK 385.3 mil.), the take of agricultural and forest land (CZK 267.6 mil.), discharge of wastewater into surface water (CZK 198.5 mil.), support for the collection, processing, recovery and disposal of selected car wrecks (CZK 170.8 mil.) or air pollution (CZK 169.6 mil.).

From the resources of the defunct National Property Fund of the Czech Republic, which are managed by the **Ministry of Finance of the Czech Republic on special privatisation accounts**, CZK 3.4 bil. was spent in 2018 (Chart 2). These expenses are directed towards the removal of old environmental damage caused before privatization and caused by the previous activities of enterprises, or the remedying of environmental damage caused by the extraction of minerals, and the revitalization of the affected territory[3].

Public expenditure from local budgets

The second main pillar of public expenditure on environmental protection is funding from **local budgets of municipalities and regions**, which is intended to finance actions that are implemented on an ongoing basis based on the competencies of the municipalities or regions. In 2018, the expenditure grew by 13.6% year-on-year to a total of CZK 40.5 bil. (Chart 2). Compared to 2000, when expenditure from regional budgets amounted to CZK 14.9 bil., its volume increased more than 2.7 times.

The main priorities of the **protection of environmental components** at the level of municipalities and regions in the long term include the protection of water, namely the collection and treatment of wastewater. In 2018, CZK 14.1 bil. were spent on that area

[2] *The New Green Savings Programme is administered by the State Environmental Fund of the Czech Republic, however, the financial resources come from the state budget.*

[3] *Examples of such expenditure include funding intended to eliminate the consequences of chemical mining of uranium in Stráž pod Ralskem, as well as funding for the Moravian-Silesian, South Moravian, Ústí nad Labem and Karlovy Vary Regions intended for the removal of environmental damage incurred before privatization of mining companies in connection with the restructuring of the steel industry and revitalization of the affected areas.*

(Chart 3). The second largest item funded from local budgets was waste management, in particular collection and gathering of municipal waste, including its recovery and disposal (a total of CZK 12.2 bil.). The third most supported areas were in 2018 the protection of biodiversity and landscape, focusing in particular on the care for the appearance of municipalities and public greenery and the protection of species and habitats (a total of CZK 11.2 bil.). In 2018, the growth of expenditure in the field of air protection continued, especially supporting changes of heating technologies, i.e. supporting measures to reduce air pollution from local combustion heaters using solid fuel. In this area, CZK 2.6 bil. was spent in 2018, mainly on providing so-called boiler subsidies to support the replacement of old boilers.

Financing from EU and other foreign sources

In addition to national funding programmes in environmental protection, managed primarily by the State Environmental Fund of the Czech Republic, public expenditures on environmental protection are strengthened since 2004 thanks to the direct support from the EU and a possibility to co-finance projects from other foreign sources as well. At present it is especially the Norwegian and the EEA Financial Mechanisms, the LIFE Programme, the Swiss-Czech Cooperation Programme and the Operational Programme Environment which is the largest source in terms of subsidies and the main source of funding for environmental protection from EU sources. It is also the Rural Development Programme, which aims inter alia to restore, conserve and improve natural ecosystems dependent on agriculture.

Under the **Operational Programme Environment 2014–2020**, State Environmental Fund of the Czech Republic and Nature Conservation Agency of the Czech Republic were designated as intermediary bodies which, on the basis of delegation agreements with the Ministry of the Environment, ensure the administration and financing of projects from EU sources.

The total allocation of Operational Programme Environment 2014–2020 at the end of 2018 amounted to EUR 3.2 bil. (CZK 86.2 bil.) of total eligible expenditure. In 2018, the allocation was increased due to the transfer of funds from Integrated Regional Operational Programme to Operational Programme Environment in the amount of EUR 78.7 mil. of EU funds (CZK 2.0 bil.), or EUR 92.6 mil. of total eligible expenditure as part of the programme revision, which included the creation of new specific objective 5.3 "Reducing energy intensity and increasing the use of renewable energy sources in central government buildings", funded by the European Regional Development Fund. Furthermore, a transfer of funds was approved from the Operational Programme Enterprise and Innovation for Competitiveness to the Operational Programme Environment in the amount of EUR 39.3 mil. of EU funds (CZK 1.0 bil.), or EUR 46.2 mil. of total eligible expenditure[4] and the related creation of new specific objective 2.4 "Reducing emissions of stationary sources contributing to the exposure of the population to above-the-limit concentrations of pollutants in coal regions", funded by the European Regional Development Fund. In 2018, 23 new calls were published with the allocation of EUR 518 mil. (CZK 13.5 bil.) of total eligible expenditure, of which 6 calls were time-limited and 17 continuous. From the beginning of the programming period until 31 December 2018, the Operational Programme Environment Managing Authority announced 117 calls with an allocation corresponding to 112% of the programme allocation. In the already closed calls, a total of 8,664 grant applications requesting around EUR 4.2 bil. (CZK 108.4 bil.) of total eligible expenditure were registered from the beginning of the programming period until the end of 2018. By the end of 2018, the selection committee recommended 5,236 applications for financing at the total financial volume of EUR 2.8 bil. of total eligible expenditure (CZK 73 bil.) and 219 applications amounting to EUR 343 mil. (CZK 8.9 bil.) of total eligible expenditure were included in the reserve of projects among the so-called substitute projects. Since the beginning of the programming period, 4,907 legal acts (decisions to provide a subsidy) amounting to EUR 2.07 bil. (CZK 53.7 bil.) of total eligible expenditure have been issued. The beneficiaries have reported to the Managing Authority the spending of about EUR 0.8 mil. (CZK 21.2 bil.) of total eligible expenditure.

Rural Development Programme 2014–2020 also implemented support that contributes to improving the environment and include mainly the agri-environment-climate measures, organic farming, forest-environmental and climate services and forest conservation, payments under Natura 2000 and payments for less favoured areas. In 2018, Rural Development Programme 2014–2020 paid CZK 6.9 bil. towards those measures.

Detailed data sources

CENIA, Information System of Statistics and Reporting

https://issar.cenia.cz

[4] Reallocation from Operational Programme Enterprise and Innovation for Competitiveness to Operational Programme Environment in the amount of EUR 39.3 mil. of EU funds (CZK 1.0 bil.), or EUR 46.2 mil. of total eligible expenditure, approved by the Operational Programme Environment Monitoring Committee on 4 December 2018, will be reflected in the total programme allocation only after its approval by the European Commission in 2019.

Investments in environmental protection and revenues from the environmental taxes in the global context

Key messages[5]

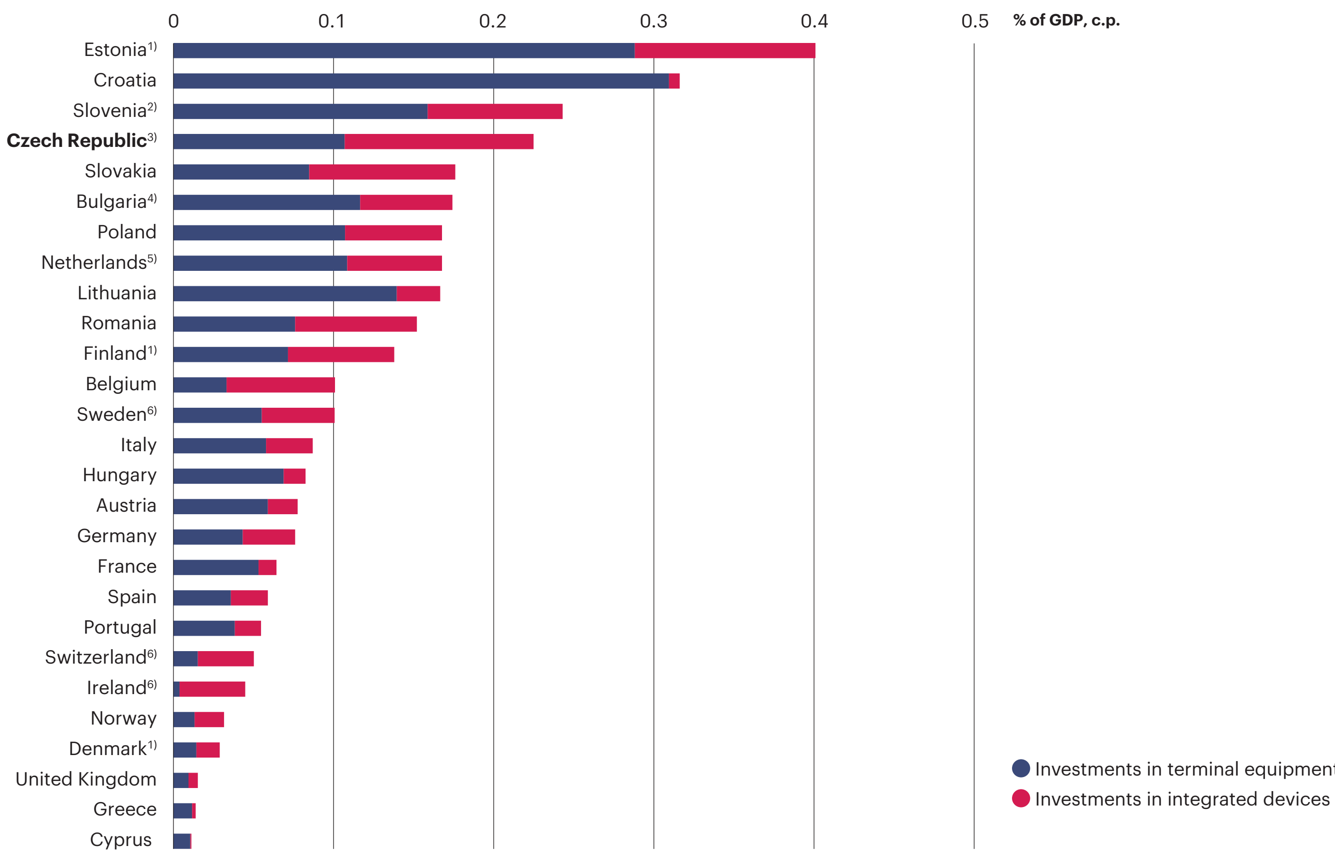
- Investments in environmental protection have long been above the EU28 average in the Czech Republic. The reason for increased investments in the Czech Republic, supported by the spending of European funding, is mainly the need to fulfil the conditions and requirements of the respective European legal regulations and the need to resolve the high environmental burden related to intensive industrial production and mining in the last century.
- Total revenue from environmental taxes in 2017 in the EU28 amounted to EUR 368.8 bil., i.e. 2.4% of GDP of the EU28. From the perspective of the subject of taxation, more than two thirds were made up of the energy products tax in EU28, which was particularly significant in the Czech Republic, Luxembourg, Romania and Lithuania, where it accounted for more than 90% of total revenue from environmental taxes.

[5] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

Indicator assessment

Chart 1

Investments in environmental protection in the industrial sector [% of GDP, current prices], 2016

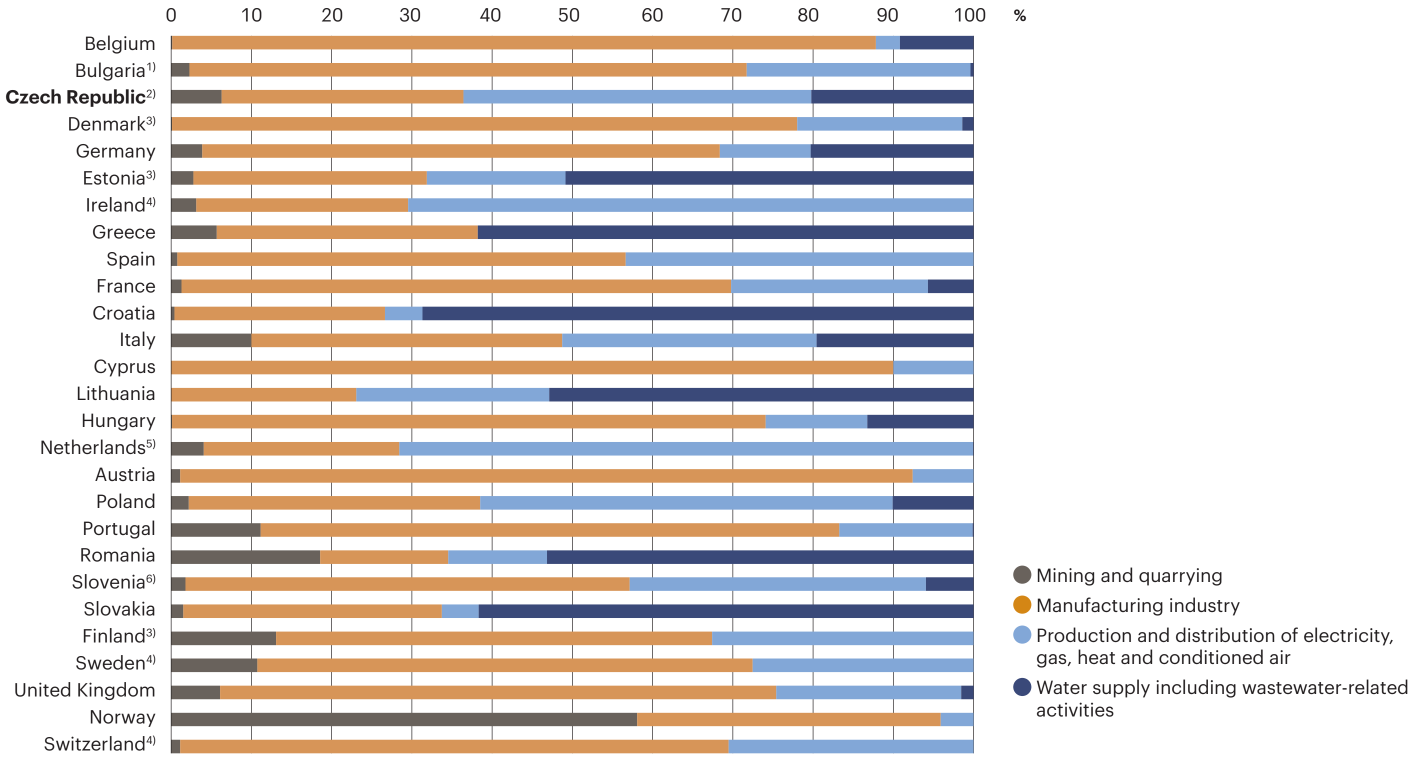


1) Data for 2015.
2) Excluding investments in integrated equipment in the sector Water supply including wastewater activities.
3) Estimation of investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
4) Excluding investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
5) Data for 2014.
6) Excluding total investments in the sector Water supply including wastewater activities.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 2

Industrial sector investments in environmental protection by the main industrial sector [%], 2016

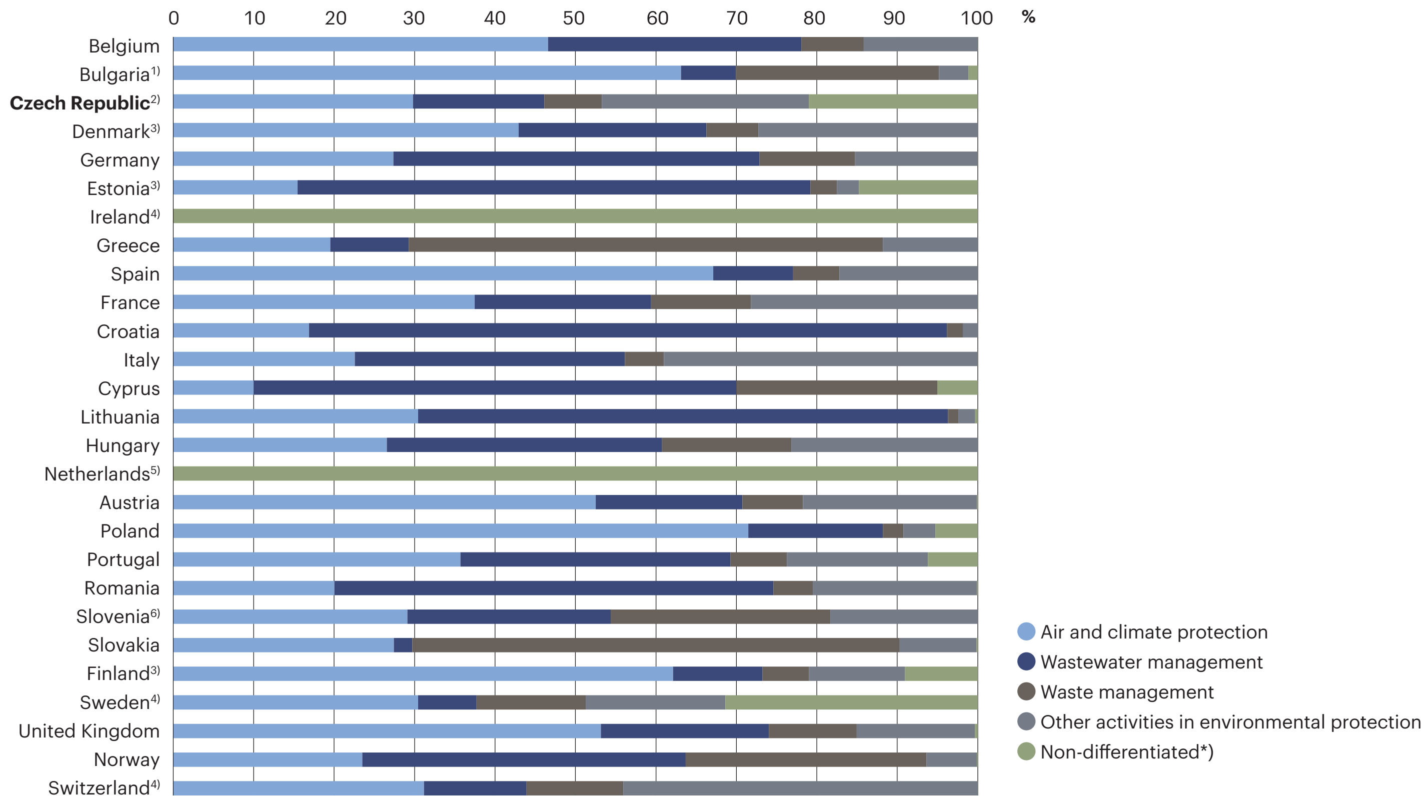


1) Excluding investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
2) Estimation of investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
3) Data for 2015.
4) Excluding total investments in the sector Water supply including wastewater activities.
5) Data for 2014.
6) Excluding investments in integrated equipment in the sector Water supply including wastewater activities.
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 3

Investments in environmental protection in the industrial sector, by the programme focus [%], 2016

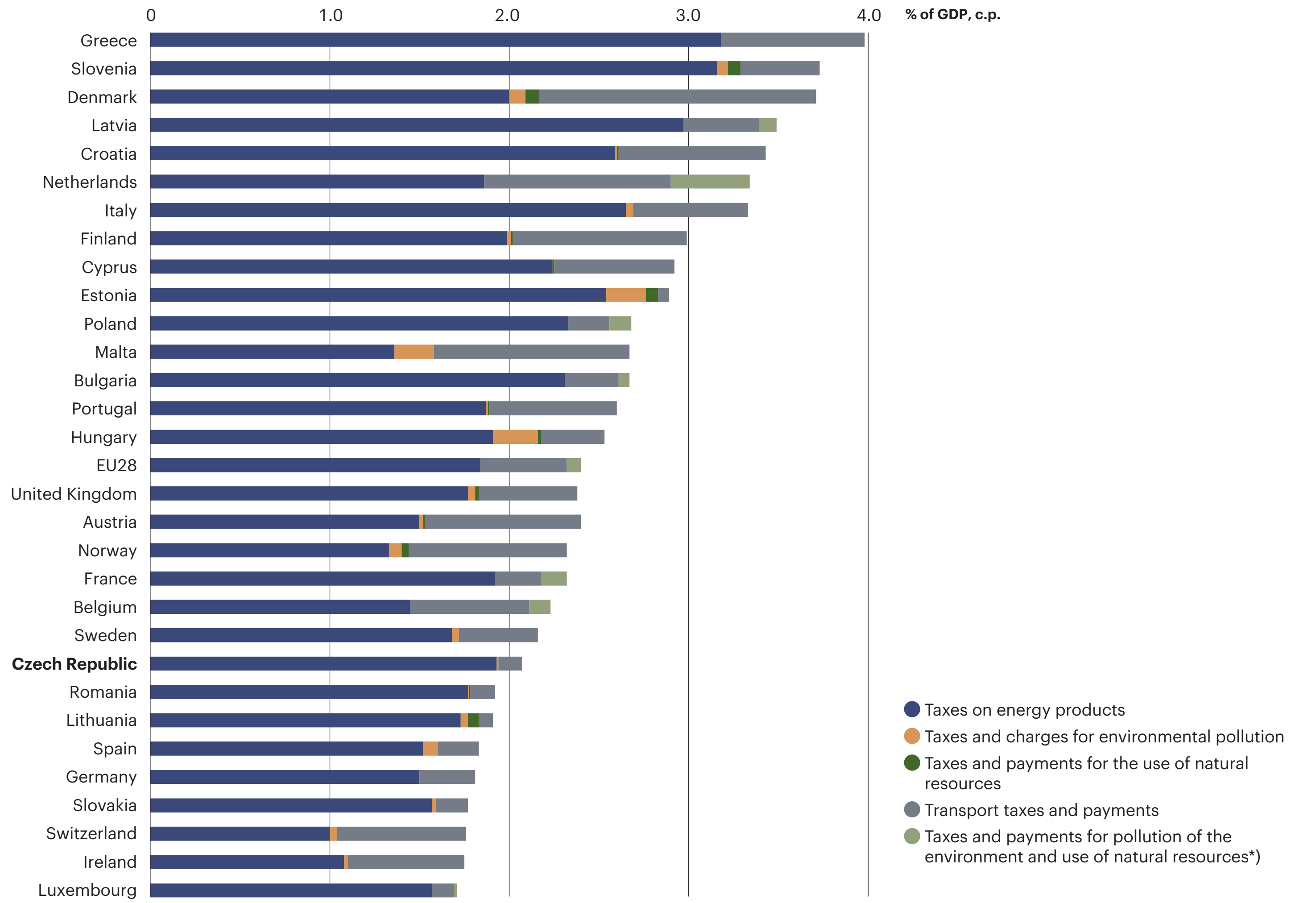


1) Excluding investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
2) Estimation of investments in integrated equipment in the sector Production and distribution of electricity, gas, heat and conditioned air.
3) Data for 2015.
4) Excluding total investments in the sector Water supply including wastewater activities.
5) Data for 2014.
6) Excluding investments in integrated equipment in the sector Water supply including wastewater activities.
**) The category is given due to missing detailed data (or classified as individual (confidential) data) where the division into individual categories of programme focus was not possible.*
Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

Chart 4

Environmental taxes by the main group [% of GDP, current prices], 2017



**) Stated for those countries that did not provide data separately for taxes and fees for environmental pollution and for taxes and fees for the exploitation of natural resources.*
Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Eurostat

© Miluše Větroňová/CENIA

From the perspective of **investments** (investment expenditure) that play a crucial role in the total expenditure on environmental protection, it can be concluded that the environmental protection investments of the Czech Republic are strongly above average compared with the EU28, within both the public and mainly the industry sectors (Chart 1).

This is due to the fact that the Czech Republic, as well as other member states that joined the EU after 2003, invests more intensively in environmental protection in order to comply with the stricter requirements of the relevant EU legislation. The increased investments are related to the need for addressing the high environmental burden caused by intensive industrial production and mining in the late 20th century. The possible use of the EU funds or other foreign subsidy sources also enhances the investment level particularly in recent years (see the indicator "Public expenditure on environmental protection").

While **investments of the industrial sector** in some of the new Member States in 2016[6] exceeded 0.3% of GDP in current prices (Estonia or Croatia), many of the original EU15 Member States did not reach even 0.02% of GDP in c.p. (Cyprus, Greece, or the United Kingdom). In this case, the Czech Republic reported investments at over 0.2% of GDP.

Unlike the Czech Republic, where in 2016 the industrial sector mostly invested in **integrated equipment**, i.e. to prevent pollution (Chart 1), in most EU28 countries, the investments were more focused on **terminal equipment**, i.e. to remove pollution.

In terms of the share of the main branches of the industrial sector in the total investments in environmental protection, in most EU28 countries, it was the biggest in the **manufacturing industry**, followed by production and distribution of electricity, gas, heat and conditioned air, i.e. the public energy (Chart 2) which was the sector that invested the highest amount in environmental protection in the Czech Republic. In terms of the programme focus, in 2016 in most EU28 countries including the Czech Republic, the largest investments were made in the **protection of air and climate**, or in the area of wastewater management (Chart 3).

Total revenue from **environmental taxes** in 2017 in the EU28 amounted to EUR 368.8 bil., i.e. 2.4% of GDP of the EU28. Between 2002–2017, total revenue from environmental taxes in the EU28 increased by an average of 2.2% per year (in current prices), while the GDP in current prices increased on average by 2.6%. In 2017, the amount of revenue from environmental taxes was EUR 104.0 bil. higher than in 2002.

In the international EU28 comparison, the Czech Republic ranks rather among States with below-average revenue from environmental taxes (2.1% of GDP, Chart 4). The levels of environmental taxation in European countries must be analysed in the context of the settings of the tax systems. For example, low revenue from environmental taxes may signal either relatively low rates of the environmental tax and the resulting lower revenue (as is the case for example in the Czech Republic), or on the contrary may result from high tax rates which may lead to a lower consumption of the related products or activities. On the other hand, a higher level of revenue from environmental taxes may be caused by a low tax rate, which encourages non-residents to purchase heavily taxed products outside the national borders (as e.g. in the case of petrol or diesel).

[6] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

From the perspective of the subject of taxation, the **energy products taxes**[7] clearly prevailed, which, in addition to the tax on electricity, gas, or solid fuels, include fuel tax. Those accounted for 76.9% in total revenue from environmental taxes in the EU28 in 2017. Energy taxes were particularly significant in the Czech Republic, Luxembourg, Romania and Lithuania, where they accounted for more than 90% of total revenue from environmental taxes. **Transport taxes and fees** (e.g. for vehicle registration, for entry into city centres, etc.) represented in 2017 the second most important contribution to the total revenue from environmental taxes (19.8% in the EU28). **Taxes and fees on environmental pollution and use of natural resources** accounted for a relatively small proportion (3.3%) of total revenue from environmental taxes in the EU28 in 2017. This category of environmental taxes puts together various taxes or fees levied for example for pollution and extraction of water or for the landfill of waste. In many European countries, such taxes were introduced after 2010, which is reflected in the low revenue from them to date.

