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on the Environment of the Czech Republic

2020

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Ministry of the Environment of the Czech Republic

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List of cooperating organisations

Bohemian Switzerland National Park Administration
Central Institute for Supervising and Testing in Agriculture
Charles University Environment Centre
CzechInvest
Czech Astronomical Society
Czech Geological Survey
Czech Hydrometeorological Institute
Czech Office for Surveying, Mapping and Cadastre
Czech Society for Ornithology
Czech Statistical Office
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, Department of Environmental Studies
Ministry of Agriculture of the Czech Republic
Ministry of Finance of the Czech Republic
Ministry of Industry and Trade of the Czech Republic
Ministry of the Environment of the Czech Republic
Ministry of the Interior of the Czech Republic – General Directorate of the Fire Rescue Service of the Czech Republic
Ministry of Transport of the Czech Republic
National Institute of Public Health
National Reference Laboratory for Environmental Noise
Nature Conservation Agency of the 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
Programme for the Endorsement of Forest Certification Czech Republic
Railway Administration, state enterprise
Research Institute for Soil and Water Conservation
Road and Motorway Directorate of the Czech Republic
State Environmental Fund of the Czech Republic
Šumava National Park Administration
T. G. Masaryk Water Research Institute, public research institution
Transport Research Centre

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Introduction

The Report on the Environment of the Czech Republic (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, Government Resolution No. 446 of 17 August 1994, and Government Resolution No. 934 of 12 November 2014. It is submitted to the Government of the Czech Republic for approval and subsequently to the Chamber of Deputies and the Senate of the Parliament of the Czech Republic for debate.

The Report is a comprehensive document assessing the state of the environment in the Czech Republic from all aspects based on data available for the year under assessment.

Czech Environmental Information Agency, has been responsible for drawing up the Report on the Environment of the Czech Republic since the 2005 Report. The Report concept was revised in 2018. As a result, a detailed version of the Report is now prepared every two years, and in the intervening period the most important information on the state and development of the environment is published in concise form. The 2020 Report is one of those detailed versions. At the same time, the content concept and structure of the Report, based on the State Environmental Policy of the Czech Republic 2030 with a view to 2050, has been changed to enable the continuous assessment of its indicators and meet the set goals and priorities. The main areas are based on the State Environmental Policy 2030 (1. Environment and health, 2. Climate-neutral and circular economy, 3. Nature and landscape) and are framed by other topics central to the state and development of the environment (Planetary boundaries, Climate change in the Czech Republic, Financing of environmental protection, Opinions and attitudes of the Czech public).

The 2020 Report was discussed and approved by the Government on 5 November 2021 and then submitted to both parliamentary chambers for debate. Because of the reporting and processing methodology used, at the time the Report was being drawn up some data sets for 2020 were not available or the data were only provisional. Information on data sets (the reasons for their unavailability and future updates) for which 2020 data were unavailable at the time of publication is provided in the relevant chapters.

The 2020 Report is also published electronically (http://www.cenia.cz, http://www.mzp.cz) together with the Statistical Environmental Yearbook of the Czech Republic 2020 and Reports on the Environment in the Regions of the Czech Republic 2020. Detailed data sources are available on the Information system of statistics and reporting portal ISSaR (https://issar.cenia.cz) and on the portal STaR (https://www.envirometr.cz).

Key messages of the Report

The year 2020, significantly impacted by the COVID-19 pandemic, was also unusual from the perspective of the environment. The downturn in economic activity, the reduction in the mobility of people and goods, as well as changes in household consumption patterns, have caused a partial decrease in anthropogenic pressures on the environment. A significant factor in recent years, and one reflected in the state of the environment, are the signs of climate change, which act both directly and indirectly by influencing economic burdens.

One major direct impact of climate change is the poor health condition of forests, which are vulnerable to these manifestations due to long-term economic exploitation that is completely different to natural processes. As a result of large-scale logging in connection with the bark beetle calamity, large areas have been cleared and forests have become a source of greenhouse gas emissions. Nevertheless, there is extensive regeneration of forests using a predominance of deciduous trees in the affected areas. Agricultural land is vulnerable to manifestations of climate change due to intensive farming based on the use of mineral fertilisers and plant protection products, excessively sized fields, and a high level of ploughing. In addition, the area of agricultural land has been declining in favour of built-up areas. The impact of intensive landscape management and climate change on biodiversity is growing. Many species are disappearing from Czech landscape, or the boundaries of their occurrence are shifting.

Year 2020 was a very warm year, but with higher precipitation compared to the previous two years. Nevertheless, soil and hydrological drought continued in parts of the country. The low water reserves accumulated in the snow cover and the deficit of precipitation in the spring months were reflected in subnormal states of flow rates and in significantly to extremely subnormal groundwater levels in most of the country.

In connection with climate change, the number of events caused by natural disasters is growing, mainly due to strong winds and flooding, which also significantly contribute to insurance losses registered by Czech insurance companies. Support for preparedness for weather extremes, respectively the impacts of climate change, including drought, is provided by a number of programmes from both national and European sources, as well as preventive educational activities.

Greenhouse gas emissions from large stationary combustion sources are decreasing, yet with the exception of 2020, greenhouse gas emissions from transport are increasing and emissions from waste continue to rise. Greenhouse gas emissions from the land use, land-use change and forestry (LULUCF) sector are significantly increasing due to poor forest health. Since 2018, forests have been a source of additional greenhouse gas emissions instead of storing carbon in biomass, as had formerly been the case.

In 2019, the Czech Republic had already met the emission ceilings set for 2020, including emissions of suspended $PM_{2.5}$ particulate matter. Although limit values for air pollutants are still being exceeded regionally, in 2020 the proportion of the country's territory and the share of the population affected by above-limit concentrations again decreased. Emissions of air pollutants from transport are decreasing as a result of the gradual renewal and modernisation of the vehicle fleet. The improvement in air quality in the last three years has been positively influenced by meteorological (especially dispersion) conditions, yet the impact of the introduction of modern technologies in manufacturing and the modernization of the composition of combustion equipment in households supported through the provision of boiler subsidies is also evident. No smog situation was announced in 2020.

The impact of the COVID-19 pandemic has been reflected in the most significant year-on-year decrease in water abstraction over the past five years. The treatment of waste water from point sources continues to improve, reflected in a significant decrease in total phosphorus and ammoniacal nitrogen in flowing waters. Pesticides that enter the water from intensively farmed agricultural land are a significant problem in terms of the quality of surface and groundwater.

In the energy sector, there has been a decline in domestic lignite extraction, and in 2020 – for the first time in history – more electricity was generated from nuclear sources than from lignite. The generation of electricity from renewable sources is also increasing, and has met the targets set for 2020 since 2013. Total electricity generation in 2020 was the lowest in 18 years, a result of lower domestic and foreign demand due to the COVID-19 measures. However, the decrease in the extraction of domestic energy sources has significantly increased the overall energy dependence of the Czech Republic, which is forced to import a larger amount of energy sources from abroad. Both primary and final energy consumption in 2019 were at levels that would meet the 2020 targets. However, the structure of primary energy sources still significantly differs from the targets set for 2040.

Transport remains dependent on fossil energy sources and is therefore carbon intensive, despite an increase in the use of alternative fuels and propulsion. Moreover, with the exception of 2020, energy consumption in transport has been growing, increasing the pressure exerted by transport on the climate system.

The material intensity of the economy is decreasing, meaning the economy needs fewer raw and other materials to create a unit of GDP. This is also associated with a decrease in environmental burdens associated with the acquisition and consumption of materials.

Efforts at reducing waste generation have not been successful, yet overall waste treatment is still dominated by material recovery, the share of which is increasing in accordance with circular economy principles and the current waste treatment hierarchy. In the case of municipal waste, however, landfilling continues to prevail despite significant efforts.

In terms of the adaptation of settlements to climate change, adaptation strategies are being prepared and implemented, but are progressing slowly. Solutions for rainwater management and the issue of increasing the adaptation capacity of settlements through support for the development of public greenery have only recently begun to be addressed. Most cities with more than 40,000 inhabitants already have approved sustainable mobility plans or strategic sustainable mobility frameworks, the implementation of which will contribute to reducing the negative impact of transport on health and the environment and to adapting cities to climate change.

In terms of financing environmental protection measures, we also note a continued increase in the volume of public expenditure on environmental protection in 2020. The successful use of funds from European sources through operational programmes, in particular from the Operational Programme Environment and the Rural Development Programme, continues. Examples of the successful financing of environmental protection measures include the implementation of the New Green Savings and Dešťovka (Rainwater) Programmes, and the already mentioned boiler subsidies.

Climate change in the Czech Republic

- The average annual temperature in the Czech Republic is growing at a rate of 0.35°C per decade. The year 2020 was significantly above normal in terms of temperature.
- Precipitation was above normal in 2020, reaching 112% of the 1981–2010 normal.
- The annual number of tropical days with temperatures above 30°C has more than doubled over the past 30 years to an average of 12 per year, highlighting the growing temperature extremes in the summer season.
- In the Poohří region, parts of Central Bohemia and South Moravia, soil moisture values fell below 10% of available water capacity in 2020, indicating significant soil drought. These are the areas where soil drought has also occurred in past years. However, the soil drought did not have an across-the-board character as in previous years, as it did not occur at all in higher altitudes and in most of Moravia and Silesia thanks to higher precipitation, and it also lasted for a shorter time in the affected areas.
- The dry winter of 2019 and the precipitation deficit in the spring of 2020 were reflected in subnormal states of flow rates in the monitored profiles and in a significantly to extremely subnormal level of groundwater levels in most of the territory, while on the other hand heavy precipitation in June and October caused flooding.

Water availability and quality

- In a water quality assessment according to Czech Technical Standard 75 7221, polluted water prevails for the two-year 2019–2020 period (quality class III).

- In the 2000–2020 period, the reduction in $N\text{-}NH_4^+$ pollution (a decrease in the average concentration of 74.5%) and P_{total} (a decrease of 46.3%) in the watercourses of the Czech Republic was most successful.

- In 2020, significant groundwater pollution was found in the sum of pesticides at a total of 200 sites (out of a total of 695 monitored sites).

- The share of the population connected to the public water supply has gradually increased – from 87.1% in 2000 to 94.6% in 2020.

- Total water abstraction has fallen by 24.3% since 2000. In 2020, total water abstraction amounted to 1,365.9 mil. m^3, a decrease of 9.3% compared to 2019.

- The number of waste water treatment plants (WWTPs) has been growing for a long time, and the share of WWTPs with a tertiary treatment stage is increasing. In 2020, a total of 2,795 WWTPs were operated in the Czech Republic, of which 58.2% had a tertiary treatment stage.

- 16.6% of the population is not yet connected to a sewer system terminated with a WWTP.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Water quality in watercourses	↗	→	→	~
Bathing water quality	↗	→	~↗	~
Groundwater quality	N/A	→	→	~
Population supplied with water from the public water supply	↗	↗	→	✓
Waste water treatment	↗	↗	↗	✓
Waste water discharge	↘	↘	↘	~
Groundwater and surface water abstraction by sector	↘	↘	↘	~
Water consumption from the public water supply and water losses in the water supply network	↘	→	→	~

Air quality

- Emissions of main air pollutants (NO_x, VOC, SO_2, NH_3 and $PM_{2.5}$) are decreasing in the long term. As part of the fulfilment of commitments (emission ceilings), the required reductions for all emissions for 2020 were achieved in 2019[1], including emissions of suspended $PM_{2.5}$ particulate matter.

- Emissions of NO_x, VOC and CO from transport are decreasing in the long term. In 2020, emissions of all monitored pollutants and greenhouse gases from transport decreased significantly year-on-year.

- Emissions from household heating are on a slightly downward trend, nevertheless households accounted for the largest share of total PM_{10} (55.1%) and B(a)P (96.4%) emissions in 2019[2].

- Some limit values are still being exceeded, but in 2020 there was a year-on-year decrease in the share of the population and the proportion of the country's territory where the daily limit values for suspended PM_{10} particulate matter and the annual limit values for B(a)P and $PM_{2.5}$ were exceeded. The limit values for the annual average PM_{10} concentration was not exceeded at all. Especially in the short term, there has been a very significant increase in the share of the population and territory affected by increased concentrations of ozone.

- The human health protection limit values set for arsenic, cadmium, lead, nickel, sulphur dioxide, carbon monoxide and benzene were not exceeded in 2020.

- No smog situation was announced in 2020.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Emissions of selected air pollutants	↘	↘	↘	✓
Emissions from transport*				
NO_x, VOC and CO emissions from transport	↘	↘	↘	✓
PM and N_2O emissions from transport	↝	↝	↝	~
CO_2 and PAH emissions from transport	↗	↗	↝	✗
Emissions from household heating	↝	↘	↘	✗
Compliance with limit values for selected pollutants	↝	→	↝	~
Air quality in terms of human health protection	↝	→	↝	~
Air quality in terms of ecosystem and vegetation protection	↘	→	→	✓

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

[1] *Final data for the year 2020 are not available at the time of publication. They will be published no earlier than February 2022.*

[2] *Data for the year 2020 are not available at the time of publication.*

Exposure of the population and the environment to hazardous substances

- Air emissions of heavy metals (except copper) and POPs are decreasing in the long and medium term.
- The remediation of 1,027 contaminated sites was completed in the 2010–2020 period while complying with remedial measure conditions, while the remediation of 437 sites was completed in 2020.
- The incremental Evidence System of Contaminated Sites database contained 11,036 sites in 2020.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Releases to water and soil and air emissions of selected hazardous chemicals	N/A	N/A	N/A	N/A
Air emissions of heavy metals and POPs*				
Air emissions of heavy metals	↘	↘	~↗	✓
Air emissions of POPs	↘	↘	↘	✓
Contaminated sites (evidence and remediation)	N/A	N/A	N/A	~

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Noise pollution and light pollution

- Noise pollution burden of the population decreased between 2012 and 2017[3] in terms of the exposure of the population to high noise levels above the limit value.
- However, there is still significant noise pollution from road transport in urban agglomerations with more than 100,000 inhabitants, above average in a Europe-wide comparison.
- In 2020, about 20 km of new motorways were put into operation and another almost 90 km of motorways were under construction. In 2020, CZK 405.0 mil. was invested in noise barriers on road infrastructure, while noise barriers are a standard part of new road construction.
- The level of light pollution is constantly worsening due to the increasing amount of illuminated areas.
- We can no longer find an area not affected by artificial illumination in the Czech Republic. However, there is no objective measurement that can monitor the development of light pollution over time.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Noise pollution burden of the population	N/A	N/A	↘	~
Noise protection measures in transport and development of transport infrastructure	N/A	↗	↗	~
Brightness of the night sky	N/A	N/A	N/A	~

[3] *Data for the year 2020 are not available at the time of publication. The noise situation in 2018–2020 will be assessed by the 4th round of Strategic Noise Mapping, the results of which will be available in 2022.*

Society preparedness for and resilience to emergencies

- To support preparedness for extreme weather or the manifestations of climate change, more than 1,100 projects worth more than CZK 10 bil. were approved in the Operational Programme Environment in the 2014–2020 programming period. At the Ministry of Agriculture of the Czech Republic, approximately CZK 14.0 bil. was spent in the Rural Development Programme and national programmes for the implementation of, for example, more than 900 flood protection structures.

- In 2020, there were a total of 28,605 events requiring the intervention of Integrated rescue system units in connection with natural disasters, in the vast majority of cases technical accidents. In the long term, the main cause of all events is strong wind followed by flooding or rain.

- In 2020, a total of 70 thous. insured events arising from natural disasters were registered by insurance companies with total damage of CZK 2.8 bil., while since 2006, insurance companies have registered a total of about 1.2 mil. insured events arising from natural disasters with total damage of CZK 50.4 bil.

- In 2020, there were eight major industrial accidents, namely spills of hazardous substances in chemical plants, a fire and an explosion.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Public expenditure spent on adapting to the manifestations of climate change	N/A	○	○	✓
Issuing alerts of the Integrated Warning Service System*	N/A	N/A	N/A	✓
Events and interventions arising from natural disasters	N/A	↗	↗	~
Amount of damage caused by natural disasters	↘	~↗	~↗	~
Preventive and educational activities for population protection and crisis management	N/A	↗	→	~
Number of major accidents reported	↗	↗	↗	✗

** It is not possible and does not make sense to set a trend for the operation of the alert system. The criterion for its success is not the number of alerts issued, but the quality, accurate and timely issuing of alerts.*

Adapted settlements

- In 2020, 18 cities or city districts in the Czech Republic had an adaptation strategy or plan prepared, with a total of over 2.6 mil. inhabitants living on their territory, and another 30 cities or municipalities were preparing these documents. However, the implementation of relevant adaptation measures at local or regional level is progressing slowly.

- In 2020, a total of 142 implementers were involved in the implementation of Local Agenda 21 at local and regional level, mainly from the ranks of municipalities or small municipalities. In the higher categories of Local Agenda 21 implementation, we can assess the stable representation and, in the case of the best implementers of Local Agenda 21 (category A), even a slight growth as positive.

- The share of the population of cities with a verified Sustainable Urban Mobility Plan in 2020 amounted to 25.3% of the population of the Czech Republic and 70.8% of the total population of cities with over 40,000 inhabitants. All ten of the largest cities in the Czech Republic by population have an approved Sustainable Urban Mobility Plan or at least a Strategic Framework for Sustainable Urban Mobility.

- Overall, 1,241 brownfields with a total area of 3,285.0 ha were newly registered in the 2014–2020 period. Brownfields in Czechia are being regenerated (in 2020 a total of 174 brownfields with a total area of 257.7 ha), mainly through subsidy programmes.

- The management of rainwater or greywater in settlements is financially supported mainly through the Operational Programme Environment and the Dešťovka (Rainwater) Programme. By the end of 2020, 115 projects had been approved in the Operational Programme Environment with a total of CZK 507.6 mil. of total eligible expenditure, the implementation of which will enable 6,500 m^3 of rainwater to be retained within the municipalities. By the end of 2020, a total of 6,230 projects had been approved in the Dešťovka (Rainwater) Programme with total support of CZK 232.8 mil., while the total volume of accumulation tanks acquired with support from this programme is almost 30 thous. m^3.

- The representation of greenery and water areas in the urban area of settlements over 20,000 inhabitants is relatively high and averaged 76.0%. However, low greenery makes up a significant part of the share of greenery in the total urban area of settlements (78.0% of the total greenery in settlements), the potential of which for increasing the adaptation capacity of settlements is low compared to high greenery.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Number of municipalities with adaptation plans	N/A	N/A	↗	~
Brownfields	N/A	N/A	N/A	~
Local Agenda 21	↗	↗	↘	~
Sustainable Urban Mobility Plans	N/A	N/A	↗	✓
Supported projects for the use of rainwater and greywater	N/A	N/A	↗	~
Green areas in cities	N/A	N/A	→	~

Transition to climate neutrality

- Greenhouse gas emissions without the LULUCF sector are decreasing and there is high probability that the Czech Republic's climate targets for 2020 will be met, partly thanks to a significant contribution from the impacts of the COVID-19 pandemic.

- The balance of greenhouse gas emissions from the LULUCF sector has increased to record high positive values as a result of the bark beetle calamity. Transport emissions and waste emissions are also rising.

- Energy consumption in transport has had an increasing trend over the long term. Fossil fuels accounted for 94.9% of transport energy consumption from fuel combustion in 2020.

- The use of alternative fuels and propulsion in transport is growing dynamically, but their representation remains marginal in relation to the overall size of the fleet.

- Gross electricity generation reached 81,443.4 GWh in 2020. It fell by 6.4% year-on-year, and is at its lowest value in 18 years.

- For the first time in history, electricity generation from nuclear power exceeded that from lignite.

- The generation of heat from solid fossil fuels has had a significantly decreasing trend since 2010, while the share of renewable sources and biofuels has been growing significantly.

- Foreign trade in electricity has retained its export character, with the balance corresponding to 14.2% of domestic consumption in 2020.

- 15.9% of households used solid fuels (coal + wood) for heating in 2019[4], an increase of 9.1% in the last five years. However, the total consumption of solid fossil fuels in households has been declining for a long time.

- The energy intensity of the economy is declining, is a result of GDP growth and, to a lesser extent, a decline in consumption.

- The overall energy dependence of the Czech Republic is increasing significantly, reaching 40.9% in 2019[5].

- Both primary and final energy consumption reached the levels for meeting the 2020 energy efficiency targets in 2019[6]. However, the structure of primary energy sources still significantly differs from the targets set for 2040.

- Electricity generation from renewable sources increased by 2.6% year-on-year to 10,291.1 GWh in 2020.

- The share of RES in final energy consumption in transport was 7.8% in 2019[7].

- The target for the share of RES in gross final energy consumption, i.e. 13% by 2020, has been met since 2013, with a share of 16.2% in 2019[8].

- The generation of heat from renewable sources grew significantly in the monitored period, the year-on-year increase in 2019[9] being 9.3%, while the generation of heat from RES actually increased by 162.6% in the 2010–2019 period.

- The energy intensity of the EU28 economies decreased from 5.6 TJ to 4.0 TJ.(EUR mil.)$^{-1}$ over the 2010–2019[10] period, i.e. by 28.6%.

- The share of renewable energy sources in final consumption in the EU28 is growing, standing at 18.9% in 2019[11], with a target of 20% for the EU28 as a whole by 2020. 14 EU28 countries, including the Czech Republic, have already achieved their national targets.

[4–11] *Data for the year 2020 are not available at the time of publication.*

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Greenhouse gas emissions (without LULUCF)	↘	↘	↝	~
Electricity and heat generation*				
Gross electricity generation	↝	↝	↝	N/A
Gross heat generation	N/A	↘	↘	N/A
Share of the balance of foreign trade in electricity in domestic consumption	↝	↘	↘	~
Household heating by fuel*				
Number of households heated with solid fuels (coal + wood)	↘	↝	↗	✗
Consumption of solid fossil fuels in households	↘	↘	↘	✗
Energy and fuel consumption in transport	↗	↗	↗	✗
Energy intensity of the economy*				
Development of the energy intensity of the economy	N/A	↘	↘	~
Structure of the primary energy sources	N/A	○	○	~
Energy efficiency	N/A	↝	↝	✓
Import energy dependence	N/A	↗	↗	✓
Renewable energy sources	↗	↗	↗	✓
Consumption of RES in transport	↗	↗	↗	~

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Transition to a circular economy

- The material intensity of the economy is steadily decreasing.

- The specific indicators of domestic material consumption per capita and per unit of GDP in the Czech Republic are slightly above average compared to other EU28 countries.

- In 2018[12], the share of secondary raw materials production volume in direct material input was 8.3%.

- Total waste generation has a significantly increasing trend in the medium and short term, as does the generation of non-hazardous waste. Municipal waste generation is increasing in the medium term. The generation of packaging waste has significantly growing medium-term and short-term trends.

- In the medium term, there has been a slight reduction in the generation of mixed municipal waste.

- The eco-labelling of products and services guarantees an environmentally friendly approach in terms of waste or packaging generation. The number of licences for the Czech Environmentally Friendly Product and Environmentally Friendly Service eco-labels has been decreasing significantly in the long term, on the other hand the number of EU Ecolabel licences is growing. In 2020, there were a total of 32 valid licenses for the use of the Czech Environmentally Friendly Product/Environmentally Friendly Service ecolabels, which corresponds to 42 certified products, while there were 20 licenses for 5,147 certified products in the case of the EU Ecolabel.

- Something positive in terms of the transition to a circular economy is that overall waste treatment is dominated by recovery, especially material recovery, the share of which is increasing in the medium term at the expense of landfilling.

- The main objective in municipal waste treatment is to significantly reduce landfilling in favour of material recovery in particular, yet almost half of municipal waste continues to be landfilled.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Material intensity of the economy	↘ (green)	↘ (green)	↘ (green)	✓ (green)
Share of secondary raw materials production volume in direct material input	N/A	~↗ (amber)	↗ (green)	~ (amber)
Waste generation	N/A	↗ (red)	↗ (red)	✗ (red)
Ecolabelling*				
Total number of valid Environmentally Friendly Product and Environmentally Friendly Service ecolabel licenses	↘ (red)	↘ (red)	↘ (red)	✗ (red)
Total number of valid EU Ecolabel licences	↗ (green)	~↗ (amber)	↗ (green)	✓ (green)
Waste treatment structure	N/A	○ (green)	○ (amber)	✓ (green)
Municipal waste treatment	N/A	○ (green)	○ (amber)	~ (amber)

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

[12] *Data for the years 2019 and 2020 are not available at the time of publication.*

Ecological stability of the landscape and sustainable land management

- Soil sealing has been increasing for a long time. Between 2019 and 2020, the area of built-up areas increased by 410 ha.
- In 2019[13], a total of 254.7 ha of agricultural and forest land was taken over for road infrastructure.
- The consumption of mineral fertilizers decreased 13.0% year-on-year to 101.7 kg of pure nutrients/ha in 2020.
- The consumption of plant protection products is gradually decreasing. In 2020, this amounted to 3,784.2 thous. kg of active substances, i.e. 9.7% less than in 2019.
- There was a further increase in the consumption of rodenticides (by 172.7% year-on-year), but this was not reflected in the total consumption of plant protection products as they have a minority share.
- The acidification of soils and reduction in the content of alkaline elements could become a limiting factor in forestry. The base saturation (BS) of the sorption complex of soils in the top part of mineral soil (up to 20 cm) ranges from 4% to 18%.
- There is extensive soil loss through erosion every year. 51.7% of agricultural land is potentially endangered by water erosion, of which 15.6% by extreme erosion. 22.9% of agricultural land is endangered by wind erosion. In 2020, a total of 399 erosion events were recorded.
- The mining of mineral resources fluctuates with an overall decreasing trend, mainly influenced by industrial production and construction.
- The area affected by mining is decreasing and, on the contrary, the area of reclaimed areas is increasing.
- Agricultural land is vulnerable to degradation due to excessively sized fields and a high level of ploughing; nevertheless, grassing is taking place and in the 2010–2020 period the average size of field soil blocks decreased by an average of 1.8% per year.
- Damage to forest stands, expressed as a percentage of defoliation, remains at a high level. In the older stands category (60 years and over), the sum of defoliation classes 2 to 4 is 78.3% for conifers and 42.7% for deciduous trees. In younger stands (up to 59 years) the situation is more favourable – in the case of conifers, 28.7% of stands fell in classes 2 to 4, and 23.3% for deciduous trees.
- In 2020, forest ecosystems were again impacted by large-scale logging after the bark beetle calamity. The volume of recorded logging increased to 35.8 mil. m^3 of wood excluding bark, surpassing the previous record set in 2019. The volume of insect-related logging in 2020 (26.2 mil. m^3 of wood excluding bark) reached almost the value of the total volume of insect-related logging for the 1990–2012 period. This large-scale logging created a large, deforested area, with forests becoming a source of greenhouse gas emissions.
- Forests are being restored in areas affected by the bark beetle calamity and, thanks to the reduction in the share of restored coniferous trees in favour of deciduous trees, a gradual approximation to the recommended tree composition is occurring. In 2020, a record 17.3 thous. ha of deciduous trees and 16.4 thous. ha of conifers were planted as part of the artificial regeneration, while the most frequently planted tree species was still spruce (10.3 thous. ha).
- Over the long term, we can observe a gradual approaching to the natural (and more stable) structure of forest stands. However, the long regeneration cycle of the forest means this process is slow and will require many years of intensive effort.

[13] *Data for the year 2020 are not available at the time of publication.*

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Infiltration capacity of soils	N/A	N/A	N/A	N/A
Land use	○ (red)	○ (red)	○ (red)	✕ (red)
Quality of agricultural and forest soil*				
Quality of agricultural soil	N/A	N/A	N/A	~ (yellow)
Quality of forest soil	↘ (red)	↘ (red)	↘ (red)	✕ (red)
Erosion and compaction of agricultural soil	N/A	↗ (red)	↗ (red)	✕ (red)
Consumption of fertilisers and plant protection products	↗ (red)	→ (yellow)	↘ (green)	~ (yellow)
Land take	~↗ (yellow)	↗ (red)	↗ (red)	✕ (red)
Mineral extraction and reclamation*				
Mineral extraction	↘ (green)	↘ (green)	↘ (green)	N/A
Reclamation after mineral extraction	↗ (green)	↗ (green)	↗ (green)	N/A
Organic farming	↗ (green)	↗ (green)	↗ (green)	~ (yellow)
Average size of fields	N/A	↘ (green)	↘ (green)	✕ (red)
Forest health condition	↘ (red)	↘ (red)	↘ (red)	✕ (red)
Sustainable forest management	~↗ (yellow)	~↗ (yellow)	~↗ (yellow)	✕ (red)
Tree species composition of forests	○ (green)	○ (green)	○ (green)	✕ (red)

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Biodiversity

- In the 2000–2016[14] period, the unfragmented landscape area decreased from 68.8% to 60.6% of the territory of Czechia.

- The numbers of common bird species have been declining for a long time. The largest decrease was recorded for agricultural landscape bird species, whose numbers decreased by 30.8% between 1982 and 2020.

- The influence of climate change on the species composition of avifauna has been growing for a long time. Since 2010, the climate indicator value has increased by 17.9%.

- The river network is not being effectively cleared. The overall implementation of the River Network Clearing Concept plan stands at 13.7%.

- Total specially protected areas, including both small-area and large-scale specially protected areas, increased by 1.8 thous. ha in 2020 – this increase was mainly due to the emergence of new small-area specially protected areas.

- Out of a total of 1,454 non-native plant species that occur or have been recorded in Czech territory, 61 species are considered invasive. Out of a total of 278 non-native animal species, 113 are invasive.

- The number of exported specimens of protected species according to CITES is growing. The most commonly exported group of animals are birds (mainly parrots), with reptiles and amphibians in second place.

[14] *Data for the years 2017–2020 are not available at the time of publication.*

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Fragmentation of the landscape	↗	↗	↗	✕
State of species and habitats of Community importance	N/A	→	N/A	~
State of bird species	↘	↘	↘	✕
Common bird species*				
Abundance of all common bird species	↘	→	↘	✕
Abundance of forest bird species	↘	↘	↘	✕
Abundance of farmland bird populations	↘	↘	↘	✕
Indicator of the impact of climate change on common bird species	↗	↗	↗	✕
State of plant, animal and fungi species according to the red lists	↘	↘	↘	✕
Share of species on red lists among protected species	N/A	N/A	N/A	N/A
Specially protected areas and Natura 2000 sites in the national territory	↗	↗	↗	~
Share of habitats and species in Natura 2000 sites	N/A	N/A	N/A	N/A
Non-native species in Czechia	N/A	N/A	N/A	✕
International trade in endangered species protected under CITES	N/A	↗	↗	✕
Breeding of endangered species in zoos	N/A	N/A	N/A	~

** Due to the different trends of the time series on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Financing of environmental protection

- Expenditure from central sources in 2020 increased by 14.8% year-on-year to CZK 60.4 bil. and expenditure from territorial budgets by 9.8% to CZK 44.9 bil. Priority areas of support included water protection, biodiversity and landscape protection, waste management and, last but not least, air protection. In this area, the implementation of programmes aimed at supporting thermal insulation, energy savings and changes in heating technologies (e.g. the New Green Savings Programme and so-called boiler subsidies) continued.

- By the end of 2020, a total of 69,472 applications for support had been submitted in the individual calls of the New Green Savings Programme, and 45,239 applications worth approximately CZK 10.0 bil. had already been paid out.

- Under the Operational Programme Environment for the 2014–2020 programming period, 19 new calls amounting to EUR 279.4 mil. (CZK 7.3 bil.) of total eligible expenditure were announced in 2020. Since the beginning of the programming period, the provision of subsidies for 9,122 applications totalling EUR 3.5 bil. (CZK 90.4 bil.) of total eligible expenditure.

- The Operational Programme Environment also finances so-called boiler subsidies; in three calls 101 thous. solid fuel boiler replacements were approved by the end of 2020 in a total volume of EUR 428.5 mil. (CZK 11.2 bil.).

- The share of environmental protection investment in GDP has long been above average in international comparison terms.

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Investments and non-investment costs in environ-mental protection	↗	↗	→	~
Public expenditure on environmental protection	↗	↗	↗	✓

Opinions and attitudes of the Czech public

- Less than two-thirds of the Czech public is interested in information related to the environment in the Czech Republic.

- Respondents think the state of the environment is better in their place of residence (70%) compared to the overall situation in the Czech Republic (53%).

- Citizens of the Czech Republic consider the most serious global problems to be the accumulation of waste, pollution, and lack of drinking water.

- A significant majority of the Czech public (three quarters) agree that climate change exists and that it is a serious problem.

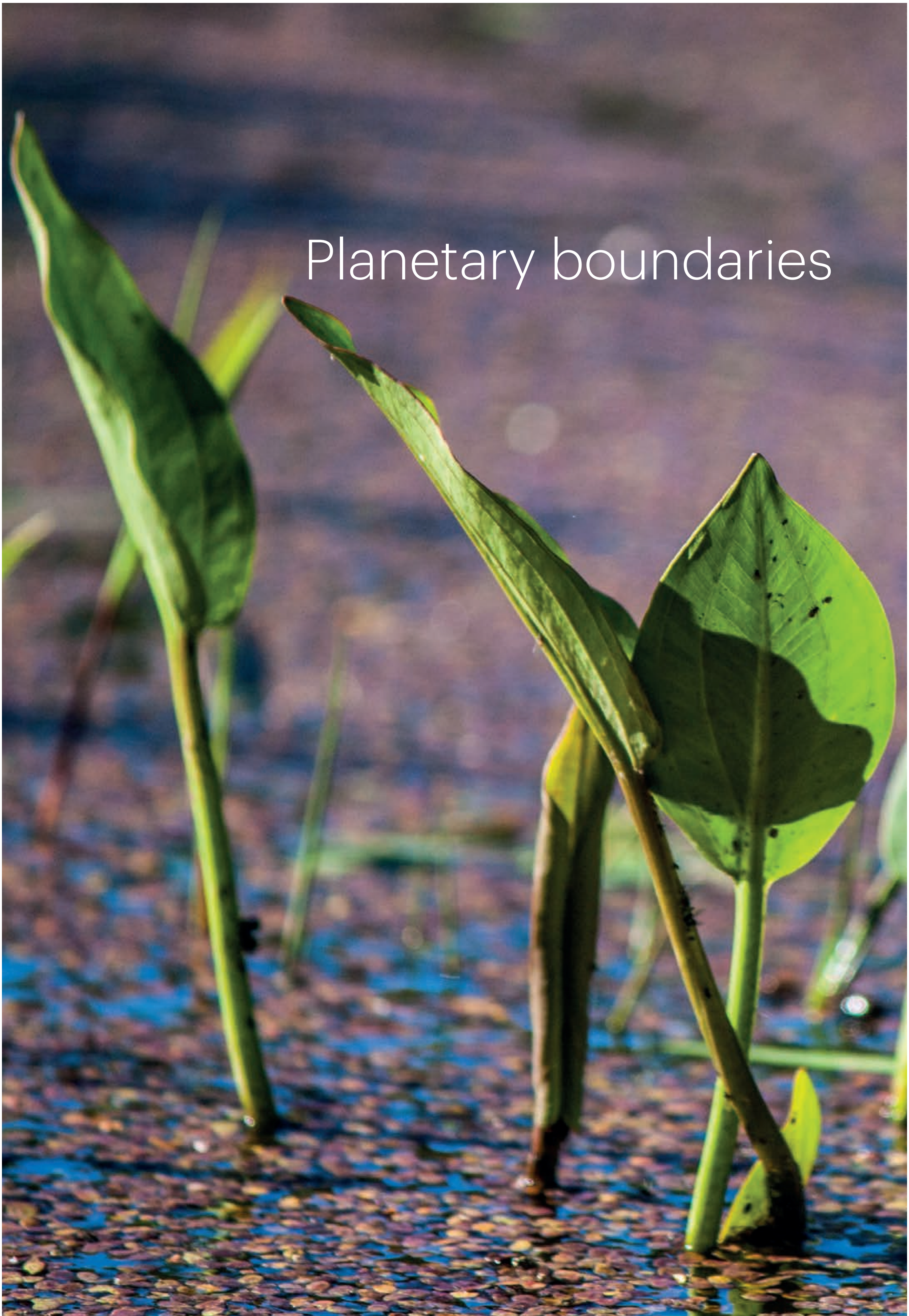
- For more than two-thirds of the Czech public it is important that the Czech Republic takes measures against climate change.

Graphical representation of the aggregate trend		
Positive upward trend	Stagnation	Negative upward trend
Positive downward trend	Fluctuating trend	Negative downward trend
N/A The trend cannot be determined		

Graphical representation of the trend in the structure indicator		
Positive trend	Neutral trend	Negative trend

Graphical representation of the state		
Good state	Neutral state	Bad state

Planetary boundaries



Planetary boundaries

Global population and economic growth, especially in the 2nd half of the 20th century, has been accompanied by a sharp increase in the use of natural resources. There has been a significant increase not only in population, but also in GDP, energy consumption, fertilizer use and water consumption. The global use of natural resources (biomass, ore and non-ore metals, fossil fuels) has increased more than threefold since the 1970s, and continues to increase. Moreover, the consumption of natural resources to meet the needs of the Earth's current population of 7.7 bil. is significantly exceeding sustainable levels. However, human activities in recent years have reached such a scale and intensity that the burden on the environment is deflecting conditions on Earth from the stable state reached in the past. Such deflection or exceeding of limits (Box 1) may cause irreversible or sudden changes in environmental conditions leading to a state less favourable to human development.

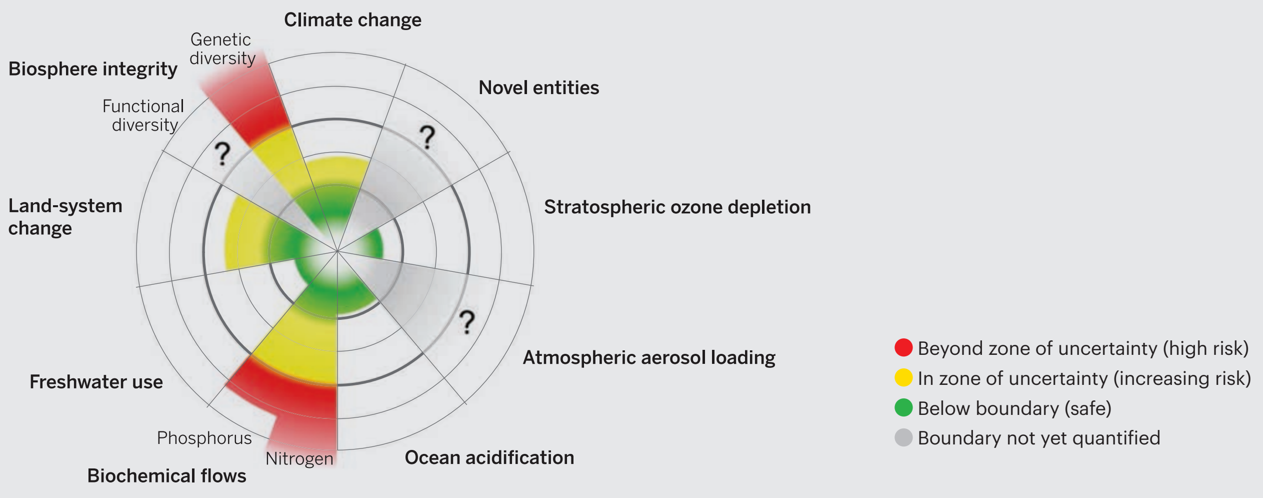
Box 1

The concept of planetary boundaries

Steffen et al., 2015[15] identified 9 processes, called planetary boundaries, that regulate the stability and resilience of the system on Earth. Within these limits, humanity can continue to develop and thrive, however exceeding these boundaries increases the risk of generating sudden and irreversible large-scale environmental changes that could affect the system of the entire Earth and could be catastrophic for human development.

These are the 9 planetary boundaries: climate change; change in biosphere integrity (previously loss of biodiversity); stratospheric ozone depletion; ocean acidification; biochemical flows – the phosphorus-nitrogen cycle; land-system change; freshwater use; atmospheric aerosol loading; novel entities. Two of these boundaries, namely climate change and change in biosphere integrity, are identified as crucial because they have the potential to affect the Earth's planetary system if they are fundamentally or permanently exceeded.

It is currently estimated that humanity has already exceeded 4 planetary boundaries, namely the change in biosphere integrity; climate change; land-system change and biochemical flows.



Data source: Steffen et al., 2015

[15] *Steffen, W. et al., 2015: Planetary boundaries: Guiding human development on a changing planet. Science, Vol. 347, Issue 6223, doi: 10.1126/science.1259855.*

Given that Europe has played an important role in shaping global geopolitical, economic, social and technological discourse since the middle of the 20th century, its development has been influenced by various factors of various scales at a time when the interconnectedness of flows of information, resources, goods, services, people and ideas is constantly increasing. These factors affecting the environment and sustainable development in Europe are often not of an environmental nature or of European origin, but are fundamental to shaping Europe's long-term outlook in terms of the environment and sustainable development. These factors are both global megatrends (less predictable long-term trends with significant impact), Box 2, as well as weak signals or emerging trends (phenomena that proceed at a rapid pace but are not yet clearly observable in the medium to long term and therefore usually allow an alternative interpretation of their potential impact on future developments), Box 3, or wild development cards (unlikely but potentially very catastrophic or warning scenarios of development), which in turn affect planetary stability.

Box 2

Global megatrend clusters

A growing, urbanising and migrating global population: Demography, urbanisation and migration are significantly linked, as population growth is very often linked to the expansion of urban areas and migration, often contingent on better employment opportunities and living standards in cities. Under long-term scenarios, the world's population can be expected to grow from the current 7.7 bil. to 8.5 bil. in 2030, 9.7 bil. in 2050 and 10.9 bil. in 2100. The largest increase is expected in urban areas of developing countries. A significant part of this increase is related to socio-economic development, improving health care, better levels of education, and an increase in wealth, which lead to a decrease in mortality rates and an increase in life expectancy. As the birth rate declines over the long term while life expectancy increases, there is an overall ageing of the population. For the first time in the entire history of mankind, the share of the population aged over 65 will outweigh children aged under five. Population growth is not evenly distributed – it is most pronounced in sub-Saharan and North Africa and Central and Southeast Asia, while East Asia and Europe are facing population decline. Population development is closely linked to population migration which, however, affects only about 3% of the world's population and is mainly dominated by intracontinental migration. While Europe is a key destination for refugees, Asia is becoming an increasingly attractive destination for migrants[16]. The most important drivers of migration are environmental degradation and climate change. At the same time, it is greatly influenced by the geopolitical situation and armed conflicts. Urbanisation rates are expected to rise globally, particularly in Africa and Asia, to reach an estimated 68% of the population living in urban areas. Moreover, cities are the areas where the biggest differences in living standards – economic activities and social changes – can be observed.

Climate change and global environmental degradation: Human activity has caused a global temperature increase of 1°C compared to the pre-industrial period. The rising global temperature is changing fundamental patterns and affecting the environment, economy, society, resources and the energy security of the population. There has been a change in the representation of native and invasive species and an increased frequency of occurrence of extreme events such as droughts, flooding, vegetation fires, heat waves and more. The Earth is facing biodiversity loss, with the sixth mass species extinction currently being observed, and overall 75% of the terrestrial and 40% of the marine environment has been significantly altered. Environmental degradation has social and economic impacts, and is contributing to an increase in inequality. Air pollution results in 6 to 7 mil. premature deaths, and water quality is deteriorating in almost all regions of the world due to significant water pollution. Plastics and e-waste are becoming a growing problem.

Increasing scarcity of and global competition for resources: Economic growth, increasing wealth, and increasing levels of well-being have long increased the demand for resources. Overall, energy consumption has increased 25-fold since 1800, and has long been based mainly on fossil resources; moreover, there has been no significant change in the global energy mix in the last 20 years. Although the share of energy supplied from renewable sources is growing, these sources and related technologies face challenges related to technological, infrastructure and security transformation. The extraction of materials has a significant impact on ecosystems, reduces biodiversity, exacerbates climate change, and contributes to the deepening of social inequalities within regions. Lifestyle changes that increase the demand for high-protein and fat-high foods and the increasing demand for biofuels are contributing to increasing demand for agricultural land. However, land-system change (deforestation) and the intensification of farming can exacerbate the impacts of climate change and degrade ecosystems.

[16] Refugee: According to the Refugee Convention (Geneva Convention) from 1951, a refugee is a person who, owing to well-founded fear of persecution for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it.

Migrant: A person who leaves his or her country of origin voluntarily, or was born in another country or lived in one for a long time.

Acceleration of technological change: Technological progress promotes the prosperity of society and develops alongside social needs, lifestyle and economic development. Technological innovation is currently accelerating, mainly due to large-scale digitalisation. However, issues of ethics, personal data security and media manipulation are closely related to technological progress. Digitalisation can also put more pressure on resources, while new technologies and digitalisation are changing the nature of jobs and thus affecting the social system.

Power shifts in the global economy and geopolitical landscape: Global economic generation has increased roughly 12-fold since 1950, leading to both improved prosperity and increased environmental burdens. Key factors in the global economy are trade liberalization, technological progress, supply chain globalization, respectively international trade, and cheap labour. Economic growth in developing countries has alleviated poverty and enabled investment in social infrastructure and services to develop. In the long term, the power of the world's corporations to influence and shape social and environmental standards and influence social discourse and policymaking is increasing, thereby limiting the ability of governments to respond to current issues. Future geopolitical challenges are expected to concern trade agreements, access to raw materials and international markets.

Diverse values, lifestyles and governance approaches: In recent years, the perception of values has changed significantly. On the one hand, there has been an increase in consumerism and thus an increase in demand for resources, while on the other, various forms of sharing, a community way of life and an overall sustainable lifestyle are developing, motivated in particular by concern for the climate and the environment. New work patterns and lifestyles are developing as a result of technological change, economic growth and digitalisation. Lifelong learning also plays an important role. However, social and health inequalities persist and, in Europe in particular, pressure on public spending is increasing as a result of an ageing population.

Data source: EEA, 2020[17]

Box 3

Weak signals and emerging trends

Blockchain is a decentralized database recording transactions with an ever-expanding number of records. It is an illustration of the new opportunities resulting from digitalisation. Environmental protection could benefit, for example, from increased traceability and accountability in supply chain management for waste, emissions or the origin of agricultural products. However, its use may have a negative impact on the mitigation of climate change due to its high energy intensity.

Drones are increasingly used in the transport of goods in transport and industry, and this could contribute to reducing greenhouse gas emissions in transport. However, drone use uncertainties include their life cycle (including the use of batteries), as well as possible threats to wildlife and birds, increased noise pollution and visual impacts in urban environments.

Artificially produced meat, grown in vitro from stem cells of live animals, can offer an alternative and new solution to the growing global demand for meat (especially in Asia). Its inclusion could help reduce greenhouse gas emissions from livestock farming. Even if its production costs can be reduced, its expansion will remain largely dependent on social acceptance as well as on food safety protocols.

Synthetic biology, which involves the creation of completely new DNA and whole genome sequences, is already beginning to be used in the pharmaceutical, chemical, agricultural and energy sectors. In environmental protection, it could be used for the bio-remediation of polluted industrial sites, pollution detection, protection of endangered species, etc. However, synthetic biology can unexpectedly disrupt ecosystems and lead to biodiversity loss, for example through disease vector control (e.g. by using genetically modified mosquitoes to limit the spread of malaria).

Data source: EEA, 2020[18]

[17] *EEA, 2020: Drivers of change of relevance for Europe's environment and sustainability, 138 p., doi:10.2800/129404*

[18] *EEA, 2020: https://www.eea.europa.eu/highlights/emerging-trends-what-are-the*

Climate change in the Czech Republic

Climate change in the Czech Republic

Based on temperature and precipitation developments, we can identify signs of climate change in the Czech Republic. Hydrometeorological conditions are also a factor in the state of, and economic burdens on, the environment. They have a direct impact on the dispersion of pollutants in the air and thus on their atmospheric concentrations, they affect the formation of ground-level ozone, the quantity and quality of surface water and groundwater, and the moisture balance. Of the economic sectors, temperature and precipitation conditions mainly affect agriculture, energy and water management. These include, for example, the generation of electricity and heat and thus the level of emissions of pollutants and greenhouse gases from the energy sector, the pollution of water due to the consumption of industrial fertilisers in agriculture, and the abstraction of water for irrigation. The increasing temperature extremes in the summer season, a manifestation of climate change, pose significant potential risks to human health.

Drought is one of the most serious phenomena associated with climate change and can have major impacts on the national economy and on the population. Damage is also caused by flooding, which occurs more often in connection with the increasing temperature extremes and precipitation conditions. This chapter describes the impact of the development of climatic elements on run-off conditions, the water regime in the landscape, moisture in the soil, and on the quantity of surface water and groundwater.

Overview of selected related 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
- mitigating the effects of flooding and droughts, ensuring sufficient reserves of surface water and groundwater and the good quality needed for sustainable, balanced and equable water use

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

Strategic Framework of the Czech Republic 2030
- increasing resilience and adaptability to climate-related hazards and natural disasters
- incorporating climate change measures into national policies, strategies and planning
- improving education and awareness of climate change, expanding human and institutional capacity to mitigate climate change, adapt to it, reduce its impacts, and provide early warning

Concept of protection against the consequences of drought in the Czech Republic
- a set of measures to increase the available amount of water in individual parts of the hydrological cycle, measures to reduce water consumption, and measures to influence its quality on the part of society
- the creation of 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 people, the economy, the environment, and on the overall quality of life in the Czech Republic

National Action Plan on Adaptation to Climate Change
- reducing the vulnerability of human society and ecosystems to the impacts of prolonged drought and water scarcity

Temperature and precipitation conditions

Key question

What were the temperature and precipitation conditions in the Czech Republic in 2020?

Key messages

The year 2020 was evaluated as above normal in terms of precipitation.

The incidence of heat waves fluctuates without any trend and was below average in 2020.

The average annual temperature is rising significantly, at a rate of 0.35°C per decade. 2020 was significantly above-normal in terms of temperature.

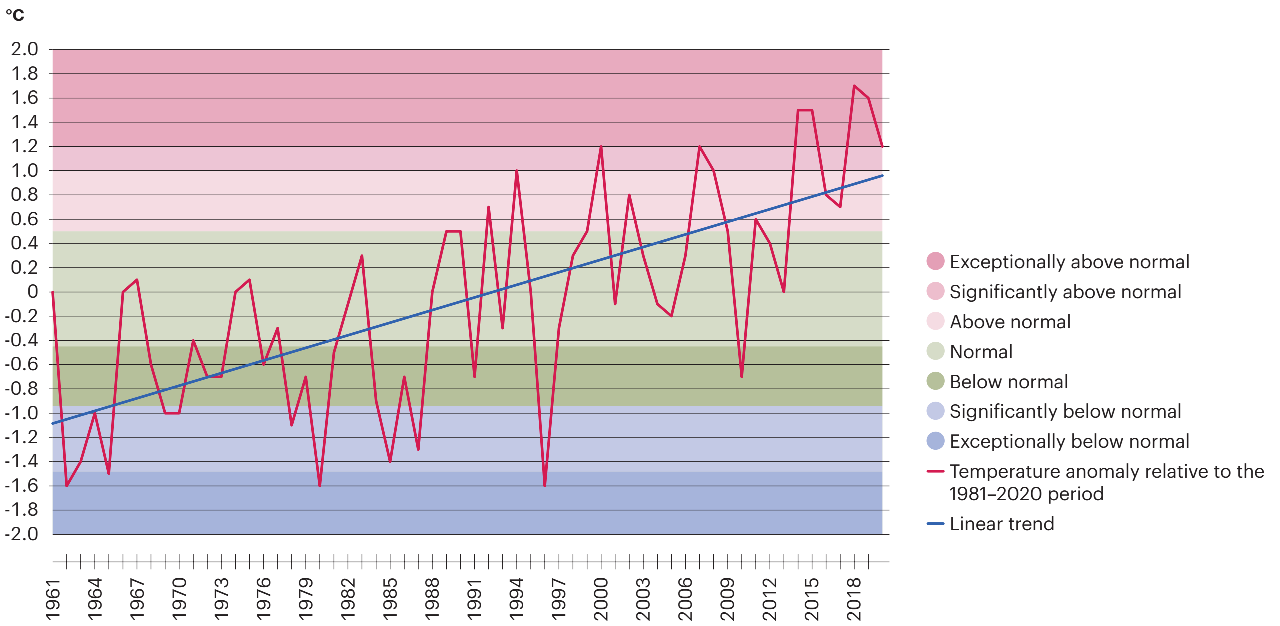
The number of summer and tropical days is increasing, as are temperature extremes in the summer season. The number of frosty and icy days is decreasing.

Anomaly of average temperatures from the climatological normal

The year 2020 was evaluated as significantly above normal in terms of temperature in the Czech Republic, as the average annual air temperature (9.1°C) was 1.2°C higher than the normal for 1981–2010 (Chart 1). Together with 2000 and 2007, the past year was ranked as the 5th to 7th warmest in the period since 1961. The previous two years 2018 and 2019 were warmer, with average annual temperatures of 9.6°C and 9.5°C.

Chart 1

Anomaly of the average annual air temperature in the Czech Republic from the 1981–2010 normal (surface temperature average) and classification of the extremity of the average annual temperature [°C], 1961–2020



Data source: Czech Hydrometeorological Institute

The **increase in average air temperature** in the 1961–2020 period is statistically significant in all seasons. For annual values in the 1961–2020 period, a positive trend of 0.35°C/10 years can be observed (Table 1). The warming is fastest in summer and winter (0.45°C/10 years and 0.42°C/10 years). In terms of individual months, a statistically significant trend is observed in all months except February, September and October. The most pronounced trends (over 0.45°C/10 years) are observed in January, July, August and December.

Table 1

Trends in average air temperature [°C/10 years] in the Czech Republic for the 1961–2020 period for individual months, seasons and years

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Air temperature	**0.46**	0.30	**0.33**	**0.39**	**0.32**	**0.37**	**0.46**	**0.51**	0.13	0.15	**0.30**	**0.47**

	Year	Winter	Spring	Summer	Autumn
Air temperature	**0.35**	**0.42**	**0.35**	**0.45**	**0.20**

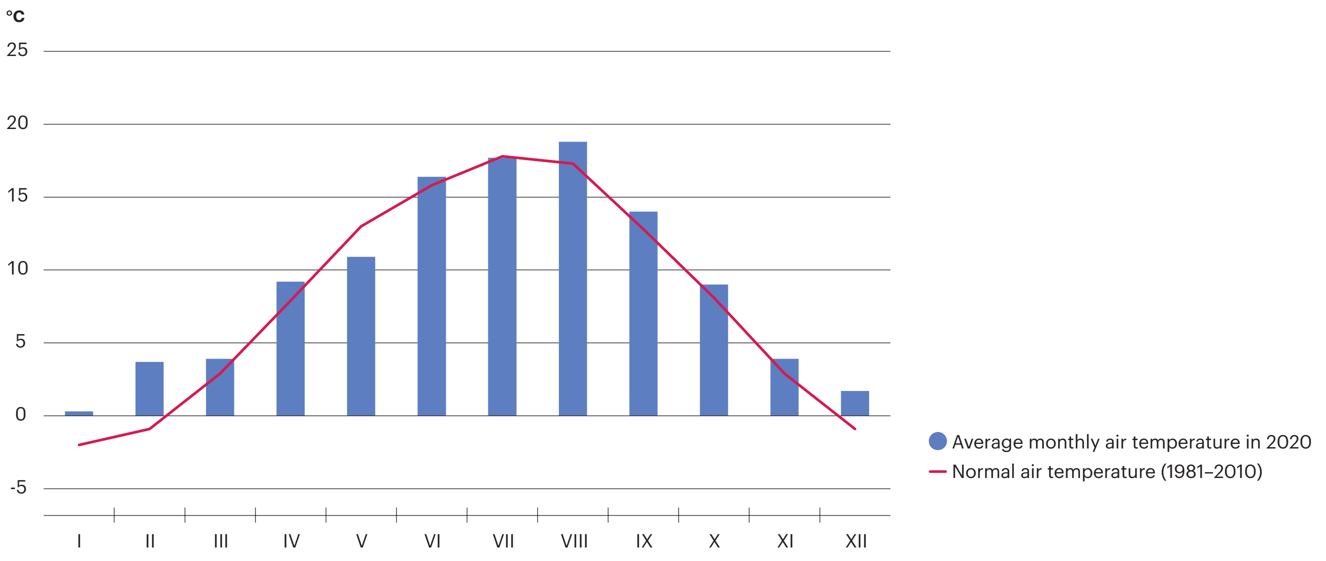
Statistically significant values at p = 0.05 are shown in bold.

Data source: Czech Hydrometeorological Institute

The **monthly average temperature** in 2020 exceeded the 1981–2010 normal in all months (Chart 2), except for May and July. Five months had temperatures above normal, namely January (anomaly +2.3°C), April (anomaly +1.3°C), August (anomaly +1.5°C), September (anomaly +1.2°C) and December (anomaly +2.6°C). The exceptionally above normal February posted the most significant positive anomaly from normal (+4.6°C). The only significantly cooler month than normal was May which, with an average monthly temperature anomaly from the normal of -2.1°C, was evaluated as a month with a temperature significantly below normal.

Chart 2

Average monthly air temperature in the Czech Republic (territorial averages) compared to the 1981–2010 normal [°C], 2020



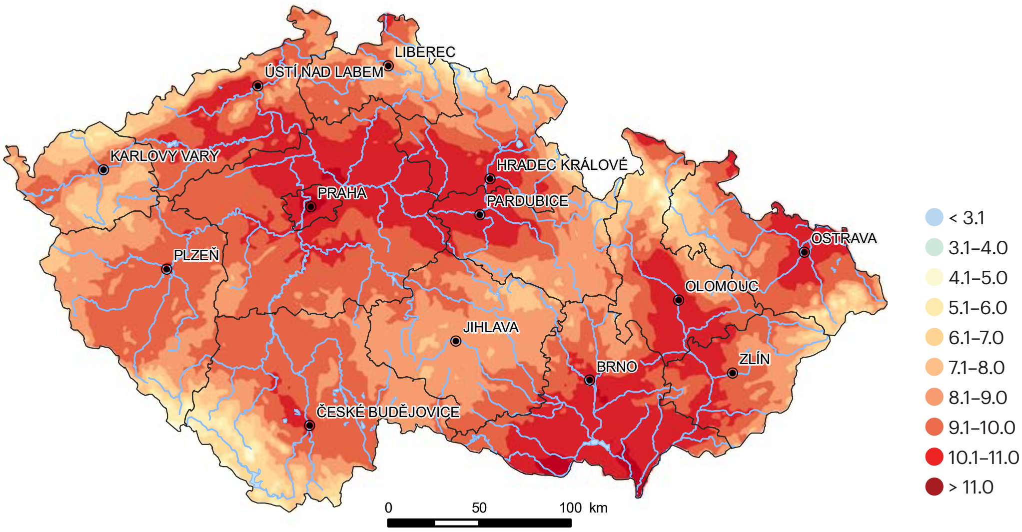
Data source: Czech Hydrometeorological Institute

In terms of **seasonal average temperatures** in 2020, the greatest anomaly from the climatological normal was recorded in winter. The average air temperature in the 2019/2020 winter season, i.e. December 2019, January and February 2020 (2.0°C), was 3.3°C higher than normal, making it the second-warmest winter since 1961 – only the 2006/2007 winter season was warmer. The summer of 2020 (June to August) was within the normal temperature values, and the situation with the hot summer of 2019 was not repeated in 2020. The absolute maximum temperature in the Czech Republic in 2020 was measured on 28 July at the Dobřichovice station (Central Bohemian Region), where the temperature reached 35.6°C.

The **distribution of the average annual temperature** in the Czech Republic is mainly determined by altitude (Figure 1). In urban agglomerations, additional warming (so-called urban heat islands) is observed, caused by a higher share of artificial impermeable surfaces with different radiation/thermal properties compared to the open landscape. The South Moravian Region (10.1°C) and the Central Bohemian Region, including the city of Prague (9.9°C) also had the highest average annual temperature in 2020, partly due to these influences. The anomaly of the average annual temperature from the 1981–2010 normal was relatively evenly distributed in 2020 and ranged between +1.1°C and +1.3°C in the individual regions.

Figure 1

Average annual air temperature in the Czech Republic [°C], 2020



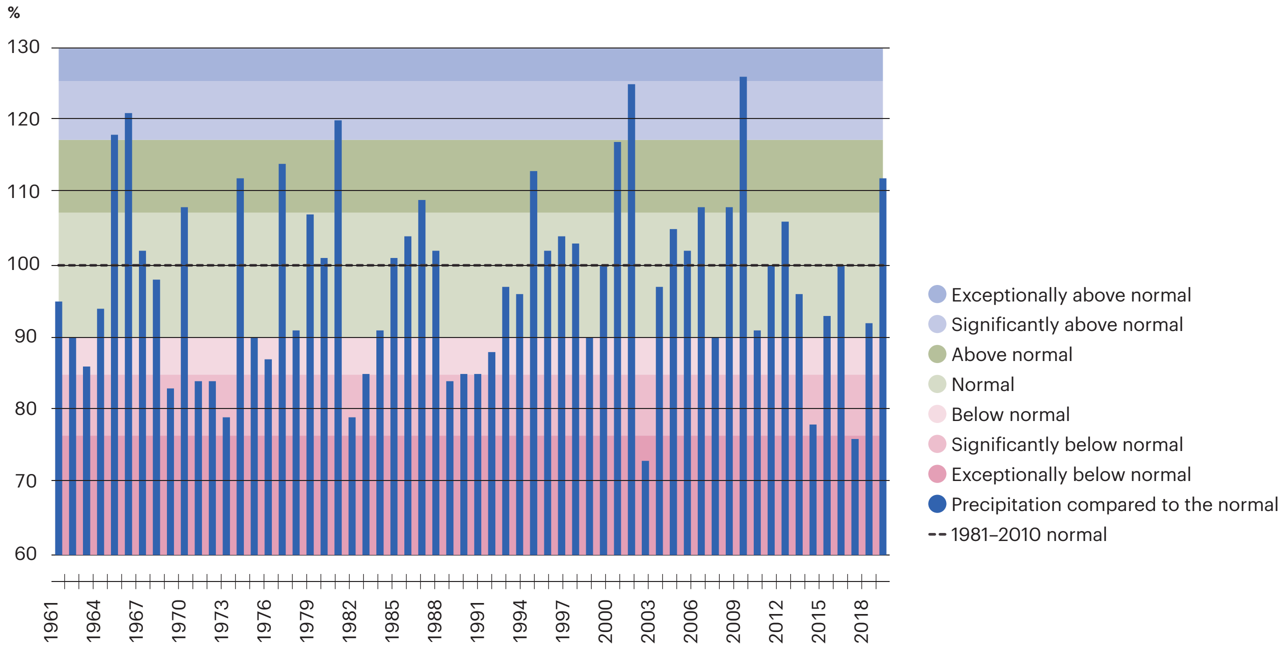
Data source: Czech Hydrometeorological Institute

Precipitation compared to the long-term normal

Precipitation totals are very variable in time and space in the Czech Republic. There is most precipitation in the summer months, mainly in storms, while the least precipitation is in winter. A gradual change in the precipitation regime is under way, with the number of days with higher precipitation totals statistically significantly increasing, mainly caused by convective processes in the summer months. However, this precipitation is territorially very limited and so, despite locally high precipitation totals, part of the territory may still suffer from a lack of precipitation during the same period. At the same time, there are more episodes when it rains very little or not at all, and they are lasting longer. Although the precipitation regime in the Czech Republic is changing, the total annual precipitation totals fluctuate and do not show any statistically significant trend (Chart 3).

Chart 3

Annual precipitation as % of the 1981–2010 normal in the Czech Republic (territorial average) and the classification of extremity of annual precipitation totals [%], 1961–2020

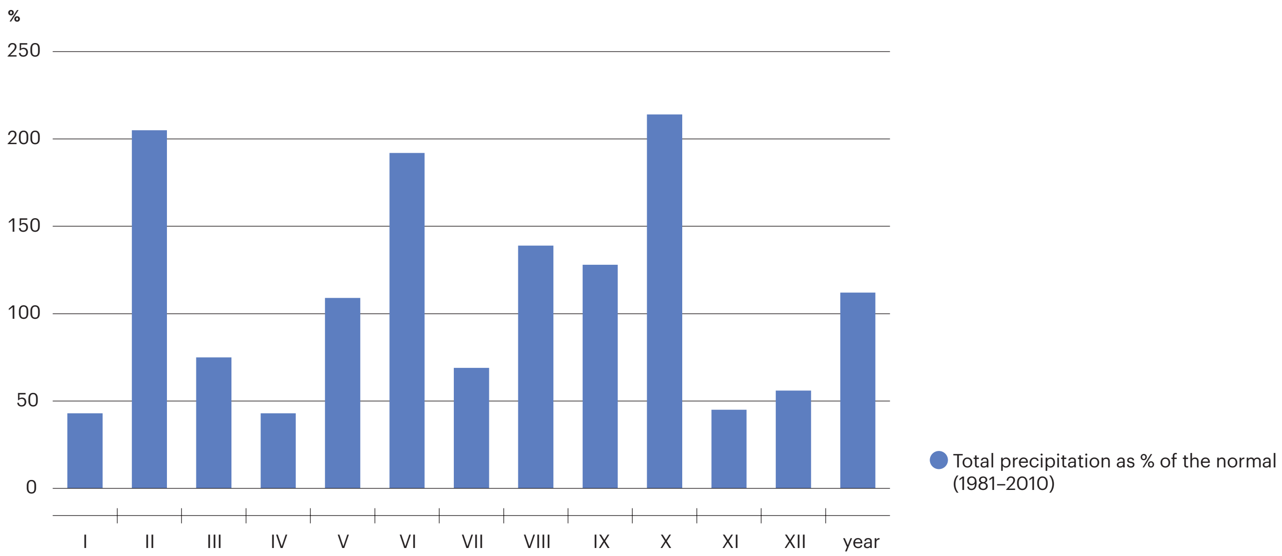


Data source: Czech Hydrometeorological Institute

The year 2020 was above normal in the Czech Republic in terms of precipitation, while the average annual precipitation of 766 mm represents 112% of the average annual precipitation in the 1981–2010 normal period. The high precipitation total was mainly due to the exceptionally above-normal June with a precipitation total of 152 mm (192% of normal, Chart 4). February (205% of normal) and October (214% of normal) were significantly above normal, while August and September (139% and 128% of normal) were above normal. On the other hand, three months in 2020 had significantly below normal precipitation, namely January (43% of normal), April (43% of normal) and November (45% of normal). July (69% of normal) and December (56% of normal) had below normal precipitation. Only March (75% of normal) and May (109% of normal) were assessed as normal months in terms of precipitation.

Chart 4

Monthly precipitation as % of the 1981–2010 precipitation normal in the Czech Republic [%], 2020

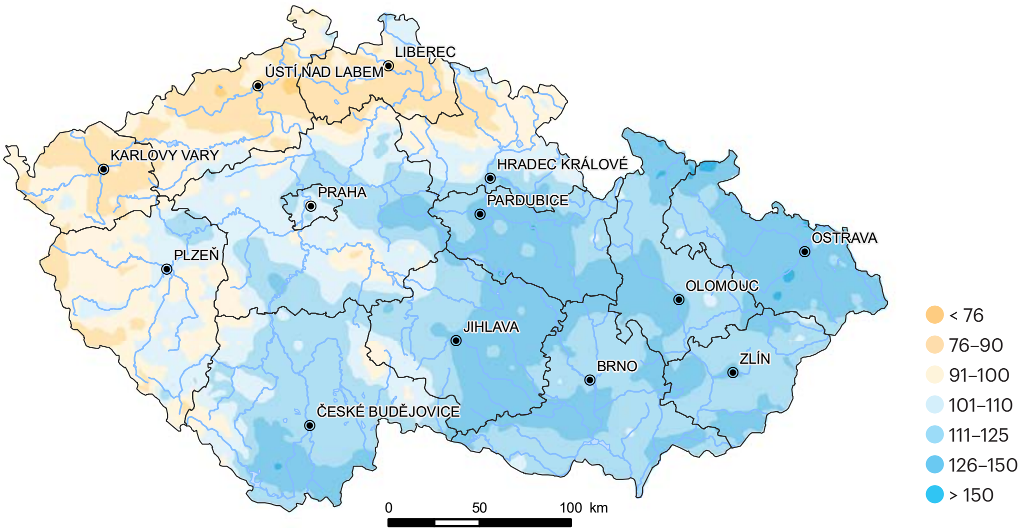


Data source: Czech Hydrometeorological Institute

The spatial distribution of total annual precipitation was uneven (Figure 2). In Moravia and Silesia, an average of 868 mm (126% of normal) was registered, while in Bohemia there was only 716 mm of precipitation (105% of normal). The least precipitation compared to normal was observed in the northwest of the country in the Liberec, Ústí and Karlovy Vary regions (90% of normal and less). On the other hand, the highest annual precipitation totals fell in the Moravian-Silesian Region (132% of normal) and Pardubice Region (128% of normal).

Figure 2

Total precipitation as % of the 1981–2010 precipitation normal in the Czech Republic [%], 2020



Data source: Czech Hydrometeorological Institute

Number of frosty, icy and arctic days

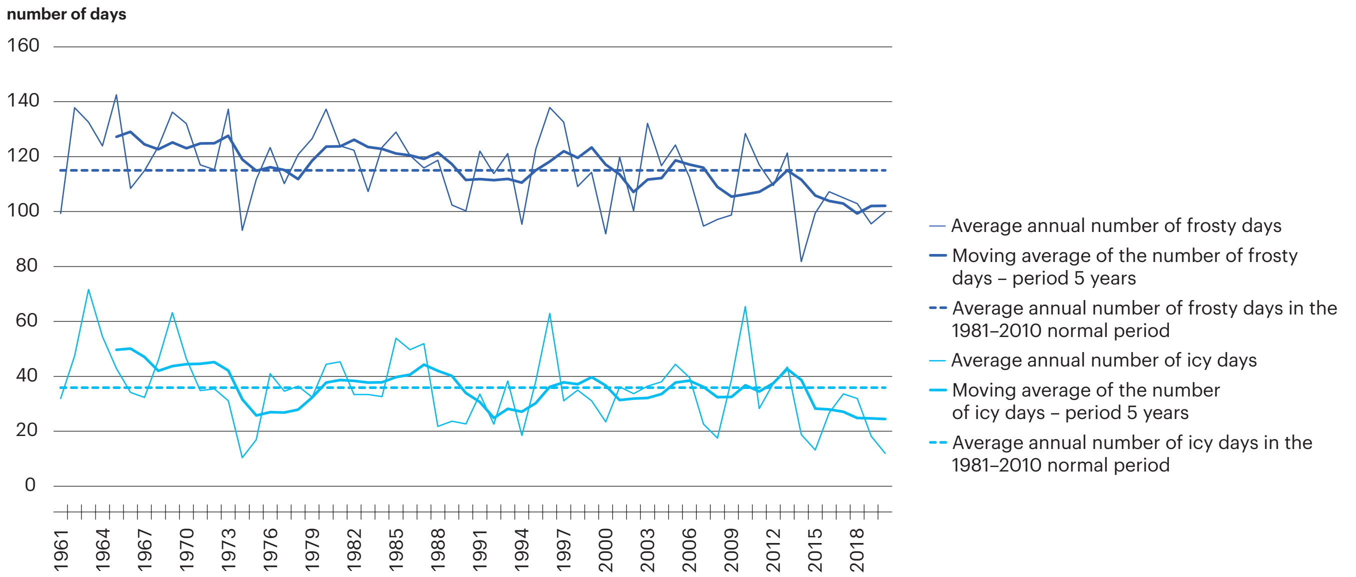
The occurrence of frosty[19], icy[20] and arctic[21] days characterizes the temperature conditions of the winter season and its temperature extremity. The increase in temperatures in the winter season due to climate change, indicated by the decreasing number of frosty and icy days, has a negative effect on vegetation and ecosystems, causes disturbance of vegetation rest season and an increased incidence of forest and agricultural pests in the following growing season, as well as a higher risk of drought due to lower water reserves in the snow cover.

The incidence of **frosty and icy days** in the Czech Republic is decreasing – in the whole 1961–2020 period the negative trend represents a decrease of 3.7 frost days and 2.6 icy days in 10 years (Chart 5). In the last ten-year period (2011–2020) there were an average of 104 frosty days per year (90.4% of the 1981–2010 normal) and only 26 icy days (73.4% of normal).

The year 2020 was characterized by an exceptionally low number of icy days due to the very warm winter, and the 12 icy days in the year was the second-lowest for the entire 1961–2020 period after 1974 and represented only 33.4% of the normal. 100 frosty days were recorded in the territorial average in 2020, 86.8% of the normal.

Chart 5

Number of frosty and icy days per year in the Czech Republic (territorial average) [number of days], 1961–2020



Data source: Czech Hydrometeorological Institute

The occurrence of **Arctic days** is quite unique in the Central European climate environment and it is not possible to identify any trend. In 2020, there was no Arctic day in the Czech Republic – the territorial average of the annual number of Arctic days in the 1981–2010 normal period was one per year.

In 2020, the highest numbers of monitored cold characteristic days were recorded by stations in the border mountains, especially in Šumava, in the Giant Mountains and in the Jizera Mountains. While the occurrence of icy days, which are defined according to daily temperature maximums, was highest in the Czech mountain ridge areas, frosty days were most common in the so-called frost basins, where temperature inversion often occurs and frost can occur even beyond the winter season.

[19] *TMI (minimum daily air temperature) < 0°C*

[20] *TMA (maximum daily air temperature) < 0°C*

[21] *TMA (maximum daily air temperature) < -10°C*

Total duration of heat waves

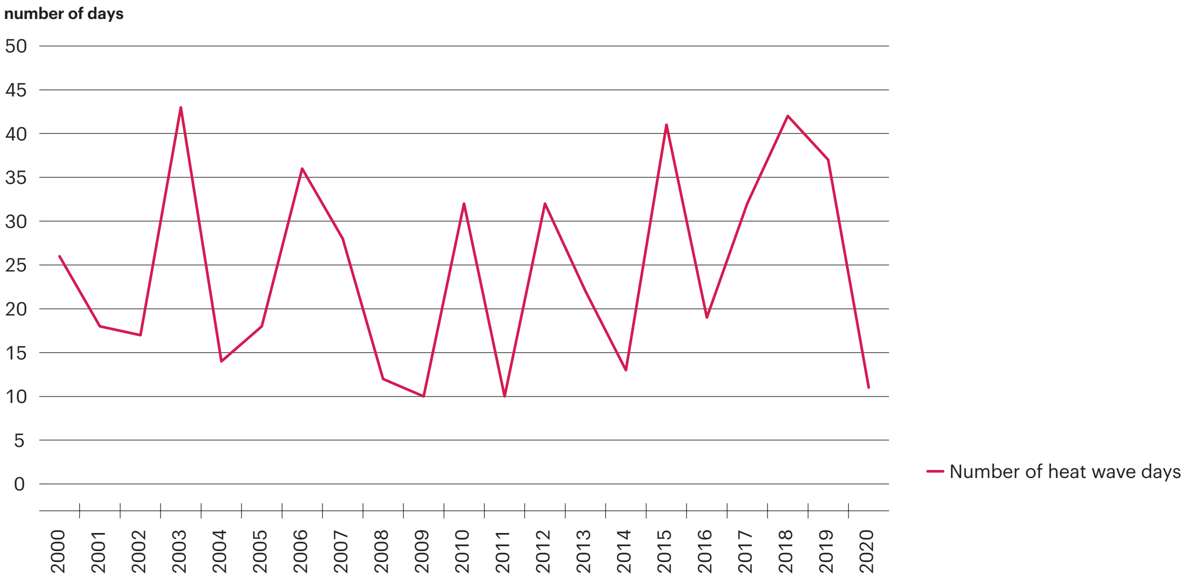
Extremely hot weather has, in the conditions in the Czech Republic, the most serious potential health impacts of all climate change manifestations. Heat waves place a significant burden on the human body, especially for people suffering from cardiovascular diseases, older people, and people with impaired thermoregulation ability. Extreme temperatures also significantly increase the risk of drought, worsen the quality of surface water, and have repercussions on national economy sectors, in particular agriculture and water management.

A **heat wave** is defined as a period of three or more consecutive days when the daily maximum air temperature is equal to or greater than 30°C and exceeds the long-term average of the maximum daily air temperature for the given location recorded in the normal period (1981–2010) by more than 5°C.

The total **duration of heat waves** in the Czech Republic fluctuated in the 2000–2020 period without any trend (Chart 6). The occurrence of heat waves in individual years was related to the development of atmospheric circulation over the European continent. The highest number of heat wave days during this period was registered in 2018 and 2015, when the summer was extremely warm and dry and heat waves lasted 42 and 41 days, respectively. In 2020, the total duration of heat waves was 11 days, the second lowest value after 2011 for the entire period since 2000.

Chart 6

Number of heat wave days per year in the Czech Republic [number of days], 2000–2020



Data source: Czech Hydrometeorological Institute

In a **regional breakdown**, the greatest total duration of heat waves in 2020 was recorded in Prague, in the Central Bohemian Region and in the Ústí Region, although on average most heat wave days occur in the South Moravian Region. Of the individual stations, Doksany (10 days), Česká Lípa (8) and Brandýs nad Labem/Stará Boleslav (8) recorded the highest number of heat wave days in 2020.

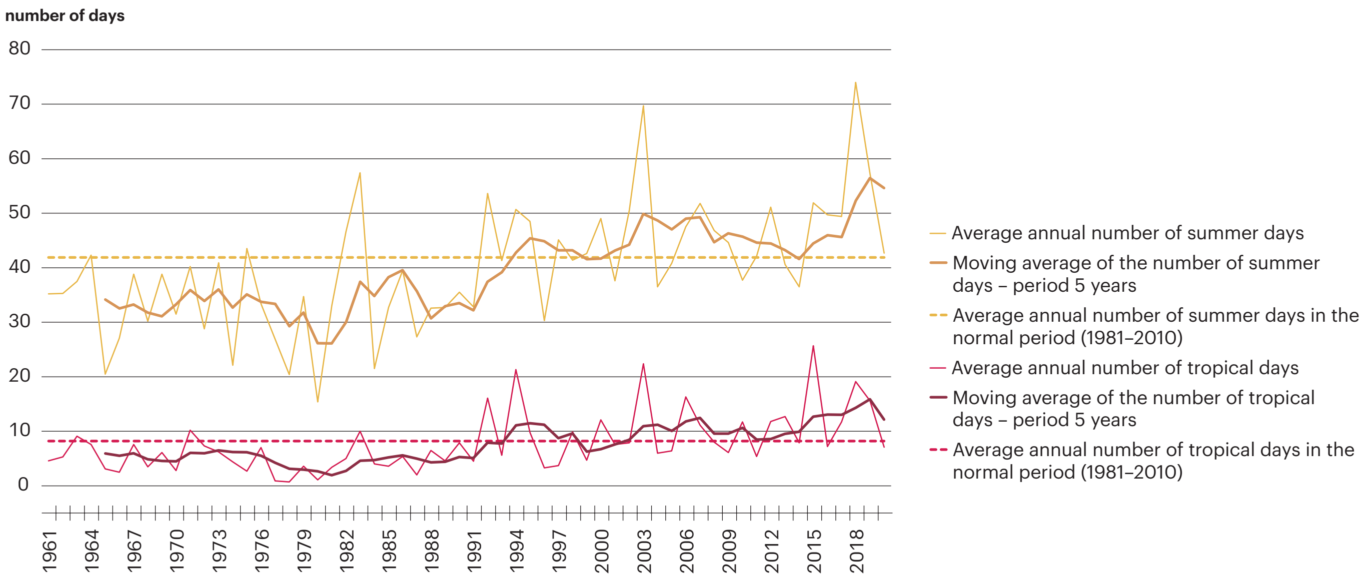
Number of summer days, tropical days and tropical nights

The occurrence of **summer days** (maximum daily temperature reaches 25°C or more), **tropical days** (with a temperature of 30°C or more) and tropical nights (when the temperature does not fall below 20°C) is used to characterize the temperature conditions of the summer season and its extremity. The rise in air temperature and temperature extremity are one of the most demonstrable manifestations of climate change.

During the 1961–2020 assessment period, the incidence of summer and tropical days in the Czech Republic slowly increased (Chart 7). The annual number of summer days increased at a rate of about 3.5 days in 10 years, and for tropical days the upward trend has been 1.5 days in 10 years. The dynamics of the upward trend, especially in the case of tropical days, have increased significantly since 1990. In the 2011–2020 ten-year period, the average annual number of summer days was 45.9 days, which is 109.5% of the 1981–2010 normal. The number of tropical days in this ten-year period reached 12.4 days, or 151.5% of normal. Compared to the 1981–1990 decade, when the number of tropical days averaged 5.2 days per year, the annual number of tropical days has more than doubled over the following 30 years. This development clearly shows the **deepening of the temperature extremes** of the summer season in the Czech Republic.

Chart 7

Number of summer and tropical days per year in the Czech Republic (territorial average) [number of days], 1961–2020



Data source: Czech Hydrometeorological Institute

In 2020, in terms of territorial average, 43 summer days were recorded in the Czech Republic, or 101.9% of the 1981–2010 normal, and 7 tropical days, or 86.6% of the 1981–2010 normal. Thus, 2020 was not a year with an exceptionally warm summer. However, despite the year-on-year variability, there is a clear upward trend in the occurrence of summer and tropical days. Most **summer and tropical days** in 2020 occurred in Central Bohemia, the Polabí region and South Moravia, i.e. in the warmest regions of the Czech Republic. The highest number of summer days (79) and tropical days (27) was recorded by the Dobřichovice station in the Central Bohemian Region.

Tropical nights occur rarely in the Czech Republic and are mainly linked to urban agglomerations – they can occur elsewhere, but rarely. The most tropical nights were recorded by the Polom-Sedloňov (3) and Praha-Klementinum (2) stations in 2020.

Occurrence of drought and flooding, run-off conditions and groundwater state

Key question

Was there any drought or flooding in the Czech Republic in 2020? What were the runoff conditions and groundwater levels?

Key messages

The climatic drought situation improved significantly in 2020 after the two very dry years of 2018 and 2019, according to the SPEI index, and the basic moisture balance there was only mild drought and only in the parts of the Czech Republic without mountains.

The soil drought in 2020 did not have an across-the-board character, especially the areas with higher altitude registered enough soil moisture.

In the Poohří region, parts of Central Bohemia and South Moravia, soil moisture values fell below 10% of available water capacity in 2020, indicating significant soil drought. These are areas where soil drought has also occurred in past years.

The spring period was influenced by the rainfall deficit, which was in turn reflected in subnormal flow rates in the monitored profiles and in the significantly to extremely subnormal groundwater levels in most of the territory, while heavy rains in June and October caused flooding.

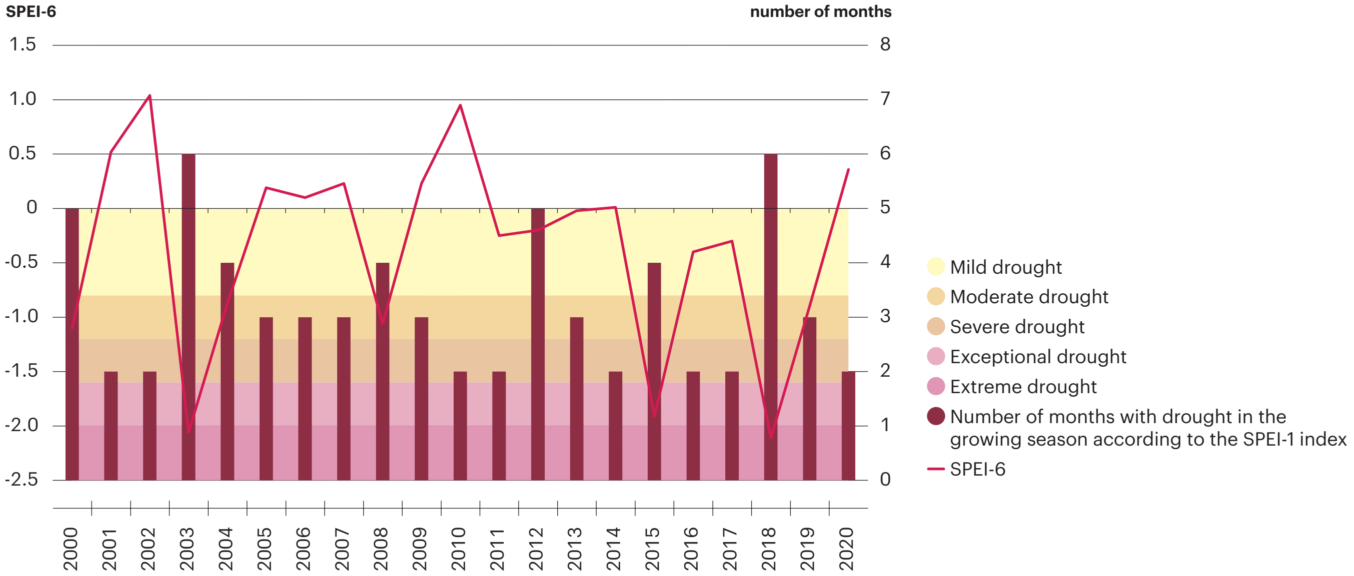
Duration of climatological drought periods

Climatic drought represents meteorological conditions (especially precipitation, air temperature and air humidity) that are unusual for the territory and lead to a lack of water in the territory, which can subsequently cause other forms of drought (hydrological, soil). Climatic drought must always be understood with respect to the locality and measures the degree of extreme meteorological conditions related to drought in relation to the normal. The SPEI index is an internationally used drought index that, in addition to precipitation-evapotranspiration conditions in the period under review, also considers the time series of these meteorological elements since 1961.

The average value of the **SPEI-6 precipitation-evapotranspiration index**, which evaluates drought cumulatively for the entire growing season (April to September) in the Czech Republic, fluctuated in the 2000–2020 period and did not show any trend. The driest years were 2003 and 2018, when the across-the-board value of the SPEI-6 index indicated extreme drought (Chart 8). In addition, in these years there was drought according to the monthly SPEI-1 index in all six months of the growing season. The year 2020 was not a dry year – rainfall was above normal and the SPEI-6 index reached 0.8, which means that there was no climatic drought in the whole growing season in terms of the average for the Czech Republic. However, during the growing season, according to the monthly SPEI-1 index there was drought in April, when its level was classified as exceptional, and in July when there was only slight drought.

Chart 8

SPEI-6 index for the growing season (April–September), occurrence of individual drought categories according to the SPEI-6 index, and the number of months with climatic drought according to the SPEI-1 index in the Czech Republic [SPEI-6, number of months], 2000–2020

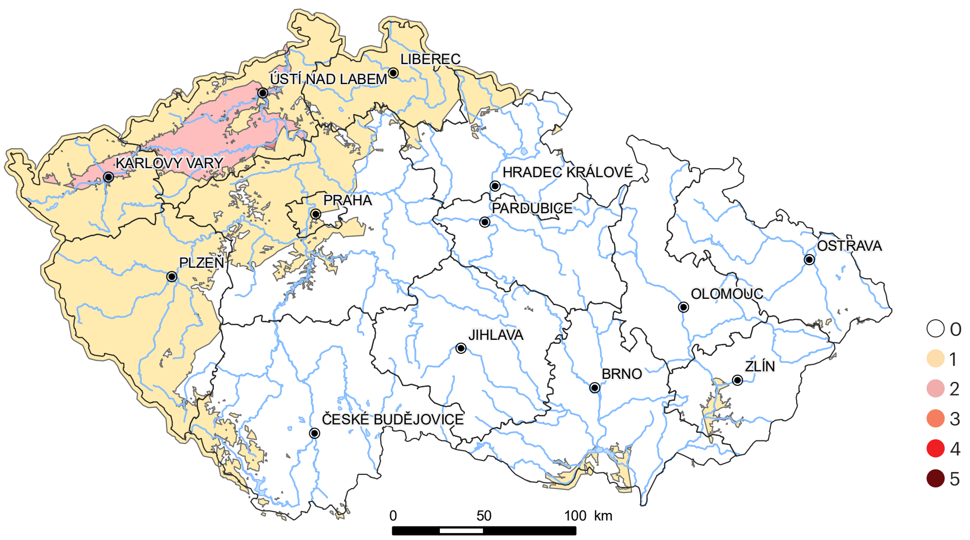


Data source: Czech Hydrometeorological Institute

According to the SPEI-6 index, in 2020 western and north-western Bohemia were mainly affected by drought (mild drought), while there was significant drought in the Ore Mountains foothills (Figure 3). These are areas where the lowest rainfall relative to normal was also recorded. On the other hand, there was either no drought in most of Moravia and Silesia, or the drought was only mild.

Figure 3

Classification of climatic drought according to SPEI-6 precipitation-evapotranspiration index for the growing season in the Czech Republic (April–September) [drought cathegory], 2020



Data source: Czech Hydrometeorological Institute

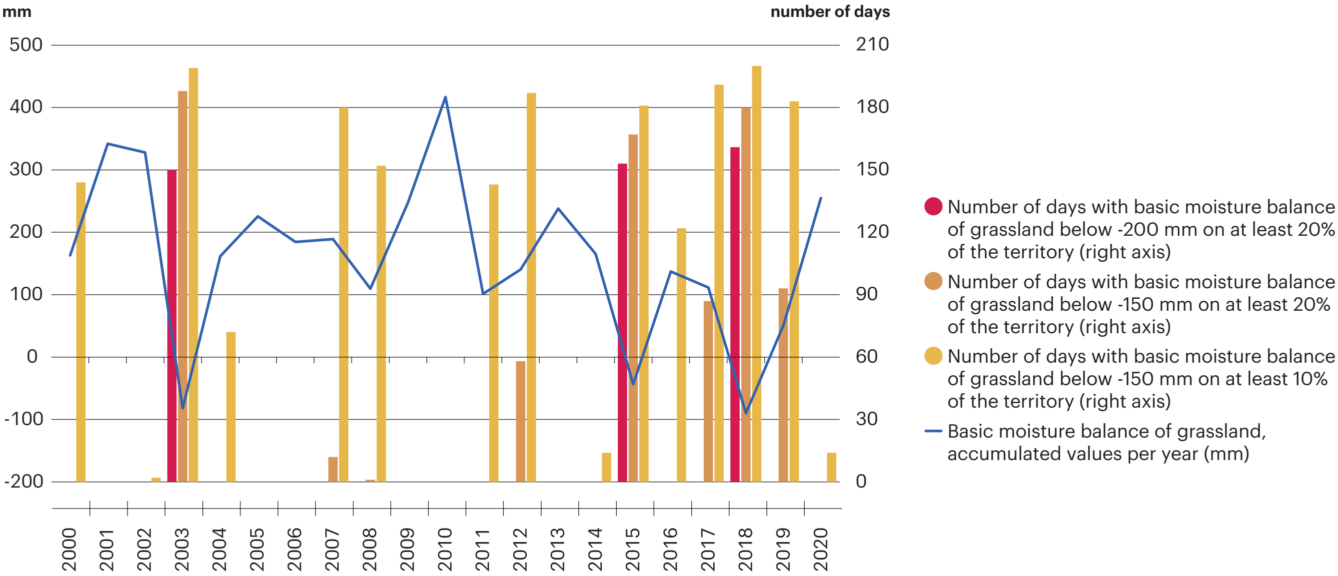
Moisture balance of grassland

The **basic moisture balance of grassland** is the difference between precipitation and potential evapotranspiration. Positive basic moisture balance of grassland is a prerequisite for sufficient soil moisture, while when the basic moisture balance of grassland falls to negative values, drought exposure increases with the consequent effects of drought on agricultural production, water management and the risk of vegetation fires.

The **annual accumulated basic moisture balance of grassland** in the Czech Republic in the 2000–2020 period fluctuated according to the temperature and precipitation conditions of the given years, while the lowest (with a negative annual total) were the very dry years 2003 and 2018 (Chart 9). In 2018, a significantly negative moisture balance in a significant part of the territory persisted for the longest time, specifically, a basic moisture balance of grassland of less than −200 mm on more than 20% of the territory occurred for 161 days. In 2020, the annual cumulative basic moisture balance of grassland reached 254.8 mm, or 137.4% of the 1981–2010 normal. The year 2020 thus belongs to wetter years in the Czech Republic according to the basic moisture balance of grassland. The basic moisture balance of grassland below −200 mm did not occur at all in a significant part of the territory during the year, and values below −150 mm persisted for more than 10% of the territory for only 14 days (compared to 183 days in 2019).

Chart 9

Annual accumulated basic moisture balance of grassland and the number of days with significantly negative values of basic moisture balance of grassland according to territorial criteria in the Czech Republic [mm, number of days], 2000–2020

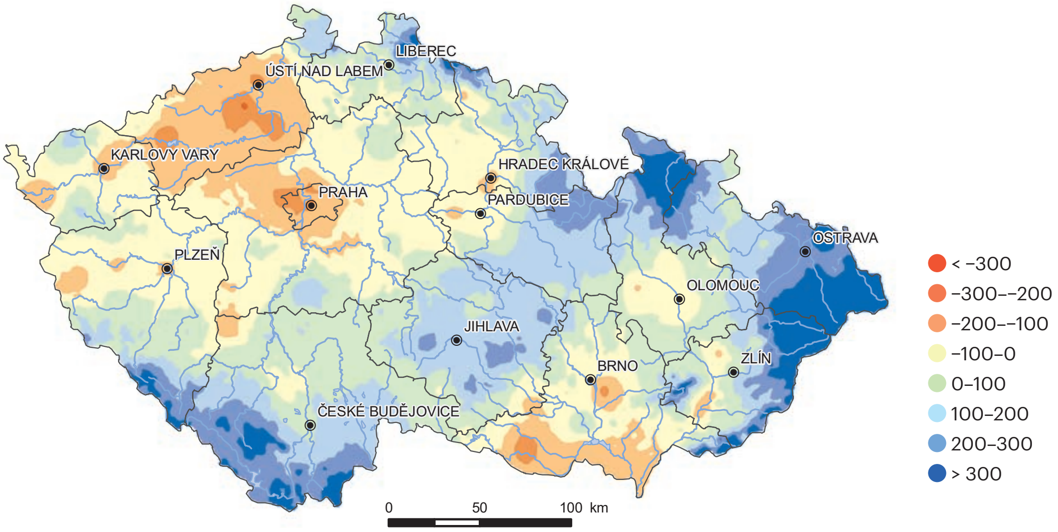


Data source: Czech Hydrometeorological Institute

From the point of view of the **regional distribution of basic moisture balance values** for the entire 2020 growing season (April to September), a negative moisture balance was recorded mainly in north-western Bohemia (Poohří), part of Central Bohemia, South Moravia and the Olomouc Region (Figure 4). In higher and colder altitudes, on the other hand, the moisture balance of precipitation and evaporation was significantly positive.

Figure 4

Basic moisture balance of precipitation and potential evapotranspiration of grassland in mm for the growing season 1 April to 30 September 2020 in the Czech Republic [mm]



Data source: Czech Hydrometeorological Institute

During the spring months of 2020, when April in particular was warm and dry, the basic moisture balance fell and the accumulated moisture balance values were negative in most of the Czech Republic at the end of May. In June, heavy rainfall led to a significant improvement in the moisture balance values except for northwest Bohemia and South Moravia, where the moisture balance values remained significantly negative during summer months. At the end of September, a negative moisture balance was recorded in more than half of the territory of the Czech Republic, with the lowest values prevailing in the Poohří region, South Moravia, the Plzeň Region, the north-western half of Central Bohemia and the Hradec Králové Region.

Available water capacity of the soil

The **availability of water in the soil** directly affects plants and is a direct indicator of soil (agricultural) drought. Available water capacity is the maximum amount of water that a soil with certain physical properties and selected profile depths can hold. Soil moisture below 30% of the available water capacity indicates drought, while values below 10% indicate significant drought. The water reserve in the soil is mainly influenced by the moisture balance of precipitation and evapotranspiration.

During the 2000–2020 period, exposure to **soil drought** fluctuated according to the number of days with low values of available water capacity in the soil (Chart 10). Very low soil moisture values below 10% of available water capacity occurred in the dry years of 2003, 2015, and especially in 2018, when the most significant soil drought since 2000 was recorded. Water reserves in soil below 10% of the available water capacity persisted over more than 20% of the territory for 138 days in that year. 2020 did not rank among those with long-term persistent and significant soil drought, yet even in that year there was soil drought in part of the Czech Republic. Soil moisture values below 30% of the available water capacity occurred on at least 10% of the territory for 76 days, but below 10% of the available water capacity only for 6 days.

Chart 10

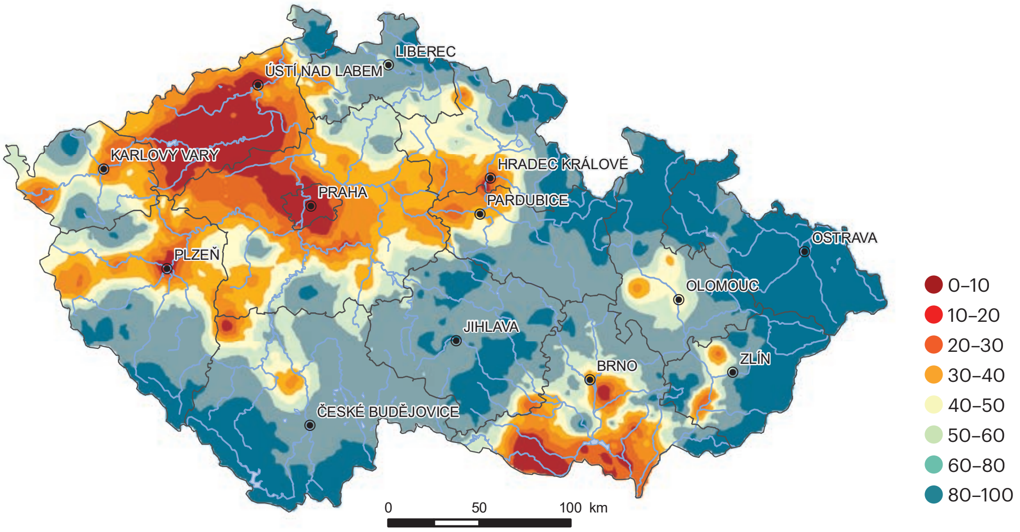
Number of days with water reserves in the profile of medium-heavy soil below 30% of the available water capacity and below 10% of available water capacity in the Czech Republic according to territorial criteria [number of days] 2000–2020

Data source: Czech Hydrometeorological Institute

The development of moisture conditions during the spring months of 2020 was reflected in a decrease in the **available water reserve in the soil** and the very negative trend of decreasing soil moisture values continued until mid-May. The situation subsequently improved slightly in the higher lying areas, but in most of the territory the available water in the soil values were at 50% of the available water capacity and lower. The situation changed significantly in mid-June when heavy rainfall totals resulted in an increase in water reserves in the soil in most of the Czech Republic. During the summer, there was again a slight decrease in available water reserves in the soil. At the beginning of the 2nd decade of September, the lowest soil moisture values were observed in the south of the South Moravian Region and especially in the Poohří region (Figure 5), while in other areas soil moisture values were high, especially in mountainous areas with the exception of the Ore Mountains. Soil moisture in drought areas was replenished at the end of September and then in mid-October.

Figure 5

Soil moisture reserves expressed in % of the available water capacity in the Czech Republic (170 mm/m) – current state of the modelled value as of 21 September 2020



This date was chosen because of the lowest soil moisture values in the regions affected by soil drought.

Data source: Czech Hydrometeorological Institute

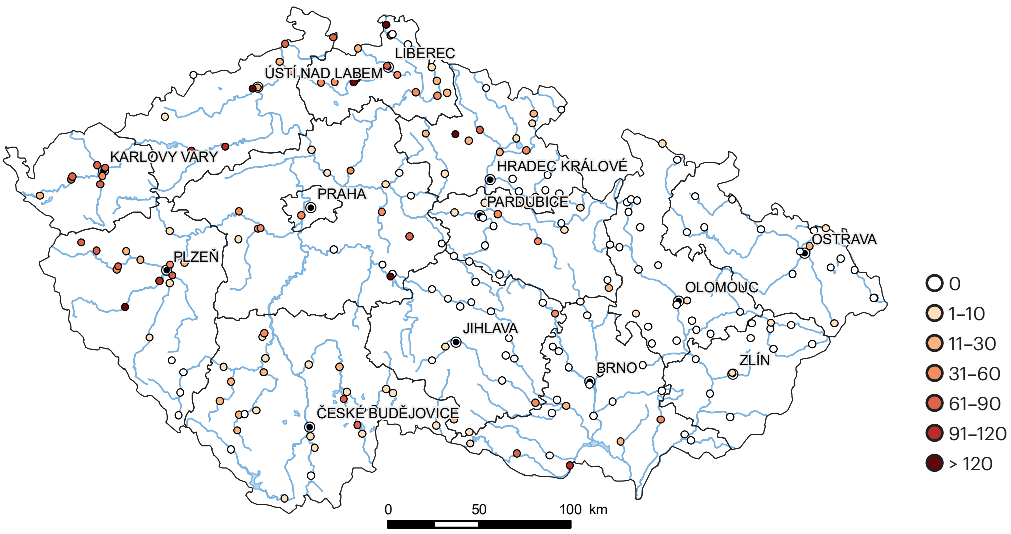
Abundance of water resources and duration of hydrological drought

From a hydrological point of view, 2020 was very diverse. From January to May, below-average flow rates values prevailed in all monitored river basins, with flow rates approaching the average (and on some profiles reaching slightly above-average values) only in February thanks to precipitation and snow cover. In terms of hydrological drought, the situation was worst in April and early May, when average flow rates fell to minimum levels. The heavy rainfall from the end of May, which continued throughout June and also in the following summer months, improved the hydrological situation significantly. In June, after a prolonged period of drought, there was more significant regional flooding, and above-average or average flow rates also prevailed in the following months. The second period of flooding, which affected most of the territory, occurred in October. The flow rates in individual river basins gradually decreased towards the end of the year, and below-average flow rates again prevailed in December.

The **average annual flow rate** in 2020 ranged from 48% to 149% of the long-term average for the 1981–2010 period, with the lowest being on the Berounka-Beroun profile and the highest on the Odra-Bohumín profile. Hydrological drought, when the flow rate is under Q_{355}, was recorded on some flows. This is the flow rate reached or exceeded on average 355 days a year, and which is important for maintaining the basic water management and ecological functions of the flow. Hydrological drought lasting more than 100 days was recorded on 11 profiles (out of a total of 217 monitored). The worst situation was on the Bílina watercourse, where the hydrological drought in the Trnice profile lasted 227 days. Also in the Stráž pod Ralskem profile on the Ploučnice river, when the flow rate was under Q_{355} for 162 days, and in the Lázně Bělohrad profile on the Javorka river, where the flow rate was under Q_{355} for 161 days (Figure 6).

Figure 6

Flow rate under the long-term 355-day flow rate in the Czech Republic for the 1981–2010 period [number of days], 2020

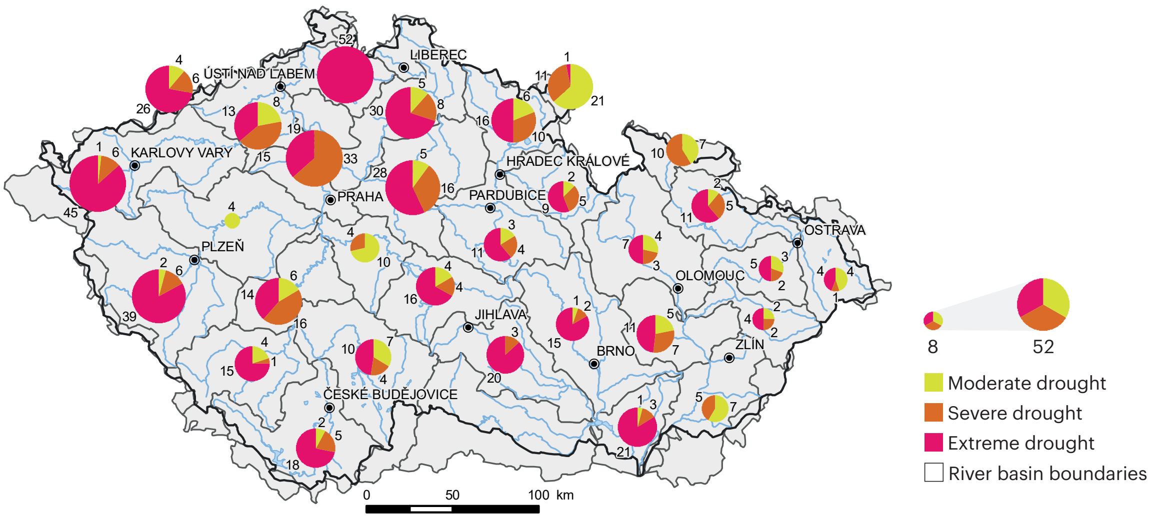


Data source: Czech Hydrometeorological Institute

Groundwater circulation in shallow wells and springs was very atypical in 2020. Spring, when groundwater levels usually peak, was very dry. During the summer, when there is a natural decline, the groundwater state actually improved significantly thanks to above-normal rainfall totals, especially in June. In June and July, there was a significant improvement up to normal, and this lasted until September. In October, there was another significant improvement up to a significantly above-normal state (shallow wells) or a slightly above-normal state (springs), and the annual maximum was reached. The situation was not the same in all regions of the Czech Republic, as in northwestern Bohemia (the Ohře river basin, the Lower Elbe and other tributaries of the Elbe) the drought persisted for almost the whole year, while there was a similar situation at the confluence of the Morava and Dyje rivers (Figure 7, Figure 8).

Figure 7

Duration of drought in springs in the Czech Republic [number of weeks], 2020

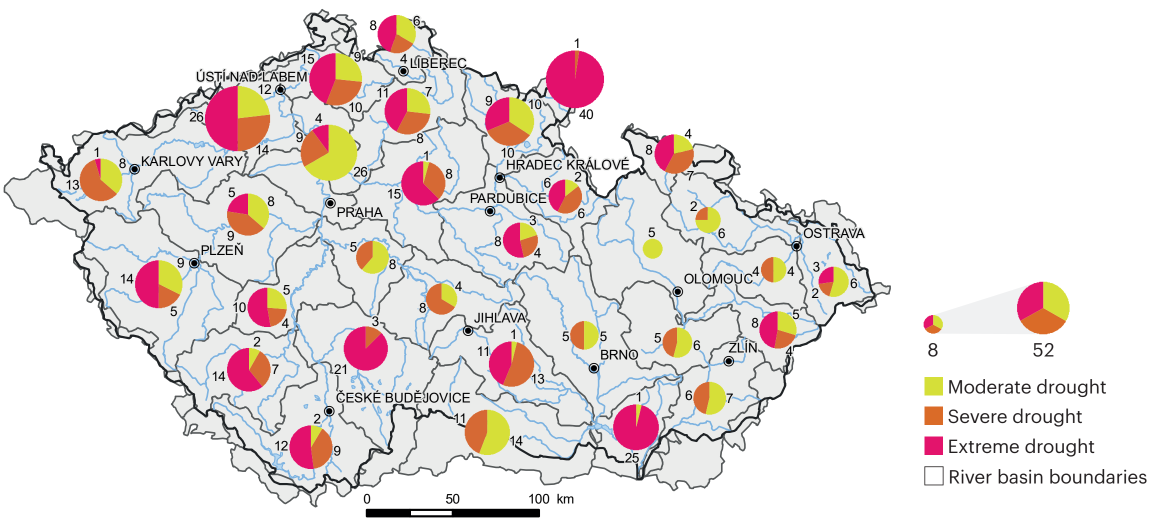


River basin data are aggregated and processed using the current drought index.

Data source: Czech Hydrometeorological Institute

Figure 8

Duration of drought in shallow wells in the Czech Republic [number of weeks], 2020



River basin data are aggregated and processed using the current drought index.

Data source: Czech Hydrometeorological Institute

The **yield of the springs** in the Reporting Network of the Czech Republic was significantly below normal from the beginning of the year – in January, 65% of the springs had a yield at severe to extreme drought level. The situation later approached normal, but at the time of the usual spring maximums (April), the yield was again significantly below normal and 75% of the springs in the Czech Republic had a yield at severe to extreme drought level. May was the driest month of the year, when a severe to extreme subnormal yield was found in 81% of the springs. The situation was also below normal for **shallow wells**, with groundwater levels for shallow wells being the lowest in April and May (81% had severe or extreme subnormal levels in April and 72% in May). Persistent rainfall in June significantly improved the situation, with 6% to 17% of shallow wells having severe to extreme subnormal levels between July and December. The state of **deep aquifers** was worst in May, when the level was severely or extremely below normal in 66% of deep wells, and in the following months the level of deep wells was severely to extremely below normal in 30% to 55% of wells.

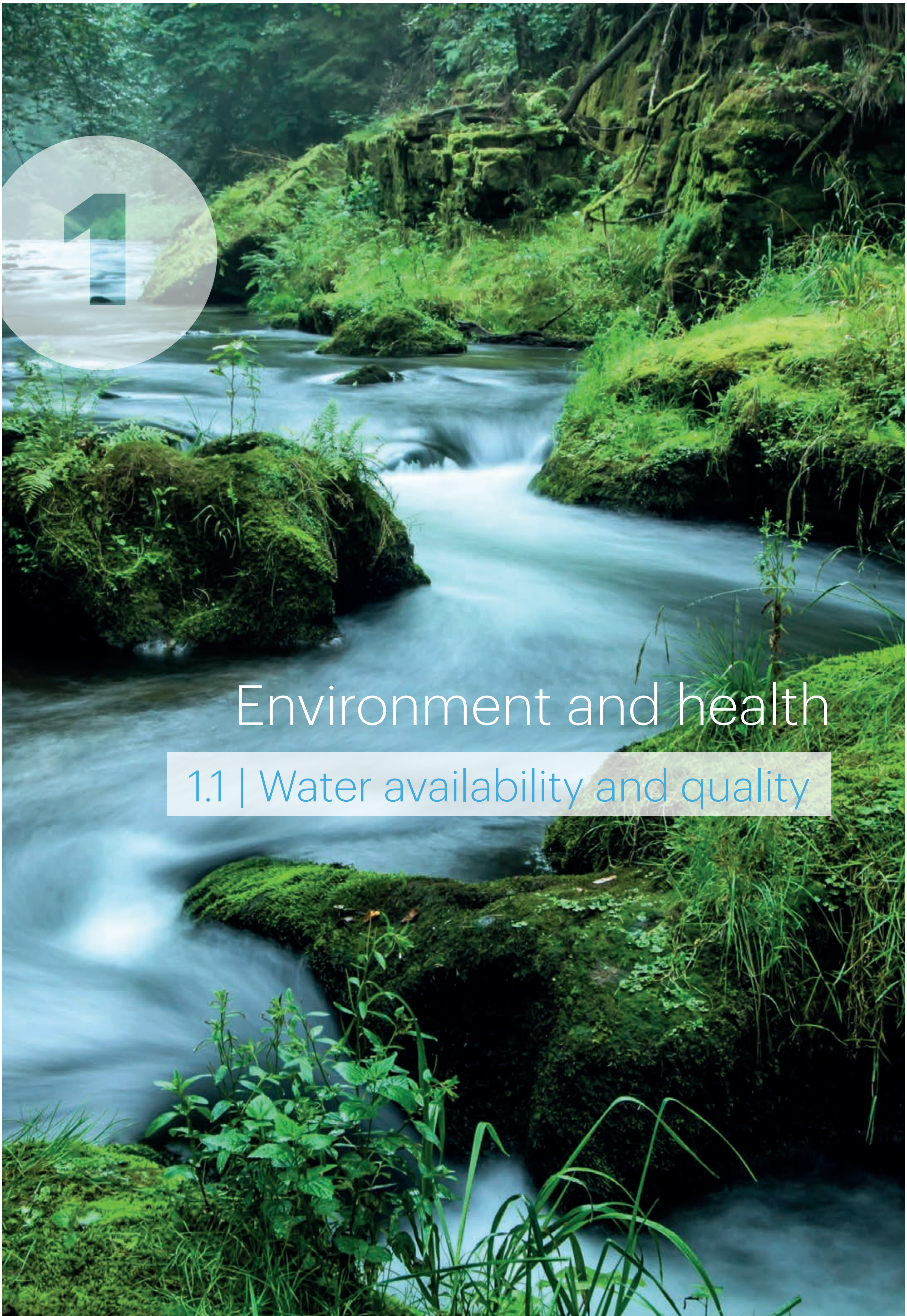
Flooding

There were several flooding events in 2020. The flooding was caused by a combination of rain and melting snow, long and torrential rainfall, and (only with the exception of January and April) run-off events occurred in all months with one of the flood activity levels being exceeded. The most extensive in terms of territory and also the largest flooding in 2020 in terms of culminating flow rates took place in June and October, with the June flooding being the first regionally significant flooding after a long dry period. There were 65 **flooding events** reaching the **third stage of flood activity** in 2020.

There was flooding caused by torrential rainfall in four episodes in June 2020. The river basins of the Upper and Middle Elbe, Lusatian Neisse, Odra, Bečva, Morava and Dyje rivers were most affected by the flooding. The highest culminating flow rates values in terms of repetition time were reached on the Velička river in the Velká nad Veličkou and Strážnice profiles with a Q20–50 repetition time, and on the Oslava in the Dlouhá Loučka profile, where the repetition time was set at Q50.

The first flooding episode was a reaction to more significant rainfall from 7 to 8 June, when 35 to 50 mm, occasionally around 100 mm, fell in 24 hours in a narrow strip running from South Bohemia through the Bohemian-Moravian Highlands to the Jeseníky Mountains. The second significant run-off episode took place on 13 and 14 June, when on 13 June torrential rain and thunderstorms occurred in most of the territory, with maximum precipitation of 30 to 40 mm/h. The most significant flow increases were in watercourses in the Chrudimka and Novohradka river basins. The third flooding episode in June was a result of precipitation from 18 to 20 June, when it rained throughout the Czech Republic and the daily nationwide averages in the country were around 15 mm. In this period, the watercourses draining the Eagle Mountains rose in particular, and there were significant rises on the tributaries of the Middle Elbe and on the watercourses draining the Beskydy, Jeseníky and Jizera Mountains. The last flooding episode in June took place between 22 and 30 June, when precipitation and the previous significant saturation caused rapid rises in water levels, especially in the basins of the Upper Vltava, Upper Elbe, Odra and Morava rivers. The highest precipitation was on 29 June, when in 24 hours it rained mostly between 5 to 30 mm, and 30 to 55 mm in some parts of the Bohemian-Moravian Highlands and Jeseníky Mountains.

As in June, the October flooding mainly affected the Upper and Middle Elbe river basins, the Lusatian Neisse and Stěnava basins, and the Odra, Bečva and Morava basins in Moravia. The highest culminating flow rates values in terms of repetition time were reached in the Morava river basin on the Lower Morava river in the Strážnice profile (Q20–50).



1 Environment and health

1.1 | Water availability and quality

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1.1 | Water availability and quality

Water quality is directly linked to the discharge of pollutants into waste water and is thus significantly affected by the level of treatment of industrial and municipal waste water. Pollution also enters surface water and groundwater from agricultural activities, through the runoff of substances used to treat and fertilise plants. Pollution entering surface water and groundwater can have negative impacts on aquatic ecosystems and can affect the quality of water for human consumption. Unpolluted water is important for all organisms and its quality influences the level of treatment needed to produce drinking water. To maintain sufficient water in aquatic ecosystems for all living organisms, it is particularly important to monitor water abstraction for human use, prevent water losses in the water supply network, and increase water use efficiency, especially in the current era of climate change.

Overview of selected related 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 the targeted reduction of discharges, emissions and releases of priority substances
- providing for the assessment of the state of surface water and groundwater

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

Council Directive 91/271/EEC concerning urban waste water treatment
- obligation to ensure the connection of municipalities with over 2,000 PE to a WWTP

State Environmental Policy of the Czech Republic 2012–2020 (updated 2016)
- support for measures leading to the capture and subsequent use of rainwater and service water in residential formations
- completion of the construction and reconstruction of missing WWTPs in municipalities with over 2,000 PE, providing support for the construction and reconstruction of sewers ending with WWTPs in municipalities with up to 2,000 PE
- achieving at least good ecological state or potential and good chemical state of surface water bodies, achieving a good chemical and quantitative state of groundwater bodies

Strategy of the Ministry of Agriculture of the Czech Republic with a View to 2030
- objectives for water infrastructure development, the sustainable management of aquatic ecosystems

Government Regulation No. 401/2015 Coll., on indicators and values of permissible surface water and waste water pollution, requirements for permits for the discharge of waste water into surface waters and sewers, and on sensitive areas
- sets limits for the permissible pollution of surface water and waste water

Act No. 254/2001 Coll., on waters and on amendments to certain other laws
- defining conditions for the economic use of water resources and for maintaining and improving the quality of surface water and groundwater
- creating conditions for mitigating the adverse effects of floods and droughts and conditions for ensuring the safety of water works
- ensuring the supply of drinking water to the population

Act No. 274/2001 Coll., on water supply and sewerage for public use and on amendments to certain other laws
- regulating relations arising in the development, construction and operation of water supply and sewerage systems serving public needs

National river basin plans
- protection of water as an environmental component
- reducing the adverse effects of floods and droughts
- sustainable use of water resources, in particular for drinking water supply
- the progressive achievement of good water state and no deterioration of the current water state
- including assessments of the state of water bodies prepared in six-year cycles

Sub-basin plans
- proposals for specific measures through programmes of measures to progressively eliminate significant water management problems

1.1.1 | Surface water quality

Key question

Is the water quality in watercourses improving? What was the quality of the waters used for open-air bathing? What is the chemical and ecological state of surface water bodies?

Key messages

Over the 2000–2020 period, the best reductions in pollution in Czech watercourses were achieved for $N\text{-}NH_4^+$ (74.5% decrease in average concentration) and P_{total} (a decrease of 46.3%).

69.5% of bathing water sites were classified as quality category I or II in 2020.

In the water quality assessment according to Czech Technical Standard 75 7221, the prevailing quality class for the 2019–2020 biennium is Class III (polluted water).

The share of profiles with at least one pesticide above the environmental quality standard – annual average was 91%.

Assessment of the trend and state of indicators

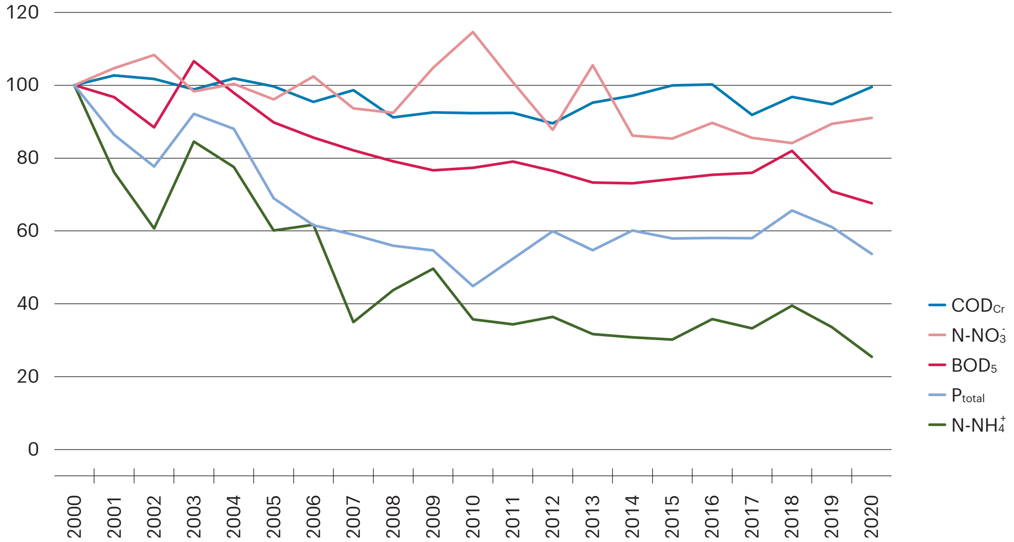
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Water quality in watercourses	↗	→	→	~
Bathing water quality	↗	→	↝	~

Water quality in watercourses

Water quality in watercourses in the Czech Republic is monitored on 1,024 representative river profiles, with 124 profiles being used for the assessment. For the assessment of the 2000–2020 period, the **basic COD_{Cr}, BOD_5, $N\text{-}NH_4^+$, $N\text{-}NO_3^-$ and P_{total} indicators** were selected. For the 2000–2020 period, the best reductions in pollution in the Czech Republic's watercourses were achieved for $N\text{-}NH_4^+$ (74.5% decrease in average concentration) and P_{total} (a decrease of 46.3%), Chart 11. The average concentration of ammoniacal nitrogen reached in 2020 was 0.126 mg per litre. The decline is mainly due to more efficient waste water treatment and a decline in livestock production. The total phosphorus concentration in 2020 reached an average of 0.154 mg per litre. The reason for the positive long-term trend is that some of the phosphorus pollution comes from point source pollution, which is undergoing more thorough treatment. Based on these indicators, a water quality map of watercourses is also produced, and watercourse sections are classified into five quality classes (Figure 9).

Chart 11

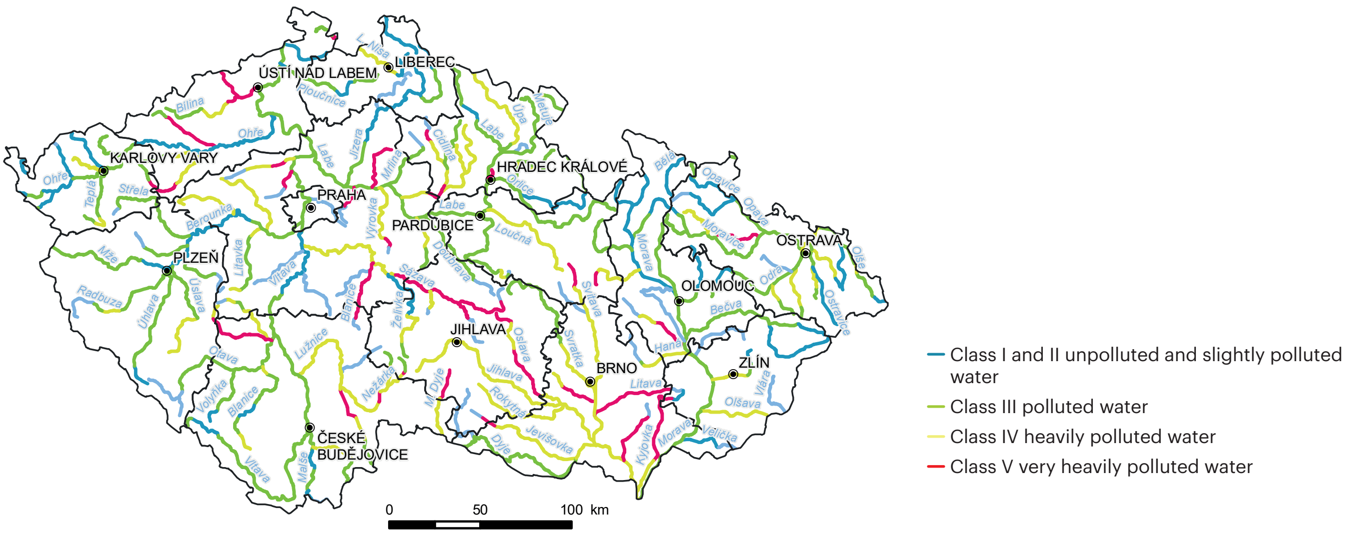
Trend in pollution concentration indicators in watercourses in the Czech Republic [index, 2000 = 100], 2000–2020



Data source: Czech Hydrometeorological Institute from the state enterprise Povodí

Figure 9

Water quality in watercourses in the Czech Republic, 2019–2020



Data source: T. G. Masaryk Water Research Institute

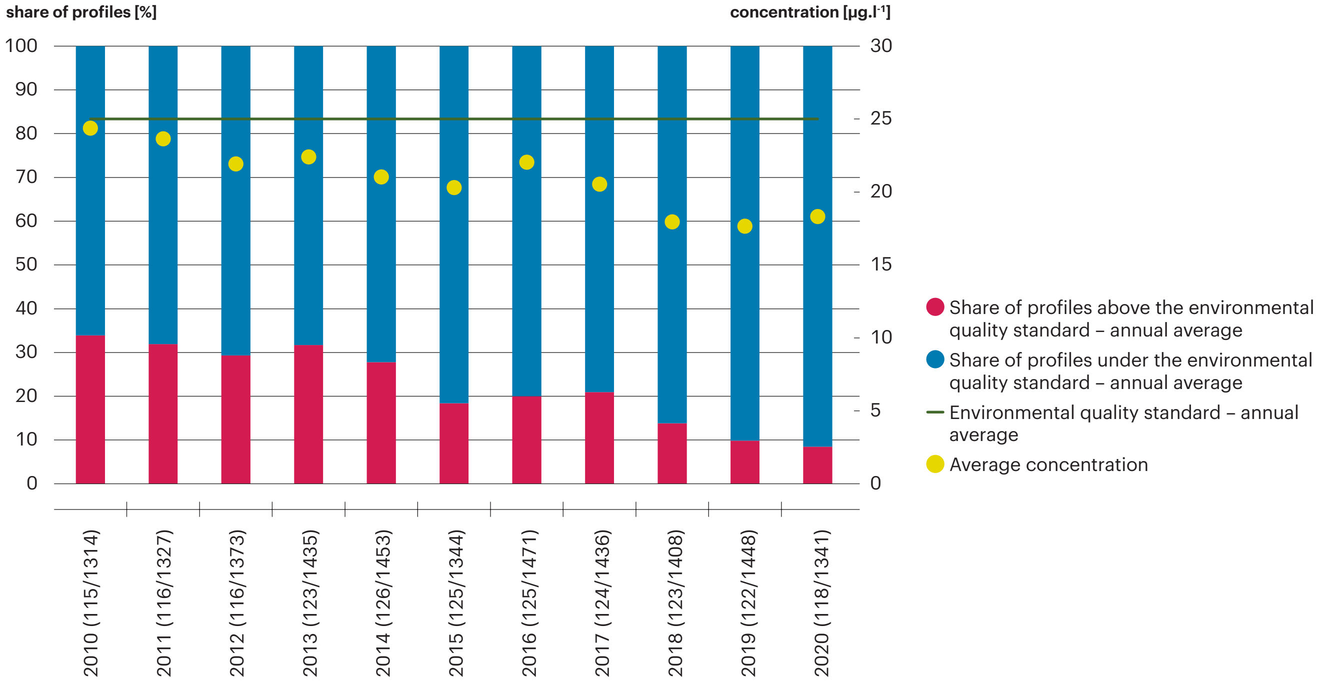
The assessment of water quality in watercourses for the 2010–2020 period was carried out for several indicators listed in Government Regulation No. 401/2015 Coll. These are COD_{Cr}, BOD_5, total organic carbon (TOC), N-NO_3^-, N-NH_4^+, total phosphorus (P_{total}) and thermotolerant coliforms, halogenated organic compounds (AOX), benzo(ghi) perylene, dissolved metals (Pb, Hg, Cd) and the sum of pesticides. Chlorophyll was assessed according to Czech Technical Standard 75 7221, updated in 2017.

COD_{Cr} shows a basically steady state over the period under assessment with concentrations between 18 and 20 mg per litre without significant fluctuations. The environmental quality standard – annual average values are above the limit for approximately 5–15% of the profiles. The average **BOD_5** concentrations did not differ significantly over the period under assessment. Values exceeded the environmental quality standard – annual average on 10–17% of the profiles. Average **TOC** concentrations did not vary significantly in the 2010–2020 period, ranging from 6.735 to 7.440 mg per litre. The number of profiles exceeding the environmental quality standard – annual average ranges from 8–15%. The **N-NO_3^-** concentrations (around 3 mg per litre) show a steady state over the last 7 years, a slight decrease compared to the beginning of the assessment period. The number of profiles exceeding the environmental quality standard – annual average was highest in 2010 (23%) and lowest in 2015 (3%). **N-NH_4^+** concentrations showed a slight decrease with small fluctuations during the period under assessment. The share of profiles exceeding the environmental quality standard – annual average was around 20%. **Total phosphorus** showed an increase in concentrations up to above the environmental quality standard – annual average in the period under assessment. The number of profiles exceeding the environmental quality standard – annual average value was in the 35–45% range.

AOX show a decrease in both concentration and number of values exceeding the environmental quality standard – annual average. At the beginning of the period under assessment, over 30% of the profiles were above the environmental quality standard – annual average, while in the last 3 years this was only 8–14% of the profiles (Chart 12). No trend can be traced for **benzo(ghi)perylene**. The share of profiles exceeding the environmental quality standard-NPK ranges from 1 to 12% in the 2010–2020 period.

Chart 12

Share of profiles in the Czech Republic where the environmental quality standard – annual average limit for AOX was exceeded [%] and average concentration [$\mu g.l^{-1}$], 2010–2020



On the x-axis, the number of profiles/number of values included in the calculation is given in brackets below the year.

Data source: Czech Hydrometeorological Institute

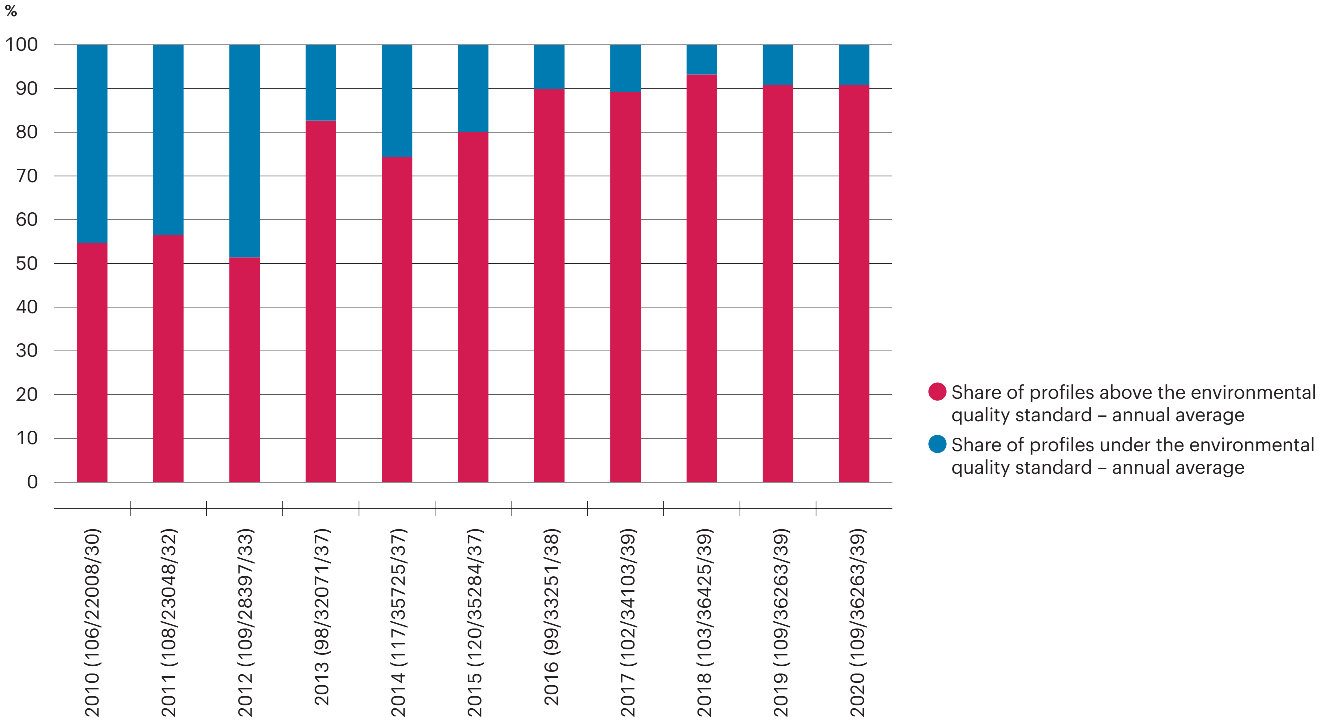
The maximum values for dissolved **mercury** were at or slightly below the environmental quality standard-NPK of 0.07 µg per litre in 2011, 2013, 2018 and 2020. In other years, the environmental quality standard-NPK was exceeded in 1–15% of profiles. The environmental quality standard – annual average for dissolved **lead** was only exceeded in the monitoring period in 2020, where 1 profile showed almost double the limit value of 1.2 µg per litre. Dissolved **cadmium** exceeded the environmental quality standard – annual average limit values only on 1–3 profiles. In 2014, 2015, 2017 and 2020, no concentration above the limit value was detected in any of the monitored profiles.

Thermotolerant coliforms are assessed according to environmental quality standard-P90 (40 KTJ per ml). This value was exceeded many times over in the period under assessment on a significant number of profiles, namely on 28–72% (the lowest number of profiles above the limit was in 2012, the highest in 2013).

For the **sum of pesticides**, the assessment was carried out in such a way that if one of the monitored pesticides did not comply with the environmental quality standard – annual average limit, the whole profile was considered non-compliant. Values where the limit of determination was higher than the environmental quality standard – annual average were excluded. The number of monitored pesticides listed in Government Regulation No. 401/2015 Coll. has gradually increased from 30 in 2010 to 39 in 2020, and this has been reflected through a deterioration of the assessment in recent years. The percentage of profiles with at least one non-compliant pesticide has also increased significantly, from 51–55% in the 2010–2013 period to 89–93% in the 2016–2020 period (91% in 2020, Chart 13).

Chart 13

Share of profiles where the environmental quality standard – annual average limit for the sum of pesticides was exceeded [%], 2010–2020



On the x-axis, the number of profiles/number of values included in the calculation/maximum number of pesticides assessed is given in brackets below the year.

Data source: Czech Hydrometeorological Institute

Chlorophyll does not have any limit in Government Regulation No. 401/2015 Coll., therefore its assessment was carried out according to Czech Technical Standard 75 7221. In this case, the classification into 5 classes is made in accordance with the standard and the share of profiles in each class is expressed as a percentage. In the last 5 years, the representation of the most polluted profiles (Class IV and V) has been around 40% in total.

Pharmaceuticals and their metabolites that enter surface waters from municipal sources due to the lack of technologies for their treatment at municipal WWTPs are problematic in surface waters. In 2020, the results from 315 profiles (2,818 samples in total) were processed for 67 individual analytes. Pharmaceuticals were found in 294 profiles (93.3% of the profiles monitored), in a total of 2,286 samples (81.1% of the samples). Monitoring is uneven in the individual Povodí company enterprises, in terms of both the number of monitored substances and profiles.

In accordance with Directive 2013/39/EU amending Directive 2008/105/EC, the assessment of[1] **mercury in fish muscle** (European chub) was carried out on 15 profiles and in **fish fry** on 22 profiles. The environmental quality standard for mercury (0.020 mg per kg) was exceeded in all fish muscle profiles during the reporting period. For fish fry, the value was exceeded in 96% of profiles in 2013. The environmental quality standard was exceeded in 46% of profiles for fish fry in 2020. The environmental quality standard value for **PBDEs** in fish muscle is 0.0085 µg per kg and was exceeded in all profiles monitored during the assessment period. The environmental quality standard for **PFOS** in fish fry is 9.1 µg per kg and was exceeded in 29% of profiles monitored in 2020 (67% of profiles in 2013). The environmental quality standard for **benzoapyrene** is 5 µg per kg and was exceeded in 30% of benthic zone profiles in 2020 (16% of profiles in 2013). The environmental quality standard for **fluoranthene** is 30 µg per kg and was exceeded for benthic zones for 10% of profiles in both 2013 and 2020.

Based on Directive 2000/60/EC of the European Parliament and of the Council (Water Framework Directive), an **assessment of the state of surface water bodies**[2] is being prepared as part of river basin management plans, which are prepared in six-year cycles. The assessment was made for chemical and ecological state or potential. The so-called one-out, all-out principle is applied to the whole assessment when synthesising the individual monitored indicators (i.e. if any of the monitored indicators of any of the components of the state assessment exceeds the threshold value, the assessment of the whole component, and therefore the whole unit, is classified as unsatisfactory, or takes the value of the worst monitored indicator). In the 2016–2018 assessment period, only 5.9% of surface water bodies achieved at least good ecological state or ecological potential, while 94.1% of surface water bodies achieved medium or worse state. The water chemistry state describes the occurrence and levels of priority substances, priority hazardous substances and other pollutants. A total of 32.5% of surface water bodies achieved good chemical state, 49.1% did not, and 18.4% were not assessed.

Bathing water quality

The **quality of bathing waters** is monitored annually in the Czech Republic. In 2020, a total of 275 bathing sites were monitored, of which 50.6% were classified in the best category, i.e. quality category I (50.2% in 2019). The share of sites classified as quality category II fell from 20.7% in 2019 to 18.9%. Bathing bans were issued at 8 sites (2.9% of sites) due to cyanobacteria overpopulation, while bans were issued at 10 sites (3.7% of sites) in 2019. The number of sites with water unsuitable for bathing (quality category IV) was the same as the year before, namely 30 sites (with a 10.9% share in 2020).

[1] Monitoring was carried out in 2013–2015 and 2019–2020.

[2] The assessment is carried out at six-year intervals (2015, 2021, 2027). The assessment for the 3rd planning period, carried out in 2019, respectively in 2018, is preliminary (National River Basin Plans will be approved at the end of 2021) and is based on monitoring data from the 2016–2018 period, and exceptionally older data.

1.1.2 | Groundwater quality

Key question

Is groundwater quality improving? What is the chemical and quantitative state of groundwater bodies?

Key messages

There have been no significant changes in nitrogen concentrations since 2010.

Significant groundwater contamination was detected for the sum of pesticides at a total of 200 sites in 2020 (124 sites exceeded the limit for shallow wells, 41 sites exceeded the limit for deep wells, and 35 sites exceeded the limit for springs).

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Groundwater quality	N/A	→	→	~

Groundwater quality

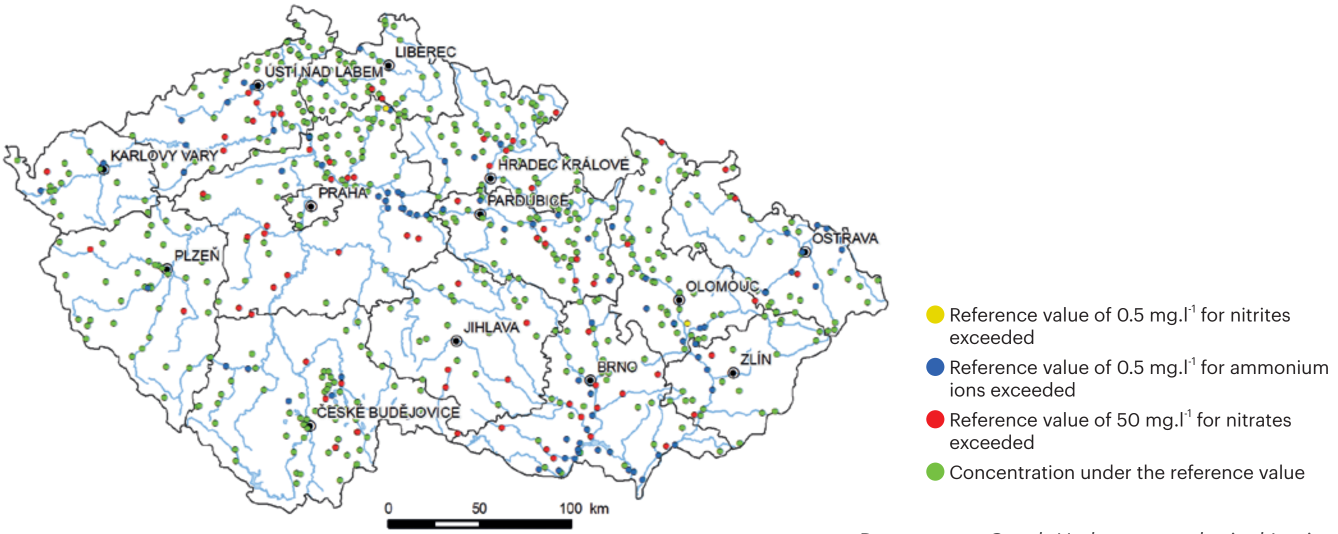
Water quality is also monitored and assessed annually for **groundwater** on the basis of Decree of the Ministry of the Environment of the Czech Republic and the Ministry of Agriculture of the Czech Republic No. 5/2011 Coll. In 2020, 695 sites were monitored in the State groundwater quality monitoring network, including 201 springs, 224 shallow wells and 270 deep wells. A total of 366 quality indicators were monitored. The number of shallow wells where groundwater limits were exceeded in at least one indicator was 183, for deep wells the limit was exceeded at 132 sites, and for springs at 89 sites[3]. The results of the groundwater quality assessment for 2020 did not change significantly compared to the previous 2017–2019 period due to the slow dynamics of changes in groundwater chemistry.

In 2020, the dominant inorganic groundwater pollution indicators compared to the threshold values of the Ministry of the Environment of the Czech Republic and Ministry of Agriculture of the Czech Republic Decree No. 5/2011 Coll., as amended, were **ammonium ions** (11.7% of above-limit samples) and **nitrates** (10.9% of above-limit samples), Figure 10. There have been no significant changes in nitrogen concentrations since 2010.

[3] *Assessment based on selected indicators (NH_4^+, NO_2^-, NO_3^-, Cl^-, SO_4^{2-}, As, Cd, Co, Ni, Pb, Hg, COD_{Mn}, DOC and pesticides).*

Figure 10

Concentration of nitrogenous substances in groundwater in the Czech Republic [mg.l-1], 2020

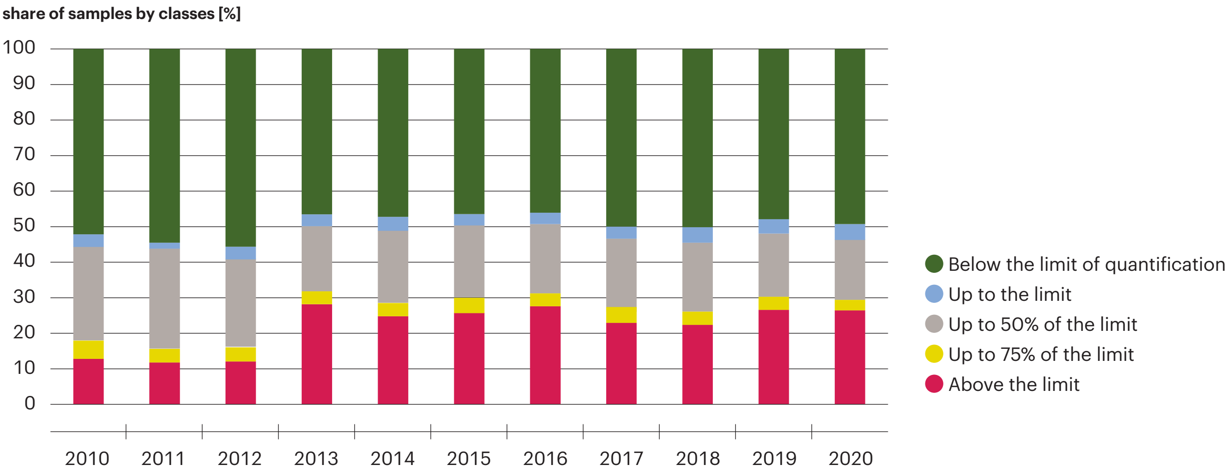


Data source: Czech Hydrometeorological Institute

Of organic substances, **pesticides** are the main pollutants (Figure 11). In this large group, it is often not the active substances of pesticide products directly, but pesticide metabolites that exceed groundwater limits. Excessive concentrations of individual pesticide substances are also reflected in the increased number of 26.4% of above-limit samples in 2020 for the sum of pesticides indicator with a quality standard of 0.5 μg per litre (Chart 14). Over the years, the set of monitored substances has been expanding, and in 2013 there was a significant jump in the number of monitored pesticide substances in groundwater quality monitoring with the inclusion of the most problematic metabolite chloridazon desphenyl, resulting in a significant change in the number of above-limit values for the sum of pesticides. Between 2013 and 2020, there was a slight fluctuation in the above-limit values and no trend is apparent. Groundwater samples with above-limit pesticide concentrations were mostly collected from shallow wells. In 2020, a total of 200 sites were found to exceed the sum of pesticides limit (124 shallow wells, 41 deep wells, and 35 springs).

Chart 14

Shares of set values for the sum of pesticides indicator in the Czech Republic [%], 2010–2020



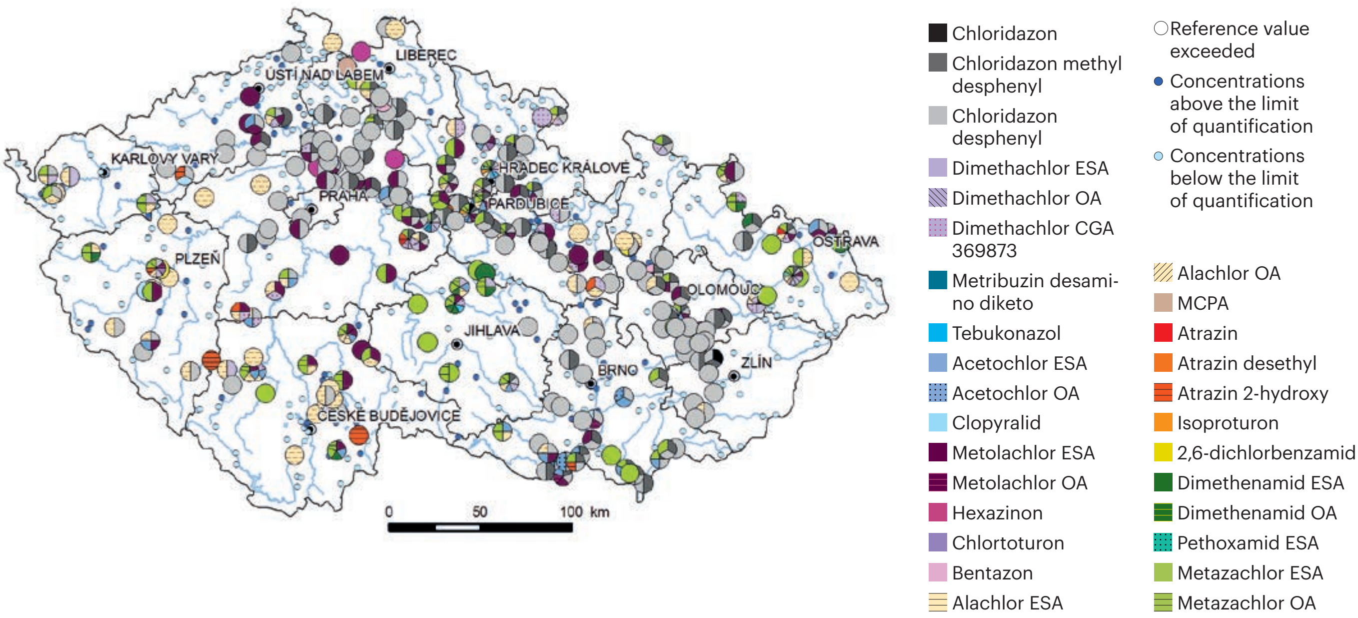
Maximum number of substances monitored from the pesticide group: in 2010 (85), in 2011 (85), in 2012 (85), in 2013 (156), in 2014 (162), in 2015 (140), in 2016 (135), in 2017 (138), in 2018 (150), in 2019 (195) and in 2020 (196).

Data source: Czech Hydrometeorological Institute

The most frequently occurring substances from the pesticides group are herbicides used for the treatment of rapeseed, corn and beets (these are metabolites of chloridazone, metazachlor, metolachlor and dimethachlor) and, of already banned herbicides, metabolites of acetochlor, alachlor and atrazine are found in groundwater. The long-term bad state of groundwater contamination by pesticides is caused, among other things, by compliance with the requirements of European legislation on the share of renewable energy sources in transport, given that pesticide preparations are widely used for the cultivation of crops to produce biofuels.

Figure 11

Pesticide concentrations in groundwater in the Czech Republic [μg.l^{-1}], 2020



The map shows the occurrence of pesticides that exceeded the quality standard set for groundwater by Directive 2006/118/EC of the European Parliament and of the Council - Annex I at more than 1 monitoring site.

Data source: Czech Hydrometeorological Institute

On the basis of Directive 2000/60/EC of the European Parliament and of the Council (Water Framework Directive), an **assessment of the state of bodies of groundwater**[4] is carried out as part of river basin management plans prepared in six-year cycles. The assessment was carried out for the chemical and quantitative state. The so-called one-out, all-out principle is applied to the whole assessment when synthesising the individual monitored indicators (i.e. if any of the monitored indicators of any of the components of the state assessment exceeds the threshold value, the assessment of the whole component, and therefore the whole unit, is classified as unsatisfactory, or takes the value of the worst monitored indicator). Out of the total of 174 groundwater bodies defined in upper, base and deep aquifers, 46 bodies had a satisfactory chemical state in the 2013–2018 period, 126 bodies had an unsatisfactory chemical state, while the chemical state could not be assessed in 2 groundwater bodies due to lack of data. The quantitative state of groundwater bodies is based on a balance assessment, as the amount of water abstracted should not exceed the usable groundwater resources and at the same time should respect the requirements for the so-called ecological flows of the associated surface waters. 162 groundwater bodies had a satisfactory quantitative state, while 12 groundwater bodies had an unsatisfactory quantitative state.

[4] *The assessment is carried out at six-year intervals (2015, 2021, 2027). The assessment for the 3rd planning period, carried out in 2019, respectively in 2018, is preliminary (National River Basin Plans will be approved at the end of 2021) and is based on monitoring data from the 2016–2018 period, and exceptionally older data.*

1.1.3 | Drinking water supply to the population

Key question

Is the share of the population connected to the public water supply increasing?

Key messages

The share of the population connected to the public water supply system increased compared to 2000, from 87.1% to 94.6%. ✓

Assessment of the trend and state of indicators

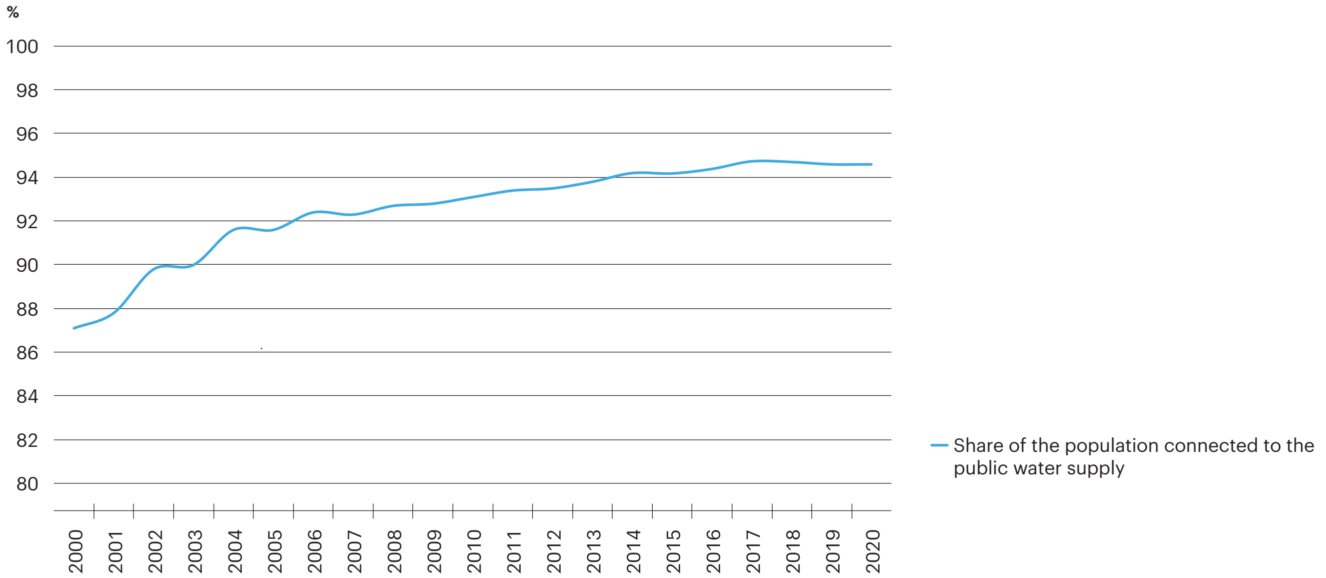
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Population supplied with water from the public water supply	↗	↗	→	✓

Population supplied with water from the public water supply

The water management infrastructure has been developing over the long term, and is being revitalised, while the share of the population connected to the public water supply is also increasing. The **share of the population connected to the public water supply** has increased significantly compared to 2000, from 87.1% to 94.6% (Chart 15). The target of 96.7% of the population connected to the public water supply set by the Strategy of the Ministry of Agriculture of the Czech Republic with a View to 2030, will probably be met in 2023 if the current trend is maintained.

Chart 15

Share of the population connected to the public water supply in the Czech Republic [%], 2000–2020



Data source: Czech Statistical Office

1.1.4 | Waste water treatment and discharge

Key question

Is the amount of pollution discharged from point sources into surface waters being reduced thanks to more efficient waste water treatment and the connection of the population to public sewers and waste water treatment plants?

Key messages

The number of waste water treatment plants (WWTPs) has been increasing in the long term, and the share of WWTPs with tertiary treatment is increasing. In 2020, a total of 2,795 WWTPs were operated in the Czech Republic, of which 58.2% had tertiary treatment.

The volume of discharged waste water decreased by 1.3% year-on-year to 1,502.4 mil. m^3, a decrease of 16.7% compared to 2000.

16.6 % of the population is not yet connected to a sewerage system terminating in a WWTP.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Waste water treatment	↗	↗	↗	✓
Waste water discharge	↘	↘	↘	~

Waste water treatment

The share of the population of the Czech Republic connected to a sewerage network was 86.1% in 2020 (Chart 16), while the share of the population connected to a sewerage network with a WWTP was 83.4%. Compared to 2000, the share of the population connected to a sewerage system with a WWTP increased by 17.9 percentage points Despite the initial significant development of the water management infrastructure from 2000, which was influenced mainly by the Czech Republic's accession to the EU, the implementation of European legislation and the drawing of European subsidies, this development is gradually running into limits due to the need to cover smaller municipalities where fewer inhabitants are concentrated and where there is a lack of budget funds. 16.6% of the population is still not connected to a sewerage system terminating in a WWTP; the waste water produced in these cases was treated, for example, in domestic sewage treatment plants or collected in cesspools and septic tanks and then taken away for professional treatment.

Chart 16

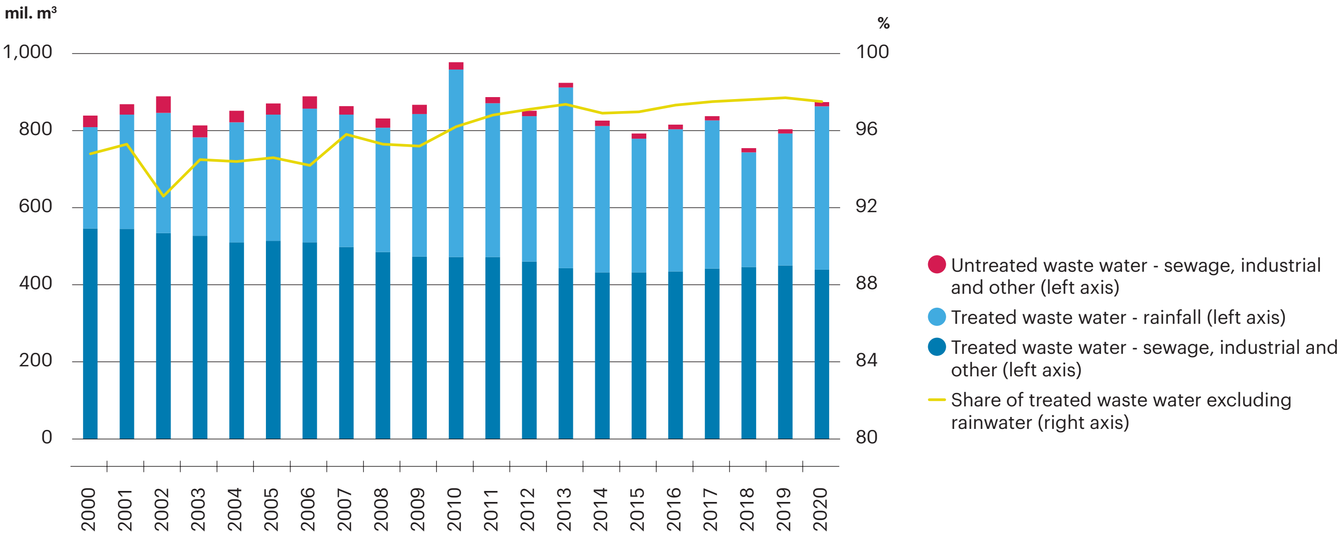
Percentage of population connected to sewerage systems and sewerage systems terminating in a waste water treatment plant in the Czech Republic [%], 2000–2020

Zdroj dat: ČSÚ

The total **volume of water discharged into a public sewerage system**, which includes chargeable rainwater, was 521.5 mil. m^3 in 2020, a decrease of 1.5% compared to 2019. Of this, the volume of water discharged to public sewers excluding rainwater was 450.5 mil. m^3 in 2020 (439.3 mil. m^3 treated and 11.2 mil. m^3 untreated, Chart 17). The share of treated waste water from water discharged to sewers has been high for a long time (94–98% since 2000), Chart 17. The fluctuation in 2002 was due to the reduced operation of WWTPs caused by flooding. WWTPs also treat a portion of uncharged rainwater. The quantity shows large year-on-year fluctuations, which correspond to the precipitation conditions of the given year. 423.7 mil. m^3 of rainwater was treated in 2020.

Chart 17

Treatment of waste water discharged into sewerage systems in the Czech Republic [mil. m^3, %], 2000–2020



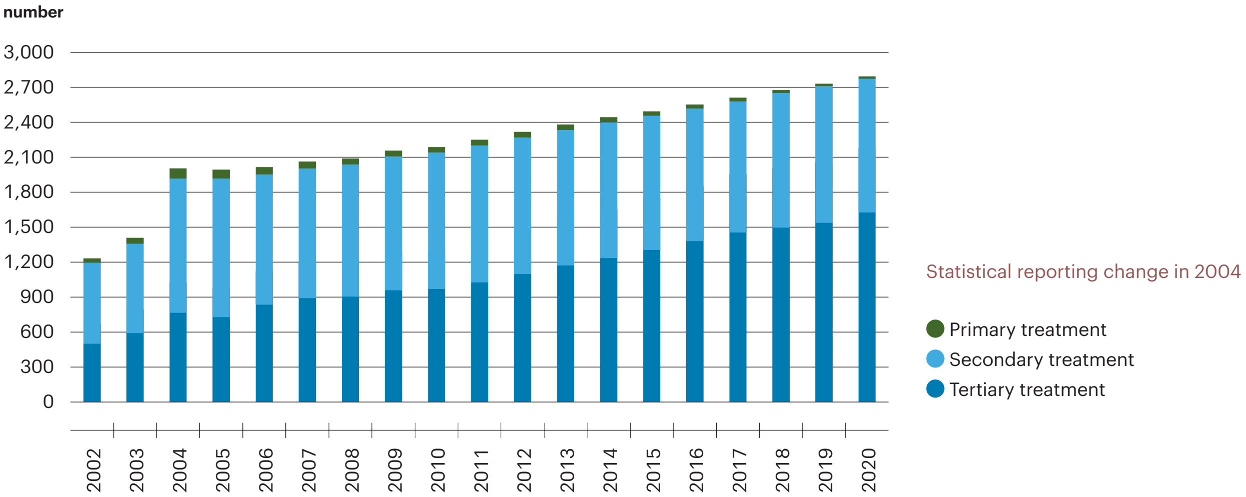
Up to and including 2003, the data are only for the sewers of the main operators. Since 2004, the number of respondents has been expanded. The given time series of selected indicators is influenced by changes in the statistical survey and the consequence of the gradual transformation of former water supply and sewerage companies (the transfer of sewerage systems into the ownership of cities and municipalities).

Data source: Czech Statistical Office

There were 2,795 **WWTPs for public use** in 2020. The number of WWTPs increased by 2.0% year-on-year (Chart 18). Due to the construction and reconstruction of WWTPs, the total number of WWTPs with nitrogen and/or phosphorus removal (tertiary treatment) in the Czech Republic increased by 88 compared to 2019 to 1,626. Only 22 treatment plants with purely mechanical treatment remained in 2020.

Chart 18

Waste water treatment plants by level of waste water treatment in the Czech Republic [number], 2002–2020



Primary treatment – mechanical WWTP, secondary treatment – mechanical biological WWTP without nitrogen and phosphorus removal, tertiary treatment – mechanical biological WWTP with subsequent nitrogen and/or phosphorus removal.

Data source: Czech Statistical Office

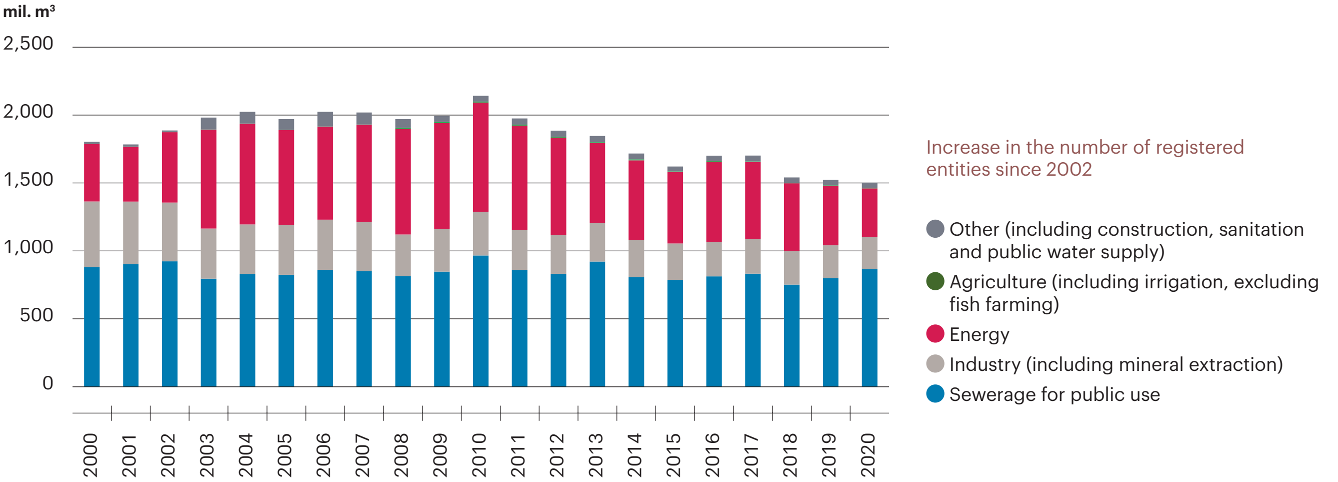
The average efficiency of WWTPs (the amount of pollution removed) is very high in the Czech Republic thanks to WWTP modernisation and reconstruction, and this has led to a reduction in the number of WWTPs with only mechanical treatment. The efficiency was 98.4% for BOD_5 in 2020. Some of the monitored indicators experienced a slight deterioration year-on-year, with P_{total} falling to 86.8%, COD_{Cr} to 94.9 % and N_{total} to 80.1%.

Waste water discharge

Since 2000, the **total volume of waste water discharged** has fallen by 16.7% to 1,502.4 mil. m^3 (Chart 19). The increase in 2002 and in the following two years was related to a change in the limit of the registered quantity of discharged water and an increase in the discharge of waste water from the energy sector, caused by the start of abstraction of cooling water for the Temelín nuclear power plant and another increase in abstraction for the Mělník power plant. In 2010, there was a significant increase in discharged water due to higher rainfall, which increased the volume of rainwater runoff. Since 2010, the volume of discharged water has been on a downward trend, with minor fluctuations. The low volume of discharged waste water in recent years was influenced by the development of rainfall patterns, and in addition by the closure of some enterprises in 2020 due to the COVID-19 pandemic.

Chart 19

Quantity of waste water discharged into surface waters in the Czech Republic [mil. m^3], 2000–2020



Until 2001, discharged waste water and mine water exceeding 15,000 m^3 per year or 1,250 m^3 per month were recorded. Since 2002, discharged waste water and mine water exceeding 6,000 m3 per year or 500 m^3 per month have been recorded - according to Section 10 of Decree No. 431/2001 Coll.

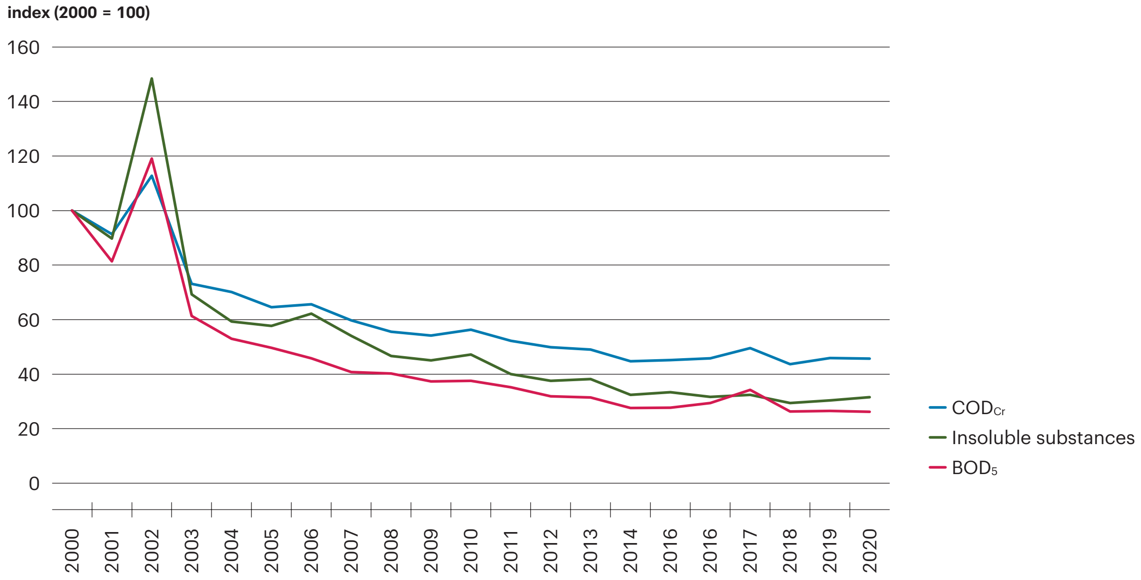
Data source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, v.v.i, Czech Statistical Office

The **structure of discharged waste water** reflects the structure of water users. The largest shares in 2020 were taken by public sewerage, with 57.6% (i.e. 865.7 mil. m^3), and energy with 23.8% (i.e. 357.5 mil. m^3). Waste water from industry accounted for 15.8% (237.6 mil. m^3), the other category accounting for 2.6% (39.7 mil. m^3), and waste water from agriculture accounting for only 0.1% (1.9 mil. m^3). A significant decrease was recorded for discharged waste water from the energy sector (by 18.5%) compared to 2019. The decline in waste water discharged from the energy sector in 2020 was largely influenced by the closure of enterprises related to the COVID-19 pandemic, and therefore a reduction in energy supply. Since 2011, there has been a gradual decline in waste water discharge from the energy sector, influenced by a reduction in electricity generation in steam power plants, a decrease in heat production from fossil fuels and, on the contrary, by the increasing use of RES for electricity and heat generation. Agriculture is a significant source of surface pollution, with substances used in agricultural activities (fertilisers, pesticides and pharmaceuticals) being washed into watercourses, yet this type of pollution is not recorded. Waste water discharged by the energy sector consists almost exclusively of waste water from flow cooling, which affects the temperature and oxygen regime of the water. On the contrary, discharged municipal waste water (sewerage for public use), significant point sources of pollution (mainly organic), increased by 8.4% year-on-year.

Monitoring the **amount of pollution in discharged waste water** is particularly important because it significantly affects the quality of surface water and groundwater. Since 2000, the quantity of discharged pollution has been on a downward trend, with minor fluctuations (there was a significant deviation in 2002, caused by the extreme flooding in that year), Chart 20. Since 2000, **BOD_5** has decreased to 26.1% of 2000 pollution levels and **COD_{Cr}** has decreased to 45.6% of 2000 pollution levels. Year-on-year, there was a decrease of 1.5% for BOD_5, 0.5% for COD_{Cr} and 3.7% for **suspended solids.**

Chart 20

Pollution discharged from point sources in the BOD_5, COD_{Cr} and suspended solids indicators in the Czech Republic [index, 2000 = 100], 2000–2020

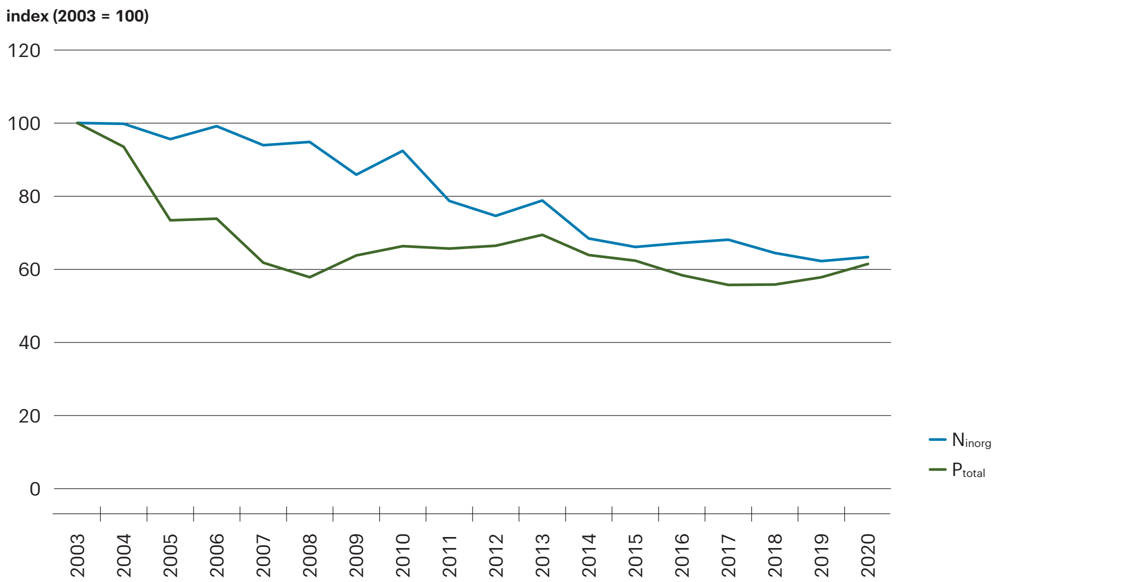


Source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, Czech Statistical Office

Nitrogen ($N_{inorg.}$) saw a 6.3% year-on-year increase in terms of the volume of pollution discharged, while phosphorus (P_{total}) saw a 1.8% increase (Chart 21). In the longer term, $N_{inorg.}$ and P_{total} have decreased by 36.7% and 38.6% respectively since 2003. The long-term decline is mainly influenced by the targeted application of biological nitrogen removal and biological or chemical phosphorus removal in the waste water treatment technology in new and intensified WWTPs, while it is further influenced by a reduction of phosphates used in detergents.

Chart 21

Pollution discharged from point sources in the $N_{inorg.}$ and P_{total} indicators in the Czech Republic [index, 2003 = 100], 2003–2020



Source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, Czech Statistical Office

1.1.5 | Efficient use of water

Key question

Are water resources in the Czech Republic used efficiently and sustainably?

Key messages

Total water abstracted has fallen by 24.3% since 2000. In 2020, total water abstraction was 1,365.9 mil. m^3, a decrease of 9.3% compared to 2019.

Total water abstracted has fallen by 24.3% since 2000. In 2020, total water abstraction was 1,365.9 mil. m^3, a decrease of 9.3% compared to 2019.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Groundwater and surface water abstraction by sector	↘	↘	↘	~
Water consumption from the public water supply and water losses in the water supply network	↘	→	→	~

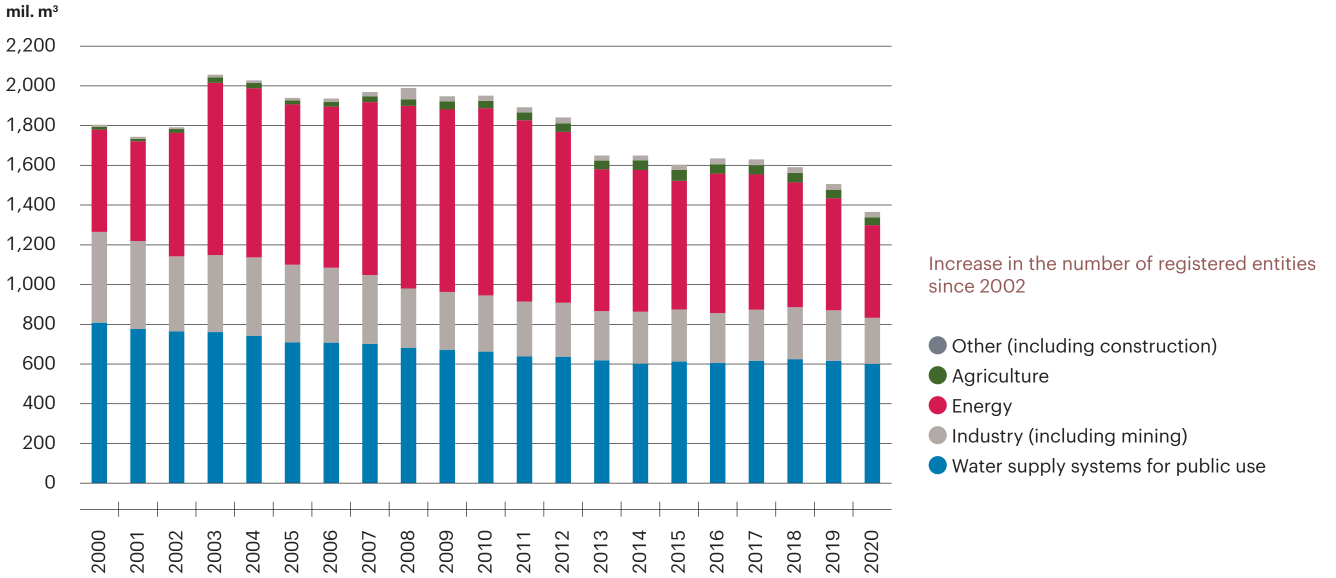
Groundwater and surface water abstraction by sector

Surface and groundwater abstraction reflects the development of the economy, the hydrometeorological conditions of the year in question, and the behaviour of households. Total water abstraction (i.e. the sum of surface water and groundwater abstraction) has fallen by 24.3% since 2000. In 2020, total water abstraction was 1,365.9 mil. m^3, a decrease of 9.3% compared to 2019.

The closure of enterprises during the COVID-19 pandemic significantly contributed to the year-on-year decline in total water abstraction. The highest abstraction was for the public water supply, accounting for 44.0% of total abstraction in 2020 (601.2 mil. m^3). The energy sector is another major customer, accounting for 34.1% of total abstraction (466.2 mil. m^3). Industry is the third-most-important water user, accounting for 231.7 mil. m^3 of water abstraction in 2020, i.e. 17.0% of total abstraction. Water abstraction for agriculture (38.9 mil. m^3 in 2020) and other sectors, including construction and waste water activities (12.2 mil. m^3 in 2020) together accounted for 4.9% of total water abstraction in 2020 (Chart 22).

Chart 22

Total water abstraction by sector in the Czech Republic [mil. m³], 2000–2020



Until 2001, water abstraction exceeding 15,000 m³ per year or 1,250 m³ per month was recorded. Since 2002, water abstraction by customers above 6,000 m³ per year or 500 m³ per month has been recorded – in accordance with Section 10 of Ministry of Agriculture of the Czech Republic Decree No. 431/2001 Coll.

Data source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, Czech Statistical Office

The majority of abstraction is from surface water (1 011.0 mil. m³, i.e. 74.0% of total abstraction), with a smaller part from groundwater (354.9 mil. m³, 26.0%). When dividing the total abstraction into **surface water and groundwater abstractions** (Chart 23, Chart 24) there are noticeable differences in the representation of individual economic sectors in terms of the source of the abstracted water.

99.6% of **water abstraction for power generation** is from surface water. This is mainly water abstraction for the flow-through cooling of steam turbines or for the operation of hydroelectric power plants. Abstraction for energy accounted for 45.9% of total abstraction in 2020. Since 2011, there has been a gradual decline in water abstraction for the energy sector, influenced by a reduction in electricity generation in steam power plants, a decrease in heat generation from fossil fuels and, on the contrary, the increasing use of RES for electricity and heat generation.

For **public water supply** abstraction in 2020, 51.9% of abstraction was from surface water and 48.1% from groundwater. The public water supply network is the most important groundwater user due to the higher quality of groundwater and thus less need for treatment for drinking water production, and accounts for 81.4% of groundwater abstraction in 2020.

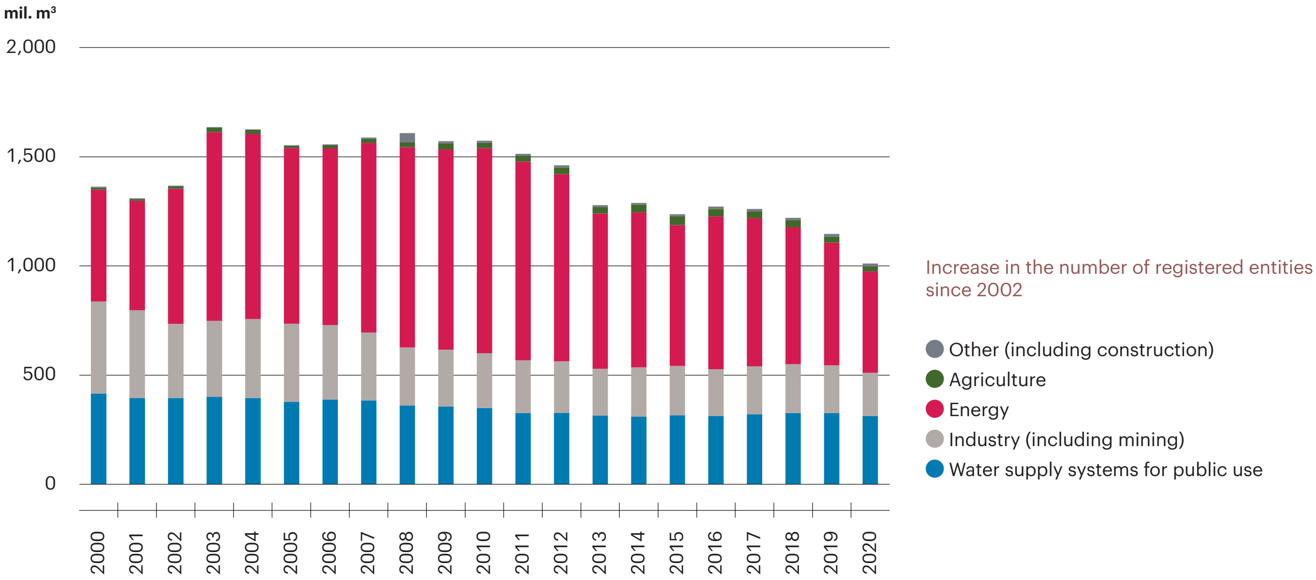
Water abstraction for **industry** was mainly from surface water (85.8%). Water abstraction for industry is generally influenced by economic developments in the sectors with the highest abstraction (the food, chemical and paper industries) and the introduction of new, more environmentally friendly production technologies. Compared to 2019, abstraction for industry fell by 8.8%, while this decline was due to production cutbacks in some sectors as a result of the COVID-19 pandemic.

60.0% of water abstraction for **agriculture** was from surface water and it accounts for 2.0% of total water abstraction. The year-to-year variation in abstraction for crop production depends on the temperature and rainfall patterns during the growing season.

A significant part of abstracted water is intended for drinking water production. In 2020, 581.6 mil. m^3 of water destined for realisation was produced. **Drinking water** billed to households and other customers amounted to 479.0 mil. m^3, of which households accounted for 70.5%. The year 2020 interrupted a short-term upward trend in billed water, with a 2.8% year-on-year decrease in billed water due to the COVID-19 pandemic and the associated closure of some enterprises, and office and commercial space. The other category therefore contributed to the overall decrease in billed water, while households saw a slight increase of 1.1% (Chart 25). In 2020, 94.6% of the population was supplied with water from the public water supply.

Chart 23

Surface water abstraction by sector in the Czech Republic [mil. m^3], 2000–2020

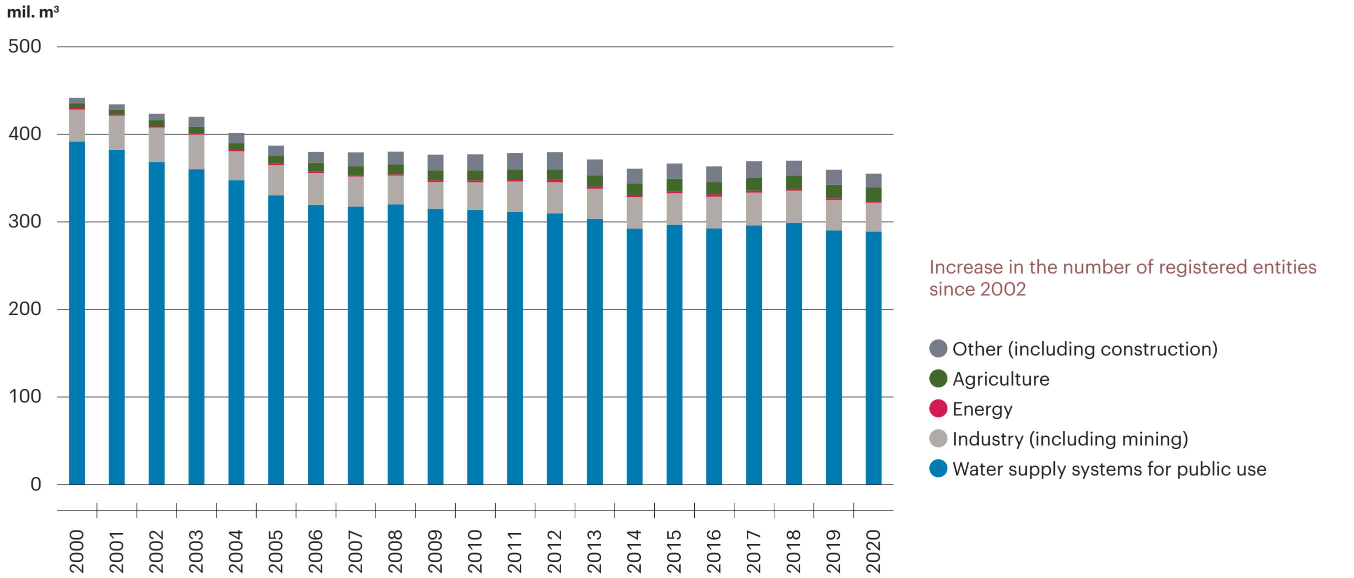


Until 2001, water abstraction exceeding 15,000 m^3 per year or 1,250 m^3 per month was recorded. Since 2002, water abstraction by customers above 6,000 m^3 per year or 500 m^3 per month has been recorded – in accordance with Section 10 of Ministry of Agriculture of the Czech Republic Decree No. 431/2001 Coll.

Data source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, Czech Statistical Office

Chart 24

Groundwater abstraction by sector in the Czech Republic [mil. m³], 2000–2020

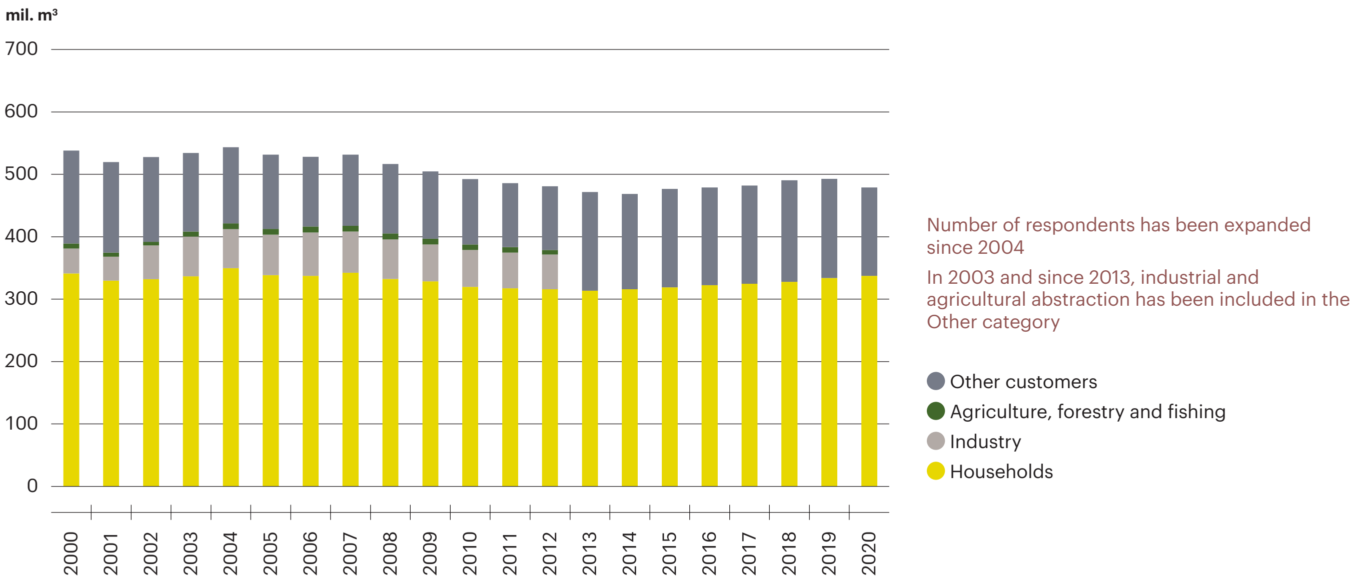


Until 2001, water abstraction exceeding 15,000 m³ per year or 1,250 m³ per month was recorded. Since 2002, water abstraction by customers above 6,000 m³ per year or 500 m³ per month has been recorded – in accordance with Section 10 of Ministry of Agriculture of the Czech Republic Decree No. 431/2001 Coll.

Data source: Ministry of Agriculture of the Czech Republic, state enterprise Povodí, T. G. Masaryk Water Research Institute, Czech Statistical Office

Chart 25

Use of drinking water from public water supply systems by individual groups of customers in the Czech Republic [mil. m³], 2000–2020



Until 2003, data are given only for the main operators. In 2003 and since 2013, the reporting of billed water has been simplified (industrial and agricultural abstraction is included in the Other category, which also includes construction, services and other customers connected to the public water supply).

Data source: Czech Statistical Office

Water consumption from the public water supply and water losses in the water supply network

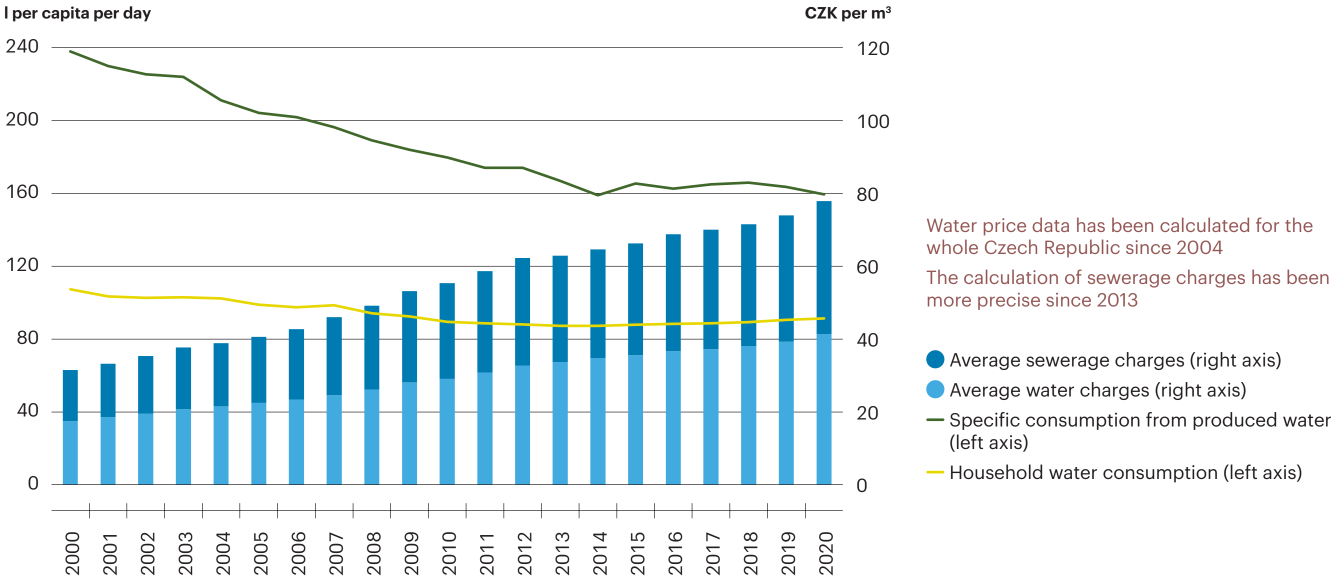
There has been a slight year-on-year increase in **water losses in the water supply network**, both in absolute terms (from 86,301 thous. m^3 to 87,840 thous. m^3) and as a share of the total volume of water produced for realisation (from 14.5% in 2019 to 15.1% in 2020). Losses of drinking water in the water supply network are caused by accidents and leaks from the public water supply systems. The share of drinking water losses in the water supply network has decreased significantly since 2000, when it was 25.2%.

Water consumption per capita supplied from the public water supply was 159.0 l per capita per day of the total amount of water produced, 2.8% less than in 2019 (Chart 26). Households saw a slight increase of 0.5% year-on-year, with 91.1 l per capita per day consumed by households in 2020.

The upward trend in **water and sewerage prices** continued in 2020, with average water and sewerage prices reaching CZK 41.4 per m^3 and CZK 36.5 per m^3 respectively (Chart 26).

Chart 26

Water consumption [$l.person^{-1}.day^{-1}$] and the price of water [$CZK.m^{-3}$] in the Czech Republic, 2000–2020



Up to and including 2003, water price data are given only for the main operators; from 2004 onwards, water price data are calculated for the whole country. Water prices are without VAT. Since 2013, the calculation of sewerage charges has been refined due to the inclusion of chargeable rainwater and also thanks to cooperation by respondents. The resulting sewerage charge per m^3 since 2013 is not fully comparable with the preceding years.

Data source: Czech Statistical Office

Water availability and quality in an international context

Key messages

In the 2019[5] bathing season, 79.1% of bathing areas in EU Member States had excellent water quality. The Czech Republic scored slightly above average (81.0% of sites had excellent water quality).

In the 2019[6] bathing season, 6,949 **inland bathing water areas** in EU Member States were assessed according to Directive 2006/7/EC of the European Parliament and of the Council, of which 79.1% had excellent water quality. The Czech Republic scored slightly above average (81.0% of sites had excellent water quality).

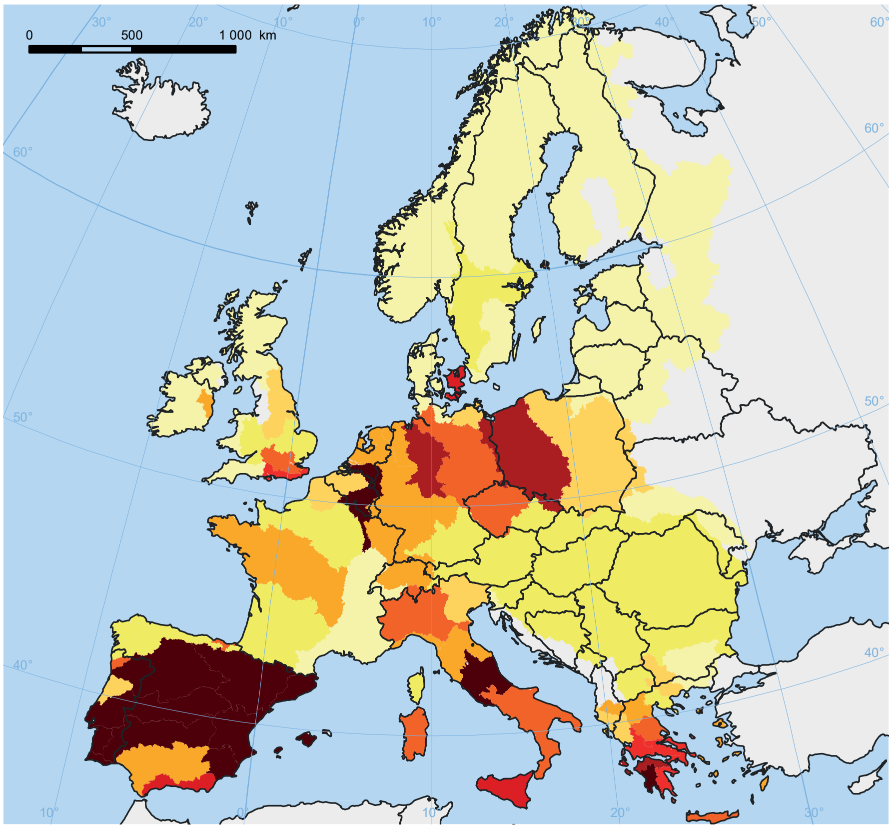
Access to water resources is strongly dependent on the geographical location and physical and geographic conditions of each country. The most at-risk countries in Europe, i.e. those with the highest WEI[7] (Figure 12) in July 2015, were Spain, Portugal, Italy, Belgium and the Netherlands. Water scarcity in these areas is due to both adverse natural conditions (climate, nature of the river network, geological conditions, etc.), anthropogenic interference with the water regime and water management in the country.

[5, 6] *Data for the year 2020 are not available at the time of publication.*

[7] *The WEI index expresses water scarcity and describes the pressure that total water abstraction puts on water resources (calculated as total water abstraction divided by the volume of renewable water supplies). It identifies countries with high abstraction relative to their resources and that are therefore prone to water scarcity (water stress). The WEI warning threshold, which separates regions with sufficient water from those with scarce water, is around 20%. Serious water shortages can occur when the WEI exceeds 40%.*

Figure 12

Water scarcity in Europe as measured by the WEI [%], July 2015



- < 5.0% without stress
- 5.1–10.0% without stress
- 10.1–15.0% without stress
- 15.1–20.0% without stress
- 20.1–25.0% water stress
- 25.1–30.0% water stress
- 30.1–35.0% water stress
- 35.1–40.0% water stress
- > 40.0% extreme water stress
- No data available

Data for the years 2016–2020 are not available at the time of publication.

Data source: EEA

Article 3 of Council Directive 91/271/EEC on **urban waste water treatment** obliges EU Member States to ensure that all agglomerations above 2,000 population equivalent are provided with urban waste water systems. Across EU Member States, the average connection rate to a sewerage system in 2016[8] was 94.7% in accordance with Article 3, with the Czech Republic achieving 100% compliance. The directive sets out individual criteria for specific types of treatment, with Article 4 stipulating that urban waste water discharged through sewerage systems must undergo secondary treatment or other equivalent treatment before discharge. Within the EU Member States, the compliance rate with this level of treatment was 88.7% (93.0% in the Czech Republic). As of 2016, the compliance rate with the stricter treatment requirements for agglomerations above 10,000 population equivalent in sensitive areas (Article 5) was 84.5% in EU Member States (65.0% in the Czech Republic).

[8] *Data for the years 2017–2020 are not available at the time of publication.*

1 Environment and health

1.2 | Air quality

1.2 | Air quality

Air quality has a major impact on human health and quality of life, as well as on ecosystems and vegetation, so it is necessary to ensure compliance with limit value for pollutants and the long-term reduction of air pollution load. Air pollution is one of the many factors affecting the health of the population, the effects of which are already evident at very low concentrations with no obvious treshold safe concentration limit. Currently the most important air pollutants in Czechia are particulate matter (PM), distinguished as suspended particles with various size fractions PM_{10}, $PM_{2.5}$ and PM_1, sulphur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) with benzo(a)pyrene (B(a)P) typical representative, ammonia (NH_3) and ground-level ozone (O_3). Air pollution is mainly concentrated in industrial and transport congested areas, but also in small settlements where households burn solid fuels. Emissions of the main air pollutants (NO_X, SO_2, NH_3, VOC, $PM_{2.5}$) as well as emissions of PM_{10}, CO and B(a)P from anthropogenic activities are closely related to the structure of the national economy, in particular the structure of industrial and agricultural production, the intensity of transport, the types of household heating, and the success of the implementation of measures to reduce air pollution. Air pollutants pass through atmospheric deposition to other environmental components, in particular water and soil.

Overview of selected related strategic and legislative documents

Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain air pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
- setting out the commitments of Member States to reduce anthropogenic emissions of SO_2, NO_X, VOC, NH_3 and $PM_{2.5}$, and the requirement to develop, adopt and implement national air pollution control programmes, as well as to monitor emissions of these substances and other pollutants

Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe
- establishing zones and agglomerations for the purpose of ambient air quality assessment for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, PM_{10} a $PM_{2.5}$, lead, benzene and carbon monoxide
- taking measures to reduce exposure to $PM_{2.5}$

Directive 2004/107/EC of the European Parliament and of the Council relating to the levels of arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
- introducing target values for concentrations of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air to eliminate, avoid or reduce their harmful effects on human health and the environment in general

CLRTAP Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (the Gothenburg Protocol)
- halving the number of days with high ozone concentrations
- setting new emission ceilings as a percentage reduction of emissions relative to 2005

Act No. 201/2012 Coll., on air protection
- full transposition of the pollution limit values set by Directive 2008/50/EC of the European Parliament and of the Council and Directive 2004/107/EC of the European Parliament and of the Council

1.2.1 | Emissions of air pollutants

Key question

Is the reduction in pollutant emissions sufficient for the Czech Republic to meet the national emissions ceilings in the coming years? What are the main sources and the contribution of each source category to total emissions of air pollutant? How are pollutant and greenhouse gas emissions from different modes of transport evolving? How does home heating affect emissions of air pollutant?

Key messages

✓ Emissions of all main air pollutants are steadily decreasing. For all emissions, the required 2020 emission ceilings were achieved in 2019[9].

NO_X, VOC and CO emissions from transport have been decreasing over the long term. In 2020, emissions of all monitored pollutants and greenhouse gases from transport decreased significantly year-on-year.

~ The decrease in PM emissions from transport is insignificant; in addition to emissions from combustion processes (mainly diesel engines), transport also produces emissions from tyre and brake wear.

Emissions from household heating have been on a slightly decreasing trend over the last 10 years, nevertheless households accounted for the largest share of total emissions of PM_{10} (55.1%) and B(a)P (96.4%) in 2019.

✗ CO_2 and PAHs emissions from transport rose in the 2000–2020 period in line with the increase in fuel and energy consumption in transport. Transport in the Czech Republic is a significant source of greenhouse gas emissions.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Emissions of selected air pollutants	↘	↘	↘	✓
Emissions from transport*				
NO_X, VOC and CO emissions from transport	↘	↘	↘	✓
PM and N_2O emissions from transport	~↗	~↗	~↗	~
CO_2 and PAH emissions from transport	↗	↗	~↗	✗
Emissions from household heating	~↗	↘	↘	✗

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

[9] Final data for the year 2020 are not available at the time of publication. They will be published in February 2022 at the earliest.

Emissions of selected air pollutants

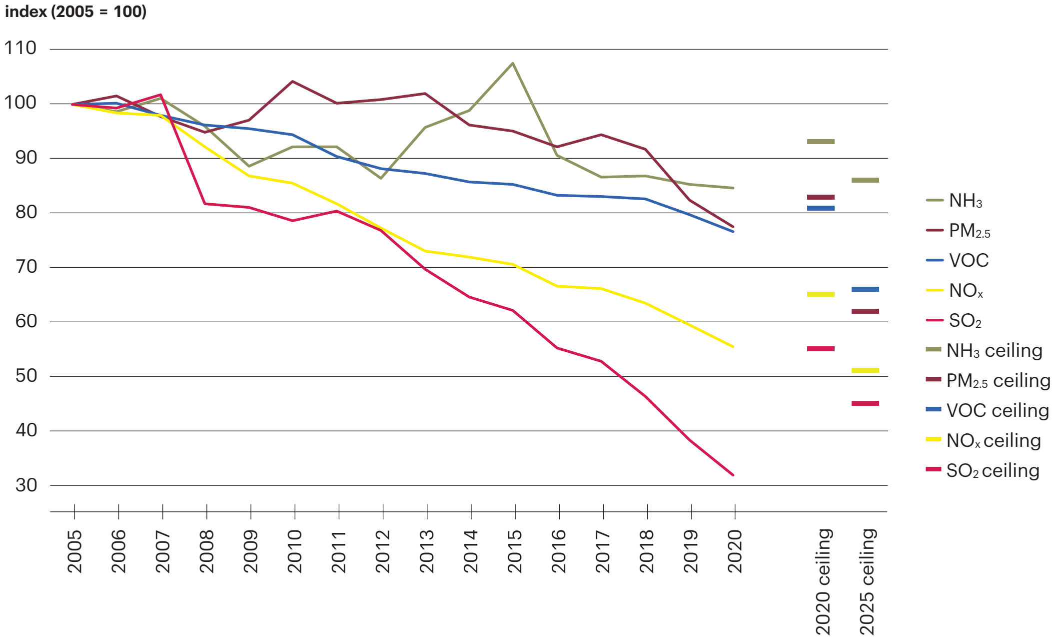
The decline in pollutant emissions reflects both the development of the national economy and the impact of the introduction of more efficient technological and production processes, the reduction of material and energy consumption, and the obligation to comply with legislative requirements for emissions from air pollution sources.

Emissions of all main pollutants (NO_X, VOC, SO_2, NH_3 and $PM_{2.5}$) into the air are decreasing in the long term. The year-on-year fluctuations are mainly due to meteorological conditions and developments in economic sectors that are sources of air pollution, in particular transport and industrial production. The largest decline in pollutants was recorded between 1990 and 2000, especially in the early part of the period, as a result of structural changes in the national economy.

Meeting the obligations of Directive 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of selected air pollutants, the so-called **emission ceilings**, assumes a reduction in emissions compared to 2005 values. It is clear from the latest submission of the emission balance that for all emissions, the required reduction for 2020 (Chart 27) was achieved in 2019[10], although only just for $PM_{2.5}$. The latest inventory includes recalculations of emissions for the entire 1990–2019 period, which therefore led to the newly calculated emission ceilings. Methodological adjustments were mainly reflected in NH_3 and VOC emissions in the range of 10 to 30 thous. t per year, mainly due to changes in the technologies used to reduce emissions from livestock farming and fluctuations in the consumption of mineral fertilisers. Assessment of preliminary emissions data for the year 2020 (Figure 27) shows further reductions for all major pollutants.

Chart 27

Trends in total emissions of selected pollutants in the Czech Republic and national emission ceilings for 2020 and 2025 [index, 2005 = 100], 2005–2020



Data for the year 2020 are preliminary.

Data source: Czech Hydrometeorological Institute

[10] *Final data for the year 2020 are not available at the time of publication. They will be published in February 2022 at the earliest.*

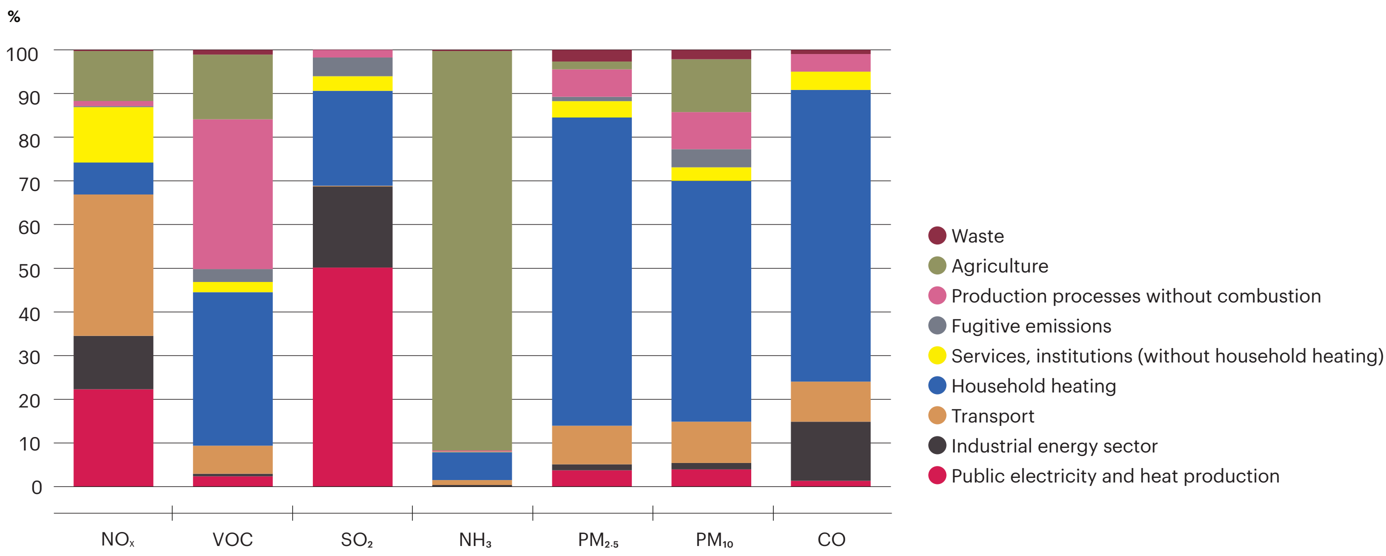
SO_2 and NO_X emissions are decreasing over the long term (SO_2 by 96.2% and NO_X by 78.5% in the 1990–2020 period) as a result of the introduction of technologies and production processes in line with requirements to apply best available techniques, change the fuels used, and reduce the energy intensity of the economy. The diversification of electricity generation, i.e. the decline of electricity generation in solid-fuel steam power plants and its increase in nuclear power plants, as well as electricity generation from renewable energy sources, plays an important role. In the short term, the dynamics of the downward trend are even more pronounced. The long-term reduction in NO_X emissions is also related to the decrease in these emissions from transport, mainly due to the gradual modernisation and renewal of the vehicle fleet. Although **NH_3 emissions** are decreasing, the dynamics are not as pronounced as for other pollutants. The long-term development of NH_3 emissions (a 50.7% decrease in the 1990–2020 period) is mainly related to the Czech Republic's agricultural policy, and the decline in livestock numbers also contributes to the long-term reduction of NH_3 emissions.

In the long term, the decrease in **PM_{10}, $PM_{2.5}$ and VOC emissions** (by 89.1%, 88.8% and 63.5% respectively in the 1990–2020 period) reflects the development of meteorological conditions in the heating season of a given year and is also significantly influenced by the type of fuel used in household heating systems. In the short term, the dynamics of the decline are even more pronounced for PM_{10} and $PM_{2.5}$. The long-term decline in **CO emissions** (61.3% in the 1990–2020 period) is linked to trends in industrial production, especially from the iron and steel works in Ostrava and Třinec, the development of which corresponds to the production volume of these facilities.

Emission sources differ by pollutant (Chart 28). For NO_X emissions, transport was the main source in 2019[11] (32.3%), followed by the public electricity and heat production (22.3%). VOC emissions came from both household heating (35.1%) and production processes without combustion (34.3%). In the case of SO_2 emissions, the majority emitter was the public energy and heat production (50.2%), followed by household heating (21.7%). NH_3 emissions were mainly from the agricultural sector (91.4%). For suspended particulate matter in the PM_{10} and $PM_{2.5}$ size fractions, the dominant source in 2019 was household heating, accounting for 70.5% of total $PM_{2.5}$ emissions and 55.1% of total PM_{10} emissions. In addition to emissions of primary suspended particulate matter by these sources, secondary suspended particulate matter is also produced by chemical reactions from precursors (NO_X, SO_2, NH_3 and VOCs). In the case of CO emissions, the main source is also local household heating (66.8%).

Chart 28

Sources of emissions of selected pollutants in the Czech Republic [%], 2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Hydrometeorological Institute

[11] *Data for the year 2020 are not available at the time of publication. They will be published in February 2022 at the earliest.*

Emissions from transport

Transport is a significant source of **air pollutants** with an impact on air quality, particularly around major roads with high traffic volumes and in large cities. In urban agglomerations without significant air pollution from stationary sources (e.g. Prague), transport is a decisive factor influencing air quality. Transport is also an important source of greenhouse gases (in 2019[12] it was the third largest source after public electricity and heat production and manufacturing industry), making development in transport essential to reducing anthropogenic pressures on the climate system and moving towards climate neutrality.

Emissions of NO_X, VOC, CO and suspended particulate matter (PM) from transport have declined over the 2000–2020 period (Chart 29). A statistically significant downward trend was registered for VOC and CO emissions in the medium term (since 2011) and short term (since 2016). Over the whole 2000–2020 period, NO_X emissions decreased by 36.9%, VOC emissions by 76.4%, CO by 81.7% and PM by 16.5%. The favourable development of emissions of these substances was influenced by the modernisation of the vehicle fleet and the growth of the share of less emissions-intensive vehicles (meeting higher EURO emissions standards) in the passenger car and truck fleets. The less pronounced decline in PM emissions, which also only occurred after 2010, was due to the increasing share of more emissions-intensive diesel cars in the passenger car fleet during this period, together with an increase in individual car transport. In addition, suspended particulate matter emissions include non-combustion emissions from brake and tyre wear, which are little affected by technology upgrades.

Emissions of **polycyclic aromatic hydrocarbons** (PAHs) from transport, which pose significant risks to public health, rose in the 2000–2020 period as fossil fuel consumption increased. Overall, emissions of PAHs more than doubled over this period (up 102.8%). However, in the short term (2016–2020), a 3.2% decrease in PAH emissions has already been observed due to the year-on-year drop in emissions in 2020.

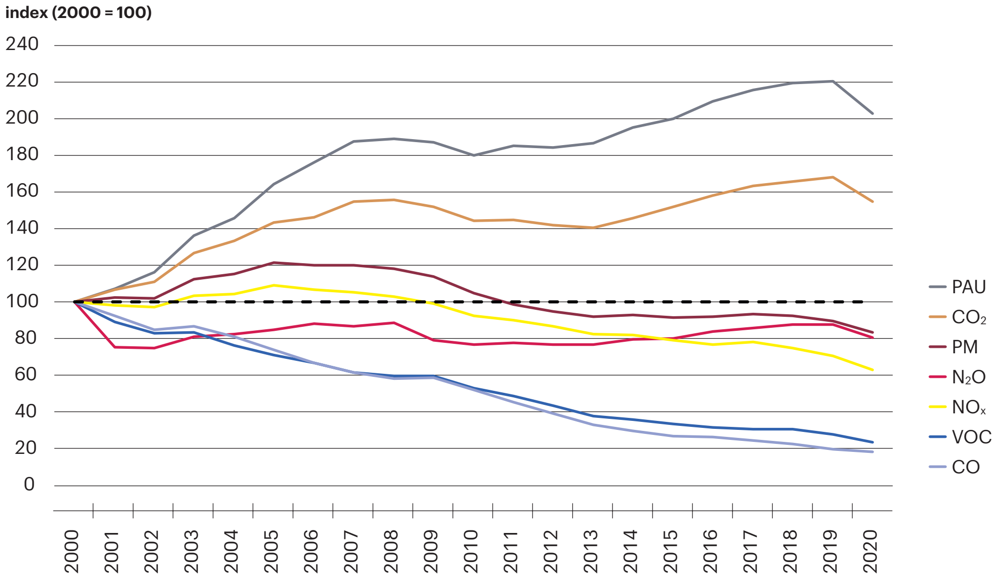
Emissions of the greenhouse gas CO_2 increased by 54.5% over the 2000–2020 period, driven by the growth in fuel and energy consumption in transport. Emissions of CO_2 from transport have risen particularly during the periods of economic growth at the beginning of the 21st century and then in the 2014–2019 period. N_2O emissions stagnated in the 2000–2020 period and accounted for only about 1% of total greenhouse gas emissions in CO_2 eq. in 2020, recalculated according to global heating coefficients.