© Magdalena Kabátová/CENIA

[7] *For Eurostat's methodology on environmental taxes see https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax_esms.htm.*

Specially protected areas in the Czech Republic

© Tereza Kochová/CENIA

Specially protected areas in the Czech Republic

Protection of the territory through specially protected areas is one of the most important tools of nature and landscape conservation in the Czech Republic. Specially protected areas are places in the Czech Republic that are significant for science or aesthetic reasons or are unique. They are divided into **large-area** and **small-area specially protected areas**. In 2018, a total of 2,639 specially protected areas were registered in the Czech Republic, their total area, given their mutual overlaps, was 1,320.2 thous. ha, i.e. 16.7% of the Czech Republic territory.

Small specially protected areas

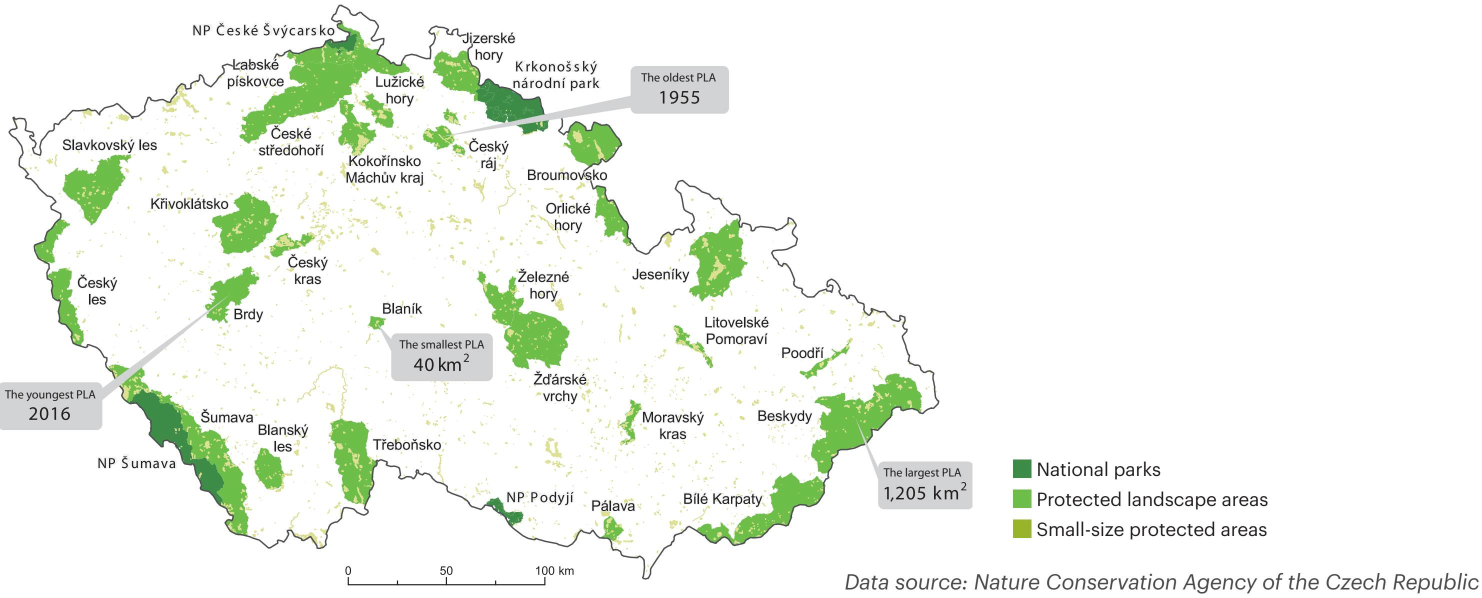
Small-size specially protected areas are divided into 4 categories. **National nature reserves** (in 2018 there were 109 national nature reserves covering an area of 29.5 thous. ha, i.e. 0.4% of the Czech Republic territory) are declared for the protection of smaller areas of extraordinary natural values, where significant and nationally or internationally unique ecosystems are bound to the natural relief with a typical geological structure. **Nature reserves** (in 2018 there were 812 nature reserves with an area of 43.0 thous. ha, i.e. 0.6% of the Czech Republic territory) are declared on smaller areas of concentrated natural values, where ecosystems typical and significant for the relevant geographical area are represented. **National nature monuments** (in 2018 there were 126 national nature monuments with an area of 6.6 thous. ha, i.e. 0.1% of the Czech Republic territory) and **nature monuments** (in 2018 there were 1,562 nature monuments with an area of 32.7 thous. ha, i.e. 0.4% of the Czech Republic territory) are declared for the purpose of protecting geological or geomorphological formations, mineral deposits, or rare or endangered species, even in areas that were formed by human activities. Nature monuments are declared for territories with regional importance, national nature monuments have national or international significance. New small-size specially protected areas are often declared mainly to protect sites of Community importance. In 2018, a total of 760 out of 2,609 small-size specially protected areas in the Czech Republic were located in the territory of national parks or protected landscape areas.

Large specially protected areas

Comprises **26 protected landscape areas (PLAs)**, areas with harmonic landscape formed by natural processes or with human involvement, whose main objective is to preserve the appropriate use of the land with a characteristic relief, and **4 national parks (NPs)**, areas with natural or little human-modified nature, with preserved natural phenomena and high potential of self-regulation processes. The total area of the PLAs in 2018 was 1,137.5 thous. ha (14.4% of the Czech Republic territory) and the total area of NPs was 119.1 thous. ha (1.5% of the Czech Republic territory). So far, the latest declared **PLA** is **Brdy** (2015), in the case of **NPs** it is **Bohemian Switzerland** (2000).

Figure 1

Specially protected areas in the Czech Republic, 2018



Data source: Nature Conservation Agency of the Czech Republic

Krkonoše Mountains National Park

Biodiversity

Status of important animal species
Out of animal species, subjects of protection of the Krkonoše Mountains Bird Area, the Krkonoše Mountains Site of Community Importance and other important species are monitored. The **black stork** (*Ciconia nigra*) has a long-term stable nesting population, and the nesting populations of the **black woodpecker** (*Dryocopus martius*) and the **red-breasated flycatcher** (*Ficedula parva*) are stable to slightly increasing in the long-term. The **bearded owl** (*Aegolius funereus*) has a long-term stable nesting population in the Krkonoše Mountains National Park (hereinafter KRNAP) with fluctuations in abundance according to the food supply.

A major problem is the dramatic decrease in the abundance of the **black grouse** (*Tetrao tetrix*), which has dropped by 45% between 2001 and 2017 and its isolated Krkonoše population is close to the survival threshold. The **corn crake** (*Crex crex*) has seen a significant abundance decrease of 76% between 2002 and 2018. A very dramatic decrease occurred between 1989 and 2018 for the **red-spotted bluethroat** (*Luscinia svecica svecica*) by 80%.

On the other hand, the **European bullhead** (*Cottus gobio*) population has been stabilized by removing migration barriers and supporting its populations at tributaries of backbone watercourses. In addition, the genetic origin of **river trout** (*Salmo trutta morpha fario*) populations in the Krkonoše streams is mapped with the aim of utilizing the knowledge gained in conservation and strengthening of genetically indigenous populations.

Management of important plant species and valuable biotopes
In 2018, 92 large-scale actions (mowing, grazing), 13 area management actions on botanical localities with specially valuable species were carried out, and on 41 localities a working group of the Krkonoše Mountains National Park administration staff made special interventions (cutting, milling, digging ditches, removing invasive plants, etc.).

Great emphasis was placed on monitoring the following subjects of protection of the Krkonoše Mountains Site of Community Importance. The population of the **Bohemian dwarf gentian** (*Gentianella praecox subsp. Bohemica*) is unstable, with a slightly positive development. A rescue programme is underway for this species that occurs on only one location in the Krkonoše Mountains National Park. The **Sudeten lousewort** (*Pedicularis sudetica* subsp. *Sudetica*) grows in the biotopes of the primary alpine forest-free area, and although it is not bound to active management, its status is highly volatile, which may be caused by climate change (growing temperature, more frequent periods with insufficient precipitation). The long-term stability of the **Bohemian campanula** (*Campanula bohemica*) is endangered in places of construction and sports activities, while the results of rescue transfers show low numbers of surviving individuals. In addition, it is necessary to ensure appropriate management of grassland with the occurrence of this species.

The populations of the Krkonoše Mountains endemic rowan (*Sorbus sudetica*) are also intensively monitored, it has a population of only about 150 individuals (a decrease by about 10% in the last 30 years) and therefore its clones have been taken to be preserved in a gene bank in order to protect the gene pool of this species. On the contrary, the population of **cloudberry** (*Rubus chamaemorus*), a significant glacial relic in the Czech Republic, is currently sufficiently large and relatively stable. The **dwarf willow** (*Salix herbacea*) occurs only on two localities above the tree line (one in a stabilized status, the other in a critical status).

Furthermore, actions are being taken to stabilize the **dwarf mountain pine stands** (*Pinus mugo*). The natural mountain pine stands are left undisturbed (only passages are maintained), in the post-war stands, intensive management phases are gradually being carried out where selective cutting is used to create a near-natural mosaic of groups of mountain pine stands. By 2018, interventions on a total area of 85 ha were successfully completed and in parallel, during 2018, the preparation of the third phase for a total area of 70 ha began.

Last but not least, the rescue and active reproduction of the gene pool of forest trees is carried out. Especially of spruce and fir. In the case of spruce, the current project aims to use elite genetic resources of the Norway spruce (*Picea abies*) to increase the stability of the Krkonoše forest ecosystems. The project "Utilization of elite genetic resources of Norway spruce for increasing the stability of the Krkonoše forest ecosystems" (2017–2023) is supported from the Operation Program

Environment (project CZ.05.4.27/0.0/0.0/15_009/0002600). In the case of silver firs (*Abies alba*), suitable prime trees are being identified, from which the grafts for establishing a special-purpose plantation will be taken. The aim is to significantly increase the proportion of firs in the forest.

Status of invasive and other problematic plant species
In 2018, the project "Reduction of invasive and expansive plant species in the Krkonoše Mountains National Park" intervened at 25 locations against 6 invasive and expansive plant species, namely the **Alpine dock** (*Rumex alpinus*; 7 sites), **many-leaved lupine** (*Lupinus polyphyllus*; 4 sites), **white hellebore** (*Veratrum album* subsp. *lobelianum*; 3 sites), **Japanese knotweed** (*Reynoutria japonica*; 1 site), **giant hogweed** (*Heracleum mantegazzianum*; 9 sites) and **Himalayan balsam** (*Impatiens glandulifera*; 1 site). Total costs amounted to CZK 130 thous., services to CZK 79 thous.

Another 41 localities were also treated as part of protection against dangerous plant species by the working group of the Krkonoše Mountains National Park Administration under the project "Restoration Management of the Krkonoše Meadows".

Regarding other potentially problematic species, outbreaks of **green alder** (*Alnus alnobetula*) are gradually declining, **Canadian goldenrod** (*Solidago canadensis*) has so far occurred only in lower elevations, **sedge brizoides** (*Carex brizoides*) is present at few locations and **senecios** (*family Senecio*) are a stable component of the fringe communities of the montane to alpine parts of mountains near roads made of alkaline materials.

Occurrence of potentially hazardous non-native animal species
The populations of **mouflons** (*Ovis orientalis musimon*), **sika deer** (*Cervus nippon*), **fallow deer** (*Dama dama*) and **raccoons** (*Procyon lotor*) has not yet been established in the Krkonoše Mountains National Park and its buffer zone. The **raccoon dog** (*Nyctereutes procyonoides*) has a regular occurrence in the foothills of the Krkonoše Mountains, a slight increase in the abundance of this species cannot be rejected. The occurrence of the **American mink** (*Neovison vison*) is recorded regularly, especially in the foothills of the Krkonoše Mountains, but its population is small, stable or slightly declining.

Projects dealing with biodiversity monitoring or habitat and species stabilization
A number of projects focusing on various components of biodiversity have been and are being carried out in the National Park. E.g. monitoring of significant European species of beasts of prey, monitoring of the current state of damage to forest and aquatic ecosystems in the Krkonoše SCI, monitoring of a number of individual species and groups (invertebrates, lichens, etc.) or ecosystems, dynamics of biodiversity development and changes, various floristic researches, etc.

Public involvement in biodiversity management
Co-operation with the public took place mainly as a co-operation with private owners of invaded land on which the invasive species were eliminated. School and scout youth are involved in the care (especially in spring) of mountain meadows and the general public in preventing amphibian clashes with road traffic during the spring move. The public also participates in regular clean-up events to remove littering. In December 2018, a campaign was launched, mainly through social networks and media communication, aimed at informing of the Krkonoše population of the black grouse and the options of the public to help to save it (2019 – Year of the Black Grouse, #2019RokTetrivka). At the same time, the public is regularly informed about the activities of the Krkonoše Mountains National Park Administration and about approximately 200 public events a year, including field trips.

Objectives of NP protection in relation to biodiversity
The above-mentioned activities to maintain or promote species diversity in the KRNAP area are contributing to the long-term objectives of nature conservation in the NP territory, where either species diversity is maintained through spontaneous development in individual ecosystems or it is supported by active and mostly long-term care in the types of ecosystems whose existence is conditioned by human activity.

Forests

Most of the Krkonoše Mountains National Park area (72.7%) is covered by forests. The stand area has been stable over the years and in 2015[1] it was 33,989.22 ha with a stand stock of 263 $m^3.ha^{-1}$. Out of this area, 4.9% (1,949 ha) is considered to be primary forest.

Forests left to spontaneous development, which include in addition to primary forests also natural forests and a part of near nature forests in 2018 represented 16.8% of the area of all Krkonoše Mountains National Park forests (6,712.8 ha).

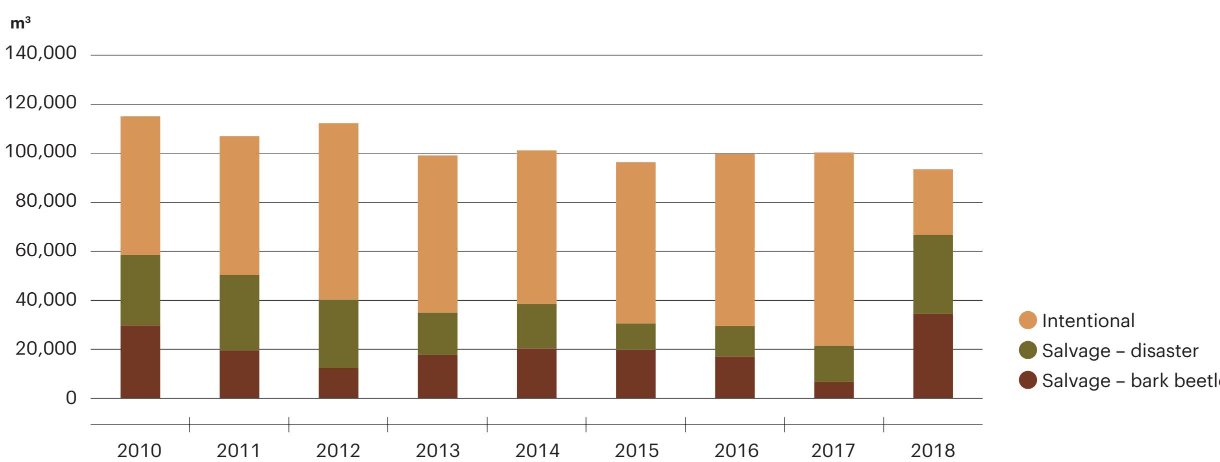
[1] *Current data are not, due to the methodology of their reporting, available at the time of publication.*

A specific feature of the Krkonoše Mountains National Park are the naturally occurring continuous stands of dwarf mountain pines covering an area of 3,145 ha. The aim of the management of forest ecosystems in the Krkonoše Mountains National Park is primarily the gradual transformation of forests into nature-like stands with an emphasis on biodiversity. The gradual increase in the representation of natural ecosystems in the NP territory, which are left to spontaneous development, contributes to the long-term objectives of nature conservation.

The total amount of **logging** in the National Park has been relatively stable over the last decade (Chart 1). In 2018, it was influenced mainly by wind disturbances in autumn 2017 and the subsequent spread of the bark beetle. A total of 92,940 m^3 of timber was harvested in 2018, of which 71.1% were salvage logging, and of that 50.7% were insect logging. With regard to the wood composition of forest stands in the NP, more than 95% of the harvested timber is consistently made up of spruce. The aim of the Krkonoše Mountains National Park Administration is not to create new clearings by logging, but only to make room for natural regeneration. In the long term, the extent of **artificial regeneration**, which consists mainly of fir, deciduous trees and spruce, has been decreasing (Chart 2). The species composition of forest stands is gradually approaching the target composition (Chart 3). Timber harvesting and subsequent restoration of forest stands in the NP territory are among the important tools by which it is possible to contribute to the long-term objectives of nature conservation in the NP. In the case of the Krkonoše Mountains National Park, this means reconstruction of forest stands and introduction of the missing, mainly deciduous wood species into the existing forest stands.

Chart 1

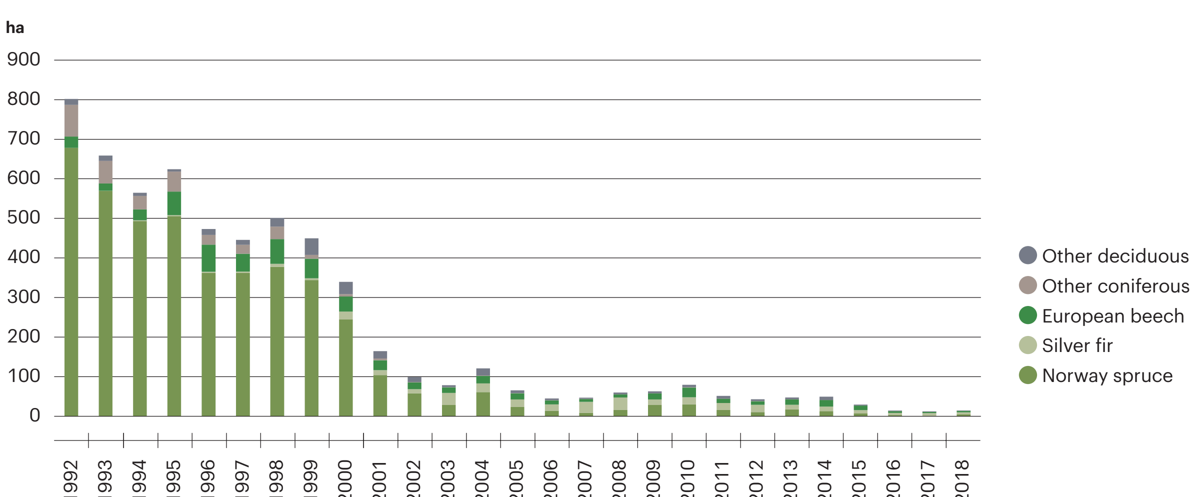
Total volume of logging in the Krkonoše Mountains NP [m^3], 2010–2018



Data source: Krkonoše Mountains NP Administration

Chart 2

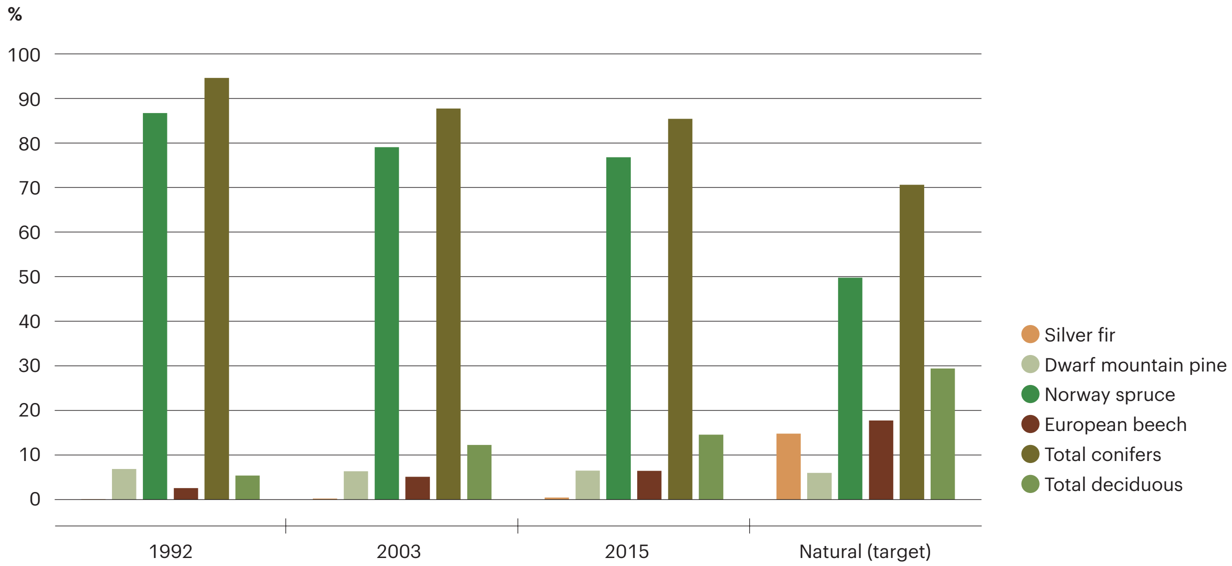
Artificial forest regeneration in the Krkonoše Mountains NP [ha], 1992–2018



Data source: Krkonoše Mountains NP Administration

Chart 3

Species composition of forests in the Krkonoše Mountains NP [%], 1992, 2003, 2015



Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Krkonoše Mountains NP Administration

Economic data

Since 2010, the total annual budget of the Krkonoše Mountains NP Administration has been in the range of CZK 350–380 mil. The budget is covered both by the founder, the Ministry of the Environment, in the amount of approx. CZK 100–150 mil. per year, and by own resources (especially revenues from the sale of timber) in the amount of approx. CZK 160–210 mil. The rest of the budget consists mainly of funds for projects financed from national or European (or international) sources (Chart 4).

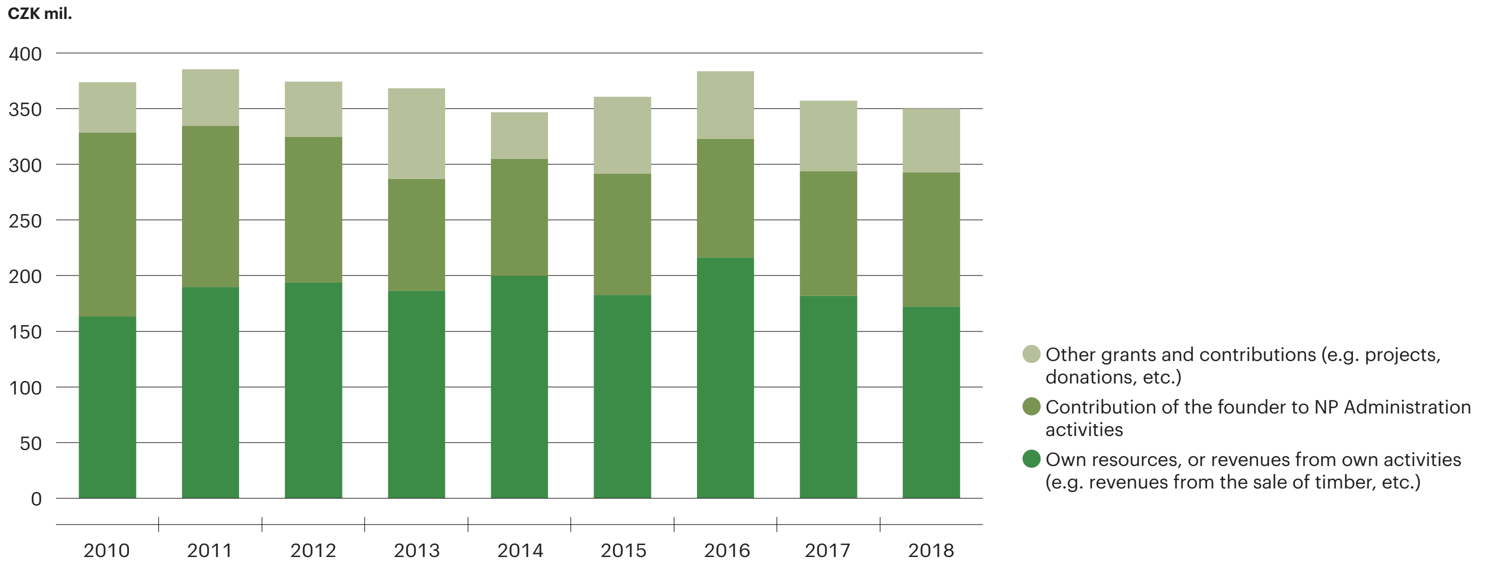
The projects are funded mainly through cross-border cooperation, Operational Programme Environment (European Regional Development Fund), LIFE, Norway Grants, Landscape Management Programme or Landscape Natural Function Restoration Programme, the share of that financing in the total coverage of the budget is on average up to 20%.

Current (operating) expenditure of the Krkonoše Mountains NP Administration reach an average of CZK 340–380 mil., the most important items of which are purchases of materials and services (CZK 135.0 mil. in 2018), wages (CZK 132.8 mil.) and repairs and maintenance (CZK 12.2 mil.). Investment expenditure has fluctuated from about CZK 40 mil. to about CZK 130 mil. over the years, with construction investment having a significant share in the long term (Chart 5).

Revenues (sales) from timber sale decreased by almost 20% year-on-year to CZK 109 mil. in 2018 due to lower overall logging (Chart 6). However, it should be noted that the share of salvage logging, especially due to bark beetle, has increased dramatically. The reason for the lower revenues from the sale of timber is also the fact that, due to the surplus of timber on the market, the production costs rise while the average price per m^3 of wood decreases (from CZK 1,508 per m^3 in 2014 to CZK 1,216 per m^3 in 2018).

Chart 4

Sources of financing the expenditure of the Krkonoše Mountains NP Administration [CZK mil.], 2010–2018

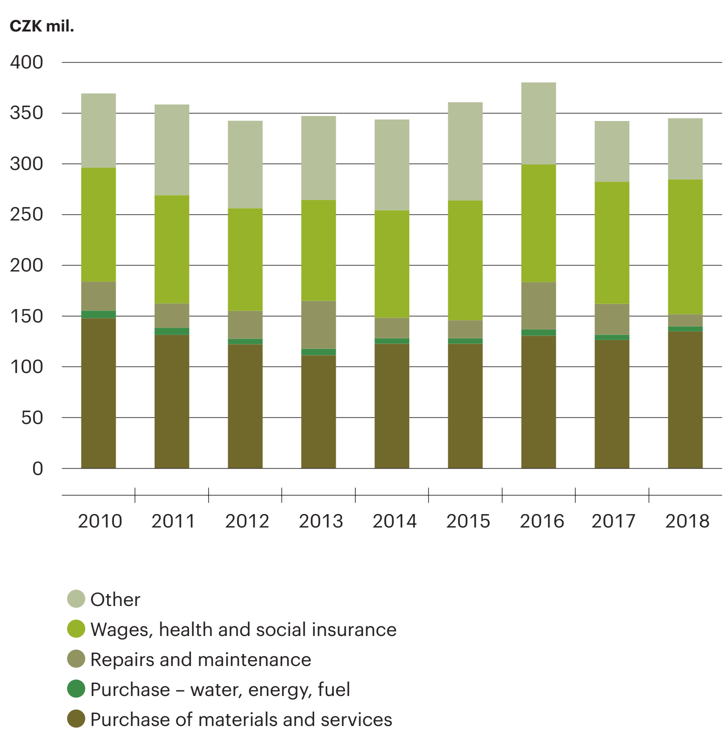


Data source: Krkonoše Mountains NP Administration

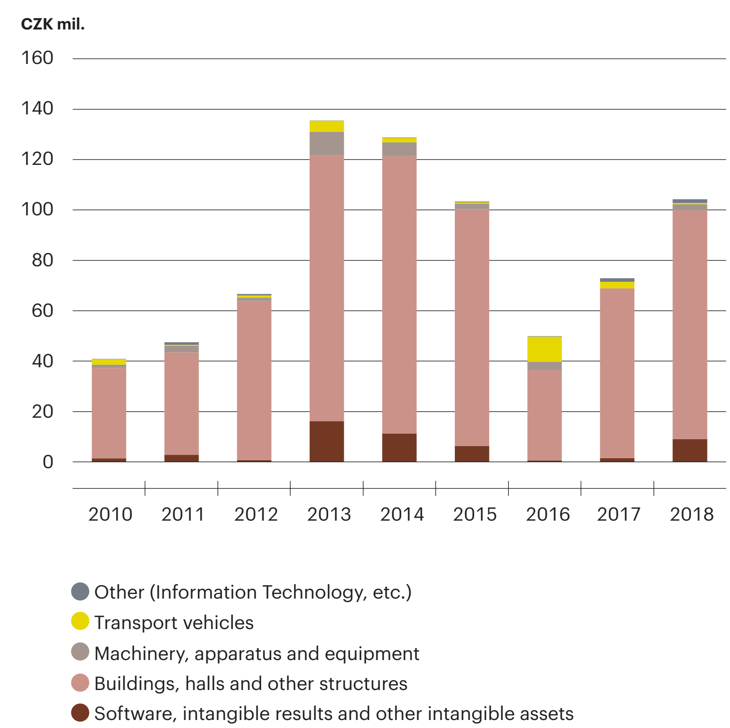
Chart 5

Current and investment expenditures of the Krkonoše Mountains NP Administration [CZK mil.], 2010–2018

Current expenditure



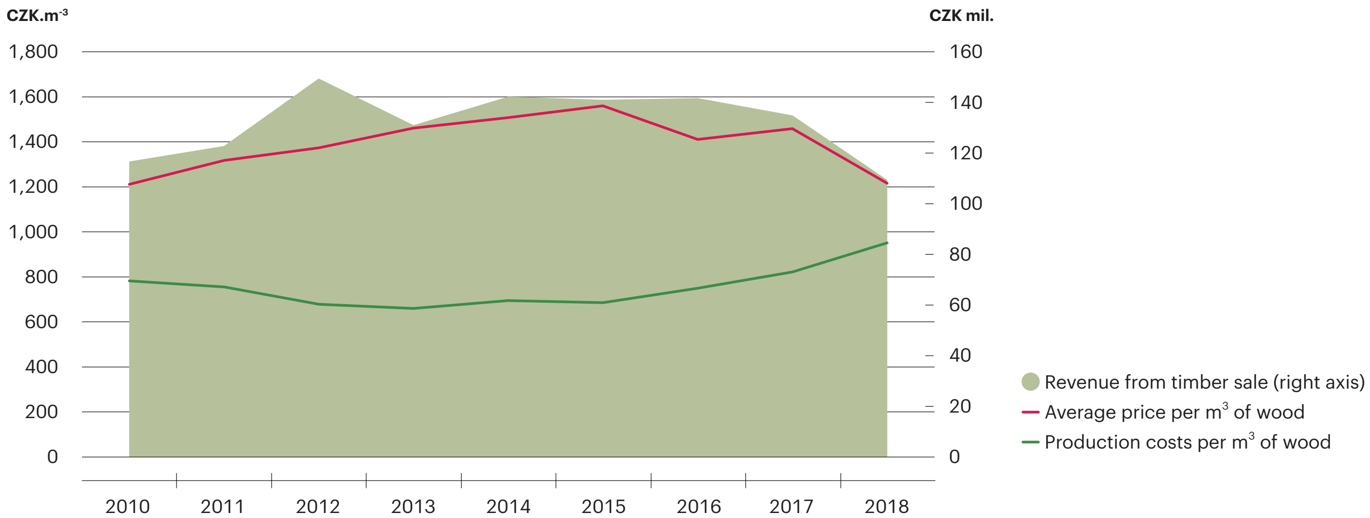
Investment expenditure



Data source: Krkonoše Mountains NP Administration

Chart 6

Sale of timber by the Krkonoše Mountains NP Administration – timber sales, average price and costs [CZK mil., $CZK.m^{-3}$], 2010–2018



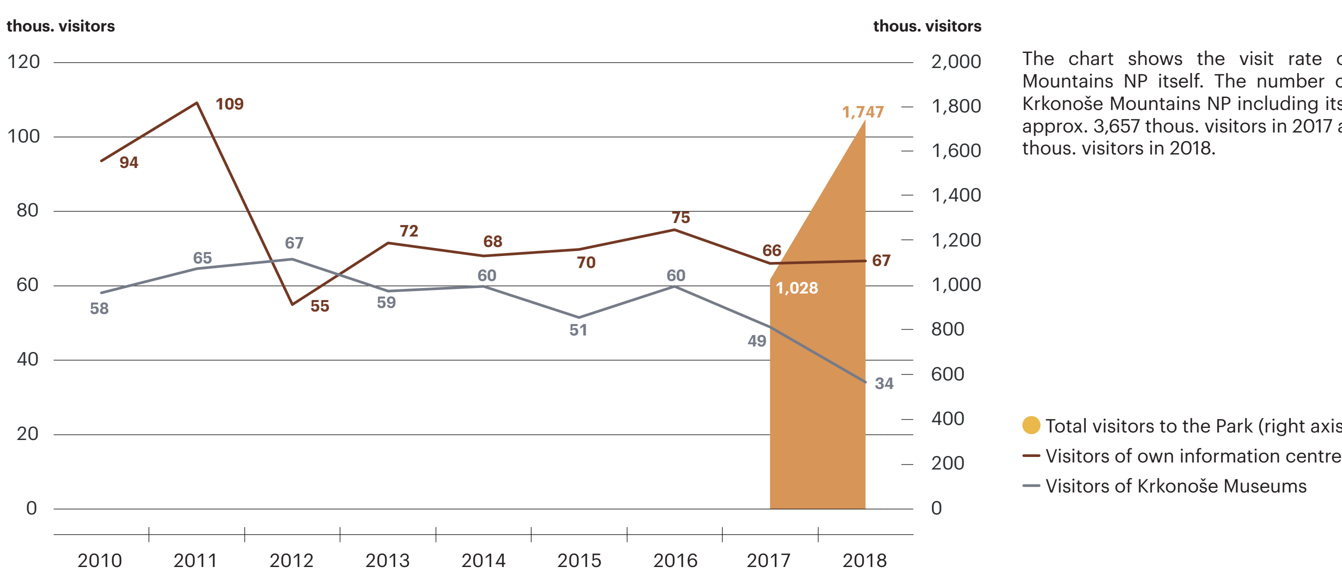
Data source: Krkonoše Mountains NP Administration

Tourism

The National Park, including its buffer zone, was visited by almost 3.8 mil. visitors in 2018 (of which more than 1.7 mil. visitors came to the park itself, Chart 7). The tourists could use 5 permanent information centres (+ 2 seasonal) and 4 Krkonoše museums managed by Krkonoše Mountains NP Administration. They were visited by almost 67 thous., or 34 thous. visitors respectively. The decrease in the number of visitors to the museums in 2017 and 2018 was mainly due to reconstructions of the Memorial to the Lost Patriots in Paseky nad Jizerou or the Krkonoše Museum in Vrchlabí Monastery.

Chart 7

Visitors of information centres and museums of the Krkonoše Mountains NP Administration and total visitors of the Park [thous. visitors], 2010–2018



The chart shows the visit rate of the Krkonoše Mountains NP itself. The number of visitors to the Krkonoše Mountains NP including its buffer zone was approx. 3,657 thous. visitors in 2017 and approx. 3,787 thous. visitors in 2018.

Data source: Krkonoše Mountains NP Administration

Šumava National Park

Biodiversity

Status of important animal species
In the Šumava NP territory, there is a stabilized population of the **Ural owl** (*Strix uralensis*), which is slightly increasing according to information from the NP Administration. Similarly, the **western capercaillie** (*Tetrao urogallus*) and the **black stork** (*Ciconia nigra)* have a stable population here. A slightly increasing trend is observed in the population of **peregrine falcon** (*Falco peregrinus*). In 2018, in order to support the population of this critically endangered species, access was restricted to two sites (Stožecká rock, Kunžvart castle ruins) at the time of breeding and rearing of this species, valid from March to July that year. Since 2000, the **common cranes** (*Grus grus*) have appeared in the NP territory, in 2018 it was 8 pairs. Regarding the abundance of the **European elk** (*Alces alces*), only individual findings are recorded. On the other hand, the population of the **European beaver** (*Castor fiber*) has been increasing in the Šumava NP since 2015, and found also in habitats relatively unfavourable for this species (Javoří Pila, Březník). The first confirmed occurrence of the **wolf** (*Canis lupus*) was recorded in 2015, reproduction of at least 3 pups was confirmed in 2017, since 2018 its occurrence has been confirmed also in the Lipno region.

Management important plant species and valuable biotopes
Every year, the Šumava NP Administration participates in expanding the area of species-rich meadow biotopes in the NP. Since 2015, this area has been expanded by approx. 60 ha thanks to active felling of self-seeding trees. Since 2017, in the Knížecí Pláně locality, the management was carried out in order to protect the **hairy stonecrop** (*Sedum villosum*). Compared to the situation in 2017, when about 40 sterile individuals were recorded, lower hundreds of flowering individuals and higher hundreds of sterile individuals have appeared on control sites.

Status of invasive and other problematic plant species
In 2018, the **many-leaved lupine** (*Lupinus polyphyllus*) was eliminated on many locations in the Šumava NP, with total area of 68.5 ha.

Occurrence of potentially hazardous non-native animal species
The abundance of the **sika deer** (*Cervus nippon*) is growing very slowly, with 1–2 specimens caught every year. The **raccoon dog** (*Nyctereutes procyonoides*) has only been captured several times on a photo-trap and the **American mink** (*Neovison vison*) has been caught near the trout hatchery of Borová Lada and 2 pieces near Železná Ruda. According to the findings of the Šumava NP Administration, it can be concluded that the American mink is gradually being pushed out by the Eurasian otter (*Lutra lutra*), even though the otter's population is not growing rapidly either.

Projects dealing with biodiversity monitoring or habitat and species stabilization
Several biodiversity conservation projects conducted directly by the Šumava NP Administration are being implemented in the NP. These include "Cross-border mapping of forest ecosystems – the way to joint management of the Šumava NP and the Bavarian Forest NP", "Mushrooms of the Bavarian/ Czech/ Austrian border area", "Strengthening and protection the population of the freshwater pearl mussel in the Šumava NP", "Šumava flowers", "Silva Gabreta Monitoring – Implementation of cross-border monitoring of biodiversity and water regime". In addition, many projects led by external entities have been or are underway in the NP territory (e.g. Monitoring of alluvial pools; Early identification of trees affected by spruce bark beetle trees using drone technology; Resilience of peat moss to decay – biochemical causes and consequences; Care for non-forest types of natural habitats in the Šumava National Park; a number of projects concerning the research of the dynamics of the Šumava mountain spruce forests, or specific species such as the freshwater pearl mussel (*Margaritifera margaritifera*) or the reaction of bird communities to various types of disturbances).

Public involvement in biodiversity management
Cooperation with students on the removal of the invasive many-leaved lupine (*Lupinus polyphyllus*) for 14 days at several national park sites. The public also participated in the project Life for Mires, focused on revitalization of previously drained wetlands.

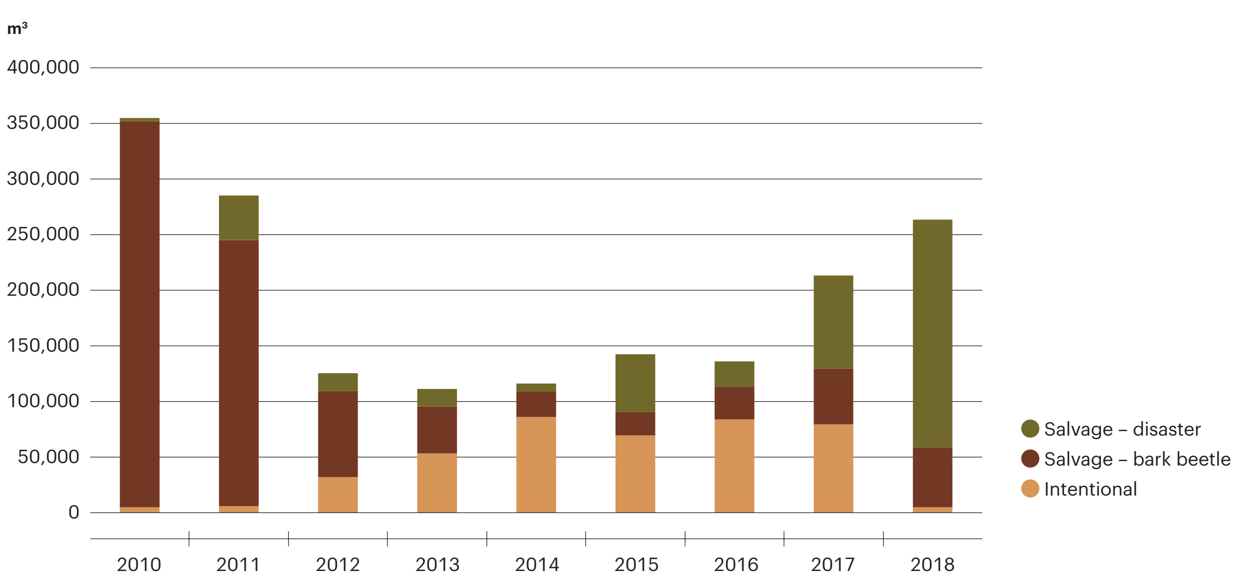
Objectives of NP protection in relation to biodiversity
The above-mentioned activities to maintain or promote species diversity in the Šumava NP are contributing to the long-term objectives of nature conservation in the NP territory, where either species diversity is maintained through spontaneous development in individual ecosystems or it is supported by active and mostly long-term management in the types of ecosystems whose existence is conditioned by human activity.

Forests

Most of the Šumava National Park territory (70.4%) is covered by **forests** and together with the Bavarian Forest National Park it forms the largest forested area in Central Europe. The stand area has been stable over the years and in 2018 it covered 48,145 ha with a stand stock of 342.2 $m^3.ha^{-1}$. Of this area, 373 ha (0.8%) are considered to be primary forests, 9,030.7 ha (15.9%) natural forests and 26,969.8 ha (47.6%) near-nature forests. The area left without human management in 2018 represented 29.7% of the forested area (16,822.2 ha). The aim of the forest ecosystems management in the Šumava National Park is primarily the restoration of natural ecosystems and the subsequent spontaneous development. The gradual increase in the representation of natural ecosystems in the NP territory, which are left to spontaneous development, contributes to the long-term objectives of nature conservation.

Logging in the National Park is carried out primarily for the purpose of rebuilding inappropriate spruce stands and protecting the forest from the spread of insect pests in those parts of the NP where this is permitted by law. In 2018, the total logging output amounted to 262,864 m^3 (Chart 1). The logging was induced mainly by the consequences of the hurricanes Angela and Herwart from autumn 2017, the processing of which accounted for the majority (77.6%) of the total logging, and the subsequent spread of the bark beetle (20.5%). In the case of salvage logging, emphasis is placed on leaving elements of disturbance on site, and only fresh spruce wood threatened by bark beetle is cleared. Due to the high volume of forced harvest, intentional logging concentrated on the most important interventions in rebuilding of young stands. Regarding **artificial regeneration**, preference is given to fir and deciduous trees (Chart 2). The species composition of forest stands is gradually approaching the target composition (Chart 3). Timber harvesting and subsequent restoration of forest stands in the NP territory are among the most important tools by which it is possible to contribute to the long-term objectives of nature conservation in the NP. In the case of the Šumava NP, this means increasing the stability and structural diversity of forest stands and introduction of the missing, mainly deciduous tree species into current forest stands.

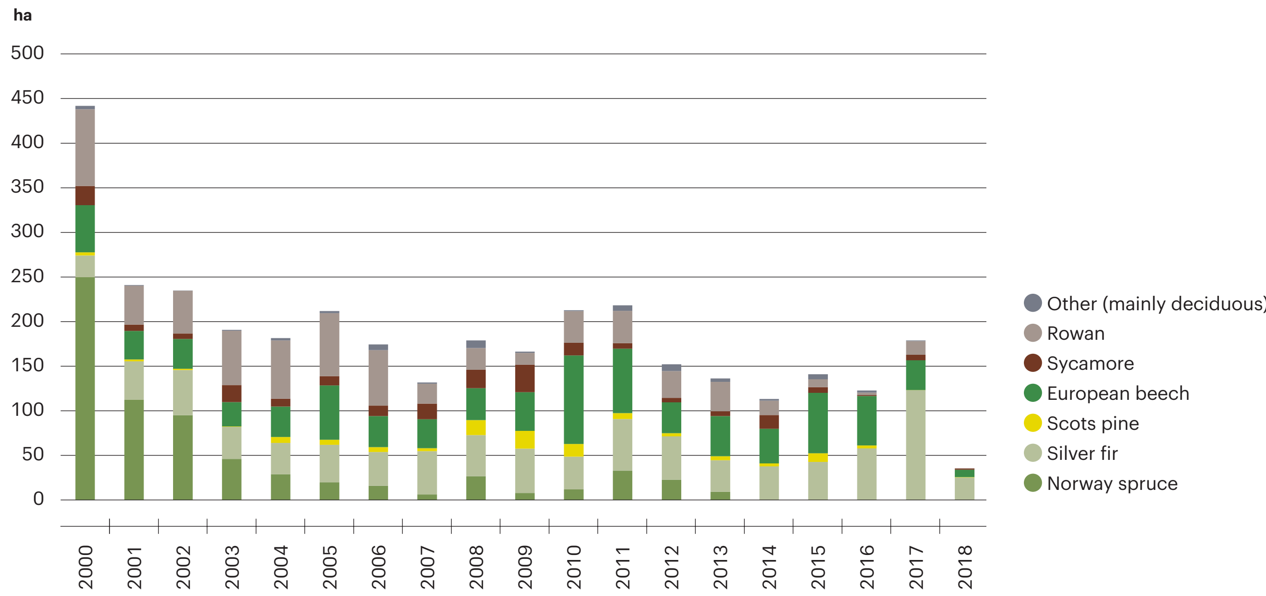
Chart 1
Total volume of logging in the Šumava NP [m^3], 2010–2018



Data source: Šumava NP Administration

Chart 2

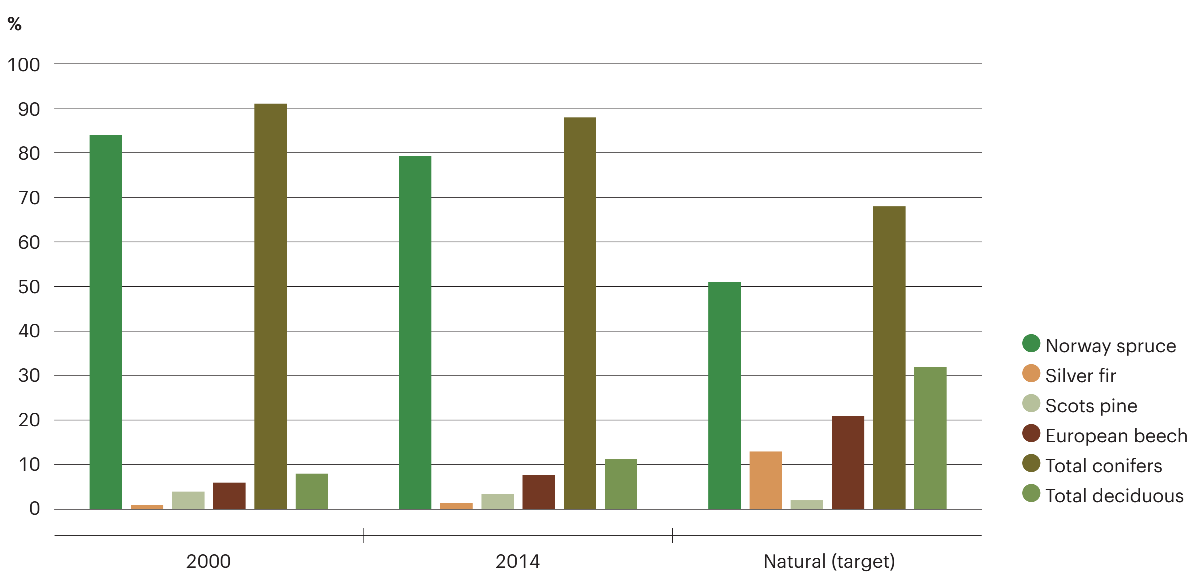
Artificial forest regeneration in the Šumava NP [ha], 2000–2018



Data source: Šumava NP Administration

Chart 3

Species composition of forests in the Šumava NP [%], 2000, 2014



Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Šumava NP Administration

Economic data

Since 2010, the total annual budget of the Šumava NP Administration has been in the range of around CZK 400–600 mil. (Chart 4). The budget is mainly covered by own resources (especially revenues from the sale of timber) in the amount of approximately CZK 150–360 mil. per year and also by the founder's (i.e. the Ministry of the Environment) contribution in the amount of around CZK 100–180 mil. per year. The rest of the budget consists mainly of funds for projects financed from national or European (or international) sources.

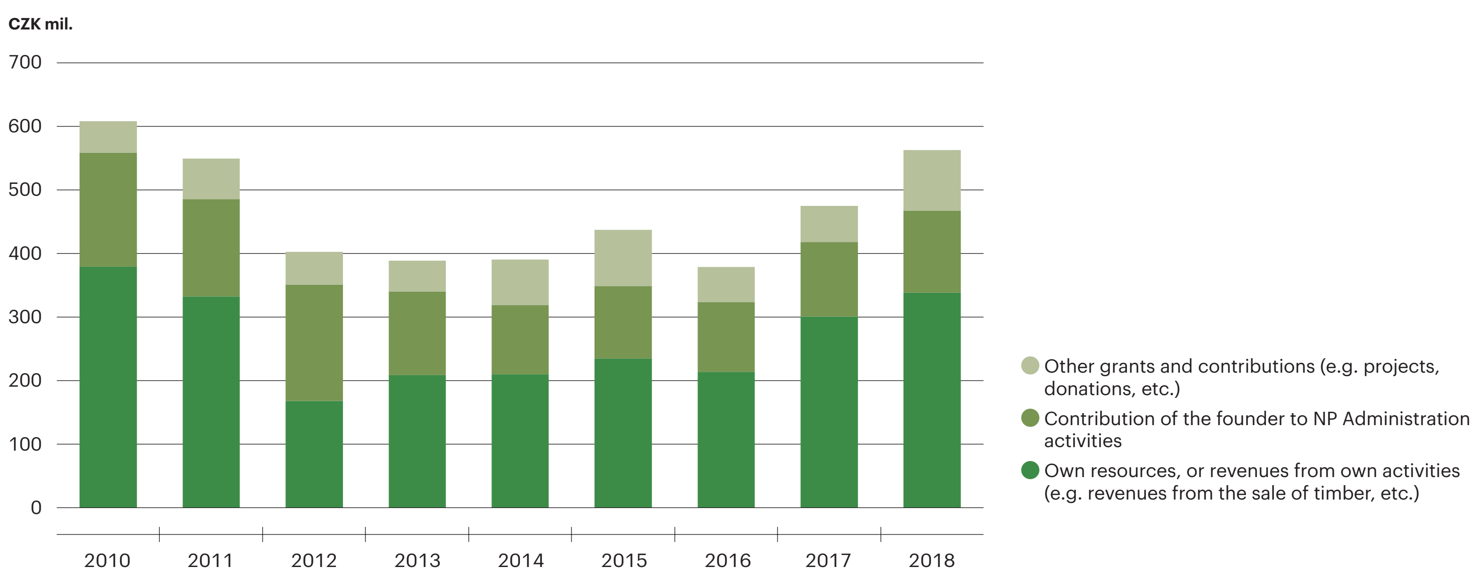
The projects are funded mainly through Operational Programme Environment (European Regional Development Fund), LIFE, a programme under the European Territorial Cooperation goal 2014–2020 (cross-border cooperation), Landscape Management Programme or Landscape Natural Function Restoration Programme, the share of that financing in the total coverage of the budget is on average 10–20%.