In a year-on-year comparison between 2019 and 2020, emissions of all monitored pollutants and greenhouse gases decreased significantly due to the economic recession caused by the COVID-19 pandemic, which had an impact on passenger and freight transport performance. The largest year-on-year drops were registered for VOC (15.3%) and NO_X (10.6%) emissions, while CO_2 emissions, which had continuously risen up to then, also fell by 8.1% year-on-year in 2020.

[12] *Data for the year 2020 are not available at the time of publication.*

Chart 29

Emissions of air pollutants and greenhouse gases from transport in the Czech Republic [index, 2000 = 100], 2000–2020

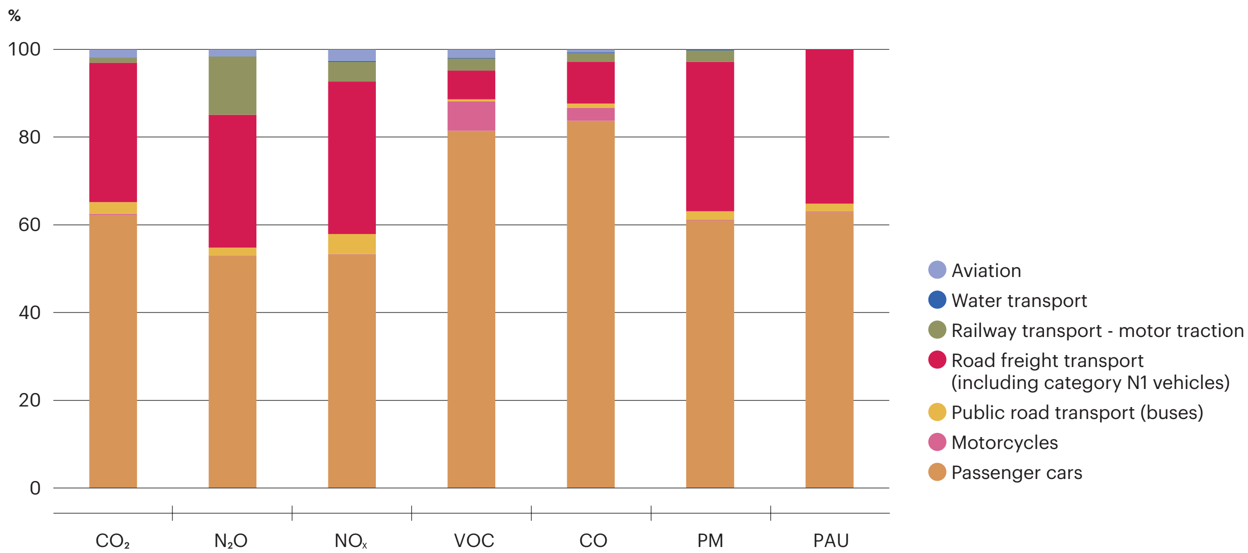


Data source: Transport Research Centre

The largest **air polluter in transport** and source of greenhouse gas emissions is **individual passenger car transport** (Chart 30), which accounted for the largest share of total transport emissions in terms of CO (83.1%) and VOC (81.5%). The share of road freight transport in the total transport emissions of individual substances was about one third, except for VOC and CO emissions. With the exception of N_2O, road transport as a whole accounts for more than 90% of the total emissions of transport pollutants. Of the non-road modes of transport, rail motor traction transport accounted for 13.3% of total N_2O emissions, air transport accounted for about 2% of total transport emissions of CO_2, N_2O, NO_X and VOC (however, this balance does not include overflights over the Czech Republic, only emissions from planes landing and taking off at airports in the Czech Republic).

Chart 30

Emissions of air pollutants and greenhouse gases by mode of transport in the Czech Republic [%], 2020



Data source: Transport Research Centre

Emissions from household heating

Household heating has a significant impact on air quality. The choice of fuel type and the way in which domestic boilers are operated in local heating systems have a significant impact on emissions and consequently on the air quality in areas where people live. Due to the imperfect combustion of solid fuels, local boilers produce significant amounts of particulate matter, polycyclic aromatic hydrocarbons and other substances that have a negative impact on the health of the population. These emissions tend to be emitted from lower chimneys than industrial emissions, and therefore do not have the opportunity to disperse in the ambient air, and so often endanger the population in high concentrations.

Another important factor affecting emissions from household heating is the duration and pattern of the **heating season**[13]. When the heating season is colder, heating emissions increase proportionally, and vice versa. The 2019 heating season was 3,832 degree days, down from the 1986–2015 long-term average, indicating a warmer season with lower heating demand. This was also reflected in the 2019 emissions from household heating[14], which were lower compared to previous years (Chart 31). In a year-on-year comparison, even with the increase in the number of degree days, there was a decrease in emissions from households for both monitored substances PM_{10} and B(a)P. In 2019, PM_{10} emissions from household heating amounted to 25.7 thous. t, the lowest value in the entire period since 2000, accounting for 55.1% of total PM_{10} emissions. This was a significant year-on-year decline of 12.5%. In the long term, and especially in the last 10 years, PM_{10} emissions from households have been on a slightly decreasing trend. B(a)P emissions from heating amounted to 14.2 t, 96.4% of total emissions. Over the long term, these emissions from household heating have also been on a slightly downward trend, but the year-on-year decline was a significant 8.1%.

The high emissions of both pollutants and greenhouse gases from households are the reason why a lot of attention is being paid to household heating, including subsidy programmes, as there is potential for further reductions in these emissions.

The Air Protection Act[15] establishes obligations for operators of local furnaces and also the possibility of controlling the fulfilment of these obligations. On 1/ 9/ 2022, solid fuel boilers classified as lower than Class 3 (according to Czech Technical Standard EN 303-5) will no longer meet the requirements of the Air Protection Act and must be replaced by that date at the latest. It is currently possible to draw support for their replacement from the so-called boiler subsidies.

However, even if a boiler complies with regulations, it is important to follow good heating practice principles, which can provide significant reductions in emissions from household heating. However, it is difficult to enforce this interest, as it is up to individuals as to how responsibly they operate their boilers.

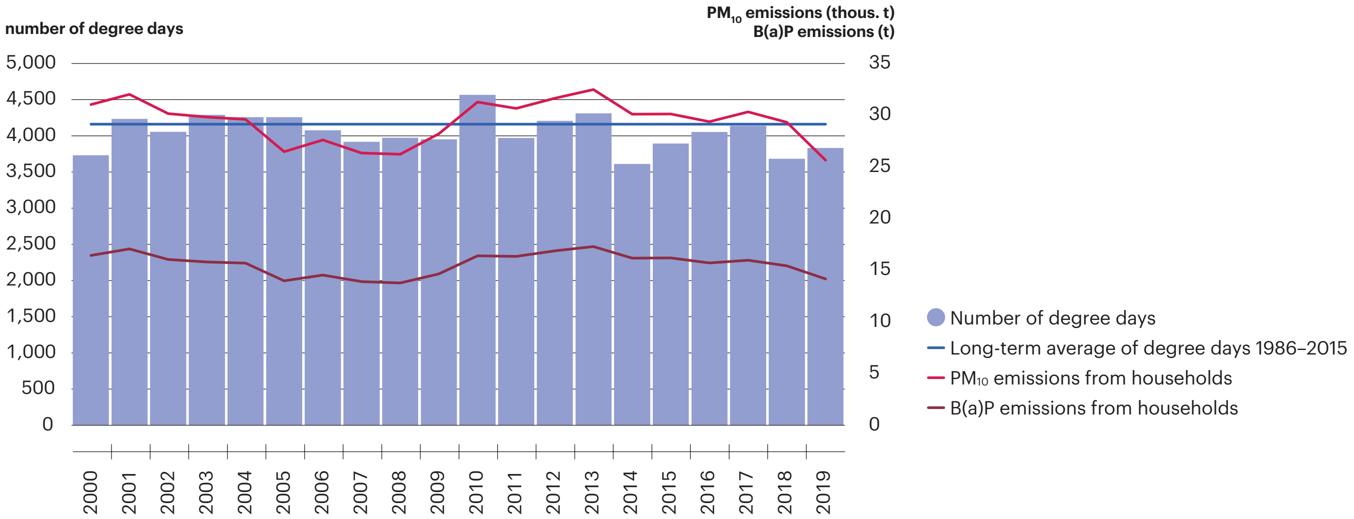
[13] *The heating season is characterised by the degree day unit, which is the product of the number of heating days and the difference between the average indoor and outdoor temperatures. Degree days thus show how cold or warm it has been for a certain period of time and how much energy was needed to heat buildings.*

[14] *Data for the year 2020 are not available at the time of publication.*

[15] *Act No. 201/2012 Coll., on air protection*

Chart 31

Comparison of heating season characteristics with PM_{10} and B(a)P emissions from household heating in the Czech Republic [number of degree days, thous. t, t], 2000–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Hydrometeorological Institute

Heating methods and fuel consumption in households are described in more detail in chapter 2.1.1.

1.2.2 | Air quality situation

Key question

Is the share of the population and the proportion of the country's territory with poor air quality decreasing? Are the limit values for health protection being met? Is the load affecting the state and function of ecosystems and vegetation decreasing?

Key messages

No smog situation was announced in 2020. ✓

In 2020, 4.6% of the Czech Republic was defined as having exceeded at least one limit value without including ground-level ozone. 19.0% of the population lived in this territory. ~

The years 2018 to 2020 were very favourable for the formation of ground-level ozone, leading to 62.0% of the territory exceeding the limit value for the protection of human health for ozone in 2020 and 51.8% of the population being exposed to above-limit concentrations. ✗

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Compliance with limit values for selected pollutants	⤳	→	⤳	~
Air quality in terms of human health protection	⤳	→	⤳	~
Air quality in terms of ecosystem and vegetation protection	↘	→	→	✓

Compliance with limit values for selected pollutants

Air pollutant concentrations in Czechia are mainly influenced by local heating and transport, industrial and energy production, but are also dependent on meteorological conditions and transboundary transmission. The year 2020 was also affected by the COVID-19 pandemic[16], when the measures associated with the declaration of a state of emergency took effect. The last three years have had very good dispersion conditions compared to the long-term average, and at the same time these years have been very warm. The improvement in air quality can therefore be attributed to meteorological (especially dispersion) conditions, but also to the continued introduction of modern technologies in production and the modernisation of the composition of combustion equipment in households (the boiler subsidy effect).

[16] *More at: https://www.chmi.cz/files/portal/docs/tiskove_zpravy/2020/COVID_ZPRAVA.pdf*

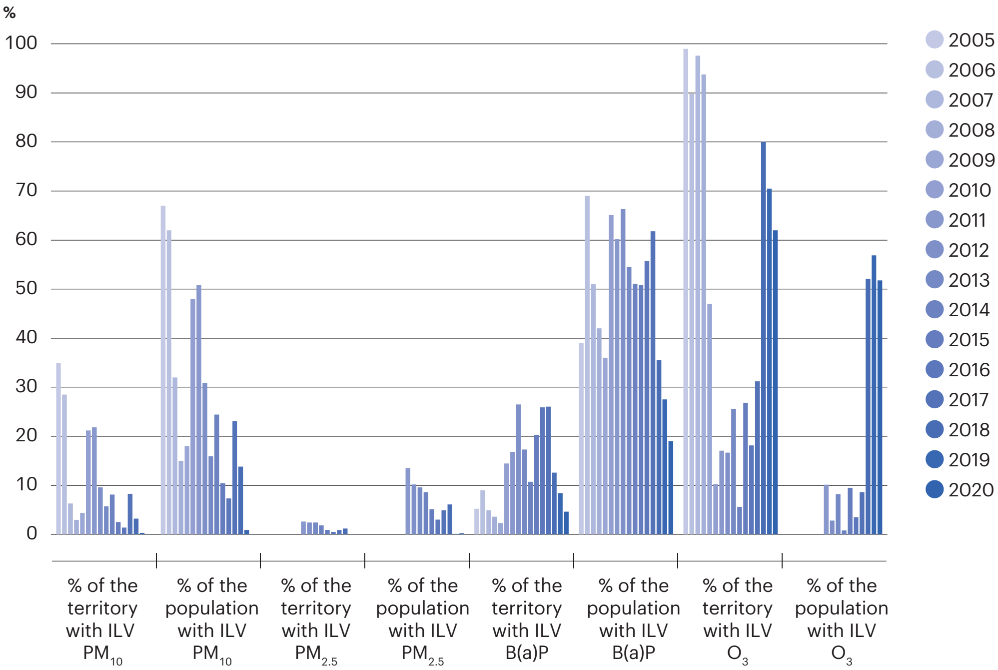
The limit values for suspended PM_{10} and $PM_{2.5}$ particulate matter are exceeded in Czechia on a long-term basis, but in 2020 the limit for the annual average concentration of PM_{10} in Czechia was not exceeded, nor was it in the previous year. The year-to-year fluctuations are mainly due to meteorological conditions in the winter part of the year, when the limit values are exceeded during inversion weather patterns and lower temperatures, which significantly affect the intensity of household heating. The limit value for the daily average concentration of PM_{10} (Chart 32) was exceeded in only 0.001% of the territory in 2020 (0.3% in 2019, 3.2% in 2018), and 0.2% of the Czech population was exposed to above-limit concentrations in this assessed year (0.1% in 2019, 13.8% in 2018). The highest number of cases when the daily average PM_{10} concentration was exceeded was at stations in the Ostrava/Karviná/Frýdek-Místek agglomeration. In 2020, a stricter limit value of 20 µg per m^3 for the annual average concentration of $PM_{2.5}$ came into effect. The limit value for the annual average concentration of $PM_{2.5}$ (Chart 32) was exceeded in only 0.04% of the territory in 2020 (also 0.04% in 2019, 1.2% in 2018), and 0.2% of the Czech population was exposed to above-limit concentrations in this assessed year (0.1% in 2019, 6.1% in 2018).

No **smog situation** was announced in 2020 due to limit values for suspended PM_{10} particulate matter being exceeded. In 2019, 5 smog situations with a total duration of 385 hours and 2 regulations were declared. This improvement compared to previous years is mainly due to the prevalence of very good dispersion conditions even in winter, with 86% of days with good dispersion conditions in 2020 (88% in 2019, while the 2010–2019 average was 79%).

Benzo(a)pyrene (B(a)P), which increases an individual carcinogenic risk, is a very serious air quality problem in Czechia. The highest concentrations are reached in industrial locations, but above-limit concentrations have long been found at urban stations. The limit values for B(a)P was exceeded in 4.6% of the territory, home for 19.0% of the population in 2020 (Chart 32). In 2019, this was 8.4% of the territory, where 27.5% of the population lived. B(a)P concentrations show a significant annual course with peaks in winter due to the deterioration of dispersion conditions and pollution from local household heating. In 2020, the decrease in B(a)P concentrations was mainly thanks to atypical conditions in February from rising temperatures, hence reduced fuel consumption in households.

Chart 32

Share of the territory and population of the Czech Republic exposed to above-limit concentrations [%], 2005–2020[17]



ILV = above-limit concentrations
Concentration of PM_{10} and O_3 are daily values, concentration of $PM_{2.5}$ and B(a)P are annual values.
Data for $PM_{2.5}$ and for the % of the population of the Czech Republic affected by above-limit daily O_3 concentrations are available only from 2011.
A stricter 20 $\mu g.m^{-3}$ emission limit came into force for the annual average $PM_{2.5}$ concentration in 2020.

Data source: Czech Hydrometeorological Institute

Another pollutant that significantly affects human health and ecosystems is **ground-level ozone** (O_3), which has irritating effects on the human respiratory system. Its concentrations are mainly influenced by the nature of meteorological conditions (intensity and duration of sunshine, temperature and precipitation), with the highest concentrations usually measured between April and September. In the short term, there is a very significant increase in the share of the population and area affected by elevated ozone concentrations. The years 2018 and 2019 were very favourable for ground-level ozone formation due to high temperatures in the summer months. In 2020, the limit values for the human health protection for ozone was exceeded in 62.0% of the territory, and 51.8% of the population was exposed to above-limit concentrations. In 2019, this was 70.5% of the territory, home for 56.9% of the population. No smog situation was announced for ground-level ozone in 2020.

High concentrations of **nitrogen oxides** (NO_X) cause respiratory problems, especially in congested areas. In 2020, no stations exceeded the annual NO_2 limit values for the first ever time since monitoring began, reflecting the measures associated with the state of emergency declaration due to the COVID-19 pandemic. Neither daily nor hourly **sulphur dioxide** (SO_2) limit values were exceeded at any location in 2020. In 2020, there were no cases of exceeding the limit values set for arsenic, cadmium, lead, nickel and carbon monoxide (CO).

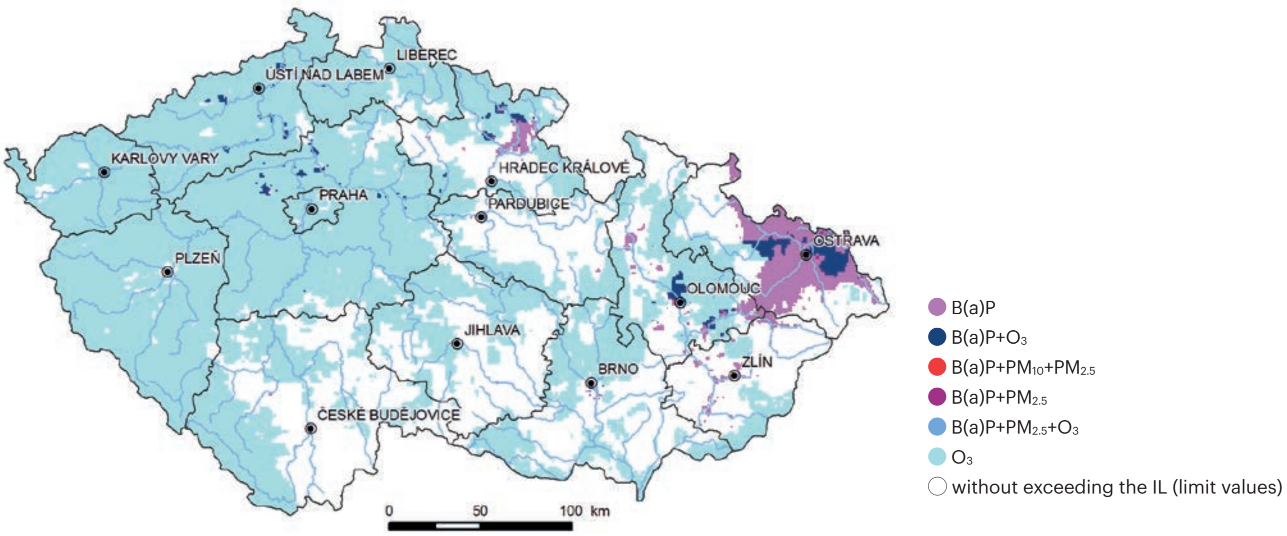
[17] *In 2005, the mapping methodology was refined and for the first time a model combining SYMOS, the European EMEP model and altitude with measured concentrations at rural background stations was used to construct PM_{10} concentration field maps. In 2009, the methodology was again refined through the application of the CAMx model. The SYMOS model accounts for emissions from primary sources. Secondary particles and resuspended particles are taken into account by the EMEP and CAMx models. The methodology for mapping B(a)P was refined during the 2002–2007 period by increasing the number of monitoring stations so that in 2006, as a result of the methodological change, a number of towns and municipalities were included in the territory with exceeded B(a)P limit values.*

Air quality in terms of human health protection

In 2020, at least one limit value was exceeded in 4.6% of Czech territory without including ground-level ozone[18]. This territory was home for 19.0% of the population. After including ground-level ozone, in 2020 the limit values for at least one pollutant was exceeded in 65.5% of the area of Czechia, home for 65.7% of the population. Pollutant concentrations were exceeded in a number of locations, with the Moravian-Silesian and Zlín Regions remaining the most polluted areas (Figure 13).

Figure 13

Areas within the Czech Republic with exceeding of the human health protection limit values [%], 2020



Data source: Czech Hydrometeorological Institute

The severity of **population exposure to suspended particles** depends on the concentration of suspended particles, their size, shape and chemical composition. Despite their proven negative effects on human health, no safe threshold concentration has yet been established. The effects of short-term elevated daily concentrations of suspended particulate matter of all PM fractions include an increase in overall morbidity and mortality, particularly cardiovascular disease, respiratory disease, increased infant mortality and worsening asthma problems. Ultrafine particles (1-100 nm in size) can also enter the bloodstream, where they reach all organs. Prolonged exposure to suspended particles leads to increased mortality, with vulnerable people (the chronically sick or the elderly) always being the most affected. In 2020, this figure was approximately 2.1% for the nation as a whole (Table 2) or 2.0% within the normal urban environment[19]. The decrease in mortality compared to 2019 was due to the year-on-year decrease in PM_{10} concentrations.

[18] *Act No. 201/2012 Coll., on air protection, Annex 1, point 1+2+3: exceeding the limit values without ground-level ozone for at least one listed pollutant (SO_2, CO, PM_{10}, $PM_{2.5}$, NO_2, benzene, Pb, As, Cd, Ni, B(a)P)*

[19] *According to the National Institute of Public Health methodology, the normal urban environment is represented by data from urban stations, where stations with a very high traffic load (i.e. over 10,000 vehicles per day) and stations significantly affected by industrial production, are excluded from the assessment.*

Table 2

Increase in total annual premature mortality due to PM_{10} (75% $PM_{2.5}$ fraction) for the whole of the Czech Republic and for urban unburdened areas [%], 2010–2020[20]

PM_{10}	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Mean estimate for the Czech Republic in %	7.6	8.3	7.4	7.3	7.1	5.8	4.5	5.8	6.5	3.7	2.1
Mean estimate for the normal urban environment in %	5.7	7.4	6.2	6.2	6.1	5.0	4.2	5.3	5.7	3.0	2.0

Data source: National Institute of Public Health

Benzo(a)pyrene (B(a)P) is described as the most problematic pollutant in Czechia, being produced by imperfect combustion (mainly by local household heating using old boilers burning solid fuels, i.e. wood, coal). Most B(a)P in the air is bound to the fine fraction of suspended $PM_{2.5}$ particulate. B(a)P has primarily been shown to be carcinogenic. According to the National Institute of Public Health, a theoretical estimate of the probability of developing cancer under lifetime exposure to measured concentrations of B(a)P in Czechia ranges from 2 to 67 people per 100,000 lifetime-exposed inhabitants, depending on the type of urban location. The estimate for urban localities unburdened by transport and industry is around 12 people per 100,000 inhabitants.

The existence of ozone in the atmosphere is essential for living organisms. While stratospheric ozone protects the Earth's surface and living organisms from the negative effects of ultraviolet solar radiation, **ground-level (tropospheric) ozone**, formed by chemical reactions from the so-called ozone precursors (VOC, NO_X, CO and CH_4), together with their precursors, is a major pollutant and a strong oxidizing agent, thus negatively affecting human health and ecosystems. In humans, it has a strong irritant effect on the conjunctivae of the eyes, damages the respiratory system in particular, and in higher concentrations causes breathing difficulties and an inflammatory reaction of the mucous membranes in the respiratory tract. High concentrations of NO_X, SO_2, VOC and CO cause respiratory problems, aggravate asthma, and are associated with an increase in overall, cardiovascular and respiratory mortality; they also adversely affect the nervous system.

[20] An indicator of the health effects of long-term exposure is an estimate of the number of premature deaths for the adult population over 30 years of age, excluding external causes of death (accidents, suicide, etc.). For the recalculation of PM_{10} effects, the WHO recommended estimate of the mean value of the $PM_{2.5}$ fraction in the PM_{10} fraction of 75% for the Czech Republic was used. The increase in total mortality was calculated from measured values in the Czech Republic and from estimated values in urban unburdened localities.

Air quality in terms of ecosystem and vegetation protection

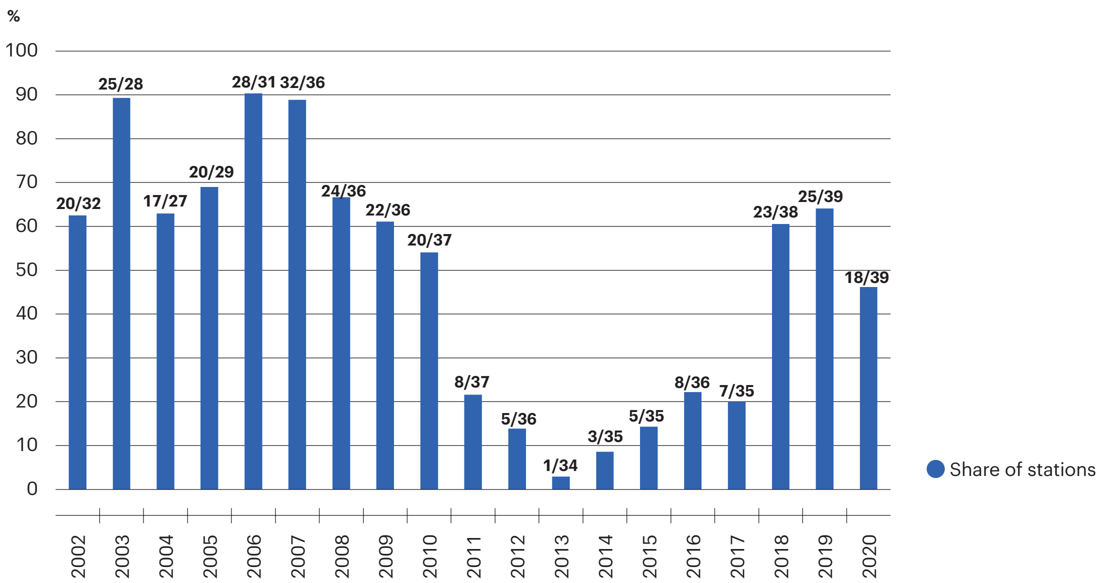
Air pollution together with atmospheric deposition has a negative impact on both humans and on ecosystems and vegetation. Atmospheric deposition and ground-level ozone reduce the resistance of vegetation to external influences and also affect the water regime and biodiversity.

Ground-level ozone damages plant assimilation organs and therefore has a negative impact on forest, grassland and agricultural vegetation. Vegetation is consequently less resilient to biotic and abiotic factors, which also affects individual habitats and ecosystems. The O_3 limit values for the protection of ecosystems and vegetation (AOT40 exposure index) was exceeded at 46.2% of stations in Czechia in 2020 (calculated as an average for 2016–2020, Chart 33). The year-to-year changes in the AOT40 exposure index are influenced by the cumulative emissions of ozone precursors, but mainly by meteorological conditions between May and July (temperature, precipitation, solar radiation). In the long term (2002–2020), the AOT40 index has been declining, but in the short term there has been a significant increase in the share of stations where AOT40 is exceeded.

Other limit values for the protection of ecosystems and vegetation for SO_2 and NO_X were not exceeded in 2020.

Chart 33

Percentage of stations where the limit values expressed as AOT40 (5-year average) for vegetation protection in the Czech Republic was exceeded [%], 2002–2020

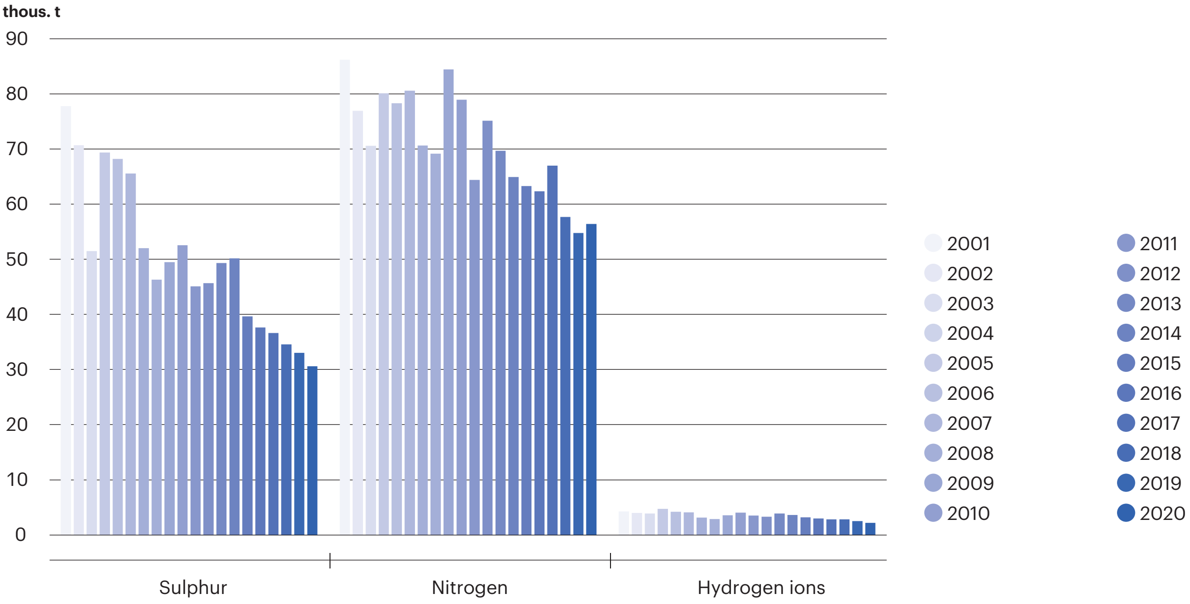


Data source: Czech Hydrometeorological Institute

Atmospheric deposition is a process that significantly contributes to the self-cleaning of the atmosphere. It consists of a wet component (atmospheric precipitation) and a dry component (deposition of gases and particles by various mechanisms), and represents the direct input of pollutants to other environmental compartments. Despite the long-term decline in pollutants (Chart 34), which is even more pronounced in the short term, the burden on ecosystems caused by atmospheric deposition remains high in many areas of Czechia. The highest total sulphur deposition values were recorded in the Ore Mountains and the Ostrava Region. With the development of sulphur and nitrogen deposition, the development of the mutual ratio of these elements in atmospheric precipitation, related to the development of emissions of individual compounds, can be observed.

Chart 34

Trend in the total atmospheric deposition of sulphur, nitrogen and hydrogen ions in the Czech Republic [thous. t], 2001–2020



Data source: Czech Hydrometeorological Institute

Air quality in an international context

Key messages

Emissions of air pollutants in Europe are decreasing, with SO_2 emissions decreasing most (by 92.2%) in the 1990–2019[21] period.

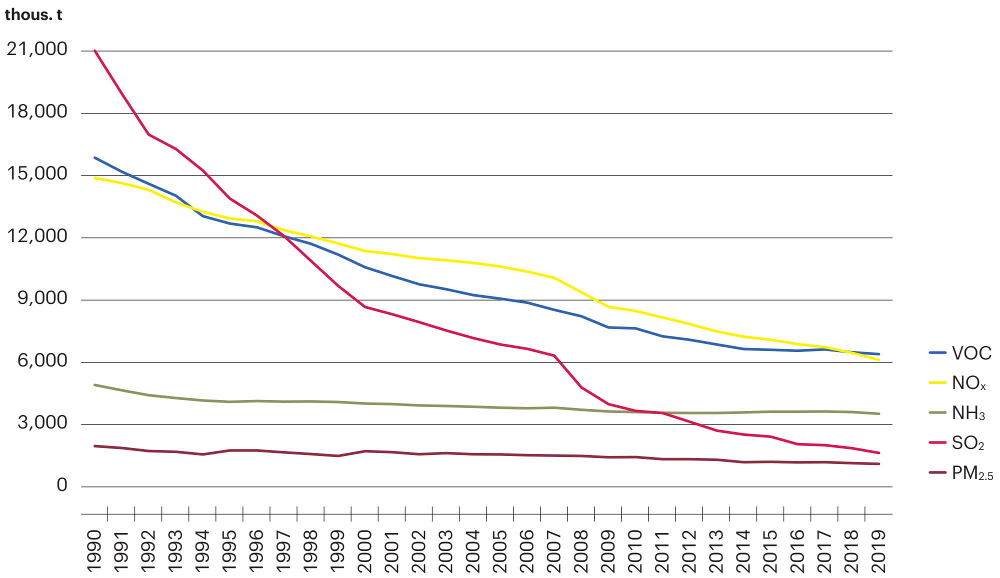
Air quality in Europe is gradually improving slightly, partly thanks to the decrease in pollutant emissions.

Air pollution is the leading cause of premature death and disease, and is the biggest health risk of all environmental factors in Europe.

Emissions of air pollutants are falling in Europe, with significant reductions (92.2%) in SO_2 emissions in the EU27 in the 1990–2019 period[22] (Chart 35), while NO_x and VOC emissions more than halved (NO_x decreased by 58.9% and VOC by 59.6%). Ammonia emissions decreased by 28.2% overall, but have been steadily increasing since 2010. $PM_{2.5}$ emissions decreased by 43.5%.

Chart 35

Emissions of the main pollutants SO_2, VOC, NO_x, NH_3 a $PM_{2.5}$ in the EU27 [thous. t], 1990–2019



Data for the year 2020 are not available at the time of publication.

Data source: EEA

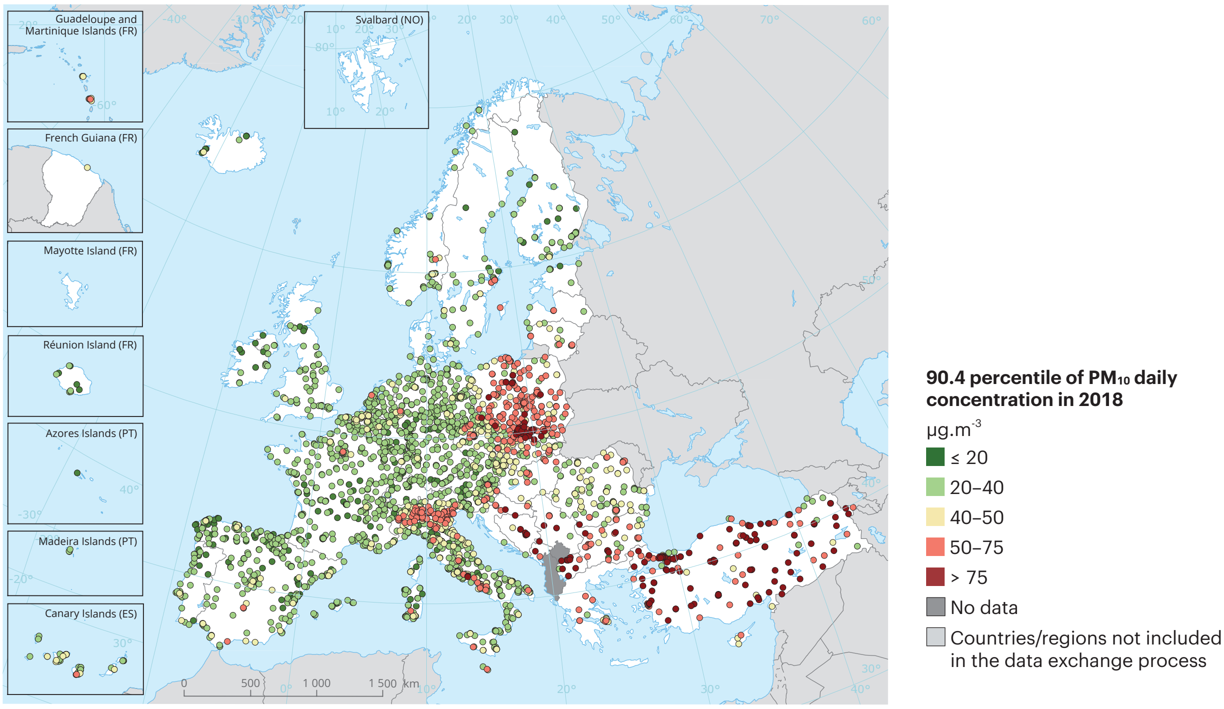
Air quality in Europe is gradually improving, partly thanks to pollutant emissions falling. The most risky substances include suspended PM_{10} (Figure 14) and $PM_{2.5}$ fractions, ground-level ozone O_3 (Figure 15) and PAHs expressed as B(a)P. The extent to which limit values are exceeded varies from year to year and is influenced by both the meteorological conditions and the current economic activity in each country, mainly industrial activities and transport.

[21, 22] *Data for the year 2020 are not available at the time of publication.*

The exceeding of limit values for PM_{10} concentrations continued in 2018[23], with around 15% of the EU28 urban population exposed to daily PM_{10} above-limit concentrations, and around 4% of the EU28 population exposed to $PM_{2.5}$ above-limit concentrations (25 µg per m^3). A significant factor influencing the exceeding of the limit values was the worsened dispersion conditions that can cause smog situations, and also the temperature conditions during heating seasons. Approximately 34% of the urban population was exposed to above-limit concentrations of ground-level ozone (O_3) in 2018. In the case of O_3 concentrations, the most important role is played by the development of meteorological conditions during the warm part of the year, while suitable meteorological conditions for ground-level ozone formation are occurring more frequently due to climate change. Around 15% of the EU28 urban population was exposed to annual B(a)P above-limit concentrations in 2018.

Figure 14

Average daily PM_{10} concentration in Europe [µg.m^{-3}], 2018



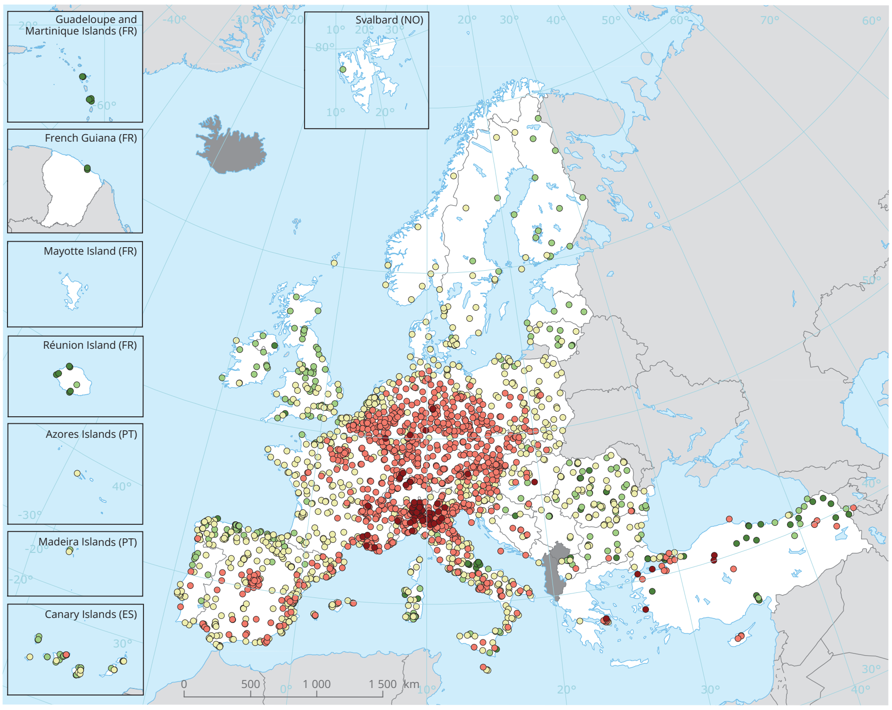
The 90.4 percentile of the daily average PM_{10} concentrations is reported, representing the 36th highest exceedance value, i.e. the established limit value. Data for the years 2019 and 2020 are not available at the time of publication.

Data source: EEA

[23] *Data for the years 2019 and 2020 are not available at the time of publication.*

Figure 15

Average daily maximum 8-hour O_3 concentration in Europe [µg.m^{-3}], 2018



93.2 percentile of O_3 maximum daily 8-hour mean in 2018

µg.m^{-3}

- ≤ 80
- 80–100
- 100–120
- 120–140
- > 140
- No data
- Countries/regions not included in the data exchange process

The 93.2 percentile of the daily maximum 8-hour average O_3 concentrations is reported, representing the 26th highest exceedance value, i.e. the established limit value. Data for 2019 and 2020 are not available at the time of publication.

Data source: EEA

According to the EEA 2020 Report[24], air pollution is the leading cause of **premature death** and disease and is the biggest health risk of all environmental factors in Europe. The latest estimates of the health impacts of air pollution for the EU28 region for 2018 show that fine $PM_{2.5}$ particulate continues to have the largest impact on health, with around 379,000 premature deaths caused by $PM_{2.5}$ exposure in 2018, although the number of premature deaths caused by $PM_{2.5}$ exposure has more than halved since 1990. The EEA 2020 Report also estimated that NO_X exposure was associated with 54,000 premature deaths and ground-level ozone was associated with 19,000 premature deaths (a 24% increase compared to 2009). Residents of central and eastern Europe, including the Balkan Peninsula, are most affected by above-limit concentrations of suspended particulate matter and B(a)P, while the Po Plain in northern Italy is also one of the most polluted areas across the board.

[24] *EEA 2020. Available from: https://www.eea.europa.eu/themes/themes/air/health-impacts-of-air-pollution*

1

Environment and health

1.3 | Exposure of the population and the environment to hazardous substances

1.3 | Exposure of the population and the environment to hazardous substances

Hazardous substances enter the environment through releases into the air, water and soil, mainly from the industrial and energy sectors. These substances are therefore regularly monitored and reported to the Integrated Pollution Register. Heavy metals and persistent organic pollutants (POPs) enter the air mainly from the burning of fossil fuels, the production of metal, and transport. The risk of exposure to heavy metals lies mainly in their bioaccumulation in other environmental compartments, through which they enter the food chain and cause various types of diseases, with carcinogenic effects in particular. Old environmental burdens, which include contaminated sites created by the improper handling of hazardous substances in the past, pose a significant risk to the environment and human health. It is therefore necessary to resolve them by taking inventories with subsequent remediation.

Overview of selected related strategic and legislative documents

Updated National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants in the Czech Republic for 2018–2023
• protecting human health and the environment from the harmful effects of persistent organic pollutants (POPs)
• regulating the production, use, import and export of listed POPs
• prioritization in dealing with old environmental burdens, improving the public database

Regulation (EC) No. 1907/2006 of the European Parliament and of the Council concerning the Registration, Assessment, Authorisation and Restriction of Chemicals, establishing a European Chemicals Agency
• setting conditions for the use of chemicals

Act No. 25/2008 Coll., on the Integrated Pollution Register and the Integrated System for Compliance with Environmental Reporting Obligations and on amendments to certain other laws, as amended
• setting out the conditions for reporting pollution to the Integrated Pollution Register

1.3.1 | Emissions and releases of hazardous chemicals

Key question

Is the long-term reduction of releases of hazardous chemicals and air emissions of heavy metals and POPs into the environment succeeding?

Key messages

Air emissions of heavy metals (except copper) and POPs are decreasing in the long and medium term.

Air emissions of copper are increasing in the medium term (by 14.1% since 2010).

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Releases to water and soil and air emissions of selected hazardous chemicals	N/A	N/A	N/A	N/A
Air emissions of heavy metals and POPs *				
Air emissions of heavy metals	↘	↘	~	✓
Air emissions of POPs	↘	↘	↘	✓

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

Releases to water and soil and air emissions of selected hazardous chemicals

For the reporting year 2020, the **required data** were **reported to the Integrated Pollution Register (IPR)** from 2,692 establishments, with 1,279 establishments reporting releases to environmental compartments (of which 1,097 were over-limit reports). There were 245 reports that included releases into water (of which 224 were above-limit). There were above-limit releases of 24 substances into water. There were 1,034 reports containing releases into the air. Releases of selected hazardous chemicals into the air are processed under indicators 1.2.1. Emissions of air pollutants (Air emissions of selected pollutants, Emissions from transport and Emissions from household heating) and the indicator Airmissions of heavy metals and POPs. There were no reports of releases into the soil in 2020 (Table 3).

Table 3

Structure of Integrated Pollution Register reporting by type of release in the Czech Republic, 2020

Type of release	Number of reports	Number of above-limit reports	Total number of substances monitored	Number of notified substances	Number of above-limit substances reported
Releases into the air	1,034	873	61	35	35
Releases into water	245	224	71	28	24
Releases into the soil	0	0	61	0	0

The data are valid as of 3/ 9/ 2020.

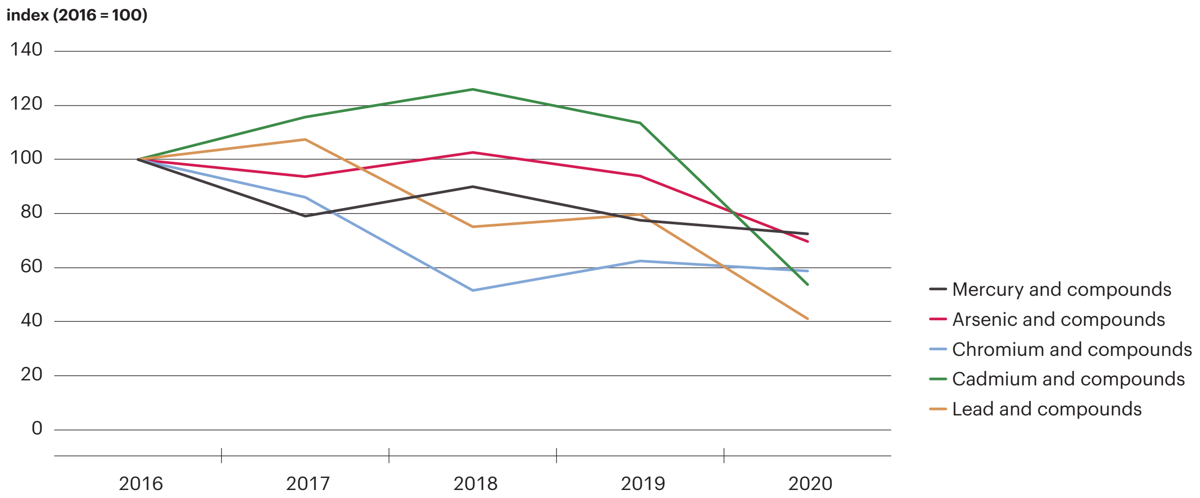
Data source: Integrated Pollution Register

The main anthropogenic sources of **heavy metals** include the processing of metal-bearing ores, industrial metal processing, the combustion of fossil fuels and waste of all kinds, fuels and fertilisers. Metals occur in different concentrations in the soil, water and air. Increased exposure leads to accumulation in the body and causes functional disorders of organs. In addition, some metals are highly toxic (mercury, cadmium, arsenic, etc.).

The number of individual substances reported had no clear trend in the 2016–2020 period (Chart 36). In the year 2020, arsenic and its compounds were reported under releases into water, totalling 1,278.4 kg per year, chromium and its compounds 802.4 kg per year, cadmium and its compounds 46.0 kg per year, lead and its compounds 236.0 kg per year, mercury and its compounds 47.5 kg per year.

Chart 36

Development of reported releases of selected heavy metals into water in the Integrated Pollution Register in the Czech Republic [index, 2016 = 100], 2016–2020



In 2016 there was a change in reporting to the Integrated Pollution Register, and so the time series is compared only from 2016.

Data source: Integrated Pollution Register

For the assessment of **organic substances, chlorinated organic substances** – halogenated organic compounds (AOX) and polychlorinated biphenyls (PCBs) – were selected. Additionally phenols and polycyclic aromatic hydrocarbons (PAHs). The number of reported substances had no clear trend in the 2016–2020 period (Table 4).

The **AOX** group includes substances that are generally hazardous and toxic to aquatic organisms. This is a broad group of organic compounds containing chlorine, bromine, iodine and fluorine. The main sources of AOX are pulp and paper production, where chlorine and chlorine-containing chemicals are used to bleach fibres, water chlorination and waste incinerators. The amount reported in 2020 was 27,261.6 kg per year.

PCBs are substances that include a large number of individual compounds (called congeners) that differ in physical and chemical properties and toxicity; PCBs are highly persistent substances. They do not occur naturally, are no longer manufactured, and their use and disposal are strictly monitored. PCBs are chemically stable, heat-resistant and non-flammable, and have therefore been used as fillers in transformers and other electrical equipment. No releases of PCBs into water were reported in 2020. For the 2016–2020 reporting period, PCBs were reported only in 2018, at 0.18 kg per year.

PAHs are hazardous to the environment and to human health. PAHs are present in a wide range of products (e.g. diesel fuel, coal tar products, asphalt and materials used in roofing and road construction). They are also produced during the combustion process of any carbon-containing material. The amount reported in 2020 was 6.7 kg per year.

Phenols, and especially their chlorinated derivatives, are hazardous to the environment and ecosystems. Their high toxicity to aquatic organisms is a serious problem. The phenol group includes both naturally occurring substances and man-made compounds. Phenols are highly toxic to aquatic animals. They are used as biocidal products to treat materials and in the manufacture of pharmaceutical products. Chlorinated phenol derivatives are used for wood preservation, as disinfectants and antiseptics, and as additives in pesticides. Anthropogenic sources of emissions include mainly the chemical industry, contaminated water, combustion processes, and leachates from landfills. The amount of phenols reported in 2020 was 1,055.1 kg per year.

In 2020, there were serious cyanide releases into the Bečva River, resulting in the death of several dozen tonnes of fish. However, these cyanide releases were not entered into the Integrated Pollution Register data – since the originator is not clear, these releases were not reported into the system.

Table 4

Reported amounts of organic matter releases into water in the Integrated Pollution Register in the Czech Republic [kg. year^{-1}], 2016–2020

	Rok				
Notified substance	2016	2017	2018	2019	2020
Phenols [kg. year^{-1}]	1,055.9	4,273.7	2,006.9	1,772.7	1,055.1
Halogenated organic compounds (AOX) [kg. year^{-1}]	35,662.4	35,533.2	22,791.2	26,111.2	27,261.6
Polycyclic aromatic hydrocarbons (PAHs) [kg.year^{-1}]	0.0	0.0	16.6	6.3	6.7
Polychlorinated biphenyls (PCBs) [kg.year^{-1}]	0.0	0.0	0.2	0.0	0.0

In 2016 there was a change in the reporting to the Integrated Pollution Register, and so the time series is compared only from 2016.

Data source: Integrated Pollution Register

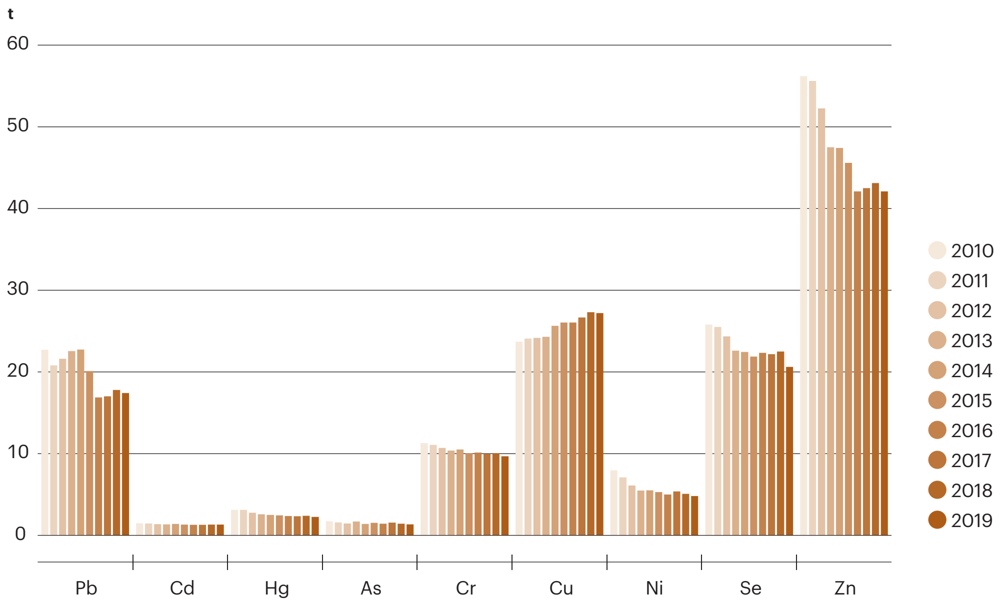
Air emissions of heavy metals and POPs

Heavy metals are metals with a density of more than 4.5 g per cm^3. They are bound in most fossil fuels, from which they are released during the combustion process. Heavy metals have carcinogenic and mutagenic properties and their danger lies mainly in their potential transfer to environmental compartments (especially the soil), where they accumulate.

Emissions of heavy metals have been declining over the long and medium term, despite significant year-to-year variations caused by the development of the economy, the characteristics of the heating seasons, and the variable heavy metal content of the fuels and raw materials used. The exception is copper emissions, which are increasing in line with the development of transport performance (by 14.1% since 2010, while the emissions are from brake abrasion). Over the 1990–2019 period[25], emissions of arsenic (down 98.1%), lead (down 94.5%) and nickel (down 91.3%) showed the largest decreases. In the medium term, nickel and mercury emissions have declined the most (Chart 37). The short-term trend in heavy metal emissions is also downwards, with the exception of copper (up 4.5%) and cadmium (up 0.3% due to a change in glass production capacity).

Chart 37

Air emissions of heavy metals in the Czech Republic [t], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Hydrometeorological Institute

The main sources of heavy metal emissions (Chart 38) in the Czech Republic in 2019[26] include the public energy and heat production (producing 82.1% of the selenium and 46.5% of the mercury emitted), local household heating (49.7% of cadmium, 33.3% of chromium and 31.9% of arsenic emissions), tyre and brake wear (74.5% of copper emissions) and metal processing (24.0% of zinc and 23.8% of lead emissions).

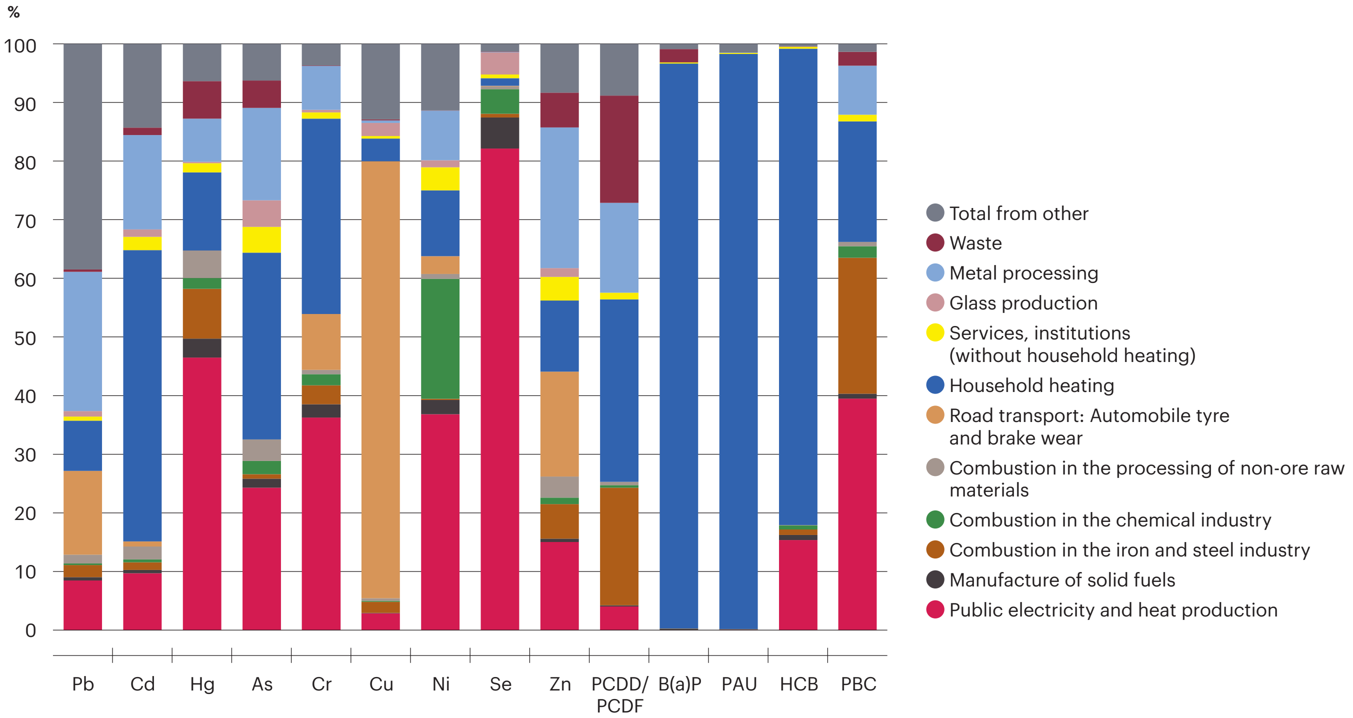
Persistent organic pollutants (POPs) are characterised by their ability to accumulate in living organisms, their toxic properties, and the resulting negative effects on human health (damage to internal organs, reduced immunity, increased risk of cancer). These substances are very resistant to breaking down in the environment and remain there for many years.

[25, 26] *Data for the year 2020 are not available at the time of publication. They will be published in February 2022 at the earliest.*

POPs enter the air from a range of industrial sources, but also from household heating, transport, agricultural spraying, and evaporation from water bodies, soil and landfill sites. Unfortunately, Czechia is a country with a relatively rich history of using and unintentionally releasing many of these substances into the environment, and environmental contamination due to their persistence is an ongoing problem. They are mainly derived from combustion processes (Figure 38). In the case of polycyclic aromatic hydrocarbons (PAHs), polychlorinated dioxins and furans (PCDDs/PCDFs) and hexachlorobenzene (HCB), local heating is the main source. Concentrations of benzo(a)pyrene, which belongs to the PAH group, show a significant annual trend with peaks in winter (due to worsening dispersion conditions and pollution from local household heating). Household heating is by far the dominant source of benzo(a)pyrene emissions (96.4% in 2019[27]). In the case of polychlorinated biphenyls (PCBs), the main source of emissions is the public energy production.

Chart 38

Sources of air emissions of selected heavy metals and POPs in the Czech Republic [%], 2019



Data for the year 2020 are not available at the time of publication.

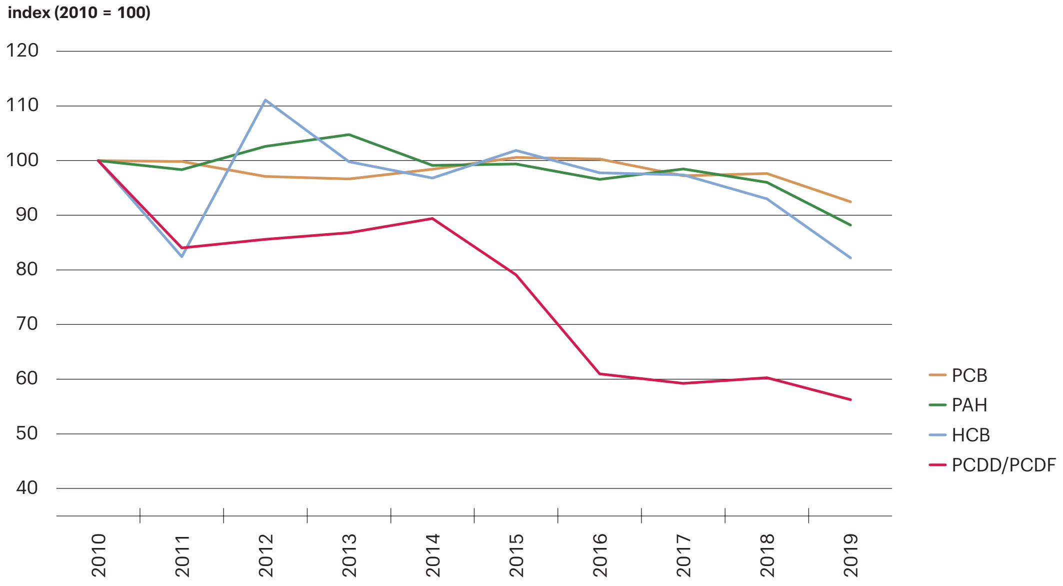
Data source: Czech Hydrometeorological Institute

The development of individual groups of POPs substances is volatile, but overall emissions of all these substances have a downward trend (Chart 39). This trend is already significant, especially in the short term. The most significant long-term reductions since 1990 were achieved for PAHs and HCB, by 85.1% and 82.5% respectively. In the medium and short term, PCDDs/PCDFs decreased the most, by 43.7% and 28.9% respectively.

[27] *Data for the year 2020 are not available at the time of publication. They will be published in February 2022 at the earliest.*

Chart 39

POPs trend in the Czech Republic [index, 2010 = 100], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Hydrometeorological Institute

1.3.2 | Contaminated sites

Key question

How is the inventory of contaminated sites, including old environmental burdens, proceeding, and are these sites being effectively remediated?

Key messages

Over the 2010–2020 period, the remediation of 1,027 contaminated sites was completed with compliance with the conditions of the remedial measures, while the remediation of 437 sites was completed in 2020.

The incremental Evidence System of Contaminated Sites database contained 11,036 sites in 2020.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Contaminated sites (evidence and remediation)	N/A	N/A	N/A	~

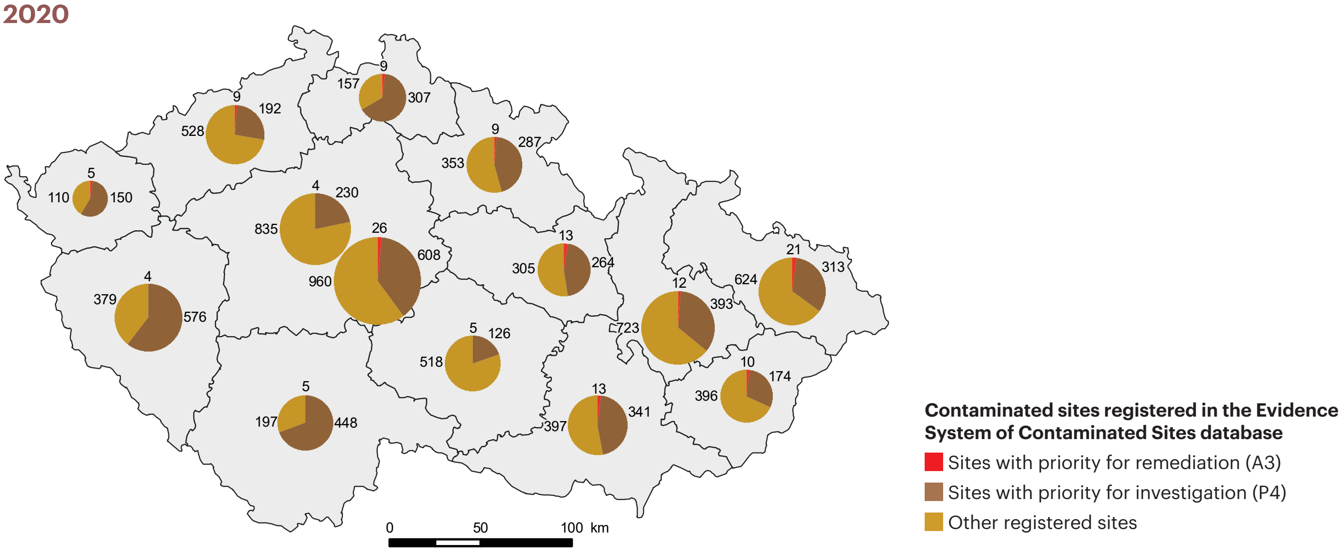
Contaminated sites (evidence and remediation)

Old ecological burdens, or contaminated sites, are a manifestation of the negative consequences of economic activity, not only in the industrial and energy sectors. It is therefore necessary to address the consequences of the activities of these sectors, i.e. remediation of the affected sites. The total **number of contaminated sites** in the Czech Republic is unknown. In 2020, the incremental Evidence System of Contaminated Sites[28] database contained 11,036 contaminated sites. Most of the contaminated sites registered in the Evidence System of Contaminated Sites are located in the Central Bohemian and Olomouc regions, and in Capital City of Prague (Figure 16). These are mostly former industrial buildings, landfills, filling stations, etc.

[28] *In 2019, the original Evidence System of Contaminated Sites database was merged with the Territorial Analytical Documents list and with other databases of other ministries that recorded contaminated sites in their areas of competence. Indications of potential contaminated sites have also been added to the database after being identified by CENIA as part of the National Inventory of Contaminated Sites project from a study of remote sensing mapping data. The number of site records has increased with this expansion (this also applies to remediation) and the actual inventory process is seeing a further increase in sites. The total number of sites is indicated without excluded sites in 2020.*

Figure 16

Number of contaminated sites registered in the Evidence system of Contaminated Sites in the Czech Republic, 2020



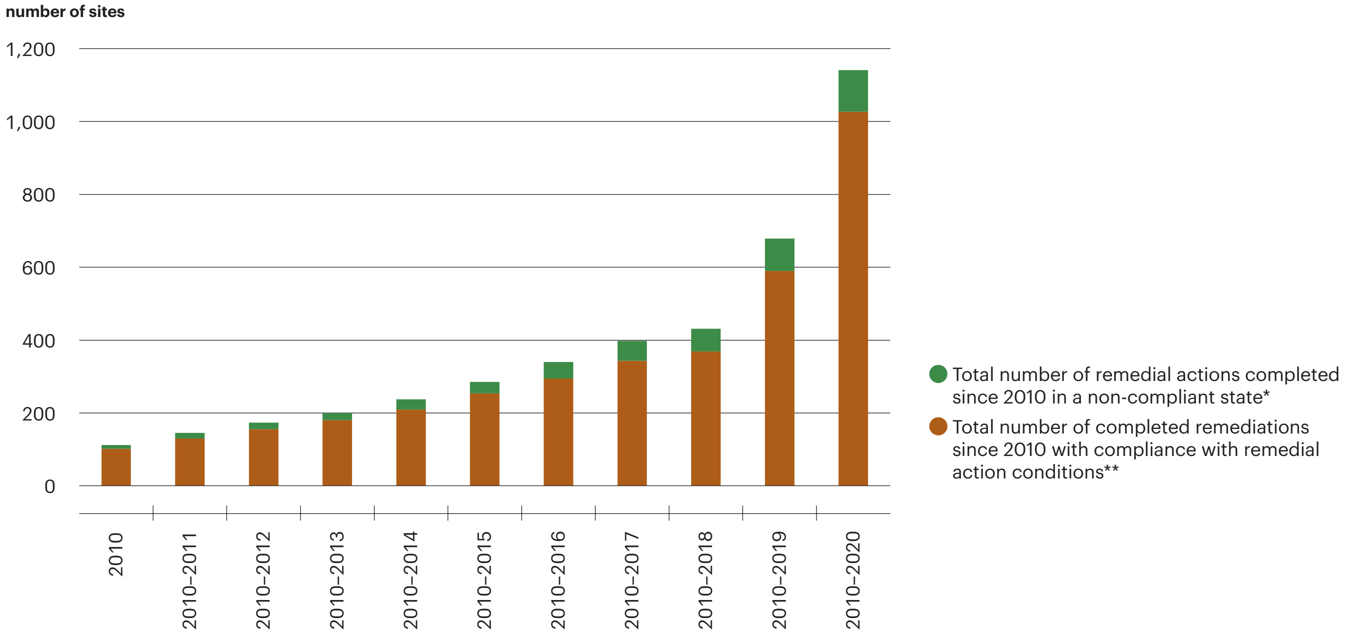
Sites with priority for remediation (A3) and sites with priority for investigation (P4) are determined according to valid methodological instruction of the Ministry of the Environment of the Czech Republic No. 1/2011.

Data source: Ministry of the Environment of the Czech Republic

These sites are continuously mapped and inventoried, mainly for their subsequent **remediation**, which can reduce their number and the potential risks to ecosystems and human health. In the 2010–2020 period, the remediation of 1,027 contaminated sites was completed with compliance with remedial action conditions (including a total of 437 sites in 2020) and a further 114 remedial actions were completed in unsatisfactory condition (including a total of 25 sites in 2020), Chart 40.

Chart 40

Number of contaminated sites with completed remediation registered in the Evidence System of Contaminated Sites in the Czech Republic, cumulatively for the period 2010–2020



** Remediation was terminated for other reasons (e.g. lack of financial resources, unforeseen larger scale contamination, newly discovered facts, etc.).*
*** Remediation may be recorded as completed even if post-remediation monitoring is still in progress.*
In 2019, the original Contaminated Sites Registration System database was merged with the Territorial Analytical Documents list and with other databases of other ministries that recorded contaminated sites in their areas of competence. Indications of the potential presence of a contaminated site, identified by CENIA through the National Inventory of Contaminated Sites project from the study of remote sensing mapping data, have also been added to the database. The number of site records has increased with this expansion, hence the noticeable jump in the chart. Second phase of the National Inventory of Contaminated Sites project was under way in 2020.

Data source: Ministry of the Environment of the Czech Republic

The remediation of contaminated sites in the Czech Republic is **financed** mainly from the Ministry of Finance of the Czech Republic (so-called "Ecological Contracts"), from the financial resources of individual ministries and also from European funds drawn from operational programmes, especially from the Operational Programme Environment. However, in 2020, no call for proposals was announced for specific objective 3.4 of the Operational Programme Environment.

Exposure of the population and the environment to hazardous substances in an international context

Key messages

Since 1990, emissions of POPs in the EU27 have decreased significantly, with polycyclic aromatic hydrocarbons (PAHs) decreasing by 52.7% in the 1990–2019[29] period.

Exceedances of limit values for heavy metals occur only locally in Europe, in areas with specific industrial production.

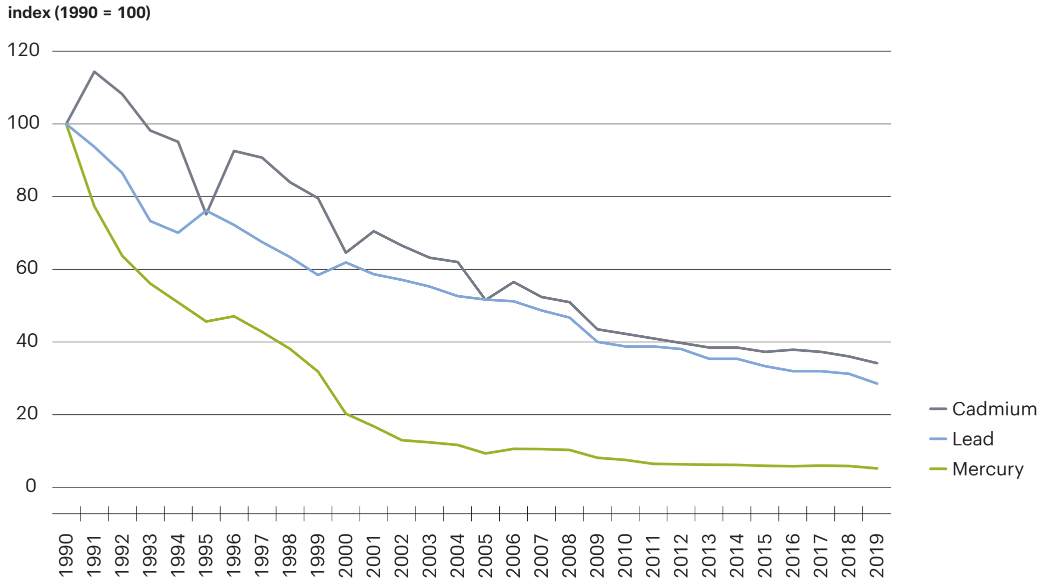
Air emissions of heavy metals and POPs in an international context

Exceedances of limit values for **heavy metals** occur only locally **in Europe**, in areas with specific industrial production. In the EU27 in 2019, cadmium and mercury emissions[30] had fallen (Chart 41) to about a third of 1990 levels. This is mainly thanks to the shift from coal to gas or other energy sources in many countries. Lead emissions decreased by 94.7%, and this decrease can be mainly attributed to the reduction of lead emissions from road transport, where lead in petrol has been replaced by other substances. The dramatic reduction in emissions is mainly the result of a combination of the introduction of best available techniques at individual facilities and the implementation of environmental legislation.

In 2019, Germany, Poland and Spain were the largest emitters of cadmium, accounting for almost half of the EU27 total. Poland is currently the largest producer of lead (26.4% of total EU27 emissions).

Chart 41

Trend in emissions of heavy metals in the EU27 [index, 1990 = 100], 1990–2019



Data for the year 2020 are not available at the time of publication.

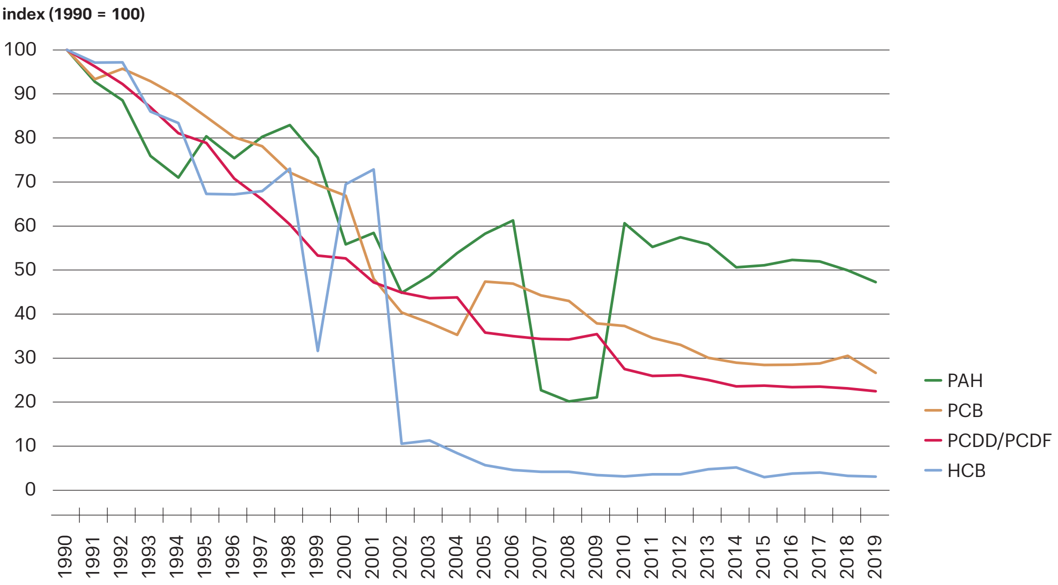
Data source: EEA

[29, 30] *Data for the year 2020 are not available at the time of publication.*

Since 1990, **emissions of persistent organic pollutants** (POPs) have decreased significantly in the EU27 (Chart 42). As of 2019[31], hexachlorobenzene (HCB) had decreased by 96.9%, polychlorinated biphenyls (PCBs) by 73.3%, dioxins and furans (PCDDs/PCDFs) by 77.5%, and polycyclic aromatic hydrocarbons (PAHs) by 52.7%. Germany and Poland emitted the most PAHs in 2019.

Chart 42

Trend in POPs in the EU27 [index, 1990 = 100], 1990–2019



Data for the year 2020 are not available at the time of publication.

Data source: EEA

Contaminated sites in an international context

In selected European countries, an estimated 2.5 mil. potentially **contaminated sites**[32] were identified as of 2011[33], of which 45% (about 1.1 mil. sites) have already been identified[34]. Of these identified sites, 30% (342.0 thous. sites) were identified as requiring remediation, and of these 15% (51.3 thous. sites) have already been remediated. In 2011, the average national expenditure of selected European countries on the removal of contaminated sites was EUR 10.7 per capita, representing on average 0.04% of national GDP. Approximately 81% of the national expenditure was spent on the remediation work itself and 15% on investigatory work[35].

[31] *Data for the year 2020 are not available at the time of publication.*

[32] *The definition of the term in each country is based on national regulations. In Czech terminology, these are old ecological burdens.*

[33] *More recent data are not available at the time of publication.*

[34] *Site identification has been carried out or a preliminary study has been carried out.*

[35] *These data reflect the situation in only 27 of the 39 EEA member states surveyed, and in addition the underlying data for all countries are incomplete, and in some cases the definitions and interpretations used to identify sites differ. Although most European countries have adopted national or regional legislation regulating exploration and remediation activities at contaminated sites, no European framework strategy has yet been developed.*

1

Environment and health

1.4 | Noise pollution and light pollution

1.4 | Noise pollution and light pollution

Today, noise is one of the most important indicators of environmental quality and factors affecting the health of the population. Excessive noise is a source of stress, which is the cause of a number of diseases of civilisation. The most frequently occurring effect of noise on humans is considered to be noise annoyance, i.e. subjective effects of acoustic discomfort, as well as sleep disturbance and effects on activities (work, rest). The most serious health effects related to noise are those on the hearing organ and the cardiovascular system. As with humans, noise also affects animals, and can lead to disruption of populations and loss of biodiversity.

Light pollution is undesirable due to the disruption of human and animal biorhythms, and has a negative impact on ecosystems. At present, light pollution is not regulated in the Czech Republic and no legislation specifies which administrative body protects this public interest, or what the light pollution limit values are.

Overview of selected related strategic and legislative documents

Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (END Directive)

- determining the extent of exposure to noise in the outdoor environment through noise mapping and using assessment methods common to all Member States
- the adoption by Member States of action plans to prevent and reduce noise in the outdoor environment
- preparation of strategic noise maps by 30/ 6/ 2007 and every five years thereafter

1.4.1 | Noise pollution burden of the population and ecosystems

Key question

Is the noise pollution exceeding noise indicator limits on the population decreasing? Is the number of people suffering from noise annoyance and sleep disturbance declining?

Key messages

Noise pollution impacting the population, in terms of the exposure of the population to high noise pollution levels above the limit value, decreased in the 2012–2017 period[36].

In 2020, about 20 km of new motorways were put into operation and almost 90 km of motorways were under construction.

Noise pollution from road transport in the Prague agglomeration and in the Liberec agglomeration increased in the 2012–2017[37] period. In the European context, the noise pollution in the Czech Republic's agglomerations is above average.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Noise pollution burden of the population	N/A	N/A	↘	~
Noise protection measures in transport and development of transport infrastructure	N/A	↗	↗	~

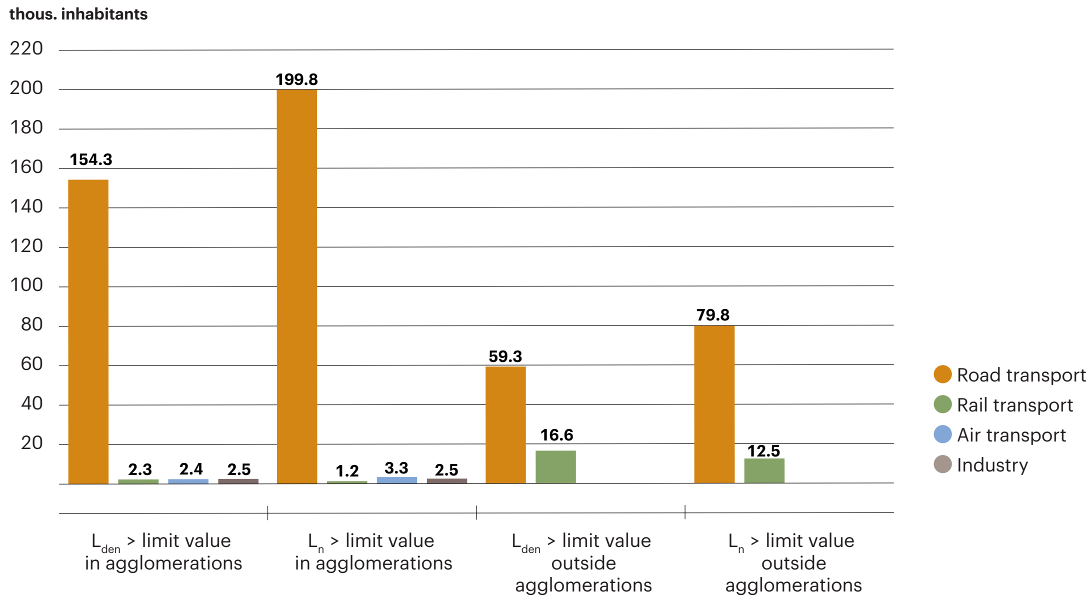
Noise pollution burden of the population

Road transport is unequivocally the largest source of **noise pollution** in the Czech Republic. According to the results of the 3rd round of the Strategic Noise Mapping from 2017[38], a total of about 2.5 mil. people, which corresponds to about a quarter of the Czech population, is exposed to road traffic noise above 55 dB all day (i.e. according to the all-day noise pollution indicator L_{den}) in the areas covered by the noise mapping. Of these, 213.6 thous. people were exposed to noise above the 70 dB limit value, for which action plans to reduce noise pollution are developed. At night (22:00–06:00), 279.6 thous. inhabitants were exposed to noise above the 60 dB limit value (Chart 43). In 2017, operation on the main **railway lines**, which carry at least 30 thous. trains per year, were the source of all-day noise pollution above the 70 dB limit value for a total of 19 thous. inhabitants. Noise from rail traffic mainly affects areas outside urban agglomerations. **Václav Havel Airport** in Prague caused noise pollution above the limit value for a total of 2.4 thous. inhabitants during the day and 3.3 thous. people at night, mostly living in the Prague agglomeration.

[36, 37, 38] Strategic noise mapping is carried out in accordance with the requirements of Directive 2002/49/EC of the European Parliament and of the Council on the assessment and management of environmental noise at five-year intervals. The noise situation in 2018–2020 will be assessed by the 4th round of Strategic Noise Mapping, the results of which will be available in 2022.

Chart 43

Noise pollution exceeding limit values for the noise indicators L_{den} and L_n by individual noise source categories, in agglomerations and outside agglomerations of the Czech Republic [thous. inhabitants], 2017



Outside agglomerations, data are only available for roads with traffic volumes higher than 3 mil. vehicles per year. Due to the five-year Strategic Noise Mapping data processing cycle in accordance with Directive 2002/49/EC, data for the 2018–2020 period are not available. This period covers the 4th round of the Strategic Noise Mapping, the results of which will be available in 2022.

Data source: National Reference Laboratory for Environmental Noise

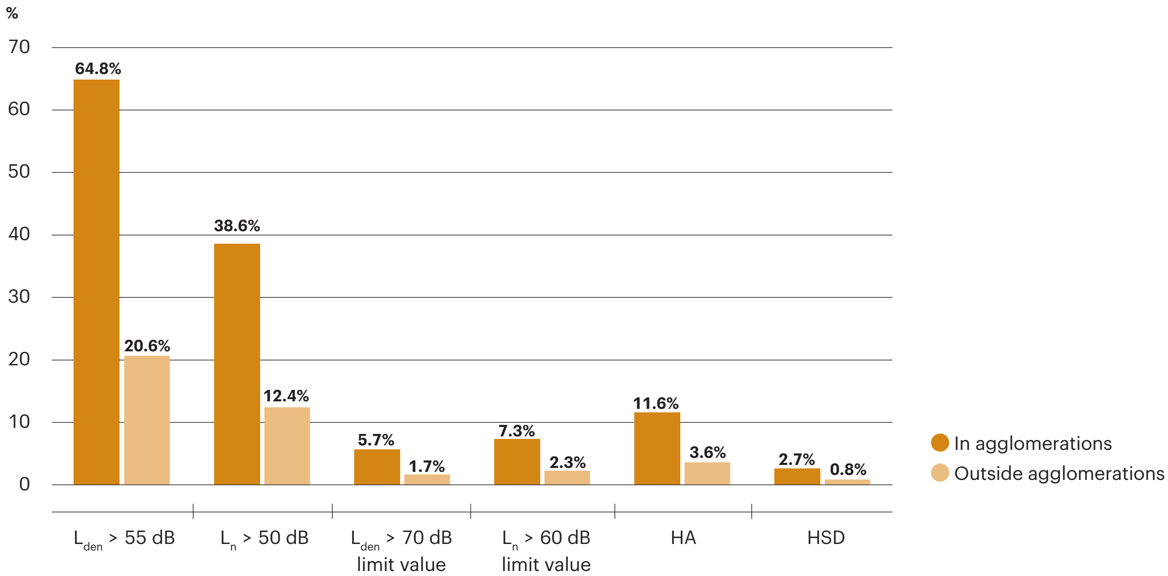
Urban agglomerations with a population of over 100 thous. are mainly exposed to **noise pollution from road transport** (Chart 44), where the share of the population exposed to noise above 55 dB on average for the whole of the Czech Republic in 2017 was 64.8% of the total population included in the noise mapping[39]. All-day exposure of inhabitants to noise above the limit value was highest in the Prague agglomeration (8.3%, Figure 17), and lowest in the Olomouc agglomeration (2.6%). According to the indicator of health effects of noise exposure[40], i.e. according to the number of people highly annoyed by noise (HA), the worst situation was also in Prague, where 159.7 thous. highly annoyed people were identified, which is 12.8% of the total number of people included in the noise mapping. According to this parameter, the situation was relatively the most favourable in the agglomerations of Plzeň and Olomouc. The number of highly sleep disturbed (HSD) people was also highest in the Prague agglomeration (36.3 thous.), and lowest in the Olomouc agglomeration (2.3 thous.).

[39] The mapping criteria were established by Directive 2002/49/EC, and the definition of agglomerations by Decree No. 561/2006 Coll., on the establishment of a list of agglomerations for the purposes of noise assessment and reduction.

[40] For the determination of the number of people with high noise annoyance (HA) and high sleep disturbance (HSD), the methodology according to Annex III of Directive 2002/49/EC was used.

Chart 44

Share of the population of the Czech Republic in agglomerations and outside agglomerations exposed to categories of noise pollution from road transport for the indicators L_{den} and L_n, share of the population highly annoyed by noise (HA), and share of the population with sleep disturbance (HSD) in the total population included in the noise mapping [%], 2017



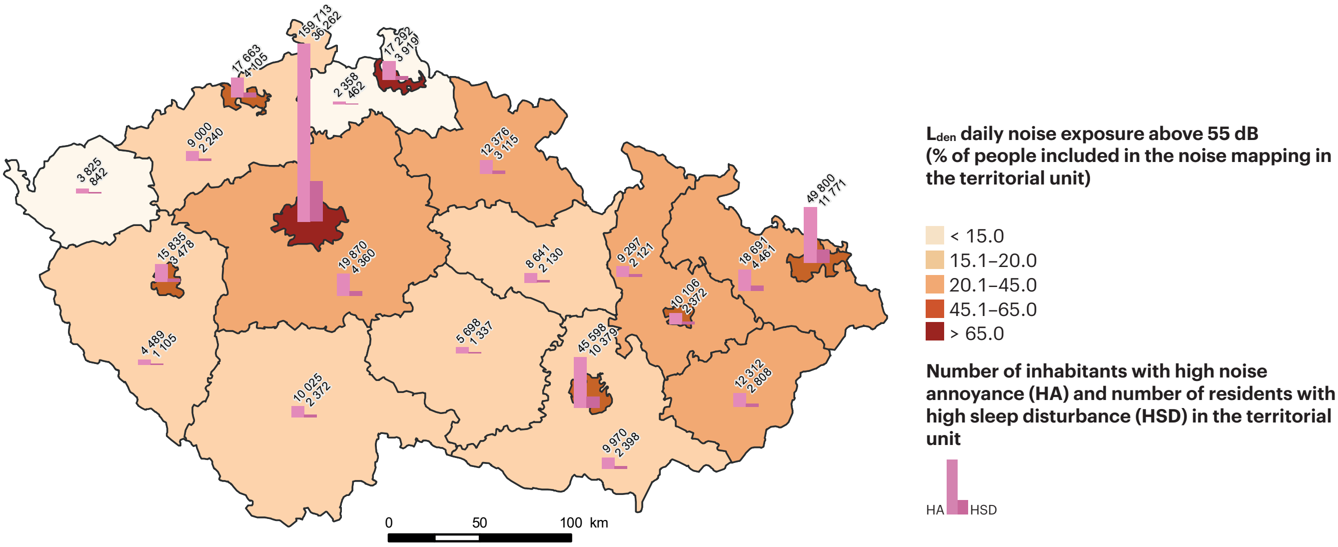
Outside agglomerations, data are only available for roads with traffic volumes higher than 3 mil. vehicles per year. Due to the five-year Strategic Noise Mapping data processing cycle in accordance with Directive 2002/49/EC, data for the 2018–2020 period are not available. This period covers the 4th round of the Strategic Noise Mapping, the results of which will be available in 2022.

Data source: National Reference Laboratory for Environmental Noise

Outside agglomerations, 20.6% of the population was exposed to noise from main roads that carry more than 3 mil. vehicles per year, of above 55 dB throughout the day, while only 1.7% of the population included in the noise mapping, i.e. living in the vicinity of roads where noise mapping is carried out, was exposed to noise above the 70 dB limit. According to the results of the 3rd round of the Strategic Noise Mapping, the Hradec Králové and Central Bohemian Regions, through which the main road and motorway routes with high traffic intensity pass, have the highest noise pollution levels from main roads.

Figure 17

Share of the population in regions and agglomerations of the Czech Republic exposed to all-day road traffic noise pollution (L_{den}) above 55 dB, share of the population highly annoyed by noise (HA), and share of the population with high sleep disturbance (HSD) in the total population included in the noise mapping [%], 2017



Outside agglomerations, data are only available for roads with traffic volumes higher than 3 mil. vehicles per year. Due to the five-year cycle of Strategic Noise Mapping data processing according to Directive 2002/49/EC, data for the 2018–2020 period are not available. This period covers the 4th round of the Strategic Noise Mapping, the results of which will be available in 2022.

Data source: National Reference Laboratory for environmental noise

Compared to the results of the last round of noise mapping (2012), the total number of inhabitants exposed to high levels of all-day road traffic noise pollution (in and outside agglomerations) above 70 dB has decreased by 19.3%. Although this conclusion must be interpreted in the context of methodological changes in noise mapping, a decline in high noise exposure during the 2012–2017 period, and the associated health risks, can be considered confirmed.

Noise protection measures in transport and development of transport infrastructure

The development of the **road infrastructure** has brought a reduction in the emissions and noise burden on the population by diverting transit traffic away from settlements, but at the same time is causing land take and landscape fragmentation. In 2020, two sections of the D6 motorway to Karlovy Vary, 9.8 km long, were put into operation (investment costs for this construction amounted to CZK 2.8 bil. in 2020). Furthermore, the 11.5 km long section of the D48 (Rybí – MÚK Rychaltice) in the Moravian-Silesian Region was put into operation and two sections of the D1 were modernized with a total length of 15.9 km (investment costs of CZK 4.0 bil.). In 2020, additional sections of the D3 motorway in the vicinity of České Budějovice (the approx. 20 km long Úsilné – Hodějovice – Třebonín section) were under construction, as well as the continuation of the D11 motorway between Hradec Králové and Jaroměř (22.4 km, investment costs CZK 7.7 bil.), the D35 motorway in the Opatovice nad Labem – Časy – Ostrov section (27.3 km, investment costs CZK 9.3 bil.) and a bypass at Frýdek-Místek on the D48 motorway. The total length of motorways in the Czech Republic reached 1,298 km at the end of 2020. In total 19.7 km of bypasses and relocations on Class I roads were put into operation in 2020 with total investment costs of CZK 3.0 bil.

The length of **noise barriers on road infrastructure** was extended by 14.4 km to a total of 450.6 km in 2020. The total investment in noise barriers was CZK 405.0 mil. in 2020, of which funds from the State Fund for Transport Infrastructure of CZK 146.2 mil. were used for solitary noise barriers away from large structures and Operational Programme Transport funds totalling CZK 258.8 mil. for the construction of noise barriers on new sections of roads and motorways. Most of the funds from these sources went into the construction of noise barriers in the Central Bohemian and Moravia-Silesian Regions (together approx. CZK 280 mil.) in connection with the construction of new sections of motorways in these regions.

The investment costs related to the implementation of **noise protection measures on railways** in 2020 amounted to CZK 49.5 mil., of which CZK 20.3 mil. was spent on the construction of about 2 km of noise barriers on railway lines. Another CZK 28.0 mil. represented the investment costs of equipping about 3 km of tracks with rail absorbers, which reduce noise levels on the tracks. The investment costs for noise protection measures on railways fluctuates significantly from year to year and has no trend; the highest costs for noise protection measures on railways related to the modernisation of corridor lines in 2015 and 2018, namely CZK 257.9 mil. and CZK 120.6 mil., respectively.

1.4.2 | Brightness of the night sky

Key question

What is the extent of light pollution in the Czech Republic?

Key messages

Areas of dark sky are being formed with the goal of protecting the preserved night environment.

There is no objective measurement for tracking the development of light pollution in Czechia over time.

The current level of light pollution is steadily worsening due to the increasing amount of illuminated areas. We can no longer find any area not affected by artificial brightness in Czechia.

Assessment of the trend and state of indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Brightness of the night sky	N/A	N/A	N/A	~

Light pollution (also popularly known as light smog) produced by artificial lighting at night is one of the major problems of civilization with negative impacts on human health, the environment, the economy, safety, and the visibility of the night sky. Light pollution is generally caused by any artificial light source and is typically caused by directing light into undesirable areas (e.g. the sky, open landscape or into windows), by illumination outside the necessary time periods (e.g. lighting a shopping centre car park outside opening hours), or by using sources with inappropriate spectral characteristics (particularly in the blue part of the spectrum). The often-discussed giant greenhouses in Poland near the Czech border are problematic, as are stadiums, ski slopes, roadside advertisements and inappropriately designed street lighting. All this has economic consequences in the form of excessive electricity consumption.

Although experts say light pollution is harmful to humans, animals and plants, **it is not currently regulated by Czech legislation**, and no legislation specifies which administrative body protects this public interest, or limit values for light pollution.

The variety of forms of light pollution make quantification difficult. Therefore, a suitable measure for assessing the level of light pollution is the **brightness**[41] **of the sky**. Artificial sky brightness is caused by light artificially added to the night-time environment,and is usually expressed as the ratio to the natural brightness of the night sky[42] (Figure 18).

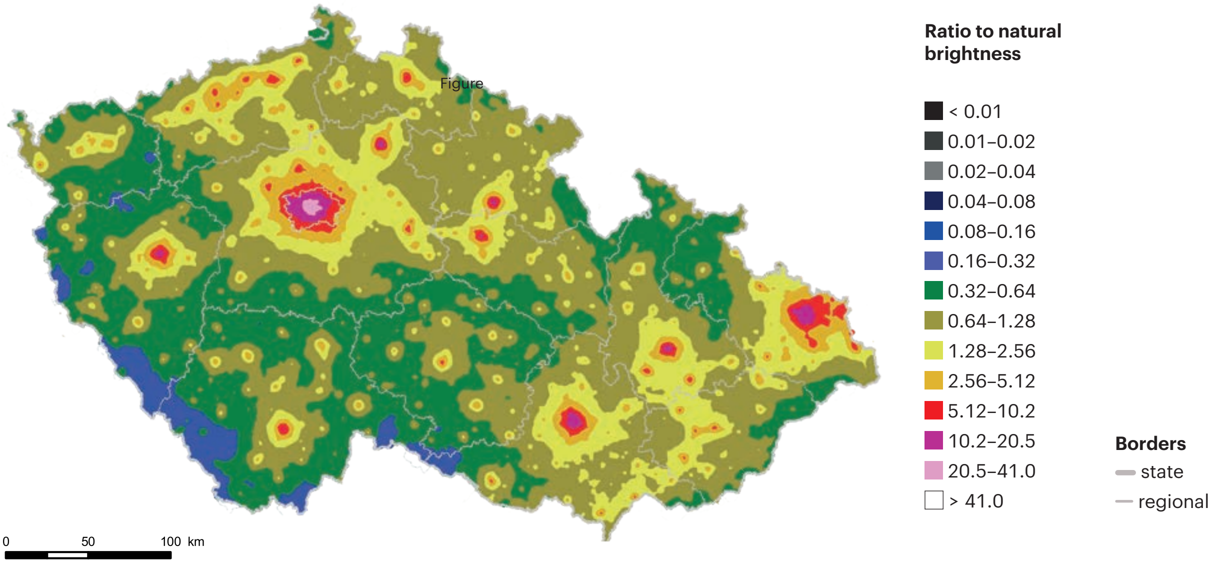
[41] Brightness is a photometric quantity and can be defined as the luminous flux per unit solid angle per unit area of the source, expressed in candelas per m^2 (L; cd per m^2).

[42] The natural brightness of the sky consists of the scattered light of the Moon, bright planets, stars, the Milky Way, zodiacal light, airglow (radiation from the upper layers of the Earth's atmosphere) and other astronomical phenomena.

The brightness of the sky is influenced by the number of light sources, the location and parameters of luminaires, the amount of greenery, snow cover, the amount and type of aerosols (smog, haze), the width of streets, the height of buildings, cloud cover and more. Of course, **large cities** have the most artificial brightness in the night sky. In Czechia, however, we can no longer find any area not affected by artificial brightness because light from cities spreads tens or even hundreds of kilometres away due to scattering in the air. According to The New World Atlas of Artificial Night Sky Brightness, as expected, the centre of Prague is the worst off, with a ratio of artificial to natural brightness above 20. The broader surroundings of Prague, Brno, Plzeň, Ostrava, Olomouc, České Budějovice and many other cities also shine brightly. On the other hand, the situation is best in the northern part of Šumava Region, in mountain areas, in the rural area of the south-western part of Czechia and in Vysočina Region. **Dark sky areas** have been established in these areas to protect the preserved night-time environment. Currently, three such areas have been declared in Czechia – in 2009, the Czech-Polish Izera Dark-Sky Park was declared the first such area in Europe and the first transboundary area in the world. In 2013, the Beskydy area (on the Czech and Slovak side of the Beskydy Mountains) was added, and in 2014 the Manětín Dark-Sky Park (between Plzeň and Karlovy Vary). Currently, a dark-sky park in the Podyjí national park is being prepared.

Figure 18

Artificial brightness of the night sky over the Czech Republic, 2016



More recent data are not available.

Data source: Czech Astronomical Society, 2017, www.svetelneznecisteni.cz. Supplement to: Falchi et al. (2016): The New World Atlas of Artificial Night Sky Brightness, http://doi.org/10.5880/GFZ.1.4.2016.001 ()

The inappropriate type of artificial lighting and, especially the lack of difference between day and night light intensity, results in a disruption of **circadian rhythm** (the natural cycles of day and night), which leads to changes in the behaviour of organisms. When animals are in environments where artificial light reaches intensities that disrupt these natural processes, the impacts are observable on entire communities and affect the ecosystem linked to them (ultimately reducing biodiversity). Their behaviour is also affected by light smog, as well as their orientation in the night landscape.

We thus talk about the **biological efficiency of light**, which depends not only on its intensity but also on its spectral composition. Current studies show that night-time light pollution is a global problem, with significant consequences particularly related to the blue component of light (460–480 nm wavelength), as the specialised receptors in the eye that send signals to the brain structures responsible for regulating physiological and cognitive functions are most responsive to it. Nocturnal exposure to light radiation leads to insufficient regeneration of the human body during sleep and suppresses the production of the hormone melatonin (affects the circadian rhythm), even at very low light intensities. Repeated disturbance of the dark phase of the night by light (especially if it contains a blue spectral component) significantly increases the risk of so-called diseases of civilization, such as immune disorders, psychiatric diseases including depression, sleep and memory disorders, cardiovascular diseases, insulin resistance and obesity, and especially many forms of cancer. The circadian cycle of animals works on a similar principle, including sensitivity to similar wavelengths.

The current **level of light pollution** is steadily worsening due to the increasing number of luminaires or illuminated areas. The use of LED-based light sources producing white light is also increasing. These light sources are more energy efficient and thus cheaper to operate, but they emit strongly in the blue region of the spectrum. It is therefore necessary to look for ways to ensure that the lighting used is not only financially beneficial, but also that it is as little disruptive as possible to the health of people, animals and entire ecosystems, as well as to the appearance of the night landscape. For this purpose, projects for the reconstruction or modification of public lighting systems are **financially supported**, including, for example, in the case of subsidy calls for environmentally friendly street lighting for municipalities in national parks and Protected Landscape Areas announced by the Ministry of the Environment of the Czech Republic under the National Environment Programme. Municipalities outside protected areas could obtain funding, for example, from the Ministry of Industry and Trade of the Czech Republic's Effect programme.

Noise and light pollution in an international context

Key messages

Czechia is comparable to other European countries in terms of artificial brightness of the night sky.

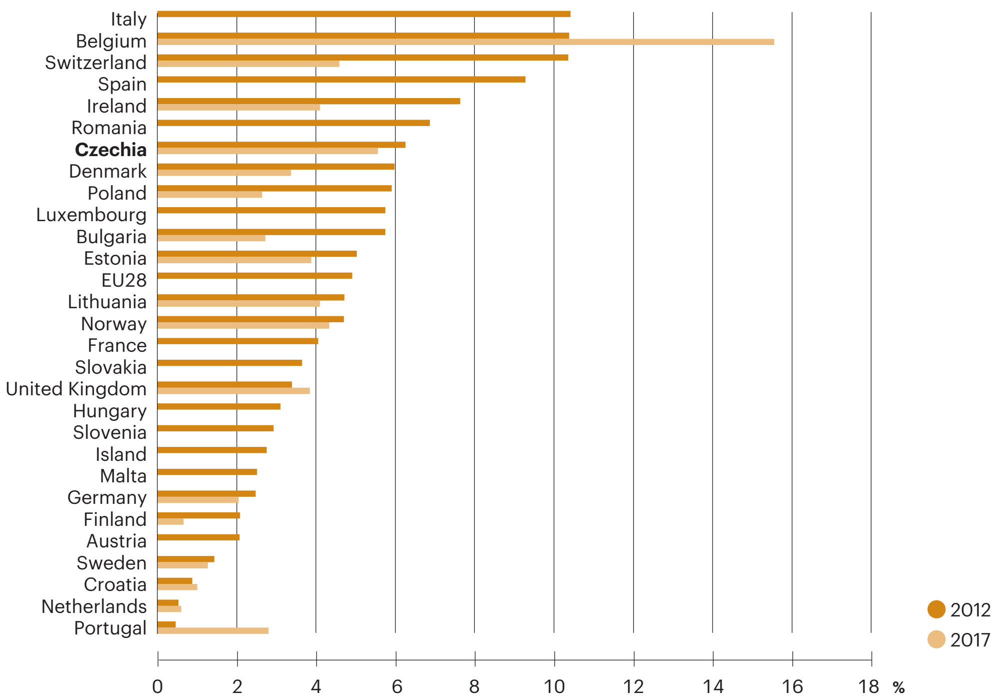
Noise pollution in urban agglomerations in Czechia with a population of over 100 thous. is above average in a European comparison.

Noise pollution in an international context

Urban agglomerations in the EU28 with a population over 100 thous. have significant noise pollution from road traffic. According to the results of the 3rd round of the Strategic Noise Mapping, more than 10% of the population of agglomerations is affected by high all-day noise pollution from road traffic above 70 dB (which is the limit value for Czechia) (Chart 45). This indicator varies considerably from country to country depending on the volume of traffic and the routing of transit routes. Czechia has a slightly above average noise pollution in terms of EU28 agglomerations. In the 2012–2017 period[43], i.e. between the 2nd and 3rd round of the Strategic Noise Mapping, noise pollution decreased in most agglomerations with available data, but there were exceptions, e.g. in Belgium, the United Kingdom and Portugal, where the share of agglomerations affected by road traffic noise increased.

Chart 45

Share of the population exposed to road traffic noise pollution above 70 dB (indicator L_{den}) in agglomerations of more than 100 thous. inhabitants. in the EU28 [% of exposed agglomeration population], 2012, 2017



Data for 2017 are only available for some countries (agglomerations), while other countries have either not yet provided any data or the number of agglomerations with available data is too low. The comparability of data between countries may be affected by their different methodologies for calculating noise pollution.

Data source: EEA

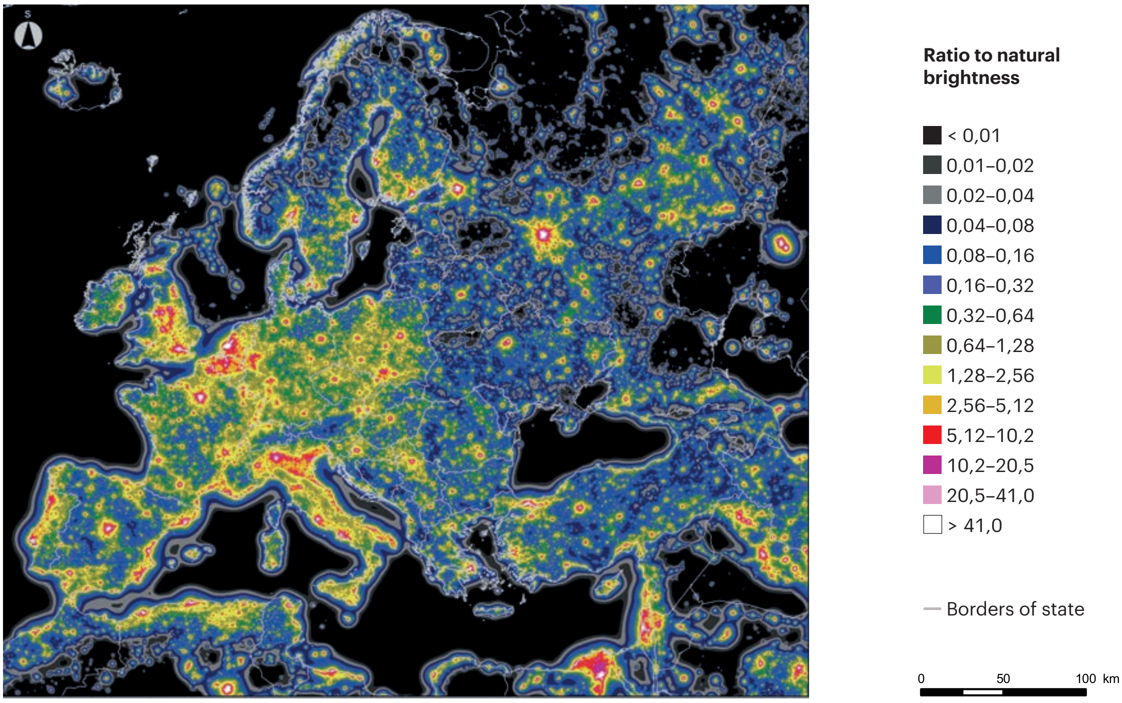
[43] Due to the five-year Strategic Noise Mapping data processing cycle in accordance with Directive 2002/49/EC, data for the 2018–2020 period are not available. This period covers the 4th round of the Strategic Noise Mapping, the results of which will be available in 2022.