Current (operating) expenditure of the Šumava NP Administration in 2010–2018 ranged between CZK 380–630 mil., the most important items of which are purchases of materials and services (CZK 282.2 mil. in 2018), wages (CZK 150.7 mil.) and repairs and maintenance (CZK 31.8 mil.). Investment expenditures have fluctuated over the years depending on the implementation of major investment projects, e.g. in 2014 these expenditures amounted to more than CZK 190 mil., mainly in connection with the construction of the Srní and Kvilda visitor centres. As with other parks, construction investment prevails in the long term (Chart 5).

Revenues (sales) from the sale of timber significantly increased to more than CZK 311 mil. in 2018 due to increased salvage, mainly bark beetle, logging (Chart 6). However, because of the wood surplus on the market, the average price, or the average monetization per m^3 of wood, decreases (from 1,665 $CZK.m^{-3}$ in 2014 to 1,233 $CZK.m^{-3}$ in 2018).

Chart 4

Sources of financing the expenditure of the Šumava NP Administration [CZK mil.], 2010–2018

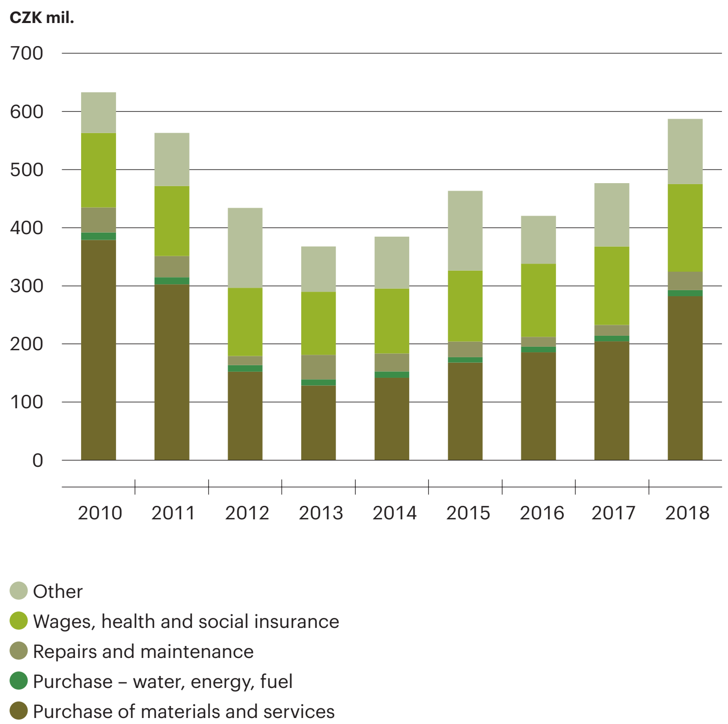


Data source: Šumava NP Administration

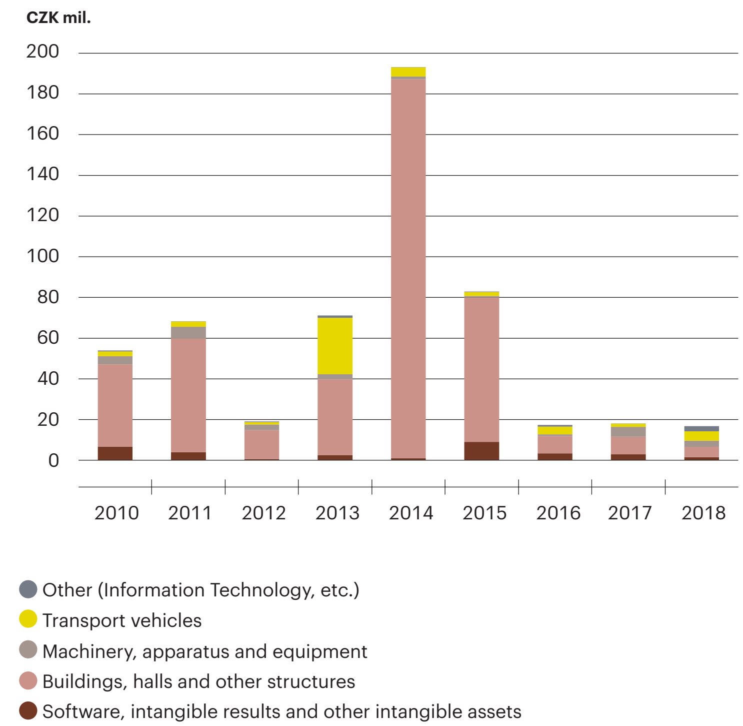
Chart 5

Current and investment expenditures of the Šumava NP Administration [CZK mil.], 2010–2018

Current expenditure



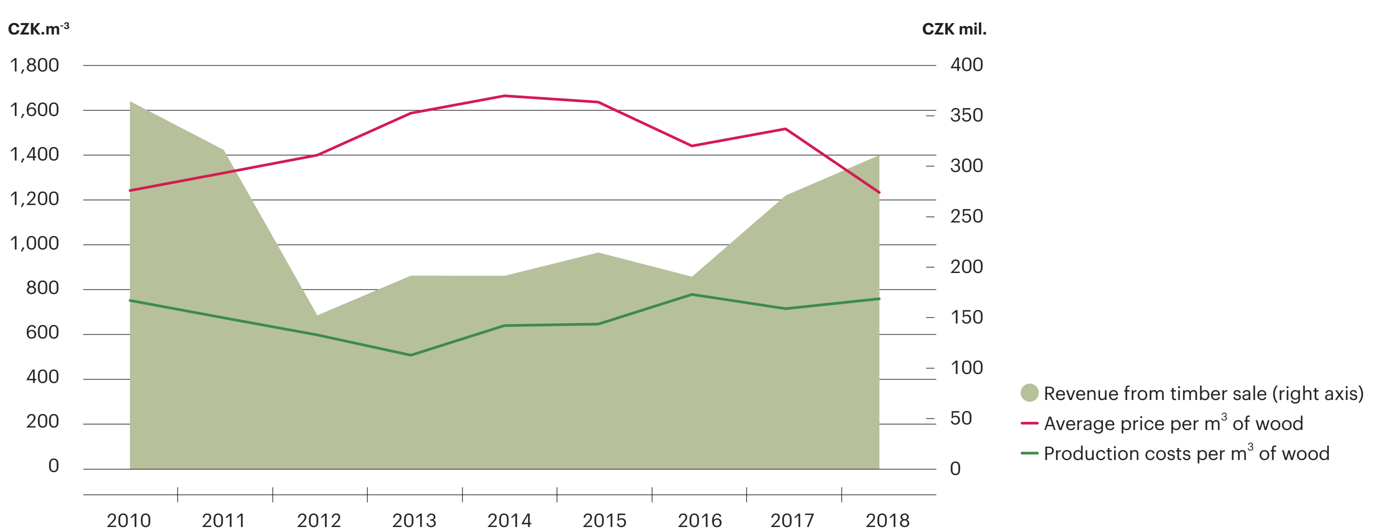
Investment expenditure



Data source: Šumava NP Administration

Chart 6

Sale of timber by the Šumava NP Administration – timber sales, average price and costs [CZK mil., CZK.m^{-3}], 2010–2018



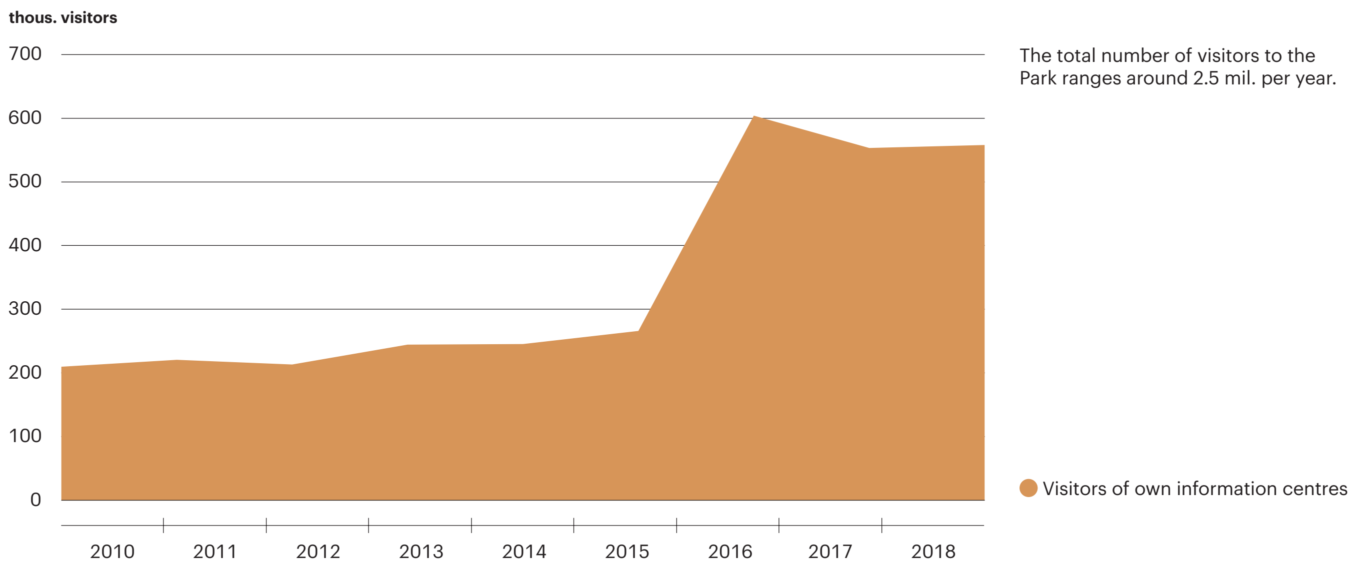
Data source: Šumava NP Administration

Tourism

The number of visitors to the National Park in 2018 was approximately 2.5 mil. Tourists could use 12 information centres or visitor centres, which in 2018 were visited by almost 560 thous. visitors (Chart 7). The sudden increase in the visitor numbers recorded in 2016 was caused by the opening of new visitor centres in Kvilda and Srní in the second half of 2015.

Chart 7

Visitors of information centres of the Šumava NP Administration and total visitors of the Park [thous. visitors], 2010–2018



Data source: Šumava NP Administration

Podyjí National Park

© Zbyněk Stein/CENIA

Biodiversity

Status of important animal species
The Podyjí NP is characterized by sharp transitions between cryophilic, hygrophilous and xerothermal communities, and the demands on the individual phenomena are often very different. Active grassland management and hard-to-reach valuable slopes around the Dyje River ensure good stocks of most target species. In 2018, a new cross-border spawning area was built for **river trouts** (*Salmo trutta morpha fario*) in the central part of the Podyjí NP and Thayatal NP in order to strengthen the local trout population. The spawning area will be monitored as to how it is used by various fish species and to what extent artificial spawning areas can ensure the development of the river trout (implemented under the project DYJE2020/THAYA2020). The Dyje Valley in the National Park is a regionally important nesting ground for the **black stork** (*Ciconia nigra*). In 2018, 2 pairs bred a total of 4 chicks.

Management of important plant species and valuable biotopes
Regular management interventions are carried out in accordance with the approved Podyjí NP Management Plan in the form of mowing meadows and lawns, grazing and cut-outs of self-seeded trees. Near Konice and Popice, almost two hectares of new meadows were added. The grassing was carried out using reproductive material from selected meadow species near Popice and Havraníky. It is part of the gradual transformation of the NP buffer zone, where new meadows, orchards, alleys and in-field patches were established in recent years. In the Havranice heath, the wilting population of the **dwarf iris** (*Iris pumila*) was revived by hand-plucking the dense tufts of the expansive **tall oat-grass species** (*Arrhenatherum elatius*). Experimental disruption of the grass sod was carried out at selected places in the Park using a forestry mulcher. The resulting areas resembling freshly ploughed ground benefit many species, headed by the **purple mullein** (*Verbascum phoeniceum*) and **buttercup** (*Ranunculus illyricus*). Selective bush clearing (release) was applied to the Hardeggská hillside to protect rare orchid species.

Status of invasive and other problematic plant species
More intensive interventions took place mainly in the eastern parts of the Park against the invasive tree species **black locust** (*Robinia pseudoacacia*). At the same time, the invasive **ailanthus** (*Ailanthus altissima*) has begun to spread noticeably in recent years, it is currently registered at fifty Podyjí localities.

Occurrence of potentially hazardous non-native animal species
No gradations of risky non-native animal species are recorded.

Projects dealing with biodiversity monitoring or habitat and species stabilization
2018 saw the start of an extensive revitalization of the Čížovský pond and the creation of a new pool to improve water retention in the landscape, increase the area of wetland and aquatic biotopes and to improve conditions for amphibians. This is a continuation of the NP Administration's long-term activities to support small water bodies. In addition, two original stone walls were restored at Papírny in the Devět mlýnů locality to support entomofauna and reptiles. A major project of the Podyjí National Park is the return of large ungulates to the Podyjí landscape in order to support the conservation of rare plant and animal species bound to the

varied non-forest landscape. The grazing of two herds of wild horses from Exmoor, England began between the former Mašovice shooting range and the western part of the Havranice heath. Gradually, a micro-relief of pastures is created and valuable species appear, such as the critically endangered *Asilus crabroniformis*. It is part of the large-scale Military LIFE for Nature project funded by the European programme LIFE. The horses always use a part of the area to create a colourful mosaic of the territory. At the same time, the effect of the grazing on insects and plants is monitored in detail.

Public involvement in biodiversity management

In 2018, students participated in the manual removal of the tall oat-grass at the Havranice heath. The public is informed about the new activities in the NP and in 2018 had the opportunity to participate in monitoring the population of the dangerous invasive ailanthus.

Objectives of NP protection in relation to biodiversity

The above-mentioned activities to maintain or promote species diversity in the Podyjí NP area are contributing to the long-term objectives of nature conservation in the NP territory, where either species diversity is maintained through spontaneous development in individual ecosystems or it is supported by active and mostly long-term management in the types of ecosystems whose existence is conditioned by human activity.

© Jiří Valta/CENIA

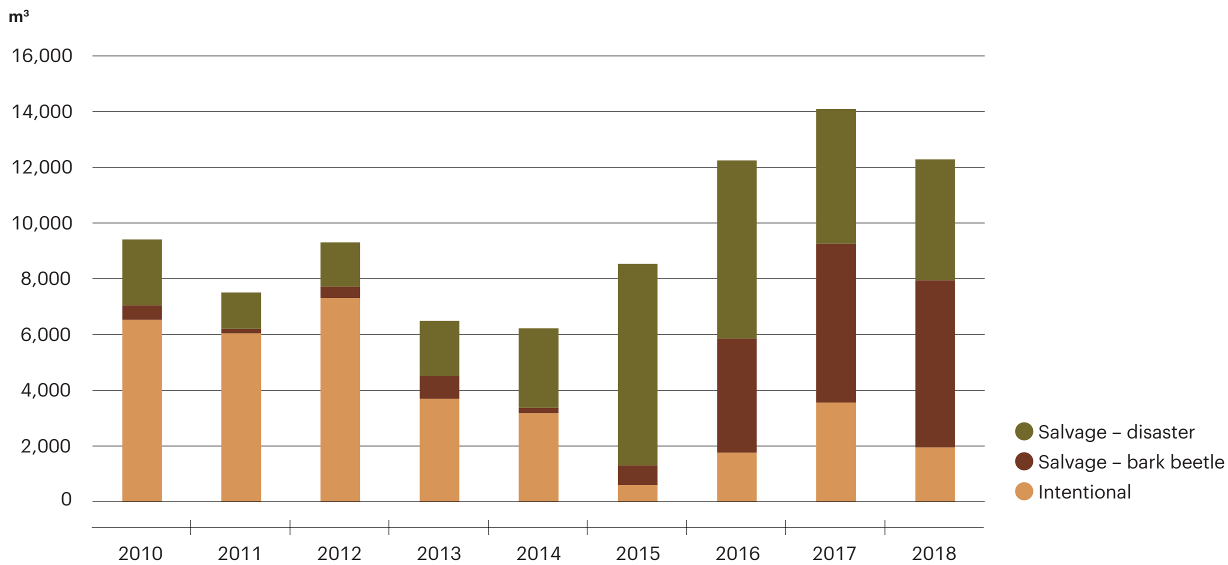
Forests

Most of the Podyjí NP territory (79.4%) is covered by forests. The stand area has been stable over the years and covers 5,003.2 ha with a stock of 211.2 $m^3.ha^{-1}$. Of that area, 340.4 ha (6.8%) are considered to be natural forests and 2,724.1 ha (54.5%) near-nature forests. Primary forests do not occur in the territory of the Podyjí NP. The area left to spontaneous development in 2018 represented 56.0% of forested area (2,800 ha). The aim of the forest ecosystems management in the Podyjí NP is primarily the restoration of natural ecosystems. The gradual increase in the representation of natural ecosystems in the NP territory, which are left to spontaneous development, is contributing to the long-term objectives of nature conservation.

Logging in the Podyjí NP is carried out primarily to support and preserve biodiversity (e.g. thinning, sprout forestry, modification of tree species composition) and to steer the forests towards spontaneous development. In 2018, the total production amounted to 12,290 m^3 (Chart 1) and was induced mainly by the consequences of the bark beetle spread (5,998 m^3) and natural disturbances (4,345 m^3). Intentional logging (1,947 m^3) focuses on interventions to change the species composition (reducing the proportion of spruce and pine) and to eliminate the invasive lucust. The species composition of forest stands is gradually approaching the target composition (Chart 2). Timber harvesting and subsequent restoration of forest stands in the NP territory are among the important tools by which it is possible to contribute to the long-term objectives of nature conservation in the NP. In the case of Podyjí NP, this means reconstruction of some cultural stands of pine and larch, and removing invasive species (locust, ailanthus).

Chart 1

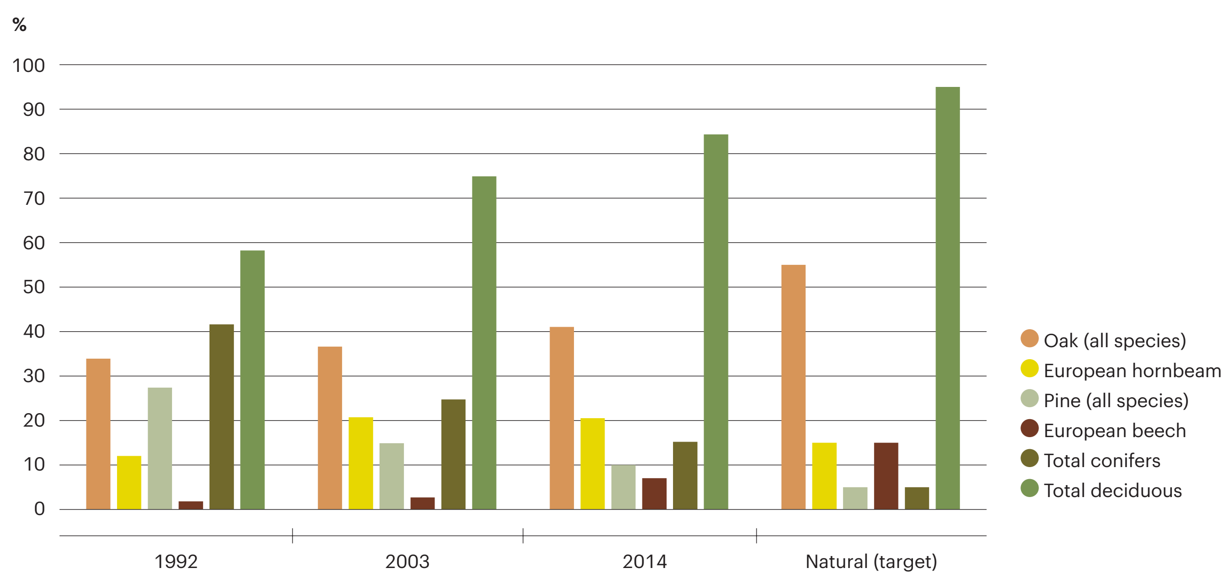
Total volume of logging in the Podyjí NP [m^3], 2010–2018



Data source: Podyjí NP Administration

Chart 2

Species composition of forests in the Podyjí NP [%], 1992, 2003, 2014



Current data are not, due to the methodology of their reporting, available at the time of publication.

Data source: Podyjí NP Administration

Economic data

Since 2010, the total annual budget of the Podyjí NP Administration has been in the range of CZK 45–55 mil. The budget is covered both by the founder (the Ministry of the Environment) in the average amount of approx. CZK 30 mil. per year, and by own resources (especially revenues from the sale of timber) in the amount of approx. CZK 15 mil. The rest of the budget consists mainly of funds for projects financed from national or European (or international) sources (Chart 3).

In terms of the national sources, projects are mainly financed through Landscape Management Programme, and in terms of the European sources through the Operational Programme Environment (European Regional Development Fund), the share of that funding in the total budget coverage is approximately 15% on average. In 2015, however, it reached almost 50% due to the implementation of projects supported by the Operational Programme Environment and aimed, for example, at the renewal of territorial system of ecological stability of the landscape elements or the reconstruction of forest roads.

Current (operating) expenditure of the Podyjí NP Administration reaches an average of CZK 45–54 mil., the most important items of which are wages (CZK 20.4 mil. in 2018), purchases of materials and services (CZK 18.3 mil.). Investment expenditures have fluctuated over the years depending on the implementation of major investment projects, reaching CZK 1.8 mil. in 2018. In the long term, investment in construction or in machinery and equipment prevails (Chart 4).

Revenues (sales) from timber sale decreased by 37% year-on-year to CZK 9.5 mil. in 2018 due to lower overall logging (Chart 5). However, despite the decline, it remains at a relatively high level compared to the period before 2016. The reason for the lower revenues from the sale of timber is also the fact that, due to the surplus of timber on the market due to high salvage logging, the production costs remain the same while the average price, or the average monetization per m^3 of wood, drop sharply (from CZK 1,422 per m^3 in 2014 to CZK 823 per m^3 in 2018).

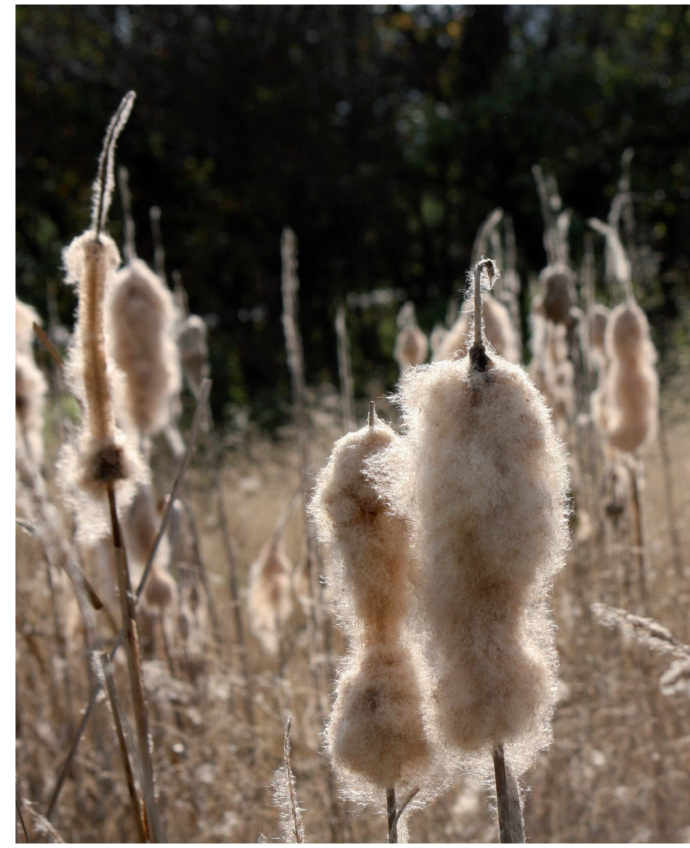
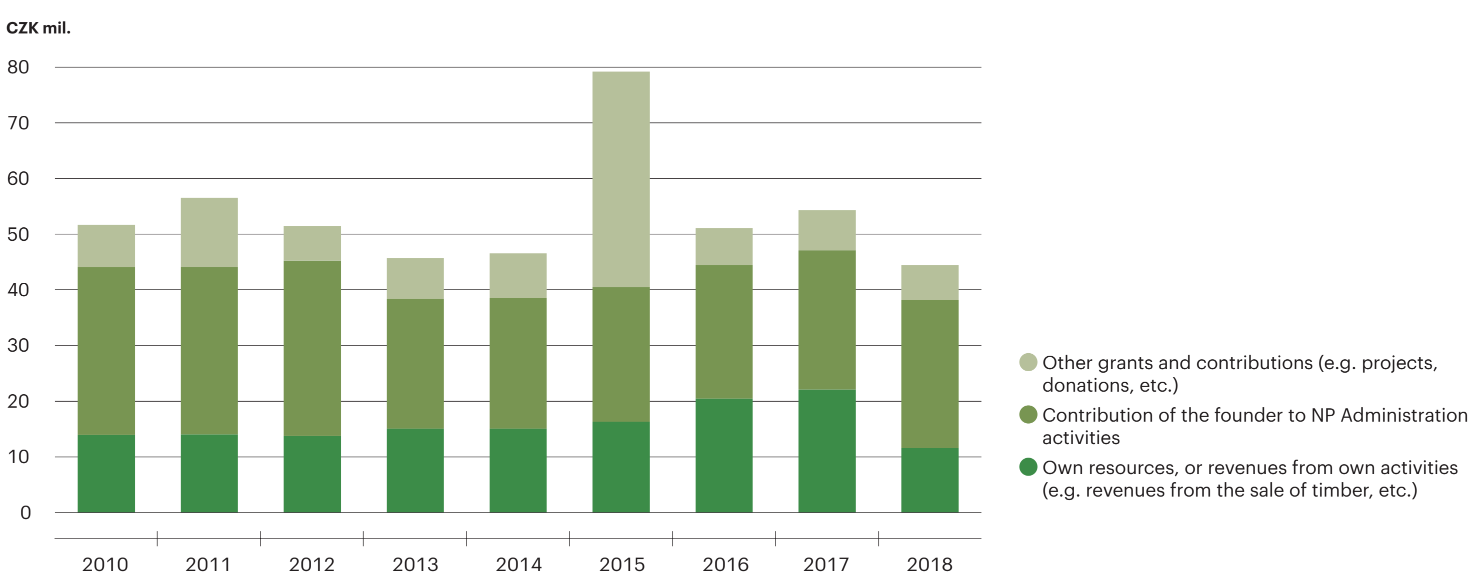