Light pollution in an international context

According to The New World Atlas of Artificial Night Sky Brightness, approximately 83% of the world's population lives under light-polluted sky[44] (Figure 19) and more than 99% of the population of the US and Europe. In terms of light pollution, Singapore is the most impacted country in the world, where the entire population lives under a sky so bright that human vision cannot fully adapt to night vision.

Figure 19

Artificial brightness of the night sky over Europe, 2016



More recent data are not available.

Data source: Czech Astronomical Society, 2017, www.svetelneznecisteni.cz. Supplement to: Falchi et al. (2016): The New World Atlas of Artificial Night Sky Brightness http://doi.org/10.5880/GFZ.1.4.2016.001

Czechia is comparable to other European countries in terms of the artificial brightness of the night sky (Table 5). The entire territory of Czechia can already be considered polluted by artificial brightness, while only 0.6% of the whole of Europe is not yet polluted. Around 40% of the Czech population cannot normally see the Milky Way in the sky (almost 60% in Europe). Almost 7.3% of the Czech population (20.5% of the European population) lives in an area where they can no longer even see the dark sky due to artificial lighting.

Table 5

Share of the population and territory with artificially bright night sky [%]

Artificial night sky brightness (µcd .m^{-2})	< 1.7	> 14	> 87	> 688	> 3000	< 1.7	> 14	> 87	> 688	> 3000
Ratio to natural brightness	do 0.01	od 0.08	od 0.5	od 3.99*	od 17.3**	do 0.01	od 0.08	od 0.5	od 3.99	od 17.3
Territory	Population in %					Area of territory in %				
Czechia	0	100	97.5	42.8	7.3	0	100	82.3	3.6	0.2
Europe	0	99.8	94	59.5	20.5	1.3	88.4	48.7	6.0	0.6
The world	8	83.2	63.7	35.9	13.9	60.3	22.5	8.6	1.2	2.0
Slovakia	0	99.8	82.3	23.8	4.8	0	98.6	46.8	1.8	0.2

* *the Milky Way is no longer visible*
** *no dark sky*

Data source: The New World Atlas of Artificial Night Sky Brightness (Falchi et al. 2016)

[44] *The brightness of the artificial sky at the zenith is greater than 14 µcd.m^{-2}, i.e. the ratio to natural brightness is greater than 0.08.*

1

Environment and health

1.5 | Society preparedness for and resilience to emergencies

1.5 | Society preparedness for and resilience to emergencies

Adaptation to climate change, leading to increasing the resilience of natural and anthropogenic systems to the manifestations of climate change, together with mitigation, is a fundamental approach to reducing the negative impacts of climate change. Adequate response and reduction of the impact of emergencies and crisis situations (disasters) require not only a prepared and functional crisis management system, but also the preparedness of the whole of society for the possibility of such events. The crisis management system must be supplemented by financial support and the implementation of measures that will help prevent or reduce the impact of emergencies and crisis situations on people and the environment. The preparedness of the Integrated Rescue System for rescue work, damage limitation and recovery from serious threats is currently assessed as very good, but it is still necessary to maintain and further develop this state. Early intervention is important to minimise negative impacts. In the first phase, warning systems, their quality and deployment, and the subsequent actions of representatives of settlements, Integrated Rescue System units, and citizens themselves play significant roles. For this reason, awareness-raising events, education in the school system and public education programmes aimed at improving the general public's understanding of the level of risk should be further promoted.

Overview of selected related strategic and legislative documents

State Environmental Policy of the Czech Republic 2012–2020
- mitigating the impact of hazards, including emergencies and crisis situations

Strategy of Environmental Security of the Czech Republic 2016–2020 with the outlook to 2030
- through close-to-nature and other measures, support for improving the capability to face the consequences of natural hazards and for slowing down negative trends causing an increase in risks of natural origin (e.g. innovation of hydrometeorological (especially forecasting) monitoring procedures for risk prevention, preparedness and management in the field of environmental security)

Concept of Population Protection to 2020 with the outlook to 2030
- in accordance with the Geneva Protocols, mitigating the effects of natural disasters and other emergencies and crisis situations on the population, infrastructure and services to ensure their survival (i.e. in particular placing emphasis on the provision of special equipment resistant to severe natural conditions, on quality and natural disaster-resistant facilities for the concentration of forces, resources or storage facilities of the Integrated Rescue System units, and on the rapid possibility of regrouping forces and resources for the performance of necessary activities)

Strategy on Adaptation to Climate Change in the Czech Republic
- supporting the development of public protection, in particular the integrated system for the prediction of natural events, the warning and notification system, the Integrated Rescue System, the protection of critical infrastructure and environmental safety
- developing principles for comprehensive risk management and the preparedness of agriculture for the negative manifestations of climate change, and continuing to motivate farmers to use agricultural insurance and insurance companies to provide it

Concept of Protection Against Drought Consequences on the Territory of the Czech Republic
- the main objective is to create a strategic framework for the adoption of effective legislative, organisational, technical and economic measures to minimise the impacts of drought and water scarcity on the lives and health of the population, the economy and the environment

Regional Development Strategy of the Czech Republic 2014–2020
- sufficient and comprehensive consideration of public interests of local and regional scope in spatial planning, such as flood protection and adaptation to climate change

1.5.1 | Preparedness for weather extremes

Key question

How is preparedness for extreme weather supported?

Key messages

Support for preparedness for weather extremes or the impacts of climate change is provided by a number of programmes from both national and European sources. At the Ministry of the Environment of the Czech Republic, the main sources of funding for measures to adapt to the manifestations of climate change are the Operational Programme Environment, the National Programme Environment (especially the Dešťovka (Rainwater) Programme), the Landscape Management Programme and the Natural Landscape Function Restoration Programme. At the Ministry of Agriculture of the Czech Republic, the main sources were the Rural Development Programme and national programmes focused on flood prevention and water retention in the landscape. Other ministries that address the issue of adaptation to climate change are the Ministry of Regional Development of the Czech Republic (especially through funding from the Integrated Regional Operational Programme) and the Ministry of Industry and Trade of the Czech Republic.

In 2020, the Integrated Warning Service System issued a total of 445 alerts for expected hazardous events and 83 reports of hazardous events. The Integrated Warning Service System has been a valuable tool for preventing the consequences of hazardous events.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Public expenditure spent on adapting to the manifestations of climate change	N/A			✓
Issuing alerts of the Integrated Warning Service System*)	N/A	N/A	N/A	✓

**) It is not possible or meaningful to set a trend for the operation of an alert system. Its success criterion is not the number of alerts issued, but the quality, accuracy and timeliness of the alerts.*

Public expenditure spent on adapting to the manifestations of climate change

Effective financial support for measures to protect against the risks of climate change or natural hazards is essential to improve the adaptation of the population and economic sectors to these risks. The aim of the measures is mainly to reduce the level of risk (e.g. to reduce flood risks in floodplains of watercourses) and to effectively combat extreme manifestations of climate change and their impacts, not only on the landscape but also on the socio-economic system.

The financial support was systematically implemented and documented especially in the case of **floods**, landslides or erosion, and was mainly implemented through the Operational Programme Environment at the Ministry of the Environment of the Czech Republic or through the designated national programmes for flood prevention and the Rural Development Programme, managed by the Ministry of Agriculture of the Czech Republic. These programmes have made a significant positive contribution to effective financial support for the above measures.

In the **Operational Programme Environment 2007–2013**, priority axis 1 and its specific objective 1.3 aimed at reducing the risk of flooding, and priority axis 6 and its objectives 6.4 and 6.6 concerning the optimisation of the water regime of the landscape and the prevention of landslides and rockfalls concentrated on these measures. In the area of flood protection measures (objective 1.3), a total of 595 projects were supported and almost CZK 2.5 bil. was paid to beneficiaries, while in the case of optimisation of the water regime of the landscape (objective 6.4), there were 1,447 projects with support of CZK 5.9 bil. Under the prevention of landslides and rockfalls (objective 6.6), 460 projects were supported and beneficiaries were paid CZK 1.8 bil.

In the follow-up **Operational Programme Environment 2014–2020**, priority axis 1 (improving water quality and reducing the risk of floods) in the supported area 1.3 (ensuring flood protection within town limits and rainwater management) and 1.4 (support for preventive flood protection measures) focused on this issue. By the end of 2020, 218 projects with a total volume of CZK 1.7 bil. of total eligible expenditure had been approved in support area 1.3 (of which CZK 0.9 bil. was reimbursed), while in area 1.4 there were 686 projects with a total volume of CZK 2.5 bil. of total eligible expenditure (of which CZK 1.2 bil. was reimbursed). Projects in these areas also address water retention in landscapes and settlements, including better water management, also in the context of the growing importance of addressing **drought**. This is the focus of support in the Operational Programme Environment for the development of water supply infrastructure to ensure sufficient drinking water for the population, specifically supported area 1.2 (ensure the supply of drinking water of adequate quality and quantity), where 140 projects with a total volume of CZK 5.5 bil. of total eligible expenditure have been approved (of which CZK 2.8 bil. has been reimbursed). In addition, drought is also addressed under priority axis 4 (protection and care of nature and landscape) in support area 4.3 (strengthening the natural functions of the landscape). Here, over 70 projects for revitalisation and construction of ponds or wetlands were approved for the purpose of maintaining water in the open landscape, with a total volume of CZK 467.4 mil. of total eligible expenditure (of which CZK 138.5 mil. has been reimbursed). In total, more than 1,100 projects with a total volume of more than CZK 10 bil. were approved in the Operational Programme Environment 2014–2020 by the end of 2020.

Since 2017, the issue of drought has also been addressed through the national subsidy programme **Dešťovka** (Rainwater) announced in the National Environment Programme. The aim of this programme is to provide motivation for efficient water management and thus reduce the amount of drinking water abstracted from surface water and groundwater sources. A total of CZK 540 mil. was allocated in two calls, while 6,230 projects with a total support amount of CZK 232.8 mil. had been approved by 2020. The National Programme Environment also supports activities related to climate measures listed in Table 6. In addition, in 2020, new calls 3 and 6/2020 were announced in the National Programme Environment for project preparation in the field of water management projects, drought and floods with a total allocation of CZK 350 mil.

Table 6

Overview of projects approved in the National Programme Environment including allocation and amount of support in the Czech Republic [number, CZK mil.], 2015[45]–2020

Supported activity	Announced allocation [CZK mil.]	Number of approved projects	Amount of support [CZK mil.]
1.4.A Environmentally sensitive restoration and maintenance of water bodies and watercourses	50	11	22.3
1.5.A Rainwater harvesting and waste water treatment within the municipality, including sustainable terminals with emphasis on decentralised or semi-centralised solutions	50	3	7.0
1.6.A Exploration, strengthening and development of drinking water resources	1,050	648	793.4
4.2.E Project preparation for projects focused on revitalization and renaturation of watercourses, restoration of ecostabilization functions of aquatic and water-bound ecosystems and implementation of close-to-nature measures aimed at slowing surface water runoff and erosion protection	100	1	5.0

Data source: State Environmental Fund of the Czech Republic

Adaptation measures to mitigate the impacts of climate change are also addressed in the national subsidy programme of the Ministry of the Environment of the Czech Republic, the **Landscape Management Programme**, especially its Sub-programme B for improving the preserved natural and landscape environment, where 5,125 actions with a total volume of CZK 254.0 mil. were supported in the 2014–2020 period. Another programme is the Natural Landscape Function Restoration Programme, where it is possible to mitigate the impacts of climate change on water, forest and non-forest ecosystems. In the 2014–2020 period, CZK 81.1 mil. was spent on 680 actions under this programme.

[45] *Since 2015, the State Environmental Fund of the Czech Republic has been providing subsidies from national sources for projects through the National Programme Environment.*

At the **Ministry of Agriculture of the Czech Republic**, measures to mitigate the negative impacts of climate change (i.e. in particular flood control measures, water retention in the landscape in relation to drought) were implemented in the programmes listed in Table 7. For example, the implementation of more than 900 flood protection structures, which will protect property with a total volume of more than CZK 400 bil. and around 865 thous. inhabitants, has been financed from the national programmes of the Ministry of Agriculture of the Czech Republic, and more than 300 projects have been implemented in the field of water retention in the landscape. It is also important to mention land consolidation (complex or simple), financed mainly from the Rural Development Programme, which contribute to the elimination of the negative impacts of climate change, especially in terms of reducing the adverse effects of floods and droughts and addressing runoff conditions in the landscape. Complex and simple land consolidation is currently being carried out on almost 37% of the agricultural land fund (more than 1.5 mil. ha), and land consolidation is underway on another 12% of agricultural land. The Rural Development Programme also finances agri-environmental-climate measures, specifically in the area of landscape care, while such measures had been implemented on almost 20 thous. ha of agricultural land by 2020. The Ministry of Agriculture of the Czech Republic is also preparing multi-purpose waterworks which, once implemented, will perform a number of functions (flood control, storage, improving flows in times of drought, etc.).

Table 7

Financing of programmes in the field of flood control measures or measures to mitigate the manifestations of climate change (drought, water retention in the landscape, ensuring drinking water supply) at the Ministry of Agriculture of the Czech Republic, 2014–2020 [CZK mil.]

Programme	Funds reimbursed [CZK mil.]
Flood prevention III and IV (emphasis on implementation of measures with a retention effect)*	3,401.6
Support for measures on small watercourses and small reservoirs (from 2016). including Phase II	2,174.0
Restoration. desilting and reconstruction of ponds and construction of water reservoirs (since 2016 replaced by the programme Support for Water Retention in the Landscape – Ponds and Water Reservoirs)	66.2
Support for Water Retention in the Landscape – Ponds and Water Reservoirs (since 2016)	456.4
Support for measures to mitigate the negative impacts of drought and water scarcity	76.2
Supporting the competitiveness of the agri-food complex – Irrigation I and II	330.9
Construction and renewal of water supply and sewerage infrastructure (to 2015). Construction and technical improvement of water supply and sewerage infrastructure I and II**	2,393.1
Vlachovice – settlement of rights to immovable property affected by the planned construction of a waterworks	120.0
Settlement of rights to immovable property affected by the planned implementation of a comprehensive drought solution in the Rakovnik region	33.0
Skalička – settlement of rights to immovable property affected by the planned construction of a waterworks	120.0
Support for the planting of ameliorative and strengthening trees according to the Forestry Act	56.8
Total national resources	9,228.2
Rural Development Programme 2014–2020*** – Implementation of land consolidation in total	9,398.0
of which anti-erosion measures	275.4
of which water management measures	1,107.1
of which environmental measures	218.5
of which roads and other (operational and technical activities)	7,797.1
Rural Development Programme 2014–2020 – agri-environmental-climate measures (grassing of arable land, biogas plantations, intercropping, concentrated runoff paths)	1,975.6
Rural Development Programme 2014–2020 – Investments in the development of forest areas and improving forest viability and Forest-environment and climate services and forest protection	1,278.9
Total European resources (excluding land consolidation in the category "roads and other")	4,855.5

** This programme follows on from the already completed Phases I and II. In Phase I, targeting the areas affected by the 1997 flooding, CZK 4.0 bil. was financed (435 flood protection structures were implemented), Phase II focused on technical measures along watercourses and measures increasing retention and safety of works during floods, CZK 11.5 bil. was financed (379 flood protection structures were implemented).*
*** Only funds paid out in the area of water supply and water treatment plants are tracked here.*
**** Including the use of funds from the General Treasury Management, the budget of the State Land Office and others (Directorate of Roads and Motorways, budgets of municipalities and towns).*

Data source: Ministry of Agriculture of the Czech Republic

In addition to the Ministry of the Environment of the Czech Republic and the Ministry of Agriculture of the Czech Republic, the issue of adaptation to climate change is also addressed by the **Ministry of Regional Development of the Czech Republic and the Ministry of Industry and Trade of the Czech Republic**. The Ministry of Regional Development of the Czech Republic administers the Integrated Regional Operational Programme, which has a specific objective 1.3 Increasing preparedness to address and manage risks and disasters in the area of protection against natural hazards. Support is primarily aimed at protection against extreme/long-term drought, above-average snowfall and massive icing, hurricanes and wind storms, and accidents related to the release of hazardous substances. Specifically, this supports increased preparedness of the basic components of the Integrated Rescue System for dealing with emergencies related to climate change and accidents involving hazardous substances. A total of 778 projects were submitted in four calls for proposals with a total volume of CZK 10.1 bil. of total eligible expenditure, while a total of 413 projects with a total volume of CZK 2.8 bil. had been completed and reimbursed by the end of 2020.

In response to the acute drought situation, the Ministry of Industry and Trade of the Czech Republic has prepared a number of modifications to existing support programmes with a total allocation of CZK 4.3 mil., while the aim of the project is to help business entities mitigate the impact of drought on their business, the economy and the social situation of a given place or region, or the Czech Republic as a whole. The adjustments are aimed in particular at more economical use of water in the industry and energy sectors, according to circular economy principles.

The development of financial support for measures to mitigate climate change risks in Czechia positively increases the adaptive capacity not only of the landscape but of the entire socio-economic system. Particularly with regard to the new issue of drought, it is important to increase this adaptive capacity in combination with other measures such as agricultural and forestry management, landscape retention capacity, land use and construction planning.

Issuing alerts of the Integrated Warning Service System

The **Integrated Warning Service System** alerts for hazardous meteorological and hydrological phenomena are issued in accordance with World Meteorological Organization (WMO) recommendations and within the European Meteoalarm system[46]. The purpose of the issued reports is to warn the public, state administration and economic entities about the risk of occurrence of hazardous phenomena in time, thus reducing their consequences and possibly supporting the effective elimination of any consequences that have already occurred. The Integrated Warning Service System is operated by the Czech Hydrometeorological Institute in cooperation with the meteorological service of the Czech Army in the field of operational meteorology and hydrology. Issuing warning information within the Integrated Warning Service System is partly the fulfilment of the Flood Reporting and Forecasting Service, which the Czech Hydrometeorological Institute provides under Section 73 of the Water Act.

Alerts are issued according to the criteria set for each group of hazardous phenomena. The **probability of occurrence** (for most phenomena, a warning is issued at a probability of more than 50%) and the **intensity of the phenomenon** (low, high, extreme) are determined for each phenomenon. The combination of probability and intensity is used to determine the degree of hazard applying to the phenomenon (Table 8). In addition to warnings for expected hazardous phenomena, **information on the occurrence of hazardous phenomena** is issued for selected particularly hazardous phenomena of high and extreme intensity according to the Integrated Warning Service System manual.

Table 8

Hazard levels and their description

Hazard degree	Hazard level		Description of hazards and activities
None	B	green	Normal situation, no danger, no need to pay extra attention. No alert is issued for this state.
Low	N	yellow	The weather is potentially hazardous. A potentially hazardous hydrological and/or meteorological event or an unusual hydrological and/or meteorological event with a low probability of occurrence is predicted. When carrying out activities exposed to the action of meteorological elements, it is recommended to pay close attention to the situation and avoid possible risks.
High	V	orange	The weather is hazardous. A hazardous hydrological and/or meteorological event is observed or predicted to occur with a high probability, or an exceptionally intense hydrological and/or meteorological event is predicted to occur with a low probability. Material damage and deaths may occur. Vigilance and regular monitoring of the meteorological situation is essential. The recommendations of the responsible authorities must be followed.
Extreme	E	red	The weather is very hazardous. An exceptionally intense hydrological and/or meteorological event is observed or predicted to occur with a high probability. Significant material damage over a large area or catastrophic consequences in the event of localised damage, serious injuries or loss of life can be expected. There is a need for frequent monitoring of detailed information on expected hydrological and/or meteorological conditions and risks. In all circumstances, the orders and recommendations of the responsible authorities must be obeyed and emergency measures are to be expected.

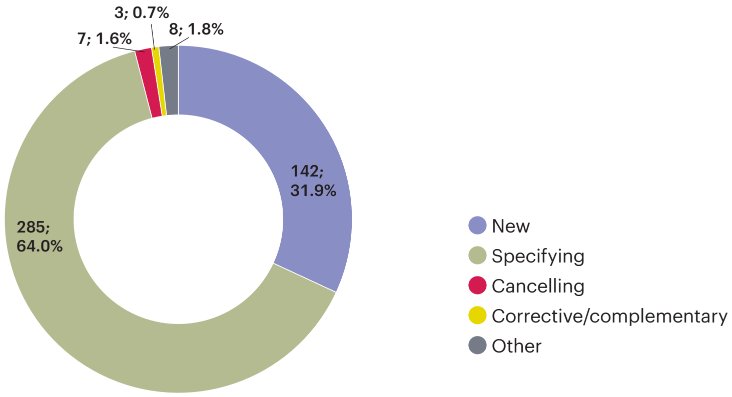
Source: Czech Hydrometeorological Institute

In 2020, a total of 445 alerts were issued through the Integrated Warning Service System, of which 142 were new alerts and 285 were refinements of previously issued alerts (Chart 46), e.g. as regards the temporal and spatial validity and intensity of the phenomenon, based on newly obtained refined forecasts.

[46] *More at: www.meteoalarm.org*

Chart 46

Integrated Warning Service System alerts issued by alert type in the Czech Republic [number, %], 2020

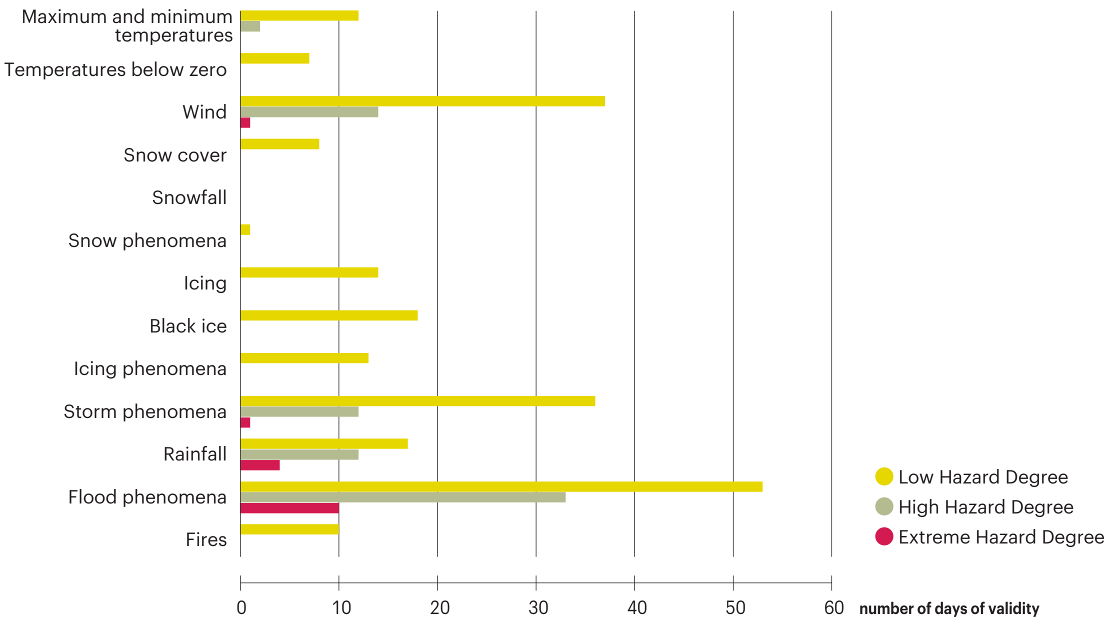


Data source: Czech Hydrometeorological Institute

In terms of **hazard groups**, warnings were most frequently issued for flood events, storm events and strong wind (Chart 47). The flood alert (low hazard) was in effect for more than 50 calendar days, while the flood hazard warning was in effect for 10 calendar days. Warnings for extreme hazard events were also issued for extreme precipitation (4 days), extremely severe thunderstorms and extremely strong wind (both on only one day of the year). Hazardous air temperature warnings were issued only for high (above 31°C) and very high (above 34°C) temperatures. Due to the mild winter, no snowfall warnings were issued, and only low-level warnings were issued for other winter phenomena.

Chart 47

Integrated Warning Service System alerts issued by hazard group and hazard degree in the Czech Republic [number of calendar days of alert validity], 2020



Data source: Czech Hydrometeorological Institute

A total of 83 i**nformation reports on the occurrence of hazardous phenomena** were issued, the largest number being for flood phenomena with an extreme hazard degree (flood hazard) with a total of 60 information reports on the occurrence of hazardous phenomena over 17 days of occurrence of this phenomenon. There were also occurrences of very and extremely hazardous storms (15 warnings) and extreme precipitation (8 warnings).

1.5.2 | Impact of emergencies and crisis situations

Key question

What are the negative impacts of emergencies and crisis situations, and how can we prevent them?

Key messages

Preventive and educational activities on population protection and crisis management focus on the issue of emergencies and crisis situations. There is a high level of public interest in safety issues among all target groups. Despite the significant reduction in preventive education activities in 2020 due to the spread of COVID-19, we can assume a future trend of further increasing interest by the population.

In 2020, a total of 28,605 events requiring intervention by Integrated Rescue System units occurred in connection with natural disasters, while in the vast majority of cases these were technical accidents, the remainder being events such as traffic accidents, fires and releases of hazardous chemicals. In the long term, the main cause of all events is high winds followed by floods, flash floods or rain.

In 2020, 70 thous. insurance events arising from natural disasters were registered by insurance companies, with total damage of CZK 2.8 bil., while since 2006, insurance companies have recorded a total of about 1.2 mil. insurance events caused by natural disasters with total damage of CZK 50.4 bil. Long-term drought has also come to the fore in recent years, with compensation of CZK 4.4 bil. being paid to farmers from national resources in the 2015–2020 period, and more than CZK 8.0 bil. in the case of forestry.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Events and interventions arising from natural disasters	N/A	↗	↗	~
Amount of damage caused by natural disasters	↘	~↗	~↗	~
Preventive and educational activities for population protection and crisis management	N/A	↗	→	~

Events and interventions arising from natural disasters

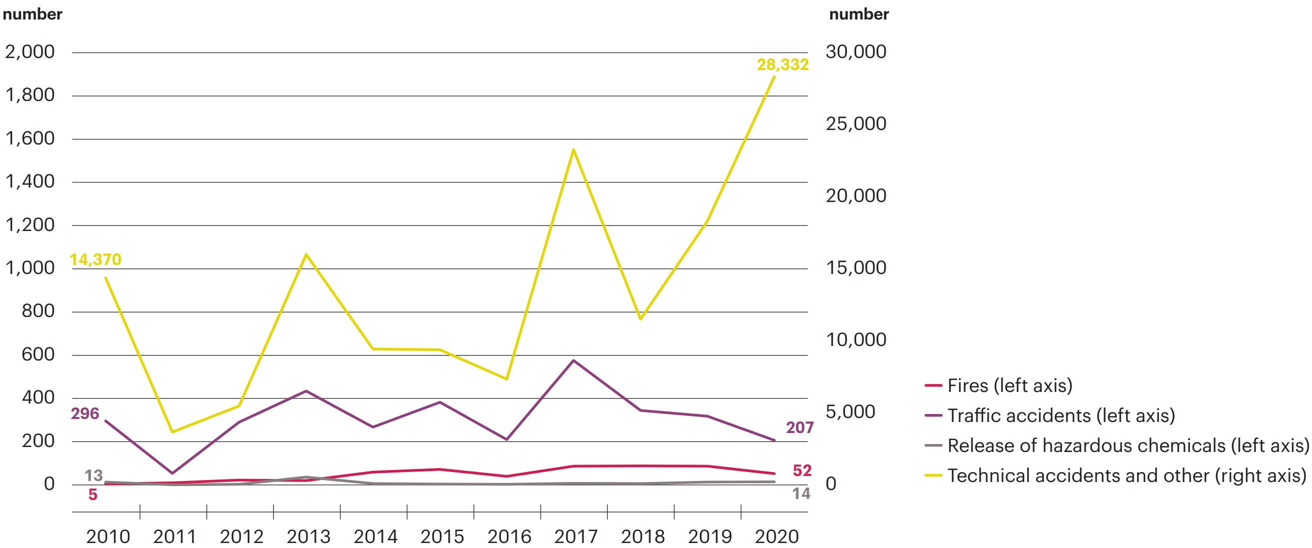
In connection with the increasing impacts of climate change, an increased incidence of extreme events requiring the activation of the Integrated Rescue System can be expected. The increased frequency of various types of natural disasters resulting from climate change is causing increasingly significant impacts on lives, health, property and the environment. The main coordinator of the Integrated Rescue System is the Fire Rescue Service of the Czech Republic which, in addition to fires, has to deal with other emergencies caused by climate change, such as prolonged droughts, hurricanes and wind storms, floods, above-average snowfall and massive icing, as well as emergencies caused by human activity, such as accidents associated with releases of hazardous substances.

In 2020, there were a total of 28,605 incidents related to natural disasters requiring 37,833 related interventions involving 34,206 fire protection units. In all cases, this is an increase of more than 50% compared to 2019. In 2020, the cooperation of the Czech Police was required in 3,875 interventions, and of the Emergency Medical Service in 163 interventions. In the vast majority of cases, these were technical accidents[47], of which there were 28,141, while the remainder were traffic accidents (207), other[48] events (191), fires (52), and releases of hazardous chemicals (14) resulting from natural disasters. 11 people died, 89 were injured and 742 were evacuated as a result of natural disasters in 2020. Damage caused by fires due to natural disasters amounted to CZK 15.4 mil. On the other hand, 498 people were rescued, and the value saved in the case of fires amounted to CZK 110.5 mil.

In terms of developments since 2010 (Chart 48), we can note an increase in the number of technical accidents and fires, mainly related to strong winds. High winds together with flooding, inundation or rain, have long been the dominant causes of all events (Chart 49).

Chart 48

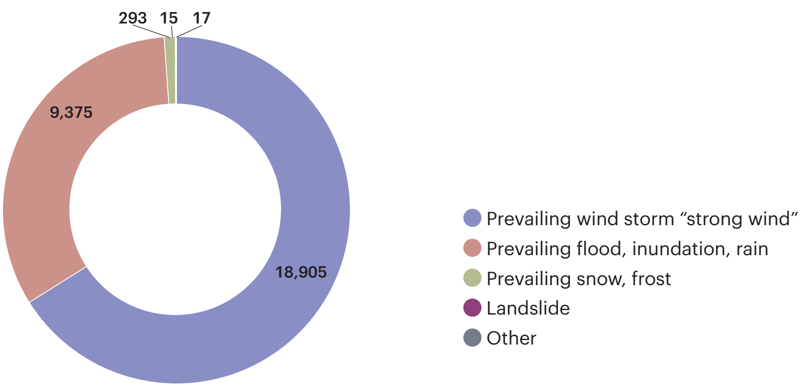
Number of incidents related to natural disasters in the Czech Republic, 2010–2020



Data source: Ministry of the Interior of the Czech Republic – General Directorate of the Fire Rescue Service of the Czech Republic

Chart 49

Representation of individual natural disasters in the total number of events in the Czech Republic [number], 2020



Data source: Ministry of the Interior of the Czech Republic – General Directorate of the Fire Rescue Service of the Czech Republic

[47] *A technical accident means intervention at an event leading to the removal of a hazard or hazardous condition (e.g. intervention in the event of the destruction of objects, disposal of fallen trees and electrical wires, ventilation of premises, rescue of people and animals, etc.).*

[48] *Other events are radiation accidents and incidents, false alarms, other emergencies (e.g. epidemics).*

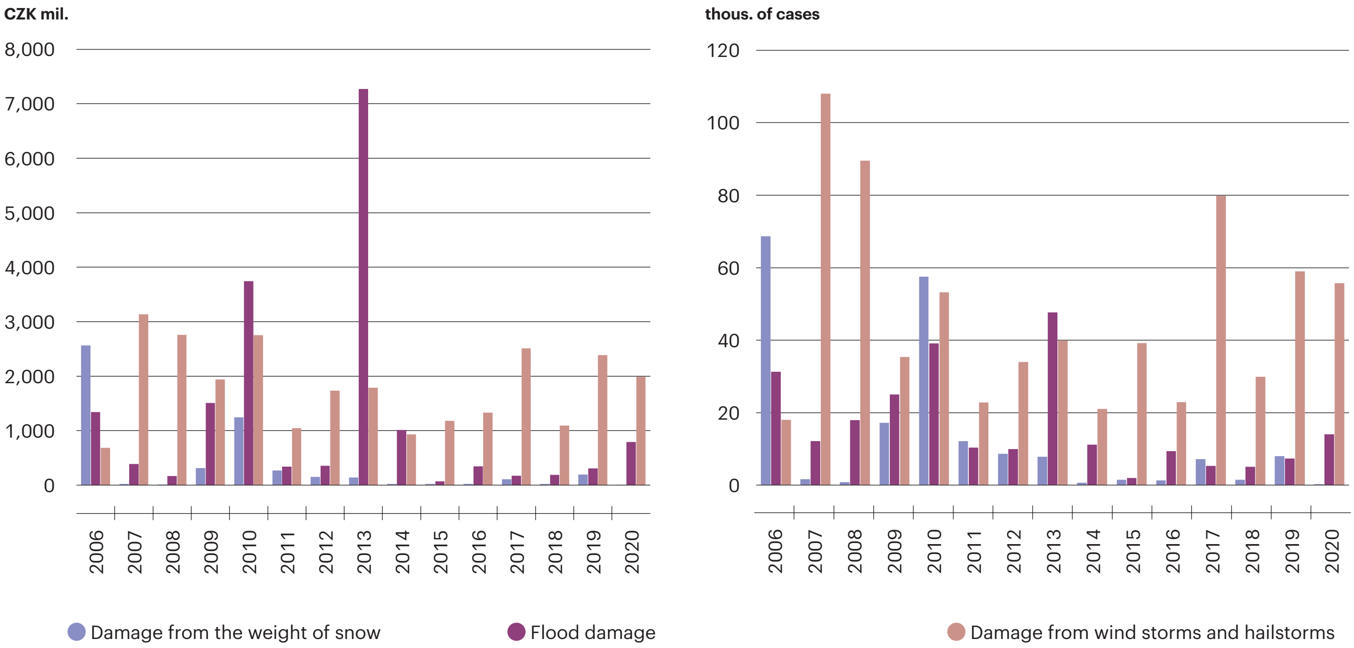
Given the growing importance of climate change risks, the 2014–2020 programming period has seen a significant increase in subsidy support from European funds, particularly through the Integrated Regional Operational Programme. Specifically, a total of CZK 4.9 bil. has been allocated to support the Fire Rescue Service, respectively the Integrated Rescue System through the Integrated Regional Operational Programme, intended, for example, for the modernisation of fire stations and their equipment and for the modernisation of existing education and training centres. In addition to upgrading existing stations, new stations were built, e.g. in places where quick and effective intervention is not possible. Other funds from the Integrated Regional Operational Programme were directed to increasing the resilience of professional and voluntary fire stations to drought, hurricanes and wind storms, snowfalls and massive frosts. Given the increasing intensity and frequency of risks, greater preparedness to address and manage these risks will be needed in the period ahead. This will consist of technical, personnel and especially financial strengthening not only of the Fire Rescue Service of the Czech Republic, but also of the entire Integrated Rescue System in the Czech Republic.

Amount of damage caused by natural disasters

A comprehensive view of the issue of monitoring and settlement of damages after natural disasters is shown by the statistics of the Czech Insurance Association which, in addition to the reported **damage caused by floods, also monitors damage caused by wind storms, hailstorms and the weight of snow** (Chart 50). Within these statistics there are fluctuations in both the volumes and numbers of cases of damage related to natural disasters, in particular storms, respectively the hurricanes Kyrill (2007), Emma (2008), Herwart (2017), Eberhard (2019), Sabine and Julie (2020), floods (2010 and 2013), hail (2010) and heavy snow and ice (2006 and 2010). Since 2006, insurers have recorded approximately 1.2 mil. insurance events caused by the above-mentioned natural events with total damage of CZK 50.4 bil., of which 70 thous. events with damage of CZK 2.8 bil. in 2020. Wind storms and hailstorms account for the largest share of both the number of claims and total damage.

Chart 50

Insurance events in natural disaster insurance in the Czech Republic [CZK mil., thous. of cases], 2006–2020



Data source: Czech Insurance Association

However, another manifestation of climate change, **long-term drought**, has not yet been recorded in the statistics of insurance companies. This is becoming a problem that in recent years has represented the most serious manifestation of climate change, with the greatest potential impacts not only on biodiversity but also on the population and the economy – for example, damage to agricultural production in the extremely dry year of 2018 was estimated at around CZK 12 bil., of which the majority was to fodder crops (CZK 5–6 bil.) followed by cereals (CZK 2–3 bil.). In the case of forestry, drought damage amounted to more than CZK 12 bil. In this context, in the 2015–2020 period, compensation of CZK 4.4 bil. was paid to farmers from national resources, while in the case of forestry, contributions were provided to mitigate the impact of the forest bark beetle calamity totalling more than CZK 8.0 bil.

Recurring natural disasters caused by natural hazards require a comprehensive approach to dealing with the damage and restoration of property after these disasters. This is why the Ministry of the Interior of the Czech Republic, in cooperation with other ministries, has developed the **strategy for the restoration of the territory** in relation to declared crisis states (i.e. states of danger or emergency). These form a document creating the framework conditions for the provision of state aid primarily through programme financing under the competence of designated ministries in accordance with applicable budgetary rules. The strategy is based on individual summaries of preliminary cost estimates for the restoration of assets serving basic functions in the territory, prepared by the affected regions where a state of emergency was declared. The reports are prepared in accordance with Act No. 12/2002 Coll., on state aid for territorial restoration and submitted to the Ministry of Finance of the Czech Republic. State aid may be granted only for the restoration of assets serving to ensure the basic functions in the territory, to regions, municipalities, and other legal persons, with the exception of legal persons managing state assets, and to individuals if they can prove they are unable to restore the relevant assets with their own resources.

In the 2005–2020 period, recovery strategies were developed mainly in the context of devastating floods, wind storms or hurricanes. Floods or inundations requiring the preparation of a recovery strategy occurred in 2006, 2009, 2010, 2013 and 2014 (no exceptional floods or inundations occurred in the 2014–2020 period). The flooding or the critical rise in water levels in large parts of the territory was not only caused by sustained rainfall but also intense storms accompanied by torrential rainfall. The total amount of damage (represented by total restoration costs) caused by the above-mentioned extraordinary natural disasters amounted to approximately CZK 44 bil. in the 2005–2020 period. The most frequently affected regions were the Ústí nad Labem, South Bohemian, Olomouc and South Moravian Regions, while the greatest damage was caused in the Liberec Region (CZK 8.8 bil.), followed by the Ústí nad Labem Region (CZK 6.9 bil.), the Moravian-Silesian Region (CZK 5.7 bil.) and the Central Bohemian Region (CZK 5.3 bil.).

In the case of wind storms or hurricanes, the recovery strategy was developed in the context of hurricane Kyrill in 2007, when the total cost of asset restoration reached almost CZK 7.5 bil.

In the majority of cases, insurance settlements have been used to restore assets, but these do not cover the total cost of restoration. Its financing was therefore also based on the strategy for the restoration of the territory through various designated programmes administered by individual ministries. These include, for example, the programmes of the Ministry of the Environment of the Czech Republic "Elimination of Damage after Natural Disasters" and "State Support for the Restoration of Flood-Affected Areas", of the Ministry of Agriculture of the Czech Republic "Support for the Removal of Flood Damage to Water Supply and Sewerage Infrastructure" and "Removal of the Consequences of Floods on State Water Management Assets", of the Ministry of Regional Development of the Czech Republic "Restoration of Municipal and Regional Assets Affected by Natural or Other Disasters" and "Support for Housing", and relevant operational programmes under EU funds. It is also necessary to mention the use of the financial reserve of the state budget for dealing with crisis situations, respectively for the removal of the consequences of crisis situations, or for their prevention, which amounts to CZK 140 mil.

Preventive and educational activities for population protection and crisis management

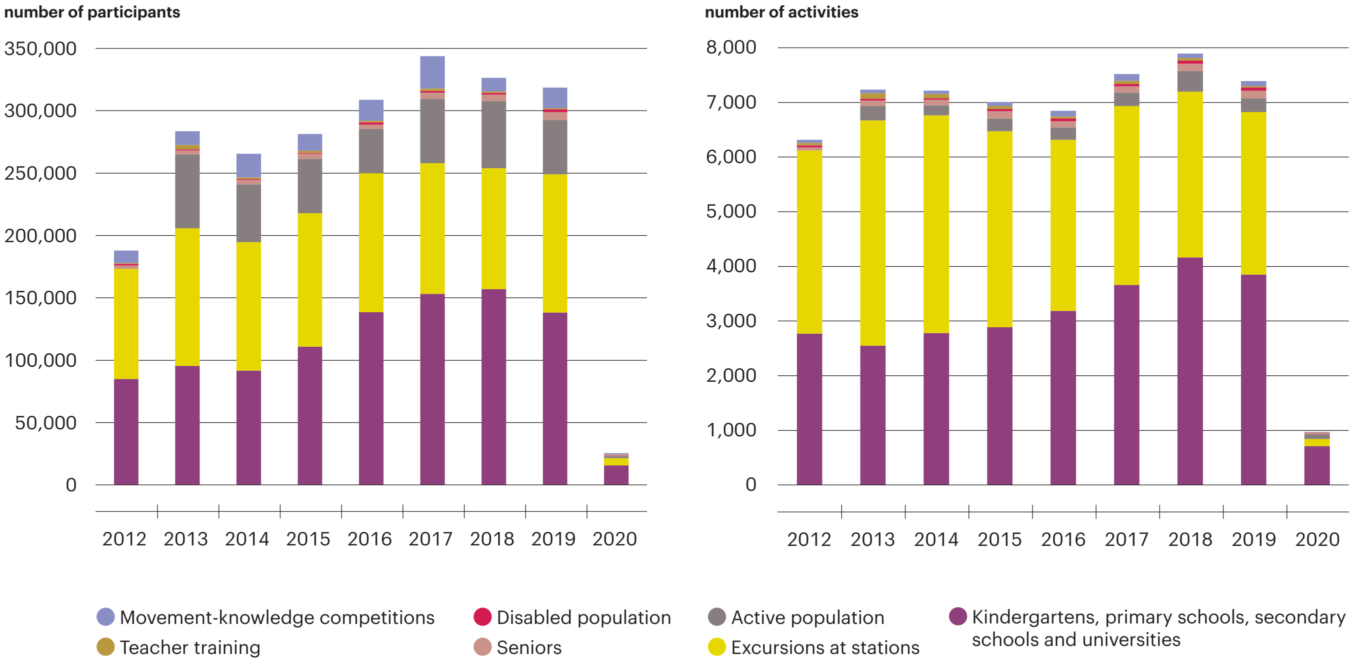
Preventive and educational activities related to public protection and crisis management include the issue of the protection of people in relation to common risks and emergencies. The guarantor of population protection, fire prevention and the Integrated Rescue System is the Fire Rescue Service of the Czech Republic which, in the field of population education through preventive and educational activities, works with children in kindergartens, pupils and students in primary and secondary schools, at universities, the adult population, the elderly, and disabled citizens.

The field of preventive and educational activities is based primarily on **personal contact** between members of the Fire Rescue Service of the Czech Republic and the public. To this end, it has long used various forms and methods: project days, lectures, discussions, the creation of teaching materials, and the training of current and future teachers. It organizes various movement and knowledge competitions, open days, excursions to fire stations, and discussions for citizens. As part of **indirect support** of public awareness, it creates educational materials – brochures, leaflets, and expert articles for the national and regional media and social networks.

The following chart (Chart 51) shows that 2020 was a very exceptional year in terms of measures related to the spread of **COVID-19** and therefore cannot be assessed in comparison with the previous period. It was possible to organise most of the activities at the beginning of the year and in the summer months of 2020 as normal, and subsequently during the declared state of emergency while observing all protective measures.

Chart 51

Preventive and educational activities in the field of the protection of people from common risks and emergencies in the Czech Republic, 2012–2020 [number of participants, number of activities]



Data source: Ministry of the Interior of the Czech Republic – General Directorate of the Fire Rescue Service of the Czech Republic

Nevertheless, it can be stated that, for example, the Hasík CZ preventive education programme continued to run in **schools**, involving 10 regional Fire Rescue Services and representing an extension beyond the normal preventive education activities in schools. The equipment at fire stations was also improved for the purposes of lectures and excursions (multimedia classrooms, educational areas). Movement-knowledge, art and literary competitions also continued in 2020. The Ministry of Education, Youth and Sports accreditation of the Preparation of Schools and Educational Facilities for Emergencies course, intended mainly for school principals and management, was extended.

Education for **people of working age** successfully continued, especially through discussions, workshops and courses. Members of the volunteer fire brigades of municipalities made up a separate group on which the individual regional Fire Rescue Services annually focus, preparing for them, for example, the Population Protection Techniques and Volunteer Fire Brigade Prevention Officers courses.

Particular attention continued to be paid to **the elderly and disabled**, the most vulnerable group in the context of common risks and emergencies. The preparation of elderly people takes place mainly in the form of lectures and discussions through senior academies, universities of the third age, in cooperation with civic associations for seniors, clubs and homes for the elderly, and municipal/city authorities.

In the crisis year of 2020, the **regional media** (municipal/city newsletters, regional radio and TV, municipal websites, bulletin boards, etc.) and **social networks** such as Facebook, Instagram, Twitter and YouTube were particularly effective tools for disseminating information to citizens. In 2020, a total of 340 educational contributions were made by the media through radio, 201 through television and 728 through print media. However, the actual impact of such information cannot be accurately quantified.

There is a high level of public interest in safety issues among all target groups. Despite the significant reduction in preventive education activities in 2020 due to the spread of COVID-19, we can assume a future trend of further increasing interest by the population. However, to further ensure the quality of the activities of the Fire Rescue Service of the Czech Republic in this field, it will be necessary to consider whether preventive and educational activities should be strengthened by increasing financial resources, switching some people from part-time to full-time positions, or even increasing the number of positions.

1.5.3 | Origin of emergencies

Key question

Is it possible to minimize the occurrence of emergencies and crisis situations of anthropogenic origin?

Key messages

There were eight major industrial accidents in the Czech Republic in 2020, involving releases of hazardous substances in chemical plants, a fire and an explosion.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Number of major accidents reported	↗	↗	↗	✕

Number of major accidents reported

Major industrial accidents involving hazardous chemicals can have very serious consequences, so we need to ensure that appropriate safety measures are in place that provide a high level of protection for citizens, communities and the environment. The Act on the Prevention of Major Accidents[49] implements the relevant European Union regulation (Directive 2012/18/EU of the European Parliament and of the Council, the so-called Seveso III) and establishes a prevention system.

The major accident prevention system requires the operators of facilities containing selected hazardous chemicals or mixtures to put in place all measures to prevent a major accident from occurring, as well as to establish procedures to deal with one in the event that an accident occurs despite the precautions taken. Operators handling hazardous substances must classify the facilities handling these substances into Category A (lower risk) or Category B (higher risk) based on the type and quantity of the hazardous substance. Substances falling under this regime are toxic, explosive, flammable, pyrophoric, hazardous for the environment, or otherwise hazardous.

In the Czech Republic, a total of 212 facilities are **included** in the **major accident prevention system**, of which 96 facilities are in Category A and 116 in Category B. These are mostly chemical plants or production plants where hazardous substances are handled, but also, for example, fuel or chemical warehouses.

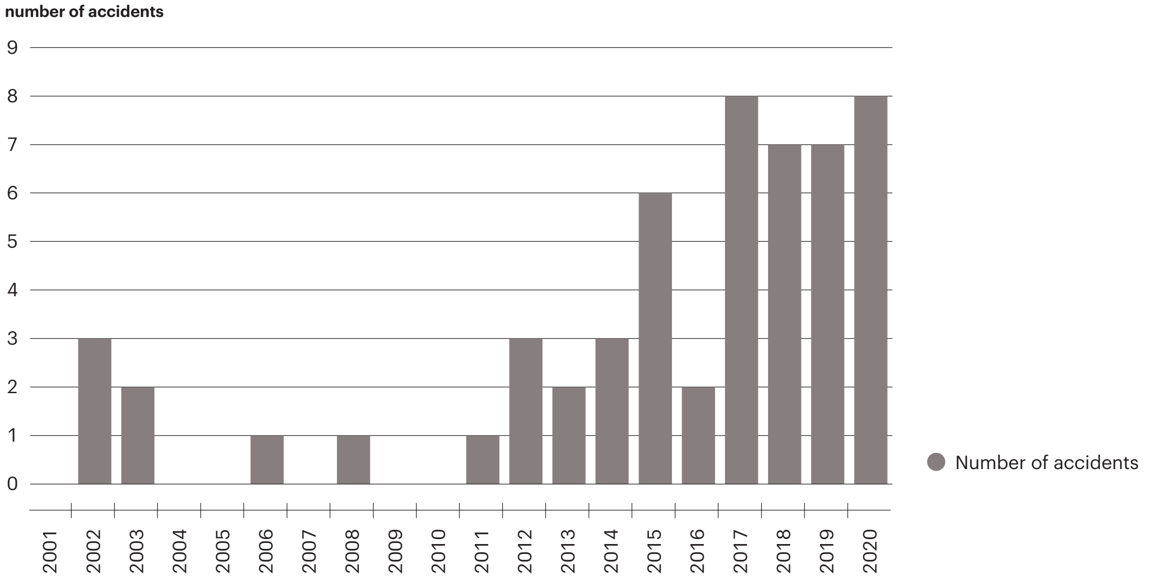
During 2020, eight major accidents occurred in the Czech Republic, three of which were in the Central Bohemian Region (at three different facilities), two in the Zlín Region and one accident each in the South Bohemian, Pardubice and Plzeň Regions. These were releases of hazardous substances at chemical plants, two explosions and a fire.

The number of major accidents has been increasing since 2001, with the highest number of accidents in recent years (since 2017) since monitoring began (Chart 52).

[49] *Act No. 224/2015 Coll., of 12 August 2015, on the prevention of major accidents caused by selected hazardous chemical substances or chemical mixtures and on the amendment of Act No. 634/2004 Coll., on administrative fees, as amended (Act on the Prevention of Major Accidents)*

Chart 52

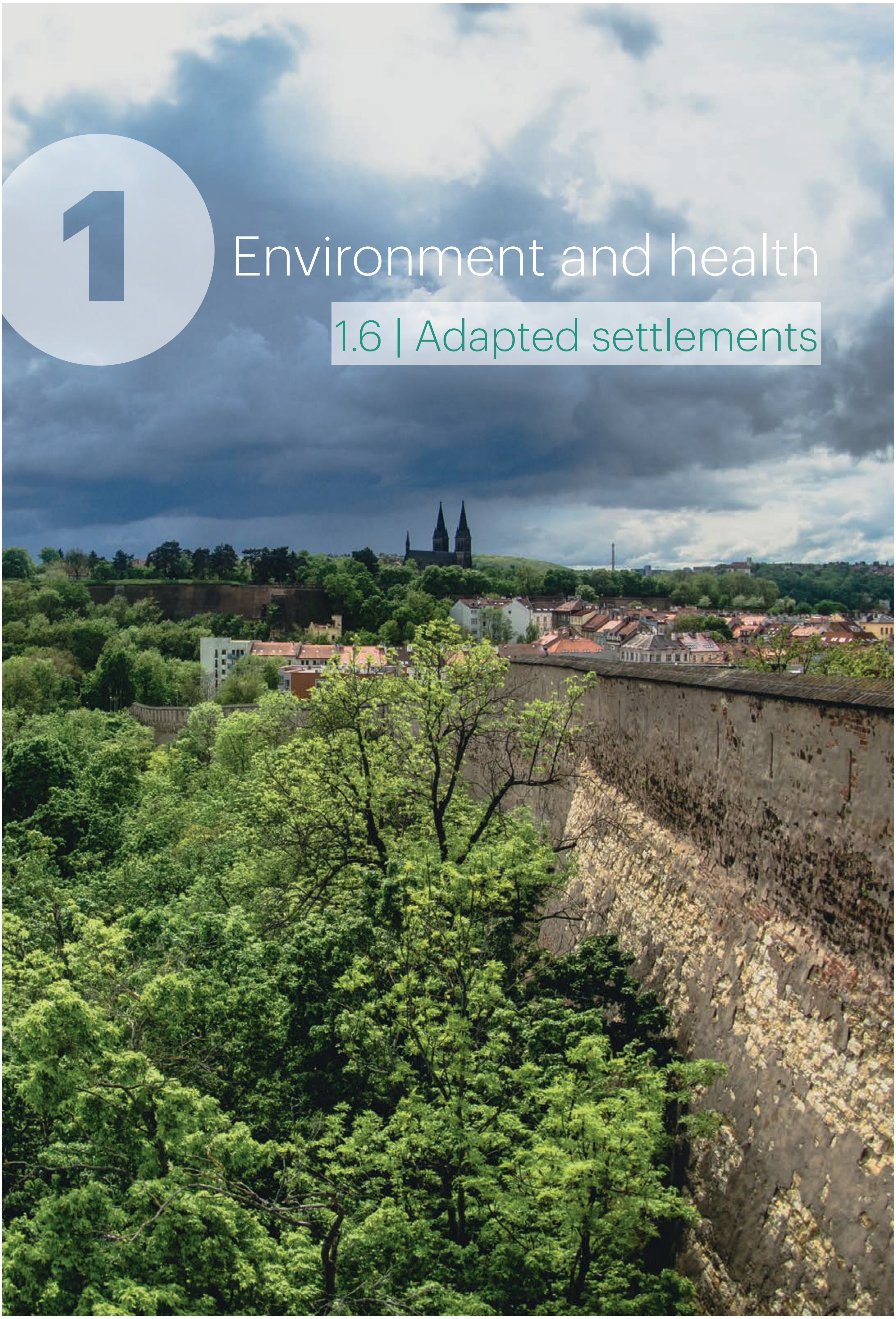
Number of major accidents reported in the Czech Republic, 2001–2020



Data source: Regional authorities, Ministry of the Environment of the Czech Republic

1 Environment and health

1.6 | Adapted settlements



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1.6 | Adapted settlements

Urban settlements are a unique type of environment characterized by paved impermeable surfaces with lower infiltration space, higher population density, services and transport, and the related environmental burdens, in particular emissions of pollutants into the air and noise. Climate change has a major impact on settlements, causing more frequent weather fluctuations and a higher incidence of extreme hydrometeorological events. Extremely high temperatures (heat waves) represent the most serious potential burden on the human body of all climate change signs in the Czech Republic. Therefore, an increased share of green and blue areas in cities has a positive effect on these manifestations and air quality. In view of the long-term development of urbanisation and the frequent occurrences of drought, it is important to promote not only green infrastructure, but also rainwater management, and to limit greenfield development in adaptation plans. In connection with the updating of spatial and strategic plans, incentives should be used for the reuse of abandoned and unused industrial, agricultural, residential or military buildings – brownfields. Brownfields are often located in the centres of towns and municipalities and represent a major problem for the sustainable development of settlements. Sustainable development issues, including sustainable mobility at local level, are addressed by various initiatives such as Local Agenda 21.

Overview of selected related strategic and legislative documents

State Environmental Policy of the Czech Republic 2012–2020
- improving rainwater management in settlements
- improving the functional state of greenery in settlements, i.e. creating conditions for the preservation and designation of new areas and elements of greenery as part of a functional and structured system of settlement greenery within the framework of spatial planning
- increasing the biological value of the settlement greenery by promoting the use of habitat-appropriate plant species, revitalizing existing areas, and implementing functional connections between existing green areas
- promoting close-to-nature practices and methods in the revitalisation and establishment of green areas
- supporting building-architectural solutions for buildings that appropriately reduce the demands placed on the built-up area

Strategy on Adaptation to Climate Change in the Czech Republic
- adaptation measures to ensure a functional and ecologically stable system of settlement greenery, i.e. increasing the share and functional quality of available green areas and water areas
- revitalizing existing and implementing new functional connections between existing green areas
- ensuring the adequate management of the residential greenery system, including effective maintenance
- ensuring sustainable water management (infiltration or reuse of rainwater, water saving measures)
- elaborating and approving rainwater management concepts in urbanized areas
- reducing the amount of rainwater discharged through the unified sewerage system by planning the drainage of urbanized areas with an emphasis on seepage and the retention of rainwater in the urban catchment area
- mitigating the effects of flooding in urbanised areas (or ensuring a reduction in the number of people residing in the floodplain)
- developing heat island prevention plans for large agglomerations, determining the urban planning requirements for protection against urban heat islands
- supporting the overall improvement of the readiness of urbanized areas for the manifestations of climate change by transitioning to passive and close-to-passive standards for new buildings, and thorough the renovation of existing buildings, supporting the technical adaptation of buildings through legislative standards and norms

Spatial Development Policy of the Czech Republic
- creating conditions for the multifunctional use of abandoned premises and areas (brownfields of industrial, agricultural, military and other origin)
- creating conditions for increasing the natural retention of rainwater in the territory with regard to the settlement

structure and cultural landscape as an alternative to artificial water storage
- in built-up areas and developable areas, creating conditions for the retention, storage and use of rainwater as a source of water and with the aim of mitigating the effects of floods
- using the built-up area economically and ensuring the protection of the undeveloped area and the preservation of public greenery, including minimising its fragmentation
- in cooperation with the municipalities concerned, designating the land necessary for the creation of continuous areas of publicly accessible greenery (green belts) and their protection from development (building)

National Brownfield Regeneration Strategy 2019–2024
- creating a coordinated approach for brownfield regeneration through state policies, financial programmes and appropriate conditions that will enable brownfields to find new economic or publicly beneficial uses (the reuse of brownfields will contribute towards the economic use of built-up areas and the development of towns and municipalities)

Strategic Framework for Economic Restructuring of the Ústí nad Labem, Moravian-Silesian and Karlovy Vary Regions
- developing the territory through the revitalisation of brownfields for investment and business use
- regenerating public spaces, buildings and brownfields that hinder the development of the territory in settlements

Regional Development Strategy of the Czech Republic 2014–2020
- sufficient and comprehensive consideration of public interests of local and regional scope in spatial planning, such as flood protection and adaptation to climate change (including rainwater management in urbanised areas and the restoration of natural landscape structures)

Strategic Framework Czech Republic 2030
- the strategic objective of increasing the share of public green spaces in urban agglomerations
- ensuring quality urban development of settlements and the targeted use of tools for the sustainable development of municipalities by the territorial public administration (especially through municipal development planning measures with public participation, support for methodological approaches to sustainable development at local level by the state administration, and especially through the involvement of more municipalities in Local Agenda 21)

2030 Agenda for Sustainable Development
- Sustainable Development Goal (SDG) No. 11 – make cities and human settlements inclusive, safe, resilient and sustainable

1.6.1 | Adaptation of settlements to climate change

Key question

How many municipalities have adaptation plans in place and how many inhabitants are affected?

Key messages

In 2020, 18 towns or municipal districts in the Czech Republic had adaptation strategies or plans (or non-binding "roadmaps" for adaptation), with a total of over 2.6 mil. inhabitants, and another 30 towns or municipalities were preparing these documents. Although a growing number of domestic cities and municipalities are becoming aware of the crucial importance of adaptation to climate change for their future development, the preparation of adaptation strategies and the implementation of relevant adaptation measures at local or regional level are progressing slowly.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Number of municipalities with adaptation plans	N/A	N/A	↗	~

Number of municipalities with adaptation plans

The impacts of climate change in settlements and urban areas are a complex cross-sectoral environmental issue that has been at the forefront of strategic documents at national and local level in recent years. However, the process of **introducing concrete adaptation measures into planning practices** has been slow. While at national level climate change is seen as a priority environmental problem for Czechia in various strategic and conceptual documents, this trend is not yet fully evident at lower administrative levels (regions, cities, municipalities)[50]. On the other hand, it is a fact that an increasing number of domestic cities and municipalities are beginning to realise that the ability to adapt to climate change through appropriate adaptation measures will be a determining factor in improving the quality of life of their inhabitants.

Adaptation strategies must be adopted not only at EU, international and national level, but also and especially at local level to prepare for the adverse impacts of climate change and to prevent or minimise any damage. These strategies often have an urban dimension, as local public administrations are best placed to respond to and adapt to climate change. Impacts of climate change in a particular town or city may manifest themselves in the near future with serious economic, environmental and social consequences. Measures taken now will be much more effective and cheaper than future solutions to problems such as flash floods, overheating of buildings and public transport, or lack of water resources.

[50] *AUBRECHTOVÁ Tereza, GELETIČ Jan, HALÁSOVÁ Olga, LEHNERT Michal, DOBROVOLNÝ Petr. Administrative Response of Czech Towns and Cities to Adaptation Processes Related to Climate Change. Urban Planning and Territorial Development. Brno: Institute of Spatial Development, issue 1/2019. ISSN 1212-0855.*

The **first adaptation strategies of towns and cities** started to emerge after 2015 (Prague, Brno, Plzeň), and their example was followed by other towns and cities, which financed adaptation strategies mainly with the support of the EEA and Norway Grants (e.g. within the UrbanAdapt project), and also through the National Programme Environment which aimed, among other things, to support the involvement of municipalities in the Covenant of Mayors ("Covenant"). The Covenant is a joint initiative of towns and cities, municipalities and the European Commission, and is the main source of EU support for towns and cities in their climate change adaptation activities. By joining the Covenant[51] a municipality is obliged to prepare a Sustainable Energy and Climate Action Plan ("SECAP") within two years. Although the SECAP is not a standard adaptation strategy, given its scope it can be considered a document addressing the adaptation of settlements to climate change.

In 2020, 18 towns or municipal districts (Table 9) in the Czech Republic had **adaptation strategies or plans** (or non-binding "roadmaps" for adaptation), with a total of over 2.6 mil. inhabitants, and another 30 towns or municipalities were preparing these documents. Transport, greenery and energy are the central themes of the adaptation strategies or plans of the towns, cities and municipalities. The introduction of sustainable mobility plans contributes to the adaptation of transport systems, while for green spaces the focus is usually on urban greenery and its aesthetic/recreational functions, but without a comprehensive solution to its functionality in terms of adaptation to climate change. A newly addressed issue is rainwater management, which most towns and cities are beginning to address through the creation and integration of relevant master plans.

Table 9

Municipalities of the Czech Republic with approved adaptation strategies or plans, and number of affected inhabitants, 2020

Municipality	Document name	Year of approval	Number of inhabitants of the municipality
Prague	Prague Capital City Climate Change Adaptation Strategy	2017	1,335,084
Brno	Sustainable Energy and Climate Action Plan	2019	382,405
Ostrava	Adaptation Strategy of the Statutory City of Ostrava to the Impacts and Risks of Climate Change	2017	284,982
Plzeň	Adaptation Strategy of the City of Plzeň using Ecosystem-based Approaches	2017	175,219
Liberec	Sustainable Energy and Climate Action Plan (2030) – Statutory City of Liberec	2018	104,261
Hradec Králové	Roadmap for Adaptation to Climate Change Impacts for the City of Hradec Králové	2016	92,683
Prague 12 district	Strategic Development Plan of the Prague 12 District for the 2020 to 2026 Period	2020	60,908
Opava	Adaptation Strategy of the Statutory City of Opava to Climate Change	2018	55,996
Písek	Sustainable Energy and Adaptation Action Plan	2019	30,379
Litoměřice	Litoměřice Sustainable Energy and Climate Adaptation Action Plan (SECAP) to 2030	2018	23,623
Chrudim	Adaptation Strategy of the City of Chrudim to Climate Change	2017	23,140
Kopřivnice	Climate Change Adaptation Strategy for the Town of Kopřivnice	2017	21,657
Žďár nad Sázavou	Roadmap for Adaptation to the Impacts of Climate Change for the Town of Žďár nad Sázavou	2016	20,485
Rakovník	Baselines and Climate Change Adaptation Options for Rakovník – Situation Report	2015	15,652
Hlučín	Climate Change Adaptation Strategy for the Town of Hlučín	2017	13,805
Nový Bor	Climate Change Adaptation Strategy for Nový Bor	2016	11,582
Hrádek nad Nisou	Climate Change Adaptation Strategy for Hrádek nad Nisou	2015	7,744
Dobruška	Roadmap for Adaptation to Climate Change Impacts for the Town of Dobruška	2016	6,651

Data source: Ministry of the Environment of the Czech Republic

[51] *By 2020, only 23 towns, cities and municipalities in the Czech Republic had joined the Covenant.*

It should be noted that the preparation and implementation of an adaptation strategy at local level is a very challenging process, with many obstacles to be taken into account. In the context of urban adaptation to climate change, in the preparatory phase towns and cities encounter mainly obstacles related to the lack of competence of the authorities (e.g. lack of political leadership and coordination, lack of comprehensive knowledge of the issue, different attitudes of individual departments) or lack of interest in topics related to adaptation policy. In the planning phase, towns and cities are mainly confronted with issues relating to property rights and coordination between districts, authorities and institutions (monument conservation, watercourse administrators, etc.). In the implementation phase, the main obstacle is finance or the readiness of legislation, which may significantly limit or even prevent the implementation of some adaptation measures.

The successful implementation of the adaptation strategy or adaptation measures requires its integration into the strategic and investment plans of the towns and cities, and should subsequently become the basis for the creation of new land use plans. In many cases, however, this is occasional activity with minimal impact on spatial planning. Towns, cities and municipalities should assess the need for specific adaptation measures by analysing the territory, as it is not advisable to implement adaptation measures randomly in a territory without a link to a vulnerability analysis of the territory that will indicate the need for specific measures in the given territory. Measures in strategic documents must be clearly defined and localised, while care must be taken to ensure the quality and specificity of the content and to avoid vague and generalised objectives and measures. Targeted monitoring and assessment of the effectiveness of adaptation measures is also essential.

1.6.2 | Conceptual development of settlements and use of brownfields

Key question

How is the development of settlements proceeding? Are brownfields being regenerated and subsequently used?

Key messages

Brownfields in Czechia are being regenerated (174 brownfields with a total area of 257.7 ha in 2020), mainly through subsidy programmes.

The implementation of Local Agenda 21 is also helping the sustainable development of settlements. In the higher categories of Local Agenda 21 implementation, the stable representation and even a slight growth in the case of the best Local Agenda 21 implementers can be seen as positive. Successful defence by the involved Local Agenda 21 implementers also continued in the 2020 COVID year. A comprehensive assessment of the development of towns and municipalities in terms of sustainable development principles has been introduced and the process of assessment of Local Agenda 21 implementation adapted to the specific conditions of individual groups of implementers. Financial support from the Ministry of the Environment of the Czech Republic, some regions and the Ministry of Labour and Social Affairs of the Czech Republic is ongoing.

A total of 26 towns, cities and urban agglomerations had Sustainable Urban Mobility Plans prepared and approved by 2020, of which 15 had been verified as fully-fledged Sustainable Urban Mobility Plans and 11 as simplified versions, i.e. Strategic Framework for Sustainable Urban Mobility. All 10 largest cities in the Czech Republic by population have an approved Sustainable Transport Plan or at least a Sustainable Transport Strategic Framework.

In total, 1,241 brownfields with a total area of 3,285.0 ha were newly registered in the Czech Republic in the 2014–2020 period.

The lower Local Agenda 21 implementation categories (especially the “Interested” category) show strong fluctuations or declines, mainly due to changes in political leadership or the need to fulfil more demanding criteria and tasks in the transition to higher levels of Local Agenda 21 implementation. The indicative target of the State Environmental Policy of the Czech Republic 2030 will thus most likely not be met.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Brownfields	N/A	N/A	N/A	~
Local Agenda 21	↗	↗	↘	~
Sustainable Urban Mobility Plans	N/A	N/A	↗	✓

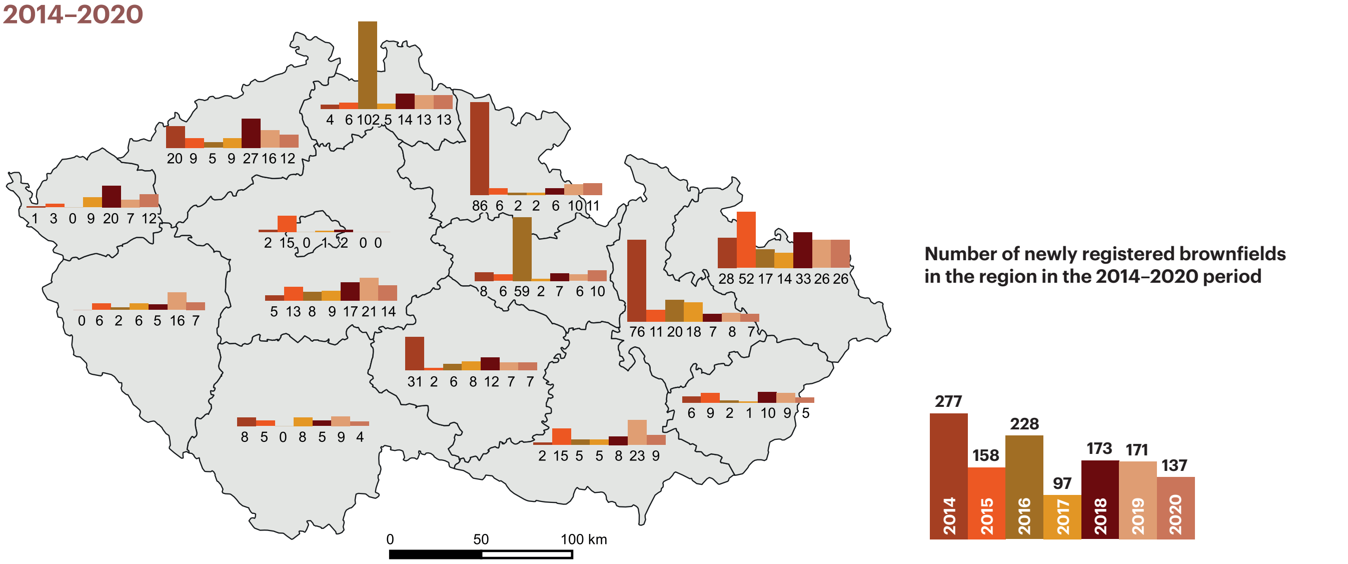
Brownfields

The issue of brownfields has long been addressed by CzechInvest, the agency for the promotion of entrepreneurship and investment, which manages the publicly accessible **National Database of Brownfields**. In total, 1,241 brownfields with a total area of 3,285.0 ha were **newly registered** in this database in the 2014–2020 period. The largest number of new brownfields entered into the database in the 2014–2020 period occurred in 2014, when 277 sites were entered (Figure 20) with a total area of 1,326.4 ha. In 2020, a total of 137 brownfields with a total area of 196.3 ha were newly registered in the Czech Republic.

The largest area of newly registered brownfields was recorded in the Central Bohemian Region (651.4 ha) in 2014, and once again in the Central Bohemian Region in 2020 (71.0 ha) with 14 objects, followed by the Moravian-Silesian Region (35.7 ha) with 26 objects.

Figure 20

New brownfields entered into the National Database of Brownfields by regions of the Czech Republic [number], 2014–2020

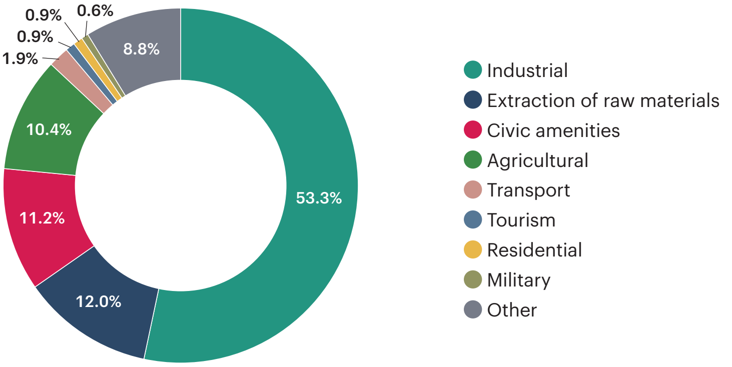


Data source: CzechInvest

In 2020, the predominant new brownfields were **those previously used for** industrial purposes (53.3% of the area of the new brownfields) and those previously used for the extraction of raw materials (12.0%), Chart 53.

Chart 53

Newly entered brownfields in the Czech Republic by previous use [% of total area], 2020



Data source: CzechInvest

Brownfields are being **regenerated**[52] mainly **through grant programmes**. The Ministry of Industry and Trade of the Czech Republic programme entitled Regeneration and Commercial Use of Brownfields, intended for towns and municipalities, supported 7 brownfields with a total area of 7.7 ha in 2020. 65 brownfields with a total area of 74.5 ha were supported under the Ministry of Regional Development of the Czech Republic programme entitled Regeneration of Brownfields for Non-commercial Use, intended for towns and municipalities. 56 brownfields with a total area of 34.9 ha were supported under the Operational Programme Enterprise and Innovation for Competitiveness programme called Real Estate, intended for small and medium-sized enterprises. A further 46 brownfields with a total area of 140.7 ha were deactivated from the database without subsidy assistance because they were offered to investors or the market "took care of them itself". The regeneration of brownfields is also assisted by the Ministry of Regional Development of the Czech Republic sub-programme entitled Demolition of Buildings in Socially Excluded Localities. It is necessary to continue to support the regeneration of brownfields so they can potentially be used in the future.

[52] *The real number of regenerated brownfields is higher. The CzechInvest agency only monitors the sites listed here because registering the site in the National Database of Brownfields is a condition, and it is not always possible to map all regeneration/reconstruction projects in the hands of private owners. Even so, this is the most comprehensive data in the whole of the Czech Republic.*

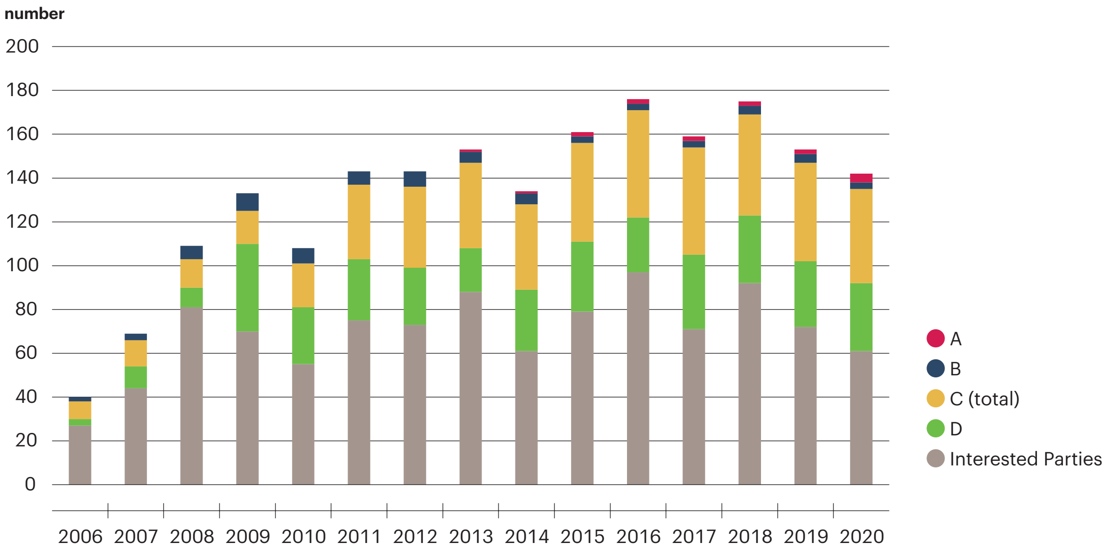
Local Agenda 21

Local Agenda 21 is a **voluntary tool**. It is a state-guaranteed programme to support the sustainable development of municipalities and regions. This tool is based on close cooperation by the relevant authorities not only with commercial entities and associations operating in the locality, but above all with the public, i.e. the people living in the given settlement or region. The **programme is managed by the Ministry of the Environment of the Czech Republic**. The practical setting and evaluation of the progress of the Local Agenda 21 implementers is discussed and approved by the Local Agenda 21 Working Group of the Government Council for Sustainable Development, which is also an advisory body to the minister. Local Agenda 21 implementers, i.e. interested municipalities and regions, demonstrate their progress towards sustainable development through a set of criteria (at lower levels) and self-assessments in 10 areas (at higher levels). A bonus for municipalities is an expert assessment within the framework of defences and recommendations for further action. All methodological and expert support for all Local Agenda 21 implementers is provided financially by the Ministry of the Environment of the Czech Republic from the state budget, and technically and administratively by CENIA. In the course of Local Agenda 21 implementation, each implementer starts at the level of "Interested Party" and progresses through levels D, C, B up to the highest level A. How fast and how far each implementer progresses is up to them[53]. Since the beginning of its monitoring in Czechia (i.e. since 2006), the voluntary Local Agenda 21 tool has been associated with a number of successes at different levels and areas of our society. Nevertheless, like any tool or concept, it still has reserves and challenges to which efforts are continuously made to respond.

In the long term, i.e. over the last 15 years, we can see a very significant upward trend in the number of implementers (including the Interested Party category) from 40 in 2006 to 142 in 2020 (Chart 54), partly thanks to the favourable development, especially at the beginning of the period under review. On the other hand, **in the short term**, i.e. in the last 5 years, the number of Local Agenda 21 implementers has shown a downward trend. If the current trends continue, the targets for the number of implementers set in the State Environmental Policy of the Czech Republic 2030 (500 registered entities) will not be met. This is mainly due to movement in the Interested Party category, where strong fluctuations can be observed during the decline over the period under review. There may be various reasons for this development, the main ones being changes of political leadership in the municipalities or towns concerned, the need to meet fulfil demanding criteria and tasks in the transition to the next phases of Local Agenda 21 implementation, the simple loss of interest, insufficient funding, and unforeseen exceptional situations such as the COVID-19 pandemic. The low level of promotion of the programme towards potential implementers also plays a significant role.

Chart 54

Overview of Local Agenda 21 implementers in the Czech Republic by level of achievement [number], 2006–2020



In the case of level C, several sub-levels can be distinguished from 2017 onwards, i.e. C, C, C** and C***.*

Data source: CENIA

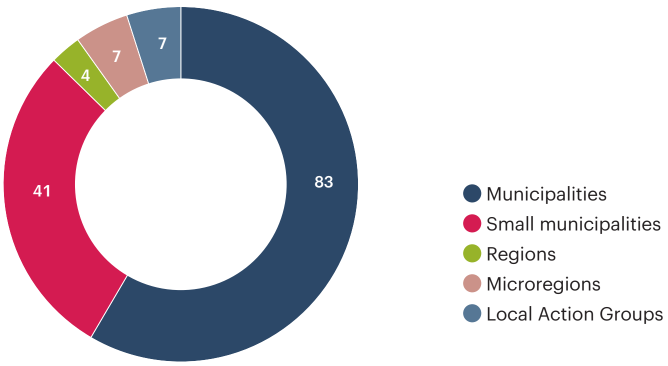
[53] *More information about Local Agenda 21 is available at https://ma21.cenia.cz/.*

On the other hand, in the higher categories of Local Agenda 21 implementation, the stable representation and even a slight growth in the case of the best Local Agenda 21 implementers can be seen as positive. For example, in 2020, the small municipality of Křižánky achieved category A (according to the new Local Agenda 21 methodology for small municipalities) for the first time, despite the COVID-19 pandemic, which can be considered a great success. In the towns/cities category, the regional city of Jihlava achieved the highest category A for the first time. All defences in 2020 were held online for the first time, including expert evaluation of the assessed Local Agenda 21 implementers. An important factor influencing this positive trend is the targeted methodological support of implementers and experts, which CENIA has considerably intensified in recent years.

The largest **group of implementers** is made up of municipalities (towns/cities), followed by small municipalities (Chart 55), with lower interest from other groups of implementers, i.e. regions, micro-regions and Local Action Groups. However, in order to support greater involvement of all groups in Local Agenda 21, a new methodology for evaluating Local Agenda 21 implementation has been gradually developed and approved for each group since 2019 (in 2019 for city districts, in 2020 for small municipalities, and in 2021 for regions), which is already more adapted to the reality and conditions of each group of implementers. This is a welcome change from the previous period, when there was a single methodology common to all groups of implementers, which did not sufficiently reflect the different situation and position of different municipalities and regions in the self-government system. The conditions for meeting the assessment criteria in a small municipality may be diametrically opposed to those in larger municipalities or at regional level. In addition to the financial support from the Ministry of the Environment of the Czech Republic and methodological support from CENIA mentioned in the introduction, various incentive programmes of some regions or project funding from the Ministry of Labour and Social Affairs of the Czech Republic also provide support for further or more intensive Local Agenda 21 development.

Chart 55

Overview of Local Agenda 21 implementers in the Czech Republic by group [number], 2020



Data source: CENIA

In addition to the above, a lack of motivation and desire to move to a higher level is also an obstacle to more intensive and successful Local Agenda 21 implementation. Some implementers stay at the same level for several years, either because it is convenient for them or they do not want to embark on more demanding projects. While this is extra work and investment, it is important to remember that with mutual cooperation both within the authority and between the authority and the public, the concrete results of such cooperation are more than positive. Examples are the results regularly achieved in Ostrava-Slezská Ostrava, Křižánky, Jihlava and Prague 14. In this case, it is evident that Local Agenda 21 implementers who have reached a higher level of implementation have a greater ambition to continue and improve further. Due to the nature of Local Agenda 21 as a voluntary tool, municipalities and regions cannot be forced to implement it, but it is possible to demonstrate the advantages of this tool to provide sustainable development at regional and local level through well-designed education.

Sustainable Urban Mobility Plans

The purpose of sustainable urban mobility plans is to ensure the availability of transport in cities while minimising its negative impacts on health, society (traffic congestion and land use) and the environment (noise and pollution), thus improving the quality of life of the population. Ensuring sustainable mobility is closely linked to both mitigation (reducing greenhouse gas emissions) and adaptation of transport to climate change, as sustainable transport systems are more resilient to climate change and also more flexible.

The **Sustainable Urban Mobility Plan** is a document prepared by individual cities with populations of over 40,000. A Sustainable Urban Mobility Plan focuses not only on addressing transport issues, but also on influencing and satisfying mobility requirements. The Ministry of Transport of the Czech Republic has certified the national methodology for the Sustainable Urban Mobility Plan, developed by the Transport Research Centre. One of the conditions for funding urban projects from the Operational Programme Transport and the Integrated Regional Operational Programme in the 2014–2020 programming period was to have either a full-fledged Sustainable Urban Mobility Plan or a simplified version known as the **Sustainable Urban Mobility Framework**, which focuses on public transport, in place after 2020.

The process of Sustainable Urban Mobility Plan and Sustainable Urban Mobility Framework approval is led by the Ministry of Transport of the Czech Republic, which cooperates with the Ministry of Regional Development of the Czech Republic and relevant partners, especially from the professional and academic spheres. For Sustainable Urban Mobility Framework approval, it is sufficient to fulfil the conditions defined in Annex 4 of the Methodology for the Preparation of Sustainable Urban Mobility Plans of the Czech Republic. The Sustainable Urban Mobility Plan and Sustainable Urban Mobility Framework approval process is carried out by the Commission for the Assessment of Urban Mobility Documents, which is appointed by the 1st Deputy Minister of Transport.

By the end of 2020, a total of 26 sustainable urban mobility documents **had been submitted for discussion** to the Commission for the Assessment of Urban Mobility Documents, 15 of them were verified as Sustainable Urban Mobility Plans, while 11 plans in which not all the requirements defined by the Methodology were met, were verified as Sustainable Urban Mobility Frameworks (Table 10). In 2020, the total population of towns/cities with verified Sustainable Urban Mobility Plans was 25.3% of the population of the Czech Republic and 70.8% of the total population of towns/cities with more than 40 thous. inhabitants. The figure for Sustainable Urban Mobility Frameworks is 21.8% of the population of large towns/cities.

The first 4 largest cities (Prague, Brno, Ostrava and Plzeň) have approved Sustainable Urban Mobility Plans in 2017 and 2018. Of the 10 largest cities in the Czech Republic by population, Olomouc and České Budějovice have approved Sustainable Urban Mobility Plans, while the other cities have verified Sustainable Urban Mobility Frameworks (e.g. the Liberec/Jablonec n. Nisou agglomeration). Of the smaller towns, Písek, Třebíč and Milevsko have approved Sustainable Urban Mobility Plans.

Table 10

Overview of the preparation and verification of Sustainable Urban Mobility Plans and Strategic Urban Mobility Frameworks, 2017–2020

Town/City	Population	Submitted as	Initially discussed at the Commission for the Assessment of Urban Mobility Documents	Verification state achieved
Prague	1,335,084	Sustainable Urban Mobility Plan	10/2018	Sustainable Urban Mobility Plan
Brno	382,405	Sustainable Urban Mobility Plan	10/2018	Sustainable Urban Mobility Plan
Ostrava	284,982	Sustainable Urban Mobility Plan	07/2017	Sustainable Urban Mobility Plan
Plzeň	175,219	Sustainable Urban Mobility Plan	04/2017	Sustainable Urban Mobility Plan
Liberec/ Jablonec n. N.	149,578	Sustainable Urban Mobility Framework	04/2018	Sustainable Urban Mobility Framework
Olomouc	100,514	Sustainable Urban Mobility Plan	07/2018	Sustainable Urban Mobility Plan
České Budějovice	94,229	Sustainable Urban Mobility Plan	07/2018	Sustainable Urban Mobility Plan
Hradec Králové	92,683	Sustainable Urban Mobility Framework	02/2018	Sustainable Urban Mobility Framework
Ústí nad Labem	91,982	Sustainable Urban Mobility Framework	05/2019	Sustainable Urban Mobility Framework
Pardubice	91,755	Sustainable Urban Mobility Framework	04/2018	Sustainable Urban Mobility Framework
Most/Litvínov	88,830	Sustainable Urban Mobility Plan	04/2018	Sustainable Urban Mobility Plan
Zlín	74,478	Sustainable Urban Mobility Framework	07/2018	Sustainable Urban Mobility Framework
Havířov	70,165	Sustainable Urban Mobility Plan	01/2019	Sustainable Urban Mobility Framework
Kladno	68,896	Sustainable Urban Mobility Plan	07/2019	Sustainable Urban Mobility Framework
Opava	55,996	Sustainable Urban Mobility Plan	07/2017	Sustainable Urban Mobility Framework
Frýdek-Místek	55,006	Sustainable Urban Mobility Plan	12/2019	Sustainable Urban Mobility Framework
Jihlava	51,125	Sustainable Urban Mobility Plan	10/2018	Sustainable Urban Mobility Plan
Teplice	49,705	Sustainable Urban Mobility Plan	10/2019	Sustainable Urban Mobility Framework
Chomutov	48,349	under preparation	-	-
Karlovy Vary	48,319	under preparation	-	-
Děčín	47,951	Sustainable Urban Mobility Plan	01/2020	Sustainable Urban Mobility Plan
Mladá Boleslav	44,327	Sustainable Urban Mobility Plan	-	-
Prostějov	43,381	under preparation	-	-
Přerov	42,451	Sustainable Urban Mobility Plan	02/2018	Sustainable Urban Mobility Framework
Třebíč	35,107	Sustainable Urban Mobility Plan	2019	Sustainable Urban Mobility Plan
Písek	30,379	Sustainable Urban Mobility Plan	2020	Sustainable Urban Mobility Plan
Kroměříž	28,360	Sustainable Urban Mobility Plan	2019	Sustainable Urban Mobility Plan
Litoměřice	23,623	Sustainable Urban Mobility Plan	2018	Sustainable Urban Mobility Plan
Kopřivnice	21,657	Sustainable Urban Mobility Plan	2019	Sustainable Urban Mobility Plan
Otrokovice	17,592	under preparation	-	-
Milevsko	8,185	Sustainable Urban Mobility Plan	2020	Sustainable Urban Mobility Plan

Data source: Ministry of Transport of the Czech Republic

1.6.3 | Water management system in settlements

Key question

How is rainwater and greywater management supported in settlements?

Key messages

The management of rainwater and greywater is financially supported mainly by subsidies through the Operational Programme Environment and the Dešťovka (Rainwater) programme.

While there is considerable interest in financial support for rainwater storage for garden watering or toilet flushing, the use of treated waste water (greywater) with the possible use of rainwater is rather marginal.

A large number of owners are not motivated to manage rainwater on their own land due to exemptions from payments for the volume of rainwater discharged to the public sewerage system.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Supported projects for the use of rainwater and greywater	N/A	N/A	↗	~

Supported projects for the use of rainwater and greywater

Rainwater that falls on the ground partly evaporates through evapotranspiration, part infiltrates into the soil and the rest is runoff from the area. The share of these components depends on the degree of urbanisation of the area. The more the area is built up and has a greater share of impermeable surfaces, the higher the runoff. In order to adapt to climate change, it is necessary to retain as much rainwater as possible in an area.

Currently, **subsidies** are offered **for the use of rainwater for citizens, municipalities, regions, public institutions**, etc. For example, municipalities can use the subsidy to capture rainwater in underground tanks and use it to irrigate municipal greenery, to cool streets or to flush toilets in public buildings. In addition to lower consumption of water from the public water supply, the aim is also sufficient infiltration of water back into the soil, and therefore an increase in the level of groundwater sources, and a reduction in pressure on the capacity of the sewerage system for rainwater, which is overwhelmed during periods of heavy rainfall. Subsidies for municipalities and regions can be drawn, for example, for underground storage tanks and infiltration equipment, as well as for the construction of green roofs and the replacement of impermeable surfaces at parking lots or other public areas with permeable ones. Subsidies for citizens can be drawn for the accumulation of rainwater for garden watering and toilet flushing, as well as for the use of treated waste water (greywater).

The above-mentioned financial support can be drawn primarily from the **subsidy title "Dešťovka" (Rainwater)** intended for the family house and apartment building segment. This title was announced in 2017 and is financed from the national funds of the State Environment Fund of the Czech Republic under the National Environment Programme. A total of CZK 540 mil. has been allocated in the two calls so far, while 6,230 projects with a total support amount of CZK 232.8 mil. had been approved by 2020. In the vast majority of cases, projects or applications concerning the storage of rainwater for garden watering or for concurrent toilet flushing and garden watering predominated (more than 6,000 applications), while the remainder were projects or applications concerning the use of treated waste water (greywater) with the possible use of rainwater. The total volume of storage tanks acquired with the support from the "Dešťovka" (Rainwater) programme is almost 30 thous. m^3.

Rainwater management measures are also supported by **European funds under the Operational Programme Environment 2014–2020**, priority axis 1 "Improving water quality and reducing flood risk", supported area 1.3 "Ensure urban area flood protection and rainwater management", specifically activity 1.3.2 "Urban area rainwater management" (the so-called "Rainwater for Municipalities"[54]). The total allocation of supported area 1.3 is approx. CZK 2.9 bil. and calls are regularly issued for activities related to the management of rainwater in urban areas. In 2020, the 144th call, the so-called **"Velká Dešťovka" ("Big Rainwater")**, was announced with a total allocation of CZK 1 bil. By the end of 2020, 115 projects had been approved for activity 1.3.2 with a total volume of CZK 507.6 mil. of total eligible expenditure (of which CZK 121.9 mil. has been paid out so far). The implementation of these projects will enable the retention of a total of 6,500 m^3 of rainwater in urban municipal areas.

Legislatively, the issue of rainwater management is addressed in particular by **Act No. 254/2001 Coll., on water (Water Act)**, which contains (since its amendment in 2010) a definition of rainwater, sets out the conditions for the general management of it, respectively introduces the obligation to apply rainwater management principles not only for new buildings, but also when making changes to buildings, in accordance with the Building Act. The aim is not only to prevent any increase in the amount of rainwater discharged through sewerage systems but to actively reduce it.

The connection of the Water Act to the Building Act is addressed in the field of rainwater management mainly through the **Implementing Decree of the Building Act No. 501/2006 Coll., on general requirements for land use**, which states the requirements for dealing with rainwater. In particular, it concerns the definition of building land on which the infiltration or retention and regulated drainage of rainwater from built-up or paved areas must be ensured. Partial requirements for rainwater management are also contained in **Act No. 183/2006 Coll., on spatial planning and building regulations (Building Act)**.

At the same time, **Act No. 274/2001 Coll., on water supply and sewerage**, introduces a payment for the volume of rainwater discharged, which motivates the owners of buildings to manage rainwater, because when it is disconnected from the public sewerage system, the payment is cancelled or reduced. However, the same law defines exceptions where the charges for the disposal of rainwater do not apply. Thanks to such exemptions, a large share of owners whose buildings discharge rainwater into the public sewerage system do not pay for the discharge and are therefore not motivated to manage rainwater on their own land.

In 2019, the first strategic material in the field of rainwater management, **"Study of Rainwater (Precipitation) Management in Urbanized Areas"**, was completed and published, which, among other things, identifies 94 shortcomings of the current situation and proposes 152 changes, in particular:
- remove exemptions from charging in Act No. 274/2001 Coll., on water supply and sewerage,
- create a legislative regulation setting out the requirements for the discharge of waste water and rainwater during rainfall runoff, and develop technical rules for it,
- make selected parts of existing water management standards for rainwater management binding,
- enshrine blue-green infrastructure in legislation,
- make the construction of green roofs mandatory for new buildings,
- supplement the spatial analytical documents and the methodological guide "Preparation of Spatial Analytical Documents" with documents related to the water regime of the territory, and create a methodological guide on how to include rainwater management in spatial planning documents and spatial planning documentation,
- revise the legal and technical regulations governing the relationship between transport structures, utilities and rainwater management or blue-green infrastructure,
- develop methodological guidance on technical options for protection from flooding due to heavy rainfall, and modify (create) standards/regulations to enable the implementation of temporary retention areas and flood corridors on the surface of public spaces,
- develop methodological guidance for the implementation of rainwater management in municipalities.

[54] This support is intended for regions, municipalities, voluntary associations of municipalities, Prague Capital City districts, organisational units of the state, state enterprises, state organisations, public research institutions, contributory organisations, universities and educational institutions, non-state non-profit organisations, and churches and religious societies and their associations.

1.6.4 | Quality of greenery in cities

Key question

What is the share of green and blue spaces in cities?

Key messages

The representation of green areas and water areas in the defined urban area of settlements with over 20 thous. inhabitants is relatively high. In 2020, the share of green areas ranged from 45.7% (Havířov) to 91.9% (Trutnov) of the total urban area.

However, a significant part of the share of greenery in the total urban area of settlements is represented by low greenery, the potential of which for providing ecosystem functions and increasing the adaptive capacity of settlements is low compared to high greenery.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Green areas in cities	N/A	N/A	→	~

Green areas in cities

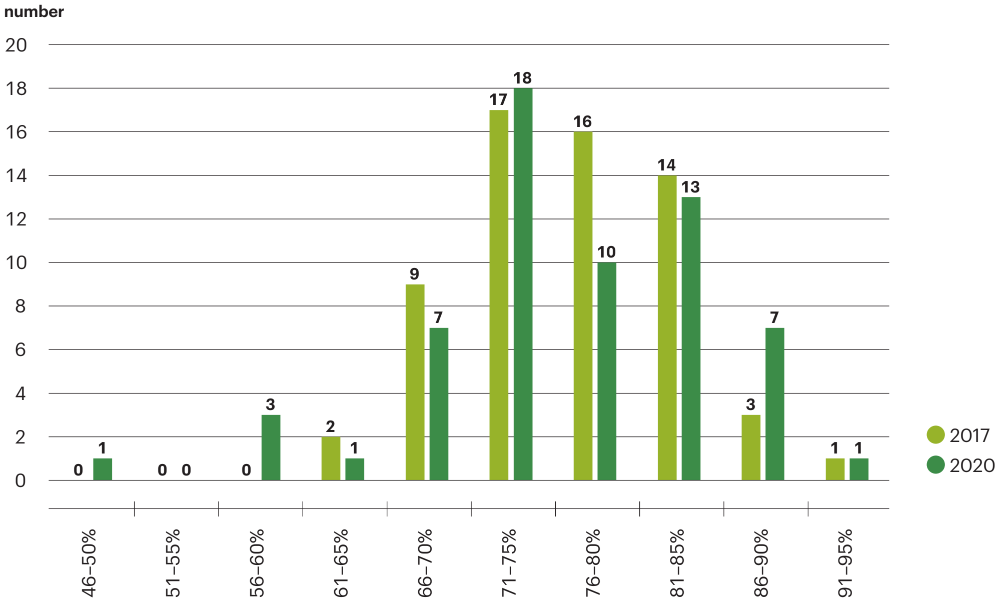
The urban environment, population and biodiversity are among the categories significantly affected by climate change. Factors that can influence the immediate impact of climate change are green areas (especially high greenery) and water resources in a city and their quality (the degree of ecosystem services provided). Greenery in settlements and water areas significantly increase the level of adaptation of the urban system and population, especially to extreme temperatures. Greenery in settlements and water areas represent important resting zones with the possibility of natural shading, improve the microclimate of the area, increase evapotranspiration, increase biodiversity in the given location, reduce surface runoff, noise and dust, and thus improve the health conditions of the population and the quality of life in cities in general. The spatial accumulation of greenery and water areas in settlements or the uniformity of their spatial distribution and their interconnectedness play important roles in the adaptation of the settlement environment. In addition, factors including the size, spatial distribution and quality of green and water areas significantly counteract urban overheating and reduce the negative impacts of the built-up urban environment.

The "Green Areas in Cities" indicator characterizes the **representation of green areas in settlements and water areas in the urban area** of all 61 cities in the Czech Republic with over 20 thous. inhabitants (i.e. including regional cities)[55]. The share of green and water areas ranged from 45.7% (Havířov) to 91.9% (Trutnov) of the total urban area (Chart 56), with an average share of 76.0% in 2020. There have been significant changes compared to the last measurement in 2017, especially in the 76% to 80% share of green and water areas in the total urban area category, where the share of cities has decreased, mainly in favour of the "higher" 86% to 90% category.

[55] *To determine the indicator values, an urban area layer was created based on Sentinel-2 satellite imagery data. The administrative areas of the cities were divided into 4 categories of cover – built-up, low green, trees and water bodies – by classifying the multispectral satellite images. A 100 m x 100 m grid was created to form an urban area layer on which the percentage of green areas in settlements and water bodies was calculated. Only the assessment years 2014, 2017 and 2020 can be used to compare the development of the indicator. Older data are not available due to the lack of Sentinel-2 data.*

Chart 56

Number of cities in the Czech Republic with a population of over 20 thous. according to the share of green and water areas in the total urban area of these cities [number], 2017, 2020

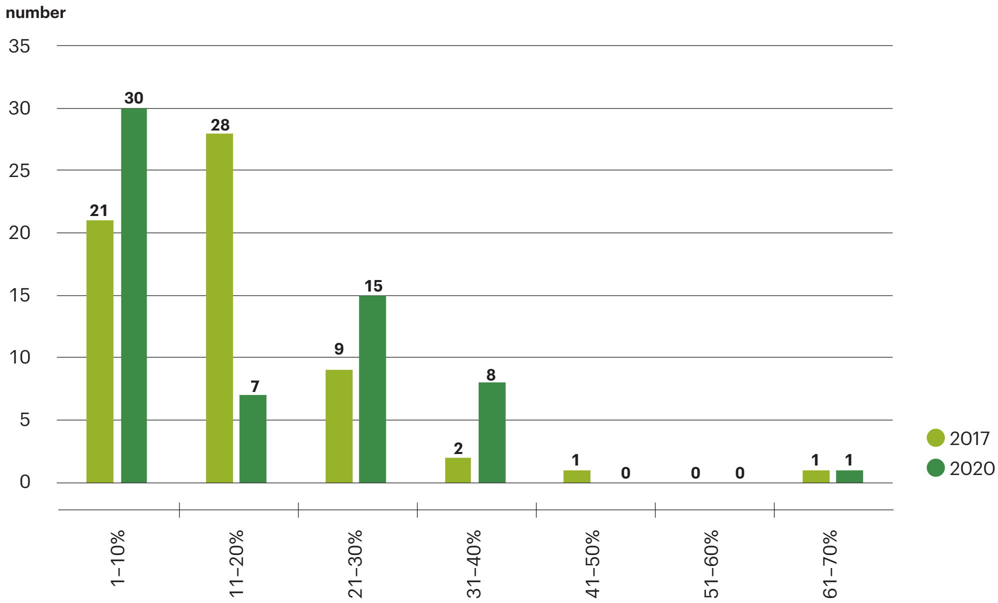


Data source: Sentinel-2, Czech Statistical Office

Despite the generally high share of total urban greenery in the urban area, we must state that a significant part of this share is **low greenery** (e.g. low mown lawns, thickets, etc.), the potential of which for providing ecosystem functions and increasing adaptive capacity is low compared to high greenery. Low greenery represents on average 59.1% of the urban area, i.e. 78.0% of the total greenery in settlements. The lowest share of low greenery in the total area was identified in Karlovy Vary (25.7%), while the highest was in Přerov (75.6%). In contrast, **tall greenery (trees)** occupies on average only 13.3% of the urban area, i.e. 19.8% of the total greenery in settlements, and the numerical representation corresponds to this with more than 60% (i.e. 37) of the surveyed cities having a share of tall greenery only between 1% and 20% of the total urban area (Chart 57).

Chart 57

Number of cities in the Czech Republic with a population of over 20 thous. according to the share of tall greenery (trees) in settlements in the total urban area of these cities [number], 2017, 2020



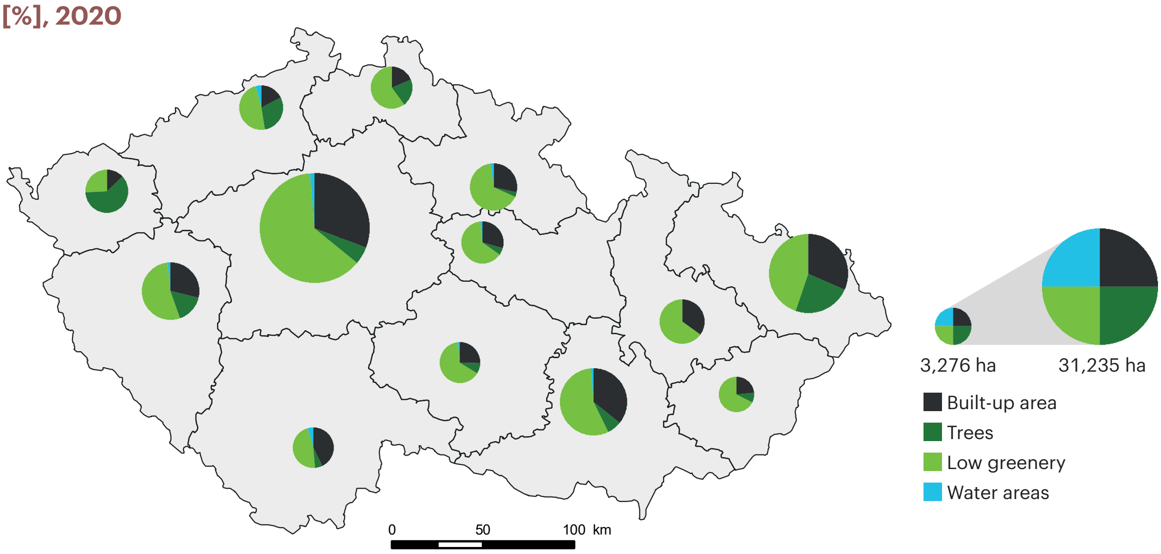
Data source: Sentinel-2, Czech Statistical Office

Water areas are also an important element in the urban microclimate that deserves more attention. The highest share of water areas and wetlands in the urban area of the surveyed cities in 2020 was identified in Hodonín (7.4%), due to the local wetlands and ponds and nearby (Old) Morava River. The second-highest share of water areas in 2020 was identified in Cheb (6.7%) due to the presence of water reservoirs and the Ohře River. The lowest share of water areas was recorded in Kladno (0.01%) and in Vsetín (0.02%).

Regional cities are a specific category of monitored settlements. Among the regional cities of the Czech Republic in 2020, greenery (trees and low greenery) accounted for the largest share of the urban area of Karlovy Vary (86.7%) and Liberec (81.4%). On the other hand, České Budějovice (52.8%) and Brno (63.0%) had the lowest share of greenery in settlements of the total urban area, Figure 21. Water areas accounted for on average 1.5% of the urban area of regional cities. The largest share of water areas in the urban area of a regional city in 2020 was identified in České Budějovice (4.6%), which is due to the presence of ponds and the Vltava River. The second-highest share of water areas in 2020 was identified in Ústí nad Labem (4.2%), where the most important role is played by the Elbe itself, its tributaries and meanders. The lowest share was recorded in Liberec (0.1%). As far as Prague Capital City is concerned, greenery occupies 68% of the urban area of the city (of which low greenery accounts for 62.8% and high greenery 5.2%), while water areas cover 1.3% of the urban area.