Chart 3

Sources of financing the expenditure of the Podyjí NP Administration [CZK mil.], 2010–2018

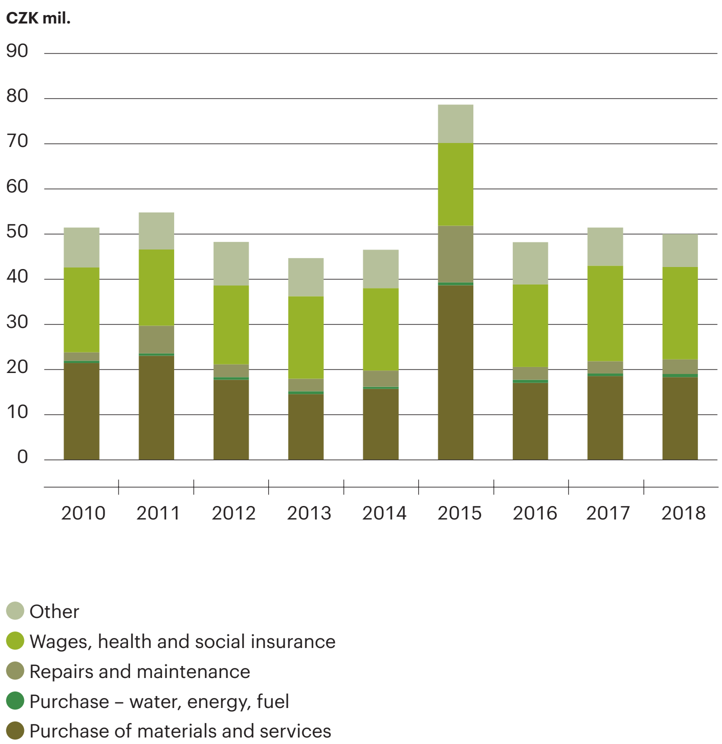


Data source: Podyjí NP Administration

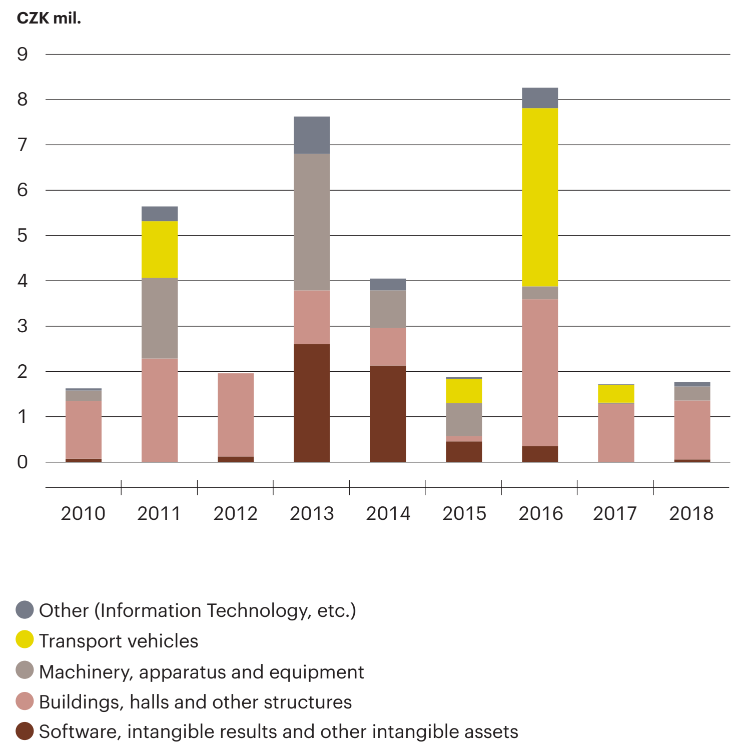
Chart 4

Current and investment expenditures of the Podyjí NP Administration [CZK mil.], 2010–2018

Current expenditure



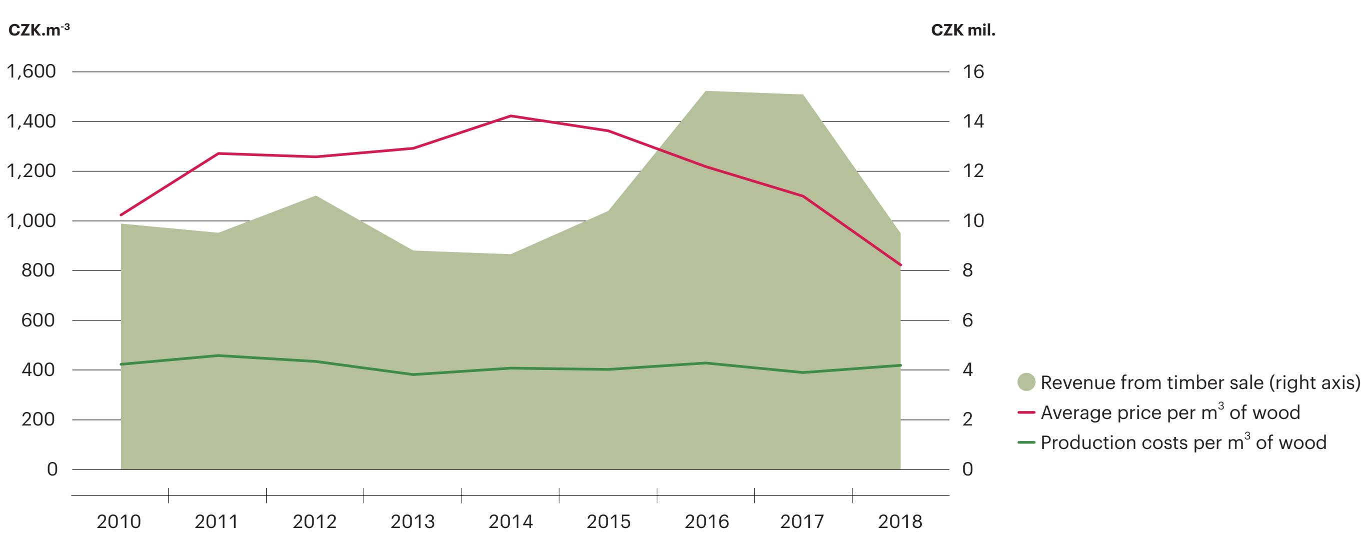
Investment expenditure



Data source: Podyjí NP Administration

Chart 5

Sale of timber by the Podyjí NP Administration – timber sales, average price and costs [CZK mil., CZK.m^{-3}], 2010–2018



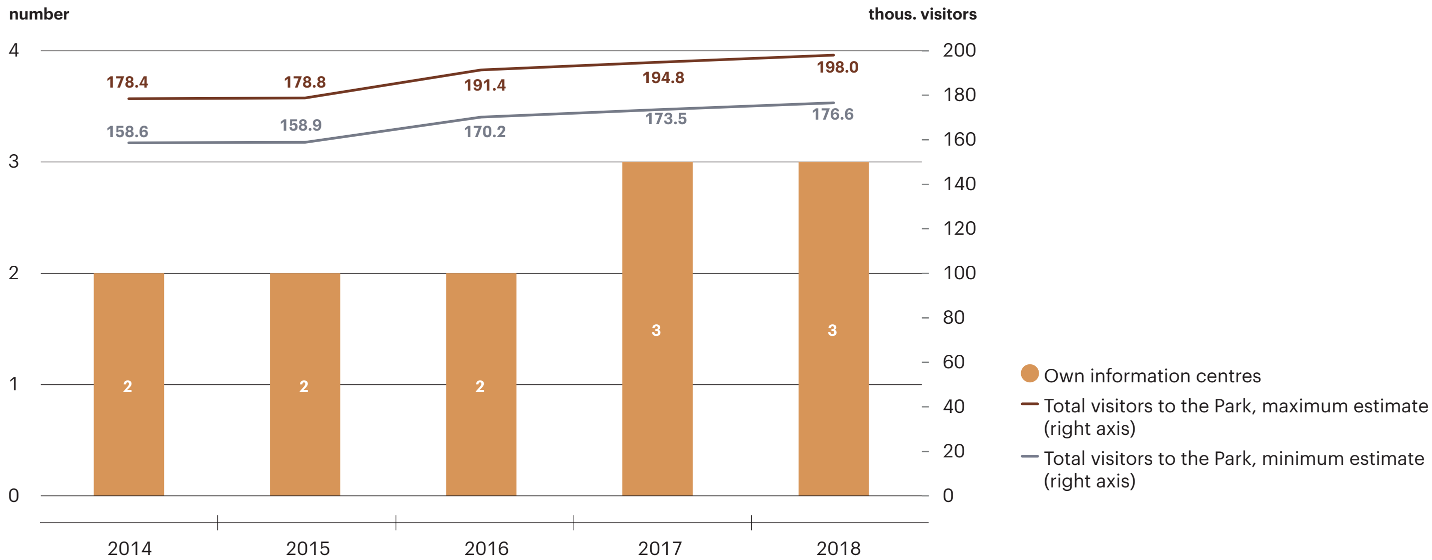
Data source: Podyjí NP Administration

Tourism

The number of visitors to the National Park has been steadily increasing; in 2018 it reached 177–198 thous. visitors (Chart 6). The tourists could use 3 information centres or information points in Čížov, Vranov nad Dyjí and Znojmo.

Chart 6

Number of information centres of the Podyjí NP Administration and total visitors of the Park [thous. visitors], 2010–2018



Data source: Podyjí NP Administration

Bohemian Switzerland National Park

Biodiversity

Status of important animal species
Due to targeted care, populations of the **peregrine falcon** (*Falco peregrinus*), the Eurasian **eagle owl** (*Bubo bubo*) and the **black stork** (*Ciconia nigra*) that are important and monitored species at the NP level are in good condition. The populations of the target bird species are being stabilised mainly due to the active protection of breeding grounds, which was implemented in 2018 as part of measures of a general nature prohibiting entry to certain localities to protect specially protected bird species at the time of breeding and nesting. The measures applied to the protection of the Eurasian eagle-owl (1 March – 30 June 2018), the peregrine falcon (1 March – 30 June 2018) and the black stork (1 March – 31 July 2018). The populations of above-mentioned species in 2018 were thus stabilized in the National Park territory.

Management of important plant species and valuable biotopes
The major long-term activities in Bohemian Switzerland National Park include a transformation of homogeneous spruce stands into species-diversified forests, elimination of invasive species (especially the **white pine** (*Pinus strobus*)), as well as increasing the representation of target species of trees in the stand, especially **silver fir** (*Abies alba*) and the originally common **European beech** (*Fagus sylvatica*).

Status of invasive and other problematic plant species
In 2018, interventions were carried out against **Himalayan Balsam** (*Impatiens glandulifera*) around the Pravčická Gate and the gorge of the Kamenice River (CZK 105 thous.), furthermore, the stands of **Japanese knotweed** (*Reynoutria japonica*) were removed on a number of smaller locations, these interventions were conducted in-house by watchkeeping personnel. The **white pine** (*Pinus strobus*) was not reduced in 2018 due to the ongoing bark beetle gradation. Regarding other problematic species in 2018, interventions were carried out to suppress the **common broom** (*Cytisus scoparius*) at several locations in the area of Jetřichovice (CZK 53 thous.).

Occurrence of potentially hazardous non-native animal species
Thanks to monitoring and regular interventions, non-native species do not currently spread to other locations. The only spreading animal in the NP is native species of bark beetle, the **spruce bark beetle** (*Ips typographus*). Along with it, however, a non-native species of the **double-spined bark beetle** (*Ips duplicatus*) has appeared in a small number in the NP.

Projects dealing with biodiversity monitoring or habitat and species stabilization
A number of projects or overlap projects of the Bohemian Switzerland NP Administration dealing with birds and other kinds of organisms are under way in the territory. These include ringing of selected bird species (**peregrine falcon** (*Falco peregrinus*), the **stock dove** (*Columba oenas*), **black woodpecker** (*Dryocopus martius*)), monitoring of wintering water and wetland birds in Děčín and Šluknov regions, or census of **great cormorants** (*Phalacrocorax carbo*) at sleeping roosts on the Elbe River. Furthermore, the monitoring of bats, entomological surveys of selected groups as well as reintroduction of the **Atlantic salmon** (*Salmo salar*) in the adjacent Elbe, monitoring of microclimate in inversion ravines or research and monitoring of selected species of plants, fungi, lichens and their habitats are carried out in the territory of the Bohemian Switzerland NP.

Public involvement in biodiversity management
The public is regularly involved in the National Park management, coordinated by the authorized staff of the NP Administration, both as part of various teambuilding events and events of geocaching devotees (cleaning up litter in the Křinice and Kamenice streams, removal of non-native species and planting of target tree species). Volunteers regularly participated in the care of the cultural monument Dolský mlýn and the area of the extinct settlement of Zadní Jetřichovice.

Objectives of NP protection in relation to biodiversity
The above-mentioned activities to maintain or promote species diversity in the Bohemian Switzerland NP area are contributing to the long-term objectives of nature conservation in the NP territory, where either species diversity is maintained through spontaneous development in individual ecosystems or it is supported by active and mostly long-term management in the types of ecosystems whose existence is conditioned by human activity.

Forests

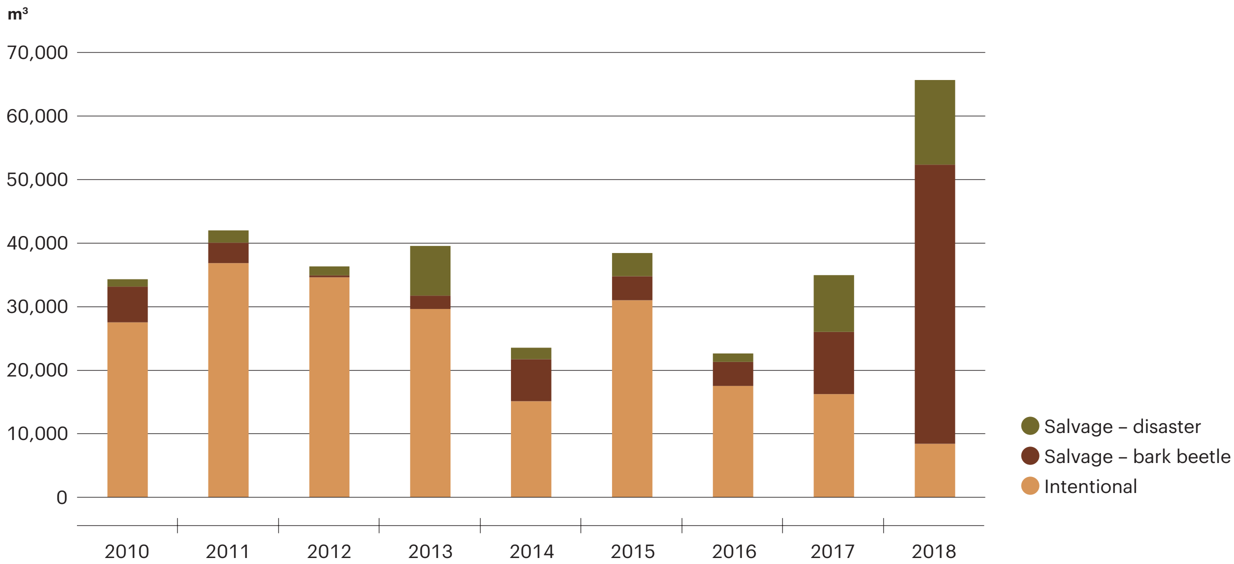
Most of the Bohemian Switzerland NP territory (97.8%) is covered by forests. The stand area has been stable over the years and in 2017[2] it covered 7,728.3 ha with a stock of 343.5 $m^3.ha^{-1}$. Out of this area, 1.2% (93.3 ha) are considered to be near nature forests. Primary and natural forests do not occur in the National Park. The area left to spontaneous development in 2018 represented 22.0% of forested area (1,699.1 ha). The aim of the management of forest ecosystems in the National Park is a gradual transformation of spruce and pine monocultures into near nature stands with an emphasis on biodiversity and geographically indigenous tree species. The gradual increase in the representation of natural ecosystems in the NP territory, which are left to spontaneous development, contributes to the long-term objectives of nature conservation.

© Jana Seidlová/CENIA

The effort of the Bohemian Switzerland NP Administration is to carry out logging primarily for the purpose of transforming the spruce monocultures, removing non-native white pines, and for the purpose of protecting the forest against bark beetle. In 2018, logging was influenced mainly by the massive expansion of bark beetle. The volume of bark beetle logging increased five times against the previous year to 43,151 m^3 (75.3% of the salvage logging, which represented 57,268 m^3). The total logging in 2018 was the highest in the history of the NP and amounted to 65,681 m^3 (Chart 1). Logging in spruce monocultures is carried out by individual or group selection, and white pine is logged using small-area clear cutting. In artificial regeneration, preference is given to fir, beech and oak (Chart 2). The species composition of forest stands is gradually approaching the target composition (Chart 3). Timber harvesting and subsequent restoration of forest stands in the NP territory are among the most important tools by which it is possible to contribute to the long-term objectives of nature conservation in the NP. In the case of Bohemian Switzerland NP, this means reconstruction of cultural forest stands (mainly spruce stands), introduction of missing, mainly deciduous tree species into the existing forest stands and removal of geographically non-native tree species (mainly white pine).

Chart 1

Total volume of logging in the Bohemian Switzerland NP [m^3], 2010–2018

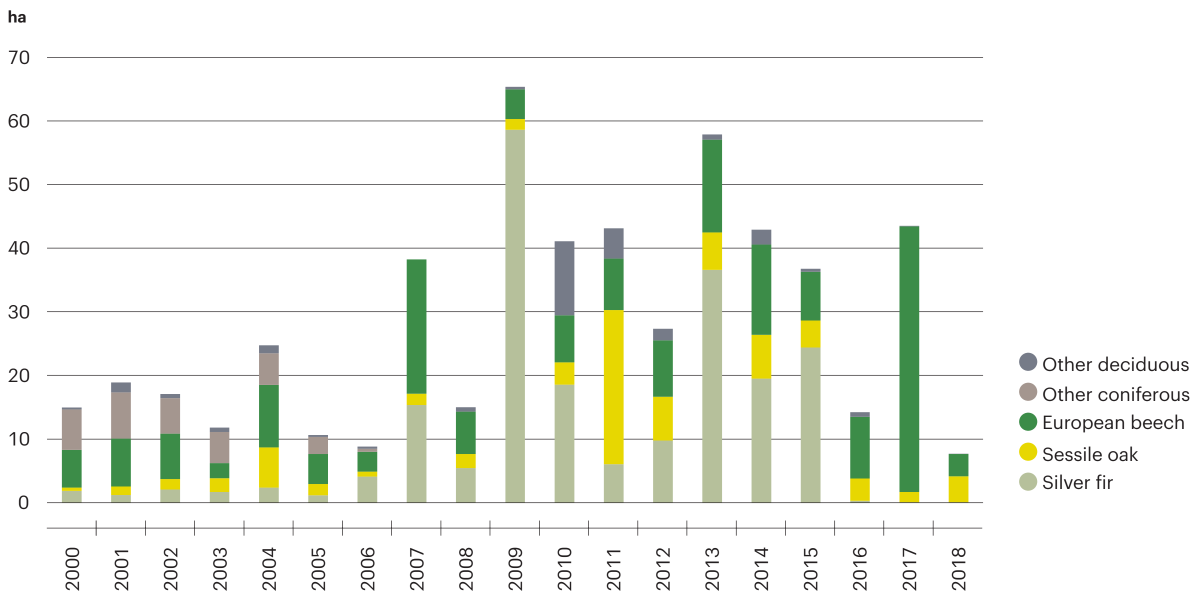


Data source: Bohemian Switzerland NP Administration

[2] Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Chart 2

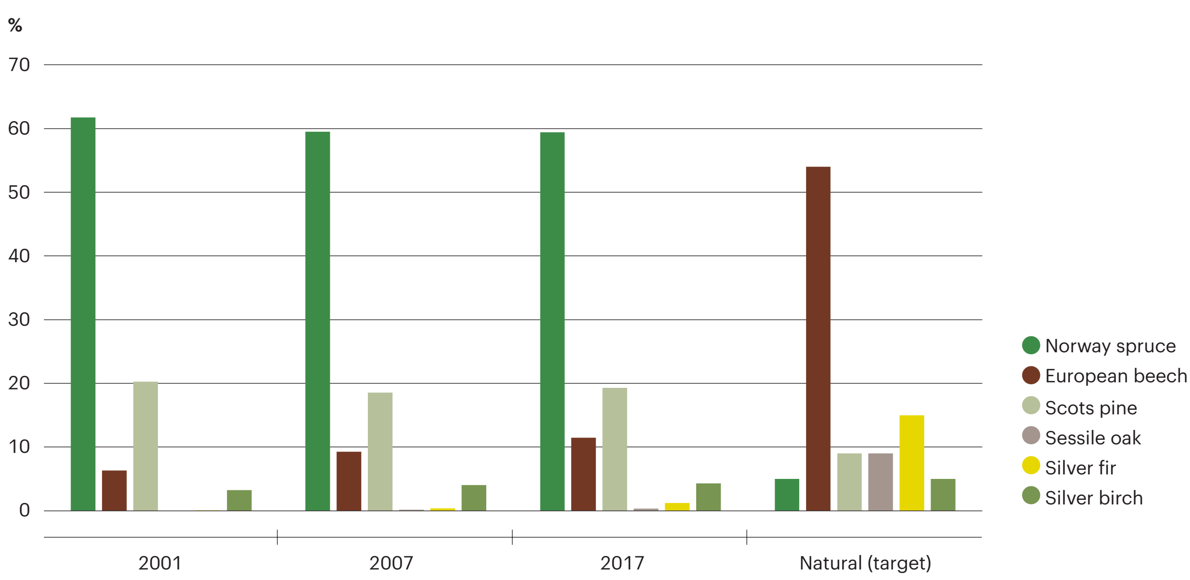
Artificial forest regeneration in the Bohemian Switzerland NP [ha], 2000–2018



Data source: Bohemian Switzerland NP Administration

Chart 3

Species composition of forests in the Bohemian Switzerland NP [%], 2001, 2007, 2017



Data for the year 2018 are not, due to the methodology of their reporting, available at the time of publication.

Data source: Bohemian Switzerland NP Administration

Economic data

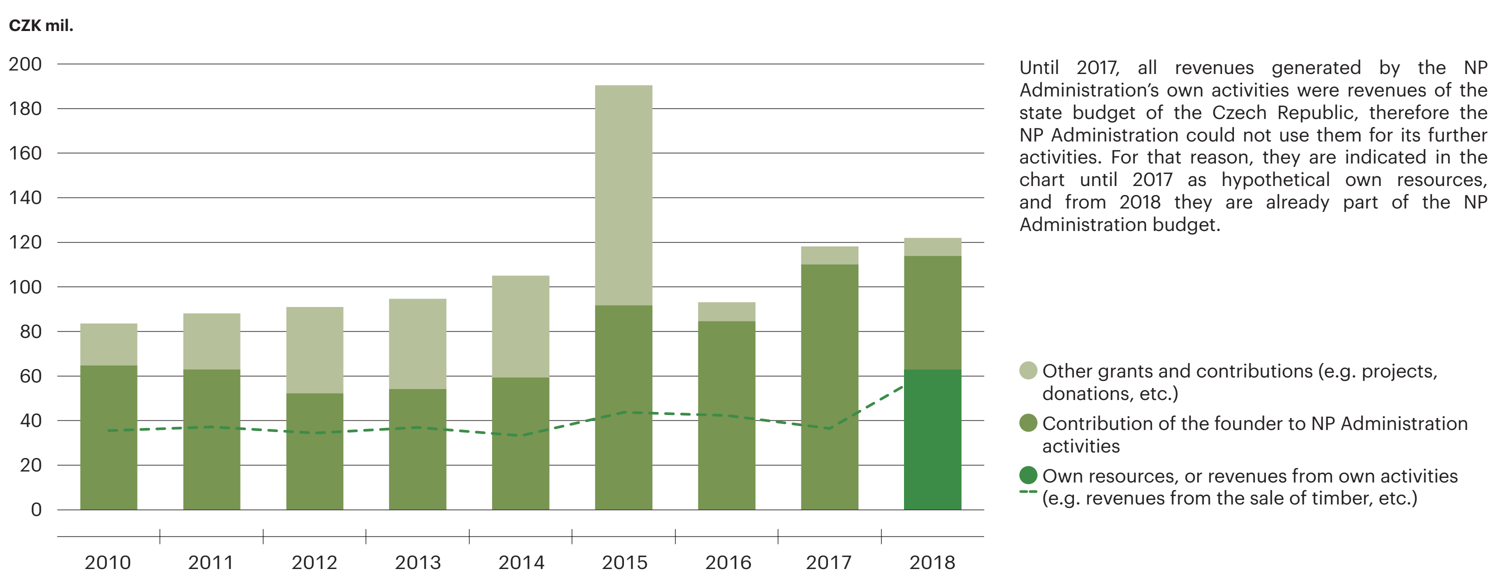
Since 2010, the total annual budget of the Bohemian Switzerland NP Administration has been in the range of approximately CZK 80–120 mil., or the amount gets higher due to the use of funding mainly from EU funds (Chart 4). As the Bohemian Switzerland NP Administration was an organizational unit of the State until 2017, its budget was covered mainly by a contribution directly from the state budget of the Czech Republic (i.e. the founder's contribution), amounting to approximately CZK 60–110 mil. Other sources of the Bohemian Switzerland NP Administration used to finance various projects were mainly national subsidy schemes (Landscape Management Programme, Landscape Natural Function Restoration Programme etc.) or European grant schemes (mainly Operational Programme Environment). Their share was on average about 25% of the budget based on the amount of absorbed funding, but in 2015 it reached more than 50% due to the implementation of securing unstable rock slopes above Hřensko financed from the Operational Programme Environment. Until 2017, the Bohemian Switzerland NP Administration could not use its own resources to finance its activities because all income generated by the activities of the Bohemian Switzerland NP Administration as an organizational unit of the State was transferred back to the state budget of the Czech Republic. Since 2018, when the Bohemian Switzerland NP Administration became a contributory organization of the Ministry of the Environment, it has been able to use its own resources.

Own resources, i.e. the Bohemian Switzerland NP Administration's revenues, were in the range of approx. CZK 35–60 mil. and consisted mainly of timber sales and real estate rentals. Revenues (sales) from timber sale have an upward trend (Chart 6), which is due, inter alia, to the increased salvage logging (mainly bark beetle). However, because of the wood surplus on the market, the average price per m^3 of wood decreases (from 1,500 $CZK.m^{-3}$ in 2014 to 1,058 $CZK.m^{-3}$ in 2018).

Current (operating) expenditure of the Bohemian Switzerland NP Administration reach an average of CZK 70–100 mil., the most important items of which have long been purchases of materials and services (CZK 55.2 mil. in 2018), wages (CZK 29.0 mil.) and repairs and maintenance (CZK 5.7 mil.). Investment expenditures have fluctuated over the years depending on the implementation of major investment projects, e.g. in 2015 these expenditures amounted to about CZK 116 mil., mainly in connection with the installation of protective barriers above Hřensko. As with the other parks, construction investment prevails (Chart 5).

Chart 4

Sources of financing the expenditure of the Bohemian Switzerland NP Administration [CZK mil.], 2010–2018



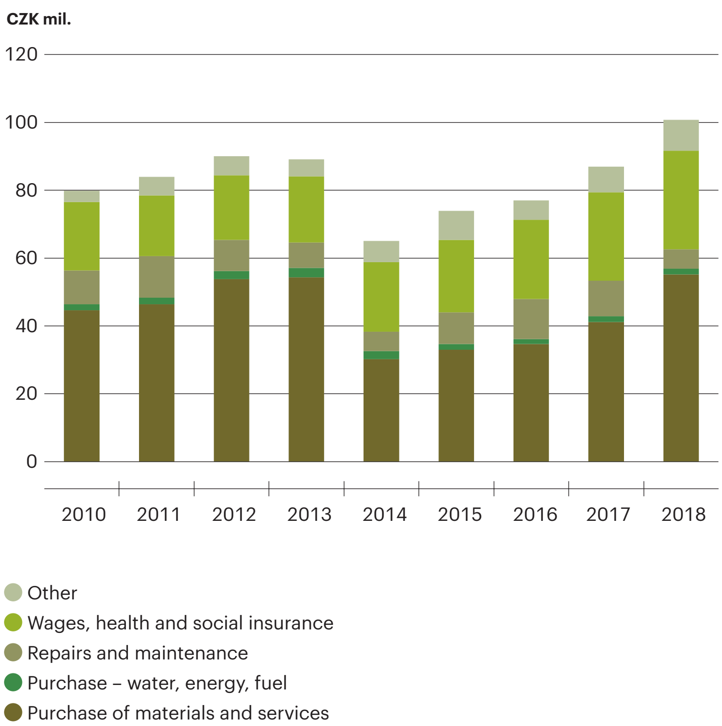
Until 2017, all revenues generated by the NP Administration's own activities were revenues of the state budget of the Czech Republic, therefore the NP Administration could not use them for its further activities. For that reason, they are indicated in the chart until 2017 as hypothetical own resources, and from 2018 they are already part of the NP Administration budget.

Data source: Bohemian Switzerland NP Administration

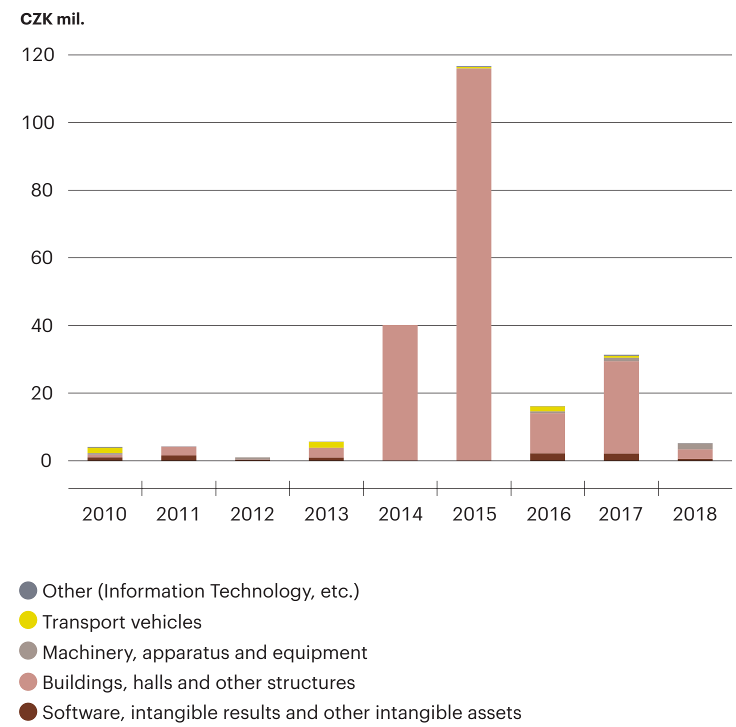
Chart 5

Current and investment expenditures of the Bohemian Switzerland NP Administration [CZK mil.], 2010–2018

Current expenditure



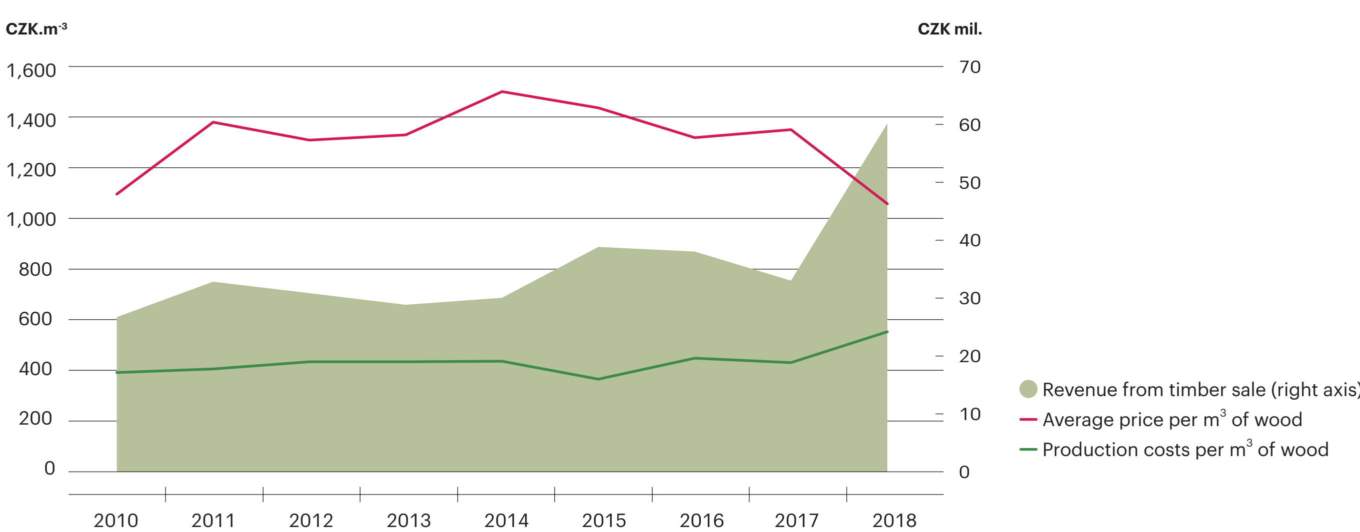
Investment expenditure



Data source: Bohemian Switzerland NP Administration

Chart 6

Sale of timber by the Bohemian Switzerland NP Administration – timber sales, average price and costs [CZK mil., CZK.m^{-3}], 2010–2018



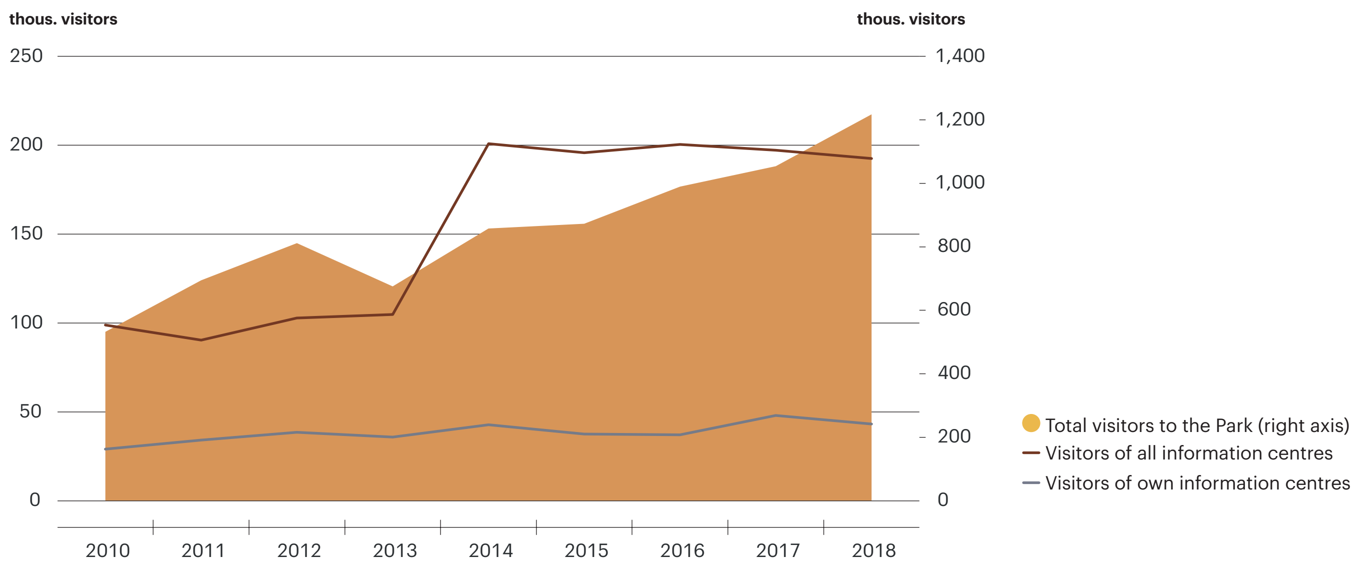
Data source: Bohemian Switzerland NP Administration

Tourism

The number of visitors to the NP in 2018 was approximately 1.2 mil. (number of recorded passages at 13 measured localities, Chart 7). Tourists could use 5 information centres, 2 of which are owned by the Bohemian Switzerland NP Administration and 3 are financially supported by the Bohemian Switzerland NP Administration. Information centres of the Bohemian Switzerland NP Administration (Saula Information Centre in Dolní Chřibská and Jetřichovice Information Centre) were visited by more than 43 thous. visitors. The total number of visitors to all information centres (i.e. including the House of Bohemian Switzerland in Krásná Lípa, the Information Centre in Srbská Kamenice and the Information Centre in Mezní Louka) was more than 192 thous.

Chart 7

Visitors of information centres of the Bohemian Switzerland NP Administration and total visitors of the Park* [thous. visitors], 2010–2018



** The number of visitors to the park represents the sum of the recorded passages of visitors at 13 measured locations.*

Data source: Bohemian Switzerland NP Administration

Public and the environment

© Jana Seidlová/CENIA

Public and the environment

Key question

Is the Czech public interested in the environment? How does it perceive the seriousness of environmental problems in the Czech Republic? And are Czechs willing to restrain themselves in the interest of environmental protection?

Assessment

These questions can be answered thanks to representative surveys of public opinion, which depict an interesting picture of the relationship of Czech society to nature and the environment. They show that the Czechs are interested in the environment, sympathize with its protection and strongly perceive the seriousness of environmental problems. However, their willingness to restrain themselves to protect nature and the environment is considerably smaller.

Taking a closer look at the interest of Czech society in the environment, regular sociological surveys conducted by the Institute of Sociology of the Czech Academy of Sciences, public opinion research centre, show that more than half of the population is interested in information on the environment in the Czech Republic. The current survey from 2018 shows that almost three fifths of the public are interested in such information (57% in total, of which 47% are rather interested and 10% definitely interested). On the other hand, 43% of respondents said they were not interested in such information (37% were rather uninterested, 6% were definitely not interested), Chart 1. This interest is relatively stable – between 2011 and 2018 it ranged within 10 p.p. The public was the least interested in 2017 (52% of the population), the most in 2013 (62%).

Chart 1

Interest in information on the environment in the Czech Republic [%], 2011–2018

Asked question: Are you interested in information on the environment in the Czech Republic?

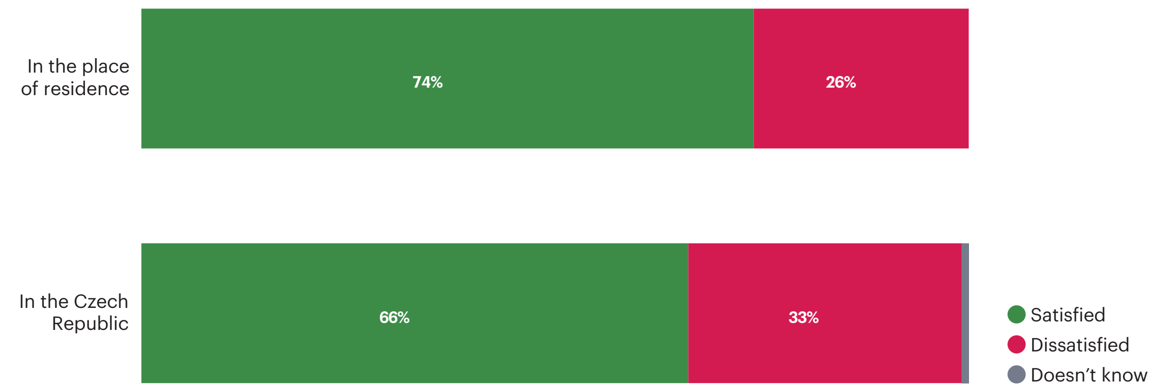
Data source: Institute of Sociology of the Czech Academy of Sciences, public opinion research centre

Besides being interested in information about the environment, the majority of the Czech public is also aware of its impact on the quality of their lives. According to the international Eurobarometer survey, the state of the environment affects the quality of life for nearly four fifths (79%) of Czechs[1]. Thus, the environment follows with only a small margin the other key factors that, according to the Czech population, affect their lives, namely the economic (affects life according to 89% of respondents) and social (84%).

Most Czechs are satisfied with the state of the environment (Chart 2). At the same time, they assess the situation in their place of residence better than the overall situation in the Czech Republic. Almost three-quarters (74%) of respondents express satisfaction with the state of the environment in their place of residence, and two-thirds (66%) in the Czech Republic.

Chart 2

Satisfaction with the environment in the place of residence and in the Czech Republic [%], 2018



Asked question: How satisfied are you with the environment in our country as a whole and in your place of residence?

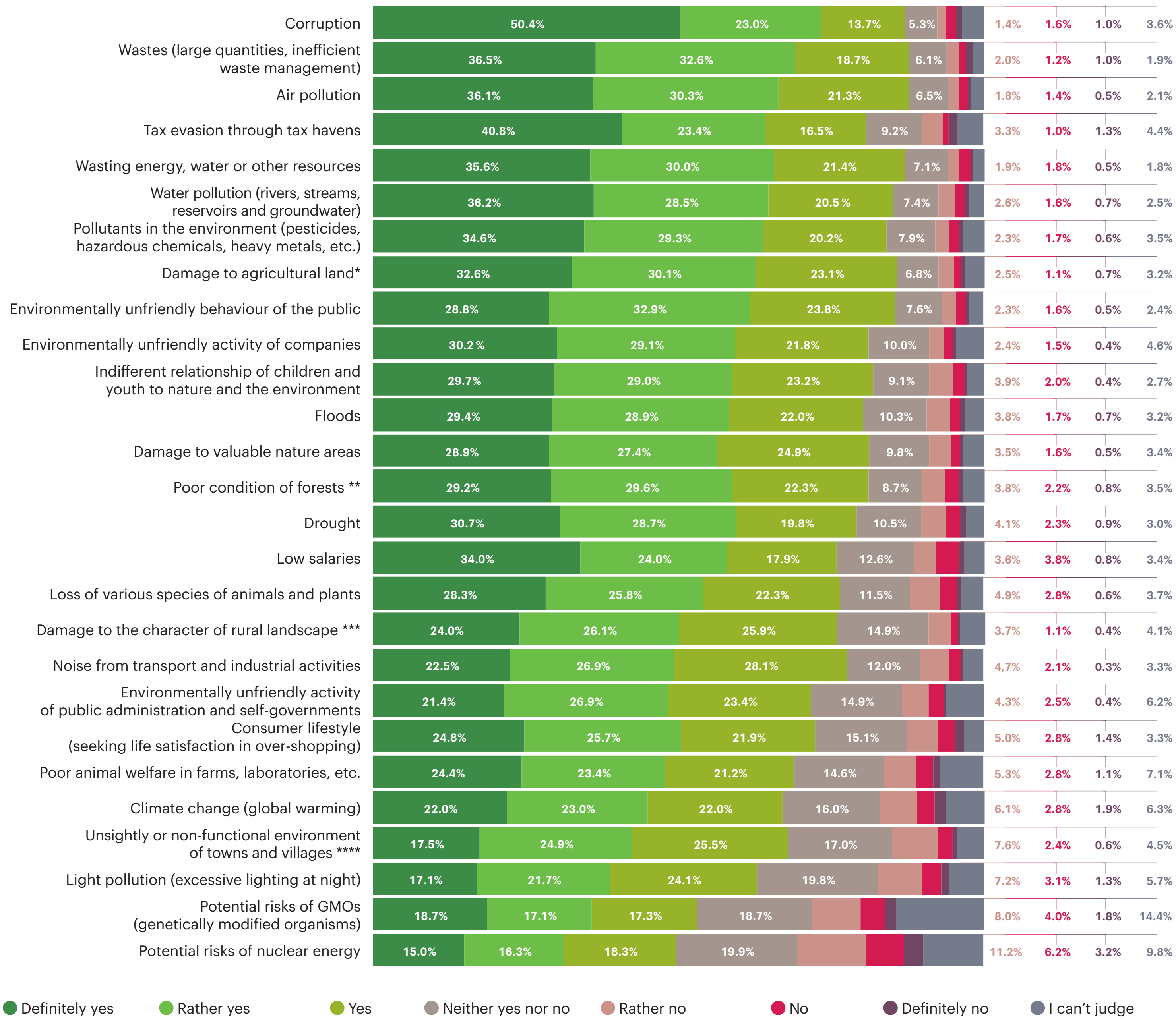
Data source: Institute of Sociology of the Czech Academy of Sciences, public opinion research centre

Although the Czech public is rather satisfied with the state of the environment in the Czech Republic, it also notices domestic environmental problems. All of the problems are considered serious by most of the population (Chart 3). There is a significant level of concern, with more than 80% of the public identifying twelve problems as serious, another five problems are considered serious by more than 70% and only two problems are perceived as serious by about half of the respondents. The greatest concern is felt about the most visible, easiest to imagine and most frequently discussed issues, such as waste, air pollution, waste of energy, water or other resources. On the contrary, the Czech society is worried the least about technological risks arising, for example, from the use of genetically modified organisms or nuclear power.

[1] *European Union. (2014e). Special Eurobarometer 416: Attitudes of European Citizens towards the Environment. Report (Wave EB81.3). Available from: http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_416_en.pdf*

Chart 3

Perception of the severity of environmental problems [%], 2018



** Erosion, reduced fertility, low water retention capacity, built-up area*
*** Unnatural composition of tree species, drying and other diseases, parasite attack, damage to forest soil*
**** Suburban development, industrial and transport constructions, mining, etc.*
***** Poor architecture and urbanism, poor solution of public space, lack of greenery*

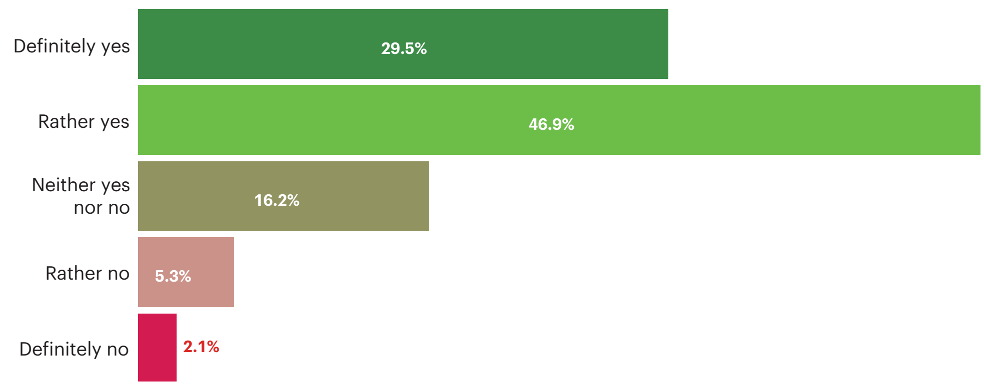
Asked question: In your opinion, is the situation in the following areas within the Czech Republic a serious problem?

Data source: Krajhanzl, J., Chabada, T., Svobodová, R.

The vast majority of the Czech public also consider the protection of nature and the environment to be important (94%)[2] and agree with its ideas. Nearly three quarters (76.4%) of the Czech public feel close to nature and environmental protection ideas, of which more than a quarter (29.5%) are intensively committed to the ideas (Chart 4)[3].

Chart 4

Feeling positive about nature and environmental protection ideas [%], 2018



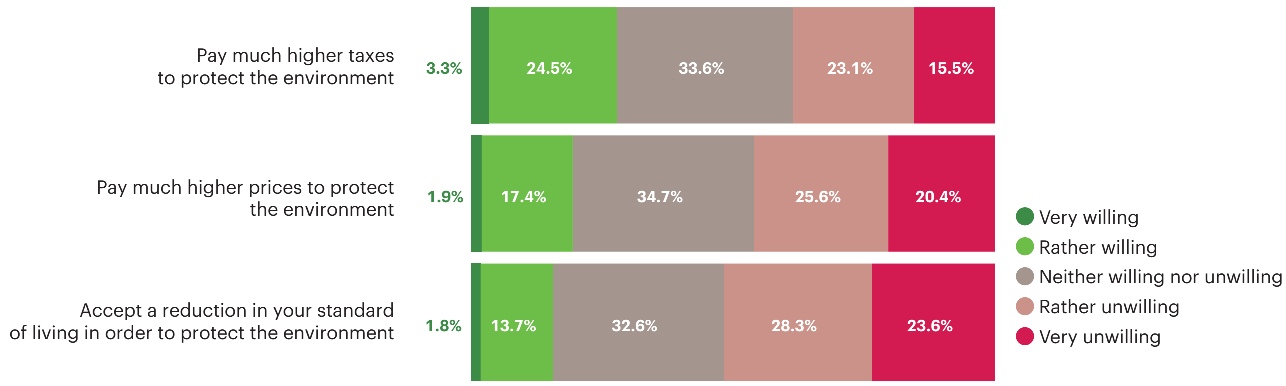
Asked question: Do you feel positive about nature and environmental protection ideas?

Data source: Krajhanzl, J., Chabada, T., Svobodová, R.

Despite the fact that the vast majority of society perceives environmental problems as serious and sympathizes with the protection of nature and the environment, only a minority of people express their willingness to limit themselves in the interest of environmental protection (Chart 5). A more detailed look at the data shows that 27.8% of respondents would agree to reduce their standard of living, 19.3% of the population would be willing to pay higher prices and only 15.5% of the public would accept paying higher taxes. The general public thus tends to be reluctant to limit themselves for the benefit of environmental protection: 51.8% of the population would not pay higher taxes and 46% would not pay higher prices, and 38.6% of respondents would not agree to lower their standard of living.

Chart 5

Willingness to limit oneself in the interests of environmental protection [%], 2018



Asked question: How far are you personally willing to ...

Data source: Krajhanzl, J., Chabada, T., Svobodová, R.

According to public opinion polls, the Czech relation to nature and the environment is not unambiguous: the public is interested in the state of the environment, the great majority sympathizes with its protection and strongly perceives the seriousness of domestic environmental problems, but is not willing to restrain itself for the benefit of environmental protection.

[2] *European Union. (2017b). Special Eurobarometer 468: Attitudes of European Citizens towards the Environment. Report (Wave EB88.1.). Available from: http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/Survey/getSurveyDetail/instruments/SPECIAL/surveyKy/2156*

[3] *Krajhanzl, J., Chabada, T., Svobodová, R. The relationship of the Czech public to nature and the environment. Representative study of public opinion. Brno: Masaryk University, 2018.*

Strategies and policies in the environmental sector

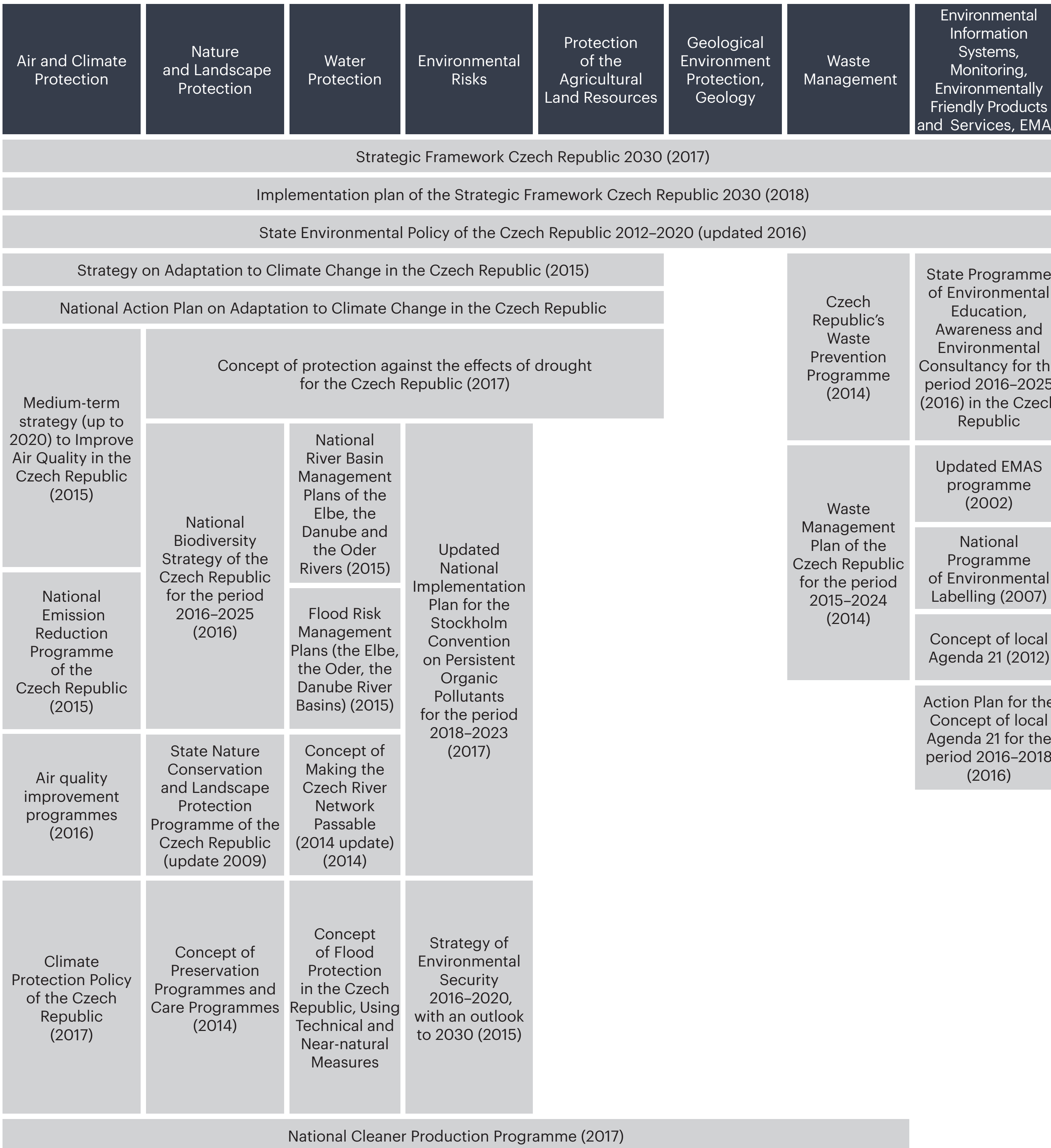
The Report on the Environment of the Czech Republic assesses the state and development of individual components of the environment in the Czech Republic and thus represents a basic source of information identifying its current problems. The results of the Report on the Environment can be subsequently used for the initial setting of the individual objectives in the relevant strategic and conceptual materials not only of the Ministry of the Environment.