Figure 21

Share of greenery in settlements and water areas in the total urban area of regional cities of the Czech Republic [%], 2020

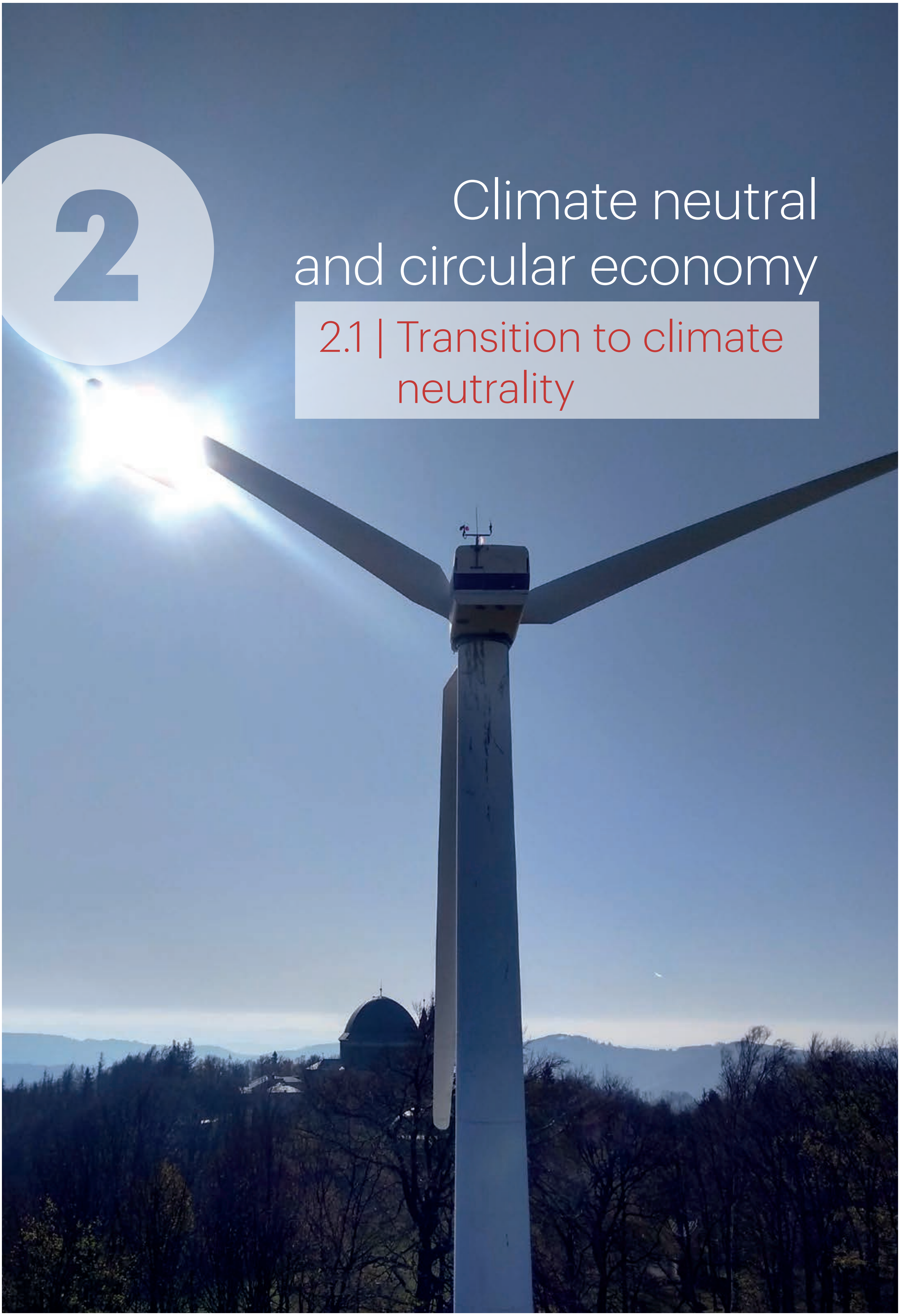


Data source: Sentinel-2, Czech Statistical Office

Within the framework of separate adaptation plans of cities in connection with the update of spatial and strategic planning, it is advisable to implement, plan, reconstruct and expand greenery in settlements and water areas so that the adaptive capacity of the environment is gradually increased, especially with regard to spatial variability and mutual combination and in the context of accessibility for the highest possible number of inhabitants. The existing areas of low greenery have the greatest potential in this regard.

2 Climate neutral and circular economy

2.1 | Transition to climate neutrality



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2.1 | Transition to climate neutrality

Climate change is one of the Earth's greatest global challenges, but also a factor in the development of human society. The signs of climate change, which are already observable and projected to intensify, are largely attributed to anthropogenic influences. Human activity is adding significant amounts of greenhouse gases to the atmosphere, while on the other hand, changes in land use are limiting carbon storage in biomass. One consequence of these mechanisms is increasing atmospheric concentrations of greenhouse gases leading to an amplification of the atmosphere's greenhouse effect and a disturbance of the energy balance in the climate system.

The main focus of global efforts to mitigate climate change is therefore on reducing greenhouse gas emissions, and this affects a number of sectors, in particular energy, industry, transport, agriculture and waste management. A decline in emissions from economic activities, especially from fossil fuel combustion, should gradually lead, if combined with increasing carbon storage in biomass, to so-called climate neutrality where emissions are balanced by greenhouse gas removals.

A decisive step in global efforts to protect the climate was taken in December 2015, when the parties to the UN Framework Convention on Climate Change adopted the Paris Agreement. The Paris Agreement formulates a long-term climate protection target, namely to contribute to keeping the increase in global average temperature well below 2°C compared to the pre-industrial period and to aim to keep the temperature increase below 1.5°C. The European Union, as a party to the Agreement, has set a binding and ambitious target (called the Nationally Determined Contribution, NDC) to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The Czech Republic, as an EU Member State, will participate in the fulfilling this target and will gradually reflect the newly adopted commitments in updated strategic documents (e.g. the Climate Protection Policy of the Czech Republic) and legislation.

Overview of selected related strategic and legislative documents

Paris Agreement
- contribute to keeping the increase in global average temperature well below 2°C above the pre-industrial period and aim to keep the temperature increase below 1.5°C
- bindingly set and meet Nationally Determined Contributions (NDCs) for greenhouse gas emissions; review NDCs in five-year cycles

Regulation (EU) 2021/1119 of the European Parliament and of the Council establishing a framework for the achievement of climate neutrality and amending Regulation (EC) No. 401/2009 and Regulation (EU) 2018/1999 (European Climate Law)
- a reduction in EU greenhouse gas emissions by at least 55% compared to 1990 by 2030
- the legal framework for meeting the Paris Agreement targets and achieving EU climate neutrality by 2050

EU climate and energy policy framework for 2030
- a reduction in aggregate EU greenhouse gas emissions of at least 55% compared to 1990 by 2030, reaching a 32% share of renewable energy sources in final consumption, and a 32.5% increase in energy efficiency
- a reduction in EU emissions in the EU-ETS by 43% in the 2005–2030 period; regarding non-EU-ETS emissions, the Czech Republic has a target of a 14% reduction in emissions compared to 2005 by 2030

Regulation 2018/1999 of the European Parliament and of the Council on the governance of energy union and climate action
- an obligation for integrated national energy and climate plans

Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable energy sources
- setting targets for the share of renewable energy sources in final energy consumption: ensuring a 13% share of RES in gross domestic final consumption in 2020
- a Europe-wide target of 32% of renewable energy sources in gross final energy consumption by 2030
- achieving a 10% share of energy from RES in final energy consumption in transport by 2020 and a 14% share of RES by 2030

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
- an increase in energy efficiency (32.5%) in primary energy consumption and final energy consumption for the EU as a whole
- meeting the main 20% energy efficiency target by 2020 and continuing to improve energy efficiency beyond that date
- meeting the national indicative target set for the Czech Republic of 47.84 PJ (13.29 TWh) of new savings in final energy consumption by 2020

Climate Protection Policy of the Czech Republic
- to reduce the Czech Republic's emissions by at least 32 Mt CO_2 eq. compared to 2005 by 2020
- to reduce the Czech Republic's emissions by at least 44 Mt CO_2 eq. compared to 2005 by 2030

State Environmental Policy of the Czech Republic 2012–2020
- reducing the environmental burden from industry, especially emissions of pollutants and greenhouse gases, reducing the energy and material intensity of industry
- ensuring a 13% share of renewable energy sources in gross final energy consumption by 2020
- ensuring a 10% share of renewable energy sources in transport by 2020
- ensuring a commitment to energy efficiency by 2020 (20% for the EU as a whole)

State Energy Concept of the Czech Republic (2015)
- import dependency will not exceed 65% to 2030 and 70% to 2040
- a diversified mix of primary sources with a target structure in corridors: nuclear 25–33%, solid fuels 11–17%, gaseous fuels 18–25%, liquid fuels 14–17%, renewable energy sources and secondary sources 17–22%
- target electricity generation mix by 2040 in corridors: nuclear 46–58%, renewable energy sources and secondary sources 18–25%, natural gas 5–15%, lignite and black coal 11–21%
- net final energy consumption in 2020 will be 1,060 PJ (Eurostat methodology) or 1,020 PJ (IEA methodology)
- ensuring self-sufficiency in electricity generation with an increasing share of RES and secondary sources, nuclear generation will gradually replace coal power as the mainstay of electricity generation
- a gradual decline in electricity exports and maintenance of a balance in the range of +/–10% of domestic consumption

Czech National Energy and Climate Plan (2019)
- 22% share of RES in gross final energy consumption by 2030

National Action Plan of the Czech Republic for Renewable Energy Sources (2015)
- achieving a 15.3% share of renewable energy sources in gross final energy consumption in 2020
- achieving a 10.0% share of renewable energy sources in gross final energy consumption in transport in 2020

5th National Energy Efficiency Action Plan of the Czech Republic (2017)
- a national target expressed in terms of primary energy consumption was set of 1,855 PJ by 2020

2.1.1 | Greenhouse gas emissions

Key question

Are greenhouse gas emissions decreasing and are the targets of national strategic documents and the Czech Republic's international commitments being met?

Key messages

Total greenhouse gas emissions in the Czech Republic without the LULUCF sector are declining and the Czech Republic's 2020 climate targets are highly likely to be met.

Gross electricity generation reached 81,443.4 Gwh in 2020. It thus fell by 6.4% year-on-year, and was the lowest level in 18 years.

For the first time in history, electricity generation from nuclear has exceeded that from lignite.

Since 2010, heat generation from solid fossil fuels has been on a significant downward trend, while the share of renewable energy sources and biofuels has been increasing significantly.

Overall household consumption of solid fossil fuels has been declining over the long term.

Transport energy consumption in 2020 has significantly fallen year-on-year, but this is a consequence of the impact of the COVID-19 pandemic on the transport sector. The purchase of new electric vehicles tripled year-on-year and the number of new hybrids almost doubled.

The downward trend in greenhouse gas emissions from combustion processes has moderated since 2015.

The balance of emissions from the LULUCF sector rose sharply to record high positive values as a result of the bark beetle calamity. Emissions from transport and waste are also rising.

The export character of foreign trade in electricity persists, with the balance equivalent to 14.2% of domestic consumption in 2020.

15.9% of households used solid fuels (coal + wood) for heating in 2019[1], a 9.1% increase in the last five years.

Energy consumption in transport has a long-term increasing trend. Fossil fuels accounted for 94.9% of transport energy consumption from fuel combustion in 2020.

[1] *Data for the year 2020 are not available at the time of publication.*

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Greenhouse gas emissions (without LULUCF)*	↘	↘	~↗	~
Electricity and heat generation**				
Gross electricity generation	~↗	~↗	~↗	N/A
Gross heat generation	N/A	↘	↘	N/A
Share of the balance of foreign trade in electricity in domestic consumption	~↗	↘	↘	~
Household heating by fuel**				
Number of households heated with solid fuels (coal + wood)	↘	~↗	↗	✕
Consumption of solid fossil fuels in households	↘	↘	↘	✕
Energy and fuel consumption in transport	↗	↗	↗	✕

** Taking into account the balance of emissions and removals from the LULUCF sector, the medium-term trend is volatile while the short-term trend is significantly increasing because of the growth in LULUCF emissions due to the bark beetle calamity.*
*** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

Greenhouse gas emissions

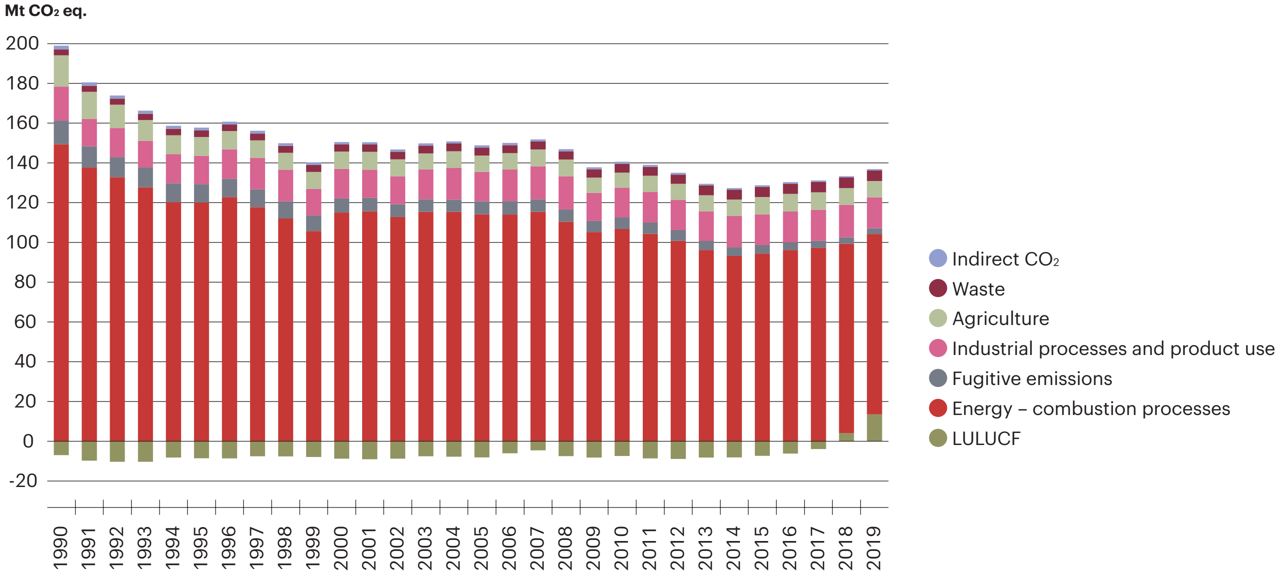
Total **aggregate greenhouse gas emissions** in the Czech Republic (excluding the LULUCF sector, including indirect CO_2 emissions) decreased by 38.0% (75.7 Mt CO_2 eq.) in the 1990–2019 period[2], and by 4.6% year-on-year to 123.3 Mt CO_2 eq. in 2019 (Chart 58). After an initial significant decline in the early 1990s caused by the restructuring of the economy, the downward trend in emissions has moderated and fluctuations have occurred, influenced by the evolution of economic performance and the share of emission-intensive sectors in GDP. In the medium term, i.e. in the 2005–2019 period, to which the Climate Protection Policy of the Czech Republic targets relate, emissions decreased by 17.2%, however by only 4.3% in the last 5 years under assessment (2015–2019).

Considering the balance of **emissions and removals from the LULUCF sector**, emissions only decreased by 28.7% in the 1990–2019 period. The development of net emissions was influenced by the balance of emissions and removals from the LULUCF sector, which increased dramatically to positive values in the 2017–2019 period (emissions exceed biomass carbon storage) to 13.6 Mt CO_2 eq. and total net emissions increased by 2.6% year-on-year. Developments in the LULUCF sector can be linked to the poor health of forests, which are impacted by the signs of climate change and the associated bark beetle calamity.

[2] *Data for the year 2020 are not available due to the preparation schedule of the emissions inventory.*

Chart 58

Aggregated greenhouse gas emissions in the Czech Republic by sector [Mt CO_2 eq.], 1990–2019



Data for the year 2020 are not available due to the preparation schedule of the emissions inventory.

Data source: Czech Hydrometeorological Institute

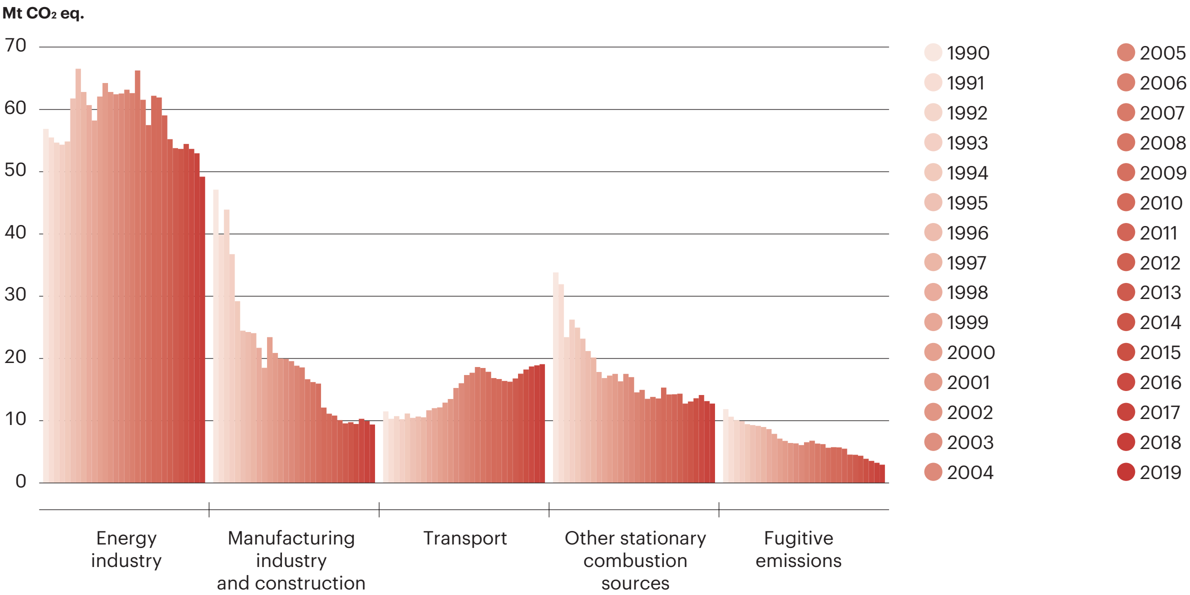
The decrease in total emissions in the long and medium term was mainly due to the declining trend of greenhouse gas emissions from **combustion processes** (1A), which accounted for 73.9% of total emissions excluding LULUCF in 2019. Within combustion emissions, emissions from the industrial energy sector (1A2, Chart 59) declined mainly due to the change in the sectoral structure of industry in the 1990s and subsequent technological upgrades leading to a reduction in the energy and material intensity of the manufacturing industry. Emissions from domestic and commercial heating (1A4) have also declined, with technological upgrades of equipment and changes to the fuel mix. In contrast, there is a long-term rising trend in transport emissions reflecting the growth in transport energy consumption, which is predominantly from fossil fuel sources.

Over the last **five-year period 2015–2019**, the decline in emissions from the above sectors has slowed and emissions continue to evolve in line with the volume of industrial production and, in the case of heating, the temperature characteristics of the winter seasons. This change in trends caused a moderation in the decline of total emissions from combustion processes, the development of which in this period was influenced by fluctuations in emissions from the energy industry in line with the development of electricity and heat generation and in relation to changes to the energy mix.

Among the other sectors, there is a statistically significant downward trend for **fugitive emissions**, which will further accelerate in the short term due to the decline in coal mining to an average of 8% per year. In the industrial process and product use sector, non-combustion emissions from the chemical and metallurgical industries continue to decline slowly, yet **F-gas emissions** from the use of CFC replacement products are increasing significantly, rising by 12.8% in the 2015–2019 period and increasing by almost an order of magnitude since 2000. In the **waste sector**, a statistically significant upward trend was observed in all the periods under review, yet the dynamics of which decreased to about 1% per year in the 2015–2019 period.

Chart 59

Development of emissions from individual energy process categories (CRF category 1) in the Czech Republic [Mt CO_2 eq.], 1990–2019



Data for the year 2020 are not available due to the preparation schedule of the emissions inventory.

Data source: Czech Hydrometeorological Institute

Of the individual greenhouse gases, CO_2 emissions in 2019 accounted for the largest share of the total aggregated emissions of the Czech Republic (including LULUCF), accounting for 83.9%, with CH_4 accounting for 9.2%, N_2O for 4.1%, and F-gas emissions for 2.8%. Combustion processes were the source of 78.9% of CO_2 emissions, waste management was the highest contributor to CH_4 emissions (39.6%), and agriculture was the dominant source of N_2O emissions (76.2%).

Greenhouse gas emissions from installations covered by the **EU Emissions Trading System (EU-ETS)** fell by 33.7% in the 2005–2020 period to 54.7 Mt CO_2 eq. The Czech Republic is thus contributing to the EU's common target under the EU climate and energy package, which is to reduce EU-ETS emissions by 21% by 2020. Year-on-year emissions in the EU-ETS fell by 12.5% to 2020, but this significant decline is partly due to the downturn in economic activity associated with the COVID-19 pandemic. In the structure of emissions from EU-ETS installations, combustion processes, including mainly power plants, heating plants and the manufacturing industry, accounted for the largest share of emissions over the whole 2005–2020 period. In 2020, combustion processes accounted for 76.8% of total EU-ETS emissions. Other major emission categories in the EU-ETS in the Czech Republic are pig iron and steel production (9.8% in 2020) and cement production (5.0%).

Non EU-ETS emissions, which mainly include small and mobile sources of air pollution, decreased in the Czech Republic by 8.4% to 60.8 Mt CO_2 eq. The target for the Czech Republic allows for an increase in emissions outside the EU-ETS by a maximum of 9% over the 2005–2020 period, given that this target has already been met and the Czech Republic is also on track to meet the 2030 target of a 14% decrease in non-EU-ETS emissions compared to 2005.

Given the economic downturn associated with the COVID-19 pandemic and the already documented EU-ETS data, meeting the 2020 Climate Protection Policy target is highly likely. Meeting the 2030 Climate Protection Policy target of a 47.3% decrease in emissions without LULUCF relative to 1990 currently appears close under the existing measures and as likely under the additional measures scenario. The Czech Republic will contribute to the Paris Agreement targets with an ambitious EU Nationally Determined Contribution (NDC), which is a reduction of at least 55% of 1990 emissions by 2030. The situation in meeting this target is complicated by the inclusion of the LULUCF sector with its currently increasing emissions trend and uncertain future development.

Electricity and heat generation

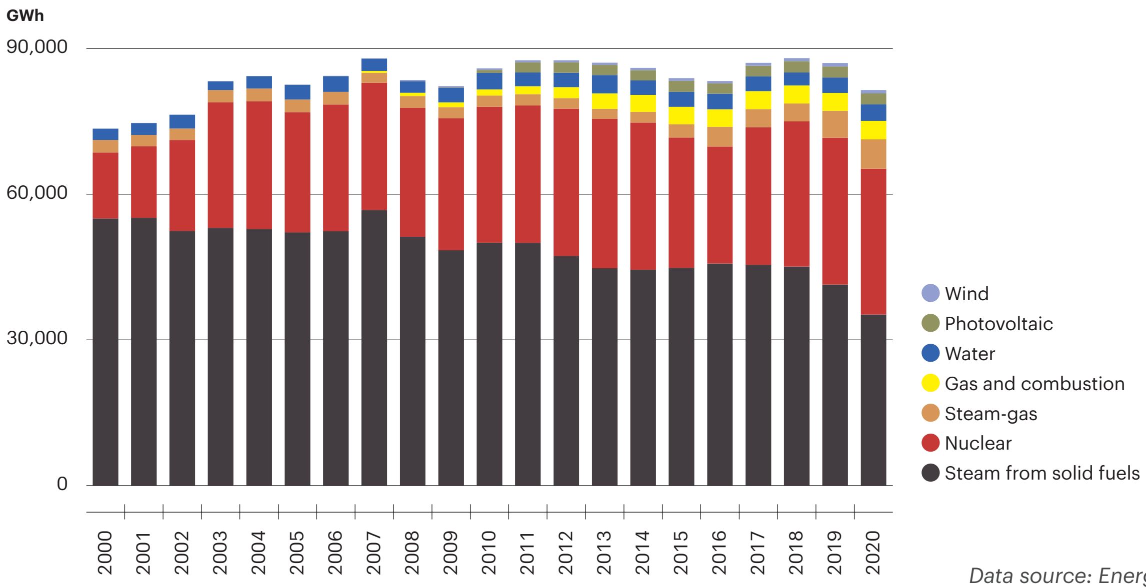
The sources from which electricity and heat are generated are determined by domestic energy resources, foreign trade in fuels, and the current energy policy that regulates the conditions for their use. The amount of electricity and heat generated is determined by the current demand and consumption on the domestic and foreign markets.

Gross electricity generation in 2020 reached 81,443.4 GWh. This was a 6.4% decline year-on-year, and the lowest level in 18 years. The decline in electricity generation since the spring of 2020 was undoubtedly influenced by the COVID-19 pandemic, which also had an impact on the reduction in overall electricity consumption. As a result of the pandemic measures, the consumption of electricity by large consumers fell significantly, while household electricity consumption increased (by 4.7%).

In terms of the different **types of power plants** (Chart 60), the largest share of electricity generation in 2020 was from solid fuel-fired steam power plants[3] (43.2%). The second most important category is nuclear power plants, which generated 36.9% of the electricity. Other sources generate electricity on a smaller scale, such as steam-gas power plants (7.4%), gas and combustion power plants (4.7%), hydroelectric power plants (4.2%), photovoltaic power plants (2.7%) and wind power plants (0.9%).

Chart 60

Electricity generation by type of power plant in the Czech Republic [GWh], 2000–2020



Data source: Energy Regulatory Office

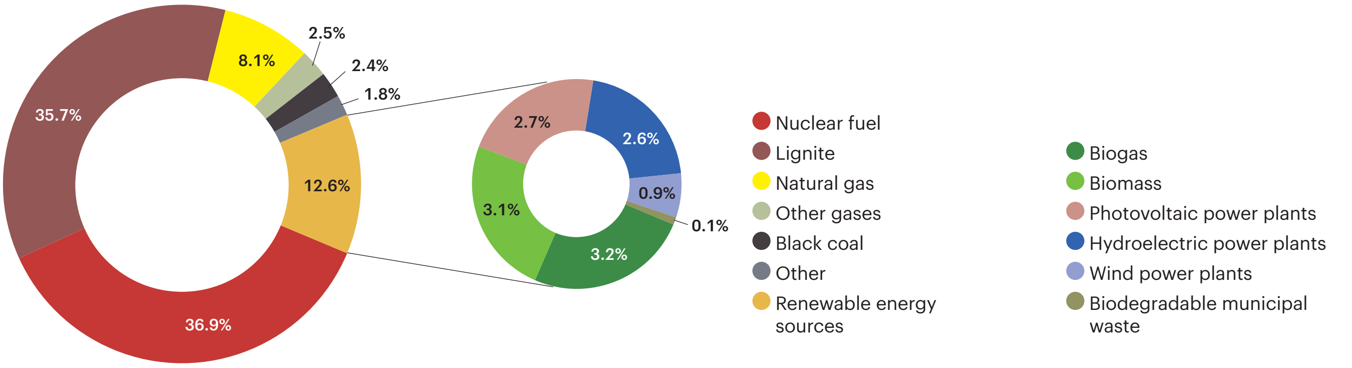
In terms of **fuels** (Chart 61), the Czech Republic generated most of its **electricity** from nuclear fuel in 2020 (36.9%), the first time in history that lignite was not the top fuel. It came in second place with a 35.7% share. However, coal accounts for a further 2.4%, which still leaves solid fossil fuels in a dominant position (38.1%). The reduction in electricity generation from coal and the resulting high share of nuclear electricity can be attributed to the impact of the COVID-19 pandemic, when generation from coal was reduced in the face of lower demand. Renewable energy sources accounted for 12.6% of electricity generation, with a relatively even mix of biogas (3.2%), biomass (3.1%), photovoltaics (2.7%) and hydroelectricity (2.6%). Wind power plants generated electricity to a lesser extent (0.9%), while the least electricity was generated from biodegradable municipal waste (0.1%). Natural gas had a share of 8.1% in 2020.

More detailed information on renewable energy sources is provided in Section 2.1.3.

[3] *Steam power plants are generally those that use steam to power an electricity generator, with the steam being obtained by heating water by burning fuels or by nuclear reaction. In this document, however, the steam power plants category is taken from Energy Regulatory Office statistics and includes thermal power plants that burn mainly lignite in the Czech Republic. Nuclear power plants are listed in a separate category.*

Chart 61

Structure of electricity generation by fuel in the Czech Republic [%], 2020

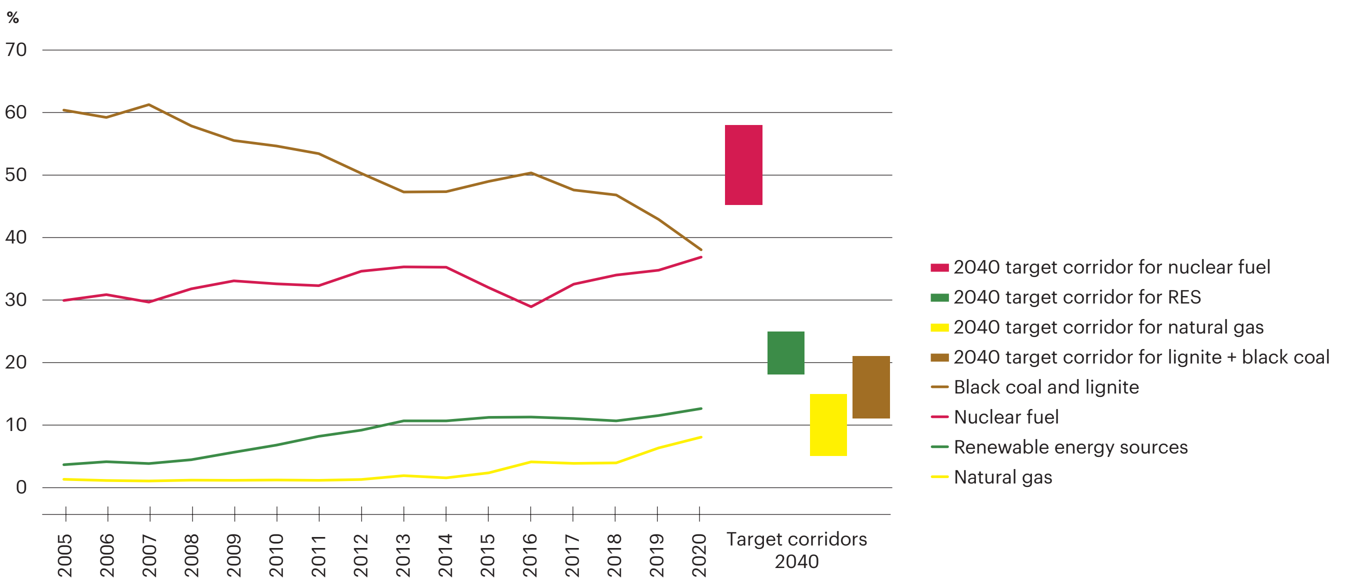


Data source: Energy Regulatory Office

The target **structure of electricity generation** by 2040, which is based on the current strategic documents, is not currently being met, but is gradually changing in the desired direction. This is particularly evident in the reduction of the share of coal and the increase in the share of renewable energy sources and natural gas (Chart 62). Electricity generation in nuclear power plants has been stable in the long term, but to increase to the target share of nuclear fuel for electricity generation in the range of 46–58% it will be necessary to increase the generation capacity of nuclear sources.

Chart 62

Share of electricity generation by fuel type in the Czech Republic [%], 2005–2020



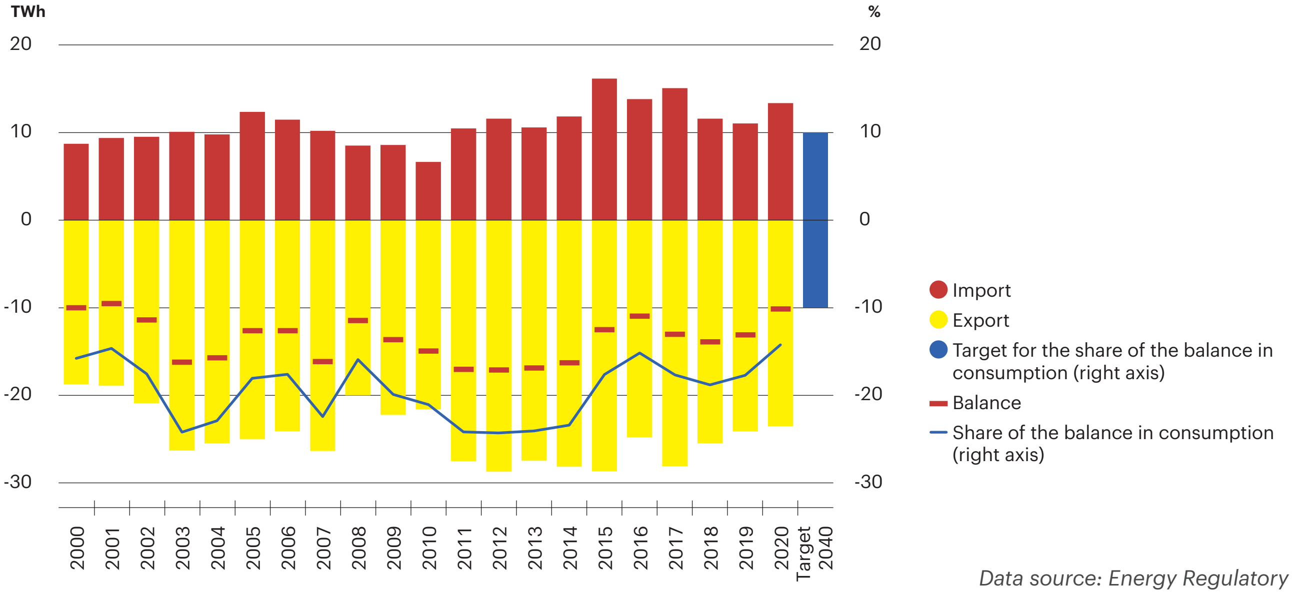
The target corridors for each source are plotted on the right side of the chart in the corresponding colours.

Data source: Energy Regulatory Office

Foreign trade in electricity remains export-oriented, with exports outweighing imports. In 2020, 13,368.1 GWh of electricity was imported and 23,520.9 GWh was exported. The foreign balance was thus negative again this year, amounting to 10,152.8 GWh, 22.5% less than in the previous year. With total electricity generation of 81,443.4 GWh in 2020, the share of exports in generation was 12.5%. The Czech Republic's target is a gradual decline in electricity exports and maintenance of the balance in the range of +/–10% of domestic consumption until 2040. In 2020, domestic electricity consumption amounted to 71,353.9 GWh, thus the share of the balance in consumption reached 14.2% (Chart 63) and is not yet reaching the required values.

Chart 63

Electricity imports and exports and the share of the balance in consumption in the Czech Republic [TWh, %], 2000–2020

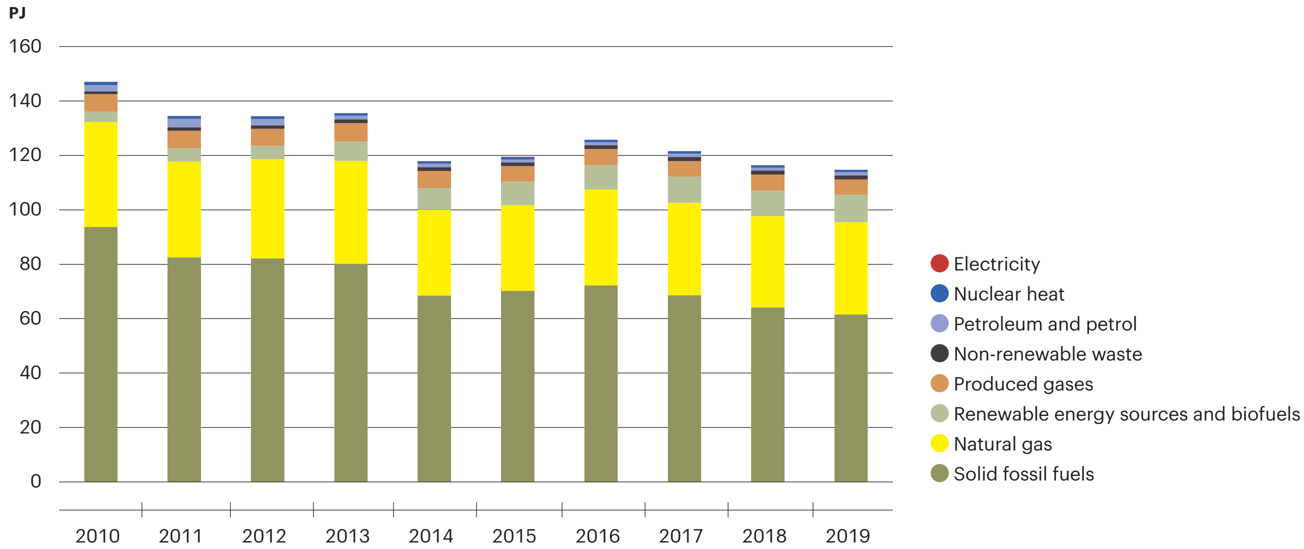


Data source: Energy Regulatory Office

Heat generation (Chart 64) was mainly through the combustion of solid fossil fuels (53.6%), which mainly consisted of lignite and black thermal coal, and natural gas (29.6%) in 2019[4]. This includes generation of heat for sale, i.e. for heat supply systems, as well as generation in domestic boilers, housing cooperatives, etc. The total amount of heat generated has been steadily decreasing and has fallen by 1.5% year-on-year to 114.7 PJ. Heat generation from solid fossil fuels decreased by 4.1% year-on-year, while generation from natural gas decreased by 1.0% year-on-year. The generation of heat from solid fossil fuels has been on a significant downward trend since 2010, however the share from renewable energy sources and biofuels has been increasing significantly (from 2.6% to 8.9% in the 2010–2019 period).

Chart 64

Gross heat generation by fuel type in the Czech Republic [PJ], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Ministry of Industry and Trade of the Czech Republic

[4] *Data for the year 2020 are not available at the time of publication.*

Household heating by fuel

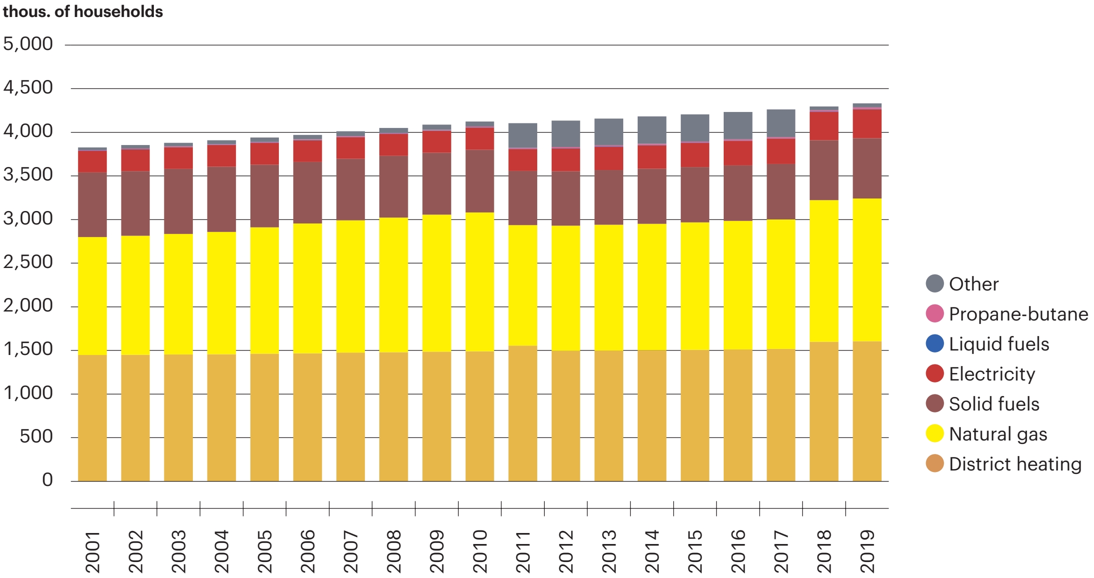
The **way households are heated** is influenced by many factors. The main ones are the availability of heating systems, the availability and prices of fuels, and also the convenience of the heating equipment. In the Czech Republic, household heating also varies significantly between regions or municipalities. In areas with larger agglomerations and in towns close to industrial facilities from which residual heat can be used, a thermal energy supply system (district heating) is usually used, while in smaller and less accessible municipalities individual heating of individual houses or housing units is more often used.

In 2019[5], 4,331,750 households were registered in the Czech Republic. In these households, the most common heating methods (Chart 65) are natural gas (37.8% of households) and district heating (37.1%). The number of housing units heated using these two methods is steadily increasing and we consider them environmentally friendly. They are followed by solid fuels – coal and wood (15.9%). These fuels are often combined, and price plays a big role in households' choice of fuel. However, the quality of the fuel usually decreases with its price, and so the situation arises that residents often turn to less environmentally friendly fuels in an attempt to save on heating costs. These steps then have a major impact on the emissions of pollutants from heating. In the long term, the number of households heated with solid fuels has fallen by 6.8% since 2001, but in the medium term it has started to grow again slightly since 2010, with an increase of 9.1% in the last five years (2015–2019). In 2019, there was only a slight year-on-year increase of 0.3%, but this represents 2,328 households.

The ratio of heating methods in households changes only very slowly over time, and is influenced mainly by the construction of new houses and apartments.

Chart 65

Predominant heating method of permanently occupied dwellings in the Czech Republic [thous. of households], 2001–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Hydrometeorological Institute

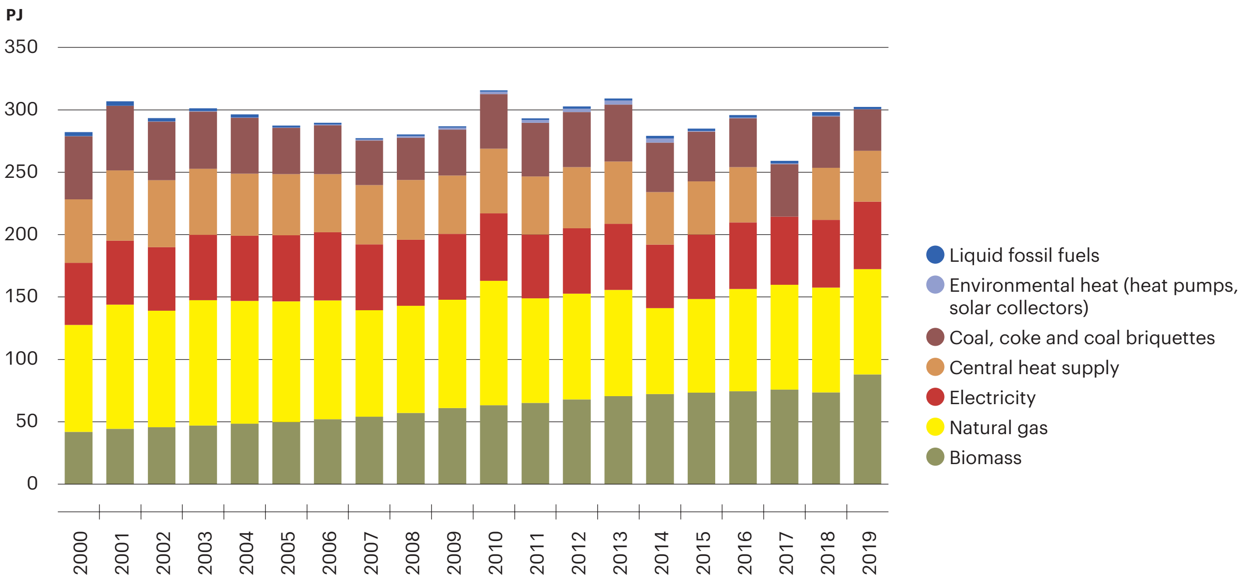
[5] *Data for the year 2020 are not available at the time of publication.*

In terms of **fuel consumption** (Chart 66), in 2019 most heat was produced **in households** from biomass (29.1%, 87.9 PJ) and natural gas (27.9%, 84.4 PJ). While the share of biomass has been growing significantly in the long term, the share of natural gas has been declining in the long and medium term, and in recent years has been rather stagnant. However, household consumption of natural gas also includes cooking gas and water heating. The situation is similar for electricity (17.9%, 54.2 PJ), which includes not only heating but also consumption for the operation of household electrical appliances, even in those households that are heated in other ways. Central heating supplies only 13.4% of household energy, although 37.2% of households are heated this way (Chart 65). This is due to the fact that district heating is more often used in apartment buildings in housing estates, where a smaller amount of heat is usually needed to heat one household than to heat a household in a family house. Household consumption of solid fossil fuels, included under the heading “Coal, coke and coal briquettes”, has been on a steady downward trend, producing 33.3 PJ of heat in 2019, representing 11.0% of total household fuel consumption. However, given the adverse impact of the combustion of these fuels in households on air quality in settlements, it is desirable to reduce these fuels as much as possible.

Emissions from domestic heating are described in more detail in chapter 2.1.1.

Chart 66

Household fuel consumption in the Czech Republic [PJ], 2000–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Statistical Office

Energy and fuel consumption in transport

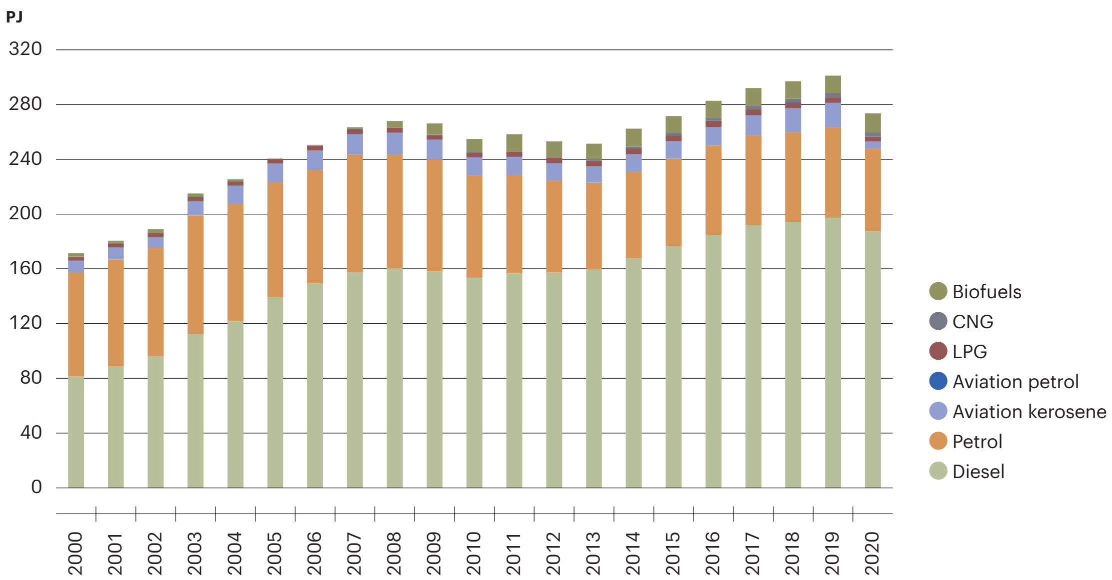
Energy consumption in transport increased by 59.6% in the 2000–2020 period. The upward trend of energy consumption in transport continued with fluctuations according to the performance of the economy until 2019, when this growth was followed by a significant year-on-year decline in energy consumption of 9.1% to 273.6 PJ in 2020 (Chart 67) due to the impact of the COVID-19 pandemic on the transport sector. In 2020, fossil fuels accounted for 94.9% of total transport energy from fuel combustion (i.e. excluding electricity consumed by railways and electric traction of city public transport). Electric modes of transport consumed 701.95 GWh of electricity according to Energy Regulatory Office data, which represents about 2.5 PJ and less than 1% of energy consumption from fuel combustion. The carbon intensity of transport remains high, partly due to the only marginal use of alternative fuels and propulsions, and transport development is not yet on track to meet the ambitious climate targets set for 2030 and 2050.

Diesel, which is the least friendly fuel in terms of the environment and climate, accounted for 68.5%, i.e. more than two-thirds, of total transport energy consumption in 2020. In addition, diesel consumption more than doubled (142.0%) in the 2000–2019 period, with the development of diesel consumption influenced in particular at the beginning of this period by the growth in road freight transport and the increasing share of diesel in the passenger car fleet. In 2020, diesel consumption declined by 5.1% year-on-year to 4.3 mil. t. **Petrol consumption** has been slowly declining since 2000, but in the short term of the last 5 years (2016–2020) there has been a clear recovery in petrol demand associated with significantly higher sales of petrol-powered passenger cars compared to diesel-powered cars. In 2020, however, petrol consumption fell by 8.1% to 1.4 mil. t due to the decline in passenger car transport.

The modest growth in **LPG consumption** at the beginning of the 21st century came to a halt around 2015, and consumption of this alternative petroleum-based fuel began to decline gradually, falling by a significant 15.8% in 2020. CNG consumption, on the other hand, showed a steep, order-of-magnitude, increase after 2000, with CNG consumption doubling since 2010. Consumption of aviation kerosene is closely linked to developments in air transport, and with the COVID-19 pandemic affecting air transport the hardest of all transport modes, kerosene consumption fell by 72.4% year-on-year in 2020 (air transport performance fell by 83.9%, to less than a fifth of 2019).

Chart 67

Energy consumption in transport by fuel in the Czech Republic [PJ], 2000–2020

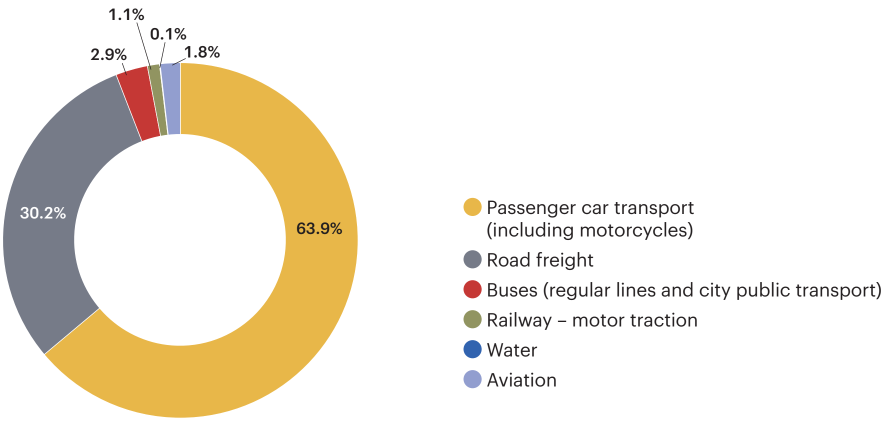


Data source: Transport Research Centre

Road transport accounted for 97% of total transport energy consumption in 2020 (Chart 68), with a year-on-year increase in the share of road transport of around 4 percentage points due to the decline in air transport. Within road transport, **passenger cars** are the largest energy consumer and thus source of greenhouse gas emissions in transport, together with motorcycles accounting for more than two-thirds of total transport energy consumption in 2020.

Chart 68

Energy consumption in transport in the Czech Republic by mode [%], 2020



Data source: Transport Research Centre

Although the use of **electromobility** in the Czech Republic is growing dynamically, it remains marginal, especially in passenger transport. In 2020, 2,866 new EVs were registered (more than triple the number from the previous year), with an EV market share of 1.4%. A total of 12,674 hybrids (all types including plug-in hybrids) were registered, representing 6.2% of the total number of new cars registered in 2020. The development of electromobility continues in public road transport, with a total of 54 electric buses in operation in public transport in 2020, according to data from the Association of Transport Enterprises. Extensive plans for the use of electric buses have been made by the Prague Public Transit Co, Inc., which plans to purchase another 14 electric buses in 2021, with the aim of having one-third of buses powered by electric propulsion by 2030.

2.1.2 | Energy efficiency[6]

Key question

Are energy efficiency targets being met and is the energy intensity of the economy falling? Is the technology for heating homes and insulating buildings being replaced?

Key messages

The energy intensity of the economy is decreasing.

Both primary energy consumption and final energy consumption in 2019 were within the range to meet the 2020 targets.

The structure of primary energy sources still differs considerably from the target values, with solid and liquid fuels having a higher share and other sources having a lower share.

The Czech Republic's energy import dependence is increasing significantly, reaching 40.9% in 2019.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Energy intensity of the economy*				
Development of the energy intensity of the economy	N/A	↘	↘	~
Structure of the primary energy sources	N/A	○	○	~
Energy efficiency	N/A	~↗	~↗	✓
Import energy dependence	N/A	↗	↗	✓

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

Energy intensity of the economy

Primary energy resources are the sum of domestic or imported energy resources expressed in energy units, and represent one of the basic indicators of the energy balance.

The 2015 State Energy Concept of the Czech Republic aims to achieve a **diversified mix of primary energy sources** by 2040, with a target structure in the following corridors: nuclear fuel 25–33%, solid fuels 11–17%, gaseous fuels 18–25%, liquid fuels 14–17%, renewable and secondary sources 17–22%. However, the actual structure of the primary energy sources still differs considerably from these targets, with solid and liquid fuels having a higher share and other sources having a lower share (Chart 69).

[6] *Data for the year 2020 are not available at the time of publication.*

Solid fossil fuels are still the most important item in the energy mix in the Czech Republic, thanks to domestic coal mining, which is traditional in the Czech Republic due to the rich reserves of this raw material on our territory. In 2019, solid fossil fuels accounted for 33.6% of total primary energy sources. However, this share is declining along with the efforts to decarbonise the energy sector and with the decline in coal generation, and these sources are gradually being replaced by other, more environmentally friendly ones.

Oil and petroleum products accounted for 22.2% in 2019. The State Energy Concept target is to reduce their share to values in the range of 14% to 17%, but the medium- and short-term trend is in the opposite direction, with their share in the energy mix increasing.

The closest to the required share (18–25%) is **natural gas**, which was 16.8% in 2019 and has not changed much in recent years.

Nuclear energy accounted for 17.7% of the energy mix in 2019. The current State Energy Concept foresees an increase in the share of nuclear power in primary energy sources to 25–33%. On the basis of this report, a National Action Plan for the Development of Nuclear Energy in the Czech Republic was drawn up, which elaborates further development of these sources in the Czech Republic, including the construction of new nuclear blocks to increase existing capacity.

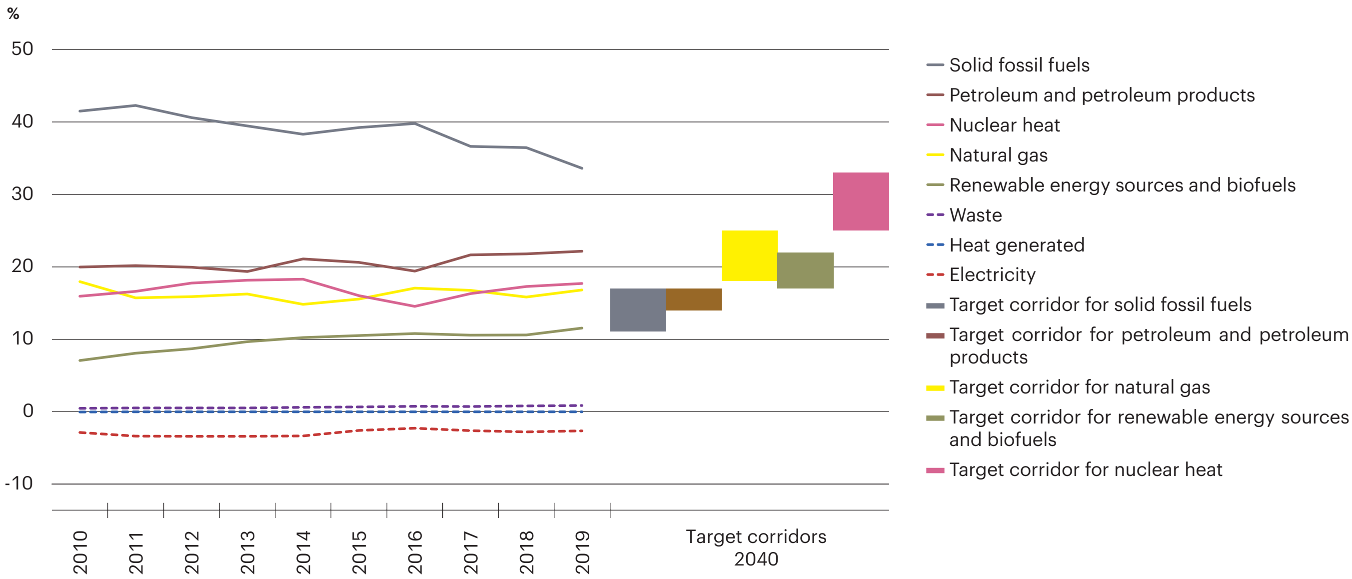
Renewable energy sources and biofuels accounted for 11.5% of primary energy sources in 2019. Their share is growing significantly and it can be assumed that the set targets for the share of RES can be achieved by 2030.

In the context of the energy balance, **waste** is waste that is not materially recoverable. This is a source of energy when the heat generated is used in waste incineration plants. It accounted for 0.8% of the primary energy sources structure in 2019, and no targets have been set for it.

The **Produced** Heat and **Electricity** categories have negative values in the primary energy sources balance sheet, as electricity is exported abroad and generated in the Czech Republic from the above-mentioned sources. There is no primary source of heat in the Czech Republic yet, however geothermal energy is potentially one. Its -0.002% share in the structure of primary energy sources is the result of foreign trade.

Chart 69

Share of primary energy sources in the Czech Republic and target corridors for 2040 [%], 2010–2019



Data for the year 2020 are not available at the time of publication.
The target corridors for each energy mix source are plotted in the right part of the chart in the corresponding colours. No targets are set for waste, electricity and heat generated (dotted lines).

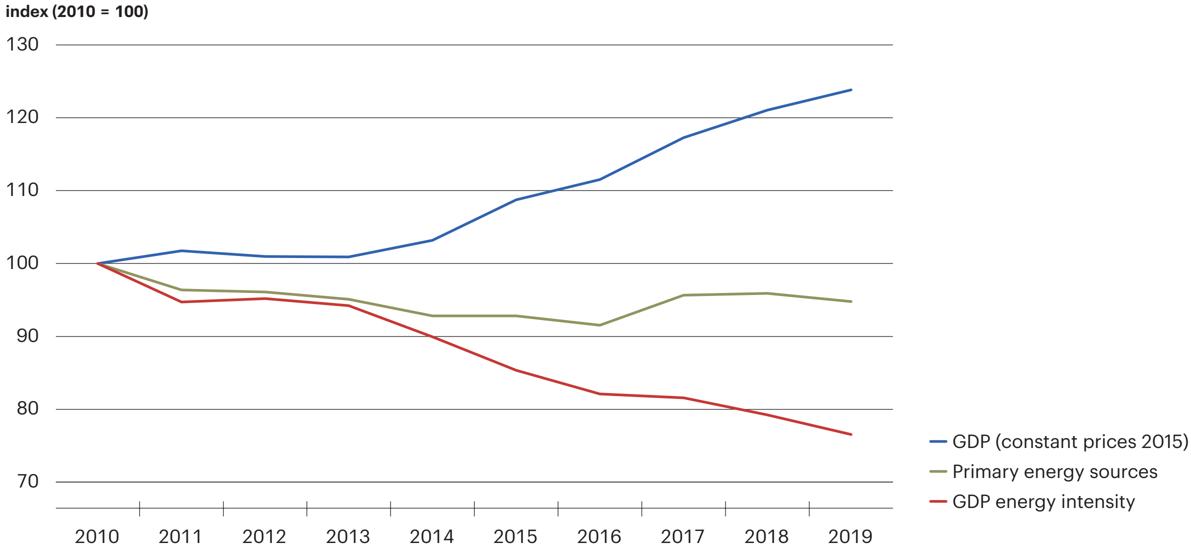
Data source: Ministry of Industry and Trade of the Czech Republic

The **energy intensity of the economy** represents the energy consumption of the national economy and the efficiency of energy use, expressed as the amount of energy consumed per unit of gross domestic product. The long-term target is to reduce energy consumption in all areas of human activity by increasing the efficiency of appliances, introducing energy-saving technologies and reducing waste. These steps are aimed at increasing energy security and self-sufficiency.

In the medium term (2010–2019), the energy intensity of the Czech economy is declining at an average rate of 2.6% per year, while in the short term (2015–2019) the decline is slower at 2.4% per year. This development is mainly due to GDP growth[7], as the consumption of primary energy resources is only declining at a moderate pace and even increased in 2017 and 2018 (Chart 70). In 2019, consumption of primary energy sources fell by 1.2% year-on-year to 1,783.5 PJ, while GDP grew by 2.3% to CZK 5,266.5 bil. This led to an overall year-on-year decrease in energy intensity by 3.4% to 338.7 MJ.thous. CZK^{-1}.

Chart 70

GDP energy intensity in the Czech Republic [index, 2010 = 100], 2010–2019



Data for the year 2020 are not available at the time of publication.

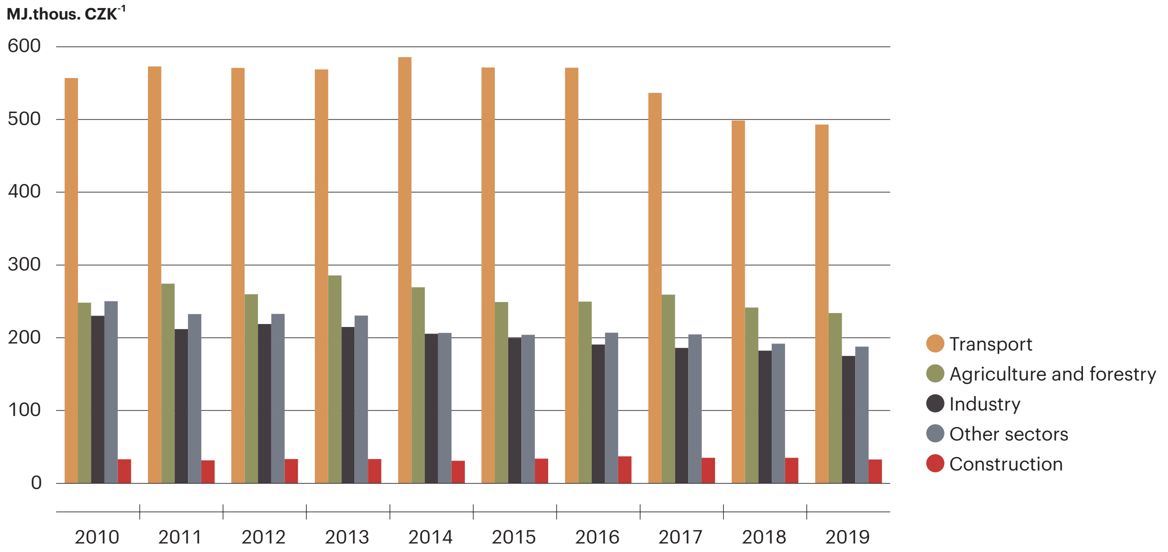
Data source: Czech Statistical Office, Ministry of Industry and Trade of the Czech Republic

When comparing the **energy intensity of different sectors** of the national economy (Chart 71), transport has the highest values, followed by agriculture, and forestry and industry. However, the high energy intensity of transport is distorted by the inclusion of individual car transport, which makes no contribution to economic performance. Over the 2010–2019 period, energy intensity declined in all sectors. The largest decline was in industry (24.0%), followed by transport (11.5%) and then agriculture and forestry (5.7%). It also decreased in the Other sectors category, by 24.9%. Energy intensity also decreased year-on-year in all sectors. Efforts to reduce energy intensity are driven by social, economic and legislative pressures, and in all areas of human activity.

[7] *GDP by expenditure method, constant prices 2015*

Chart 71

Energy intensity of individual sectors in the Czech Republic [MJ.thous. CZK^{-1}], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Statistical Office, Ministry of Industry and Trade of the Czech Republic

Energy efficiency

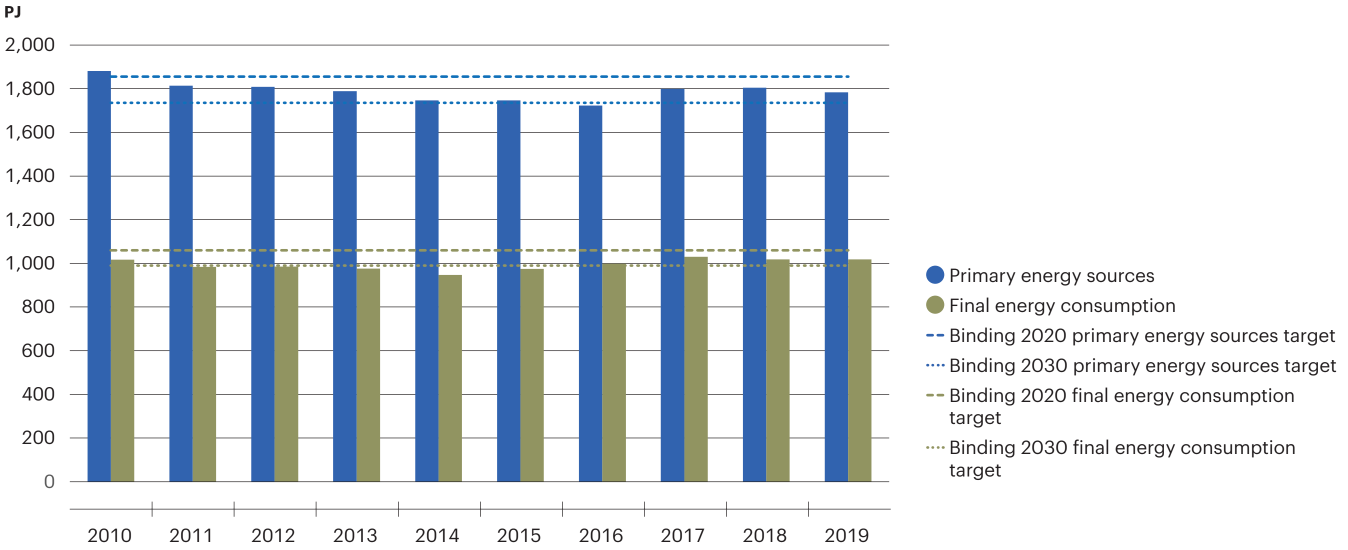
Energy efficiency is an indicator that tracks energy savings. Within the framework of energy efficiency, binding targets are set for primary energy sources of 1,855 PJ to 2020 and 1,735 PJ to 2030. Further targets are set for maximum final energy consumption, which should not exceed 1,060 PJ in 2020 and 990 PJ in 2030.

The **consumption of primary energy sources** in the Czech Republic in the medium term (2010–2019) decreased by 2.5% from 1,881.4 PJ in 2010 to 1,783.5 PJ in 2019, with a year-on-year decrease of 1.2% in 2019 (Chart 72). The 2020 target (not to exceed 1,855 PJ) was already met in 2011 and has not been exceeded since. However, to meet the 2030 target (not to exceed 1,735 PJ), further efficiency measures need to be implemented.

Final energy consumption has been below the target maximum value (1,060 PJ) throughout the monitored period since 2010, with a value of 1,018.0 PJ in 2019. Given the fluctuating trend with a slightly increasing tendency, achieving the 2030 target (990 PJ) will require further efforts.

Chart 72

Primary energy sources consumption and final energy consumption compared to 2020 and 2030 targets in the Czech Republic [PJ], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Ministry of Industry and Trade of the Czech Republic

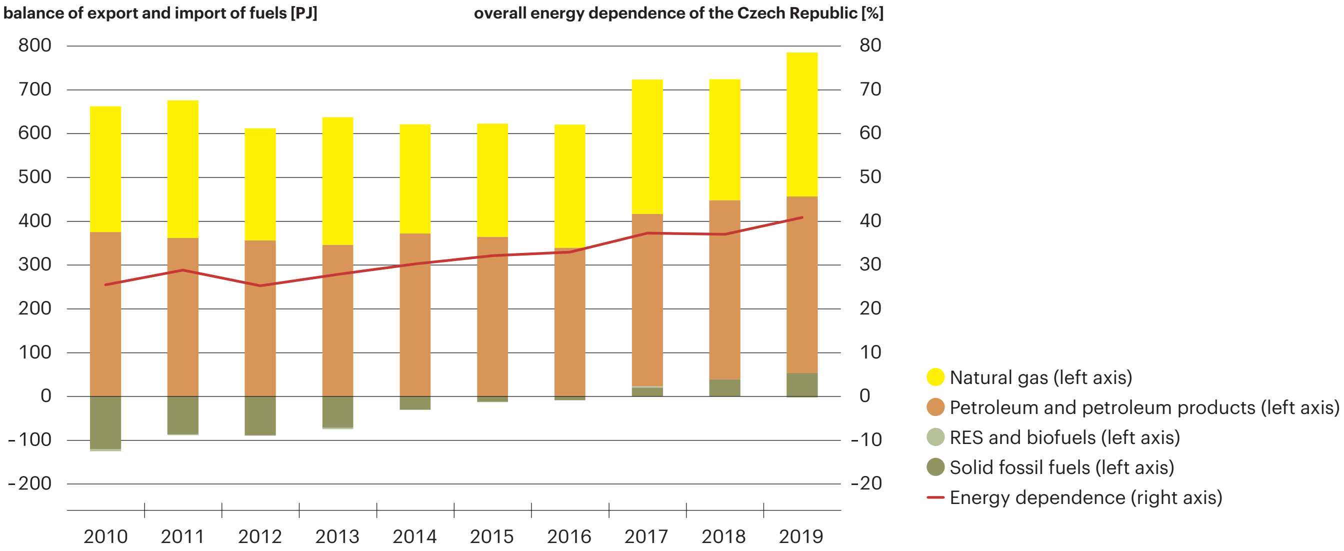
Import energy dependence

A fundamental condition for energy consumption is its **availability**. The Czech Republic has been self-sufficient in solid fossil fuel consumption in recent years thanks to lignite and hard coal mining. However, since 2017, due to the decline in extraction, domestic consumption has exceeded generation and some has had to be 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.

Energy dependence is an indicator of the extent to which an economy is forced to rely on importing energy or energy sources to meet its energy needs. In general, maximum self-sufficiency is advantageous, as it guarantees the energy security of the State. The Czech Republic has set a target of not exceeding 65% energy import dependence to 2030 and 70% to 2040. In 2019, this share was 40.9%, but it is increasing significantly and, if this trend continues at the current rate, it will exceed 65% in 2035 and 70% in 2038 (Chart 73).

Chart 73

Balance of exports and imports of individual fuels, import energy dependence of the Czech Republic [PJ, %], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Ministry of Industry and Trade of the Czech Republic

2.1.3 | Use of renewable energy sources

Key question

Is the share of renewable energy sources in energy generation increasing? Is the use of RES in transport increasing?

Key messages

10,291.1 GWh of electricity was generated from renewable energy sources in 2020, a year-on-year increase of 2.6%.

The target for the share of RES in total final energy consumption of 13% by 2020, set out in the State Environmental Policy 2012–2020, has been met since 2013; in 2019[8] the value for the Czech Republic was 16.2%.

The generation of heat from renewable energy sources in the Czech Republic grew significantly in the monitored period, with an annual increase of 9.3% in 2019[9], while the generation of heat from RES increased by 162.6% in the 2010–2019 period.

The consumption of RES in transport in the Czech Republic is increasing significantly.

The share of RES in electricity generation was 12.6% in 2020, the State Energy Concept target is to achieve a share in the range of 18% to 25% by 2040.

Consumption of biofuels alone (e.g. E85) is negligible. Most biofuels consumption is due to their mandatory blending into petrol and diesel.

Meeting the target of 10% RES energy in transport by 2020 is uncertain, and the target was not met in 2019.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Renewable energy sources	↗	↗	↗	✓
Consumption of RES in transport	↗	↗	↗	~

Renewable energy sources

Renewable energy sources include wind energy, solar energy, potential water energy, geothermal energy and biomass energy. Although these are inexhaustible resources, their availability is limited in time and space due to their dependence on climatic, meteorological and geographical conditions. The generation of electricity and heat from these sources is thus limited by these factors and at the same time is difficult to regulate according to current market demand. Nevertheless, RES are advantageous in terms of energy security and sustainable development.

Electricity generation from renewable energy sources grew sharply in the 2008–2013 period, when these sources were widely promoted due to the implementation of political decisions in international and national strategies and targets. Since 2014, however, the rate of growth has slowed (Chart 74) and the year-on-year increase is no

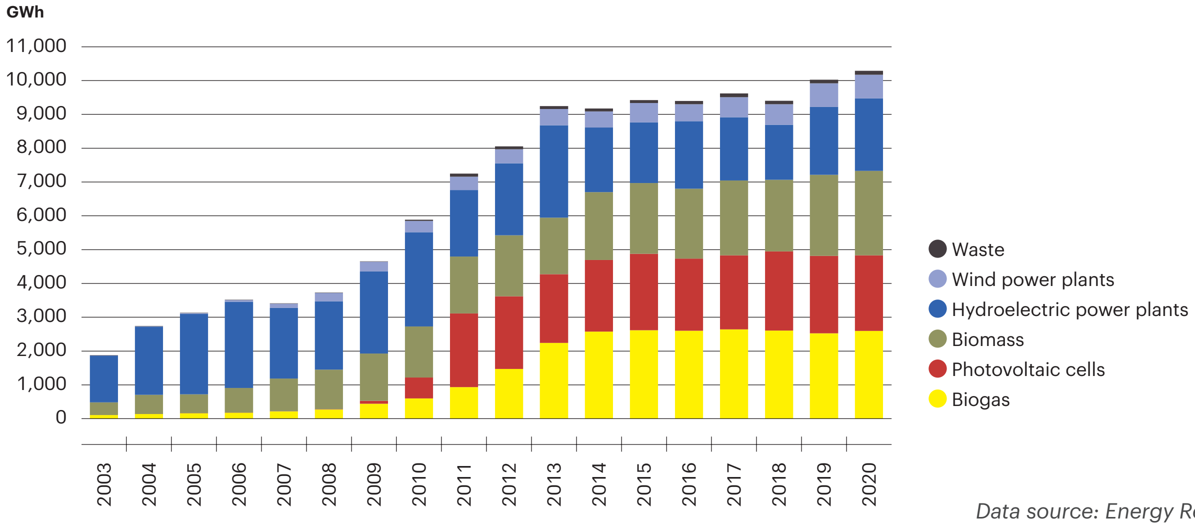
[8,9] *Data for the year 2020 are not available at the time of publication.*

longer as steep. In 2020, 10,291.1 GWh of electricity was generated from renewable energy sources, a year-on-year increase of 2.6%.

The generation of electricity from RES is relatively extensive in terms of sources and their share is relatively balanced. In 2020, most electricity from renewable energy sources was generated from biogas (25.2%, 2,594.7 GWh), followed by biomass (24.3%, 2,498.9 GWh), photovoltaic power plants (21.7%, 2,235.1 GWh), and hydroelectric power (20.8%, 2,143.9 GWh, excluding pumped storage). There was less electricity generation from wind power plants (6.8%, 699.1 GWh) and from waste (1.2%, 119.4 GWh).

Chart 74

Electricity generation from RES in the Czech Republic [GWh], 2003–2020

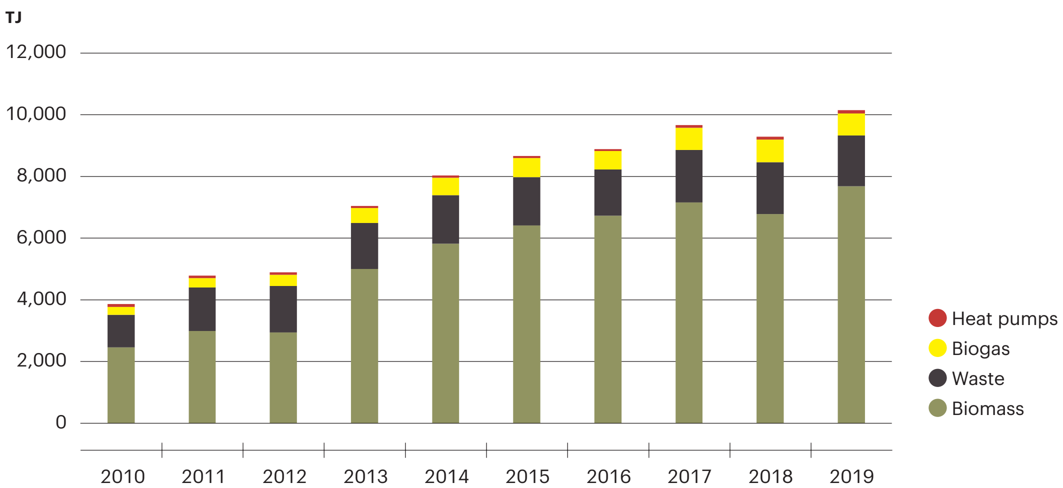


Data source: Energy Regulatory Office

The **generation of heat from renewable energy sources** in the Czech Republic grew significantly in the monitored period (Chart 75). In 2019[10], 10,151.2 TJ was generated, an annual increase of 9.3%, while heat generation from RES even increased by 162.6% in the 2010–2019 period. Biomass clearly dominates this category, accounting for 75.7% in 2019. The largest share is accounted for by local household heating burning wood. Other heat sources are waste (16.2%), biogas (7.0%) and heat pumps (1.1%).

Chart 75

Gross heat generation from RES and biofuels in the Czech Republic [TJ], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: Ministry of Industry and Trade of the Czech Republic

[10] *Data for the year 2020 are not available at the time of publication.*

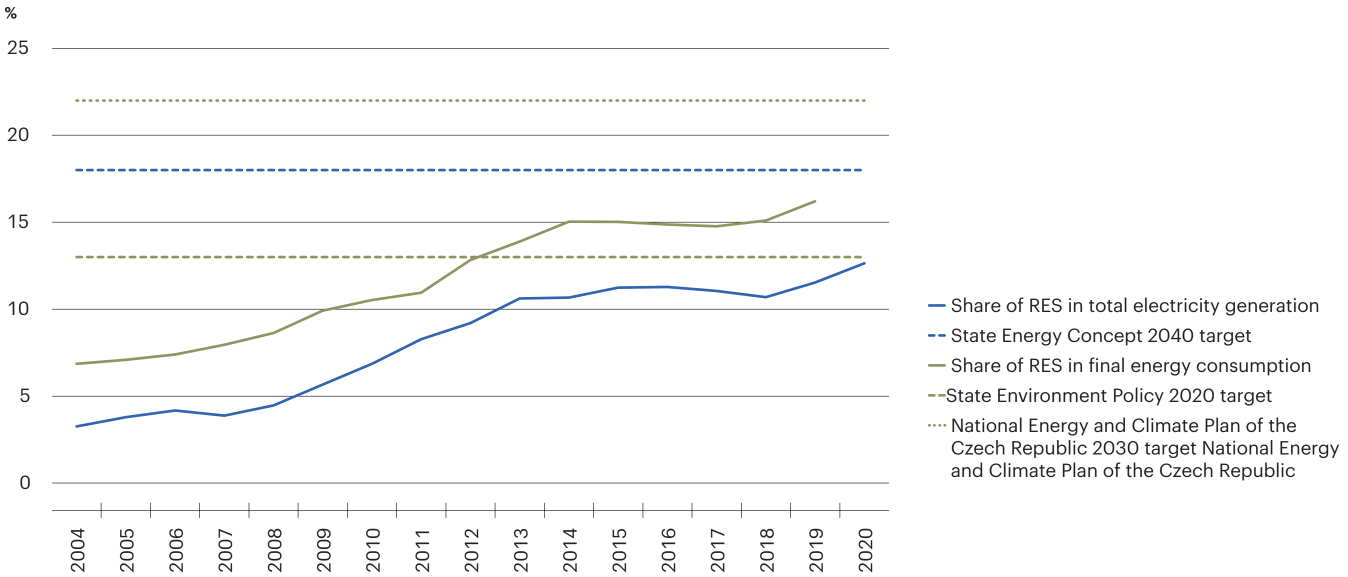
The following strategic targets have been set for renewable energy in the Czech Republic. The State Environmental Policy of the Czech Republic adopted the target resulting from Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable energy sources, i.e. a 13% **share of RES in gross final energy consumption** by 2020. In 2019[11] the value for the Czech Republic was 16.2%, while the indicative target was already met in 2013. Another milestone is 2030, for which the Czech National Energy and Climate Plan sets a target of 22%.

The second indicator for renewable energy sources resulting from the State Energy Concept, is to achieve a **share of RES in electricity generation in the range of 18% to 25% by 2040**. In 2020, this share was 12.6% (Chart 76).

The 2030 **sectoral indicative target for heating and cooling** is based on increasing the share of energy from RES in heating and cooling by 1.1 or 1.3 percentage points per year (without or with waste heat). In 2019[12], there was a year-on-year increase of 2.0 percentage points

Chart 76

Renewable energy sources targets and their fulfilment in the Czech Republic [%], 2004–2020



The State Energy Concept of the Czech Republic target for 2040 is to ensure a share of annual electricity generation from RES and secondary sources in the range of 18–25% – only the lower limit, i.e. 18%, is marked on the chart.

Data for the share of RES in final energy consumption for the year 2020 are not available at the time of publication.

Data source: Energy Regulatory Office, Ministry of Industry and Trade of the Czech Republic

[11, 12] *Data for the year 2020 are not available at the time of publication.*

Consumption of RES in transport

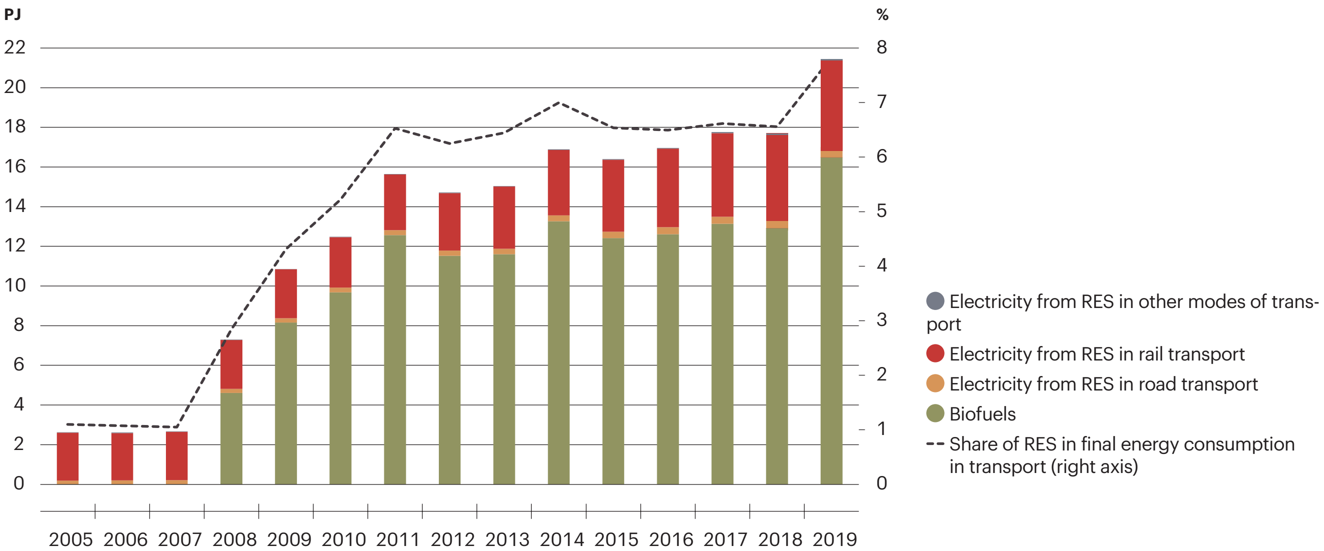
The growing use of **RES in transport** is a crucial tool for reducing the dependence of transport on fossil energy sources, reducing the carbon intensity of transport and greenhouse gas emissions, and thus moving towards climate neutrality. Binding targets for the share of RES in final energy consumption in transport are set by Directive 2009/28/EC and Directive 2018/2001/EU. These targets, including their implementation, are part of the National Renewable Energy Action Plan and are set at 10% RES energy in transport by 2020 and 14% RES energy by 2030.

According to the internationally harmonised SHARES methodology[13], **RES energy consumption** in transport had a significantly increasing trend in the 2005–2019 period[14]. In the last 5 years of this period (2015–2019), RES energy consumption increased by 31.0%, and by 20.9% year-on-year in 2018–2019 to 21.5 PJ, indicating an acceleration in RES use in transport at the end of the monitored period. In 2019, the largest share of RES energy consumption in transport was accounted for by biofuels with 76.7%, while the share of RES electricity consumed in rail transport (including railway types of city public transport) was 21.2%, and RES electricity in road transport accounted for only 1.8%.

The development of the **share of RES in the final energy consumption in transport** was influenced by the growth of total energy consumption in transport in the 2005–2019 period (see the Energy and Fuel Consumption in Transport indicator). For this reason, the share of RES stagnated after 2011 and only increased at the end of the monitored period by 1.2 percentage points year-on-year to 7.8% (Chart 77). Thus, the target of 10% RES energy in transport by 2020 had not been met in 2019. The likelihood of reaching the 2020 target, for which data are not yet available, is increased by the year-on-year growth in biofuel consumption in 2020 (especially FAME, see below), and the projected decline in total transport energy consumption due to the COVID-19 pandemic (a reduction in diesel and petrol consumption). If the current trend of the share of RES in transport continued, the target of 14% RES energy in transport would be reached around 2030, yet this prediction contains many uncertainties, mainly related to economic development. In addition, the current target setting is not very ambitious in terms of meeting the 2030 climate targets, and a revision of the targets can be expected.

Chart 77

Energy consumption from RES in transport in the Czech Republic and share of RES in final energy consumption in transport [PJ, %], 2005–2019



Data for the year 2020 are not available at the time of publication.

Data source: Ministry of Industry and Trade of the Czech Republic, Eurostat

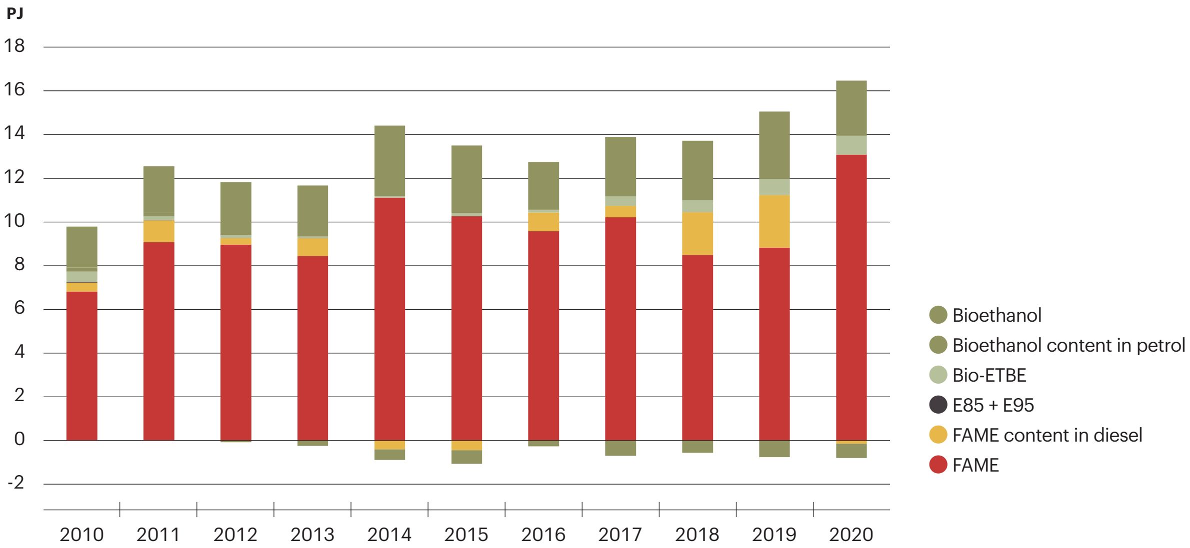
[13] *SHARES (Short Assessment of Renewable Energy Sources) methodology, in line with Directive 2009/28/EC and Directive 2018/2001/EU. Multipliers are used to calculate the energy consumption of each mode of transport, and these also vary according to the generation of biofuels. For this reason, the energy balance data for biofuels are not consistent with the SHARES data. SHARES data for the year 2020 are not available.*

[14] *Data for the year 2020 are not available at the time of publication.*

Biofuels are an essential renewable source of energy in transport, and their consumption is increasing; at the end of the assessment period, the biofuel consumption in transport had increased in the short term (the last 5 years) at the rate of about 6% per year, and in 2020 biofuel consumption increased by 9.7% year-on-year to 15.7 PJ (Chart 78). However, most biofuel consumption is due to its mandatory blending in petrol and diesel, and sales of high-percentage biofuels are negligible. Among individual biofuels, the consumption of FAME, a biocomponent of diesel, is growing significantly and, including the balance of FAME in imports and exports of fuels, increased by 24.0% in the 2016–2020 period and by 15.1% in the latest year-on-year comparison to a total of 12.9 PJ (349.5 thous. t). The consumption of bioethanol added to petrol (including bio-ETBE and bioethanol content in the balance of foreign trade in fuels) fluctuated during this period in relation to the evolution of petrol consumption. In 2020, bioethanol consumption declined by 10.3% to 2.7 PJ (101.6 thous. t) due to a decline in passenger car transport as a result of measures taken in connections with the COVID-19 pandemic and the subsequent economic recession.

Chart 78

Biofuels consumption in the Czech Republic and balance of imports and exports of biofuels in finished fuels [PJ], 2010–2020



FAME data for 2020 include HVO (hydrogenated vegetable oils) consumption.

Source: Ministry of Industry and Trade of the Czech Republic

Greenhouse gas emissions and their economic factors in an international context[15]

Key messages

The energy intensity of the EU28 economy decreased from 5.6 to 4.0 TJ.(EUR mil.)$^{-1}$ over the 2010–2019 period, i.e. by 28.6%.

In total 14 of EU28 countries, including the Czech Republic, achieved their national renewable energy target.

All EU28 countries report a decline in the energy intensity of their economies over the 2010–2019 period.

The share of renewable energy sources in final consumption in the EU28 is growing, at 18.9% in 2019 against a target of 20% for the EU28 as a whole by 2020. Fourteen of EU28 countries, including the Czech Republic, have already achieved their national targets.

Per capita greenhouse gas emissions and the emissions intensity of the economy in the Czech Republic are above average in the European context.

The Czech Republic is below the EU average when it comes to the use of RES in transport.

Greenhouse gas emissions in an international context

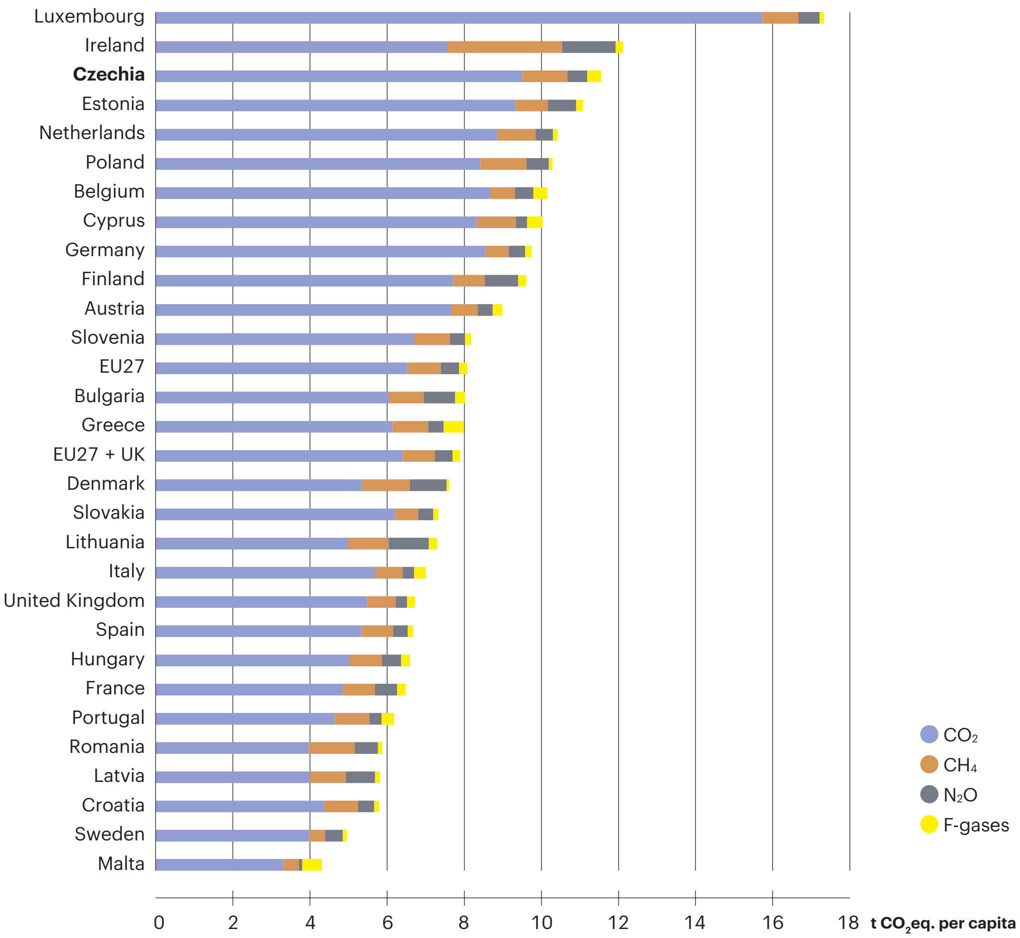
The Czech Republic has above-average **greenhouse gas emissions per capita and per unit of GDP** (emissions intensity of the economy) in the European context. This fact results from the nature of the Czech economy with its high share of industry in GDP and from the significant share of coal in the energy mix. Total EU28 emissions (excluding LULUCF, including indirect CO_2 emissions) fell by 28.3% in the 1990–2019 period. The Czech Republic accounted for 3.0% of total EU28 emissions in 2019, with Germany accounting for the largest share at 19.9%.

Per capita greenhouse gas emissions in the Czech Republic (11.6 t CO_2 eq. per capita) were the third-highest in the EU28 (after Luxembourg and Ireland) in 2019 and were 46.2% above the EU28 average (Chart 79). The **emissions intensity of GDP generation** in the Czech Republic in 2019 was the fourth-highest in the EU28 (after Bulgaria, Poland and Estonia), with specific greenhouse gas emissions per unit of GDP reaching 0.39 t CO_2 eq.1000 PPS^{-1}, 58.9% higher than the average emissions intensity of the EU28 countries.

[15] *Data for the year 2020 are not available at the time of publication.*

Chart 79

Greenhouse gas emissions per capita in EU28 countries [t CO_2 eq. per capita], 2019



Data for the year 2020 are not available at the time of publication.

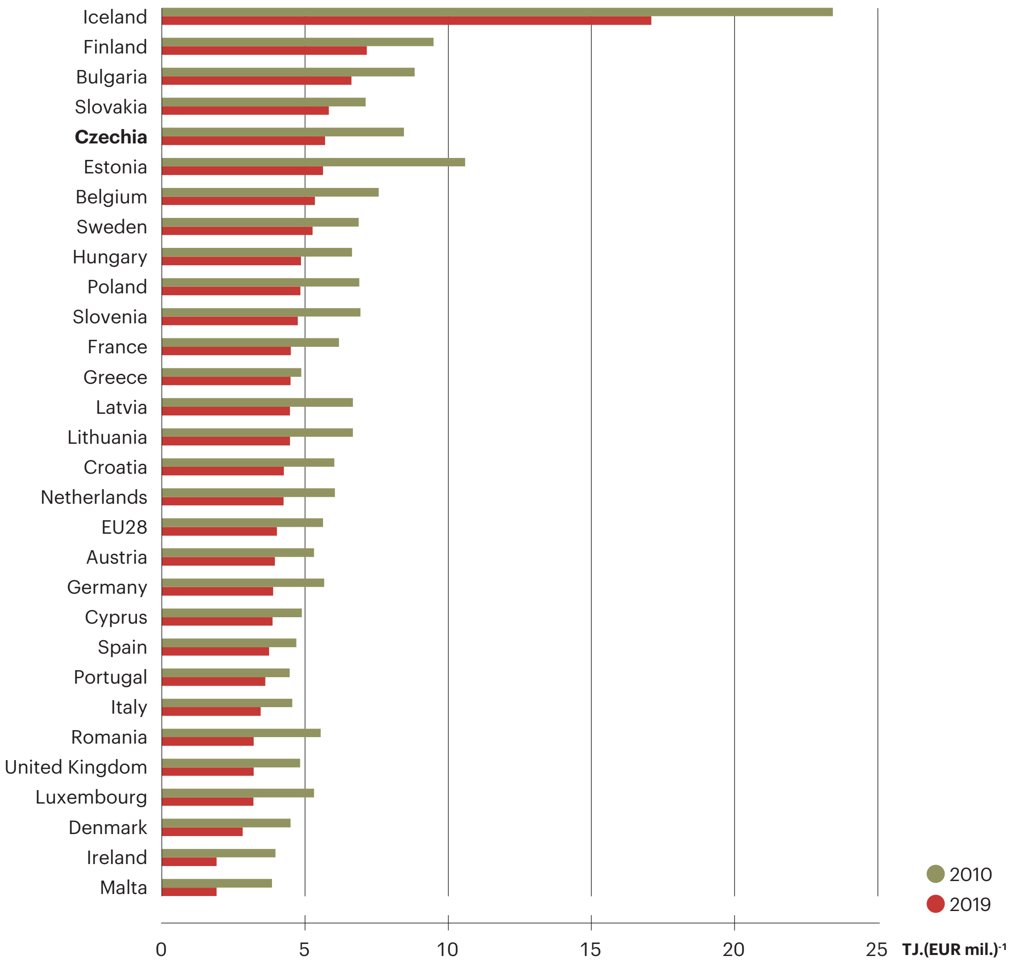
Data source: EEA

Energy intensity of the economy in an international context

The **energy intensity of the EU28 economy** (Chart 80) is decreasing significantly. Over the 2010–2019 period, it fell from 5.6 to 4.0 TJ.(EUR mil.)$^{-1}$, i.e. by 28.6%. This trend was influenced by improvements in energy efficiency, both in energy generation and at end-user level. National economies are undergoing changes, including, for example, a shift from energy-intensive to less energy-intensive industries, and an increase in the share of services in GDP. All EU28 countries without exception reported a decline in the energy intensity of their economies over the 2010–2019 period. In the Czech Republic during this period, the energy intensity of the economy fell from 8.5 to 5.7 TJ.(EUR mil.)$^{-1}$, i.e. by 32.6%, yet is still 41.7% higher than the EU28 average. The main reason for this is the significant position of energy-intensive industry in the Czech Republic's GDP.

Chart 80

Energy intensity of the economy in EU28 countries [TJ.(EUR mil.)$^{-1}$], 2010, 2019



Data for the year 2020 are not available at the time of publication.

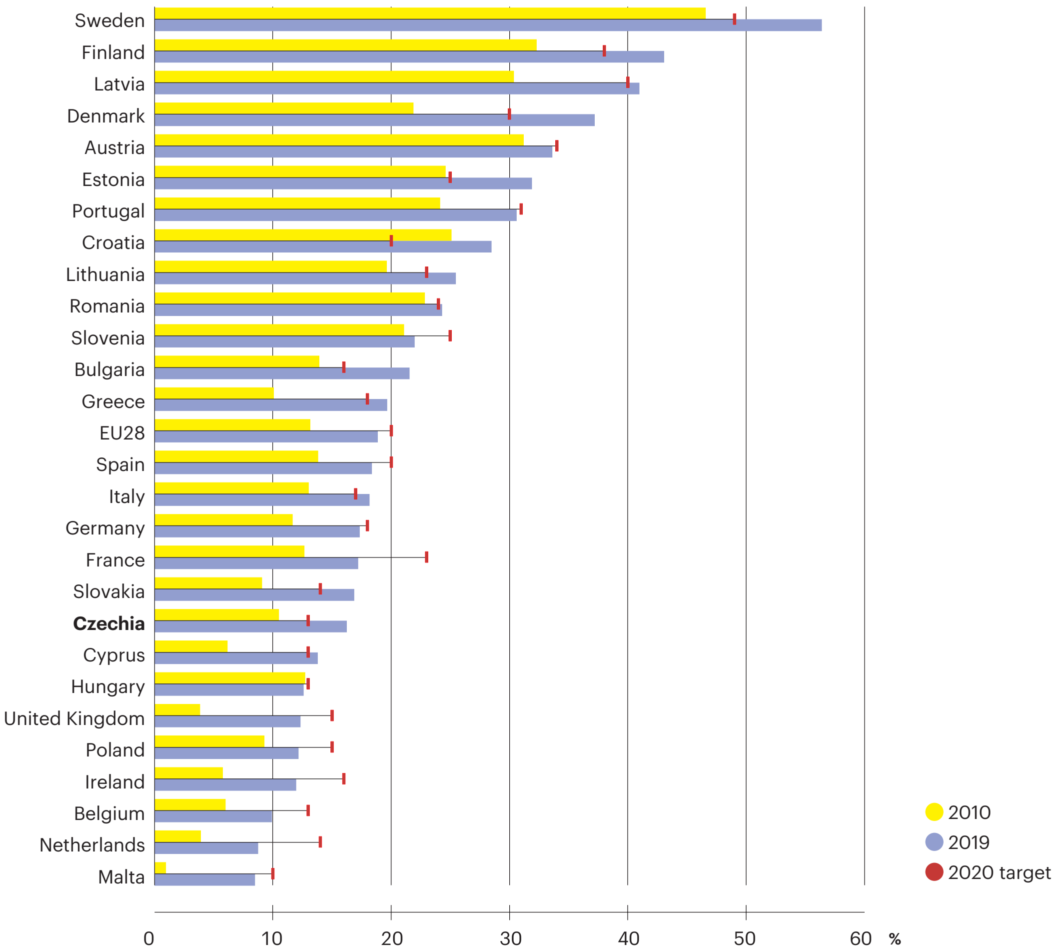
Source: Eurostat

Renewable energy sources in an international context

The **share of renewable energy sources (RES) in final energy consumption** in the EU28 rose from 18.0% to 18.9% in 2019, up from just 13.2% in 2010 (Chart 81). EU Member States have set a target of 20% of final energy consumption from renewable energy sources by 2020. However, due to the differing potential of renewable energy sources, individual countries have set their own national targets for which national action plans have been drawn up, including the measures to achieve these targets. Denmark, Finland and Estonia, for example, make extensive use of offshore and onshore wind farms to generate electricity. After the Fukushima nuclear accident, Germany is shutting down its nuclear power plants and trying to replace them with renewable energy sources – it is developing photovoltaics and plans to add offshore wind power to its energy mix. Due to the morphological conditions, Austria relies on hydropower and thanks to pumped-storage plants can well regulate RES with larger generation fluctuations (photovoltaics and wind). In 2019, 14 EU28 countries, including the Czech Republic, achieved their national renewable energy targets. The share of renewable energy sources in final consumption in the Czech Republic reached 16.2% in the comparative year 2019 against a national target of 13% by 2020.

Chart 81

Share of renewable energy sources in final energy consumption in EU28 countries and 2020 target [%], 2010, 2019



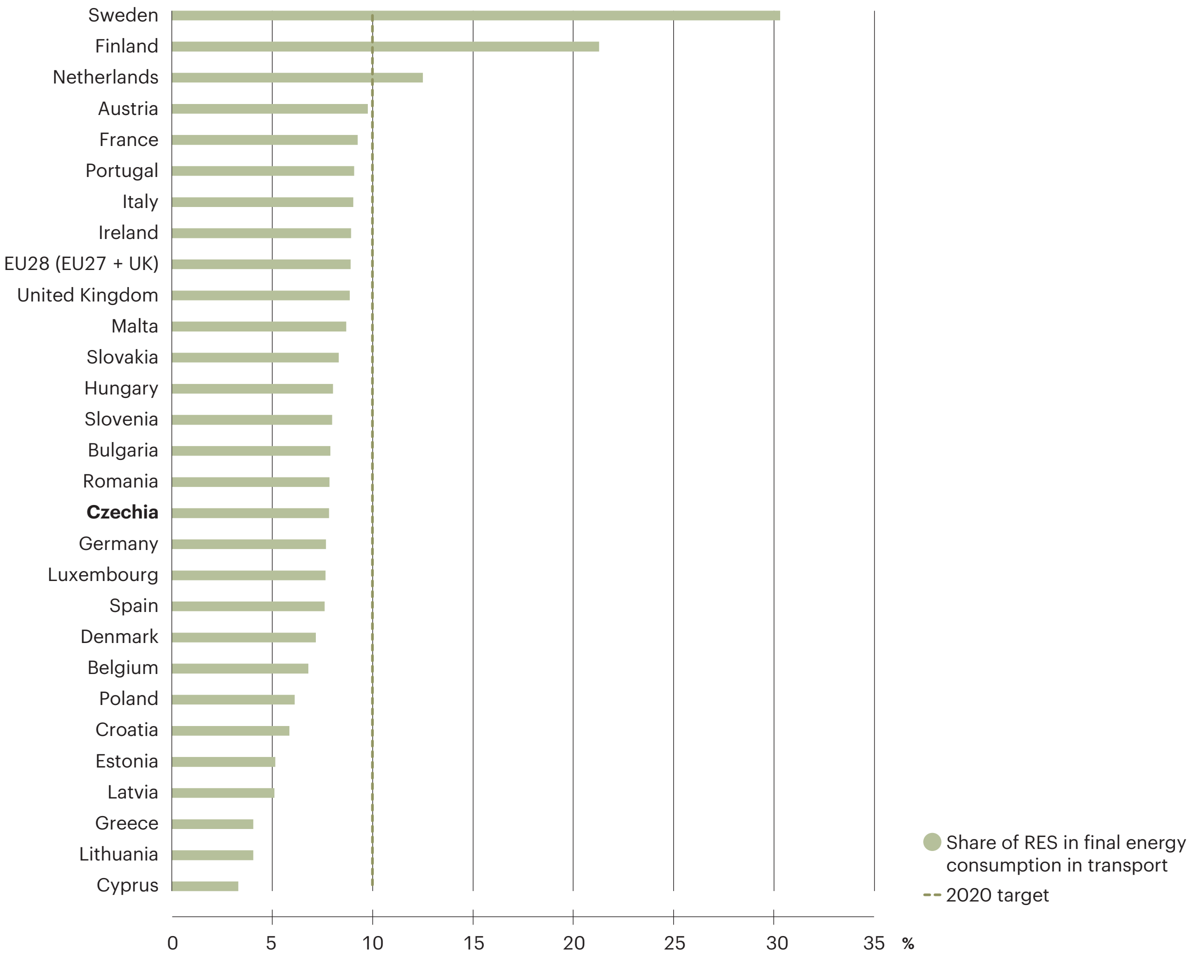
Data for the year 2020 are not available at the time of publication.

Source: Eurostat

Of the EU28, only three countries met the target of 10% **RES energy in transport** by 2019 (Chart 82), while Austria is close to meeting the target. The Czech Republic is slightly below the EU average when it comes to the use of RES in transport, with EU28 countries having a RES share of 8.9% in 2019 (Czech Republic 7.8%). The Scandinavian countries have the highest share of RES in transport, with Sweden having a share of close to one third (30.3%).

Chart 82

Share of RES energy in final energy consumption in transport in EU28 countries [%], 2019



Data for the year 2020 are not available at the time of publication.

Source: Eurostat

2

Climate neutral and circular economy

2.2 | Transition to a circular economy

2.2 | Transition to a circular economy

The circular economy uses waste as a source for recovery (material, energy), which makes it possible to reduce the environmental burdens associated with the extraction of materials and to contribute to achieving a climate-neutral economy. The transition to a circular economy can be assessed using the material flow accounts methodology at the macroeconomic level (Economy-Wide Material Flow Analysis, EW-MFA) and waste management data, whereby increasing the material recovery of waste at the expense of landfilling is fundamental to the circular economy. The assessment of material flows enables a comprehensive assessment of the natural resource intensity of the economy and the level of environmental burdens associated with the consumption and processing of raw materials and materials.

Overview of selected related strategic and legislative documents

Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives
- increasing the level of preparation for reuse and recycling of municipal waste to at least 55% by weight by 2025 (60% by 2030, 65% by 2035)
- minimising the adverse effects of waste generation and treatment on the environment and human health
- supporting the application of the waste treatment hierarchy

Council Directive 1999/31/EC on the landfill of waste
- reducing the amount of municipal waste landfilled to 10% (by weight) or less of the total amount of municipal waste generated by 2035

Directive 94/62/EC of the European Parliament and of the Council on packaging and packaging waste
- preventing packaging waste by reducing the total volume of packaging

Europe 2020
- efficiently using resources, creating a knowledge base and analytical apparatus for monitoring resource use efficiency
- creating a circular economy based on the use of secondary raw materials as resources
- reducing the material intensity of the economy

Renewed EU Sustainable Development Strategy
- improving resource efficiency to reduce the overall use of non-renewable natural resources and the environmental impact of raw material use
- transitioning to a low-carbon and low-material-input economy, based on resource-efficient technologies and sustainable consumer behaviour

EU Circular Economy Action Plan
- transitioning to a circular economy in which the value of products, materials and resources in the economy is preserved for as long as possible and in which waste is minimised

Government Regulation No. 352/2014 Coll., on the Waste Management Plan of the Czech Republic for the period 2015–2024
- preventing waste and reducing specific waste generation, including hazardous waste
- maximising the use of waste as a substitute for primary resources and moving towards a circular economy

Czech Republic 2030
- using natural resources efficiently and sustainably
- reducing the environmental impact of material flows
- preferring the use of domestic material sources
- increasing the material efficiency of the economy

Secondary raw materials policy
- increasing the Czech Republic's self-sufficiency in raw material sources by using secondary sources
- including secondary raw materials in the material accounts of the statistical survey

2.2.1 | Material intensity of the economy

Key question

Is the material intensity of the Czech economy decreasing and thus the consumption of materials per unit of GDP?

Key messages

The material intensity of the Czech economy is steadily decreasing.

There is only a relative decoupling of domestic material consumption and economic development.

In 2018[16], the share of secondary raw material production volume in direct material input was 8.3%.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Material intensity of the economy	decreasing	decreasing	decreasing	positive
Share of secondary raw material production volume in direct material input	N/A	fluctuating, increasing	increasing	neutral

Material intensity of the economy

The **material intensity of the economy** has been declining over the long term, falling by 44.2% between 2000 and 2019[17] (Chart 83). Declining material intensity indicates a reduction in the natural resource intensity of the economy as a result of increasing efficiency in converting material inputs into economic output. This development is also associated with a decline in the extraction of raw materials and the consumption of materials per unit of GDP generated. There is also a significant decreasing material intensity trend in the medium term (the last 10 years) and short term (the last 5 years assessed), with material intensity decreasing at an average rate of about 2.6% per year. In 2019, the material intensity of the economy fell by 1.9% to 32.3 kg.(CZK 1,000 GDP)$^{-1}$.

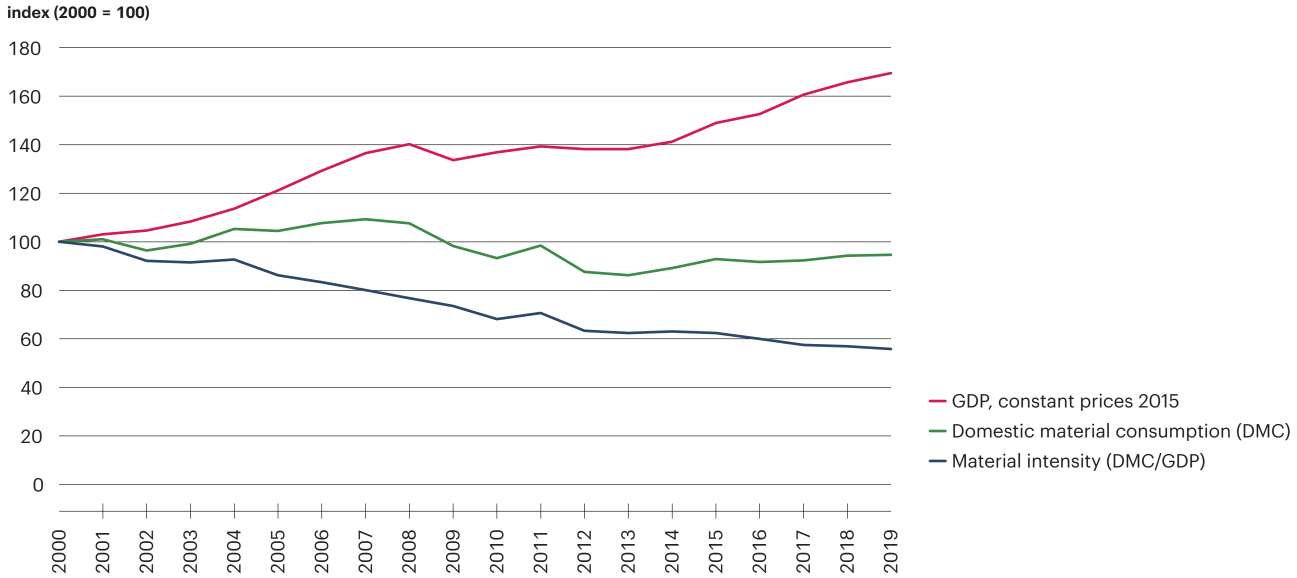
The evolution of material intensity over the 2000–2019 period is referred to as **relative decoupling**, in which the environmental burden represented by domestic material consumption per unit of GDP is declining, but in absolute terms domestic material consumption is heading in the same direction as the economy (i.e. rising when the economy is growing and declining when the economy is decreasing). This is a consequence of the structure of GDP generation in the Czech Republic with a high share of industry and of the fact that economic growth during the 2000–2019 period was significantly influenced by the manufacturing industry and its more material-intensive sectors. **Absolute decoupling**, in which the environmental burden decreases in absolute terms despite economic growth, which is the optimal development from an environmental perspective, was rare during the monitored period. It occurred five times in total during the assessment period, most recently in 2016.

[16] *Data for the years 2019 and 2020 are not available at the time of publication.*

[17] *Data for the year 2020 are not available at the time of publication.*

Chart 83

Development of material intensity of the economy, domestic material consumption and GDP in the Czech Republic [index, 2000 = 100], 2000–2019



Data for the year 2020 are not available at the time of publication.

Data source: Czech Statistical Office

Factors causing the decline in material intensity after 2000 include a reduction in the share of solid fuels in the energy mix for electricity and heat generation, growth in the use of renewable energy sources and other non-fossil energy sources, and a reduction in the energy and material intensity of industry. Declining material intensity makes it possible to reduce the landscape impacts associated with mineral extraction and to reduce the waste streams from the economy associated with the use of materials and raw materials, which include air emissions and waste generation. Increasing efficiency in the cultivation and use of biomass is also reducing the pressure from agriculture on water quality and ecosystems.

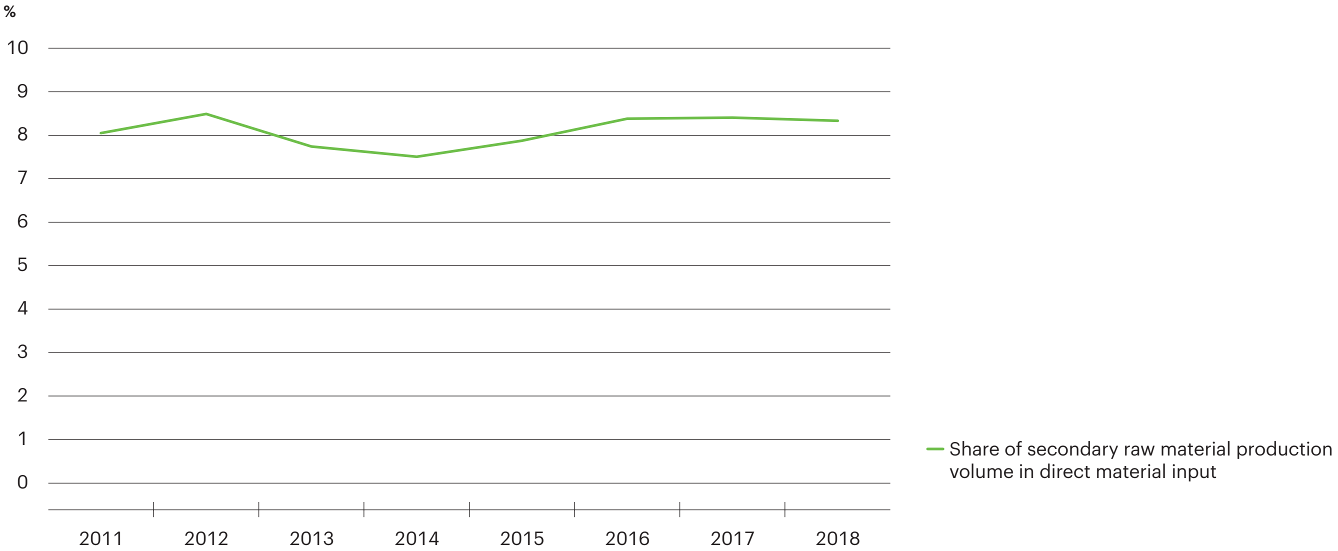
Share of secondary raw material production volume in direct material input

The indicator shows the relative size of secondary raw material production to the total material input into the economy. Direct material input measures the input of materials used in the economy, i.e. all materials that have economic value and are used for production and consumption.

In the short term, the share of secondary raw material production volume in direct material input has an increasing trend. In 2018[18] it was 8.3%, and since 2011, when it was 8.0%, there has been a rather fluctuating medium-term trend with no major variations (Chart 84). In the future, in line with the principles of circular economy and the need to replace primary raw materials with secondary ones, this share will have to be increased.

Chart 84

Share of secondary raw materials production volume in direct material input in the Czech Republic [%], 2011–2018



Data for the years 2019 and 2020 are not available at the time of publication.

Data source: Czech Statistical Office

[18] *Data for the years 2019 and 2020 are not available at the time of publication.*

2.2.2 | Waste prevention

Key question

Is waste prevention effective in reducing waste generation?

Key messages

Total waste generation has a significantly increasing trend in the medium and short term, as does the generation of non-hazardous waste. Municipal waste generation is increasing in the medium term. The generation of packaging waste has a significantly increasing trend in the medium and short term.

There is a slight reduction in the generation of mixed municipal waste in the medium term.

A sustainable approach to waste or packaging generation is one of the principles guaranteed by the ecolabelling of products and services. In terms of long-term development, we note a significant downward trend in the number of licences for the Czech Environmentally Friendly Product and Environmentally Friendly Service ecolabel, while the number of EU Ecolabel licences is increasing despite fluctuations over the last ten years.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Waste generation	N/A	↗ (negative)	↗ (negative)	✗
Ecolabelling*				
Total number of valid Environmentally Friendly Product and Environmentally Friendly Service ecolabel licences	↘ (negative)	↘ (negative)	↘ (negative)	✗
Total number of valid EU Ecolabel licences	↗ (positive)	~ (fluctuating)	↗ (positive)	✓

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

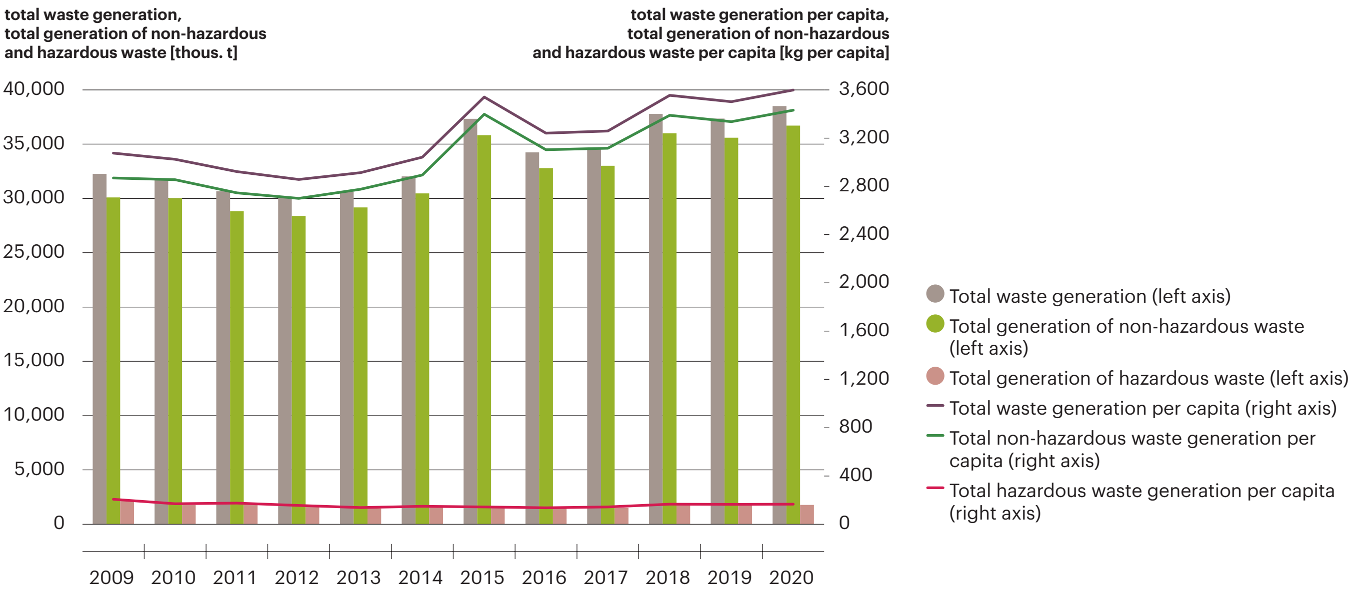
Waste generation

A key current trend in waste management is the move towards a **circular economy**, whereby material flows are closed in long-term cycles and the emphasis is on waste prevention, product reuse, recycling and conversion to energy instead of mineral extraction and landfilling.

Total waste generation (the sum of total generation of other and hazardous waste) increased by 19.3% between 2009 and 2020 and by 3.1% between 2019 and 2020 to 38,503.7 thous. t (Chart 85). It has a significant upward trend in the medium and short term. Reducing waste generation is possible by preventing its origin, which is in line with the principles of circular economy. Another important indicator is total waste generation per capita, which in 2020 was 3,598.4 kg per capita. **Total generation of non-hazardous waste** accounts for a significant share of total waste generation (95.4% in 2020). This is mainly influenced by the generation of construction and demolition waste. Between 2009 and 2020, the total generation of non-hazardous waste increased by 22.0% and by 3.1% between 2019 and 2020 to 36,721.8 thous. t. In the medium and short term it has a significantly increasing trend, as does the total generation of waste. The total per capita generation of non-hazardous waste in 2020 was 3,431.9 kg per capita. **Hazardous waste** accounted for 4.6% of total waste generation in 2020. The value of this share has fallen from 6.7% since 2009. In the 2009–2020 period, the total generation of hazardous waste decreased by 17.6% to a total of 1,781.8 thous. t despite a year-on-year increase of 1.3% in 2019–2020. Total hazardous waste generation per capita in 2020 was 166.5 kg per capita. This waste can be prevented by reducing the hazardous substances in products.

Chart 85

Total generation of waste, non-hazardous and hazardous waste in the Czech Republic [thous. t], total generation of waste, non-hazardous and hazardous waste per capita in the Czech Republic [kg per capita], 2009–2020



The data was determined using the methodology Mathematical expression of the "Waste management indicator system" calculation valid for the given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

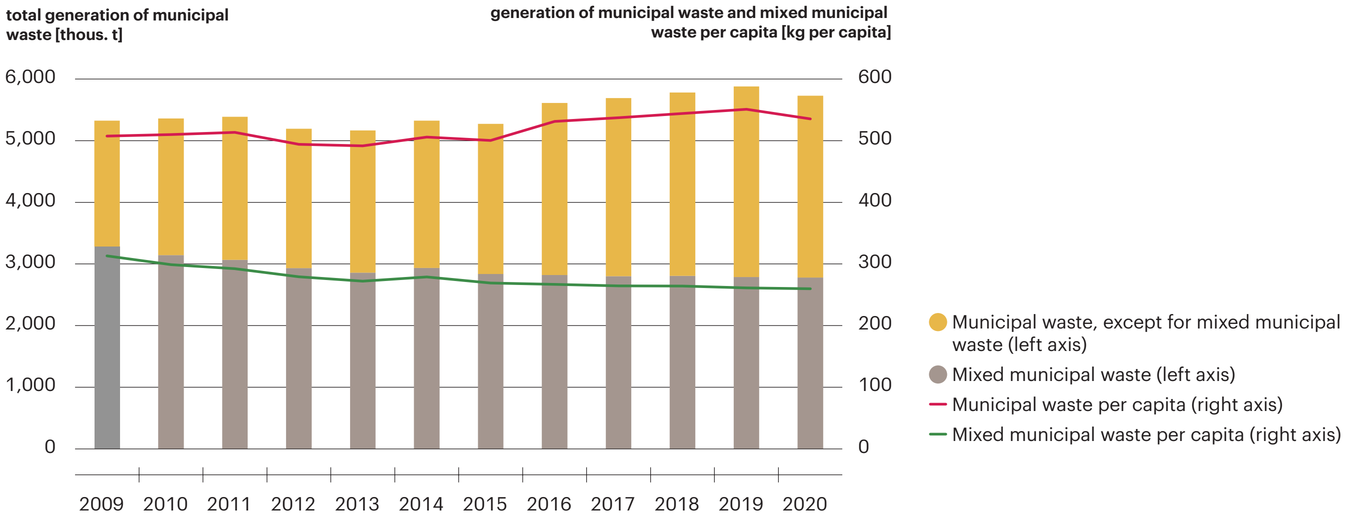
Data source: CENIA, Czech Statistical Office

Total municipal waste generation[19] decreased by 2.5% year-on-year to 5,729.9 thous. t in 2019–2020 (Chart 86). Since 2009, however, there has been a 7.6% increase. It is also increasing in the medium term. The total per capita generation of municipal waste in 2020 was 535.5 kg per capita. On the positive side, there is a slight reduction in the generation of mixed municipal waste in the medium term. Between 2009 and 2020, the generation of mixed municipal waste decreased by 15.3% and by 0.3% between 2019 and 2020 to a total of 2,780.3 thous. t. The total generation of mixed municipal waste per capita in 2020 was 259.8 kg per capita.

[19] *Waste catalogue numbers 20 02 02 and 20 03 06 are now not included in the total municipal waste generation for 2020 (change in methodology).*

Chart 86

Total generation of municipal waste in the Czech Republic [thous. t], per capita generation of municipal and mixed municipal waste in the Czech Republic [kg per capita], 2009–2020



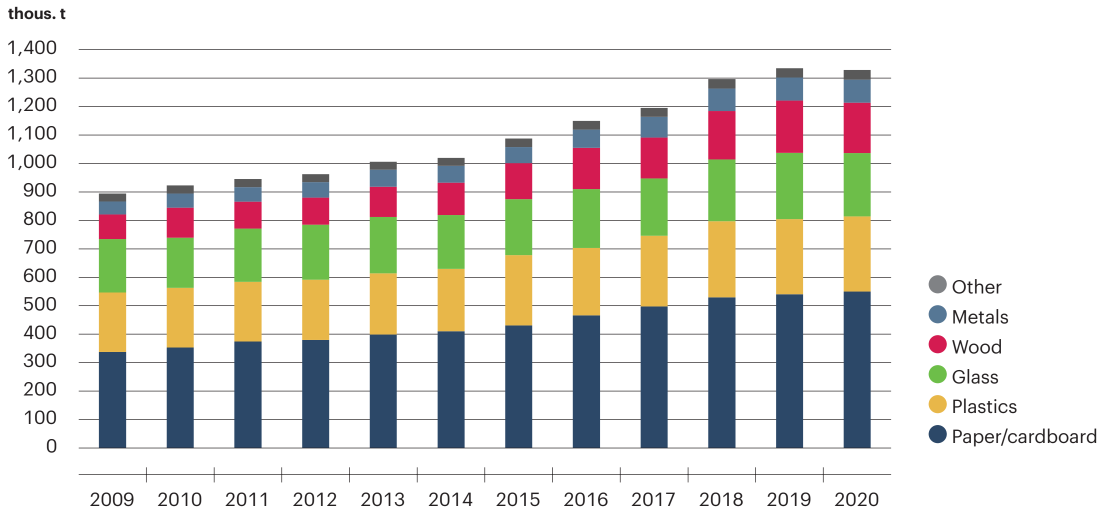
The data was determined using the methodology Mathematical expression of the "Waste management indicator system" calculation valid for the given year.
Czech Statistical Office is the source of data on the population of the Czech Republic (mid-year population).

Data source: CENIA, Czech Statistical Office

One of the most characteristic manifestations of a consumer society is the increasing **generation of packaging waste**. Between 2009 and 2020, packaging waste generation increased by 48.6% (Chart 87). In 2020, 1,328.7 thous. t of packaging waste was generated in the Czech Republic, a 0.4% reduction compared to 2019. However, a significant upward trend can be observed in the medium and short term. In terms of the material structure of packaging waste, paper or cardboard packaging is the most common (41.4% in 2020), distantly followed by plastics (19.9%) and glass (16.8%).

Chart 87

Packaging waste generated and material structure of packaging waste in the Czech Republic [thous. t], 2009–2020



Data source: Ministry of the Environment of the Czech Republic

Ecolabelling

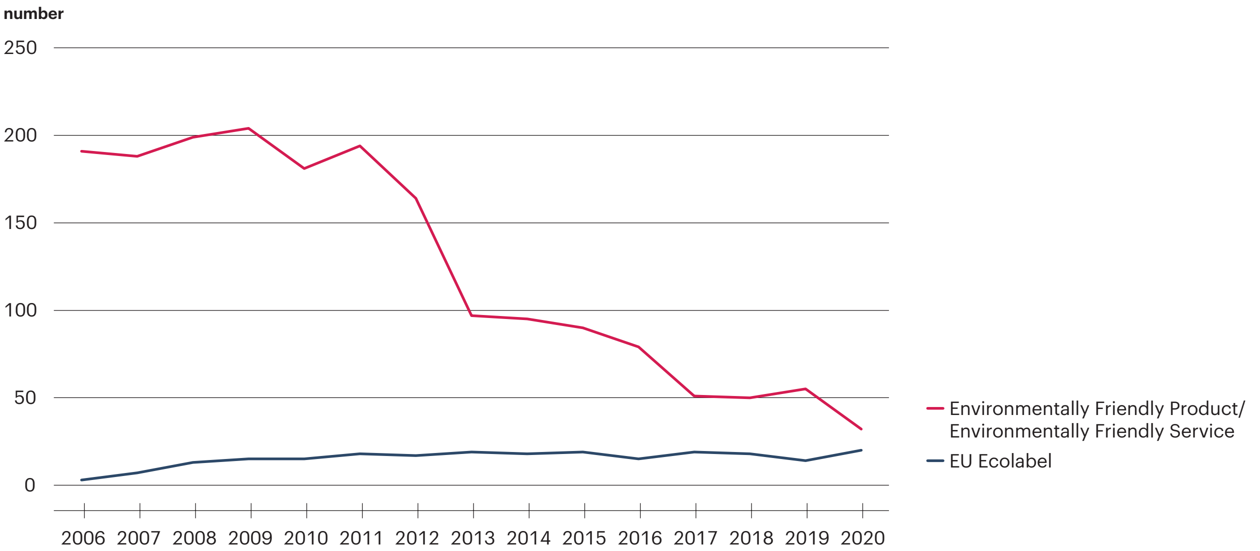
Ecolabelling is the labelling of products and services that are demonstrably more environmentally friendly throughout their life cycle, as well as being better for the health of the consumer. Their quality must remain at a very high level, and their utility properties are tested by accredited laboratories. Certified products or services can be identified by a simple and easy-to-remember symbol, the ecolabel logo. Ecolabels are awarded after a comprehensive verification of the entire product life cycle, and help producers and consumers avoid the pitfalls of "greenwashing".

The most common classic ecolabels used in Czechia are the Czech national ecolabel Environmentally Friendly Product/Environmentally Friendly Service, and the EU Ecolabel. The certification authority for both ecolabels is CENIA.

In 2020, there were a total of 32 **valid licenses** to use the Czech Environmentally Friendly Product/Environmentally Friendly Service ecolabel in Czechia, which corresponds to 42 certified products; in the case of the EU Ecolabel, there were 20 licenses for 5,147 certified products. In terms of long-term development, there is a significant downward trend in the number of licences for the Czech Environmentally Friendly Product and Environmentally Friendly Service ecolabels, whereas the number of EU Ecolabel licences is increasing, despite fluctuations over the last ten years (Chart 88). It is therefore clear that, if current trends are maintained, the Environmentally Friendly Product/Environmentally Friendly Service ecolabel will fail to achieve the target set for 2030 (100 valid licences), unlike the EU Ecolabel where the target is likely to be achieved (25 valid licences). The **criteria for ecolabel certification** are continuously updated according to the latest knowledge and available technologies so that the ecolabel remains a symbol of environmental excellence. This means only 10% to 20% of environmentally friendly products obtain ecolabel certification. Unfortunately, motivation to recertify has fallen for many license holders after the conditions were made stricter. The strict criteria, coupled with low consumer awareness of the true value of ecolabels, is leading to license holders losing interest in ecolabels, especially for the Czech Environmentally Friendly Product/Environmentally Friendly Service ecolabels. For the EU Ecolabel, the situation is more favourable thanks to better consumer education and the associated higher demand for certified products.

Chart 88

Valid Czech Environmentally Friendly Product/Environmentally Friendly Service and EU Ecolabel licences in the Czech Republic [number], 2006–2020



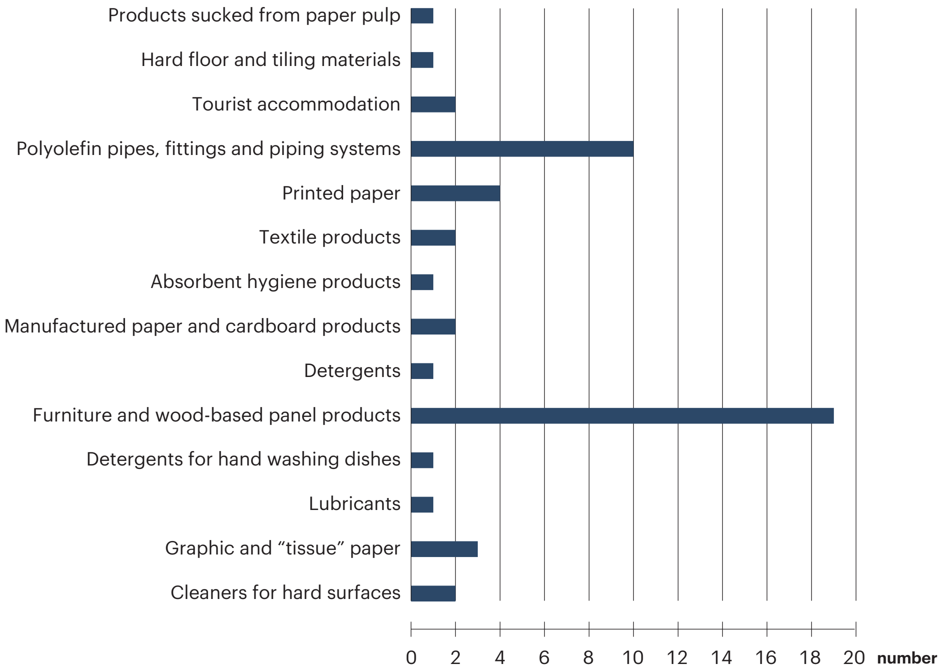
Data source: CENIA

In December 2020, an **amendment to Act No. 134/2016 Coll., on public procurement**, as amended, was approved, and introduced the obligation for socially and environmentally responsible public procurement with effect from 1 January 2021. The contracting authority can thus take into account the environmental impact of a supply, service or construction work in public procurement. In practice, preference may be given to the supply of products or services that are certified as Environmentally Friendly Product/Environmentally Friendly Service or with the EU Ecolabel. This is currently contributing to interest in ecolabel certification, especially in the graphic and printed paper, furniture and cleaning services categories.

Despite the economic uncertainty for companies in the ongoing COVID-19 pandemic, 14 new **licenses for both ecolabels** were granted in 2020 in the furniture, cleaning products, graphic and tissue paper, hard flooring and tiling materials categories (Chart 89). In other categories such as laundry and cleaning products or absorbent hygiene products, new products have been certified under existing licences. Most of the applicants for certification are currently from the cosmetics, chemist's, furniture and paper categories. However, many of them find it difficult to meet the strict certification criteria, or even to place their product in one of the categories for which certification criteria are set. For example, in cosmetics, criteria are currently set only for rinse-off cosmetics (shower gels, soaps, shampoos, conditioners), which is very limiting (however, a European directive for rinse-free cosmetics and cosmetic products for pets is already under preparation).

Chart 89

Valid Environmentally Friendly Product/Environmentally Friendly Service and EU Ecolabel licences by category in the Czech Republic [number], 2020



Data source: CENIA

2.2.3 | Compliance with the waste treatment hierarchy

Key question

How is waste treated? Is the waste treatment structure in line with the current waste treatment hierarchy and circular economy principles?

Key messages

A positive aspect of the transition to a circular economy is that the overall waste treatment is dominated by waste recovery, especially material recovery, which is increasing in the medium term at the expense of landfilling.

The main target in the field of municipal waste treatment is to significantly reduce landfilling in favour of material recovery in particular, yet almost half of municipal waste is still landfilled.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Waste treatment structure	N/A			
Municipal waste treatment	N/A			

Waste treatment structure

Waste recovery, especially material recovery, dominates **overall waste treatment** and is increasing in the medium and short term (Chart 90). The share of **materially recovered** waste to total waste generation, which was 38,503.7 thous. t in 2020, increased from 72.5% to 86.2% in the 2009–2020 period, and from 84.8% to 86.2% in the 2019–2020 period. The amount of waste material recovered in 2020 was 33,174.0 thous. t.

Only a small part of total waste generated is **used for energy recovery**. The share of waste used for energy recovery increased from 2.2% to 3.6% in the 2009–2020 period, and from 3.5% to 3.6% in the 2019–2020 period. The amount of waste used for energy recovery in 2020 was 1,382.8 thous. t.

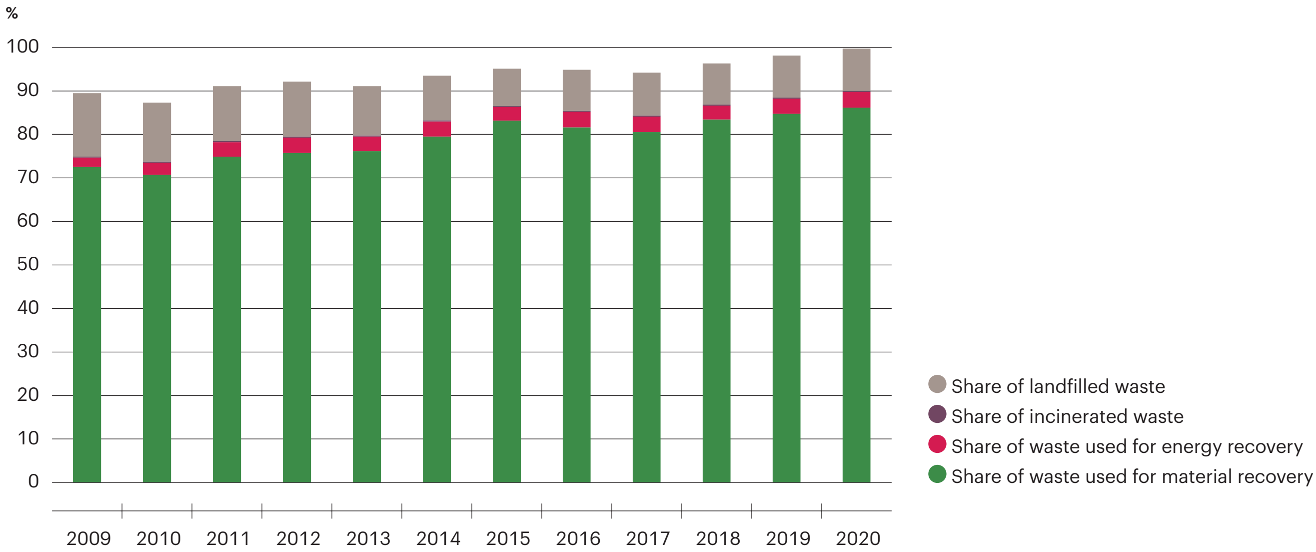
The most common waste disposal method is disposal at or below ground level, i.e. **landfilling**. This is a persistent and significant problem in the Czech Republic. The landfill share fell from 14.6% to 9.8% in the 2009–2020 period. It has a downward trend in the medium term. However, the share of waste disposed of by landfilling increased from 9.7% to 9.8% in the 2019–2020 period in a year-on-year comparison. The amount of waste disposed of by landfilling was 3,761.8 thous. t in 2020.

The aim is to further reduce the share of landfilling in total waste generation in favour of material and energy recovery, i.e. in accordance with the current waste treatment hierarchy. It is important to use the right tools for this gradual change, which can significantly help the transition to a circular economy.

Incineration is another way of disposing of waste. Together with landfilling, incineration is last in the waste hierarchy (both are waste disposal), with the above-mentioned material recovery and energy recovery taking precedence over it. Approximately 0.2% of the waste generated each year is incinerated, a negligible share compared to landfilling. The amount of waste disposed of by incineration was 88.8 thous. t in 2020.

Chart 90

Share of selected waste treatment methods in total waste generation in the Czech Republic [%], 2009–2020



The data was determined using the methodology Mathematical expression of the "Waste management indicator system" calculation valid for the given year.

Data source: CENIA

Municipal waste treatment[20]

Municipal waste is a specific group of waste, and this is reflected in the way it is **treated**. Unlike other waste groups, disposal **by landfilling** dominates in this case. However, the share of municipal waste landfilled fell from 64.0% to 47.8% in the 2009–2020 period (Chart 91). However, in a year-on-year comparison between 2019 and 2020, the share of municipal waste disposed of by landfilling of the total municipal waste generation of 5,729.9 thous. t in 2020 increased from 45.9% to 47.8%. A downward trend can be observed in the medium term, but there has been an increase in the short term (since 2016). In 2020, the amount of municipal waste disposed of by landfilling was 2,737.3 thous. t.

Diversion from landfilling is increasing the share of municipal waste used for **material recovery**, which increased from 22.7% in 2009 to 38.6% in 2020, despite a year-on-year decrease from 41.0% to 38.6% 2019–2020. It has a significantly increasing trend in the medium term. The amount of material recovery of municipal waste was 2,213.8 thous. t in 2020.

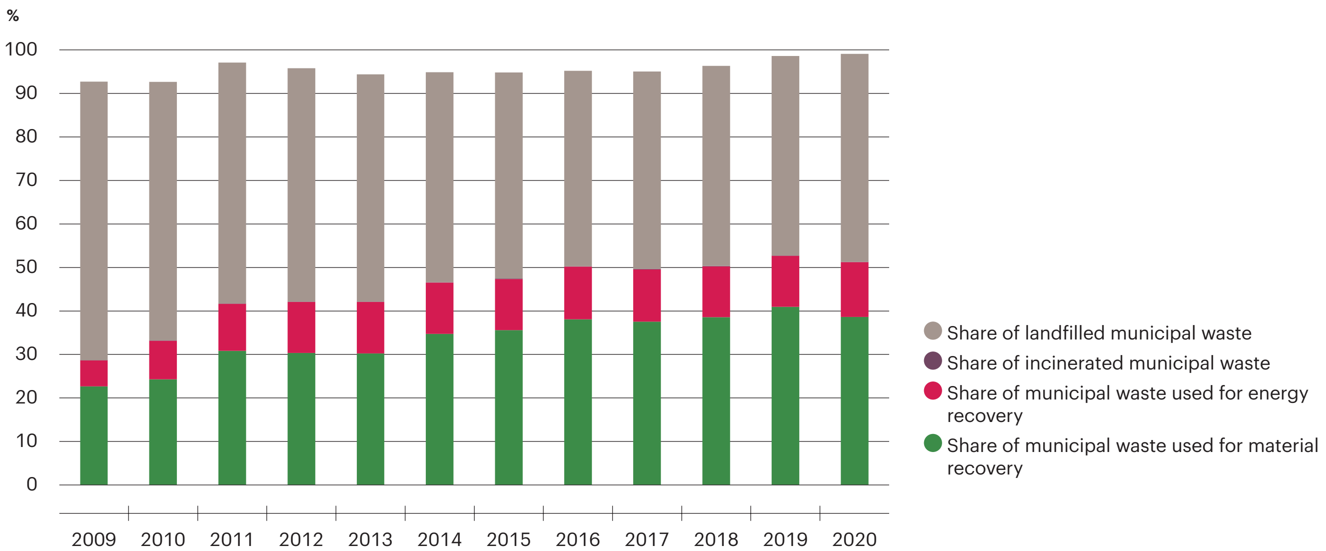
At the same time, the importance of **energy recovery** from municipal waste also increased, from 6.0% in 2009 to 12.6% in 2020. The share of municipal waste used for energy recovery increased from 11.7% to 12.6% year-on-year 2019–2020. It has a slightly increasing trend in the medium term. The amount of energy recovery of municipal waste was 721.2 thous. t in 2020.

The situation is diametrically different for **incineration**, through which an almost negligible amount of municipal waste is treated (4.4 thous. t in 2020). In this case, the percentage share is almost zero (0.08% in 2020).

Nevertheless, the municipal waste treatment situation in the Czech Republic is not satisfactory (municipal waste landfilling is above the EU28 average and recycling below the average). The aim is to reduce the share of landfilling in total municipal waste generation more drastically and at the same time to increase its material and energy recovery, in accordance with the current waste treatment method hierarchy and circular economy principles associated with the need to meet European circular economy targets[21]. If current trends continue, achieving the 2025, 2030 and 2035 municipal waste recycling and 2035 municipal waste landfilling targets will be challenging.

Chart 91

Share of selected municipal waste treatment methods in total municipal waste generation in the Czech Republic [%], 2009–2020



The data was determined using the methodology Mathematical expression of the "Waste management indicator system" calculation valid for the given year.

Data source: CENIA

[20] Waste catalogue numbers 20 02 02 and 20 03 06 are now not included in municipal waste treatment and total municipal waste generation for 2020 (change in methodology).

[21] The targets for municipal waste are set out in Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives, and in Council Directive 1999/31/EC on the landfill of waste.

The transition to a circular economy in an international context

Key messages

Intensity indicators for domestic material consumption per capita and per unit of GDP are slightly above average in the Czech Republic compared to other EU28 countries.

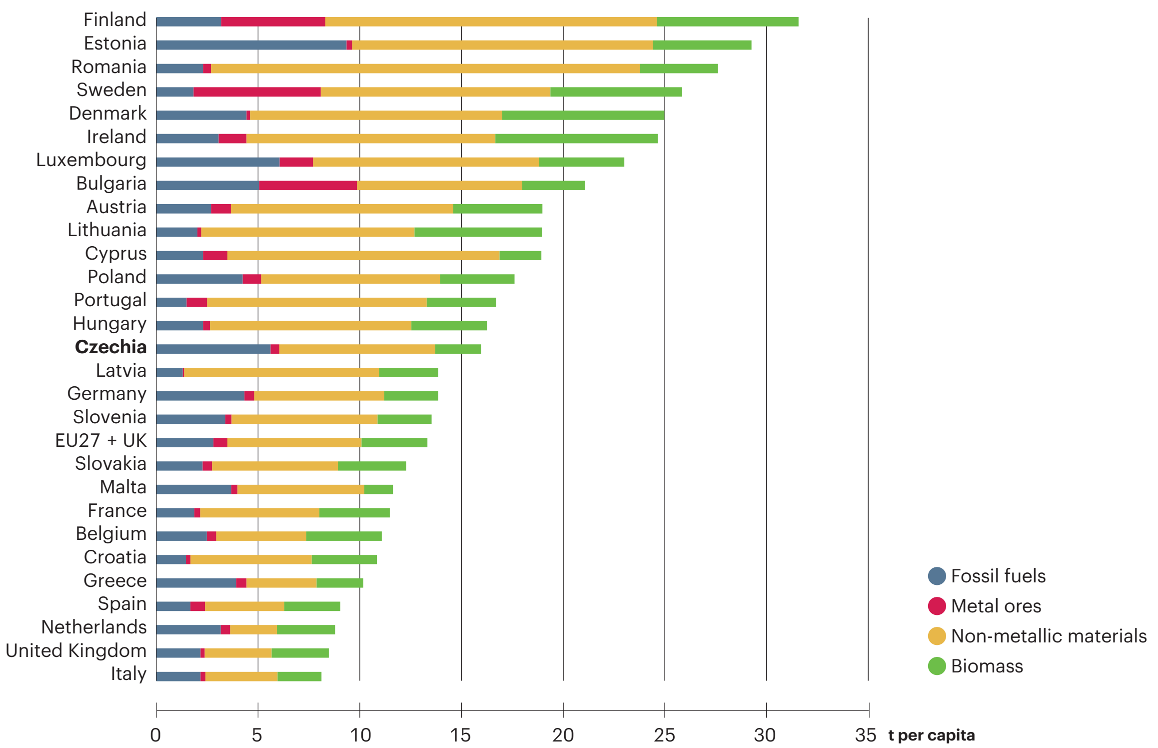
In the case of ecolabelling, the Czech Republic performs above average within the EU, both in the number of EU Ecolabel licences (14th position) and especially in the number of products certified with this ecolabel (5th position).

Material intensity of the economy in an international context

The intensity indicators of material flows, and hence the per capita and per unit of GDP environmental burdens associated with the extraction and consumption of materials, are slightly above average in the Czech Republic, due to the structure of the economy, compared to other EU28 countries. However, these indicators are gradually approaching the EU average thanks to developments in the Czech Republic and other EU countries. **Domestic material consumption per capita** in the Czech Republic in 2019[22] reached 16.0 t per capita, 19.8% above the EU28 average (Chart 92). The material intensity of the Czech economy in 2019 was 0.5 t (1,000 PPS)$^{-1}$, 29.3% higher than the EU28 average material intensity.

Chart 92

Domestic material consumption per capita by material category in EU countries and United Kingdom [t per capita], 2019



Data for the year 2020 are not available at the time of publication.

Data source: Eurostat

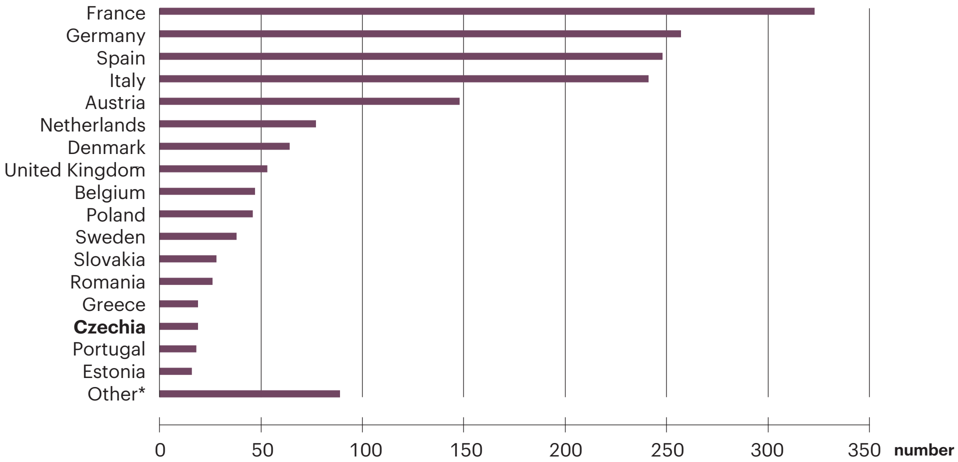
[22] *Data for the year 2020 are not available at the time of publication.*

Ecolabelling in the international context

In the international context, we can compare the number of licences or products and services certified with the EU Ecolabel in individual European countries. Across the EU, a total of 1,757 valid licences had been granted for 75,796 certified products and services as of September 2020. Czechia ranked 14th in the number of licenses together with Greece (Chart 93), and 5th in the number of certified products and services (Chart 94) among all European countries. As of September 2020, there were 19 valid licenses in Czechia, corresponding to 5,352 certified products and services.

Chart 93

Valid licences by EU country [number], September 2020

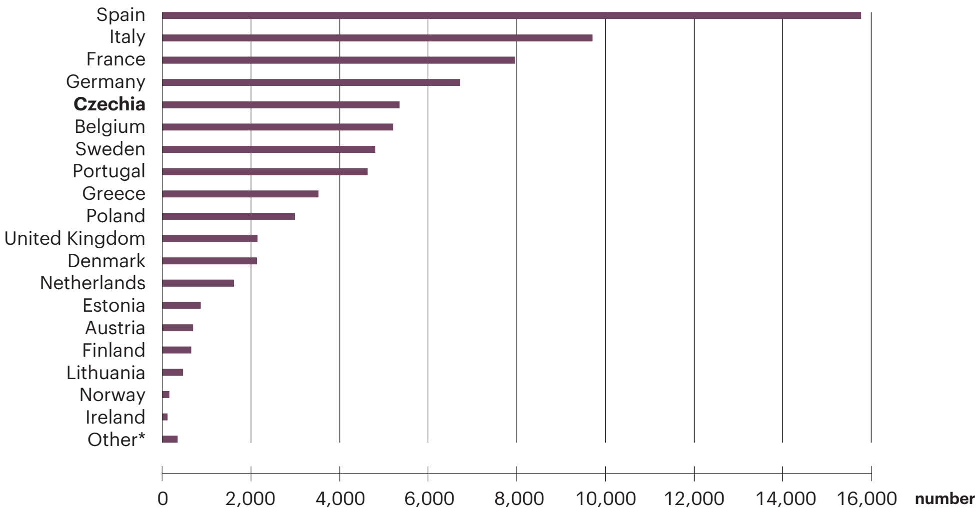


** Other: 10 countries with less than 15 valid licences.*

Data source: Ecolabel.eu

Chart 94

Certified products and services in EU countries [number], September 2020



** Other: 10 countries with less than 100 certified products and services.*

Data source: Ecolabel.eu

Nature and landscape

3.1 | Ecological stability of the landscape and sustainable land management

3.1 | Ecological stability of the landscape and sustainable land management

Intensive land use without applying the principles of sustainable management of natural resources leads to the loss of the biodiversity essential for maintaining the ecological stability of the landscape and its ecosystem functions on which human society relies. Sustainable landscape management is also important for maintaining soil quality, which is subject to several degradation processes as a result of some current management methods. These processes are to a large extent influenced by agricultural and forestry activities, especially the lack of good agricultural practice and sustainable forest management, notably the past cultivation of unstable monoculture forests which are currently impacted by a widespread calamity. Inappropriate watercourse modifications, changes in land use, soil degradation, large-scale building of drainage systems on fields and the expansion of built-up areas have resulted in a reduction in the retention capacity of the landscape, an important attribute of the landscape for securing water resources. Today, adaptation to increasing weather extremes in the face of ongoing human-induced climate change is also key to sustainable land use.

Overview of selected related strategic and legislative documents

7. EU Environment Action Programme to 2020
• protecting and developing the EU's natural capital

EU Common Agricultural Policy 2014–2020
• measures to protect the environment – e.g. crop diversification, conservation of permanent grassland and creation of ecological areas

EU Forest Strategy 2013–2020
• promoting a balance of different forest functions, meeting demand and providing essential ecosystem services

Strategic Framework Czech Republic 2030
• perception of the landscape of Czechia as a complex ecosystem and ecosystem services that provide a suitable framework for the development of human society

Strategy of the Ministry of Agriculture of the Czech Republic with a View to 2030
• promoting the competitiveness and sustainability of agriculture, food and forestry

Climate Change Adaptation Strategy in the Czech Republic
• mitigating the impacts of climate change by adapting to it as far as possible, preserving livelihoods and preserving and improving economic potential for future generations

Spatial Development Policy of the Czech Republic, as amended by Amendment No. 1
• economical use of built-up areas, ensuring the protection of undeveloped land (especially agricultural and forest land) and the preservation of public greenery

Action Plan of the Czech Republic for the Development of Organic Agriculture 2016–2020
• increasing the real contribution of organic farming to the environment and animal welfare = achieving a 15% share of organic areas in the total agricultural land in Czechia and achieving a share of at least 20% of arable land of the total organic farming land area

National Action Plan for the Safe Use of Pesticides in the Czech Republic 2018–2022
• setting objectives, targets, measures and timetables to reduce the risks and limit the impacts of the use of

products on human health and the environment, with a view to encouraging the development and implementation of integrated pest management and alternative approaches or practices to reduce dependence on the use of preparations

Rural Development Programme 2014–2020
- promoting sustainable farming methods, including organic farming
- restoring, conserving and enhancing biodiversity, developing agricultural areas of high natural value, and improving the condition of the European landscape
- improving water management, including fertiliser and pesticide management
- preventing soil erosion and improving soil management

State Forestry Policy Concept to 2035
- ensuring the balanced and adequate performance of all forest functions for future generations
- increasing biodiversity and the ecological stability of forest ecosystems while maintaining their productive function in the face of ongoing climate change
- ensuring the competitiveness of forestry and related sectors, and their importance for regional development

Act on the Protection of the Agricultural Land Fund No. 334/1992 Coll. (as amended)
- defining ways of protecting agricultural land

Act on Forests and on amendments to certain other laws (Forest Act) No. 289/1995 Coll.
- setting the conditions for the preservation, care and restoration of forests, for the fulfilment of all their functions, and for the promotion of sustainable management

3.1.1 | Landscape water retention

Key question

What is the retention capacity of the landscape?

Key messages

Land development is increasing in the long term. The built-up area increased by 410 ha between 2019 and 2020.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Infiltration capacity of soils	N/A	N/A	N/A	N/A
Land use				

Infiltration capacity of soils

The infiltration capacity of agricultural soils was assessed based on soil properties and characteristics combined with a layer of land with reduced infiltration. For the assessment of the potential infiltration capacity of soils, soil categorization (HPJ) is used, which is prepared according to the saturated hydraulic conductivity, the depth of the impermeable layer and the groundwater level in combination with the hydrogeological characteristics of the soil-forming substrates. The natural susceptibility of soils to compaction is based on the farmland classification system, the classification was based on soil classification, soil grain size and changes, the typical water regime of soils, depth of the impermeable layer and the presence of a barrier limiting root growth.

High infiltration capacity: Soils with a saturated hydraulic conductivity of the least permeable layer above 0.40 mm per second with an impermeable layer more than 50 cm below the surface and a water table at a depth of more than 60 cm. This also includes deep soils with an impermeable layer and a water table more than 1 m deep, where the saturated hydraulic conductivity of all horizons is greater than 0.1 mm per second.

Medium infiltration capacity: Soils with a saturated hydraulic conductivity of the least permeable layer of 0.1–0.4 mm per second with an impermeable layer more than 50 cm below the surface and a groundwater level of more than 60 cm. This also includes deep soils with an impermeable layer and a water table more than 1 m deep, where the saturated hydraulic conductivity of all horizons is in the 0.04–0.1 mm per second range.

Lower mean infiltration capacity: Soils with a saturated hydraulic conductivity of the least permeable layer of 0.01–0.1 mm per second with an impermeable layer more than 50 cm below the surface and a groundwater level of more than 60 cm. This also includes deep soils with an impermeable layer and a water table more than 1 m deep, where the saturated hydraulic conductivity of all horizons is in the 0.004–0.04 mm per second range.

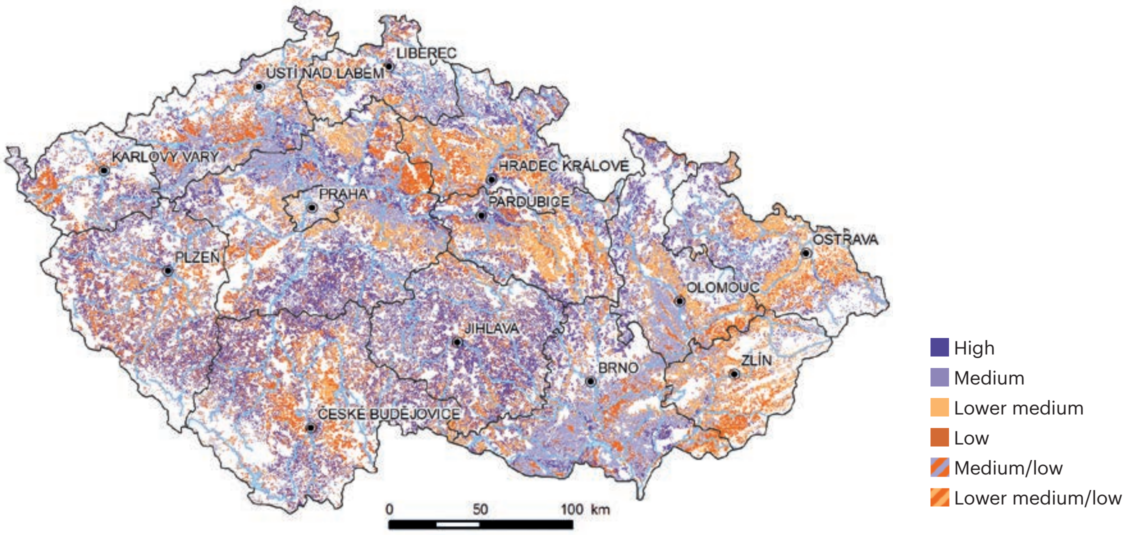
Low infiltration capacity: Soils with an impermeable layer less than 50 cm deep or a water table less than 60 cm deep. This also includes soils with an impermeable layer or groundwater level more than 100 cm deep whose saturated hydraulic conductivity is less than 0.004 mm per second.

The dual soil groups (medium/low, lower medium/low) are given for soils belonging to the low infiltration group only on the basis of the presence of a water table at a depth of up to 60 cm, the saturated hydraulic conductivity of which is favourable. If these soils are adequately drained (water table > 60 cm deep), they can be grouped according to their saturated hydraulic conductivity.

Soils with lower medium to low infiltration capacity accounted for a total of 38.9% (Figure 22). Dual soil groups (medium/low and lower medium/low infiltration capacity) accounted for a total of 1.5% of agricultural soils.

Figure 22

Infiltration capacity of soils in the Czech Republic, 2020



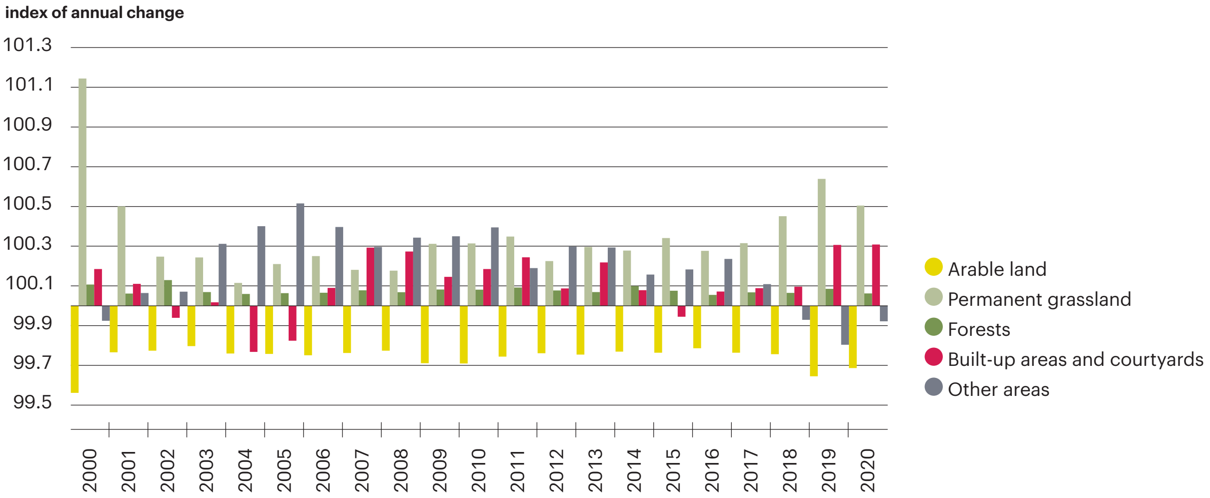
Data source: Research Institute for Soil and Water Conservation

Land use

There has been a long-term decline in agricultural land, which decreased by 1.9 thous. ha in 2020 (11.7 thous. ha since 2016 and 79.7 thous. ha since 2000, i.e. 1.9%)[1]. This decline was mainly due to a decrease in the area of arable land (Chart 95), which decreased by a total of 9.2 thous. ha in 2020. In total, 4.9% of arable land has been lost since 2000. The area of grassland is steadily increasing, and this can be described as ecologically favourable. The total increase in grassland was 5.1 thous. ha in 2020. Agricultural land is being converted into built-up areas over the long term (see 3.1.2, Land use). Within agricultural land, hop farms and orchards have been declining for a long time. In 2020, a total of 279 ha of hops and 354 ha of orchards were lost. Since 2000, the percentage decline has been 15.0% of hop-growing areas and 10.2% of orchard areas.

Chart 95

Land use in the Czech Republic [annual change index], 2000–2020



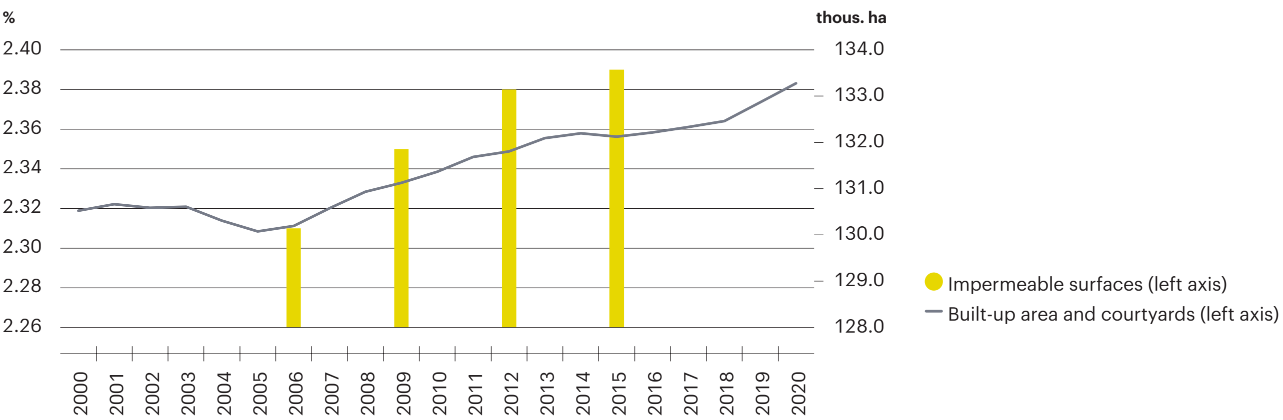
The year-on-year change index is calculated as the year-on-year percentage change in the given category.

Data source: State Administration of Land Surveying and Cadastre

The area of built-up land has been growing for a long time. Between 2019 and 2020, the area of built-up land increased by 410 ha, compared to a total of 1,155 ha in the 2015–2020 period, and a total of 2,755 ha in the 2000–2020 period. This is associated with an increase in impermeable surfaces from 2.31% in 2006 to 2.39% of Czechia's land area in 2015 (Chart 96).

Chart 96

Land use, built-up area and impermeable surfaces in the Czech Republic [%, thous. ha], 2000–2020



Data source: State Administration of Land Surveying and Cadastre, EEA

[1] *More at: https://www.cuzk.cz/Periodika-a-publikace/Statisticke-udaje/Souhrne-prehledy-pudniho-fondu.aspx*

3.1.2 | Soil degradation

Key question

What is the state of the land in terms of its quality and its vulnerability to degradation and land use?

Key messages

The consumption of mineral fertilisers decreased by 13.0% year-on-year to 101.7 kg of net nutrients per ha in 2020.

The consumption of plant protection products is gradually decreasing. In 2020, this amounted to 3,784.2 thous. kg of active substances, 9.7% less than in 2019.

Mineral extraction in Czechia is fluctuating with an overall downward trend, and is mainly influenced by industrial production and construction. The area affected by extraction is decreasing, while the area of reclaimed land is increasing.

Soil acidification and the depletion of alkaline nutrients may become a limiting factor for forestry. The base saturation (BS) of the soil sorption complex in the top part of mineral soil (up to 20 cm) is 4–18%.

There is extensive annual soil loss through erosion. Potentially 51.7% of agricultural land is endangered by water erosion, of which 15.6% by extreme erosion. 22.9% of agricultural land is endangered by wind erosion.
A total of 399 erosion events were recorded in 2020.

There was a further increase in the consumption of rodenticides (172.7% year-on-year).

In 2019[2], a total of 254.7 ha of agricultural and forest land was taken by road infrastructure.

[2] *Data for the year 2020 are not available at the time of publication.*

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Quality of agricultural and forest soil*				
Quality of agricultural soil	N/A	N/A	N/A	~
Quality of forest soil	↘	↘	↘	✕
Erosion and compaction of agricultural soil	N/A	↗	↗	✕
Consumption of fertilisers and plant protection products	↗	→	↘	~
Land take	~↗	↗	↗	✕
Mineral extraction and reclamation*				
Mineral extraction	↘	↘	↘	N/A
Reclamation after mineral extraction	↗	↗	↗	N/A

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

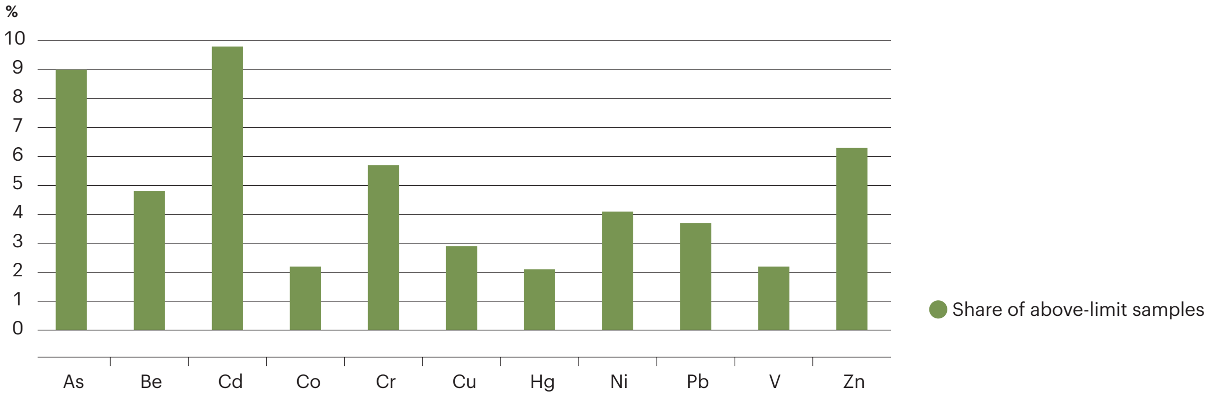
Quality of agricultural and forest soil

The **quality of agricultural soil** is determined by a number of properties (e.g. soil structure, soil reaction (pH), sorption capacity, humus content). The quality of agricultural soil is negatively affected by the content of hazardous substances in the soil, which enter the soil and sediments through anthropogenic activities. As part of **monitoring the content of hazardous elements and substances in soil** (basal soil monitoring – BMP), both inorganic pollutants and hazardous elements (e.g. As, Cd, Ni, Pb, Zn, etc.) and persistent organic pollutants (POPs) are monitored. These include in particular 12 polycyclic aromatic hydrocarbons (12 PAHs), polychlorinated biphenyls (PCBs) and organochlorine pesticides (HCH, HCB, DDT group substances). The core network of BMP points was established in 1992. The system currently contains 214 monitoring areas. The presence of hazardous elements and substances in soil is not necessarily related to agricultural activities and, if it is, it is mainly due to the application of plant protection products, sewage sludge or sediment from water reservoirs and streams.

Based on the results of the determination of the content of hazardous elements in the soil during extraction with aqua regia (Chart 97), cadmium content was the most problematic in the 1998–2020 period with 9.8% of above-limit samples for all soils (i.e. for light and other soil types that include sandy-loamy, loamy, clay-loamy and clay soils), followed by arsenic (9.0%), chromium (5.7%), zinc (6.3%) and beryllium (4.8%).

Chart 97

Share of soil samples exceeding the preventive values for element content in leachate of qua regia in the Czech Republic [%], 1998–2020



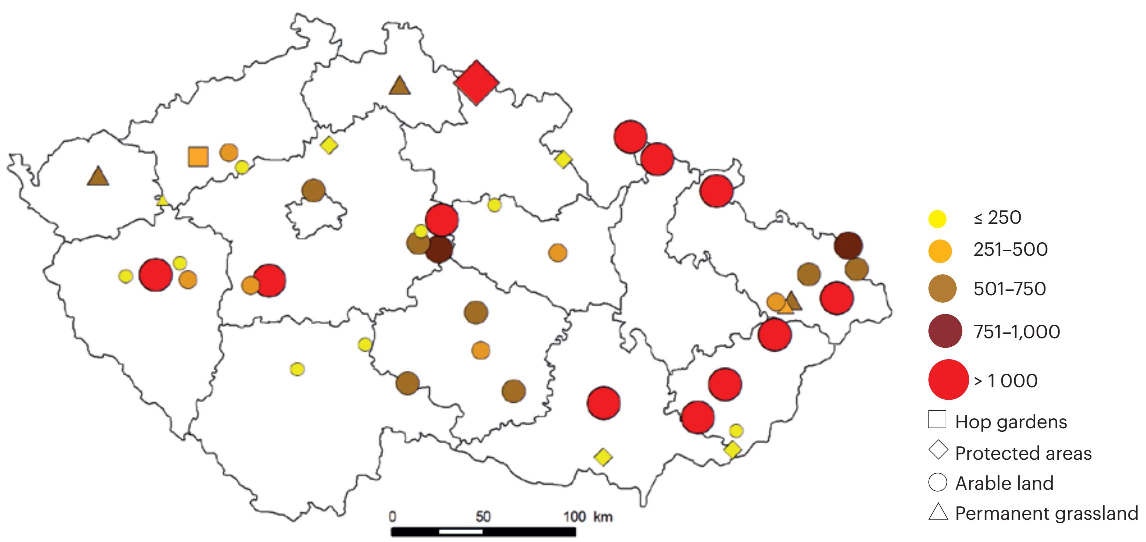
Results of the Contaminated Sites Register, 17,058 to 55,723 samples were assessed. The preventive values for the above-mentioned hazardous substances are set by Decree No. 153/2016 Coll.

Data source: Central Institute for Supervising and Testing in Agriculture

Organic pollutants are determined annually at the same 40 selected BMP monitoring sites and five sites in protected areas (Krkonoše Mountains National Park, Kokořínsko, Pálava, White Carpathians, Eagle Mountains) from the topsoil perspective. In 2020, the preventive value was exceeded for PCBs, PAHs, HCB and DDT. The HCH preventive value was not exceeded in any of the samples assessed at the monitored sites. The highest share of samples exceeding the preventive values was measured for the sum of 12 PAHs. PAHs are also produced by natural processes, but are currently present in the environment at higher levels, partly as a result of human activity, particularly the imperfect combustion of carbon-based fuels. They have a high bioaccumulation capacity and, depending on their structure, some have carcinogenic effects. Limits were exceeded at a total of eleven selected arable land observation sites and one sample from a site in a protected area (Figure 23). DDT levels were exceeded at five sites. The limit for PCBs in arable land was exceeded at two monitoring sites in 2020 and for HCB at one site.

Figure 23

Sum of 12 PAHs in topsoil of agricultural soils (at BMPs) in the Czech Republic [μg .kg^{-1} dry weight], 2020



Based on samples from 40 selected monitoring sites and five sites in protected areas. The preventive value for the sum of 12 PAHs according to Decree No. 153/2016 Coll. is 1,000 μg per kg dry matter.

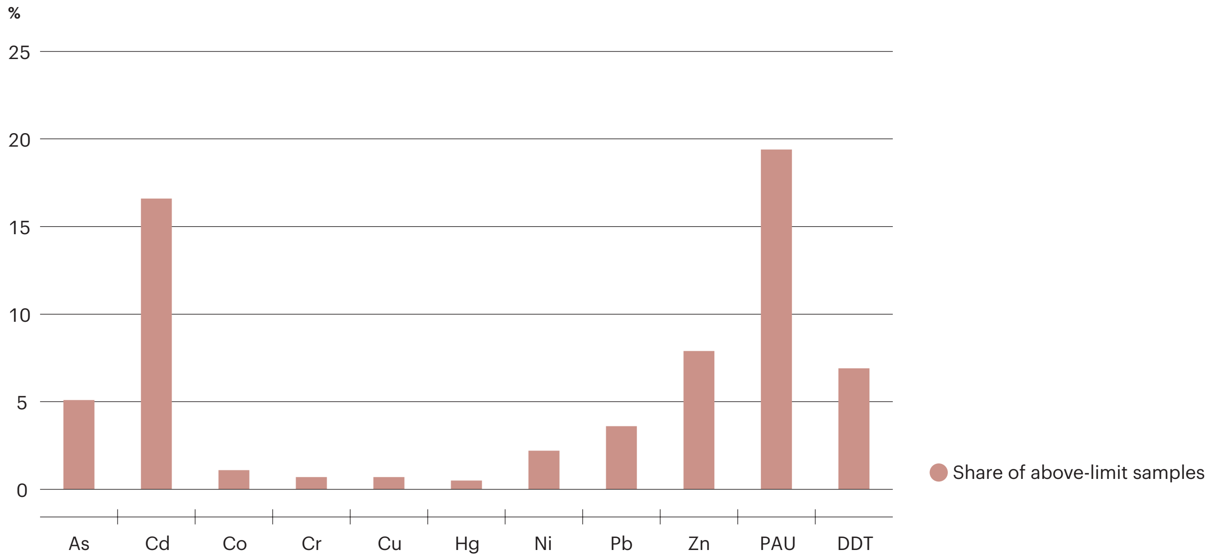
Data source: Central Institute for Supervising and Testing in Agriculture

Pond and river sediments can be deposited on agricultural land to improve its production characteristics. Sediments must first undergo analysis and, they can only be used on agricultural land if they meet the relevant limits according to Decree No. 257/2009 Coll. The content of hazardous elements and organic pollutants is monitored, as well as the grain composition, organic matter content, pH and nutrient content. The Central Institute for Supervising and Testing in Agriculture has been **monitoring the quality of pond and river sediments** since 1995 (Chart 98). A total of 602 sediment samples were assessed in the 1995–2020 period. The highest percentage of samples exceeding the limit values was recorded for PAHs (19.4% overall) and cadmium (16.6% of samples). 5% to 8% of the samples were found to be above the limit for arsenic, zinc and DDT.

As part of the soil quality assessment, the pH value is also determined, and the average soil reaction value for agricultural soil in Czechia in the 2015–2020 period was 6.0 pH (slightly acidic). The organic matter content of soils is also monitored, with 46.1% of agricultural land having organic matter content in the low to lower medium category in 2020. The low humus content in the soil is influenced by intensive agricultural management with a predominance of mineral fertiliser application and low use of manure and compost. Erosion also contributes significantly to dehumification.

Chart 98

Percentage of pond and river sediment samples exceeding limit values in the Czech Republic [%], 1995–2020



Results of long-term monitoring of soil inputs (sediments). Hazardous elements 1995–2020, approximately 500 samples; PAHs: polycyclic aromatic hydrocarbons (sum of 12 PAHs), monitored 2009–2020, 57 samples; DDT: sum of DDT including metabolites, monitored 2007–2020, 57 samples.

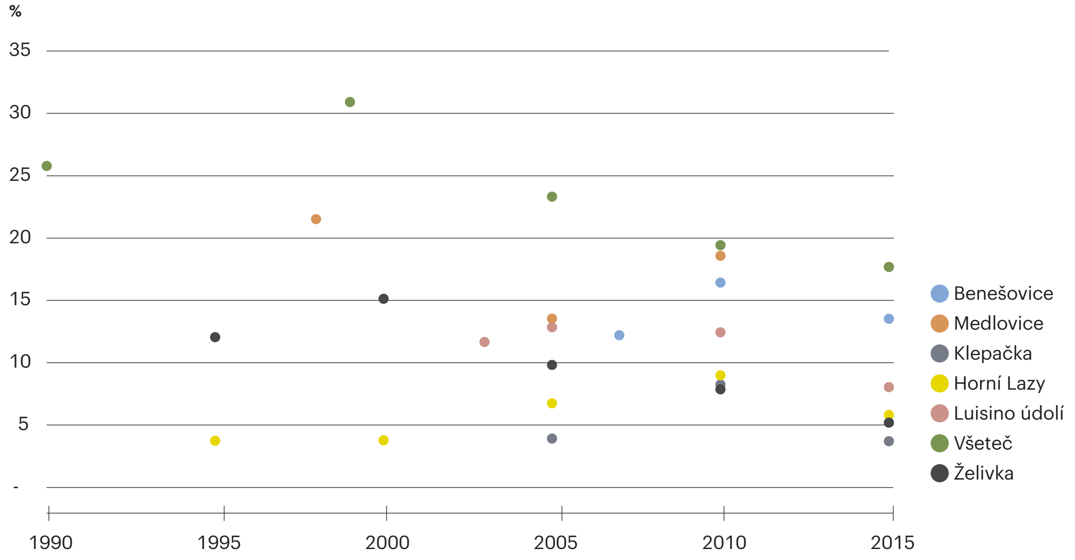
Data source: Central Institute for Supervising and Testing in Agriculture

The limiting factor of **forestry** is the availability of nutrients (especially the alkaline cations Ca, Mg, Na, K) in the soil sorption complex. The unavailability of these nutrients has a negative effect on the formation of the assimilative organs of trees, manifested by defoliation. In the past, forest soils were negatively affected by acidification caused by acid deposition from anthropogenic air pollution. Acidification of forest soils is also influenced by management, which determines the species composition and intensity of logging. For the long-term sustainability of forest management, it is a prerequisite that nutrient losses from biomass extraction (logging) do not exceed nutrient replacement by natural processes (weathering, atmospheric deposition).

The available data show acidification and reduction in **the content of alkaline nutrients** in forest soils, mainly in the upper mineral horizons, in different parts of Czechia[3]. The most pronounced deficiency is in available calcium, the content of which in the top part of the soil (up to 40 cm) in most areas is well below 140 mg.kg^{-1}, which is the limit for very low content. The low exchangeable alkaline nutrients content is also related to the base saturation (BS) of the soil sorption complex, which is 4–18% in the top part of the mineral soil (up to 20 cm) (Chart 99). The unfavourable state from the perspective of forest soils is illustrated by the poor health of forests, particularly evident in coniferous stands even in regions without a significant pollution history. Here, nutritional problems are often combined with other stress factors, most often drought and biotic damaging agents, yet they play a significant role.

Chart 99

Average base saturation (BS) of the sorption complex in the top part of the soil (0–20 cm) at ICP Forests Level II monitoring sites in the Czech Republic [%], 1990–2015



Data for the year 2020 are not available at the time of publication.

Data source: Forestry and Game Management Research Institute

[3] *Šrámek V., Jurkovská L., Fadrhonsová V., Hellebrandová-Neudertová K., 2013: Chemistry of forest soils of Czechia by typological category – results of monitoring of forest soils as part of the "BIOSOIL" project. Forest Research Reports, 58: 314. Available from: https://www.vulhm.cz/files/uploads/2019/01/324.pdf.*

Erosion and compaction of agricultural soil

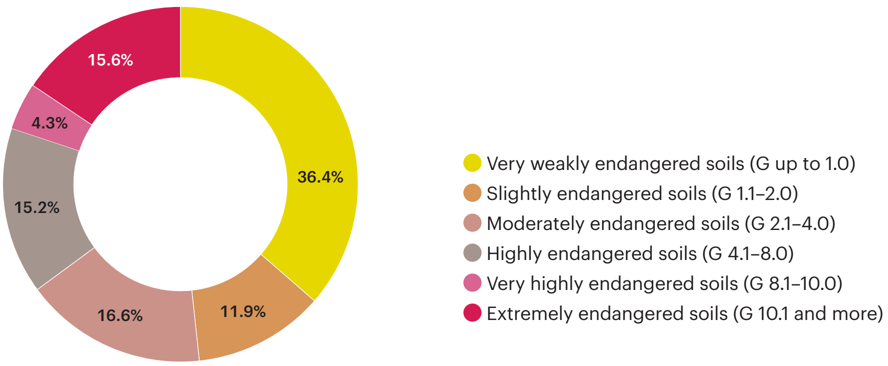
The most serious form of soil degradation in our country is erosion, to which Czechia is vulnerable due to intensive farming relying on mineral fertilisers. Under natural conditions, erosion is a slow process that is compensated by the weathering of the substrate and the formation of new soil. However, erosion is greatly accelerated by human activity, up to a thousand-fold in the case of erosion-prone crops (e.g., maize). Such a rate of erosion cannot be compensated by the very slow soil formation processes (it is estimated that the formation time of a 1 cm soil is around 100 years in the climatic conditions of Czechia and Central Europe). Soil is thus considered a non-renewable resource.

Currently, the maximum **soil loss** in Czechia is estimated at approximately 21 mil. t of topsoil per year, which can be expressed as a loss of at least CZK 4.3 bil. per year and a loss of land productivity of 0.1% per year[4]. Excessive loss of soil particles due to erosion can lead to a reduction in the depth of the topsoil or to the destruction of the entire topsoil layer. On severely eroded soils, yields per ha are reduced by up to 75% and land prices by up to 50%. In addition to soil loss, soil particle washout also causes surface water pollution and the silting up of water reservoirs. Accelerated erosion is mainly caused by the cultivation of crops prone to erosion, monocultures, low amounts of organic matter in the soil, the absence of landscape elements, grassed strips or terraces, land consolidation, soil management without regard to the slope of the land, etc. In addition, climate change is increasing the risk of erosion events due to the occurrence of high intensity localised rainfall following periods of drought.

Water erosion, expressed by long-term potential soil loss (G)[5] higher than 2.1 t per ha per year (i.e. above the lower limit of moderately endangered land), threatens 51.7% of the agricultural land fund, while 15.6% is at extreme risk (G higher than 10.1 t per ha per year, Chart 100). The areas most endangered by water erosion (potential soil particle loss of 10.1 t per ha per year and more) are the areas bordering the Moravian valleys and hills and uplands of Czechia (Figure 24). The potential vulnerability expressed in terms of long-term average soil loss is calculated based on long-term regionalised factors and therefore does not change greatly over time.

Chart 100

Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil loss G in the Czech Republic [% of agricultural land fund], 2020



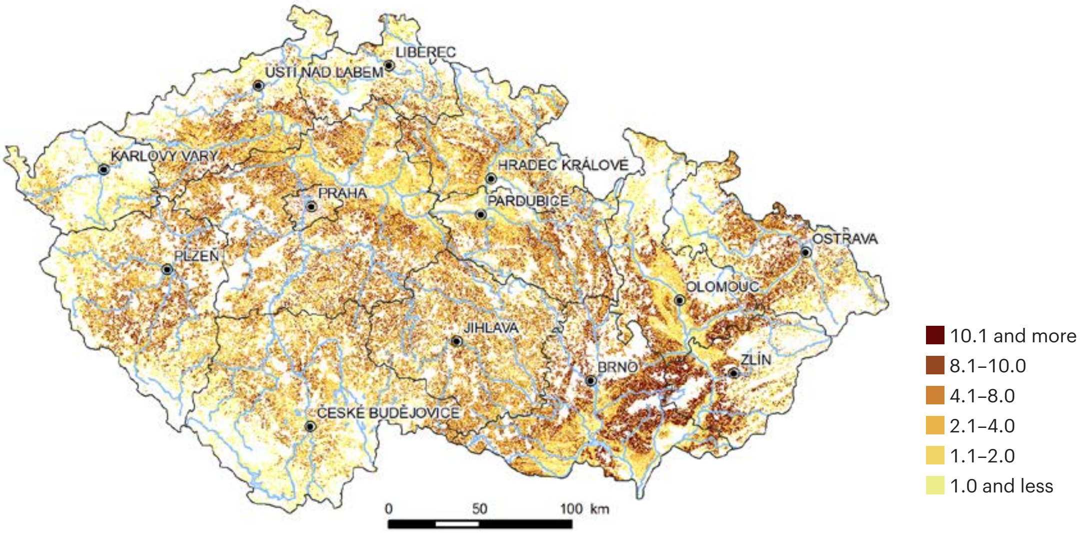
Data source: Research Institute for Soil and Water Conservation

[4] Panagos P., Standardi G., Borrelli P., Lugato E., Montanarella L., Bosello F. Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models. LandDegrad Dev. 2018; 29: 471–484. https://doi.org/10.1002/ldr.2879.

[5] The calculation of the average long-term soil loss G is based on the Universal Soil Loss Equation (USLE): $G = R \times K \times L \times S \times C \times P$ [$t.ha^{-1}.year^{-1}$]. The following factors are included as inputs to the equation: the rainfall and runoff factor by geographic location on arable land according to the LPIS (R), the soil erodibility factor (K), the slope length factor (L), the slope steepness factor (S), the crop/vegetation and management factor by climatic regions (C), and the erosion control practices efficiency rate (P).

Figure 24

Potential vulnerability of agricultural land to water erosion expressed by the long-term average soil loss G in the Czech Republic [$t.ha^{-1}.year^{-1}$], 2020



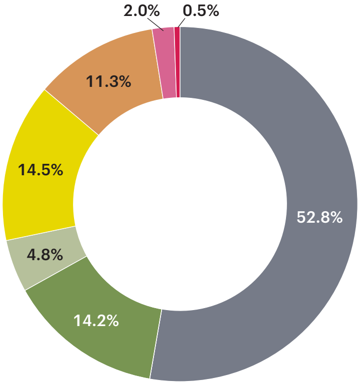
Data source: Research Institute for Soil and Water Conservation

The level of water erosion risk can also be expressed as the maximum admissible values of the protective vegetation influence factor and erosion control measures ($C_p.P_p$)[6]. This value serves for determining the suitable type of **management method** that does not yet result in the manifestation of excessive soil particle loss. In 2020, erosion-prone crops could be grown on 67.0% of the area, of which 52.8% could be grown without restrictions and 14.2% with soil protection technologies (Chart 101). The cultivation of erosion-prone plants was conditioned by strip crop rotation on 4.8% of the area. The exclusion of erosion-prone crops was recommended for 28.2% of the area. Of this, 14.5% of the area included a recommendation to use soil protection technologies, and 11.3% included a higher share of perennial forage crops. On the remaining 2.5% of the area, the cultivation of perennial forage crops or protective grassland was recommended. The management methods are recommended according to good agricultural and environmental conditions (GAEC) standards, which ensure farming consistent with environmental protection. Restrictions on management methods in areas with low Cp values are defined mainly in mountainous areas and on steeper slopes (Figure 25). However, steepness always influences erosion rates in combination with other factors. Thus, erosion runoff also occurs on soils where no systematic protection is in place to prevent further losses.

[6] *The calculation of C_p is based on the Universal Soil Loss Equation (USLE) expressed as: $C_p = G_p / (R \times K \times L \times S \times P)$. The following factors are included as inputs to the equation: the admissible average annual soil loss with respect to the preservation of soil functions and soil fertility relative to soil depth (G_p), the rainfall and runoff factor by geographic location on arable land according to the LPIS (R), the soil erodibility factor (K), the slope length factor (L), the slope steepness factor (S) and the erosion control practices efficiency rate (P). Cp are divided into five categories. This value is a limit value and, if exceeded, should be eliminated using erosion protection measures (P_p).*

Chart 101

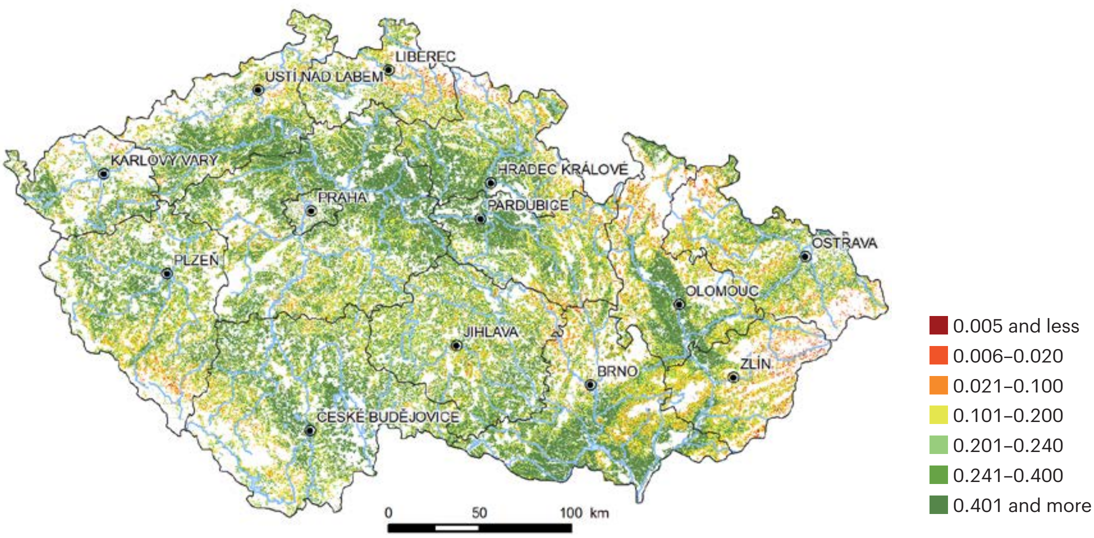
Vulnerability of agricultural land to water erosion expressed as the maximum admissible values of the protective vegetation influence factor (Cp) and erosion protection measures (P_p) in the Czech Republic [% of agricultural land fund], 2020



Data source: Research Institute for Soil and Water Conservation

Figure 25

Vulnerability of agricultural land to water erosion expressed as the maximum admissible values of the protective vegetation influence factor (C_p) and erosion protection measures (P_p) in the Czech Republic, 2020



Data source: Research Institute for Soil and Water Conservation

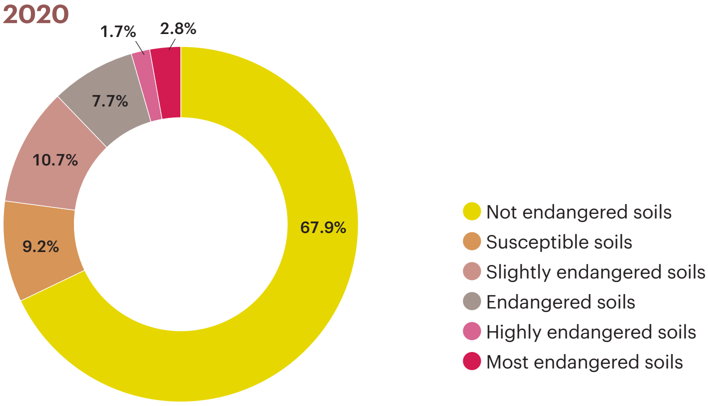
According to agricultural soil **erosion monitoring**, fewer erosion events were recorded in 2020 (399) than in 2019 (427)[7]. The number of cases of soil loss decreased by 86 and the area of erosion by 1,800 ha year-on-year, but the number of recorded erosion events is increasing in the long term. The highest number of erosion events (40.6% in 2020) typically occurs in the Vysočina Region, most often in areas with maize, which is unambiguously the most erosion-prone crop (more than 50% of recorded erosion events). Most erosion events occur on soils without erosion protection measures according to the good agricultural and environmental conditions (GAEC) standards, and primarily on soils without cover or with little crop cover.

[7] *An overview of recorded erosion events is available on the web portal for monitoring agricultural soil erosion: https://me.vumop.cz/app/.*

In 2020, 22.9% of agricultural land was potentially endangered **by wind erosion**[8] and, of this, 2.7% were the most endangered soils, located mainly in southern Moravia and the Polabí region (Chart 102, Figure 26). 67.9% of the agricultural land belonged to the category of not endangered soils. Wind erosion affects agricultural land in a similar way to water erosion, and its causes are also similar (excessive size of plots with one type of crop, lack of windbreaks – avenues, hedgerows, etc.). Given the current trend in farming, it can be assumed that the risk of wind erosion will increase in the future.

Chart 102

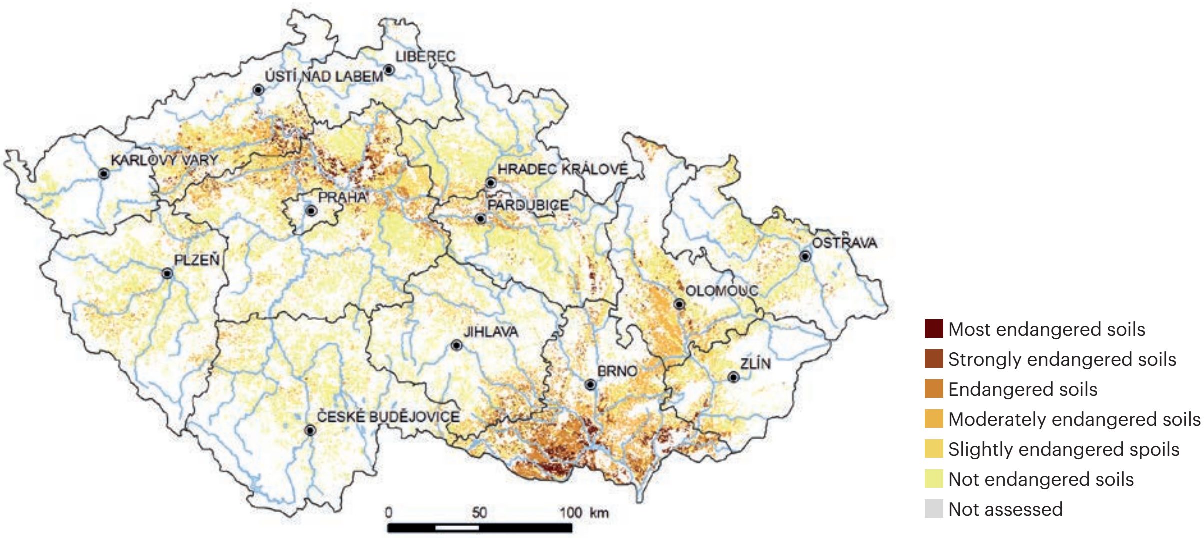
Potential vulnerability of agricultural land to wind erosion in the Czech Republic [% agricultural land fund], 2020



Data source: Research Institute for Soil and Water Conservation

Figure 26

Potential vulnerability of agricultural land to wind erosion in the Czech Republic, 2020



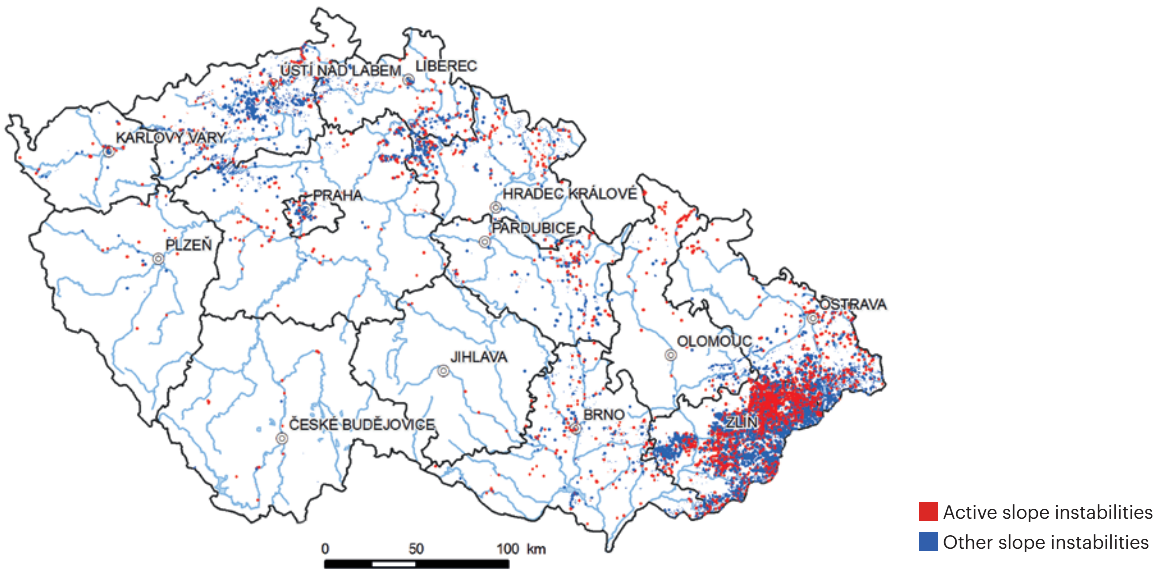
Data source: Research Institute for Soil and Water Conservation

[8] *The methodology for determining the potential soil vulnerability to wind erosion was used. Data on climatic regions (sum of daily temperatures above 10 °C, average moisture certainty over the growing season, probability of dry growing seasons, average annual temperatures, annual precipitation) and data on the main soil units (genetic soil type, soil substrate, grain size, soil skeleton, degree of hydromorphism) from farmland classification data were used. The resulting assessment is expressed as the product of the climate region factor and the main soil unit factor.*

Serious direct and indirect damage can also be caused by some geodynamic processes, especially **slope instability**. Slope instabilities can be of natural or anthropogenic origin but are distinguished by the speed of movement into four basic groups: creep (movement of millimetres to centimetres per year), slump (movement of metres per day), flow (movement of metres per hour) and fall (movement of metres per second). In Czechia, the behaviour of slopes is influenced mainly by extreme rainfall, rock type, inappropriate building foundations and landscape management. Landslides most often affect large areas of the Outer Western Carpathians, the Bohemian Central Highlands and the Poohří region (Figure 27). In 2020, a total of 21,980 slope instability objects were registered in the Register of slope instabilities of the Czech Republic. The total area of landslides was 84,921.8 ha, of which active landslides, considered the most serious sources of risk, accounted for 4,474.5 ha. The area of slope instabilities is increasing in the context which can be attributed to the increasing intensity of extreme weather events, but especially to the mapping of the phenomenon on the territory of Czechia[9].

Figure 27

Landslides and other dangerous slope instabilities in the Czech Republic, 2020



Data source: Czech Geological Survey

Soil quality is affected by soil **compaction** caused by intensive farming. Soil compaction negatively affects both the productive and non-productive properties of the soil. As a result of compaction, rainfall infiltration is reduced, surface runoff is accelerated, and the risk of erosion increases, natural soil processes are suppressed as the water, air and thermal regimes of the soil are disturbed and the soil organic matter content is therefore reduced. The potential vulnerability of lower level soils to compaction is partly due to the type of soil – so-called genetic compaction, which is typical of soils with higher clay content. Of the total area of soils at risk of compaction, genetic compaction accounts for only 30%, while compaction caused by intensive farming accounts for 70%. For agricultural soils, high potential vulnerability of the lower layers to compaction was assessed for 16.2% of the agricultural land area.

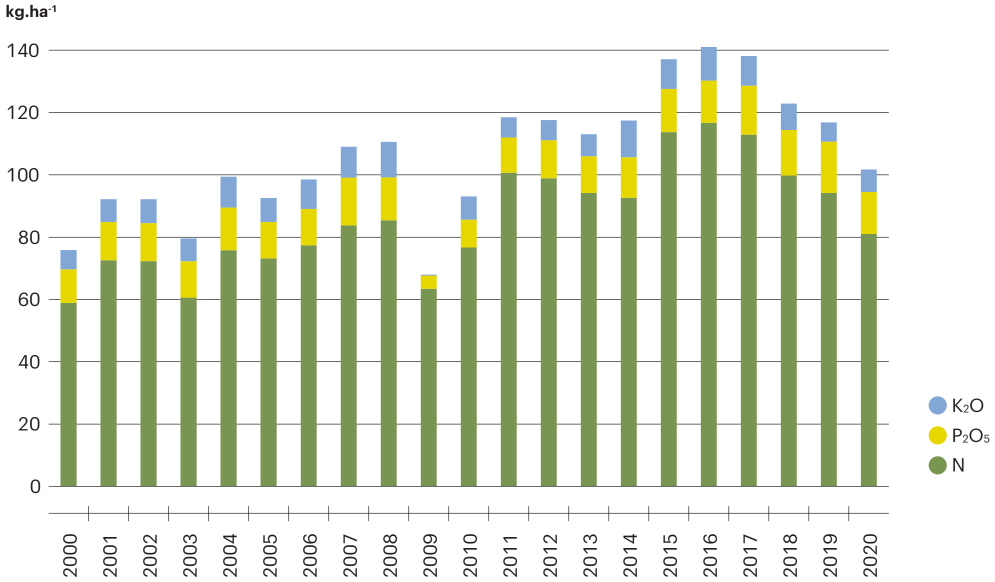
[9] *As of 31 December 2020, 19% of the territory of Czechia had been mapped.*

Consumption of fertilisers and plant protection products

Compared to 2000, the **consumption of mineral fertilisers** has increased gradually (by 33.9%). However, since 2017 the trend has been downwards, with a 13.0% year-on-year decrease in mineral fertiliser consumption to 101.7 kg net nutrients per ha in 2020 (Chart 103). Decreases were recorded compared to 2019 for phosphate fertiliser consumption, down 18.0% to 13.5 kg per ha, and for nitrogen fertiliser consumption (down 14.0% to 81.0 kg per ha). Potassium fertiliser consumption increased by 17.5% year-on-year to 7.2 kg per ha. In terms of the composition of mineral fertiliser consumption, nitrogen fertilisers clearly predominate, accounting for 81.0% of total consumption. The high consumption of fertilisers in recent years has been linked, among other things, to efforts to offset the negative effects of drought on crops. 2009 was an atypical year in this period, with a significant decline caused by the high price of mainly phosphate and potassium fertilisers and low prices of agricultural products.

Chart 103

Mineral fertiliser consumption in the Czech Republic [kg net nutrients.ha^{-1}], 2000–2020

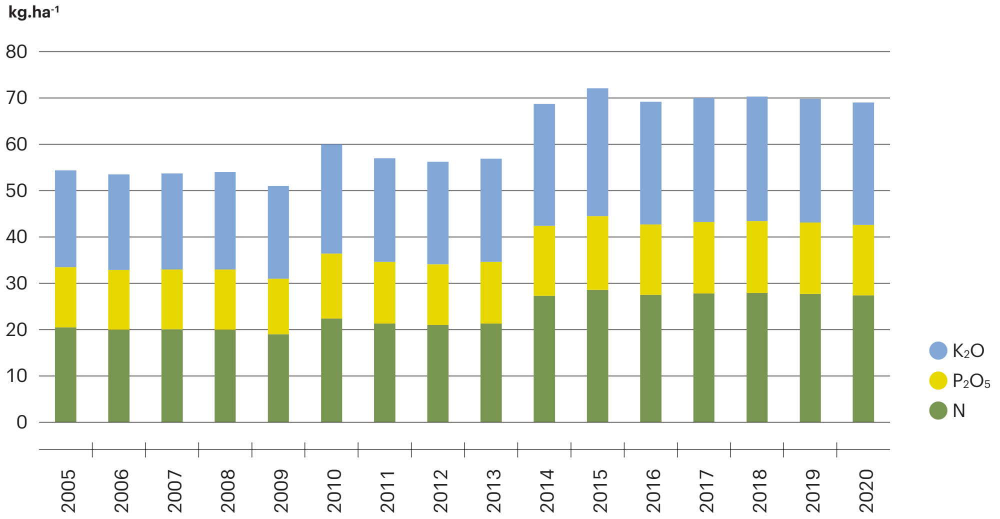


Data source: Ministry of Agriculture of the Czech Republic

Manure consumption has remained relatively flat since 2014 (Chart 104). In 2020, 27.4 kg N, 15.2 kg P_2O_5 and 26.4 kg K_2O per ha of agricultural land were supplied by manure (manure, slurry, etc.) and organic fertilisers (mainly digestate from biogas plants) (relative to the used land of 3,523.9 thous. ha). In 2020, the total net nutrient input from manure and organic fertilisers was 69.0 kg per ha. To maintain the soil's productive capacity and keep nutrients in the soil, it is advisable to increase the consumption of manure and to use compost to improve soil structure.

Chart 104

Consumption of manure and organic fertilizers in the Czech Republic [kg net nutrients.ha-1], 2005–2020



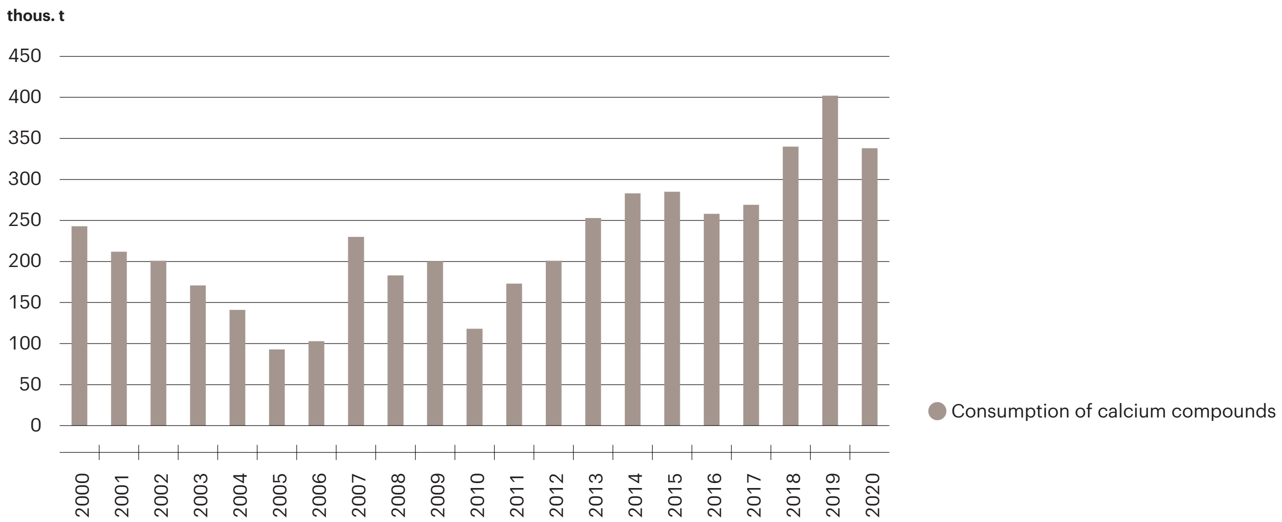
Since 2014, the nutrient input in the digestate is also counted. At the same time, part of the manure (mainly slurry, but also dung) is deducted, forming the feedstock for biogas plants.

Source: Ministry of Agriculture of the Czech Republic

Agricultural soil in Czechia has an acid soil reaction, so it is important to add lime. The modification of the soil reaction by application of **calcium compounds** contributes to improving the fertility and productive capacity of soils by maintaining and improving their physical, chemical and biological properties. In 2020, a total of 338.0 thous. t of calcium compounds were consumed. This was a year-on-year decrease of 15.9% (Chart 105). Increased use of liming has led to an increase in the share of soils with an alkaline reaction. The average soil reaction value of agricultural soil in the 2015–2020 period in Czechia was 6.0 pH (i.e. slightly acidic). A total of 30.0% of the agricultural land area has an acid soil reaction (i.e. pH up to 5.5). As a further 40.5% of agricultural land area has a weakly acidic soil reaction, 70.5% of the agricultural land would need to be limed regularly. The share of alkaline soils (with a pH higher than 7.2) was only 13.6% of the agricultural land area.