As part of its strategic work, the Ministry of the Environment of the Czech Republic continuously monitors the progress in implementation of various strategic materials (Figure 1). In 2018, evaluations were made of the State Environmental Policy 2012–2020, the National Action Plan on Adaptation to Climate Change in the Czech Republic as an implementing document for the Strategy on Adaptation to Climate Change in the Czech Republic, and an update was made to the indicators of the Czech Republic's vulnerability to the effect of climate change for the National Action Plan for Adaptation to Climate Change. These documents are part of the analytical materials that will be used to update these strategic documents for the period after 2020.

The report does not include an annual evaluation of the measures of the National Emission Reduction Programme of the Czech Republic, because the detailed evaluation is part of the 2019 National Emission Reduction Programme Update.

Figure 1

Map of the strategic documents of the Ministry of the Environment of the Czech Republic, 2018



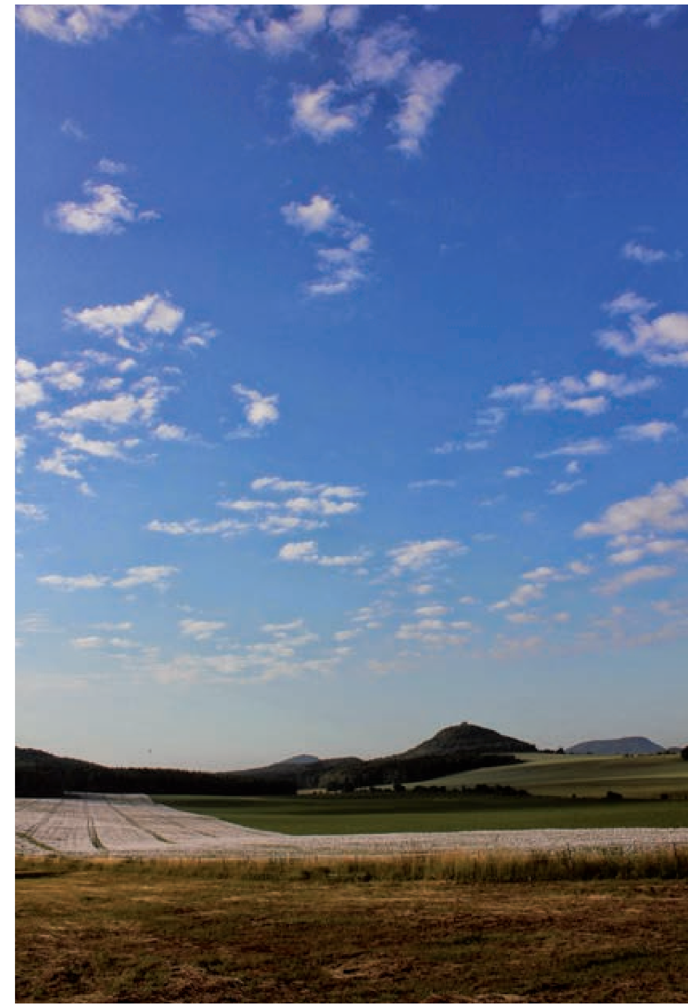
Data source: Ministry of the Environment of the Czech Republic, adjusted according to the output of the project "Streamlining the activities of the Technology Agency of the Czech Republic in the area of R&D&I and support of strengthening the expertise of public administration organisations in R&D&I; key activity 1: output of the Strategic Map of Ministries, the Strategic Map of the Ministry of the Environment of the Czech Republic

State Environmental Policy of the Czech Republic 2012–2020

The State Environmental Policy of the Czech Republic 2012–2020 is the main cross-cutting document, which defines the plan for implementing effective protection of the environment in the Czech Republic. Its objective is to ensure a healthy and high-quality environment for inhabitants of the Czech Republic, to make a significant contribution to the efficient use of all resources and to minimize the negative environmental impact of human activity, including transboundary impacts, and so contribute to improving the quality of life in Europe and in the world.

The implementation of the individual specific objectives and their associated measures and instruments of the State Environmental Policy of the Czech Republic 2012–2020 was evaluated in 2018–2019.

Specific objectives are evaluated according to the achievement of the State Environmental Policy of the Czech Republic 2012–2020 target parameters. Based on the results of the submitted evaluation, it can be stated that out of the total of 30 specific objectives, 8 specific objectives (27%) were continuously or fully achieved, 21 objectives (70%) were partially met and only objective 1.3.2 Reducing the erosion risk for agricultural and forest land (Table 1). Out of the thematic areas of evaluation, the best achievement of objectives and thus the highest policy effectiveness is indicated by the area of climate and air protection, the growth in the use of renewable energy sources and reducing the energy and material intensity of the economy. In the period of validity of the State Environmental Policy of the Czech Republic 2012–2020, only partial progress was made under the objectives concerning waste management, protection of water and soil, protection of landscape and its functions and protection of biodiversity. The reduction of anthropogenic risks to the environment, including remediation of already existing environmental damage, was also evaluated as partially achieved. The lowest policy effectiveness and failure to meet the target were found in the case of erosion control, due to climate change which increases exposure to risk processes that intensify soil and water erosion.


© Zdeněk Suchánek/CENIA

The indicated 30 specific objectives were implemented in individual thematic areas through measures (Chart 1), which represented the actual activities and processes contributing to (operationalizing) the objectives and implementation of the State Environmental Policy of the Czech Republic 2012–2020. Out of 139 measures, a total of 116 measures were implemented on an ongoing basis or completed (83%), and 23 measures (17%) were partially implemented.

Specific objective 1.3.2 is evaluated as not implemented despite the ongoing or partial implementation of its individual measures. Despite this implementation, however, the target parameters have not been achieved, which indicates an inappropriate selection of measures or their ineffectiveness.

Table 1

Overview of the achievement of the individual State Environmental Policy of the Czech Republic 2012–2020 specific objectives

Conservation and sustainable use of resources		
Specific objective 1.1.1	Achieving at least good ecological status or potential and good chemical status of surface water bodies, achieving good chemical and quantitative status of groundwater bodies and ensuring water protection in protected areas defined by the Water Framework Directive	**Implemented on an ongoing basis**
Specific objective 1.2.1	Reducing the share of waste disposed by landfilling	**Implemented partially**
Specific objective 1.2.2	Increasing the share of material and energy recovery of waste	**Implemented partially**
Specific objective 1.2.3	Waste prevention	**Implemented partially**
Specific objective 1.3.1	Reducing the agricultural land take	**Implemented partially**
Specific objective 1.3.2	Reducing the erosion risk for agricultural and forest land	**Not implemented**
Specific objective 1.3.3	Limiting and controlling the contamination and other degradation of soil and rocks caused by human activities	**Implemented on an ongoing basis**
Specific objective 1.3.4	Prevention and obliteration of negative consequences of mining operations and the extraction of minerals	**Implemented partially**
Climate protection and air quality improvements		
Specific objective 2.1.1	Reducing greenhouse gas emissions within the EU-ETS by 21% and limiting the increase in emissions outside the EU-ETS to 9% by 2020 compared with the 2005 level	**Implemented partially**
Specific objective 2.2.1	Improving air quality in areas where air pollution limits are exceeded	**Implemented on an ongoing basis**
Specific objective 2.2.2	Implementing the national emission ceilings for sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), ammonia (NH_3) and fine suspended particulates ($PM_{2.5}$)	**Implemented on an ongoing basis**
Specific objective 2.2.3	Reducing the emissions of heavy metals and persistent organic substances	**Implemented on an ongoing basis**
Specific objective 2.3.1	Ensuring 13% proportion of energy from renewable sources in gross final energy consumption by 2020	**Implemented on an ongoing basis**
Specific objective 2.3.2	Securing a 10% share of energy from renewable sources in transport by 2020, while reducing emissions of NO_x, VOC and $PM_{2.5}$ from transport	**Implemented partially**
Specific objective 2.3.3	Implementing the commitment to increase energy efficiency by 2020	**Implemented on an ongoing basis**

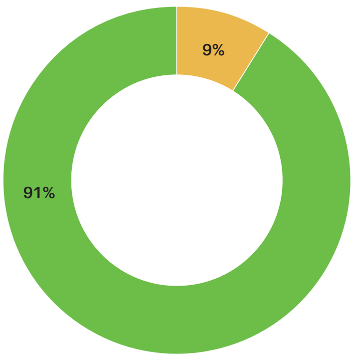
Nature and Landscape Protection		
Specific objective 3.1.1	Increasing the ecological stability of the landscape	Implemented partially
Specific objective 3.1.2	Restoring the landscape water regime	Implemented partially
Specific objective 3.1.3	Reducing and mitigating the impacts of landscape fragmentation	Implemented partially
Specific objective 3.1.4	Maintaining and strengthening the non-productive functions of the agricultural landscape and forests	Implemented on an ongoing basis
Specific objective 3.2.1	Ensuring the protection and care for the most valuable parts of nature and landscape	Implemented partially
Specific objective 3.2.2	Halting the decline of native species and natural habitats	Implemented partially
Specific objective 3.2.3	Limiting the negative impact of invasive species and taking effective measures to regulate them	Implemented partially
Specific objective 3.3.1	Improving the functional status of greenery in settlements	Implemented partially
Specific objective 3.3.2	Strengthening the regeneration of brownfields with a positive impact on the quality of the environment in settlements	Implemented partially
Specific objective 3.3.3	Improving the rainwater management in settlements	Implemented partially
Safe environment		
Specific objective 4.1.1	Preventing the sources of anthropogenic risks	Implemented partially
Specific objective 4.2.1	Mitigating the impacts of anthropogenic risks	Implemented partially
Specific objective 4.2.2	Mitigating the impacts of natural hazards	Implemented partially
Specific objective 4.2.3	Mitigating climate change impacts and adaptation	Implemented partially
Specific objective 4.2.4	Remediation of contaminated sites, including old environmental burdens, and repair of environmental harm	Implemented partially

Data source: CENIA according to the documents from individual coordinators

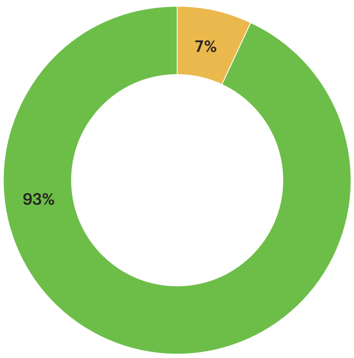
Chart 1

Overview of the implementation of the National Action Plan on Adaptation to Climate Change in the Czech Republic measures by the individual impacts of climate change

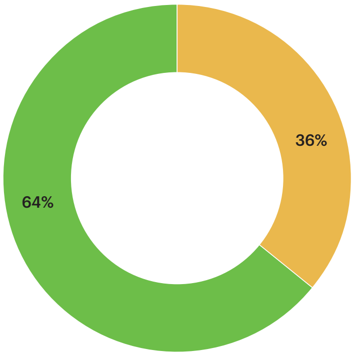
Thematic area 1
Conservation and sustainable use of resources



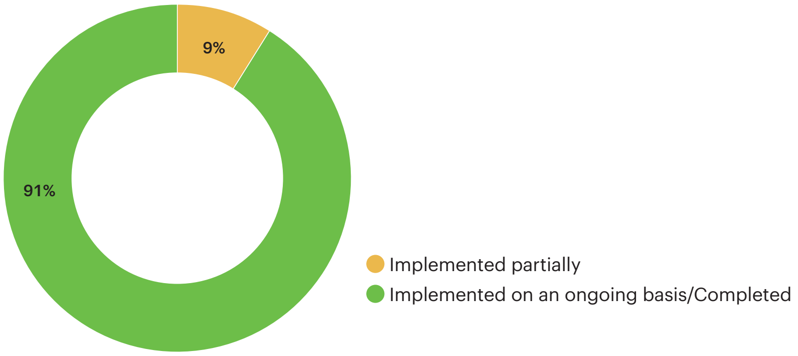
Thematic area 2
Climate protection and air quality improvements



Thematic area 3
Nature and landscape protection



Thematic area 4
Safe environment



Data source: CENIA according to the documents from individual coordinators

Based on the conclusions of the State Environmental Policy of the Czech Republic 2012–2020 evaluation, the individual objectives and measures are gradually being implemented, particular attention must be paid to the area of conservation and sustainable use of water and soil, strengthening the ecological stability of the landscape in the context of increasing impacts of climate change, protection of the urban environment and its adaptation to climate change, as well as mitigation of the occurrence and impacts of anthropogenic and natural risks.

National Action Plan on Adaptation to Climate Change in the Czech Republic

In 2017, the National Action Plan on Adaptation to Climate Change in the Czech Republic was adopted as an implementing document for the Strategy on Adaptation to Climate Change in the Czech Republic (the Adaptation Strategy). The main aim of the National Action Plan on Adaptation to Climate Change in the Czech Republic is to mitigate the impacts of climate change by adapting to that change, to maintain welfare and to preserve and, where possible, enhance the economic potential for the next generations.

In 2018, the process of updating the Adaptation Strategy and the National Action Plan on Adaptation to Climate Change in the Czech Republic began. Within the National Action Plan on Adaptation to Climate Change in the Czech Republic evaluation, 34 specific objectives were evaluated, of which 7 (i.e. 21%) were assessed as being continuously implemented, 26 (i.e. 76%) were partially implemented and only one specific objective (specific objectives 22: Strengthening the knowledge base of mutual relations and impacts of climate change on tourism) was not implemented, Table 2.

Within the specific objectives, 129 measures were evaluated, of which 73 (56%) were assessed as being implemented ongoingly or completed, 46 (36%) as partially implemented and 10 (8%) as not implemented.

The implementation of the measures was also evaluated with respect to the individual impacts of climate change (Chart 2). One or more impacts of climate change are assigned for each measure. The highest number of measures are linked to the impact of long-term drought (83 measures) and also to the impact of extreme temperature (78 measures), on the contrary the lowest number of measures are linked to the impact of floods and flash floods (35 measures).

At the lowest level of the National Action Plan on Adaptation to Climate Change in the Czech Republic, i.e. tasks specifying the responsibilities and activities leading to the implementation of measures and thus to meeting the set objectives, a total of 350 tasks were evaluated. Out of that number of tasks, according to the evaluation results, 240 tasks (68%) were continuously implemented or completed, 65 (19%) tasks were partially implemented and 45 (13%) tasks were not implemented (Chart 2).

Despite the fact that approximately half of the National Action Plan on Adaptation to Climate Change in the Czech Republic measures were assessed as being continuously implemented (or completed), the impacts of climate change are already observed in the Czech Republic and are deepening further, which has an impact on the national economy, population and ecosystems. Based on a detailed vulnerability assessment (Figure 2) the population and the sectors of forestry and agriculture are the most affected by climate change in the Czech Republic. The impacts of climate change, which represent the greatest risk for the Czech Republic, include rising and extreme temperatures and long-term drought on the one hand, and floods on the other hand. It can therefore be stated that the individual areas of the national economy are not fully adapted.

Table 2

Overview of the achievement of the National Action Plan on Adaptation to Climate Change in the Czech Republic specific objectives

Specific objective 1	Supporting the natural adaptation capacity of forests and strengthening their resilience to climate change	Implemented partially
Specific objective 2	Protection and restoration of natural water regime in forests	Implemented partially
Specific objective 3	Improving the effectiveness of land consolidation with regard to climate change	Implemented partially
Specific objective 4	Ensuring and preserving genetic resources in agriculture	Implemented on an ongoing basis
Specific objective 5	Stopping soil degradation by excessive erosion, nutrient depletion, loss of organic matter and compaction	Implemented partially
Specific objective 6	Reducing the occurrence and impacts of agricultural drought	Implemented partially
Specific objective 7	Strengthening the stability and biodiversity of agroecosystems	Implemented partially
Specific objective 8	Ensuring the sustainability and production function of farming in the landscape to reduce the negative impacts of climate change	Implemented partially
Specific objective 9	Improving risk management in agriculture	Implemented partially
Specific objective 10	Improving rainwater management in urbanized areas by using the rainwater	Implemented partially
Specific objective 11	Increasing natural retention capacity of watercourses and floodplains	Implemented partially
Specific objective 12	Effective protection and use of water resources	Implemented partially
Specific objective 13	Mitigation of flood consequences in urbanized areas	Implemented partially
Specific objective 14	Strengthening environmental stability and reducing the risks associated with temperature and air quality in urbanized landscapes	Implemented partially

Specific objective 15	Adaptation of buildings to climate change	Implemented partially
Specific objective 16	Promoting the adaptability of settlements by reducing the footprint of urbanized areas	Implemented partially
Specific objective 17	Increasing the ecological-stabilizing functions and permeability of the landscape	Implemented partially
Specific objective 18	Conceptual extension of nature protection with the perspective of climate change	Implemented partially
Specific objective 19	Reducing the spread of invasive species	Implemented partially
Specific objective 20	Ensuring research, prevention, health care and elimination of infectious and non-infectious diseases	Implemented partially
Specific objective 21	Managing and developing environmentally responsible and sustainable tourism with regard to climate change	Implemented on an ongoing basis
Specific objective 22	Strengthening the knowledge base of mutual relations and impacts of climate change on tourism	Not implemented
Specific objective 23	Ensuring transport sector flexibility and reliability with regard to climate change, ensuring operation after extreme weather events	Implemented partially
Specific objective 24	Ensuring the safety of industrial installations in view of the expected impacts of climate change	Implemented on an ongoing basis
Specific objective 25	Securing strategic reserves of the Czech Republic	Implemented on an ongoing basis
Specific objective 26	Ensuring the possibility of island operation	Implemented partially
Specific objective 27	Ensuring high resilience of the Czech transmission network, diversification of transport routes and source territories	Implemented on an ongoing basis
Specific objective 28	Renewable energy sources resilient to the impacts of climate change	Implemented partially
Specific objective 29	Population protection, early warning system for emergencies	Implemented on an ongoing basis
Specific objective 30	Development and strengthening of the Integrated Rescue System	Implemented partially
Specific objective 31	Increasing the critical infrastructure protection	Implemented partially
Specific objective 32	Increasing environmental security	Implemented on an ongoing basis
Specific objective 33	Enhancing security research and development	Implemented partially
Specific objective 34	Education and awareness with regard to climate change	Implemented partially

Data source: CENIA according to the documents from individual coordinators

Chart 2

Overview of the implementation of the National Action Plan on Adaptation to Climate Change in the Czech Republic measures by the individual impacts of climate change

Data source: CENIA according to the documents from individual coordinators

Figure 2

Synthesis of vulnerability of the Czech Republic to the effects of climate change, evaluation as of 2017

Data source: CENIA

Global context

National and international environmental conditions and the policies linked to them cannot be fully understood, nor properly managed, without the identification of new trends, pressures, technologies and principles that are and and may be of environmental importance in the future.

Long-term environmental scenarios mainly include IPCC emission scenarios and climate change development as a key factor. Global megatrends will change the future European models of consumption and affect the European climate and the environment. In this respect, several basic global megatrends have been identified (Box 1), some of which are already foreseen in the environmental management. For example, global climate change, biodiversity loss, or chemicals in the environment. Weak signals and emerging technologies are another important area affecting the state and management of the environment, the substantial ones include genome editing, false environmental reports, bioplastics, blockchain, carbon capture, precision farming, and geoengineering.

Box 1

Global megatrends

Increasingly severe consequences of climate change: Changes in the concentration of greenhouse gases in the atmosphere disturb the planet's energy balance. This brings about intense weather events, changes in rainfall patterns, desertification, shift in vegetation zones, glacier melting, ocean level rising and environmentally conditioned migration.

Opposing global population trends: From the 1960s, the population doubled to 7 billion and should continue to grow (until 2050 to 9.6 bil.), even though the population in advanced economies is aging, and even reduces at some places. On the contrary, in the least developed countries, the population increases rapidly.

Urbanization growth: Half the world's population lives in urban areas. By 2050, thanks to megacities and slums, it will be 67% of the population. Smart investments can, along with urbanisation, strengthen innovative solutions of environmental problems, but the use of resources and the production of pollution can also increase.

Changing disease burdens and risk of pandemics: The risk of exposure to new, newly emerging and reoccurring diseases and new pandemics is associated with poverty and grows with the climate change and the increasing mobility of people and goods.

Accelerating technological change: New technologies are radically changing the world – nanotechnology, biotechnology, information and communication technologies. The technological development allows more efficient use of raw materials, but also brings risks and uncertainty.

Continued economic growth: While the recent economic recession in Europe still dampens economic optimism, most studies assume a steady economic growth for the coming decades – accelerating consumption and use of resources, especially in Asia and Latin America.

Increasingly multipolar world: In the past, the global production and consumption was dominated by a relatively small number of countries. Today there is a significant regrouping of economic forces, as particularly Asian countries come to the forefront, which has an impact on international trade and economic interdependence.

Intensified global competition for resources: With the growth of the economy there is also the growth in consumption of renewable and non-renewable biological resources stocks of minerals, metals and fuels. This increase in demand is contributed to by the development of industry and the changing patterns of consumption. The consumption of materials has increased 10 times since 1900, and by 2030 it will most probably be doubled. In recent years there is a mass acquisition of land, most frequently, rich countries are buying land in developing countries. Between 2000 and 2050, global water consumption will increase by 55%, mainly due to industrial production.

Growing pressures on ecosystems: The growth of the human population, and therefore the production of food and energy, will continue to be at the expense of global biological diversity and natural ecosystems – which shall most of all influence poor citizens of developing countries. By 2050, the biodiversity will be reduced by 10% and 13% of long-lived forests will be lost.

Increasing environmental pollution: Around the world today ecosystems are subjected to a critical level of pollution with the increasingly complex components. Human activity, population growth in the world and changes in consumption patterns are the main incentives of such growing environmental burden.

Diversifying approaches to governance: A mismatch between a still longer-term global challenges and more and more limited possibilities of effective measures creates a demand for new approaches to management, where businesses and civil society will play a greater role. These changes are necessary, but raise concerns with regard to coordination, efficiency, and accountability.

Data source: EEA, 2015. The European environment – state and outlook 2015

International environmental management

The Czech Republic has gradually built a position of an active and respected participant of international relations in the field of environmental protection and sustainable development in a number of international organisations. The most important in terms of monitoring the state of the environment is the United Nations Environment Programme (UNEP), which issues reports on the state of the environment in the world, so-called Global Environmental Outlook[1]. In addition to UNEP, a report on the state of the environment is also issued by the Organisation for Economic Cooperation and Development (OECD). Its latest release is from 2012 and covers the period up to 2050.

United Nations Environment Programme (UNEP)
UNEP is the leading environmental authority indicating the global environmental agenda. In particular, it promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as the voice of the world's environment.

UNEP's work includes:
• analysis of global, regional and national trends and state of the environment,
• developing international and national environmental instruments,
• strengthens the institution for wiser management of the environment.

United Nations Environment Assembly (UNEA):
• is the supreme body of UNEP and the global authority of international environmental governance,
• the Assembly addresses the most pressing problems of the global ecosystem.

Organisation for Economic Co-operation and Development (OECD)
The main mission of the OECD is to provide the governments of the Member States a scope to allow comparison with the experience of the implementation of government policies and the search for answers to common problems. Ministry of the Environment of the Czech Republic is represented in the Committee on the environment and the Committee on chemicals, while within the committees working groups are created, which is also an active member of the Ministry of the Environment of the Czech Republic.

European Environment Agency (EEA)
It is an agency set up in the framework of the EU, its members are also some non-EU countries. The aim of the EEA is to promote sustainable development through providing and sharing information, knowledge and capacity building in the field of the environment. The National Coordinator for cooperation is CENIA, within the Management Board the Czech Republic represented by the Ministry of the Environment of the Czech Republic.

Information provided by the EEA is from a wide spectrum of sources of the European Environment Information and Observation Network, the so-called EIONET, which is made up of individual experts, the so-called National Reference Centres (NRC), and European thematic centres, the so-called ETC. In 2018, there was a total of 6 ETCs, each with representation of Czech institutions, which is exceptional in the European context:
• European Topic Centre on the Inland, Costal and Marine Waters (ETC/ICM)
• European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM)
• European Topic Centre on Spatial Information and Analysis (ETC/SIA)
• European Topic Centre on Biological Diversity (ETC/BD)

[1] Global Environmental Outlook 6 (GEO 6) was released in March 2019.