Chart 105

Consumption of calcium compounds in the Czech Republic [thous. t], 2000–2020

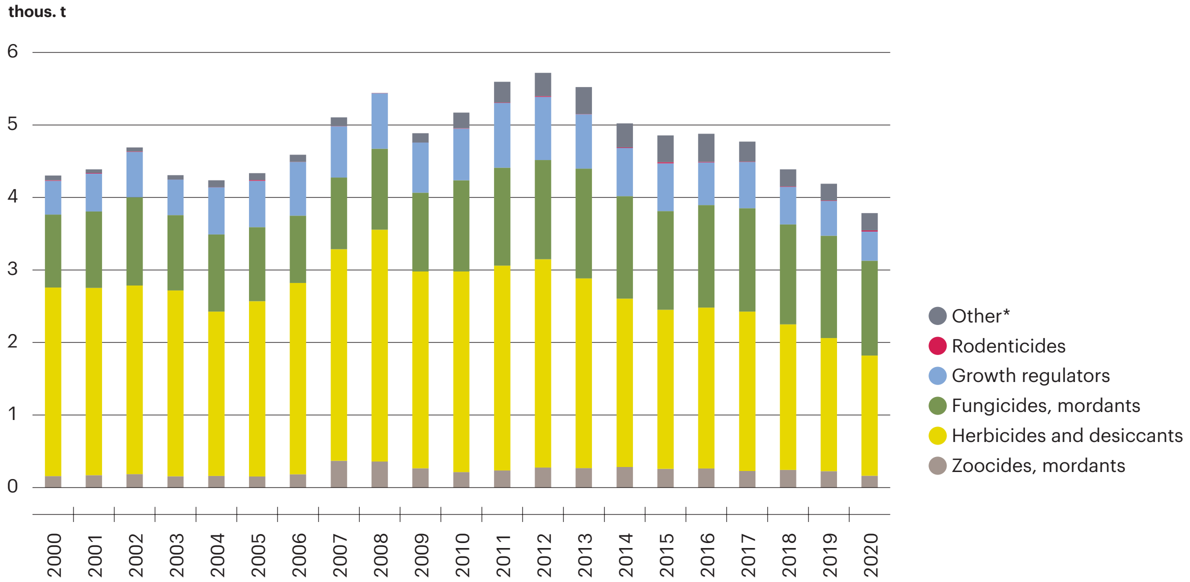


Data source: Ministry of Agriculture of the Czech Republic

The **consumption of plant protection products** is influenced by the actual occurrence of crop diseases and pests in a given year, and this varies according to the weather patterns during the year. The consumption of active substances in plant protection products has fallen by 12.1% since 2000. In 2020, it amounted to 3,784.2 thous. kg of active substances, or 9.7% less than in 2019 (Chart 106). Herbicides and desiccants accounted for the largest share of total consumption (43.8%), followed by fungicides and mordants (34.6%) and growth regulators (10.6%).

Chart 106

Consumption of active substances in plant protection products and other products by purpose of use in the Czech Republic [thous. t of active substance], 2000–2020



**Other – excipients, repellents, mineral oils, etc.*

Data source: Ministry of Agriculture of the Czech Republic

The most significant year-on-year decrease was recorded in the consumption of active substances in the category of **zoocides and mordants** (by 27.2%). The reduction was mainly in insecticide-based products, with consumption falling mainly due to the ban on the active ingredients chlorpyrifos and chlorpyrifos-methyl in 2020 as one of the most widely used groups in the control of insect pests of rapeseed and virus vectors in cereal crops. Spring 2020 was dry, and consequently associated with a lower level of fungicide protection. The consumption of active substances in the **fungicides and mordants** category decreased by 7.4%. Consumption of **herbicides and desiccants** fell by 9.8% year-on-year. The reduced consumption was mainly due to lower herbicide consumption (thanks to the effective protection in the autumn of 2019 there was no need for additional treatment in the spring of 2020). In addition, the weather conditions meant it was not possible to apply herbicide products in the autumn of 2020. In 2020, the field vole continued to strongly multiply, influenced by the homogeneity of the landscape, inappropriate management and a lack of natural predators. This led to a further significant increase in the consumption of active substances in the **rodenticide** category (172.7% year-on-year).

Excessive use of plant protection products and mineral fertilisers contributes to the deterioration of soil quality, a decline in the biodiversity of soil micro-organisms, and negative impacts on the quality of surface water and groundwater. Measures and targets to reduce the adverse effects of plant protection products are defined in the National Action Plan for the Safe Use of Pesticides in Czechia 2018–2022.

Land take

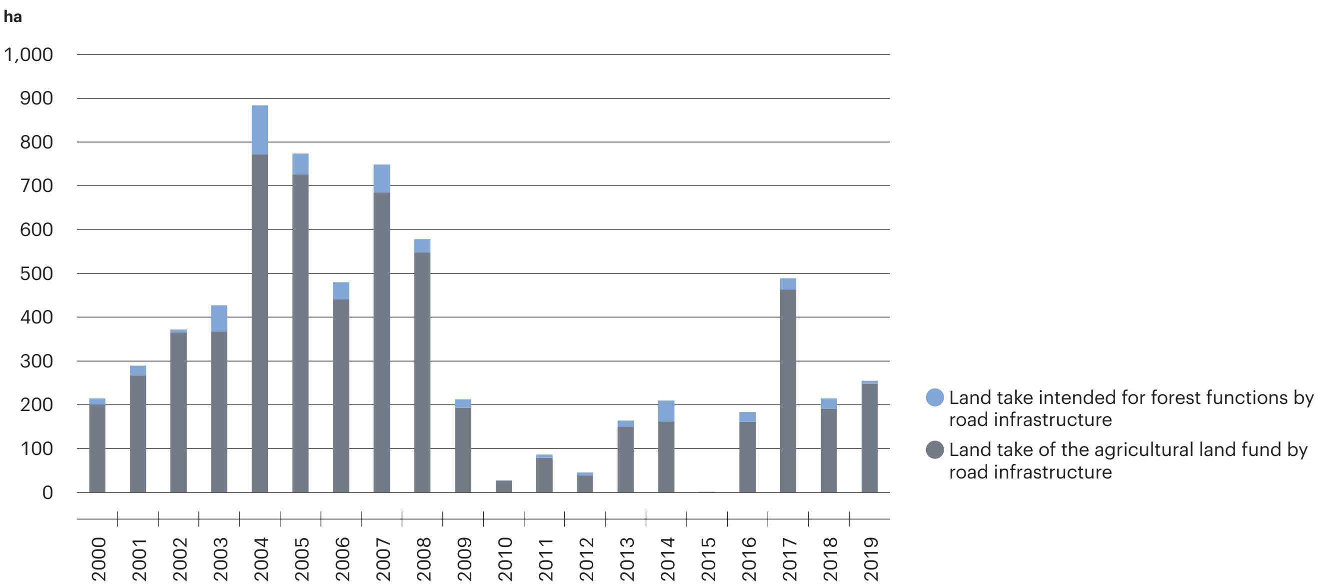
Soil is a finite natural resource and the way it is used is one of the main drivers of environmental change with a significant impact on the quality of life and ecosystems.

Agricultural, forest and other semi-natural areas are being taken up for the **development** of urban and other anthropogenic areas, especially for buildings and infrastructure, over the long term. 315.4 ha of arable land was developed in 2020. In addition, 1.8 thous. ha of arable land was converted into gardens in 2020. This is mainly related to the growth of dispersed built-up residential areas and gardens around these buildings.

The taking of agricultural and forest land use for road infrastructure showed a slightly decreasing trend between 2005 and 2010, while it fluctuated between 2011 and 2019[10], increasing slightly overall (Chart 107). In 2019, a total of 254.7 ha of agricultural and forest land was taken for road infrastructure.

Chart 107

Land take for road infrastructure in the Czech Republic [ha], 2000–2019



Data for the year 2020 are not available at the time of publication.

Data source: Transport Research Centre

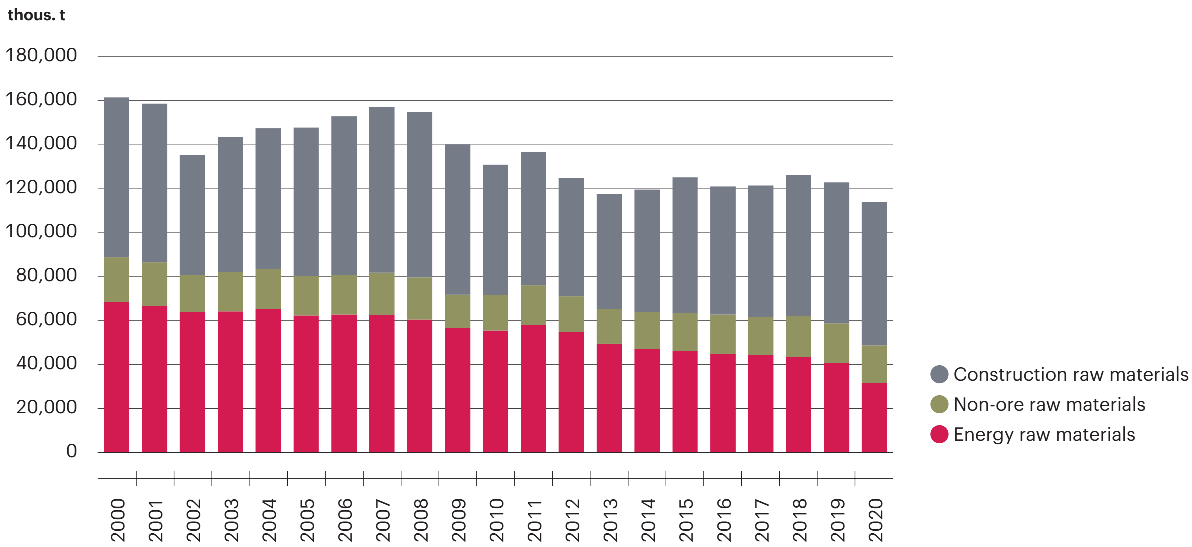
[10] *Data for the year 2020 are not available at the time of publication.*

Mineral extraction and reclamation

Extraction of mineral resources has a tradition in Czechia 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 extraction can be divided into four basic groups: energy raw materials, construction raw materials, non-ore raw materials and metallic minerals. In Czechia, construction and energy raw materials are extracted in the largest volumes, and non-ore raw materials to a lesser extent (Chart 108). Ore extraction is no longer carried out in Czechia, being terminated for economic reasons in the 1990s. This extraction was for iron ore and non-ferrous metal ores.

Chart 108

Mineral extraction in the Czech Republic [thous. t], 2000–2020

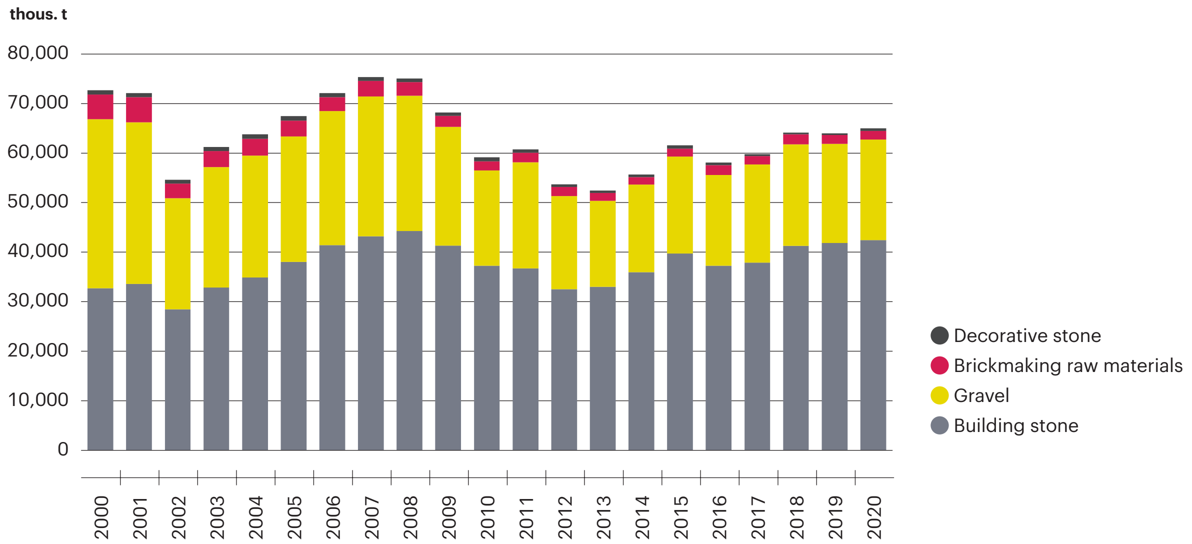


Data source: Czech Geological Survey

The extraction of **construction raw materials** includes mainly building stone and gravel, and to a lesser extent brickmaking and decorative stone materials (Chart 109). The volume of extraction of construction raw materials was 64.9 mil. t in 2020, an increase of 1.5% year-on-year but 10.6% less than in 2000. The extraction of construction raw materials is closely linked to the construction industry and the performance of the national economy, so the intensity of extraction corresponds to the intensity of construction production.

Chart 109

Extraction of construction raw materials in the Czech Republic [thous. t], 2000–2020



Data source: Czech Geological Survey

Of **energy raw materials** (Chart 110), coal is mainly extracted in Czechia. **Lignite** is extracted in Czechia in the North Bohemian and Sokolov Basins. **Hard coal** is currently extracted in the Upper Silesian Basin using deep mining. In the past, the extraction of solid fossil fuels fully covered their consumption, but since 2017 the decline in coal extraction has meant imports of these raw materials from abroad have outweighed exports.

The amount of extracted energy raw materials decreased in the 2000–2020 period, with the exception of natural gas. Brown coal extraction has decreased over the long term, by 41.7% since 2000, and by 21.2% year-on-year 2019–2020, to 29.5 mil. t. Hard coal extraction has decreased by 89.1% since 2000, and by 40.9% year-on-year to 1.9 mil. t. Lignite extraction in 2000 amounted to 453.0 thous. t, but its production gradually decreased and since 2010 is no longer extracted in Czechia.

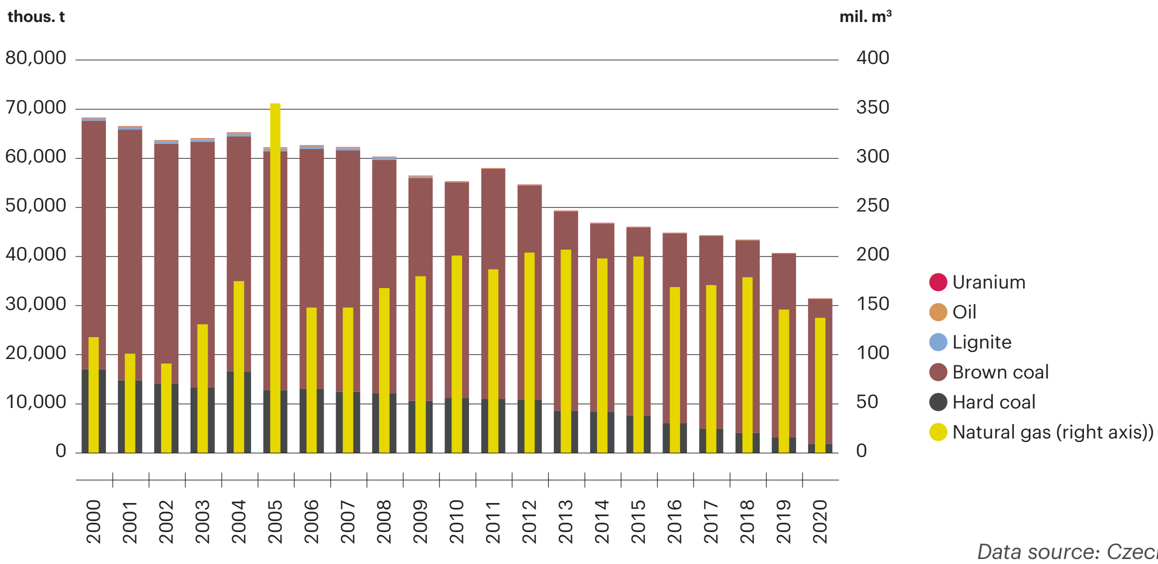
After the closure of the last uranium mine, Rožná, in 2016, **uranium** is now being extracted in Czechia only as a by-product of groundwater and mine water purification as part of post-extraction decommissioning and reclamation, especially in the Příbram and Stráž pod Ralskem deposits. Extracted uranium must be processed into nuclear fuel before it can be used, but this is not done in Czechia. Therefore, despite its own uranium reserves, Czechia is dependent on imports of nuclear fuel from abroad. Uranium extraction decreased from 498 t to 29 t in the 2000–2020 period (a 94.2% decrease), with a 13.5% annual decrease in 2020.

Natural gas is extracted in South and North Moravia, with extraction covering only approximately 2.5% of domestic consumption. In 2020, 137.7 mil. m^3 of natural gas was extracted, 16.7% more than in 2000 but 5.7% less than in 2019.

Oil is extracted in South Moravia in the Vienna Basin and to a lesser extent in the Moravian-Silesian Region in the Carpathian Foothills deposit area. Oil extraction in Czechia accounts for approximately 1.5% of domestic consumption. Oil extraction fell by 46.0% in the 2000–2020 period, and increased by 12.1% year-on-year to 90.8 thous. t in the 2019–2020 period.

Chart 110

Extraction of energy raw materials in the Czech Republic [thous. t, mil. m^3], 2000–2020



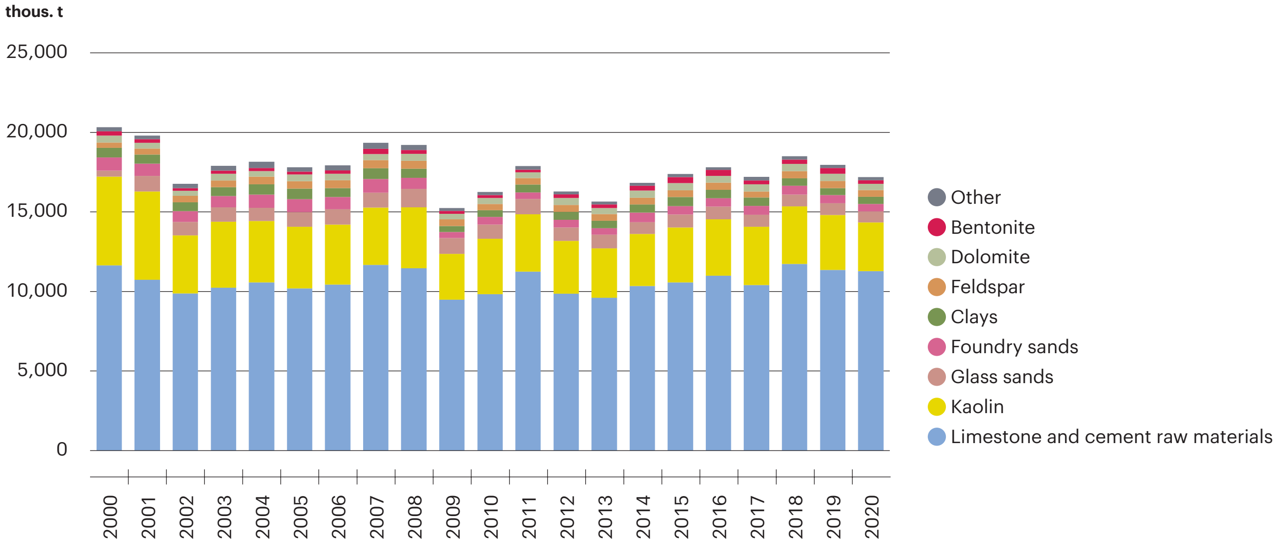
Data source: Czech Geological Survey

The **minerals** extracted in Czechia include mainly limestone and cement raw materials, which are used in the construction industry. Their extraction is fluctuating, with 11.3 mil. t extracted in 2020, a 0.7% year-on-year decline. Kaolin is another important mineral raw material, even on a global scale. Karlovy Vary kaolin actually sets the international standard for the quality of this rock in industrial use (porcelain production). Czechia ranks 4th in global kaolin production, and its share in world production is approximately 8.6%. In 2020, kaolin production in Czechia amounted to 3.1 mil. t.

Mineral extraction fluctuated in the 2000–2020 period, reflecting the gradual reduction in the material intensity of industrial production, the decline in industrial production after 2008, and the subsequent economic recovery and development of industrial production after 2009. The year-on-year decline in mineral extraction in the 2019–2020 period was 4.3%, but this was a significant decline of 15.4% from 2000 (Chart 111).

Chart 111

Mineral extraction in the Czech Republic [thous. t], 2000–2020



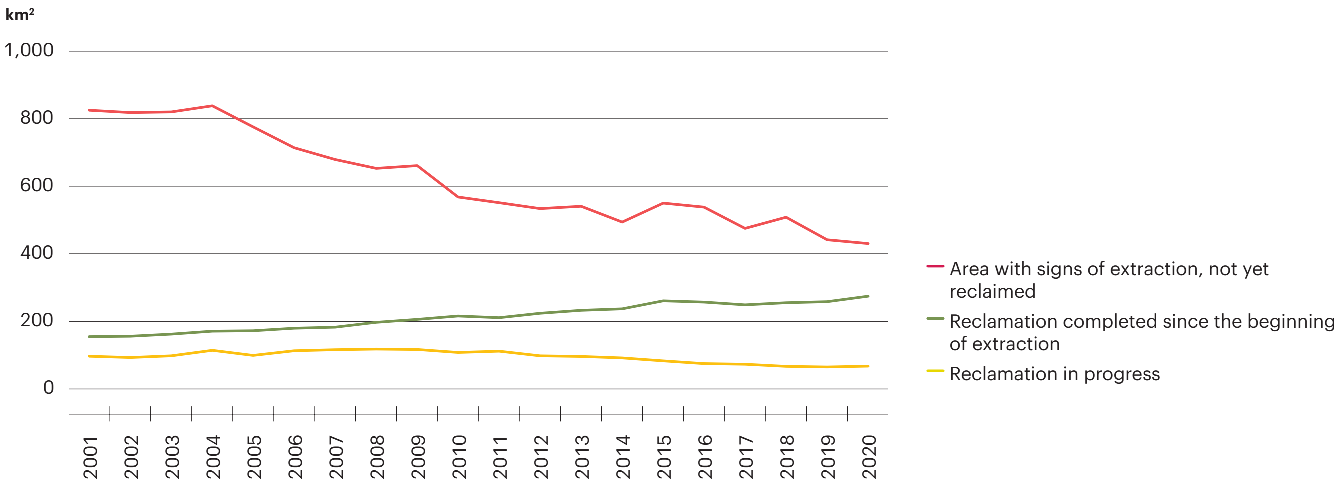
Data source: Czech Geological Survey

Extraction has a significant **impact on the environment** as it disturbs the landscape, alters plant and animal habitats, and degrades the quality of surface water and groundwater. It is therefore important to minimise these negative impacts. Act No. 44/1988 Coll., on the protection and utilisation of mineral wealth (Mining Act) requires extraction companies to reclaim areas affected by extraction and to create financial reserves for such reclamation. The area affected by extraction has been gradually decreasing since 2001, while the amount of reclaimed land has been increasing (Chart 112). In 2020, there was 430.4 km^2 of unreclaimed land (825 km^2 in 2001). By contrast, in 2020 there was 274.8 km^2 of reclaimed land (only 155 km^2 in 2001).

After the end of extraction, the new arrangement of natural conditions and relationships in the area is far from immediately apparent. Where reclamation has occurred through natural succession, ecosystems have developed and are often subsequently designated as specially protected nature areas and Natura 2000 sites. Hydric reclamation of the area affected by extraction also has a positive impact on the environment, retaining water in the landscape and thus creating sources of drinking water or welcome landscape features to which wetland habitats are tied.

Chart 112

Reclamation after mineral extraction in the Czech Republic [km^2], 2001–2020



Data source: Czech Geological Survey

3.1.3 | Non-productive functions and ecosystem services of the landscape

Key question

What is the state of agricultural land and forest ecosystems?

Key messages

Forests are being restored in areas affected by the bark beetle calamity, and the share of coniferous trees is gradually approaching the recommended tree species composition. In 2020, a record 17.3 thous. ha of deciduous trees and 16.4 thous. ha of conifers was reforested by artificial regeneration, with spruce still the most frequently planted tree species (10.3 thous. ha).

Agricultural land is vulnerable to degradation due to excessively sized fields and high levels of ploughing, however grassing is taking place and the average size of fields decreased at an average rate of 1.8% per year in the 2010–2020 period.

In the long term, we can observe a gradual approach to a more natural (and stable) structure of forest stands. However, this process is slow due to the long-term nature of the forest production cycle and requires many years of intensive effort.

In 2020, the set target for organic farming – 20% of arable land managed organically – was not achieved.

Damage to forest stands, expressed as the percentage of defoliation, remains high. In the category of older stands (60 years and older), the sum of defoliation classes 2 to 4 was 78.3% for conifers and 42.7% for deciduous trees. In younger stands (up to 59 years) the situation is more favourable, with 28.7% of conifers and 23.3% of deciduous trees in classes 2 to 4. In 2020, forest ecosystems were again affected by large-scale logging after the bark beetle calamity. The volume of recorded logging increased to 35.8 mil. m^3 od wood without bark, surpassing the previous record set in 2019. The volume of insect-related logging in 2020 (26.2 mil. m^3 of wood without bark) was almost the same as the total volume of insect-related logging in the 1990–2012 period. Large-scale logging has created large areas of clearing and forests have become a source of greenhouse gas emissions.

Assessment of the trend and state of indicators

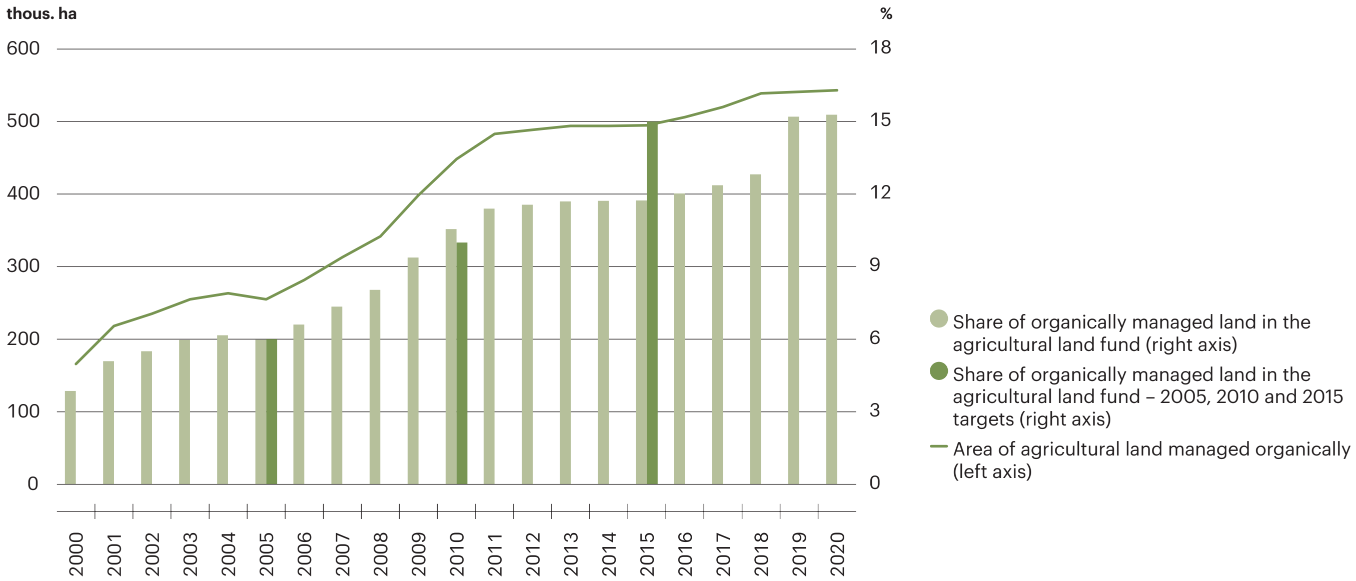
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Organic farming	↗	↗	↗	~
Average size of fields	N/A	↘	↘	✕
Forest health condition	↘	↘	↘	✕
Sustainable forest management	↝	↝	↝	✕
Tree species composition of forests	○	○	○	✕

Organic farming

Organic farming is one way to maintain and improve soil fertility and ecological functions. The area of **organically managed land** (Chart 113) has increased significantly thanks to subsidy support, from 165.7 thous. ha in 2000 to 543.3 thous. ha in 2020. The year-on-year increase in organically managed land was only 0.4% (2.3 thous. ha). The share of organically managed land in the agricultural land fund registered in the LPIS in 2020 was 15.3% (the 15% target set in the Action Plan for the Development of Organic Agriculture in 2016–2020 was already met in 2019).

Chart 113

Area and share of organically managed land in agricultural land in the Czech Republic [thous. ha, %], 2000–2020



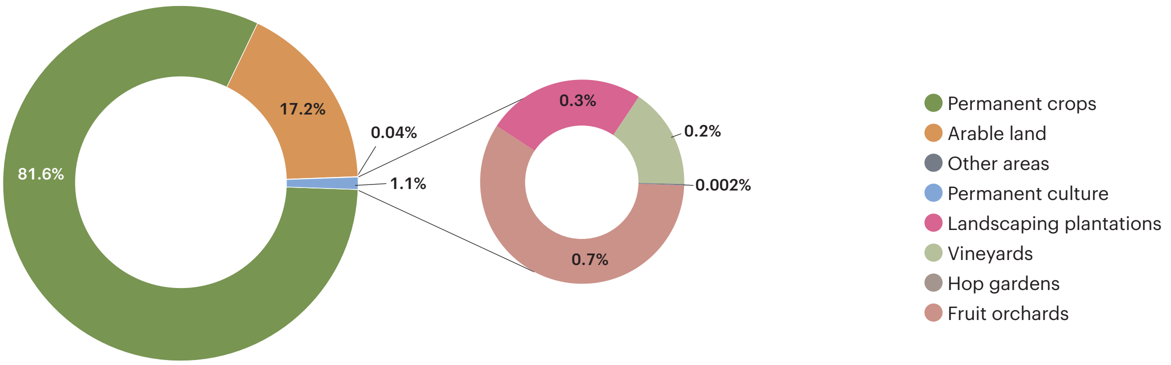
Until 2018 (inclusive), the share of organically managed land of the total agricultural land in the agricultural land fund was calculated, while from 2019 it is the share of organically managed land in relation to the total land in the agricultural land fund registered in the LPIS.

Data source: Ministry of Agriculture of the Czech Republic

Permanent grassland accounts for the largest share in the structure of organically managed land, occupying 81.6% (443.3 thous. ha) in 2020, followed by arable land, which occupied 17.2% (93.7 thous. ha) in 2020, Chart 114. Although the area of organically farmed arable land is slowly growing (the area of arable land increased by 3.5% year-on-year), the target of achieving a 20% share of arable land in the agricultural land fund in the Action Plan for Organic Farming in 2016–2020 is still not being met. The balance of the area of organically managed land, i.e. 1.2%, is made up of permanent crops (vineyards, orchards, hops) and other areas. Although permanent grassland has an important function in the landscape and is used for organic livestock farming, it is necessary to increase the share of other categories, especially arable land and orchards, in the future, mainly to increase the production of organic food and for the sustainable management and use of agricultural land.

Chart 114

Structure of the land fund in organic farming in the Czech Republic [%], 2020



The category Other areas includes areas of fast-growing trees and nurseries, wooded land and ponds.

Data source: Ministry of Agriculture of the Czech Republic

PThe number of **organic farming entities (ecofarms)** farming according to established organic principles increased significantly from 563 in 2000 to 4,665 in 2020 (Chart 115). After a period when the number of eco-farms rather stagnated between 2011 and 2014 due to the development of the Rural Development Programme 2007–2013, the number of eco-farms has been growing again since 2015. In 2020, 25 fewer eco-farms were registered than in 2019. The total number of organically reared animals was 420.0 thous. head in 2020, while cattle farming significantly predominated with a share of 64.0%.

Chart 115

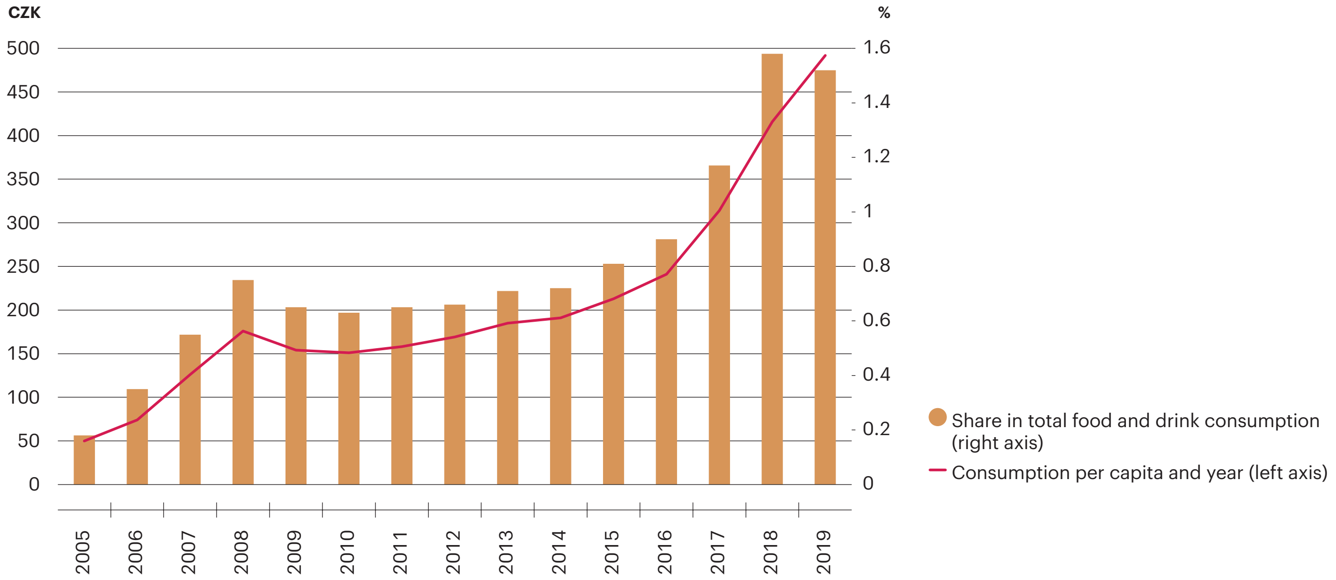
Number of organic farming entities in the Czech Republic [number], 2000–2020

Data source: Ministry of Agriculture of the Czech Republic

The number of **organic food producers** has also been increasing in the long term. While in 2001 there were 75 organic food producers, there were 865 in 2020. Despite the growing trend, the Czech organic food market is still underdeveloped – the average annual per capita consumption of organic food was CZK 392 in 2019[11], and the share of organic food in total food and beverage consumption was 1.5% (Chart 116). Apart from the still relatively high average price of organic food, this mainly due to the underdeveloped marketing and distribution network for organic products, as well as the underdeveloped processing sector for organic products. A large share of organic food is imported, with distributor imports accounting for around 48% in 2019.

Chart 116

Organic food consumption in the Czech Republic [CZK, % of total food and beverage consumption], 2005–2019



Data for the year 2020 are not available at the time of publication.

Data source: Institute of Agricultural Economics and Information, Ministry of Agriculture of the Czech Republic

Support for agricultural entities farming under organic farming principle s 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 title „Organic farming" has been relatively balanced in recent years at around CZK 1.3 bil. The Ministry of Agriculture of Czechia also financially supports the annual training of organic farmers and organic food producers, with educational activities mainly carried out by NGOs.

[11] *Data for the year 2020 are not available at the time of publication.*

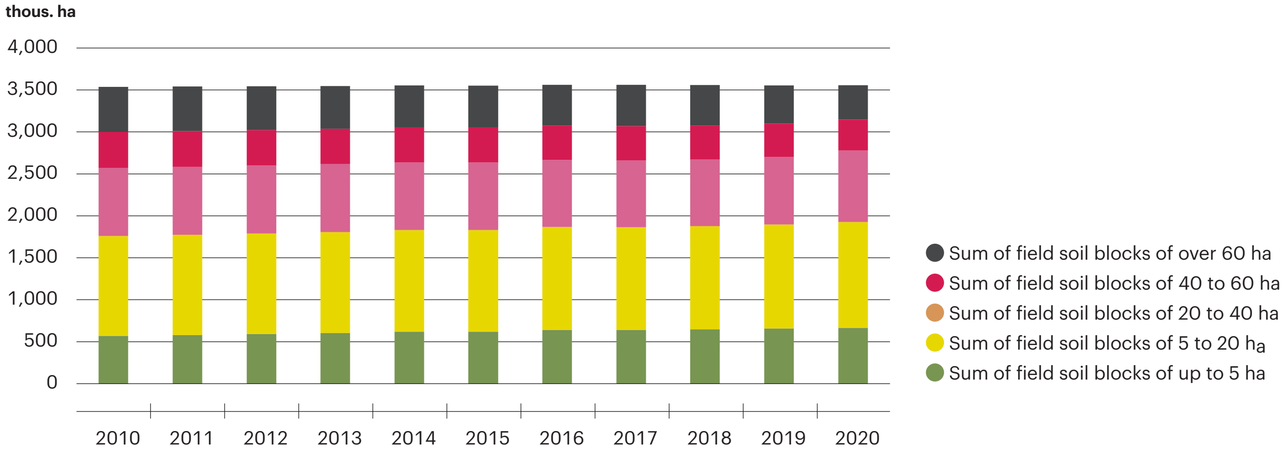
Average size of fields

Czechia has one of the largest **fields** in Central Europe, a result of the collectivisation and intensification of agriculture that took place in the 1940s and especially in the 1950s. During this period, to increase the efficiency of agrotechnical practices, massive land consolidation and the associated large-scale cultivation of land were carried out, as well as the destruction of hydrographic and landscape elements. One consequence is the excessive size of the current fields, which does not respect the relief and the ruggedness of the terrain. Large fields increase the vulnerability of the soil to degradation and reduce landscape diversity, with a negative impact on biodiversity. The negative impact of the excessively sized fields on agricultural ecosystems can also be compounded by inappropriate management of individual fields, especially if it does not respect the slope of the terrain. A suitable solution to reduce the sensitivity of agricultural land would be to plan field size according to the slope gradient, the topography, and the actual soil in the given area, and in addition to adjust the growing plan according to these (and other) factors (e.g., for soil blocks with a steep slope, deep-rooting crops or permanent grassland are suitable solutions).

While in 1948 the average size of field soil block was 0.23 ha, in 2020 the average size of field soil blocks[12] was 5.6 ha. However, the average size of the field soil blocks has been declining, decreasing by an average of 1.8% per year in the 2010–2020 period. In 2020, there were a total of 631,027 field soil blocks in Czechia with a total area of 3,555,380 ha (Chart 117). The largest part of this area (35.5%) was represented by field soil blocks in the 5 to 20 ha category. There are 4,768 of the largest field soil blocks of 60 ha or more, and these cover an area of 408,959 ha (11.5%). The representation of field soil blocks depends on the type of agricultural and settlement structure in each region. The largest field soil blocks are in the Karlovy Vary Region (average 8.1 ha) and the smallest in the Liberec Region (average 3.8 ha).

Chart 117

Size of field soil blocks in the Czech Republic [thous. ha], 2010–2020



Data source: Ministry of Agriculture of the Czech Republic

According to the LPIS (Land Parcel Identification System) public land register database in 2020, the most highly represented categories of **agricultural land** are arable land (68.8%) and permanent grassland (28.3%). The area of all other categories together amounts to 2.9% of the total agricultural soil area. Within agricultural land, there is a noticeable decrease in arable land and an increase in permanent grassland, forests, and permanent crops (hops, vineyards, orchards and gardens). In the 2005–2020 period, the total area of registered grassland in the LPIS increased by 144.0 thous. ha (16.7%). Grassing is supported by the state subsidy policy and the application of Common Agricultural Policy principles and is aimed at areas with a higher degree of soil vulnerability to water erosion, at areas of frequent washouts and in catchment areas with high soil permeability (infiltration areas), where it supports the reduction of nitrate input to groundwater and surface water. The preference for regional grassland seed mixtures contributes to the stabilisation of biodiversity.

[12] *A field soil block is a continuous area of agriculturally managed land with a minimum area of 0.01 ha, the boundaries of which can be identified in the terrain and on which a natural or legal person carries out agricultural activity on their own behalf and at their own responsibility, and on which one type of agricultural crop is cultivated, as determined in accordance with Government Decree No. 307/2014 Coll. on determining the details of the registration of land use according to user relationships, or where an ecologically significant element is located.*

Forest health condition

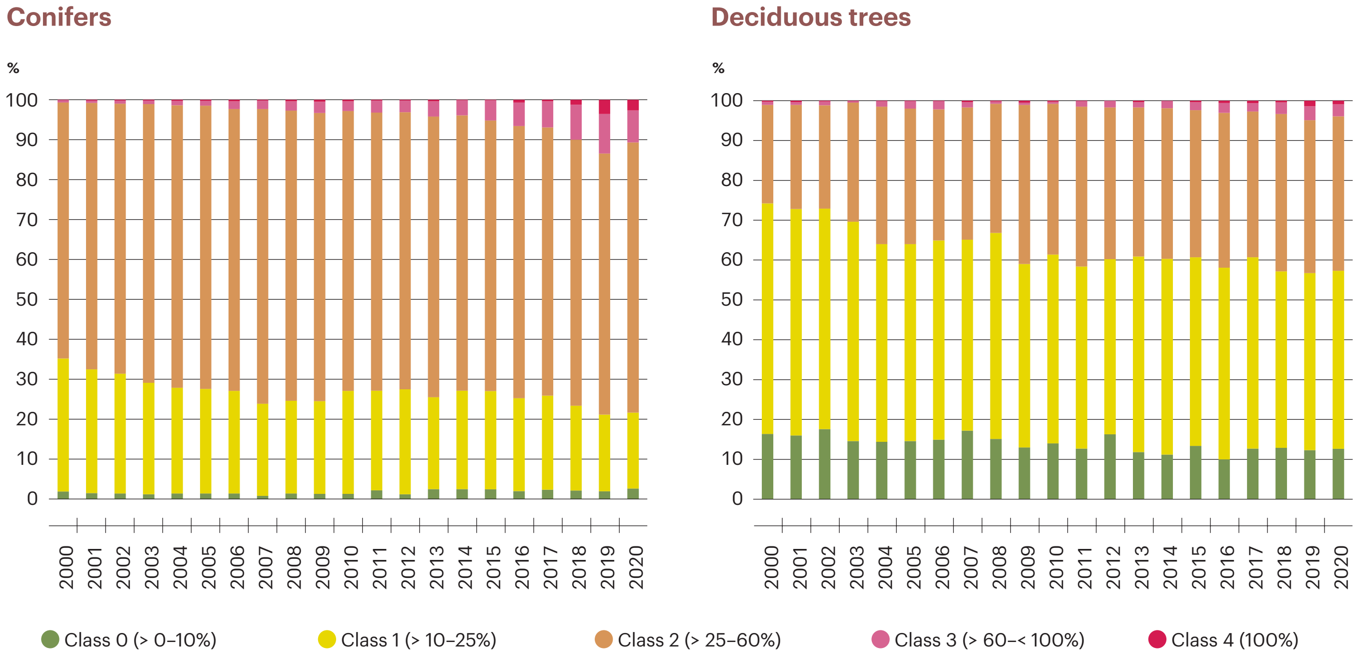
Forest land covers roughly one third of Czechia's territory and is expanding slightly, accounting for 33.9% of all land in 2020. Forest ecosystems are thus an important element for the landscape, and forestry is an important economic sector. As a renewable resource, wood has significant potential in the transition to sustainable production and consumption systems. In addition, stable forest ecosystems support biodiversity, regulate the water regime of the landscape, protect soil from erosion, improve air quality, and provide recreational and aesthetic functions. The current state of forests is very far from natural, making them vulnerable to the current threats posed by manifestations of climate change. As a result, the non-productive functions of forests are endangered and the utility and value of their main product – timber – is reduced.

The ability of forests to perform some of their functions can be assessed through the state of health expressed as the degree of defoliation, defined as the relative loss of the assimilative apparatus in the crown of a tree compared to a healthy tree growing in the same stand and habitat conditions. The assessment of the health of coniferous and deciduous stands by defoliation level is divided by age into two categories – older (60 years and older) and younger (up to 59 years). The defoliation values are divided into five basic classes (0 to 4), of which classes 2 to 4 indicate significant tree damage.

In 2020, 78.3% of conifers and 42.7% of deciduous trees were classified in **defoliation** classes 2 to 4 for older stands (60 years and older; Chart 118) and 28.7% of conifers and 23.3% of deciduous trees for younger stands (up to 59 years; Chart 119). In older stands, defoliation in the sum of classes 2 to 4 for conifers is highest for pine (94.4% in 2020), followed by larch (83.8%) and spruce (66.5%; Chart 120). Among deciduous trees, oak showed a significant defoliation rate in classes 2 to 4, with a total of 69.9% of the assessed trees, while beech showed a defoliation rate of 18.0%. For conifer stands aged up to 59 years, the situation is again least favourable for pine, which accounted for 75.6% of trees in the sum of classes 2 to 4 in 2020. A more favourable situation compared to older stands is observed in the case of spruce (only 9.7% in classes 2 to 4). In deciduous stands, even in the younger age category, oak (56.6% in classes 2 to 4) has a higher defoliation rate than beech (7.6%).

Chart 118

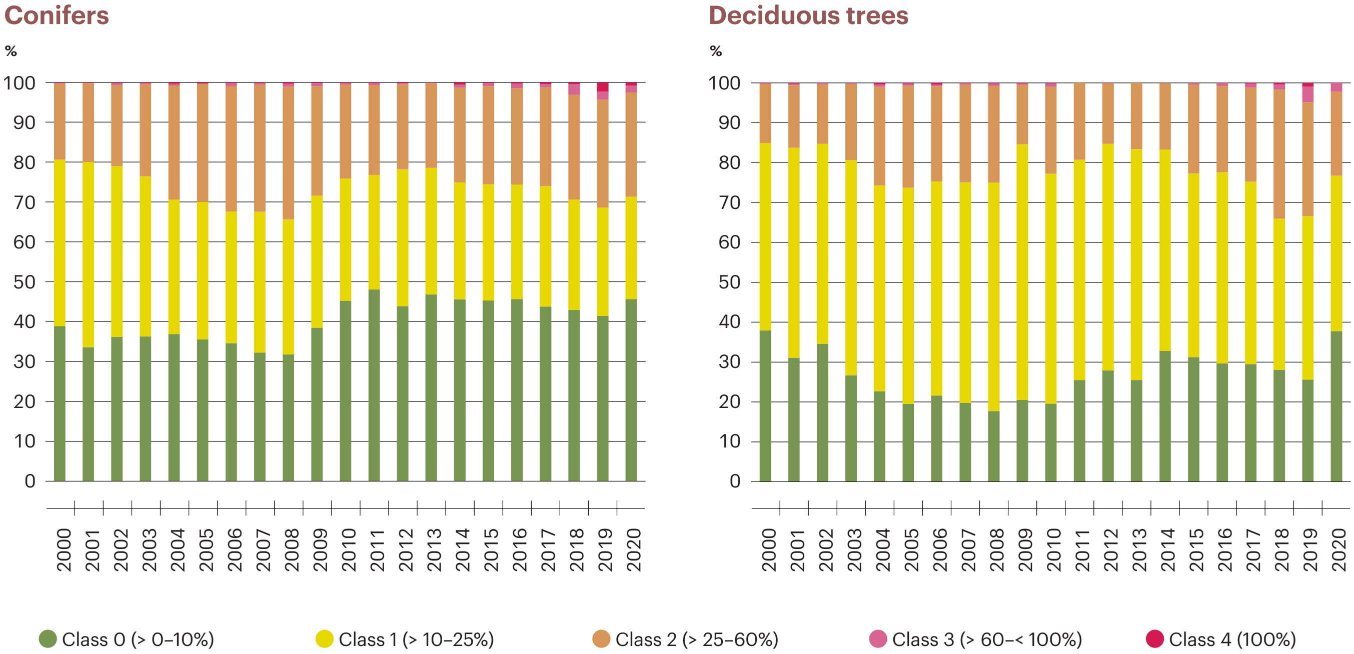
Defoliation of older conifer and deciduous stands (60 years and older) in the Czech Republic by class [%], 2000–2020



Data source: Forestry and Game Management Research Institute

Chart 119

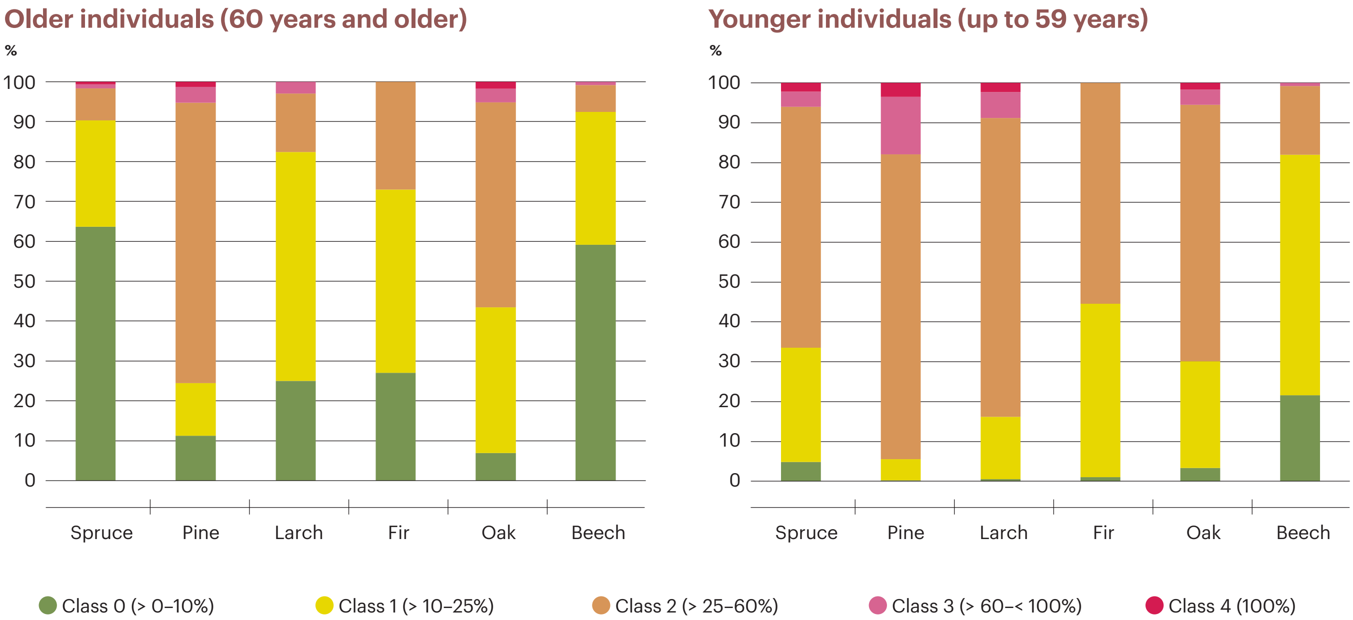
Defoliation of younger conifer and deciduous stands (up to 59 years) in the Czech Republic by class [%], 2000–2020



Data source: Forestry and Game Management Research Institute

Chart 120

Defoliation of basic tree species in the Czech Republic by class [%], 2020



Data source: Forestry and Game Management Research Institute

In younger stands (up to 59 years) the defoliation level is lower as younger stands have greater vitality and ability to withstand adverse environmental conditions. In addition, older stands were burdened by sulphur (SO_2) and nitrogen (NO_x) pollution during the 1970s and 1980s. The effects of anthropogenic air pollution are divided into primary, caused by direct damage to the surface of assimilating organs, and secondary, caused by leaching of alkaline nutrients due to soil acidification. Since 1989, the air pollution situation has significantly improved thanks to the installation of new industrial equipment, changes in the fuel mix, and the application of emission limits at air pollution sources. However, forest stands respond to changes with a considerable delay and, moreover, even though the pollution load intensity is demonstrably lower, it still exists. In addition to the habitat conditions and the amount of acid deposition, management practices, including tree species composition and logging intensity, also influence the acidification and overall nutrient balance of forest ecosystems. Coniferous stands are more vulnerable to acidification due to the slow decomposition of their litter, associated with the production of low molecular weight organic acids, and due to the higher concentrations of pollution in sub-crown precipitation due to dry deposition on needles.

Currently, the health of forest stands is negatively affected by the bark beetle calamity and manifestations of climate change such as drought, strong winds and the lengthening of the growing season. In addition, many forest stands are characterised by an inappropriate species composition with a predominance of pastoral farming. Trends in the representation of defoliation classes are negative in the long term, and the health of forest stands therefore remains unsatisfactory.

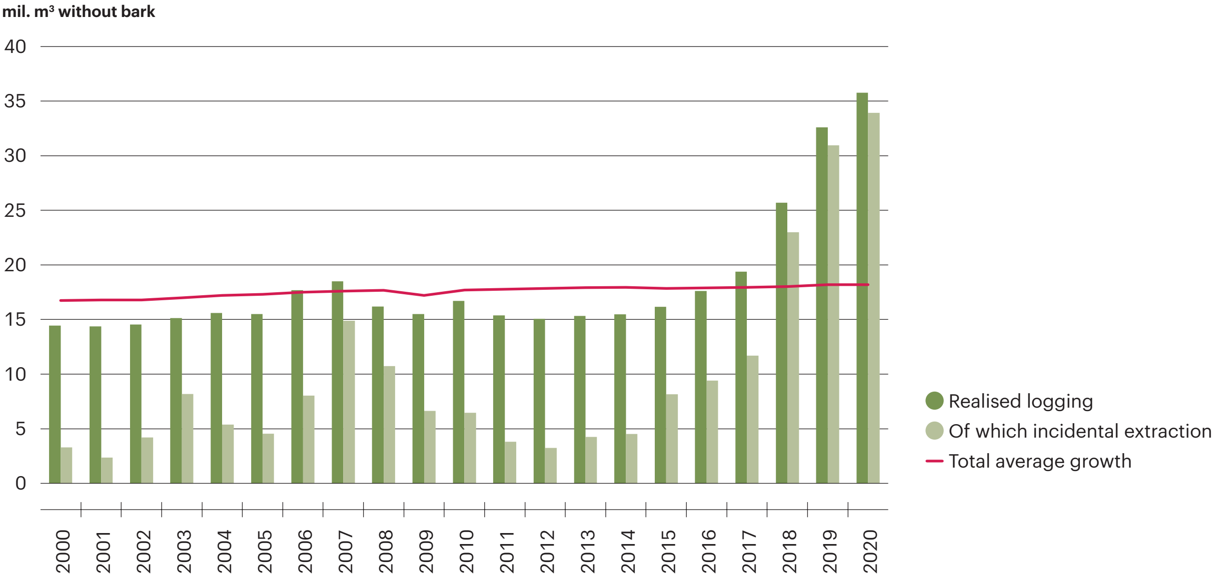
In 2020, forest ecosystems were again affected by large-scale logging after the bark beetle calamity. The **volume of recorded logging** increased again, to 35.8 mil. m^3 of wood without bark, surpassing the previous record set in 2019 (Chart 121). The share of incidental (calamity-related) logging in total logging in 2020 decreased slightly to 94.8% from 95.0% in 2019, still well above average compared to the previous period from 2000 to 2015, when the current bark beetle calamity started. 2007 was the exception when, after Hurricane Kyrill, incidental logging accounted for 80.4% of total logging. The **volume of incidental logging** in 2020 was 33.9 mil. m^3 of wood without bark, the highest recorded in history (Chart 122). Most of the incidental logging was insect-related logging (26.2 mil. m^3 of wood without bark). Thus, the volume of insect-related logging in 2020 was almost the same as the total volume of insect-related logging in the 1990–2012 period (26.0 mil. m^3 of wood without bark). insect-related logging has been on the rise since 2015, when the largest ever bark beetle calamity in our territory began in North Moravia in the Jeseníky region, and gradually spread to other areas. The bark beetle calamity is caused simultaneously by climatic conditions and the low ecological stability of forest stands, largely composed of spruce monocultures. Drought and the lengthening growing season improve conditions for the spread of the bark beetle and at the same time reduce the ability of spruce stands to resist this pest. At the same time, stands damaged by abiotic factors, such as wind, are much more susceptible to insect infestation and fungal diseases. Natural logging in 2020 was 4.6 mil. m^3 of wood without bark, which can be considered an average value in the context of previous years.

The total logging volume in 2020 significantly exceeded the **total average growth rate**, which has been slowly increasing since 2000, and in 2020 was 18.2 mil. m^3 of wood without bark (Chart 121). The overall average increment is an expression of the productive capacity of forest habitats and is a crucial indicator in assessing the principle of balance and sustainability of logging options. The record logging was reflected in the **total timber stock**, which decreased year-on-year for the first time in 2020 and amounted to 701.1 mil. m^3 of wood without bark[13]. Massive tree felling also affects the overall carbon balance of forests. While in the previous period Czech forests were carbon sinks, in the last three years they have become carbon sources. Leaving part of the wood mass in forests to decay would have a positive effect on the carbon balance, and on the quality of forest soils and biodiversity.

[13] *The total stock of timber also decreased in 2019 according to estimates based on data from the project Monitoring the State and Development of Forest Ecosystems, which since 2016 has followed on from the second cycle of the National Forest Inventory in Czechia 2011–2015. Read more: https://nil.uhul.cz/downloads/vysledky_projektu_ssvle/2020_05_18_zasoby_drivi_ssvle_2019.pdf.*

Chart 121

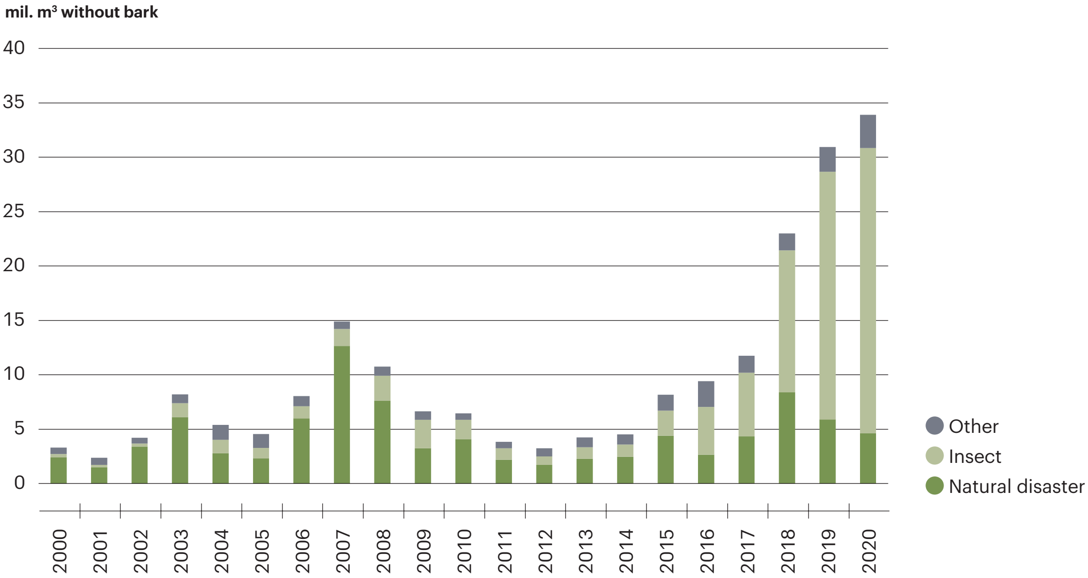
Comparison of realised timber logging with total average growth rate in the Czech Republic [mil. m^3 without bark], 2000–2020



Data source: Czech Statistical Office, Forest Management Institute

Chart 122

Incidental extraction by cause in the Czech Republic [mil. m^3 without bark], 2000–2020



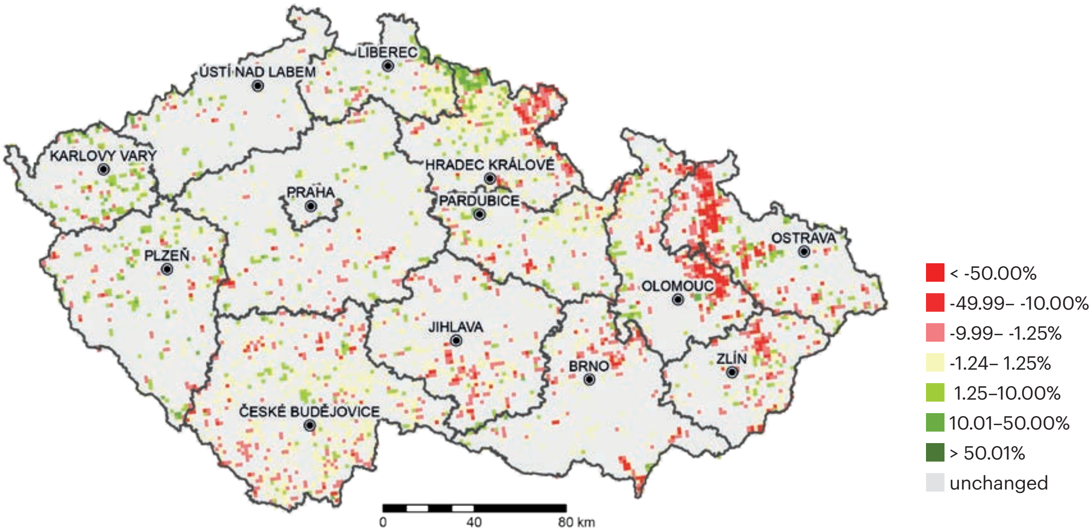
Data source: Czech Statistical Office

Many so-called calamity clearings have recently been created in areas with high logging volumes. The total area of clearings increased by 30% year-on-year to 70.9 thous. ha. Large-scale logging of wood impacted by bark beetles has also affected the land cover of Czechia, which may have downstream consequences for the entire landscape (e.g., affecting the hydrological regime). According to the CORINE Land Cover dataset[14], a total of 37.4 thous. ha of forest was lost between 2012 and 2018 (Figure 28).

[14] *Data for the years 2019 and 2020 are not available at the time of publication.*

Figure 28

Percentage change in forest cover between 2012 and 2018 in the Czech Republic according to the CORINE Land Cover dataset [%], 2018



Data for the years 2019 and 2020 are not available at the time of publication.

Data source: Czech Environmental Information Agency, European Environmental Agency

Sustainable forest management

According to their predominant function, forests are classified into the commercial, protective, or special-purpose **forest categories**. The share of commercial forests, whose main function is timber production, has been declining steadily (76.7% in 2000 to 74.2% in 2020). In contrast, the share of special-purpose forests increased from 19.8% to 23.8% over the same period. The share of protective forests is decreasing, at 2.0% in 2020, down from 3.5% in 2000. Significant commercial use of forests has resulted in a shift away from natural conditions, leading in many places to a reduction in their resilience. Increasing the resilience of forests and improving their productive and non-productive functions can be achieved by using nature-friendly management practices and maintaining a diverse forest structure.

A **management method** can be considered close to nature when it uses the creative forces of nature to the maximum extent to achieve the goal of forest management, respects habitat conditions and where the economic measures are carried out in accordance with natural processes and the condition of stands. According to data from forest management plans[15], grazing farming methods (shelterwood, strip, clear-cutting) are used almost exclusively. The most used method is strip (48.5% of forest stands), which is based on the restoration of stands by clear-cutting elements (strips), the width of which does not exceed the height of the restored stand (Chart 123). The second most-frequently used management method is the shelterwood method (29.8% of forest stands), which uses the so-called screen cutting, in which a new stand is created under the protection (screen) of the parent stand. The third is the clear-cutting method (17.7% of forest stands), which because of incidental logging can lead to the creation of clearings, the size of which adversely affects the structure of the forest and the processes naturally occurring in it, including increasing the sensitivity of forest stands to the manifestations of climate change. Forests managed in a selective way make up the lowest share (3.6% of stands), where logging is not differentiated in time and space for the purpose of regeneration and reforestation and does not lead to the formation of clearings. The transition to selective management can be gradually introduced in older stands on suitable sites and with an appropriate share of shade trees (in the current and natural species composition). The representation of these individual management methods in the forest management plans has been stable since 2010.

Chart 123

Area of forests in the Czech Republic by management type according to the forest management plans [%], 2005–2020

The data from the proposition part of the forest management plans are influenced by the owner's economic intentions and may not correspond to the actual representation of individual management methods.

Data source: Forest Management Institute

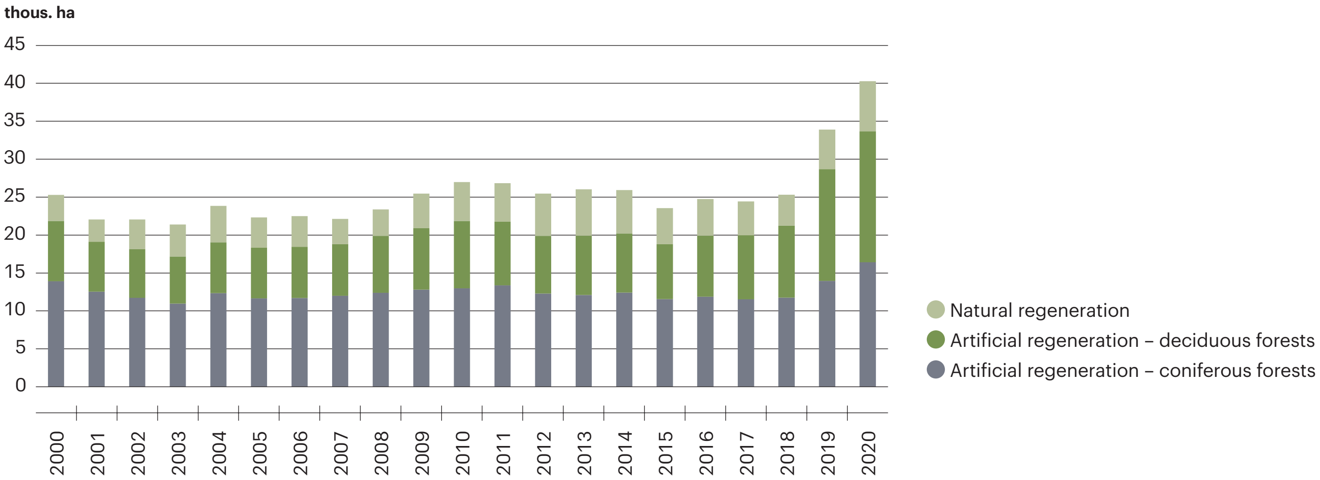
[15] *The data from the proposition part of the forest management plans are influenced by the owner's economic intentions and may not correspond to the actual representation of individual management methods.*

The long-term application of predominantly glade management methods has resulted in a significant predominance of **simple-structured** forest stands (81.1% of forests)[16]. Richly structured stands (1.1% of the forests) are found mainly in natural forest ecosystems and stands where selective management methods are applied. In terms of **forest shapes**, tall forests clearly predominate (about 97.2% of the stands), characterised by a long regeneration cycle. However, there are efforts to increase the share of medium and low forests and forests with a richer structure, which is positive in terms of forest resilience and biodiversity support. Many species of forest organisms are endangered by the lack of dead wood left in forests to decompose spontaneously. According to estimates from the second cycle of the National Forest Inventory, there is a total of 69.2 mil. m^3 (i.e. 10% of the total stock) of **dead wood** in Czechia. The average volume is 24.8m^3 of dead wood per ha of forest land. The amount of dead wood in Czechia is lower than under natural conditions but is increasing slightly.

One of the principles of nature-close management is the use of **natural regeneration** in stands with an appropriate species composition. There was a highest recorded total area of regeneration in 2020 (40.3 thous. ha), which corresponds with the also highest recorded logging after the bark beetle calamity (Chart 124). Most of this regeneration has consisted of artificial afforestation. The trend in natural regeneration is fluctuating. The share of natural regeneration in the total regeneration area has decreased from 23.5% in 2013 to 15.4% in 2019. However, in 2020, the area of natural regeneration increased (6.6 thous. ha) and its share of the total area of forest regeneration rose to 16.4%. Greater use of natural regeneration and appropriate management practices could significantly reduce the cost and need for planting material and human resources, which are in short supply at this time of calamity, while achieving higher forest production value.

Chart 124

Forest regeneration in the Czech Republic [thous. ha], 2000–2020



Since 2002, changes in the methodology mean that shelterwood regeneration has also been included in natural regeneration (originally only regeneration in clearings was counted).

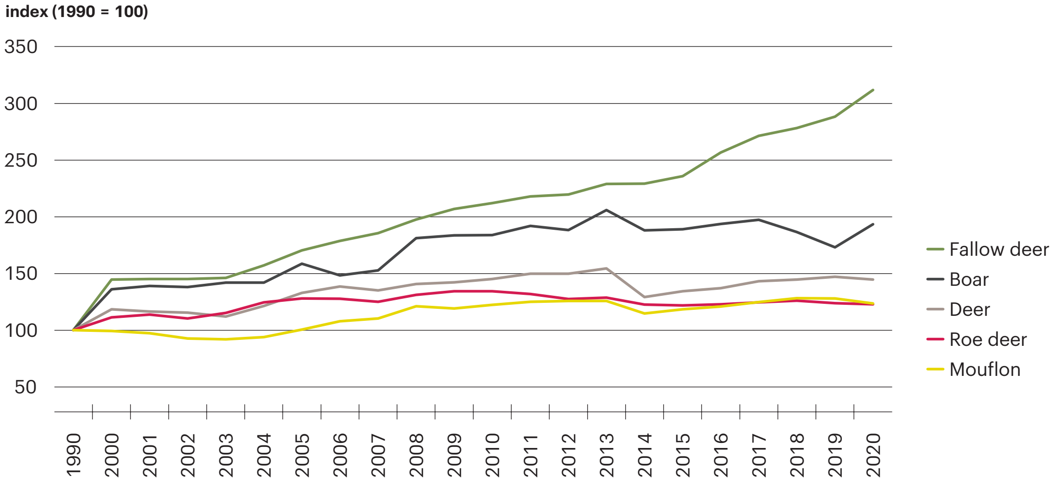
Data source: Czech Statistical Office

The priority for enabling natural and artificial forest regeneration is to reduce and maintain the **number of ungulates**, especially regarding the damage they cause by gnawing on newly established forests, but also to agricultural crops and land. In addition to the gnawing of young trees, which prevents natural and artificial regeneration of the forest, high numbers of ungulates have a negative impact on the entire forest ecosystem. The reason for the high ungulate numbers is intensive human use of the landscape, especially agricultural farming, which creates suitable cover and feeding conditions, and reduced natural regulation of game, or its complete absence. After previous increases in the numbers of monitored game, the numbers have rather stagnated in recent years, apart from fallow deer, which more than doubled in the 2000–2020 period. Deer have long been the most abundant game with a spring count of 291,070 in 2020 (Chart 125). Damage caused by game has long been between CZK 25 and 35 mil. and has been increasing since 2018.

[16] *KUČERA M., ADOLT R., eds., 2019: National Forest Inventory in the Czech Republic – results of the second cycle 2011–2015 [online]. First edition. Brandýs nad Labem: Forest Management Institute, 2019 [cited 29 June 2021]. ISBN 978-80-88184-24-9. Available from: http://nil.uhul.cz/downloads/kniha_nil2_web.pdf.*

Chart 125

Spring stocks of selected game species in the Czech Republic [index, 1990 = 100], 1990–2020



State as of 31 March of the given year.

Data source: Czech Statistical Office

A tool for introducing responsible forest management and at the same time informing consumers about the origin and environmental consequences of logging is the **certification of forest land** using the standards of international certification organisations, which has been adopted in Czechia especially since 2000. Currently, PEFC (Programme for the Endorsement of Forest Certification Schemes) and FSC (Forest Stewardship Council) certificates are available. In 2020, 67.1% of forest land had PEFC certification and 4.7% FSC, the standards of which place higher demands on sustainable management (Chart 126). About half of the forest land with FSC certification also had PEFC certification, so in total 69.5% of forest land was certified in 2020.

Chart 126

Percentage of forest land with PEFC and FSC certification in the total area of forest land in the Czech Republic [%], 2002–2020

Since 2017, PEFC and FSC have been jointly surveying the area of forests with both certifications (PEFC + FSC).

Data source: Programme for the Endorsement of Forest Certification Schemes, Forest Stewardship Council

Tree species composition of forests

A key aspect of nature-like forest management is a targeted approach to the appropriate species composition of forests. The current species composition of the forests is significantly different from the reconstructed natural and recommended composition, mainly due to the widespread planting of spruce and pine monocultures in the past. Even-aged conifer monocultures, often of an unsuitable ecotype, reduce biodiversity and are significantly more susceptible to damage due to biotic and abiotic factors. In 2019, an estimated 84.6% of the total stock of Norway spruce was located on sites endangered by bark beetles[17] In contrast, a natural species composition of forests in Czechia corresponding to the natural conditions of the habitat, forms the basis for the overall stability of the forest. According to this composition, oak and hornbeam forests should occur naturally in the lower altitudes and should gradually change to beech and fir forests with increasing altitude, and then to spruce forests in the highest altitudes. The most natural tree composition is achieved in mountain areas where the natural abundance of Norway spruce is high[18].

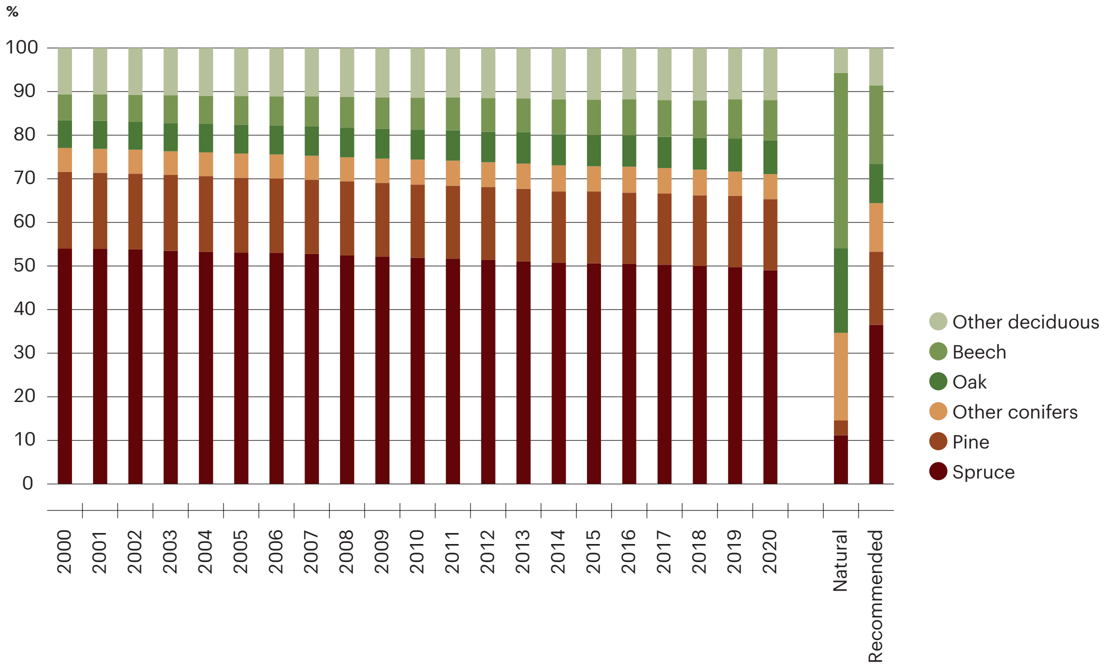
The **recommended tree species composition** is a compromise between the current and natural tree species composition, considering economic interests, non-productive forest functions and knowledge related to climate change adaptation. Within this composition, the representation of deciduous trees is expected to increase to 35.6%. The overall **share of deciduous stands** in the forest area is slowly increasing, rising from 22.3% in 2000 to 28.2% in 2020 (Chart 127). In terms of the representation of individual tree species, spruce is the most represented tree species, although its share in the total forest composition has been steadily decreasing, from 54.0% to 48.8% in the 2000–2020 period. A further reduction to 36.5% is expected in relation to the recommended composition. In addition, the current bark beetle calamity will further reduce spruce incidence in the coming years. Fir is an important part of the natural forest ecosystem, contributing significantly to maintaining forest stability. The share of fir, classified as an ameliorating and reinforcing tree species, is increasing much more slowly, and in 2020 it accounted for 1.2%, while the recommended share is 4.4%. The failure of efforts to increase the share of fir in stands is mainly attributed to damage caused by game. A significant increase (to 18% of the forest area) is also predicted for beech, but this increased only slowly from 6.0% to 9.0% in the 2000–2020 period. Slower growth has also been recorded for oak, which has increased from 6.3% in 2000 to 7.5% in 2020.

[17] *ADOLT R., eds. 2020: Estimation of timber stocks in forests in the Czech Republic based on Monitoring the State and Development of Forest Ecosystems data from 2019 [online]. Brandýs nad Labem: Forest Management Institute, 2019 [cited 29 June 2021]. Available from: https://nil.uhul.cz/downloads/vysledky_projektu_ssvle/2020_05_18_zasoby_drivi_ssvle_2019.pdf.*

[18] *KUČERA M., ADOLT R., eds., 2019: National Forest Inventory in the Czech Republic - results of the second cycle 2011-2015 [online]. First edition. Brandýs nad Labem: Forest Management Institute, 2019 [cited 29 June 2021]. ISBN 978-80-88184-24-9. Available from: http://nil.uhul.cz/downloads/kniha_nil2_web.pdf.*

Chart 127

Species composition of forests in the Czech Republic, reconstructed natural and recommended composition [%], 2000–2020



Data source: Forest Management Institute

In recent decades, a targeted change in species composition towards a more natural (and more stable) structure of forest stands is evident, manifested by more frequent **planting of deciduous trees** at the expense of conifers. In 2019, for the first time in history, a larger area of forests was reforested with deciduous trees than with conifers as part of artificial regeneration, and this trend continued in 2020 when a record 17.3 thous. ha of deciduous trees and 16.4 thous. ha of conifers was regenerated, although spruce was still the most frequently planted tree species (10.3 thous. ha). The total area of artificial regeneration was thus a record due to the regeneration of forests after the bark beetle calamity.

The **age structure of forests** is uneven. From the point of view of sustainability and balancing logging options (normality), stands up to 60 years old have a smaller area than desired and older stands have a larger area. In 2000, age classes IV (61–80 years; 18.8%) and V (81–100 years; 17.3%) were abundant due to extensive planting of forest monocultures in the late 19th and first half of the 20th century. Since then, there has been a decrease in the representation of age class IV (13.5% in 2020), which correlates with the ongoing bark beetle calamity, which has mainly affected the monoculture stands. On the other hand, since 1990, there has been a steady increase in older to over-aged stands in age class VII (121+ years). 8.8% of the area of forest land was in this class in 2020. One reason for this increase may be the change in the management method in some protection forests and special-purpose forests and the postponement of the restoration of economically unattractive, low-quality, or inaccessible stands. On the contrary, this trend, which poses a risk of losses from an economic point of view, is very positive in terms of supporting biodiversity. This is because older forest stands provide a favourable habitat for species tied to ecosystems with a high share of dead wood.

Landscape management in an international context

Key messages

The total area of forest cover and the volume of wood and carbon stock in biomass is increasing. Forests cover more than a third of Europe and almost 90% of them are used for logging. From the perspective of production, most forests are managed according to sustainable development principles.	Organic farmland accounted for 7.9% of total cultivated land in the EU28 in 2019. With a share of 15.2% in 2019[19], Czechia has an above-average share of organically managed land.	Europe's forests are facing increasing pressure from the intensifying manifestations of climate change. Damage caused by intense winds, drought, fires, and biotic agents is increasing. The health of Europe's forests is deteriorating. In total, 28.4% of the assessed stands exceeded the 25% rate in 2019[20]. 4% of forests are classified in the highest damage category (above 60%).

Forests in an international context

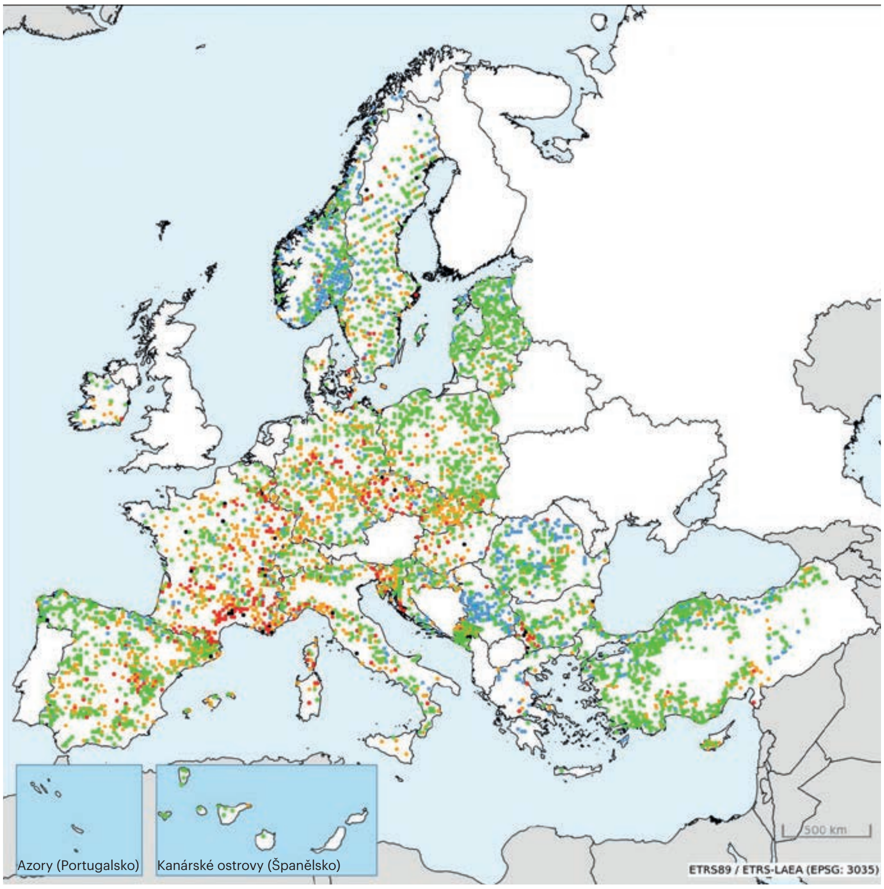
Europe's forests are human-disturbed ecosystems facing increasing impacts of climate change and atmospheric pollution, posing a risk to the vitality of forest soils and forest health. Defoliation is the result of a complex of influences and short-term factors (pest overpopulation, diseases, frost, drought, wind, and other weather damage) together with long-term factors (inappropriate age and species composition of stands, soil acidification, long-term exposure to atmospheric pollution, etc.). High defoliation rates generally indicate a reduction in the resilience of forest stands to various environmental influences. An important factor for the stability and resilience of forest ecosystems to acidification and climate change is an appropriate forest stand species composition that reflects natural conditions.

The above factors causing defoliation are the reason why Czechia is among the countries with the highest **defoliation** rates in Europe (Figure 29). In 2019[21], 71.6% of the forests in Europe were in the low defoliation damage category (0–25%) while 28.4% of the assessed stands exceeded 25% defoliation and were classified as damaged or dead. 4% of forests are classified in the highest damage category (above 60%). Forests with significant damage are mainly located in central and southern Europe, namely in southern and south-eastern France, northern Italy, Czechia, Slovenia, and Croatia. Defoliation rates in Europe are not improving. This is a worrying finding, particularly in the context of ongoing climate change and the failure to reduce nitrogen deposition.

[19, 20, 21] *Data for the year 2020 are not available at the time of publication.*

Figure 29

Defoliation in the main monitoring plots of all tree species in Europe [%], 2019



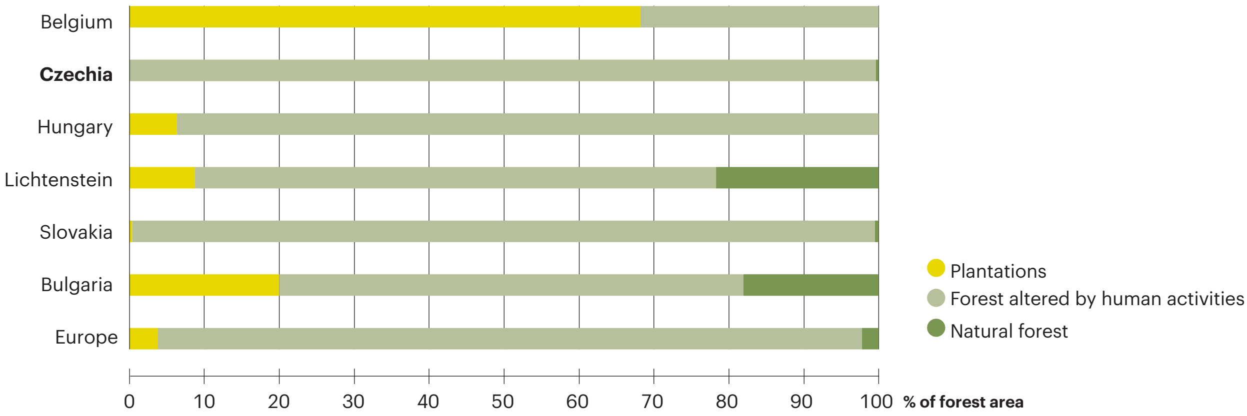
Data for the year 2020 are not available at the time of publication.

Data source: ICP Forests

In Europe, only 2.2% of the total forest area are not affected by human activity (**natural forests**). In Czechia, this share is 0.4% (Chart 128). This low level is due to the use of Europe's forests and land for commercial purposes. The highest share of native forests is found in Liechtenstein, Bulgaria and Georgia. By contrast, the highest share of plantations is found in the United Kingdom, Ireland and Belgium.

Chart 128

Share of forests affected by human activities in selected countries [% of forest area], 2020



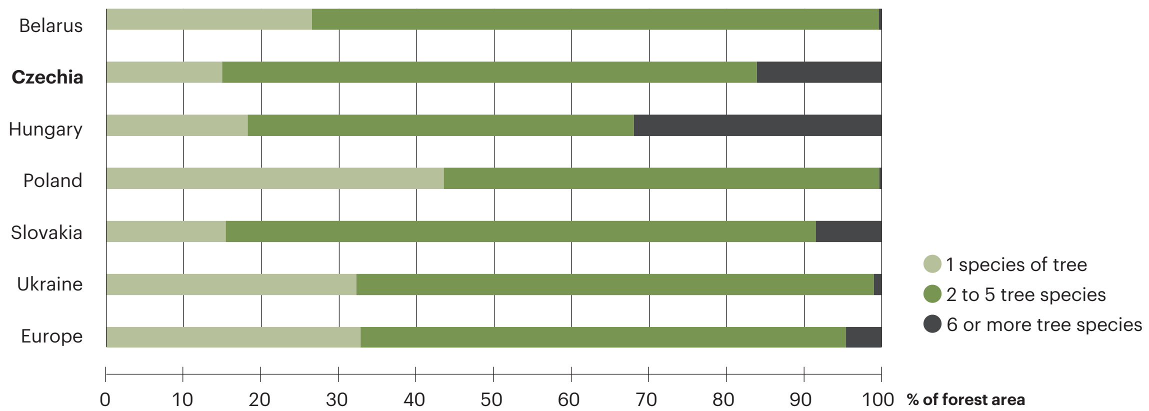
A forest altered by human activities usually differs from a natural forest in its species composition, which is influenced by human activities such as artificial regeneration. Plantations are forest stands established with the intention of obtaining as much timber as possible in a short period of time (10 to 60 years). The wood from forest plantations is mostly used to produce paper, pulp, particleboard, or firewood.

Data source: Forest Europe

Monocultures account for an average of 15.4% of forests in Czechia and 32.8% across Europe (Chart 129). At the same time, the area of stands composed of more than 6 tree species in Czechia is significantly higher than the European average (16.6% in Czechia, 4.6% in Europe). However, the species composition of forest stands in Czechia in comparison with the European average is not relevant, as specific forest ecosystems naturally composed of only one or two species (e.g. northern pine forests, subalpine spruce forests) were also included in the European average.

Chart 129

Species composition of forest stands in selected countries [% of forest area], 2015



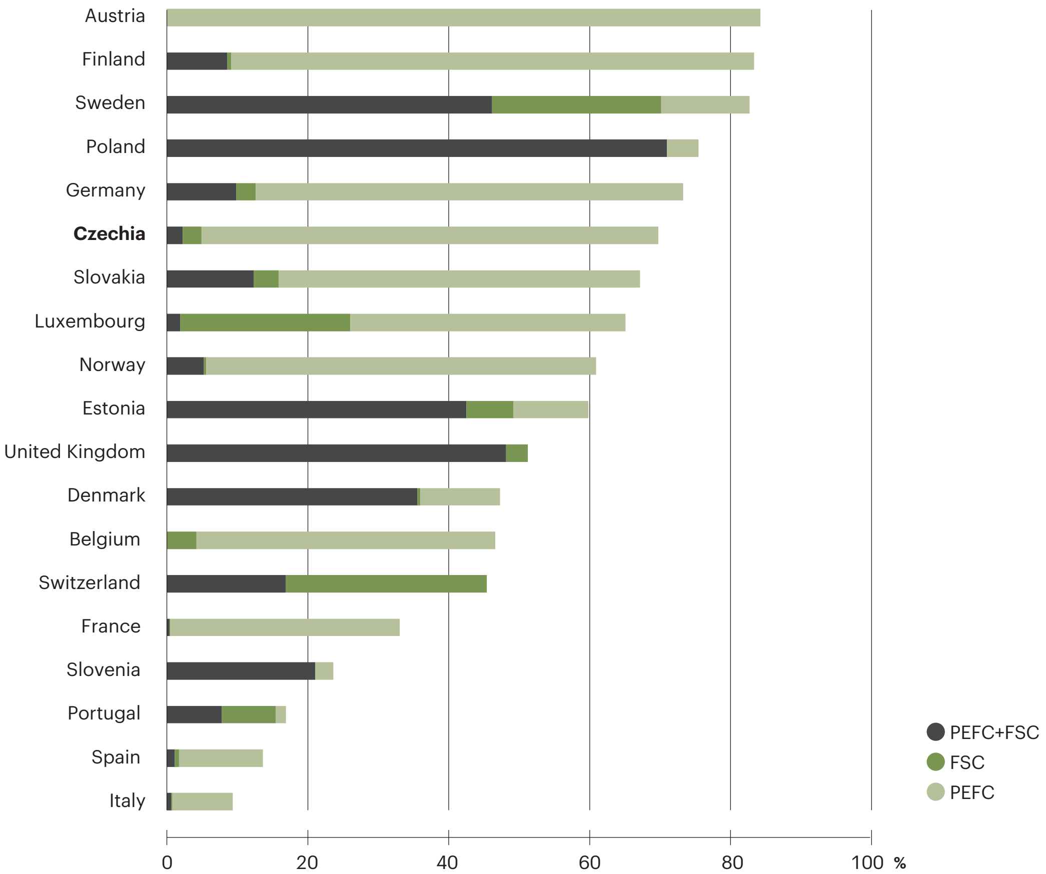
Data for the years 2016–2020 are not available at the time of publication.

Data source: Forest Europe

On average, about half of forest land in European countries is certified. The **share of PEFC and FSC certified forests** in the total forest area in the selected EU countries is highest in Austria (84.2%) and Finland (83.3%). On the other hand, the lowest share is in Italy (9.3%) and Spain (13.6%). Czechia is above average in Europe with 69.7%, mainly thanks to its high share of PEFC certified forests (Chart 130).

Chart 130

Share of PEFC and FSC certified forests in total forest area in selected countries [%], 2020



Since 2017, PEFC and FSC have been jointly surveying forest areas with both certifications (PEFC + FSC).

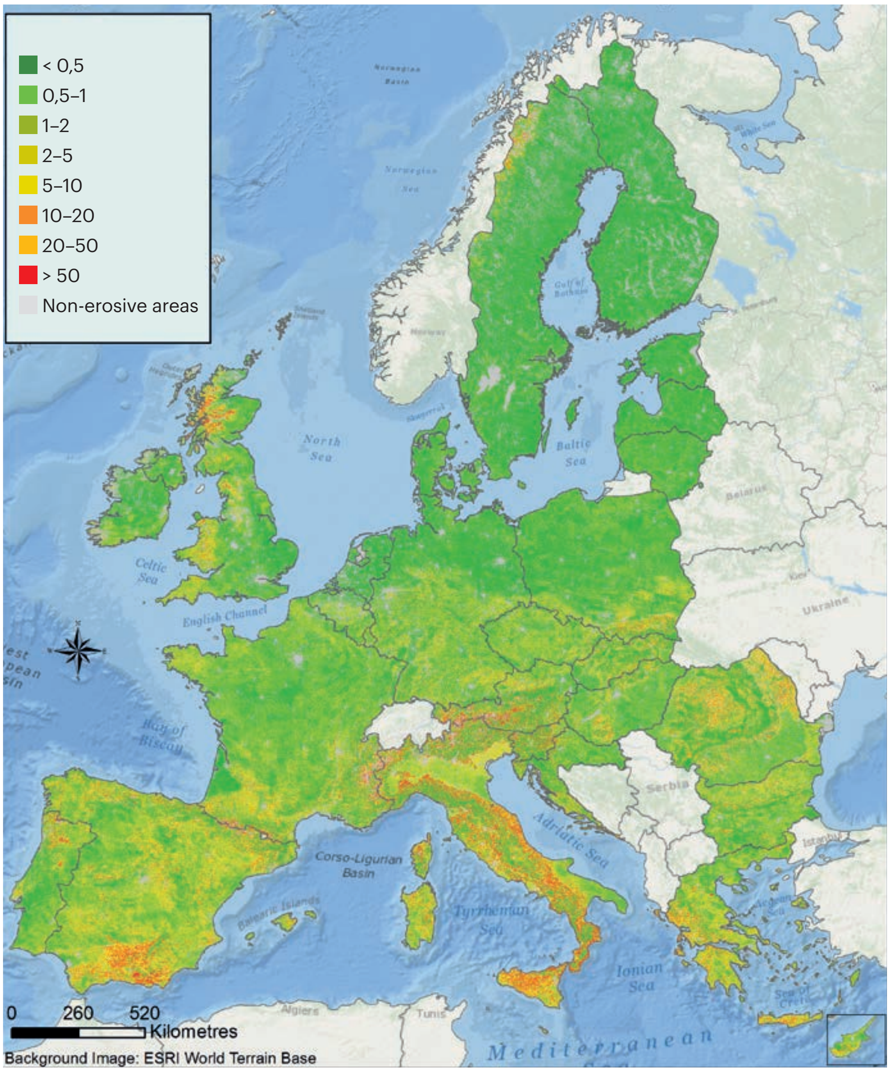
Data source: Programme for the Endorsement of Forest Certification Schemes, Forest Stewardship Council, Eurostat

Soil erosion in an international context

According to the latest available model data (Figure 30), 90.3% of EU28 territory is at risk of **water erosion** (about 394.1 mil. ha out of a total area of 436.6 mil. ha). The most endangered soils are exposed to a loss of more than 10 $t.ha^{-1}.year^{-1}$, mainly in the southern European region (Italy, Slovenia, Greece). Losses more than 10 $t.ha^{-1}.year^{-1}$ contribute 50% of total erosion. Moreover, in the future, climate change is expected to increase the vulnerability of soils to water erosion due to increasing extremes of rainfall and changes in land use.

Figure 30

Soil water erosion in Europe determined by the RUSLE2015 model [$t.ha^{-1}.year^{-1}$], 2015



Soil water erosion is determined by calculations according to RUSLE2015 (Revised Universal Soil Loss Equation). The current model includes a slope length (L) and slope gradient (S) factor, a vegetation cover and seeding factor (C), an erosion control factor (P), a rainfall erosivity factor (R), and a soil erodibility factor (K). This model reflects average rainfall patterns and does not include the influence of local rainfall extremes. The map presented here therefore only provides an approximate picture of the vulnerability of soils to water erosion in Europe and cannot be used as a basis for a detailed assessment of specific sites. Validation against national data and expert assessments is currently under way. Data for the years 2016–2020 are not available at the time of publication.

Data source: Joint Research Centre

A serious problem, especially in many areas of Denmark, the east of England, northwest France, north Germany, and the east of the Netherlands, is also **wind erosion**, which is estimated to affect around 42 mil. ha of land (about 9.6% of EU28 territory), of which 1 mil. ha is seriously endangered. In the case of wind erosion, the erosion risk is also expected to increase due to the more frequent occurrence of droughts.

The annual **loss of agricultural production** due to extensive soil erosion in the EU28 is estimated at EUR 1.25 bil.[22]. The highest annual loss of soil productivity due to erosion is recorded in Slovenia (3.3%) and Greece (2.6%). The lowest is in Denmark and Finland (0.0003%). This figure is 0.1% in Czechia.

The share of **degraded land** in total land area was 6%[23] in Czechia in 2015[24], and this value was below average compared to other European countries.

Although Czechia is not among the most erosion-prone countries in the European context, there are areas of its territory that are significantly endangered by erosion. In an overall assessment, it is necessary to consider the uncertainties resulting from inaccuracies in the model input data and the fact that these are not specific measured soil erosion values but rather values of erosion risk given by individual factors.

[22] *Panagos P., Standardi G., Borrelli P., Lugato E., Montanarella L., Bosello F. Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models. LandDegrad Dev. 2018; 29: 471–484. Available from: https://doi.org/10.1002/ldr.2879.*

[23] *This is a calculation under the international Sustainable Development Goal indicator 15.3.1, for which data on land cover, soil productivity and soil carbon stocks were used. Available from: https://landportal.org/book/indicator/un-aglnddgrd.*

[24] *Data for the years 2016–2020 are not available at the time of publication.*

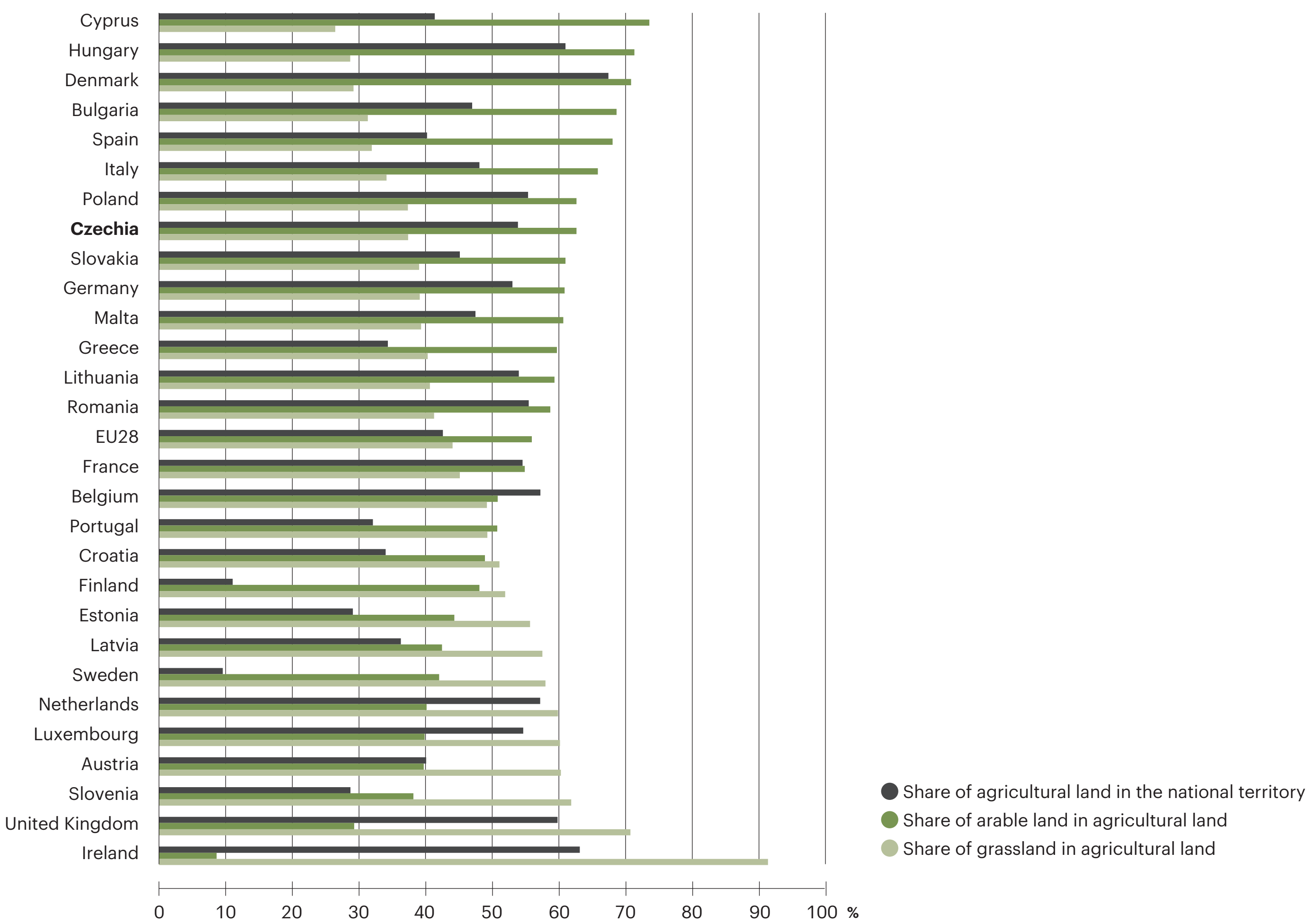
Agriculture in an international context

Although **organic farming** is developing in the EU28 thanks to European subsidy funds, conventional farming still prevails. Organic farmland accounted for 7.9% of total cultivated land in the EU28 in 2019[25]. With a share of 15.2% in 2019, Czechia has an above-average share of organically managed land. In terms of consumption of plant protection products, Czechia's position in 2019[26] was also favourable compared to other EU28 countries, i.e. it was below the European average.

Czechia is one of the countries with a high share of agricultural land, covering more than 50% of the total area of the country. It is also one of the countries with the largest share of arable land on agricultural land with ploughing (over 60%), but also with a lower share of grassland on agricultural land (less than 40%). In addition to Czechia, this characteristic is also typical for Cyprus, Hungary, Denmark, Spain, Italy, Poland and Slovakia. The average share of agricultural land to total territory in the EU28 was 42.6% in 2018[27]. Denmark, Ireland and Hungary have the highest share of agricultural land in their territories (more than 60%). Countries with less than 30% of agricultural land in their territories include Estonia, Slovenia, Finland and Sweden (Chart 131). The countries with the lowest ploughing rates (less than 40%) and high grassland coverage (60% or more) are Ireland, the United Kingdom, Slovenia, Austria, Luxembourg and the Netherlands.

Chart 131

Share of agricultural land, arable land and permanent grassland in selected EU countries [%], 2018



Data for the years 2019 and 2020 are not available at the time of publication.

Data source: Eurostat

[25, 26] *Data for the year 2020 are not available at the time of publication.*

[27] *Data for the years 2019 and 2020 are not available at the time of publication.*

3 Nature and landscape

3.2 | Biodiversity

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3.2 | Biodiversity

Biodiversity refers to the variability of life or ecosystems, species and genes. Its decline is manifested globally by the accelerating extinction of species, declining populations of common species, deterioration and loss of natural habitats, and a decline in the genetic variability of organisms. The main reason for biodiversity loss is human activity, resulting in the overexploitation and unilateral use of land and natural resources, the pollution of environmental components, and the spread of invasive species. Another factor affecting biodiversity is climate change, to which humans are also contributing.

To promote biodiversity, it is essential to improve the protection and condition of habitats and species as a basic prerequisite for the functioning of ecosystems and to ensure the appropriate management of open landscapes and protected areas, to regulate the impact of invasive species, and to protect wildlife kept in human care. It is also essential to raise awareness of the importance of maintaining functional ecosystems and their benefits for people, such as the dependence of food production on the presence of pollinators or the importance of natural communities for water retention in the landscape and mitigating the effects of drought.

Overview of selected related strategic and legislative documents

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
- the creation of the Natura 2000 European network of protected areas, the protection and care of biodiversity

Council Directive 2009/147/EC on the conservation of wild birds
- the designation of bird areas which, together with sites of Community importance, form the European Natura 2000 network, and the protection of populations of all bird species occurring naturally in the wild

Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species
- setting basic rules for the most problematic invasive species from an EU perspective

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

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- protection of migratory animal species, thus not only birds, but also mammals, fish and invertebrates

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

Convention on International Trade in endangered Species of Wild Fauna and Flora
- regulating international trade in certain rare species of wild fauna and flora to prevent overexploitation

Act No. 114/1992 Coll., on nature and landscape protection
- defining the general principles of nature and landscape protection, defining specially protected areas, their protection and the obligations of natural and legal persons in nature protection, defining nature protection authorities and their powers, defining and protection of the Natura 2000 system, species protection

Act No. 334/1992 Coll., on the protection of the agricultural land fund
- protection of the agricultural land fund as an irreplaceable component of the environment
- setting the principles of land protection, fines and the process of removing land from the fund

Biodiversity Strategy of the Czech Republic 2016–2025
• determining a comprehensive strategy for biological protection in Czechia

Concept for River Network Improvement in the Czech Republic, 2020 update
• setting transnational and national priorities for the gradual two-way crossing of transverse barriers in watercourses

3.2.1 | State of habitats, species and landscapes

Key question

Is the state of plant and animal species, habitats and landscapes improving?

Key messages

In the 2000–2016 period[28] the area of unfragmented landscape decreased from 68.8% to 60.6% of the territory in Czechia. The abundance of common bird species has been declining for a long time. The greatest decline was recorded in farmland bird species, which decreased by 30.8% in the 1982–2020 period. Climate change is having a long-term effect on the species composition of the avifauna. The value of the climate indicator has increased by 17.9% since 2010.