• European Topic Centre on Climate Change Impact, Vulnerability and Adaptation (ETC/CCA)
• European Topic Centre on Waste and Materials in a Green Economy (ETC/WMGE)

Visegrad Group (V4)
• within the Visegrad Group, comprised of the Czech Republic, Hungary, Poland, Slovakia, there is a mutual cooperation on the basis of consultations and regular meetings at various levels (Presidents, Prime Ministers, ministers, experts, etc.),
• V4 countries primarily coordinate their positions to presented proposals for EU legislative and policy documents, and in the area of the environment they often work together with Bulgaria and Romania.

The Czech Republic presided over V4 from 1 July 2015 to 30 June 2016; its next presidency will run from 1 July 2019 to 30 June 2020. The main objective of the Czech presidency should be to strengthen the position of the V4 countries in the EU and NATO, while strengthening the unity and coherence of the two organizations. The environmental priorities of the Czech presidency in V4 will include air quality and its relation to health, international trade in endangered species of wild fauna and flora, adaptation measures in the landscape, light pollution and implementation of the Agenda 2030.


© Jarmila Cikánková/CENIA

The Czech Republic is a contracting party to several dozens of important multilateral and bilateral environmental agreements. The treaties, negotiated very often in the framework of international organisations with an environmental segment, are a specific manifestation of the responsibility of the States for the state and development of the environment at the global, regional and subregional levels. By ratifying the treaties, the States commit to delivering their objectives. The Czech Republic currently has 77 bilateral agreements concluded with a total of 32 countries. In terms of multilateral relations at the international level, the Czech Republic is active in the treaties aimed at:
• **climate change:** the United Nations Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement;
• **nature and landscape protection:** the Convention on Biological Diversity, the UN Convention to Combat Desertification, the European Landscape Convention, the Convention on the Protection and Sustainable Development of the Carpathians, the Convention on Wetlands of International Importance, the Antarctic Treaty[2], the Protocol on Environmental Protection to the Antarctic Treaty, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization; the Cartagena Protocol on Biosafety, the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety;
• **species protection:** the Convention on the conservation of migratory species of wild animals, the Agreement on the Conservation of African-Eurasian Migratory Waterbirds, the Convention on the Conservation of European Wildlife and Natural Habitats, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Agreement on the Conservation of Populations of European Bats, the Memorandum of Understanding on the protection of the Central European Population of the Great Bustard, the Memorandum of Understanding for the Protection of Birds of Prey and Owls of Africa and Eurasia, the International Convention on the Regulation of Whaling;
• **air protection**: the Convention on Long-Range Transboundary Air Pollution; the Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, the Protocol concerning the Control of Emissions

[2] *The Czech Antarctic Research Station of Johann Gregor Mendel (James Ross Island) is located in Antarctica.*

of Nitrogen Oxides or their Transboundary Fluxes, the Protocol on the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, the Protocol on further reduction of sulphur emissions, the Protocol on Heavy Metals, the Protocol on Persistent Organic Pollutants, the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone;

- **protection of the ozone layer:** the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer;
- **water protection:** the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, the Protocol on Water and Health;
- **chemical substances and the risks to the environment:** the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the Stockholm Convention on Persistent Organic Pollutants, the Minamata Convention on Mercury, the Cartagena Protocol on Biosafety;
- **waste:** the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- **industrial accidents:** the Convention on the Transboundary Effects of Industrial Accidents;
- **horizontal issues** – the public access to the environmental information, the environmental impact assessment: the Convention on Access to Information, the Public Participation in Decision-Making and Access to Justice in Environmental Matters, the Protocol on Pollutant Release and transfer Registers, the Convention on Environmental Impact Assessment in a Transboundary Context, the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context.

© Jiří Valta/CENIA

Glossary of terms

Acidification. It is a process in which the environment is acidified. It is primarily caused by emissions of acidifying substances (i.e. sulphur oxides, nitrogen oxides and ammonia) into the atmosphere.
Agricultural Land Resources. The agricultural land resources consist of land that is cultivated in agriculture, i.e. arable land, hop-gardens, vineyards, gardens, fruit orchards, meadows, pastures (i.e. "agricultural land") and land that was and should continue to be cultivated by agriculture, but is not cultivated at present (i.e. "temporarily uncultivated land"). The agricultural land resources also includes ponds to breed fish and water poultry and non-agricultural land required for the provision of agricultural production, such as field paths, plots with irrigation devices, irrigation reservoirs, drainage furrows, dams to protect against flood or water logging, anti-erosion terraces, etc.
AOT40. The limit value for ground-level ozone levels from the perspective of ecosystem and vegetation protection. It refers to the accumulated ozone exposure over the threshold of 40 ppb. The AOT40 cumulative exposure to ozone is calculated as the sum of the differences between the hourly ozone concentration and the threshold level of 40 ppb (= 80μg.m^{-3}) for each hour in which the threshold value was exceeded. The AOT40 is calculated from ozone concentration measurements taken every day between 8.00 and 20.00 CET over a three-month period from May to July.
AOX. Adsorbable organically-bound halogens. The summary indicator AOX is expressed in chlorides as the equivalent weight of chlorine, bromine, and iodine contained in organic compounds (e.g., trichloromethane, chlorbenzene, chlorophenols, etc.), which, under certain conditions, adsorb onto activated carbon. The main source of these substances is the chemical industry. While poorly degradable and water-soluble, these compounds are soluble in fats and oils, and thus easily accumulate in adipose tissues.
Areal temperatures and precipitation totals. Values of individual weather elements related to a particular territory, representing the mean value of the element in this area.
Assimilation organs. Parts of plants primarily ensuring photosynthesis (most often leaves, needles).
Bactericides. Antimicrobially active substances intended to exterminate bacteria.
Alkaline nutrients. Cations of calcium, magnesium, sodium and potassium in the sorption complex of the soil.
Biomass. As a general concept, biomass includes all organic material that participates in the energy and element cycles within the biosphere. It includes mainly substances of plant and animal origin. For the purposes of the energy sector, biomass is considered plant material that can be utilised for energy (e.g. wood, straw, etc.) and biological waste. The energy accumulated in the biomass originates from the sun, similar fossil fuels.
Biotope. A set of all biotic and abiotic agents that together create the environment of a particular organism or group of organisms. In the Czech Republic, there are 157 types of natural biotopes as defined in the Catalogue of Biotopes of the Czech Republic. The basic groups of biotopes are watercourses and reservoirs, wetlands and coastal vegetation, spring areas and peatland, rocks, debris and caves, alpine forest-free areas, secondary lawns and heaths, shrubs and forests.
BMW. Biodegradable municipal waste is a biodegradable component of municipal waste, such as food and garden waste, and paper and cardboard, which undergoes anaerobic or aerobic decomposition.
BOD_5. Biochemical oxygen demand measured over a five day period. BOD_5 represents the amount of oxygen consumed by microorganisms during the biochemical oxidation of organic substances over five days under aerobic conditions at a temperature of 20 °C. It is thus an indirect indicator of the amount of biodegradable organic pollution in water.
BPEJ. The evaluated soil-ecological unit (BPEJ) is a five-digit numeric code associated with agricultural land plots. It expresses the main soil and climatic conditions, which affect the production capacity of agricultural land and its economic value.
Circular economy. The sustainable development concept, which creates functional and healthy relationships between nature and the human society. With a perfect closing of the flows of materials in long-running cycles, it opposes the current linear system where raw materials are transformed into products, sold and after the end of their life incinerated or landfilled. It represents a comprehensive system optimizing the manufacturing processes and technology, consumption and treatment of natural resources and waste. Instead of the extraction of minerals and growing landfills, it supports waste prevention, it reuses products, recycles them and transforms them into energy.
Climate conditions (climate). This is the long-term weather conditions that are determined by the energy balance, atmospheric circulation, the character of the active surface and human activities. Climate is an important component of natural conditions of any specific location. It affects the landscape and its use for anthropogenic activities. It is geographically contingent and it reflects the latitude, altitude and degree of ocean influence.
Climatological normal. A special kind of average used in climatology to assess the state and evolution of climatological elements (e.g. air temperature, precipitation, air pressure and other). The length of the normal period is 30 years, according

to WMO's recommendation the currently used normal period is 1981–2010.
Cloven-hoofed game. Hunting even-toed ungulates. Ruminants (e.g. deer, fallow deer, roe) and wild boar.
CO_2 eq. This carbon dioxide emission equivalent measures aggregate greenhouse gas emissions. It expresses any greenhouse gas unit converted to CO_2 radiative forcing unit that is counted as 1, the coefficient for CH_4 is 25, for N_2O it is 298. The radiative forcing of F-gases is orders of magnitude higher than that of CO_2.
COD_{Cr}. Chemical oxygen demand determined by the dichromate method. COD_{Cr} is the amount of oxygen consumed in the oxidation of organic substances (including substances biochemically non-degradable) in water through an oxidizing agent – potassium dichromate under standard conditions (two hours of boiling in a 50% acid with a catalyst). It is therefore an indirect indicator of the amount of all organic pollution in water.
Contaminated site. A severe contamination of the rock environment, groundwater or surface water, soil or building structures and soil air, which occurred due to negligent handling of dangerous substances in the past and which might endanger the health of humans and the environment. The discovered contamination can be considered an old environmental burden only if the originator of the contamination does not exist or is not known, and this rule must be respected even in the case of the legal successor to the originator of the contamination. Contaminated sites may be of different nature – they may be landfills, industrial and agricultural areas, small retail outlets, unsecured warehouses of hazardous substances, former military bases, areas affected by mining of mineral resources or abandoned and closed mining waste repositories posing serious risks.
CORINE Land Cover. An EU programme aimed at collecting information about the environment. The CORINE Land Cover database describes the land cover using remote sensing methods.
Day-degrees. It is a unit of characterizing the heating season. It is calculated as the product of the number of heating days and the difference between the average indoor and outdoor temperature. Therefore, it shows how cold or warm a given period of time was and how much energy is needed to heat the buildings.
Decade. In climatology this term is referred to a set of ten consecutive days within a month. The first decade always begins on the first day of the month and each month is therefore divided into three decades. In general terms, the decade is a set of ten consecutive years.
Decoupling. The separation of the economic growth curve from the environmental pressure curve. Decoupling reduces the specific environmental pressure per unit of economic output. It can be either absolute (performance of the economy grows while the pressure decreases) or relative (economic output grows, while the pressure also grows, yet at a slower rate).
Defoliation. The relative loss of assimilation capacity in the tree crown compared to a healthy tree growing in identical vegetation and habitat conditions.
Desiccants. Products used for the removal of excess moisture.
Digestate. The residue from the anaerobic fermentation process occurring in biogas production. Digestate fertilisation is similar to the organic fertilisation. Nevertheless, it is always advisable to take into account the actual nitrogen content. Compared to organic fertilisers, digestates usually have higher total nitrogen content in the original mass.
Domestic material consumption (DMC). DMC is calculated as domestic extraction used minus exports plus imports. It measures the amount of materials (raw materials, semi-finished products and products) consumed by the economy for production and consumption.
Ecological stability. The ability of an ecosystem to counterbalance changes due to external factors and to maintain its natural features and functions.
Ecosystem Services. The benefits that people obtain from ecosystems. They are divided into production services (food, wood, medicines, energy), regulating services (regulation of floods, drought and diseases, land degradation), supporting services (soil formation and nutrient cycling) and cultural services (recreational, spiritual and other nonmaterial benefits).
Ecotype. A genetically distinguishable part (population) of a species showing adaptability to a given environment.
Emissions. Pollutants emitted from anthropogenic sources to the atmosphere.
Erosion. A complex process involving the disruption of the soil surface, its transport and re-sedimentation of the loosened soil particles. Under normal conditions, it is a process which is natural, gradual and fully in accordance with the soil-forming process. Human activity, however, creates triggering conditions for the so-called anthropogenically conditioned accelerated erosion of agricultural land.
EU-ETS. The European Union Emission Trading System. One of the key instruments of the EU greenhouse gas emission reduction policy. The system covers large industrial and energy enterprises, its legislative basis is laid down in the Directive 2003/87/EC of the European Parliament and of the Council.
Eutrophication. The process of enriching ecosystems with nutrients, especially nitrogen and phosphorus. Eutrophication is a natural process where the primary source of nutrients is the weathering of rocks and input from the atmosphere. Excessive eutrophication is caused by human activities. The source of nutrients is the rinsing of fertilizers from agricultural land, discharge of sewage, fishpond farming, air pollution, etc. In aquatic ecosystems, excessive eutrophication leads to overgrowth of cyanobacteria and algae and consequently to oxygen deficiency. Soil eutrophication distorts its original communities.
Evidence System of Contaminated Sites. Evidence System of Contaminated Sites is a public database, which contains information on localities where old environmental burdens are present, i.e. contaminated sites addressed especially by

projects of the Ministry of Finance of the Czech Republic, the Ministry of the Environment, the Operational Programme Environment, and also information on the removal of the old environmental burdens resulting from Soviet army presence in the Czech Republic and priority locations addressed by the Czech Environmental Inspectorate. It also includes test data from the district authorities existing at the time of the database inception in 2004 and landfill sites closed before the adoption of Act No. 238/1991 Coll., on waste. The Evidence System of Contaminated Sites database does not include information on remedial actions implemented by the regions, State Environmental Fund of the Czech Republic, other ministries and does not record any private investors.

Frost day. A day on which the minimum daily air temperature is below 0 °C.

Fungicides. Plant protection products intended to control fungi.

Government institutions. All institutional units whose competency extends either on the whole economic territory of the Czech Republic (central government, e.g. ministries or state funds) or on certain defined territory of the Czech Republic (local government, such as: territorial self-governing units represented by the regional, urban and municipal authorities or associations of municipalities).

Hazardous waste. Waste showing one or more of the hazardous properties listed in an annex of the directly applicable European Union legislation on hazardous properties of waste (Commission Regulation (EU) No. 1357/2014 of 18 December 2014, replacing Annex III to European Parliament and Council Directive 2008/98/EC on waste and repealing certain directives).

Heat wave. Continuous period of 3 days or more, when the maximum daily air temperature in the summer period in a certain location exceeds the long-term average of the maximum daily air temperature for that location recorded in the normal period (1981–2010) by more than 5 °C.

Heating season. It is characterized by the "day-degree" unit, which is the product of the number of heating days and the difference between the average indoor and outdoor temperature. The day-degree thus illustrates how cold or warm it was during a certain period of time and the quantity of energy needed to heat the buildings.

Herbicides. Products intended for the disposal of unwanted plants, such as weeds or invasive plants.

Ice day. A day on which the maximum daily air temperature does not rise above 0 °C, frost lasts all day.

Indirect greenhouse gas emissions. CO_2 and N_2O emissions, which are produced by chemical reactions in the atmosphere from NO_x, NH_3, CO and NMVOCs. These emissions are therefore quantified in the emission inventories and are included in the national emissions balance.

Insecticides. Plant protection products intended to control insects.

Investment in environmental protection (= investment expenditure). Investment expenditure on environmental protection includes all expenditures on the acquisition of tangible fixed assets, spent by the reporting entity in order to acquire tangible fixed assets (by purchase or their own activities), together with the total value of tangible fixed assets acquired free of charge, or not transferred under applicable legislation, or reassigned from private use to business use.

Landscape fragmentation. The division of compact parts of the landscape into smaller parts, which decreases its ecological stability.

Lime fertilisers. Calcium for the production of lime fertilizers is obtained from carbonate rocks and magnesium carbonate rocks that naturally formed from calcium that had been released from minerals. Another source of lime fertilisers are waste materials from industry – carbonation sludge, cement dust, phenol lime, etc., and natural lime fertilisers of local importance. Lime material is used as fertiliser either directly (possibly after mechanical processing) or in the form of fertilisers produced through a chemical process (burnt lime, slaked lime, etc.).

Livestock manure. Fertilisers in the form of livestock excrements, including plant residues, compost, straw, tops and green manure. Their main component are organic substances of plant and animal origin (carbohydrates, cellulose, amino acids, proteins, etc.). Along with these substances, organic fertilisers also contains nutrients (N, P, K, Ca, Mg and other).

LULUCF. The category covering emissions and removals of greenhouse gases resulting from land use, land use changes and forestry. This category is usually negative for countries with high forest cover and low levels of logging, and positive for countries with low forest cover or where rapid changes in landscape towards cultural landscape are taking place.

Megatrend. Long-term transformative processes that, in the longer time horizon, have an impact on human thinking, activities, organization of the society and the future reality of the world.

Mineral fertilisers (inorganic, industrial, chemical fertilisers). Fertilisers containing nutrients in the form of inorganic compounds obtained through extraction and/or physical and/or chemical industrial processes.

Mixed municipal waste. The waste that remains after the separation of recoverable components and hazardous components from municipal waste, sometimes also called "residual" waste.

Municipal waste. Are all of the waste generated in the territory of the community during activities of natural persons who are listed as municipal waste in the Waste Catalogue, with the exception of waste arising from legal entities or natural persons authorised to undertake business.

Non-hazardous waste. Waste not showing any of the hazardous properties listed in an annex of the directly applicable European Union legislation on hazardous properties of waste (Commission Regulation (EU) No. 1357/2014 of 18 December 2014, replacing Annex III to European Parliament and Council Directive 2008/98/EC on waste and repealing certain directives).

Non-investment costs on environmental protection. Common or operating expenses, which include payroll costs, payments for material and energy consumption, repairs and maintenance, etc. and payments for the services whose main purpose is the prevention, reduction, modification or removal of pollution and pollutants, etc. or other degradation of the environment, which are generated by the production process of a given business.
Normality of temperature and precipitation. Indicates to what extent the course of temperature and precipitation in a reporting period is different from the climatological normal (1981–2010) and the probability (repetition time) with which the measured values of the temperatures and precipitation occur. The values of the deviations from normal temperatures and normal rainfall between the 25^{th} and 75^{th} percentile are referred to as normal values, the values between the 25^{th} and 10^{th} as below-normal, values between the 75^{th} and 90^{th} percentile as above-normal, values below the 10^{th} and over the 90^{th} percentile as significantly below/above-normal and values below the 2^{nd} and above the 98^{th} percentile as extremely below/above-normal. Statistically thus a normal year (month) occurs every 2 years, whereas exceptionally below/above-normal once every 50 years.
PCB. Polychlorinated biphenyls is the collective term for 209 chemically related compounds (congeners), which differ in the number and position of chlorine atoms bound to the biphenyl molecule. They had a wide range of commercial use in the past. Their production was banned due to their persistence and bioaccumulation ability. The most harmful effects of these substances include carcinogenic effects, damage to the immune system and liver and reduced fertility.
PEFC and FSC certification. Certification systems based on the principles of sustainable management in forests.
Physical foreign trade balance (PTB). Balance between physical imports of raw materials, materials and products, and physical exports. An increasing positive balance goes hand in hand with growing material dependence on foreign countries (as a whole or in a given material group), a negative balance indicates the export character of the economy in a given material group and the excess of domestic production (extraction) over consumption.
Persistent organic pollutants (POPs). POPs are substances that remain in the environment for a long period of time. They accumulate in the fatty tissues of animals and enter human organisms through the food chains. Even in very small doses, they can cause reproductive disorders, affect hormonal and immune functions and increase the risk of cancer.
Population equivalent. Population equivalent is a number expressing the size of a municipality as a pollution source through converting pollution from facilities and other pollution sources to the amount of population that would be needed to produce the same amount of pollution. One population equivalent corresponds to the production of 150 l wastewater and 60 g BOD_5 (organic pollution) per day.
Primary energy sources (PES). PES are the sum of domestic or imported energy sources, expressed in energy units. Primary energy sources are one of the basic indicators of energy balance.
Private non-financial corporations. All non-financial corporations, which are not controlled by governmental institutions, i.e. are privately owned. They are commercial companies, non-profit companies or non-profit institutions providing services for non-financial corporations (Association of entrepreneurs, etc.).
Public non-financial corporations. All non-financial corporations, which are controlled by government institutions. They are mainly state-owned enterprises and enterprises with the prevailing state participation (companies), the Fund of Market Regulation (or the State Agricultural Intervention Fund), the Support and Guarantee Fund for Farmers and Forestry and contributory organisations, public benefit companies and public companies, which are market manufacturers.
Q_{355}. The flow rate of a watercourse, which is reached or exceeded on average on 355 days of the year.
Renewable energy sources. These sources are called "renewable" because they constantly replenish themselves thanks to solar radiation and other processes. From the perspective of human existence, direct sunlight and some of its indirect forms are "inexhaustible" energy sources. RES include wind energy, solar energy, geothermal energy, water energy, soil energy, air energy, biomass energy, landfill gas energy and sludge gas and biogas energy.
Rodenticides. Chemical substances intended to control rodents.
Steam power plant for solid fuel. Steam power stations are generally those that use steam to drive the generator of electricity, whereas water vapour is extracted by heating the water that occurs by burning fuels or nuclear reactions. In this document, however, the category of steam power plants using solid fuel is taken from the statistics of the Energy regulatory office (where it is referred to as the "steam" category) and includes thermal power plants that burn, in our conditions, particularly brown coal. Nuclear power plants are then listed in a separate category.
Stocking level. It is calculated as the ratio of the actual circular base of a forest stand to the base set out in tables. It shows the use of the growth environment of forest stands.
Summer day. A day on which the maximum daily air temperature reaches or exceeds 25 °C.
Suspended particles. Solid or liquid particles that remain in the atmosphere for a long time due to their negligible stalling speed. Particles in the air pose a significant risk factor for human health.
Territorial analysis materials. The obligation to create territorial analysis materials is imposed by Act No. 183/2006 Coll., on spatial planning and the building code (the Building Act). According to Annex 1 to Decree No. 500/2006 Coll., on territorial analysis materials, planning documentation and methods of recording planning activities, as amended by Decree No. 458/2012 Coll., this is phenomenon No. 64 – old burdens in the territory and contaminated areas. The first data for

territorial analysis materials were submitted to the authorities of spatial planning in 2007. In accordance with the Building Act, also the ongoing updates of the Evidence System of Contaminated Sites database (http://www.sekm.cz/) are promptly and immediately made available to the spatial planning authorities.

Throughfall. Rainwater captured beneath the tree crown cover. It is enriched with substances rinsed off the leaf surface.

Total eligible expenditure. In the context of the Operational Programme Environment, it is a sum of funding from the Cohesion Fund, the European Regional Development Fund, other (national) public sources and private sources of financing.

Transport performance. The number of passengers or the weight of cargo transported over a distance of 1 kilometre. It is measured in “passenger-kilometres” (pkm) and “tonne-kilometres” (tkm).

Tropical day. A day on which the maximum daily air temperature reaches or exceeds 30 °C.

UAT. Unfragmented Areas by Traffic. It is a method of determining “areas that are unfragmented by traffic”, i.e. areas which are delimited by roads with traffic intensity higher than 1,000 vehicles per 24 hours or multi-track railways, and are larger than 100 km^2.

Waste. Each movable thing that a person discards or intends or is obliged to discard.

Weak signal. A potentially emerging problem or factor that does not seem very important in the present, but may become a trigger for significant events in the future.

Zoocides. Plant protection products intended against animals that can cause damage to plants.

© Zbyněk Stein/CENIA

List of abbreviations

AOT40 Accumulated Ozone exposure over a Threshold of 40 ppb
AOX Adsorbable Organically Bound Halogens
AWC available water capacity
B(a)P benzo(a)pyrene
BAT Best Available Techniques
BMW biodegradable municipal waste
BOD_5 biochemical oxygen demand over five days
BRICS a group of economically emerging countries consisting of Brazil, Russia, India, China and South Africa
BSM basal soil monitoring
c.p. current prices
CENIA CENIA, Czech Environmental Information Agency
CF Cohesion Fund
CNG Compressed Natural Gas
COD_{Cr} chemical oxygen demand by potassium dichromate
Cp protective vegetation influence factor
CRE Cadastre of Real Estate
CSN Czech technical standard
CZ Czech Republic
CZK Czech crowns
CZ-NACE Classification of Economic Activities (Nomenclature génerale des Activitiés économiques dans les Communautés Européennes)
DDT dichlorodiphenyltrichloroethane
DG Directorate General
DMC domestic material consumption
ECMWF European Center for Medium-Range Weather Forecast
EEA European Environment Agency
ETC European Topic Centre
EU European Union
EU25 Member States of the European Union (1 May 2004 – 31 December 2006)
EU28 Member States of the European Union (from 1 July 2013)
EUA European Union Allowances (European emission allowances)
EUAA European Union Aviation Allowances (European emission allowances allocated to aircraft operators)
EU-ETS European Union Emission Trading System
FAME Fatty Acid Methyl Ester
FC coliform bacteria
FSC Forest Stewardship Council certification system
GDP gross domestic product
GVA gross value added
HCH hexachlorocyclohexane
ICP Forests International co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
IEA International Energy Agency
IED Industrial Emissions Directive
IPCC Intergovernmental Panel on Climate Change
ISPA Instrument for Structural Policies for pre-Accession (financial assistance instrument in support of investment projects)
IUCN International Union for Conservation of Nature
KRNAP Krkonoše Mountains National Park
LPG Liquefied Petroleum Gas
LPIS Land Parcel Identification System
LULUCF Land Use, Land-Use Change and Forestry
LV limit value

MA ISOH Car Wrecks Module of the Waste Management Information System
NP National Park
OECD Organisation for Economic Co-operation and Development
p.p. percentage point
PA priority axis
PAH polycyclic aromatic hydrocarbons
PCB polychlorinated biphenyls
PE population equivalent
PEFC Programme for the Endorsement of Forest Certification Schemes (certification system)
PES primary energy sources
pkm passenger-kilometre
PLA Protected Landscape Area
PM suspended particles (particulate matter)
POPs persistent organic pollutants
Pp factor of effectiveness of erosion control measures
PPS Purchasing Power Standard
RES renewable energy sources
SHARES Short Assessment of Renewable Energy Sources
SPEI Standardized Precipitation Evapotranspiration Index
tkm tonne-kilometre
TSP total suspended particles
UAT Unfragmented Areas by Traffic
UNEA United Nations Environment Assembly
UNEP United Nations Environment Programme
UNFCCC United Nations Framework Convention on Climate Change
V4 Visegrad Group
VOC volatile organic compound
WEEE waste electrical and electronic equipment
WEI Water Exploitation Index
WHO World Health Organization
WMO World Meteorological Organization
WWTP Wastewater Treatment Plant

2018