The river network is not being effectively improved. The overall implementation of the River Network Improvement Concept Plan is 13.7%.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Fragmentation of the landscape	↗	↗	↗	✕
State of species and habitats of Community importance	N/A	→	N/A	~
State of bird species	↘	↘	↘	✕
Common bird species*				
Abundance of all common bird species	↘	→	↘	✕
Abundance of forest bird species	↘	↘	↘	✕
Abundance of farmland bird populations	↘	↘	↘	✕
Indicator of the impact of climate change on common bird species	↗	↗	↗	✕
State of plant, animal and fungi species according to the red lists	↘	↘	↘	✕

** Due to the different time series trends underlying the construction of the indicator, an assessment of the sub (elementary) indicators is presented.*

[28] *Data for the years 2017–2020 are not available at the time of publication.*

Fragmentation of the landscape

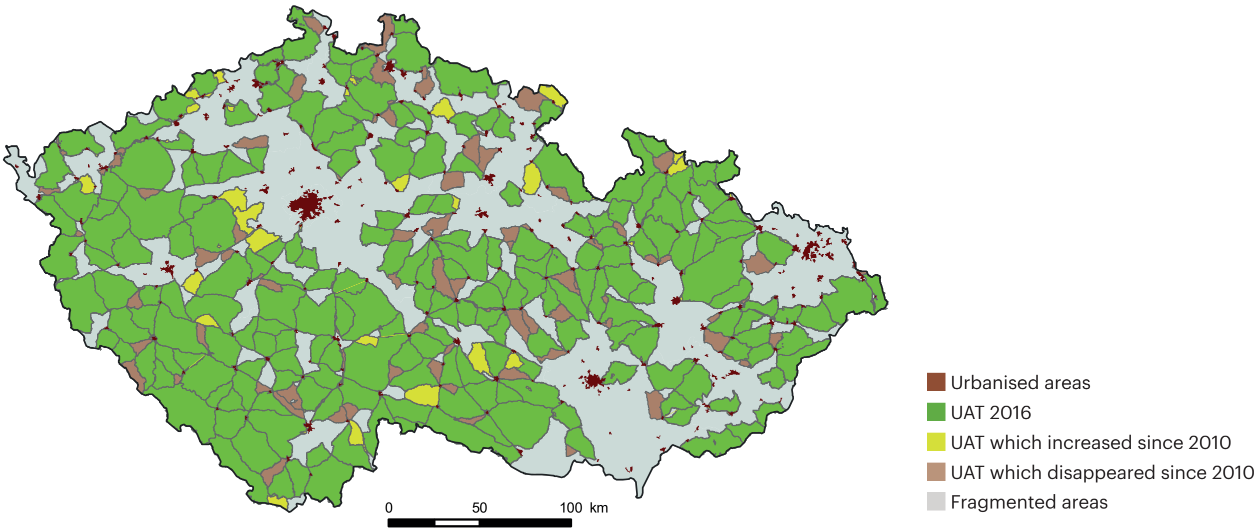
Landscape fragmentation leads to the loss of original habitat qualities and connectivity important for animal migration. In the 2000–2016 period[29], the **area of unfragmented landscape** decreased by 11.7% from 54.1 thous. km^2 in 2000 (68.6% of the territory) to 50.0 thous. km^2 in 2010 (63.5% of the total area) and further to 47.8 thous. km^2 (60.6% of the territory) in 2016 (Figure 31). According to forecasts, the process of landscape fragmentation by transport will continue and in 2040 the share of unfragmented landscape will reach only 53%.

The highest landscape fragmentation in Czechia is recorded in the Central Bohemia, South Moravia and Moravian-Silesian Regions, which were also among the regions with the highest decline in unfragmented areas in the 2010–2016 period (Figure 31). The high increase in fragmentation is caused by the expansion of built-up areas as a result of the continuing urbanisation of the territory, especially urban agglomerations, and as a result of the development of transport infrastructure, including in particular the construction of urban ring roads, expressways and motorways. On the other hand, the regions with the largest unfragmented areas include the Plzeň Region and the South Bohemia Region where the more rugged relief and a larger area of large protected areas means there is lower population density and thus a lower need for transport services.

For many species of animals, **roads** are a significant and often insurmountable barrier. The construction of migration underpasses and overpasses is a suitable solution, but there is no systematic monitoring of their functionality.

Figure 31

Landscape fragmentation due to transport in the Czech Republic, 2010–2016



Assessed using UAT (Unfragmented Areas by Traffic) polygons. UAT is a method for determining so-called unfragmented areas, i.e. areas that are bounded by roads with traffic volumes higher than 1 000 vehicles per 24 hours or by multiple-track railways, and are over 100 km^2 in size. Data for the years 2017–2020 are not available at the time of publication.

Data source: Evernia

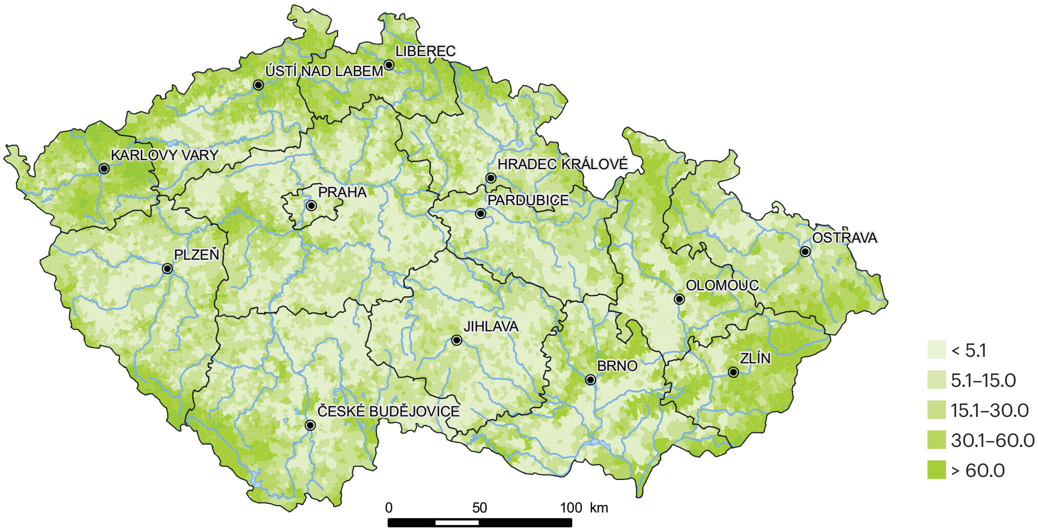
The ecological stability of the landscape can be assessed by the amount of natural biotopes. The average **share of natural habitat area** to cadastral land area was 13.0% nationally in 2019[30] (13.4% in 2016 and decreasing by 0.1 percentage points every year since 2016). Areas with maximum disturbance of natural structures are located in the most agriculturally exploited areas and in urban agglomerations, while natural and close-to-nature landscapes are found mainly in the border mountains and are associated with designated specially protected areas (Figure 32).

[29] *Data for the years 2017–2020 are not available at the time of publication.*

[30] *Data for the year 2020 are not available at the time of publication.*

Figure 32

Share of natural biotopes in the area of cadastral territories in the Czech Republic [%], 2020



Data source: Nature Conservation Agency of the Czech Republic

Watercourses and their floodplains are a specific migration route to which various species of animals and plants, especially fish, are tied. Fish are constrained by artificial **barriers to migration** between different types of aquatic ecosystems (sea and inland flows) or their environments (lower, middle and source sections). Significant declines in migratory fish populations have been observed in the context of increasing fragmentation over the last century. Fragmentation of watercourses and the associated restriction or prevention of free migration, often in combination with other anthropogenic pressures (hunting, pollution, climate change, modification or loss of original habitats as a result of regulation and modification of watercourse channels), have led to a significant numerical decline in the populations of most rheophilic[31] fish species and the partial to complete disappearance of specialised diadromous[32] fish species. More than 6,600 crossing structures higher than 1 m have been constructed on watercourses of various orders in our territory, while the number of lower migration barriers is not precisely known and will be orders of magnitude higher. Other influences that cause fragmentation of watercourses are run-off and accumulation of water, inappropriate watercourse modifications (flood control measures), water abstraction and pollution (Figure 33). To preserve and strengthen populations linked to the need for migration, and to implement the River Network Improvement Concept, proposals for the construction of fish crossings have been under preparation since 2010[33].

A total of 34 "concept" watercourses (19 international and 15 in watercourses of national importance) were assessed in 2020 within the framework of the **River Network Improvement Concept**, some of which were planned to be implemented by 2021 (subject of assessment). As of 2020, a total of 798 cross barriers (584 barriers in international and 214 barriers in watercourses of national importance) were located on 34 watercourses (2,316 line km, 19 international and 15 national watercourses). Here, the construction of 161 **fish crossings** was planned (152 in international and 9 in watercourses of national importance), of which 22 measures were implemented (12 fish crossings and 10 other measures to restore the migratory permeability of the watercourse). The overall implementation of the Concept plan is thus only 13.7%, with 19 measures implemented on watercourses of international importance, i.e. main migration corridors with international priority, and 3 measures on watercourses of national importance (the assessment of measures implemented outside the plan was not considered). The implementation of planned measures continues to fail to make the river network of Czechia accessible in a hierarchical systemic manner. In practice, fish crossings are still mostly constructed "alternatively" in other parts of watercourses (than would be most effective) and especially in watercourses where the restoration of migration permeability tends to be of regional or local importance, which cannot be assessed as optimal. The implementation of other measures, such as the removal of transverse obstacles, which are comprehensive measures, can be seen as very positive.

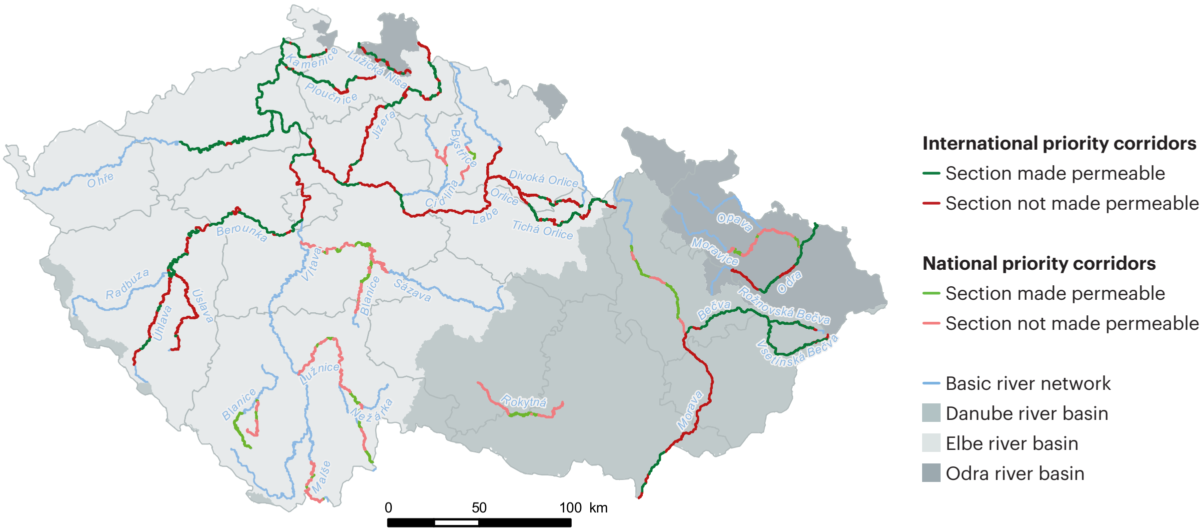
[31] *Species of fish that prefer to live in water with higher flow rates.*

[32] *Species of fish that migrate between salt and fresh water.*

[33] *Slavíková, A., et al. 2020. River Network Improvement Concept in the Czech Republic, update 2020. Prague: Ministry of the Environment of the Czech Republic, 2020.*

Figure 33

State of migration permeability of defined migration-significant watercourses in the Czech Republic, 2020



Due to the scale of the map, information on migration permeability may be distorted in some sections. One example is the Bečva River, where the connected section appears to be almost migration-permeable, yet there are several impassable obstacles. The principle for showing linear permeability is set as follows: If two transverse structures (e.g. weirs) on a watercourse are impassable, the section between them is marked as impermeable, i.e. in red. However, if one weir is made permeable and the other is not and is followed by a weir that is again permeable, the entire section between them is permeable, i.e. marked in green.

Data source: Nature Conservation Agency of the Czech Republic

State of species and habitats of Community importance[34]

The **overall state of each assessed species** of plant or animal consists of four sub-parameters, namely the state of the range, population, habitat and future prospects. If any of these parameters is assessed as bad, the overall state of the species is also assessed as unfavourable (according to the one out – all out principle). The state of the monitored species is assessed separately for the Pannonian (southeastern Moravia) and continental (most of Czechia) biogeographical regions.

Fish and lamprey show the worst state in both recent assessments, with no species classified in a good status in the 2007–2012 and 2013–2018[35] assessment periods (while this was 19.2% in the first 2000–2006 assessment period), while 70.4% of species in the 2007–2012 period and 66.7% of species in the 2013–2018 period were classified as in a bad status. This negative situation is due in many places to the changed water regime, the large number of different watercourse regulations and mechanical barriers, and to the water quality and intensive water management. Compared to the 2000–2006 assessment period, the state of the **amphibian and reptile** group has improved (5.0% of species were assessed as being in a good status in the 2000–2006 period, 30.0% in the following 2007–2012 period and 32.5% in the 2013–2018 period), Chart 132. Overall, the state of **insect** species of Community importance has improved significantly (36.2% of species were in a good status in the 2013–2018 period compared to 18.9% in the 2007–2012 period and 16.0% in the 2000–2006 period). At the same time, there has been a significant decline in the number of species assessed as in a bad status (from 66.0% in the 2000–2006 period and 43.4% in the 2007–2012 period to 31.0% in the 2013–2018 period). Overall, **mammals** have the highest share in a good status, at 42.1% for the 2013–2018 period. Compared to the previous 2007–2012 period, although there was a slight decrease in the representation of mammals in this category (from 43.2% to 42.1%), there was also a positive decrease in the bad status category, namely from 18.9% to 15.8%.

Sub-indicators are also defined for vascular plants and non-vascular plants (bryophytes and lichens), Chart 132. In the case of mosses and lichens, the lack of research at national level is most pronounced. Although there was a decrease in the representation of mosses and lichens in the unknown status category from 60.0% to 33.3% compared to the first 2000–2006 assessment period, this value remained constant over the following two periods. Similarly, the value of 33.3% for mosses and lichen species assessed in a good status remained constant over the last two assessment periods. For vascular plants, whose occurrence is monitored intensively and over a long period, there was a clear decline in species in a bad status between the 2000–2006 and 2007–2012 periods (from 42.9% to 26.5%), but in the 2013–2018 period there was a renewed, albeit slight, increase in the share of species assessed in a bad status, to 28.6%. 14.3% of plants in the 2013–2018 period is assessed as being in a good status.

[34] Species of Community importance and similar habitats are designated by European Union legislation. This is Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, under which assessment reports are submitted every six years; the assessment began in 2000. This does not include bird species that have a separate assessment system under Directive 2009/147/EC of the European Parliament and of the Council. The most recent year-on-year change cannot be assessed for this indicator due to the fact that changes are mapped at six-year intervals and there is no data for the most recent year monitored.

[35] Data for the years 2019 and 2020 are not available at the time of publication.

Chart 132

Assessment of the state of animal and plant species of Community importance in the Czech Republic by defined group [%], 2000–2006, 2007–2012, 2013–2018

The improvement in the situation between the first 2000–2006 and 2007–2012 periods, when the methodology was partially modified, is more a methodology-related effect. The improvement between the 2007–2012 and 2013–2018 assessment periods is more telling, although methodological limits must be considered here as well. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator methodology.

Data source: Nature Conservation Agency of the Czech Republic

The **overall condition of each assessed habitat type** consists of four sub-parameters, namely existing area, potential area, structure and function, and future prospects, with the proviso that if any of these parameters is rated bad, the overall condition of the habitat is also rated bad. In the long term, parameters such as the area of the site and its development have a better partial assessment compared to structure and function, which relate to the biological value of the habitat and its ability to withstand external pressures. Each habitat type is assessed separately for the continental (most of Czechia) and Pannonian (southeastern Moravia) biogeographic regions. There are 93 habitat types assessed in Czechia in the long term.

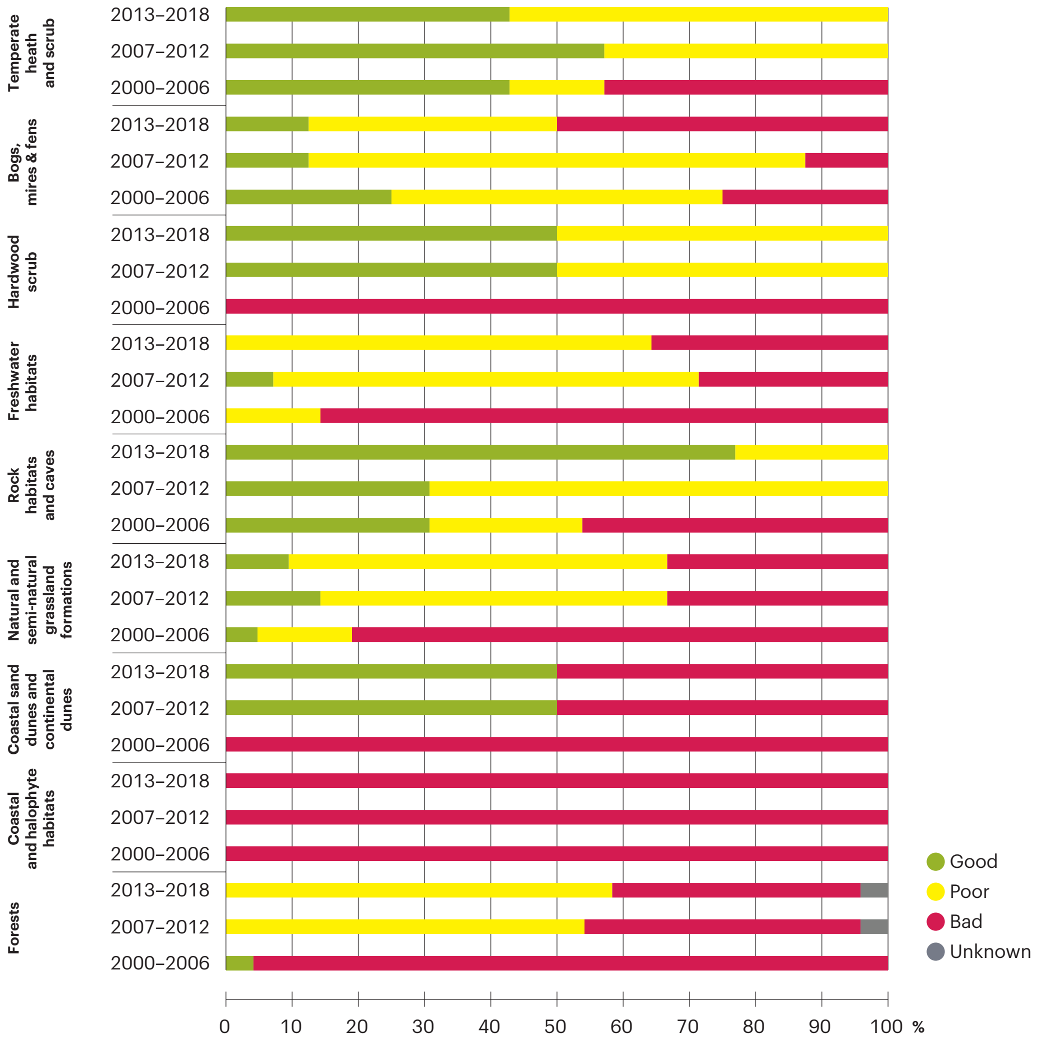
A comparison of all three assessments carried out so far (2000–2006, 2007–2012, 2013–2018) shows a gradual improvement in the overall condition of habitats in Czech territory. However, it is important to stress the need for cautious interpretation of the individual results, especially in terms of trends, as improvements are often more a methodological artefact than a real change caused by active intervention.

In all three periods (2000–2006, 2007–2012, 2013–2018), the **coastal and halophyte habitats** formation group was assessed in a strictly bad status, within which all habitat types were categorised as bad. The **freshwater habitats** formation group is also in a long-term poor condition. Currently, no habitat type within this group is rated in favourable condition, while 64.3% of these habitat types are rated in poor status. This is a deterioration compared to the previous 2007–2012 period, when 7.1% of sites in this formation group were assessed in good status. The assessment results indicated a partial improvement within the **forest** formation group, although this was only an improvement in the unfavourable condition category results (from 41.7% in the 2007–2012 period to 37.5% in the

2013–2018 period), as 54.2% of habitats were assessed in the poor status category in the 2007–2012 period and 58.3% of habitats in the 2013–2018 period. No habitats from the Forests formation group were included in the good status category. The **uplands, peatlands and bogs** formation group was assessed in the 2013–2018 period in a significantly worse condition than in the previous period, with a full 50% of habitat types now assessed in the worst, bad status, category. The assessment results, on the other hand, indicate a significant improvement in the **rock habitats and caves** formation group, where 76.9% of habitat types were classified as in good status and only 23.1% as in inadequate condition during the last assessment. One of the highest-rated groups in the long term is the **temperate heath and scrub** formation group, although there has been a minor reduction in the number of habitat types in the good status category from 57.1% to 42.9% between the last two assessment periods. The other formation groups have been in a roughly similar overall state for a long time (Chart 133).

Chart 133

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



The improvement in the situation between the first 2000–2006 and 2007–2012 periods, when the methodology was partially modified, is more a methodology-related effect. The improvement between the 2007–2012 and 2013–2018 assessment periods is more telling, although methodological limits must be considered here as well. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: Nature Conservation Agency of the Czech Republic

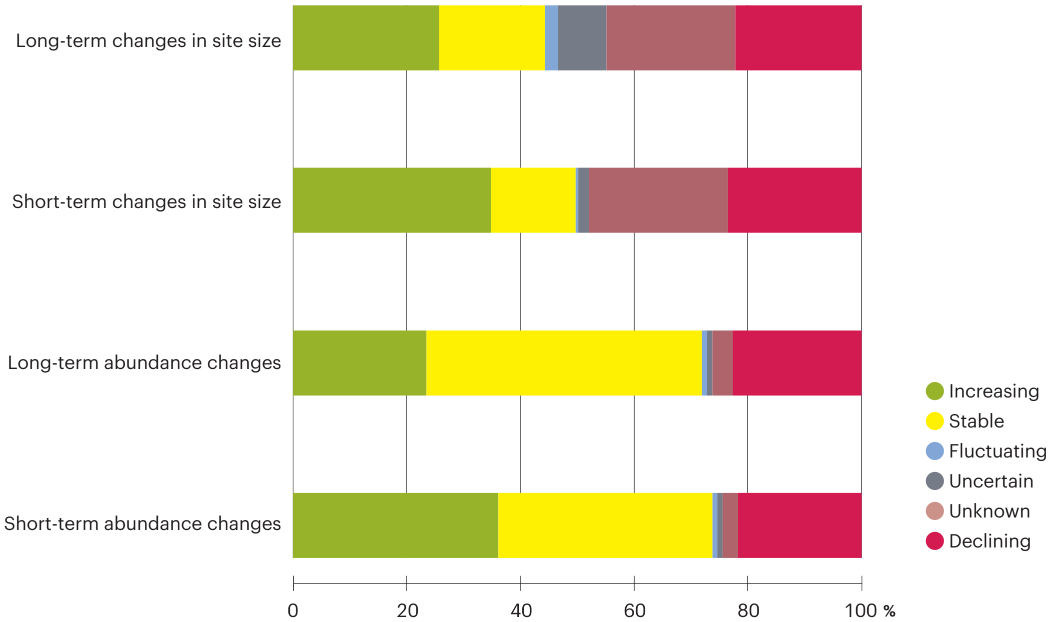
State of bird species

The EU protects more than 460 species of wild birds in all their life stages under the EU Birds Directive. In Czechia, according to the most recent assessment (2013–2018)[36], 50% of the populations of wild bird species have an increasing or stable population abundance state in both long-term and short-term assessments. For short-term abundance changes, 26% of wild bird populations were assessed as increasing, 19% as stable, followed by 2% as fluctuating, 48% as decreasing, 2% as uncertain and 23% as unknown.

For long-term abundance changes, 35% of bird populations were assessed as increasing and 15% as stable. The other half of bird populations show long-term declining (24%), uncertain (2%) and unknown states (24%). The population states of bird species depend to a large extent on the state of their ranges. In the long term, 74% of sites are in a stable or increasing state (i.e. increasing in area), and 72% in the short term (Chart 134).

Chart 134

Conservation state of wild birds in the Czech Republic under the EU Birds Directive [%], 2013–2018



Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: Nature Conservation Agency of the Czech Republic

[36] *Data for the years 2019 and 2020 are not available at the time of publication due to the indicator methodology.*

Common bird species

Trends in bird populations[37] reflect changes in the landscape and its use, as well as overall changes in ecosystems. The impacts of climate change impacts are evident to a lesser but increasing extent.[38]

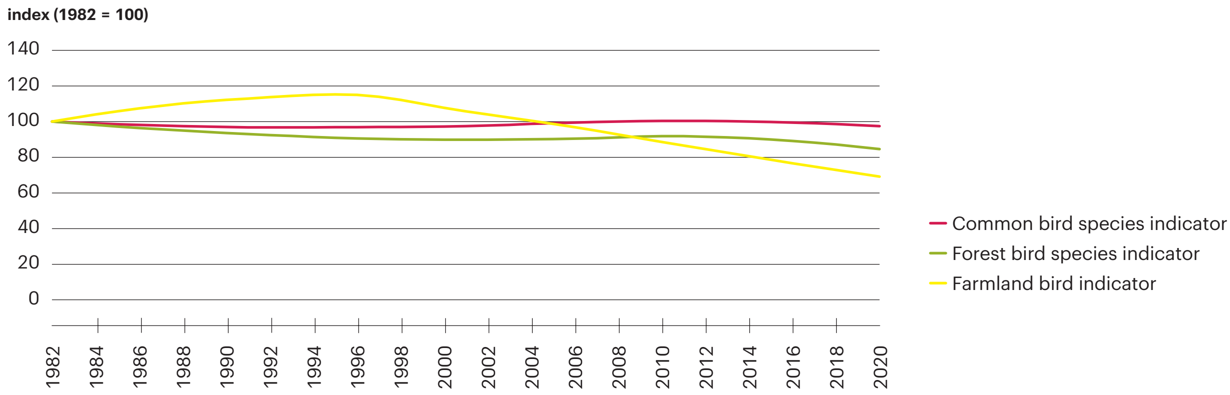
Populations of common bird species show a long-term declining trend. Since 1982, the **abundance of all common bird species** in Czechia has declined by 2.6% overall, with new modelled trends showing stability until 2015 and a slight decline since 2016 (Chart 135).

The **abundance of farmland bird populations** had declined by 30.8% in 2020 compared to the start of the census in 1982, with the decline already starting before 1982. The main reasons for this significant decline are the ever-increasing intensity of agriculture. A temporary positive development occurred after 1989, when the intensity of agriculture was temporarily reduced, to which the birds of the agricultural landscape immediately responded by increasing their abundance[39]. The economic consolidation of agriculture was followed by another sharp decline in the abundance of farmland birds, exacerbated by the implementation of the EU Common Agricultural Policy[40]. The decline has slowed since 2012, but this is due to depletion of species populations rather than real environmental improvements. The abundance of some well-known species (partridge (Perdix perdix), lapwing (Vanellus vanellus), meadow pipit (Anthus pratensis) and western yellow wagtail (Motacilla flava)) has decreased to a fraction of the baseline. And the situation is not improving.

The **abundance of forest bird populations** has been gradually declining since 1982, but the trend of decline began to slow down significantly and gradually reverse around 2000. Over the last decade, forest bird populations have been slowly increasing, resulting in a 15.4% decrease in 2020 compared to 1982. In the case of forest species, the unification of bird communities is a major problem, with a decrease in the abundance of forest habitat specialists (e.g. red-breasted flycatcher (Ficedula parva), wood warbler (Phylloscopus sibilatrix), goldcrest (Regulus regulus)), which are being replaced by common species with a wide ecological valence such as the blackbird (Turdus merula), song thrush (Turdus philomelos), common robin (Erithacus rubecula), Eurasian blackcap (Sylvia atricapilla), and great tit (Parus major) and blue tit (Cyanistes caeruleus). This makes rare and highly specialised species even rarer and reduces biodiversity at local and regional level.

Chart 135

Indicators of all common bird species, forest bird species and farmland bird species in the Czech Republic [index, 1982 = 100], 1982–2020



Data source: Czech Society for Ornithology

[37] *For the purpose of calculating the common bird species indicator, 42 species were selected whose populations (together with the population of the common pigeon, Columba livia f. fera, which was excluded from the analysis) together represent 95% of all birds breeding in Czechia. 17 species were included in the forest bird indicator calculation, and the farmland bird indicator contains data from 20 species of field and grassland birds. The input data come from the Unified Bird Census Programme. Since 2014, the species selection has differed from previous years to improve the classification of individual species and, unlike previous calculations and until 2019 the indicator was smoothed through the use of the TrendSpotter algorithm to reduce seasonal fluctuations. The entire time series is thus recalculated each year after the addition of new data, which refines the trend estimate, and this smoothing has a retroactive effect on the numerical value of the index in each year. The values are also affected by the application of the new calculation methodology from 2020. Instead of the previously used smoothing of geometric averages by TrendSpotter, a script developed for the purpose of calculating multispecies indices was used (more at: www.pecbms.info).*

[38] *Reif J., Škorpilová J., Vermouzek Z. & Šťastný K. (2014): Changes in breeding populations of common bird species in the Czech Republic during the 1982–2013 period: analysis using multispecies indicators. Sylvia 50: 41–65.*

[39] *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.*

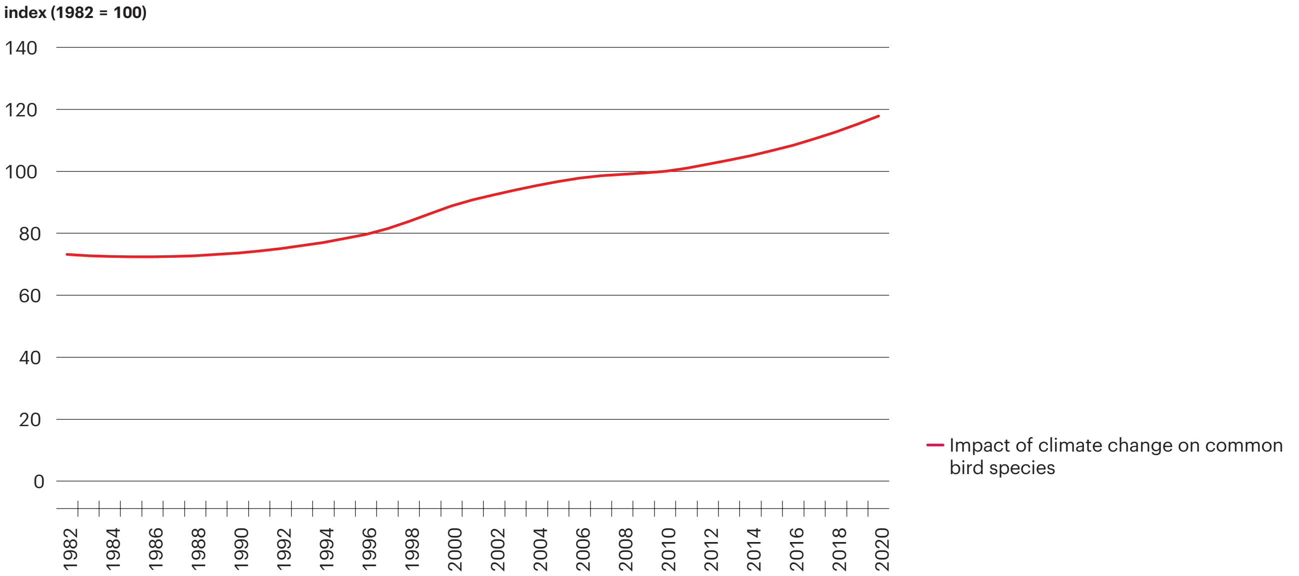
[40] *Reif J. & Vermouzek Z. (2018): Collapse of farmland bird populations in an Eastern European country following its EU accession. Conservation Letters 2018, doi: 10.1111/conl.12585.*

Climate change is a factor that has increasingly influenced bird composition since the 1990s. Due to its influence, the northern species are gradually disappearing from Central Europe (whinchat (Saxicola rubetra), common grasshopper warbler (Locustella naevia), icterine warbler (Hippolais icterina)), while thermophilic species (Eurasian collared dove (Streptopelia decaocto), nightingale (Luscinia megarhynchos), Eurasian golden oriole (Oriolus oriolus)), which used to occur in southern Europe, are slightly increasing. Along with this, we can expect a gradual decline of birds in Czechia, as the area with the greatest species diversity – of which we are currently a part – will move in a north-easterly direction[41].

The **impact of climate change** on bird species in Czechia was insignificant in the 1980s, however its importance began to grow after 1990 with a visible acceleration around the turn of the millennium. This was followed by a period of slower growth until about 2010, since when the impact of climate change on bird populations has been increasing again, especially in recent years[42]. The **Climate Change Impact Indicator for Common Bird Species** describes the impacts of one of the main influences currently affecting the diversity of Czech nature (Chart 136). Considering that, at global level, climate change is considered to be the most significant global threat factor, the increasing impact of climate change on bird populations is clearly negative and alarming news. The indicator also illustrates that the impacts of global climate change are observable even at the level of much smaller geographical units than continents.

Chart 136

Indicator of the impact of climate change on common bird species in the Czech Republic [index, 1982 = 100], 1982–2020



The climate indicator is based on changes in the abundance of bird species in relation to their climatic requirements and is expressed as a ratio of abundance changes between "winners" and "losers" over a defined time period.

Data source: Czech Society for Ornithology

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

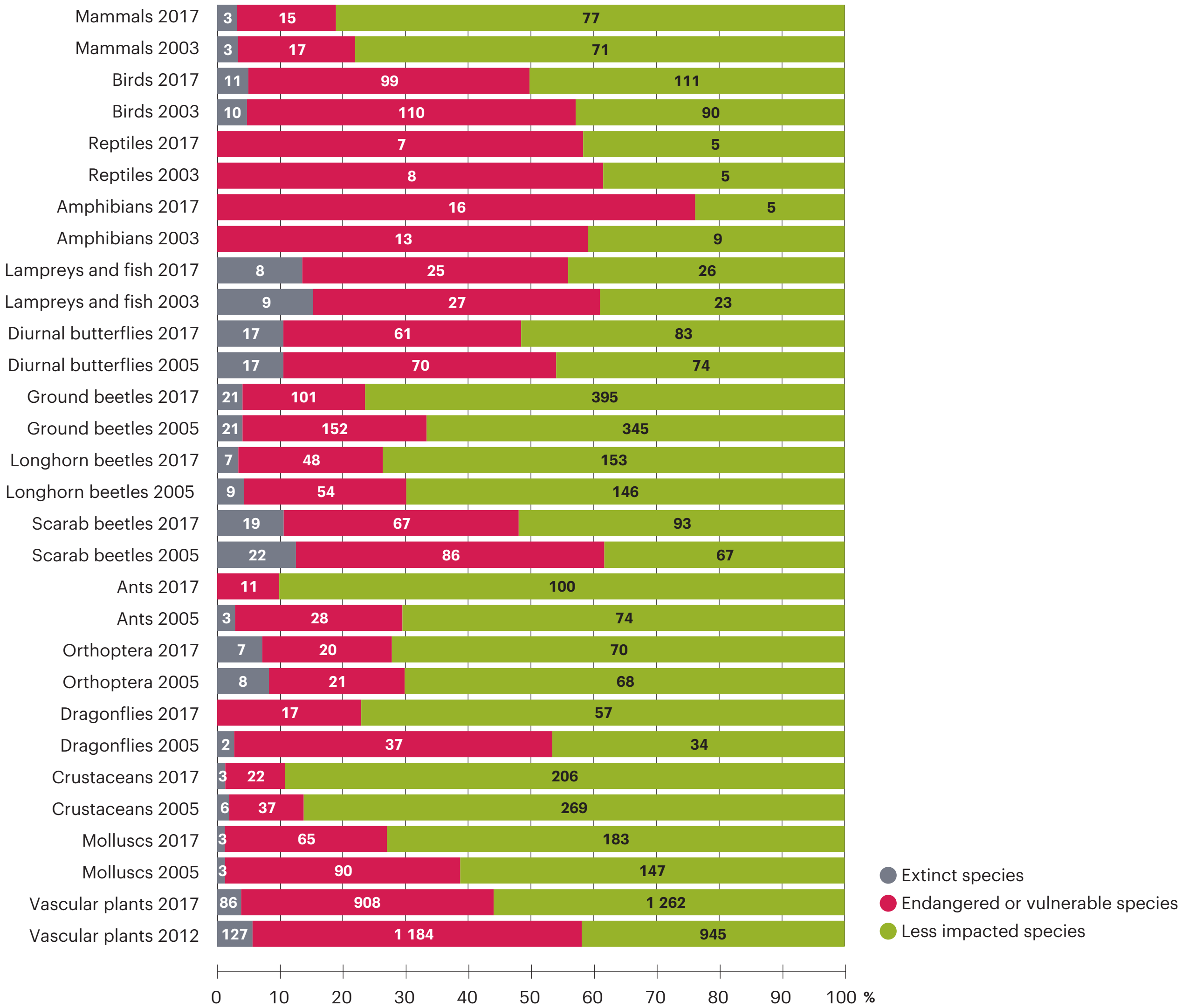
[42] *99 species in our territory were assessed. Czech Statistical Office according to the methodology: STEPHENS P. A., MASON L. R., GREEN R. E., GREGORY R. D., SAUER J. R., ALISON J., AUNINS A., BROTONS L., BUTCHART S. H. M., CAMPEDELLI T., CHODKIEWICZ T., CHYLARECKI P., CROWE O., ELTS J., ESCANDELL V., FOPPEN R. P. B., HELDBJERG H., HERRANDO S., HUSBY M., JIGUET F., LEHIKOINEN A., LINDSTRÖM A., NOBLE D. G., PAQUET J.-Y., REIF J., SATTLER T., SZEP T., TEUFELBAUER N., TRAUTMANN S., VAN VAN STRIEN A. J., VAN TURNHOUT C. A. M., VOŘÍŠEK P. & WILLIS S. G. 2016: Consistent response of bird populations to climate change on two continents. Science 352: 84–87.*

State of plant, animal and fungi species according to the red lists

In the 2017 red lists[43] , 908 species of vascular plants, 162 species of vertebrates (16 species of amphibians, 7 species of reptiles, 25 species of lampreys and fish, 99 species of birds and 15 species of mammals) and over 3,300 species of invertebrates were listed as **critically endangered**, endangered or vulnerable. However, a high number of vertebrates and some invertebrate groups were found to be **endangered** in 2017, and the trend has even worsened in the case of amphibians. A large share of endangered species can be found among reptiles, fish and lampreys, birds, diurnal butterflies and scarab beetles (Chart 137), pointing to the main problems in the Czech landscape, namely the large number of inappropriately managed watercourses, the poor, though improving, water quality in many places, and the general uniformity of many parts of the Czech landscape. A large number of endangered plant and animal species (Figure 34) are found in the border areas of Czechia, where many protected areas are located, and in the Pannonian region (southern Moravia).

Chart 137

Assessment of the state of selected groups of native endangered plant and animal species in the Czech Republic according to the red lists [number of species, %], 2003, 2005, 2012, 2017



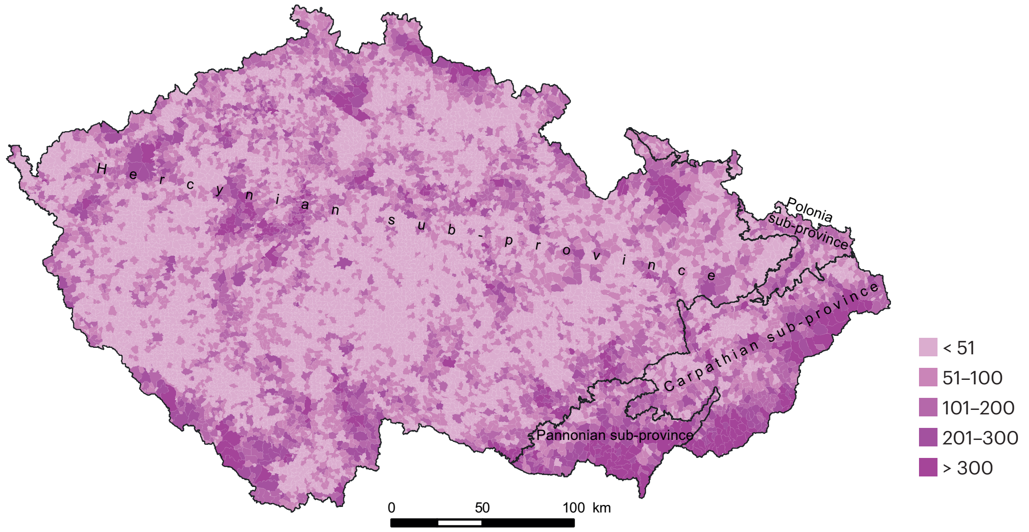
Data for the years 2018–2020 are not available at the time of publication.

Data source: Nature Conservation Agency of the Czech Republic

[43] *Data for the years 2018–2020 are not available at the time of publication.*

Figure 34

Occurrence of endangered plant and animal species according to the red lists in individual cadastral territories of the Czech Republic [number of species], 2020



Data source: Nature Conservation Agency of the Czech Republic

3.2.2 | Protection and care of the most valuable parts of nature and landscape

Key question

What and how effective is the protection for the most valuable parts of nature?

Key messages

The total area of specially protected areas in Czechia, including both small-area and large-area specially protected areas, increased by 1.8 thous. ha in 2020, while this increase was mainly due to the establishment of new small-area specially protected areas. ✓

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Share of species on red lists among protected species	N/A	N/A	N/A	N/A
Specially protected areas and Natura 2000 sites in the national territory	↗	↗	↗	~
Share of habitats and species in Natura 2000 sites	N/A	N/A	N/A	N/A

Share of species on red lists among protected species

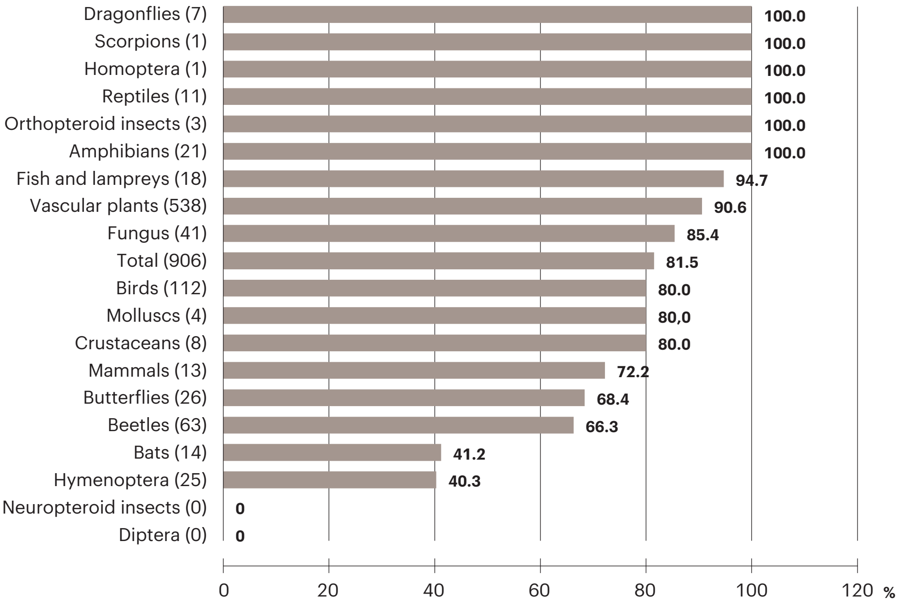
Protected species are listed in the Annex to the Act on Nature and Landscape Protection No. 114/1992 Coll., Decree No. 395/1992 Coll. as amended[44], Decree of the Ministry of the Environment of the Czech Republic implementing certain provisions of the Act of the Czech National Council mentioned above. Yet there are many more species that deserve attention. These species are included in the so-called **red lists**, which are continuously updated (the last edition of the Czech red lists was published in 2017, but there is also an updated digital database of red lists[45]). Not all endangered species are protected in this way (there are about ten thousand species on the red lists, and around one thousand of them are protected). On the other hand, not all specially protected species are truly endangered, even though the Czech decree calls them protected species categories. The causes are changes in the distribution and ecology of the species, as well as the selection of species for legal protection. As of 2020, 81.5% of specially protected species were on red lists (i.e. genuinely endangered) (Chart 138).

[44] *More at https://portal.nature.cz/redlist/v_cis_vyhl.php?akce=none&choice=1&plny_vypis=1*

[45] *More at https://portal.nature.cz/redlist/v_cis_redlist.php?akce=none&choice=1&plny_vypis=1*

Chart 138

Share of protected species on red lists in the Czech Republic [%], 2020



The number of taxa is a technical parameter derived from the taxonomic codebook of the Findings Database of Nature Conservation (this also includes subspecies and potentially other units). Neuropteroid insects do not have a current red list.

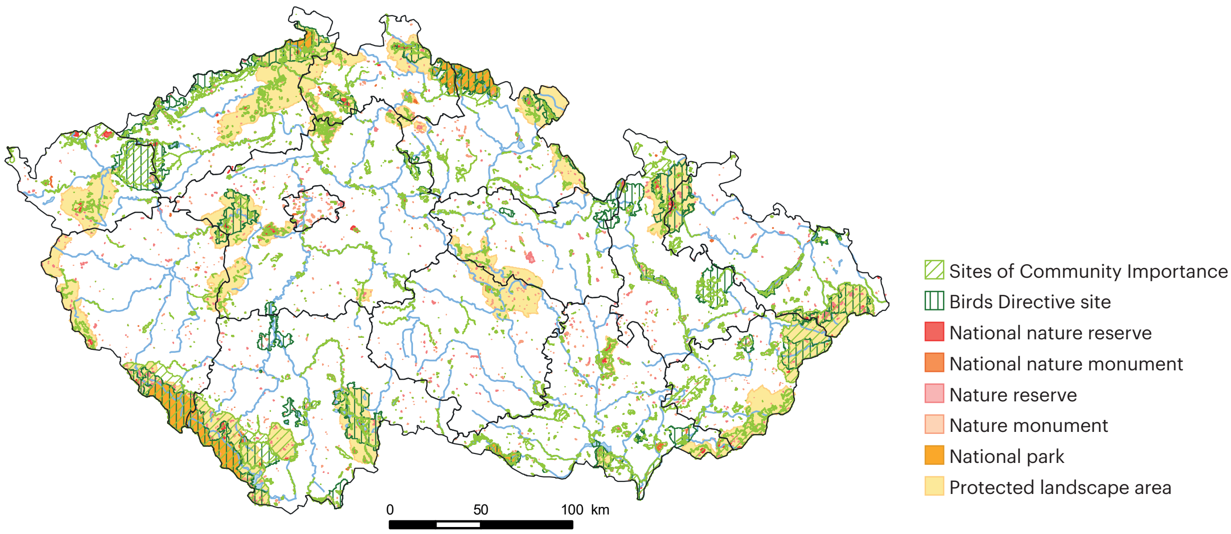
Data source: Nature Conservation Agency of the Czech Republic

Specially protected areas and Natura 2000 sites in the national territory

The **total area of specially protected areas** in Czechia, including both small-area and large-area specially protected areas, was 1,323.8 thous. ha in 2020, i.e. 16.8% of the national territory. This has increased by 1.8 thous. ha since 2019, while this increase was mainly due to the creation of new small-area specially protected areas and the revision of the national park and protected landscape area designation in 2020 (Figure 35). The area of large-scale specially protected areas, which include national parks and protected landscape areas, amounted to 1,257.2 thous. ha (15.9% of the territory of Czechia). This was 1,257.1 thous. ha in 2019. In 2020, small-area specially protected areas covered 114.9 thous. ha, i.e. 1.5% of the national territory (in 2019 it was 113.3 thous. ha). In 2020, six new small-area specially protected areas were created, increasing their total area by 1.6 thous. ha. Almost a third of the small-area specially protected areas are located in a protected area or a national park. In 2020, there were 1,154 **Natura 2000** sites (the last amendment in 2020 added the site Louky u Přelouče to the national list and a gravel-sand embankment habitat was added as a subject of protection at the Porta Bohemica site). Of these, 41 bird areas covered a total of 703.4 thous. ha, and 1,113 sites of Community importance covered a total of 795.2 thous. ha. The total area of all Natura 2000 sites was 1,115.0 thous. ha, i.e. 14.1% of the national territory. The majority of Natura 2000 sites lie within the territory of another specially protected area; 35.9% of the Natura 2000 area was outside other specially protected areas. Natura 2000 covers more than 18% of the territory of the EU Member States. The **total area of specially protected areas and Natura 2000 sites**, taking into account their overlaps, was 1,725.7 thous. ha in 2020, i.e. 21.9% of the area of Czechia (Figure 35)[46].

Figure 35

Specially protected areas and Natura 2000 sites in the Czech Republic, 2020



Data source: Nature Conservation Agency of the Czech Republic

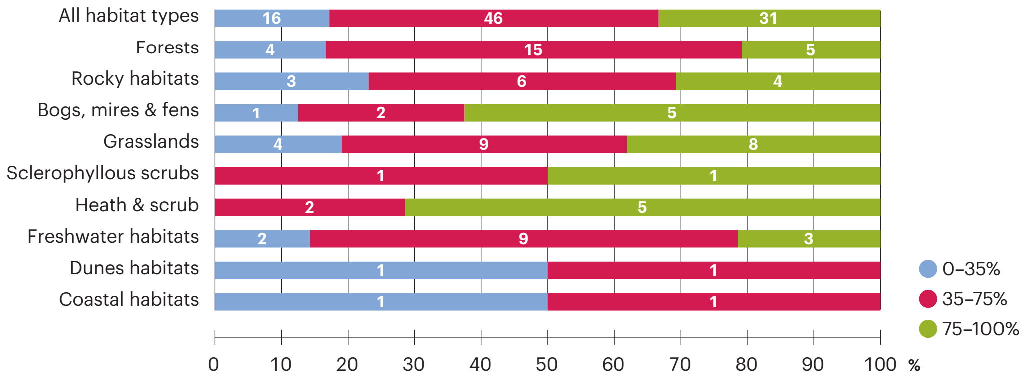
[46] The ongoing census of visitors recorded by protected landscape areas and national parks shows a significant increase in visitor numbers. This was mainly due to the limited opportunities to travel abroad in the context of the COVID-19 pandemic and the desire to "escape the cities" or avoid busy places. These reasons have led not only to an increase in the number of visitors to protected areas as such, but also to visitors more frequently straying off marked trails into closed areas (national nature reserve), or to the use of less visited sites. The overall pressure on the vegetation cover and the stress load on animals has thus increased significantly and across the board (including the amount of litter left by visitors). From a nature conservation point of view, 2020 can therefore be considered problematic in terms of the aforementioned higher numbers of visitors to protected areas.

Share of the area of habitats and species in Natura 2000 sites

The **representation of individual habitats in Natura 2000 sites** according to cover classes distinguishes nine habitat types and three cover classes, which express what share of the Natura 2000 site area is occupied by a particular habitat type (or species), (Chart 139)[47]. Information is reported for the 2013–2018 period[48]. It is noticeable that the majority of covered sites are bogs, mires & fens.

Chart 139

Representation of habitat types in Natura 2000 sites in the Czech Republic by cover classes [%], 2013–2018



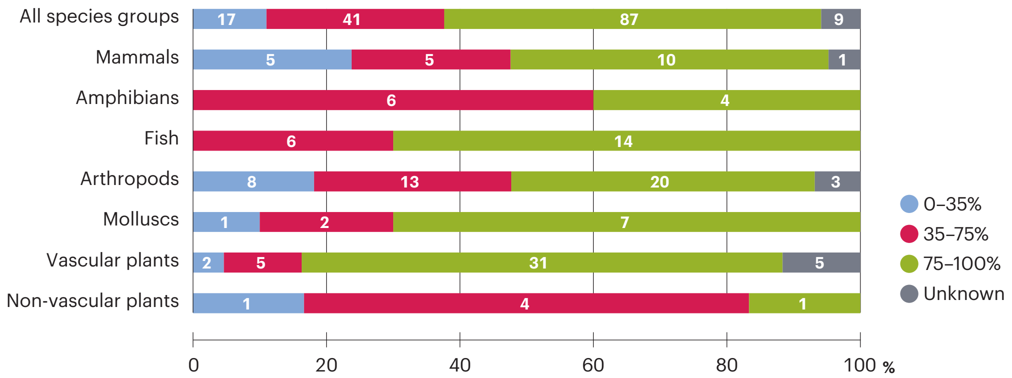
Assessment of the share of habitats in cover classes 0–35%, 35–75% and 75–100%, which express the percentage of the monitored habitat type at the assessed site. The 2013–2018 assessment period includes 93 sites. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: Nature Conservation Agency of the Czech Republic

The **representation of the number of species in Natura 2000** sites was assessed similarly. A total of 154 species were assessed for the 2013–2018 reporting period (Chart 140). Most of the species covered in Natura 2000 sites are molluscs, fish and vascular plants.

Chart 140

Representation of species types in Natura 2000 sites in the Czech Republic by cover class [%], 2013–2018



Assessment of the share of species in the 0–35%, 35–75% and 75–100% cover classes corresponding to the population size share in the Natura 2000 network. The numbers in the chart reflect the number of individual species assessments in the coverage classes by Natura 2000 site. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: Nature Conservation Agency of the Czech Republic

[47] *More at: https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/article-17-national-summary-dashboards/natura-2000-coverage*

[48] *Data for the years 2019 and 2020 are not available at the time of publication due to the indicator methodology.*

3.2.3 | Invasive species

Key question

How many invasive species live in Czechia?

Key messages

Of the total of 1,454 non-native plant species that occur or have been recorded in Czech territory, 61 species are considered invasive. Of the 278 non-native species, 113 are invasive.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Non-native species in Czechia	N/A	N/A	N/A	✕

Non-native species in Czechia

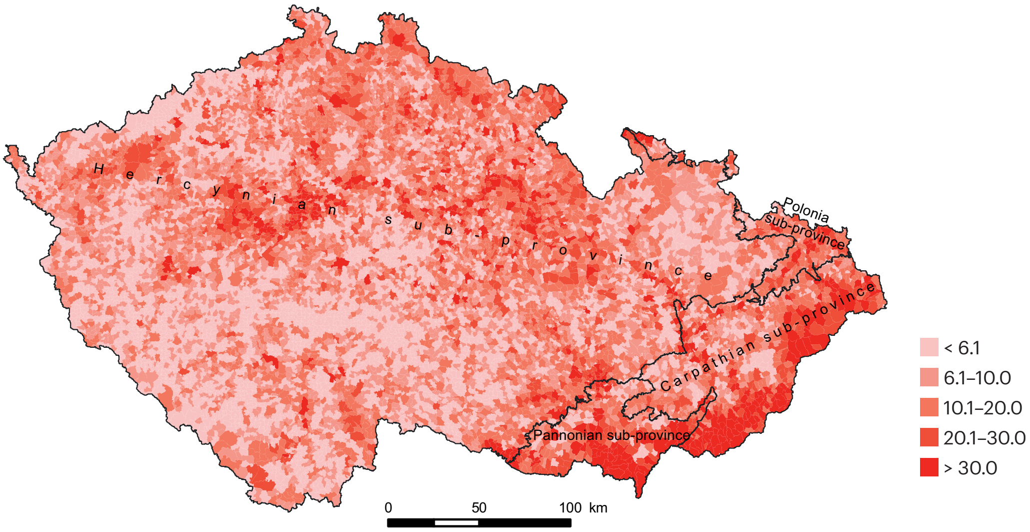
Populations of native plant and animal species and individual valuable communities in Czechia are endangered by the spread of geographically non-native species, especially invasive species. Of the total of 1,454 **non-native plant species** that occur or have been recorded in Czech territory, 61 species are considered **invasive**[49]. Widespread invasive plant species are considered to be, among others, the giant hogweed (Heracleum mantegazzianum), Japanese knotweed (Reynoutria japonica), Sakhalin knotweed (Reynoutria sachalinensis), Bohemian knotweed (Reynoutria x bohemica), Himalayan balsam (Impatiens glandulifera), large-leaved lupine (Lupinus polyphyllus) and the tree of heaven (Ailanthus altissima)[50]. Of the 595 **non-native animal species**, 113 were considered **invasive** in 2020. Widespread invasive species include, but are not limited to, the American mink (Neovison vison), the common raccoon (Procyon lotor), the Sika deer (Cervus nippon), the stone moroko (Pseudorasbora parva), the Prussian carp (Carassius gibelio), the spinycheek crayfish (Orconectes limosus), the signal crayfish (Pacifastacus leniusculus) and the Spanish slug (Arion vulgaris). The highest number of invasive species occurs along watercourses and roads that facilitate their spread. Increased numbers of invasive species are also recorded in human settlements and their surroundings. From a geographical point of view, a high number of invasive species occurs in the North-Pannonian sub-province (southern Moravia), where a higher number of endangered plant and animal species are also found (Figure 36).

[49] *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.*

[50] *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.*

Figure 36

Occurrence of invasive plant and animal species in individual cadastral territories of the Czech Republic [number of species], 2020



Data source: Nature Conservation Agency of the Czech Republic

3.2.4 | Wildlife conservation in human care

Key question

What is the involvement of Czechia in the breeding of endangered species and international trade in these species under CITES?

Key messages

The number of exported specimens of CITES protected species is increasing. The most-exported group of animals is birds (especially parrots), the second group is reptiles and then amphibians.

Assessment of the trend and state of indicators

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
International trade in endangered species protected under CITES	N/A	↗	↗	✗
Breeding of endangered species in zoos	N/A	N/A	N/A	~

International trade in endangered species protected under CITES

The **exploitation of wildlife for international trade** is the second most serious cause of species loss on our planet, immediately after the destruction of natural habitats. The main export areas for CITES-protected animals and plants are developing countries, for which live exports often represent a significant economic resource[51].

Reptiles have the highest number of registered specimens, especially tortoises of the genus Testudo. They are followed by a group of birds, in which parrots are the most represented. Hundreds of mammals are registered annually.

The ratios of **the number of exemptions (permits)** issued to allow intra-EU trade in specimens of species listed in Annex A to Council Regulation (EC) No. 338/97 reflect the species representation of registered specimens. Again, reptiles (mainly tortoises) account for the largest share of exemptions, while birds are also significantly represented (mainly parrots, but also raptors and owls), with mammals again accounting for the lowest number of exemptions issued. Exemptions are also exceptionally issued for other groups of animals and plants (rare woods).

Imports, exports and the number of seizures show an increasing trend in the assessed medium-term (2011–2020) and short-term (2016–2020) periods. Reptiles are the most **imported group of live animals** into Czechia, while anthozoa are another important group. Mammals, birds, amphibians, etc. are imported in numbers of at most a few tens or lower hundreds of individuals per year. Imported specimens are mostly from the wild (mainly corals and some reptiles), less so from captive breeding. Of **inanimate animal specimens**, watch bracelets made of crocodile skin (hundreds to thousands per year) are the most commonly imported to Czechia. **Imported live plant specimens** include artificially grown orchids as well as representatives of the resinous and apocynaceae families. Of **inanimate plant specimens**, we import mainly the extract of the Burdock tree for traditional Chinese medicine.

[51] *Read more: www.mzp.cz/cites*

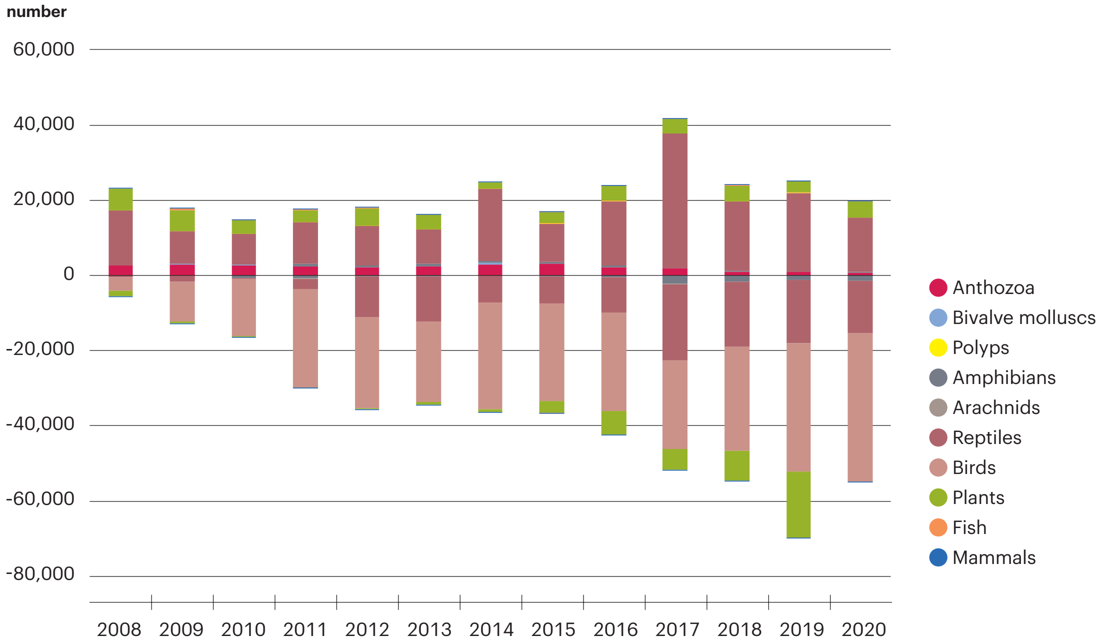
Birds (mainly parrots, but also raptors for falconry purposes) are the most **exported group of animals**, followed by reptiles and amphibians. Mammals, fish and invertebrates are exported in tens or lower hundreds of individuals per year at most. The exported specimens are overwhelmingly from captive breeding (Chart 141).

In recent years, the number of **artificially cultivated plants** has increased sharply, with succulents – cacti and resinous plants – clearly predominating among the exported plants, and carnivorous plants from the sundew and pitcher families being exported to a lesser extent.

Among **living specimens seized due to illegal trade**, plants (mainly cacti) dominate and are in the order of hundreds of specimens, while reptiles are the most frequently seized animals, with minimal seizures of other animal groups (Chart 142). In 2019, the capture of approximately 70,000 eels at Václav Havel Airport was exceptional (not included in the chart). Of the **inanimate specimens seized due to illegal import**, the majority are invertebrates – corals imported as tourist souvenirs. In recent years, there has been an increase in the number of seizures of traditional Asian medicine products containing specimens of endangered species, especially plants (e.g. costus, orchids, etc.), and animals, mainly containing specimens of reptiles (e.g. extracts of python or cobra fat) or mammals (e.g. bear bile, musk from the kabar deer, etc.).

Chart 141

International trade in CITES-protected endangered species in the Czech Republic [number of customs-cleared specimens], 2008–2020



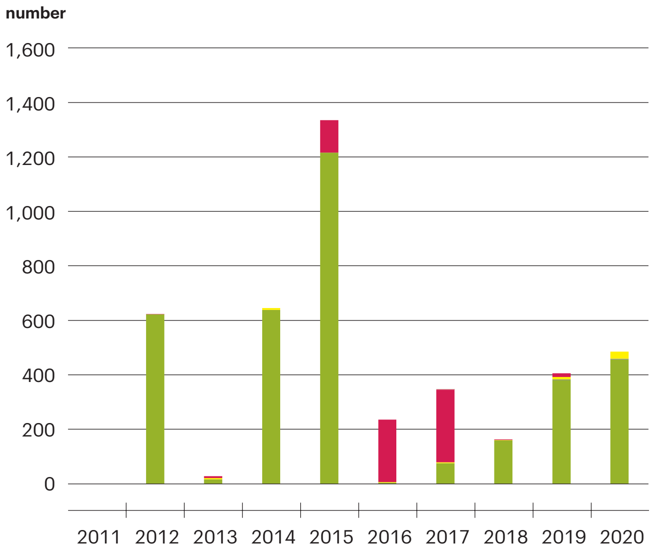
Values above the x-axis represent imports, values below the x-axis represent exports.

Data source: Ministry of the Environment of the Czech Republic

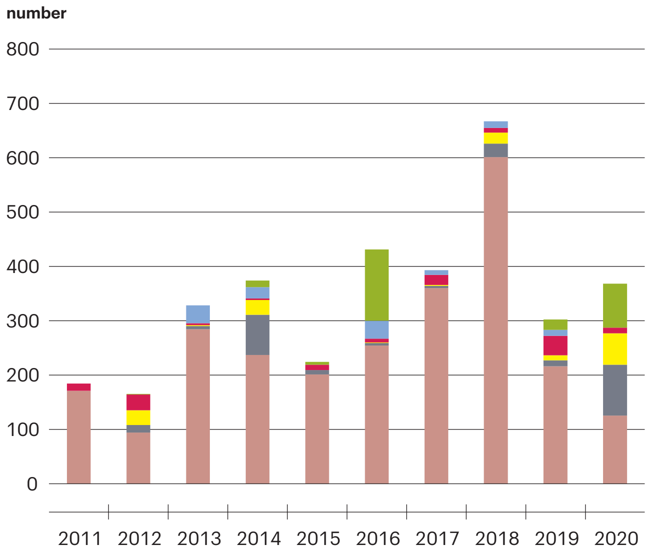
Chart 142

Illegal trade in endangered species protected under CITES in the Czech Republic [number of seized specimens], 2011–2020

Live specimens



Inanimate specimens



Plants Mammals Birds Reptiles Fish Invertebrates

Data source: Ministry of the Environment of the Czech Republic

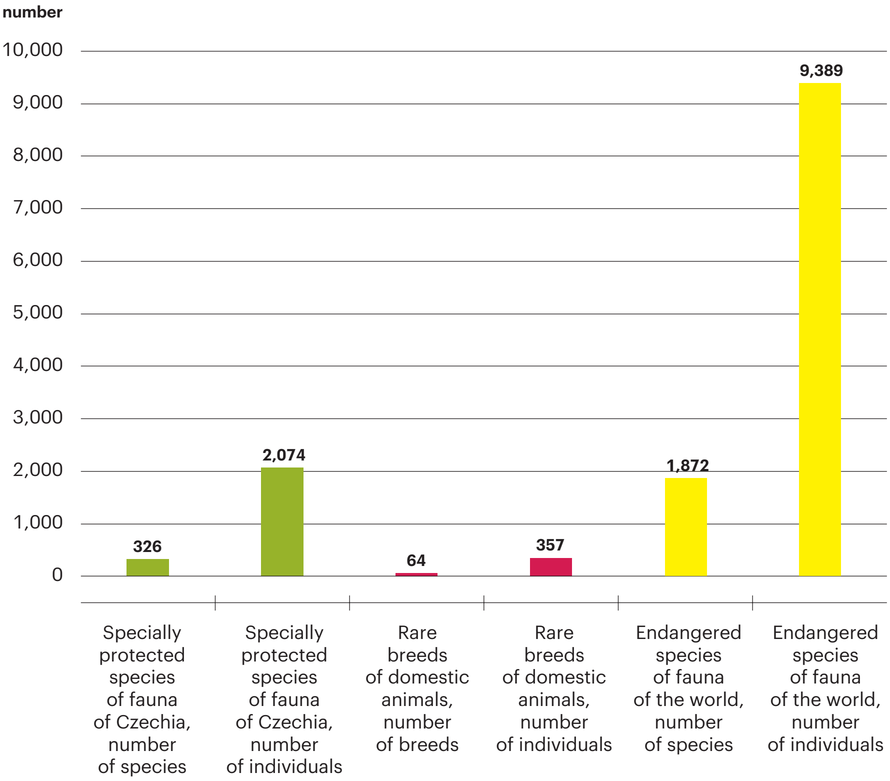
Breeding of endangered species in zoos

According to Act No. 162/2003 Coll., the Act on Zoological Gardens, the **main mission of zoological gardens** is to contribute to the preservation of the biodiversity of wild animals by breeding them in human care, with special attention to the conservation of endangered species, as well as to educate the public about nature conservation. This is why zoos are actively involved in the breeding of specially protected species and endangered species of the world's fauna. Zoos are also involved in breeding rare and endangered breeds of livestock, i.e. the domestic horse, domestic donkey, taurine cattle, domestic sheep, domestic goat and domestic pig. In 2020, 326 specially protected species of Czech fauna, 1,872 endangered species of world fauna and 64 rare breeds of domestic animals **were bred** in zoos. Endangered species of the world's fauna represented the largest number of individuals (Chart 143).

Some Czech zoos are involved in national and international conservation programmes that aim to **contribute to biodiversity conservation** both ex situ (in human care) and in situ (in natural habitats).

Chart 143

Breeding of endangered species in zoos in the Czech Republic [number], 2020



Data source: Ministry of the Environment of the Czech Republic

Biodiversity in an international context

Key messages

The share of terrestrial sites of Community importance and Natura 2000 bird areas in 2019[52] was 18% of EU territory, higher than the global biodiversity target (17% of terrestrial protected areas; Aichi Target 11). The share is 14% for Czechia.

The abundance of common bird species in Europe decreased by 6.4% between 1990 and 2019[53], the abundance of farmland bird species decreased by 28.1%, and the abundance of forest bird species increased by 5.1%. Meadow butterfly abundance in Europe has been declining for a long time, falling by 31.6% between 1991 and 2018.

Landscape fragmentation in an international context

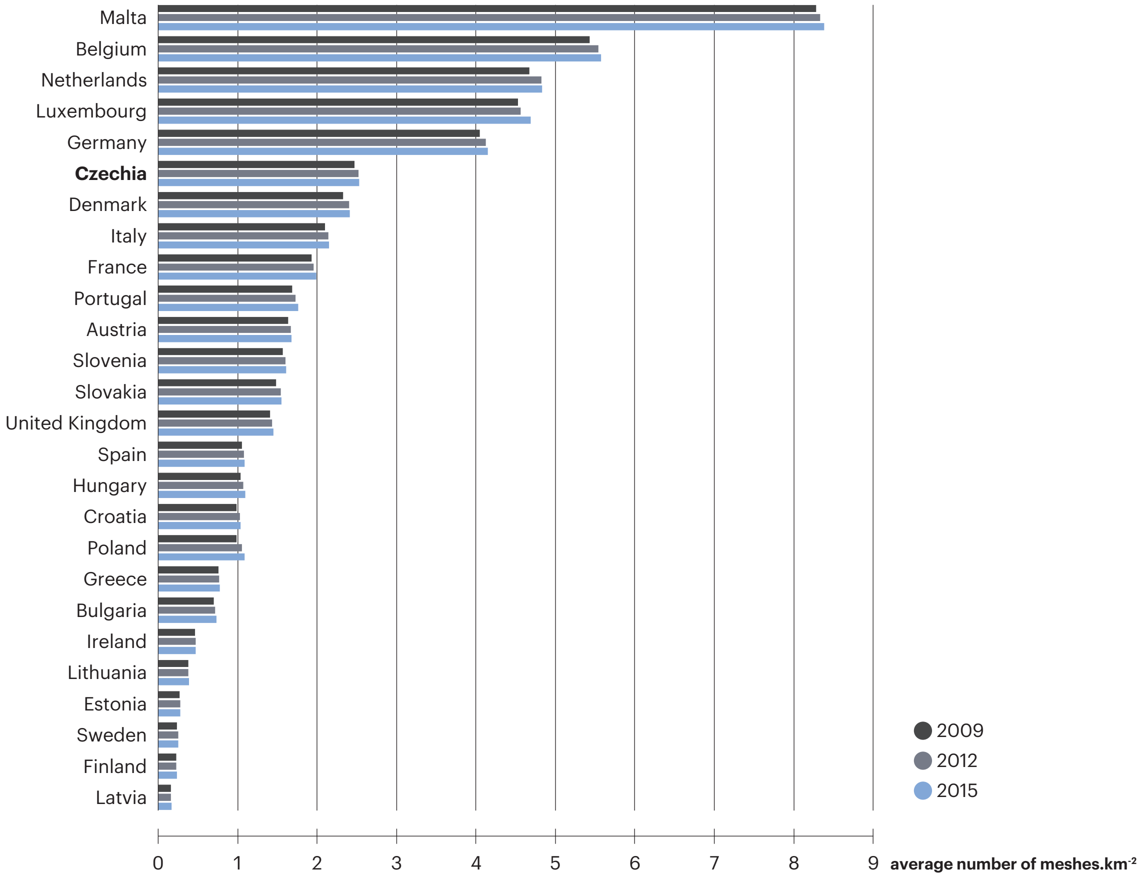
In all the years monitored (2009, 2012 and 2015), the most **fragmented** areas were Malta, Belgium, Luxembourg and the Netherlands (according to the average density of meshes expressing the degree of interruption of movement through the landscape due to fragmentation)[54]. Malta had around 8.3 fragmented meshes per km^2, the highest of any country. The average was around 5 meshes per km^2 in Belgium, Luxembourg and the Netherlands. Czechia is one of the European countries with the most fragmented landscape, with a density of 2.5 meshes per km^2. Areas with more than 0.5 meshes per km^2 are considered highly fragmented. The least fragmented countries in Europe are Estonia and Sweden (both with 0.3 meshes per km^2), followed by Finland and Latvia (0.2 meshes per km^2), Chart 144.

[52, 53] *Data for the year 2020 are not available at the time of publication.*

[54] *EEA (2020): https://www.eea.europa.eu/data-and-maps/indicators/mobility-and-urbanisation-pressure-on-ecosystems-2/assessment. This is the Effective mesh density index.*

Chart 144

Landscape fragmentation in EU countries [number of meshes.km^{-2}], 2009, 2012, 2015



Fragmentation due to the expansion of urban and transport infrastructure. The Effective Mesh Density is a measure of the degree to which movement between different parts of the landscape is interrupted by a Fragmentation Geometry (FG). FGs are defined as the presence of impervious surfaces and traffic infrastructure, including medium sized roads. The more FGs fragment the landscape, the higher the effective mesh density hence the higher the fragmentation. The geographical coverage of the dataset is EEA39. Data for the years 2016–2020 are not available at the time of publication.

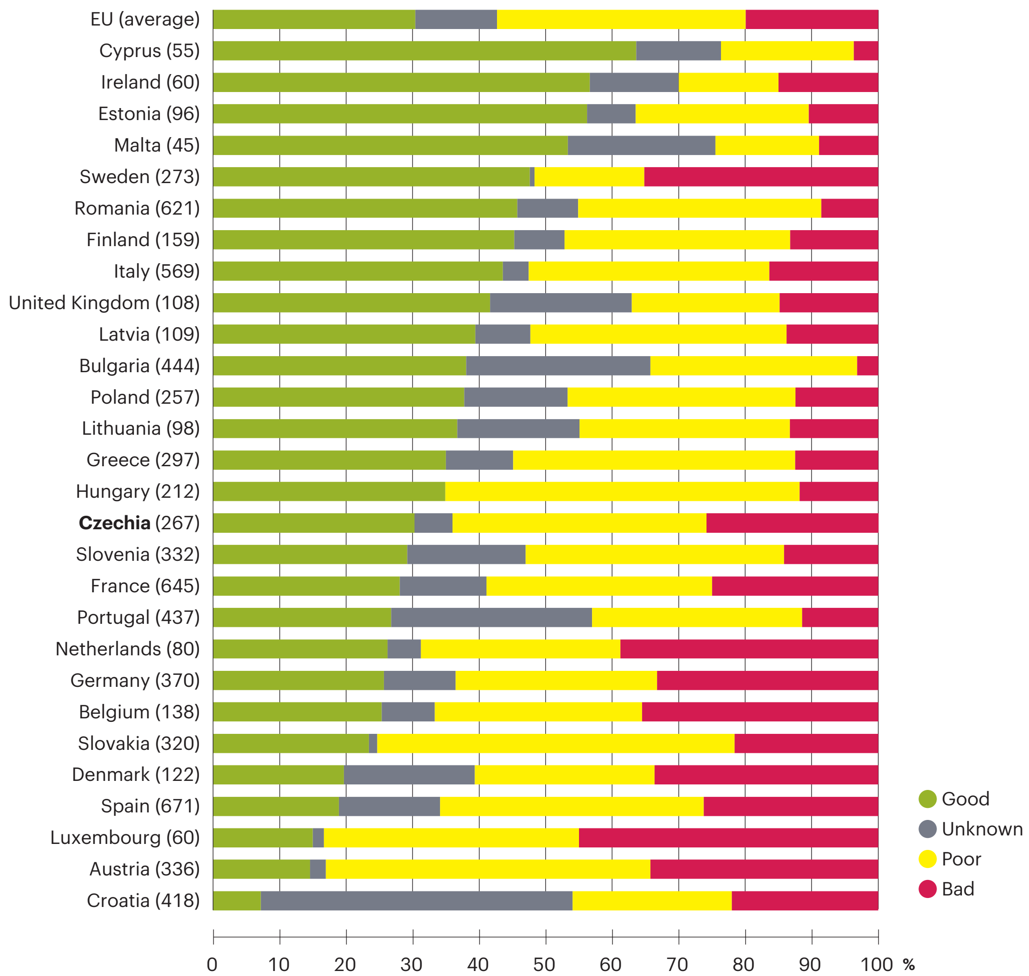
Data source: EEA

State of species and habitats of Community importance in an international context

In an international comparison of the **state of animal and plant species of Community importance**, Czechia is around the European average (Chart 145). Cyprus (63.7%) has most species in good status, with Croatia (7.2%) having the least, while Czechia has 30.3%. On the other hand, Luxembourg has the highest number of species in a bad status (45%), Bulgaria (3.2%) the lowest, while Czechia has 26.2%. Only an average of 30.4%[55] of species of Community importance (EU28) are in a good status (Chart 145)[56].

Chart 145

Conservation state of animal and plant species of Community importance in EU28 [%], 2013–2018



The numbers in brackets show the total number of species assessed. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: EEA

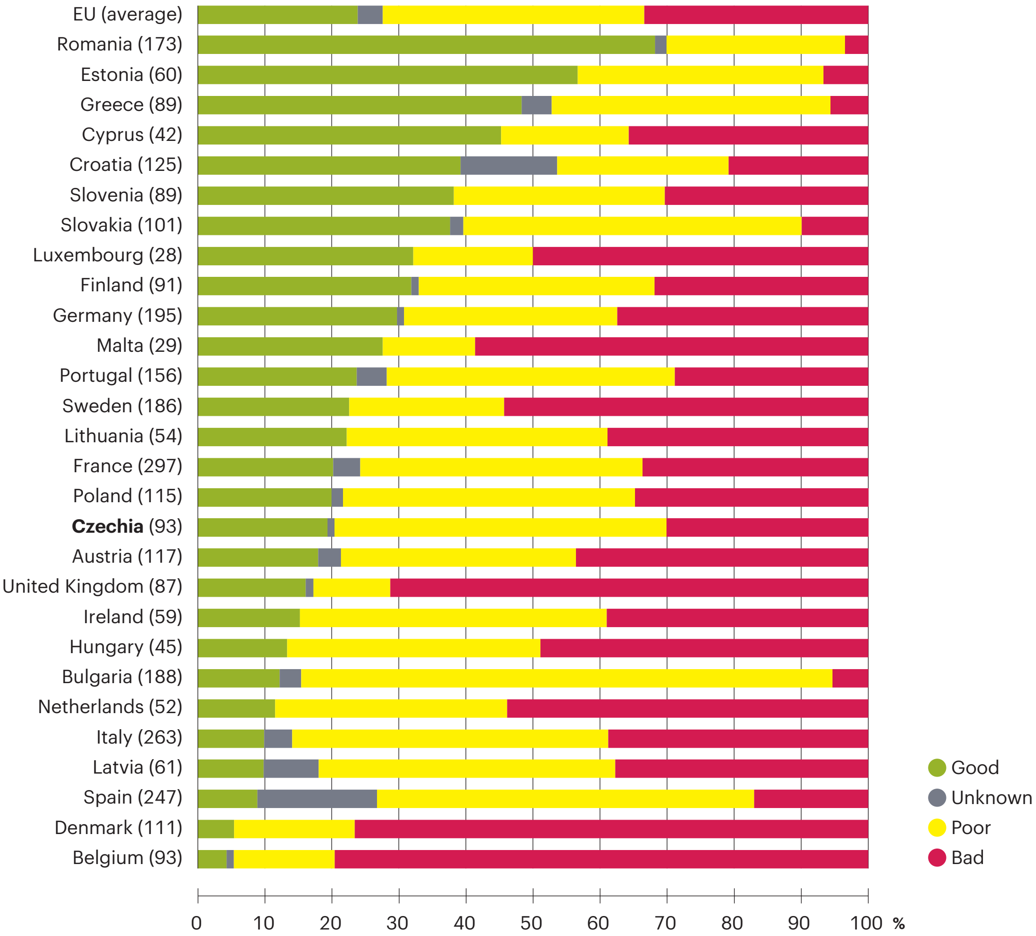
[55] *This is the average of the countries listed. An expert assessment at European level indicates an even lower 27% share of species in a good state. Read more: https://www.eea.europa.eu/data-and-maps/indicators/species-of-european-interest-3/assessment*

[56] *Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.*

Of the habitat types assessed, the highest number of **habitat types of Community importance** in a good status are found in Romania (68.2%), the least in Belgium (4.3%), while the EU28 average is 23.9%[57]. 19.4% of the assessed habitat types were in a good status in Czechia. Belgium (79.6%) and Denmark (76.6%) had the highest number of habitats in a bad state, with Romania again the least (3.5%). At EU level, 33.4% of the assessed habitats are in a bad state, while this figure for Czechia is 30.1%. On average across the EU, 39.0% of assessed habitats are in a poor state and 3.7% are in an unknown state (Chart 146).

Chart 146

Conservation state of habitat types of Community importance in the EU28 [%], 2013–2018



The numbers in brackets represent the number of sites assessed. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles .

Data source: EEA

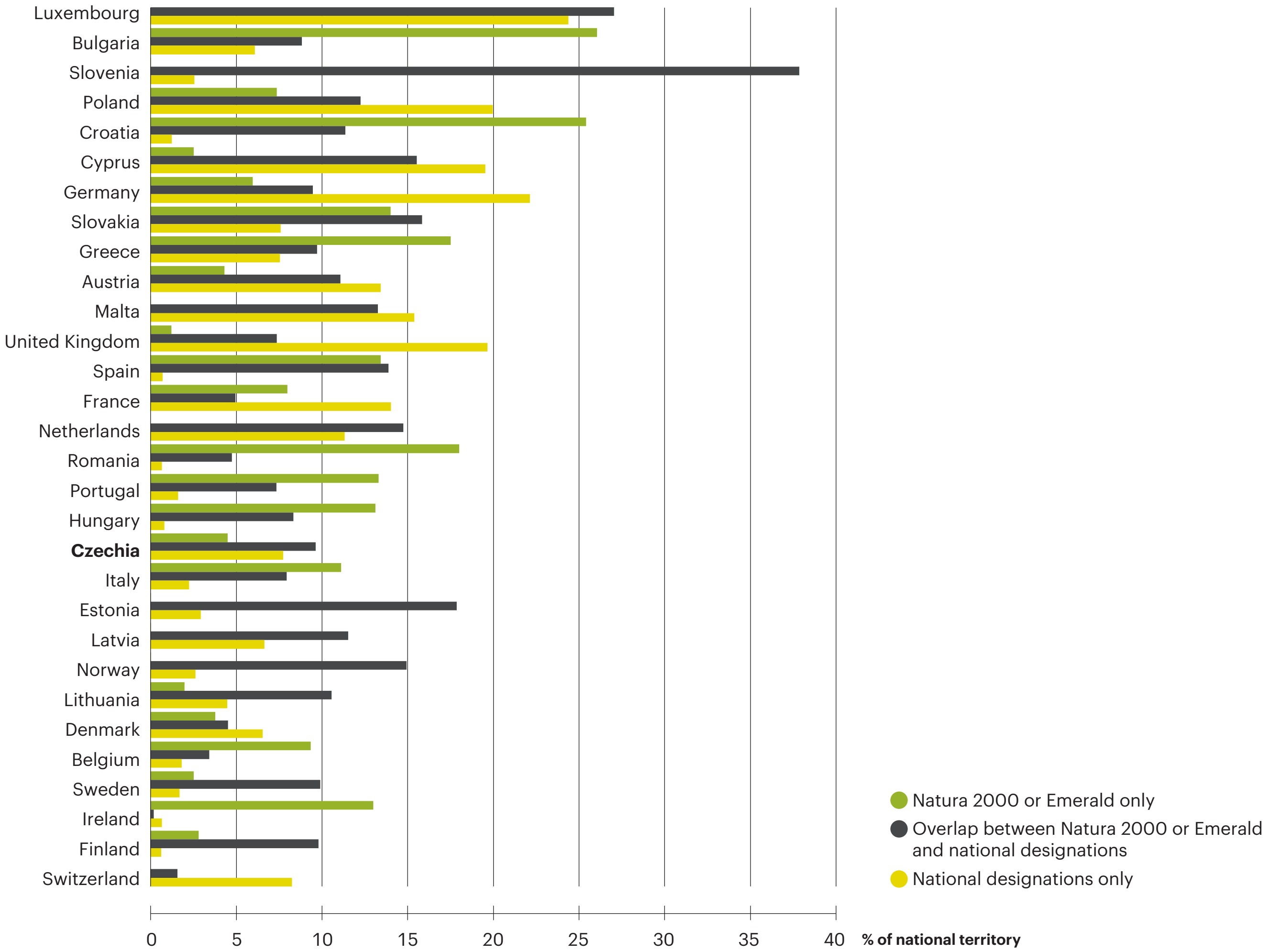
[57] *This is the average for the countries listed. Expert assessments at European level indicate an even lower 15% share of habitats in a good status. Read more: https://www.eea.europa.eu/data-and-maps/indicators/habitats-of-european-interest-2/assessment*

Protected areas in an international context

Luxembourg has the highest **overlap between** Natura 2000 and Emerald sites and national protected areas (27.0%) and also the highest share of national protected areas in the country (25.4%), while Switzerland has the lowest (only 1.6% overlap and 8.2% national protected areas). In Czechia, specially protected areas and areas protected under the European Natura 2000 network have a 9.6% territory overlap (Chart 147).

Chart 147

Percentage of the territory designated as a protected area and overlap between Natura 2000 or Emerald sites and national protected areas in EU countries [%], 2016, 2019, 2020



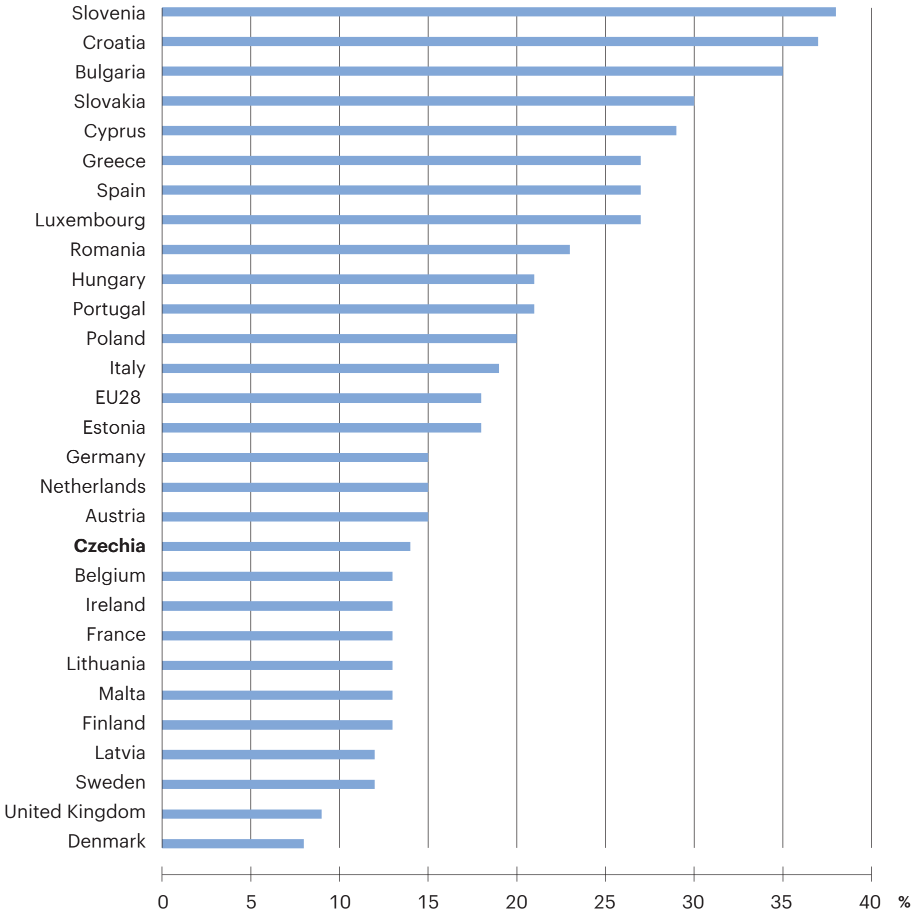
Data are available for 2019 for Natura 2000 areas, for 2016 for Emerald data, and data for the year 2020 for national protected areas. Data for the year 2020 for all Member States are not available at the time of publication. The Emerald network is similar to the Natura 2000 network in non-EU countries (Switzerland, Norway).

Data source: EEA

Slovenia (38%), Croatia (37%) and Bulgaria (35%) have the highest **share of terrestrial sites of Community importance and Natura 2000 bird sites**. The EU28 average was 18% in 2019[58]. Czechia, with 14%, is one of the countries with a lower share of Natura 2000 sites. Denmark (8%), the United Kingdom (9%) and Sweden (12%) have the lowest shares, Chart 148. The global biodiversity target is 17% of terrestrial protected areas; (Aichi Target 11)[59].

Chart 148

Percentage of terrestrial sites of Community importance and Natura 2000 bird sites in EU countries [%], 2019



Data for the year 2020 are not available at the time of publication.

Data source: EEA

[58] *Data for the year 2020 are not available at the time of publication.*

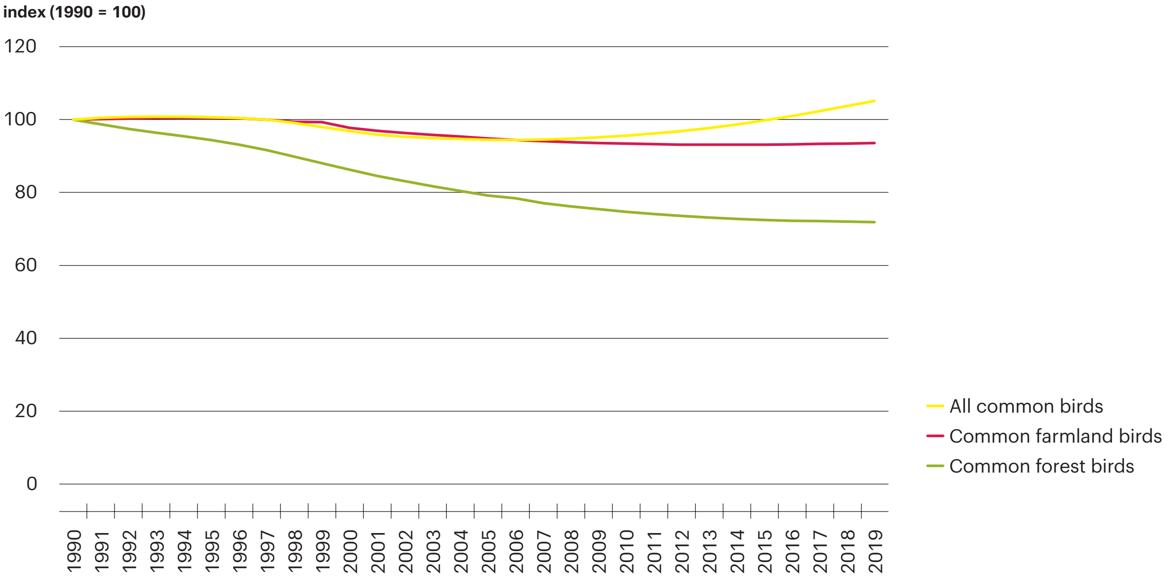
[59] *Strategic Objective 11 of the Convention on Biological Diversity: "By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes." See more at: https://chm.nature.cz/umluva-o-biologicke-rozmanitosti-cbd/strategicky-plan-2011-2020cbd/aichi-cile/*

Common bird species in an international context

The **abundance of common bird species** in Europe declined by 6.4% in the 1990–2019 period[60], the abundance of farmland bird species declined by 28.1% and the abundance of forest bird species increased by 5.1%[61] (Chart 149).

Chart 149

Indicator of common bird species, forest bird species and farmland bird species in Europe [index, 1990 = 100], 1990–2019



Data for the year 2020 are not available at the time of publication.

Data source: EEA, EBCC (European Bird Census Council)

[60] *Data for the year 2020 are not available at the time of publication.*

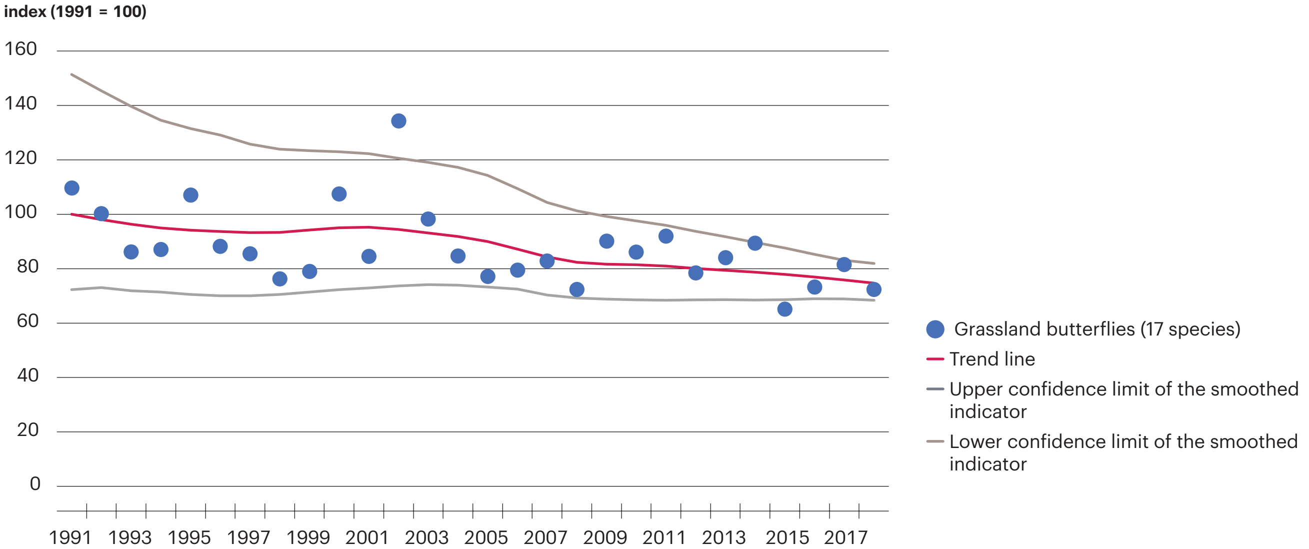
[61] *The index includes only common species (rare species are excluded). Three groups of bird species are represented: farmland bird species (39 species), common forest bird species (34 species) and all common bird species (167 farmland and forest bird species). The indices are presented for EU aggregates only and with smoothed values. The index draws on data produced by the European Bird Census Council and its pan-European bird monitoring programme. The data coverage increased from 9 to 22 EU Member States in the 1990–2010 period, and covered 25 countries from the 2011 reference year. The number of participating countries included the United Kingdom.*

Grassland species of butterflies in an international context

One important indicator that gives an overall overview of the development of biodiversity is the **Grassland butterfly indicator**. Grassland butterflies have been declining in Europe for a long time. From 1991 to 2018[62], they declined by 31.6% (Chart 150).

Chart 150

Grassland butterfly indicator in Europe [index, 1991 = 100], 1991–2018



Geographical coverage: Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Romania, Spain, Slovenia, Sweden. Data for the years 2019 and 2020 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: EEA

[62] *Data for the years 2019 and 2020 are not available at the time of publication.*

Financing of environmental protection

Financing of environmental protection

Environmental financing is one of the decisive factors influencing the state of the various components of the environment, and is also an expression of the public need for environmental protection at central and regional level. This need can be quantified not only by the volume of economic entities' own resources spent, but also by the amount of public financial support from local, central and international sources.

Without an adequate level of expenditure devoted to environmental protection, the targets set out in environmental policies or sustainable development targets cannot be achieved. Their absolute amount and share in GDP testifies to the difficulty of maintaining and achieving the required state of the environment, but also to the social consensus in terms of the understanding of the need for a quality environment.

The topic of financing is divided into two chapters, the first of which focuses on the investment activity of both the corporate and government sectors, i.e. on investments and the related current (non-investment) costs in environmental protection. Their aim is in particular to reduce or directly eliminate environmental pollution produced by an enterprise or public entity.

The provision of sufficient financial resources is an essential prerequisite for the success of investment activities and projects. These can be in the form of own resources and also in the form of public resources, the focus of the second chapter on this topic. Public resources for expenditure on environmental protection include, in particular, grants and subsidies provided from national and international public resources, i.e. mainly from the state budget, state funds, territorial budgets and the related funds from European or international sources.

Overview of selected related strategic and legislative documents

Strategic Framework Czech Republic 2030
- ensuring the most efficient spending of public funds and sustainable public finances, which must be able to cope with changes in the structure of income or new expenditure requirements in the future
- adhering to the principle of additionality to avoid the displacement of national resources and to prevent public policies and the regular operation of the state from becoming dependent on EU funds, the inflow of which to the Czech Republic will gradually decrease
- promoting investment in research, development and innovation
- supporting investments in quality infrastructure, in improving the energy performance of buildings, in more sustainable forms of mobility, in priority areas of risk prevention and the protection of health, lives, the environment, etc.

State Environmental Policy of the Czech Republic 2012–2020
- increasing investment in the use of clean technologies, renewable energy sources, and in the more careful management of non-renewable energy sources, in the protection and preservation of ecosystem services, and in the protection of biodiversity
- strengthening support for science, research and innovation, including support from foreign resources for the effective implementation of environmentally sound technologies and eco-innovation in industry
- inclusion of negative externalities in polluter costs as an application of the "polluter pays" principle
- strengthening financial support for monitoring and mitigating natural risks and strengthening financial resources to ensure the permeability of migration barriers, in particular transport structures
- ensuring maximum use of financial resources, especially from EU funds

Strategy on Adaptation to Climate Change in the Czech Republic and National Action Plan on Adaptation to Climate Change

- investments, for example in the restoration of ecosystems and natural qualities of the territory in both open and urbanized landscapes, contributing to adaptation to climate change impacts
- use of promising financial instruments, e.g. insurance against natural risks, payments for ecosystem services, carbon taxes
- support for research into adaptation to climate change

Operational Programme Environment 2014–2020

- allocation of financial support to the Operational Programme Environment 2014–2020 of EUR 3.2 bil. of total eligible expenditure (of which the contribution from the EU, respectively the Cohesion Fund and the European Regional Development Fund, in the amount of EUR 2.8 bil.) into the following priority axes:
  PA 1 – Improving water quality and reducing flood risks: 28% of programme allocation
  PA 2 – Improving air quality in human settlements: 19% of programme allocation
  PA 3 – Wastes and material flows, environmental burdens and risks: 17% of programme allocation
  PA 4 – Protection and care for nature and landscape: 13% of programme allocation
  PA 5 – Energy savings: 20% of programme allocation
  PA 6 – Technical assistance: 3% of programme allocation

National Reform Programme of the Czech Republic 2020

- support for the implementation of measures to reduce the risk of flooding, long-term drought and water scarcity (e.g. implementation of general measures of a non-construction nature as well as nature-friendly and technical flood protection measures, support for water retention in the landscape, and rainwater management) in the context of climate change impacts

Investments and non-investment costs in environmental protection

Key question

What is the structure and volume of investments to maintain and improve the quality of the environment?

Key messages

In 2020, total expenditure, i.e. investments and non-investment costs in environmental protection, totalled CZK 102.2 bil., a slight increase of CZK 1.7 bil. or 1.7% compared to 2019. Given these developments and the slump in the economy due to the COVID-19 pandemic, the share of investments and non-investment costs in GDP increased by 0.06 percentage points from 1.74% to 1.80% of GDP. From the perspective of the programme focus, most funds were spent on waste water management, air and climate protection, and waste management, as in previous years.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Investments and non-investment costs in environmental protection	↗	↗	→	~

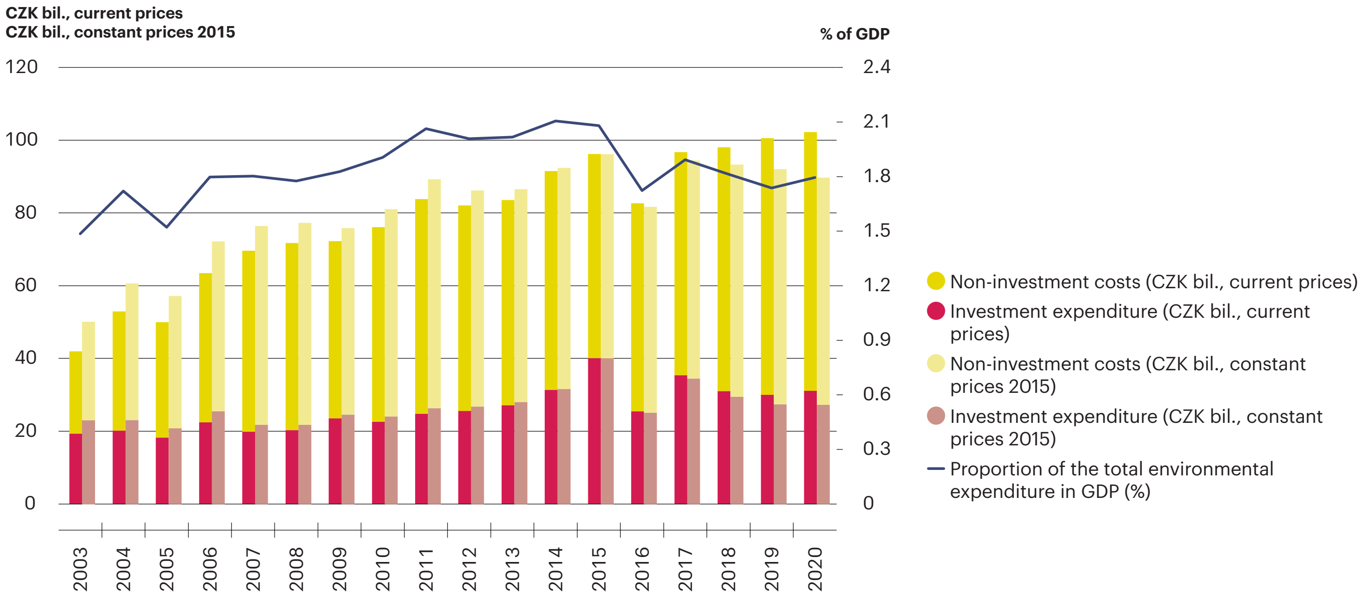
The total statistically monitored expenditure on environmental protection consists of the sum of investments on environmental protection and non-investment costs in environmental protection issued by monitored economic entities of the Czech economy (i.e. both private enterprises and the public sphere). Investment expenditure includes all expenditure on the acquisition of tangible fixed assets, i.e. expenditure relating to environmental protection activities, the main objective of which is to reduce the negative effects caused by business activity. Non-investment costs are so-called current expenses, especially wage costs, material consumption, energy, repairs, maintenance, etc. Statistical surveys of source data have been carried out by the Czech Statistical Office since 1986 in the case of investment expenditure in environmental protection, or since 2003 in the case of non-investment costs.

In 2020, investments and non-investment costs in environmental protection increased by 1.7% year-on-year to a total of CZK 102.2 bil. in current prices (Chart 151). **The total share of investments and non-investment costs in GDP** thus increased by 0.06 percentage points to 1.80% of GDP, partly because of the economic downturn in 2020 due to the COVID-19 pandemic. In addition to non-investment costs, which are growing steadily, investments also increased by 3.8% in 2020 to a total of CZK 31.1 bil., especially in connection with higher investment activity in waste water management. In 2020, investing entities increased the volume of investments financed from their own resources and budgetary resources by CZK 1.4 bil. year-on-year, while this was at the expense of financing, especially through credits and loans, as well as grants and subsidies from abroad.

In the long and medium term, after excluding the impact of price changes (i.e. in constant prices 2015), an increasing trend in the total volume of expenditure on environmental protection can be noted, but in the short term and in comparison with the overall performance of the economy or GDP, the trend is rather gradual or slightly decreasing. While the total volume of investments and non-investment costs (in constant prices 2015) increased by 79.3% in the 2003–2020 period, their share of GDP increased by only 0.31 percentage points partly thanks to favourable developments at the beginning of the period. In the medium term, i.e. in the last 10 years, this share has actually decreased by 0.11 percentage points.

Chart 151

Total expenditure on environmental protection in the Czech Republic [CZK bil., % GDP, current prices, constant prices 2015], 2003–2020



Data source: Czech Statistical Office

In 2020, expenditure on integrated devices (i.e. for pollution prevention) outweighed expenditure on terminal equipment (i.e. on cleaning up pollution) in **investments**. It is thus possible to state a long-term high level of investment, where an integrated approach to environmental protection based on the principle of the introduction and use of BAT and other innovations is being applied. The aim of this approach is the gradual modernisation of the production facilities of environmental polluters, leading in particular to the elimination of the negative effects caused by their activities.

From the perspective of the programme focus of investments, the largest investment expenditure in 2020 was on waste water management (CZK 11.6 bil., e.g. for the reconstruction and construction of sewers and WWTPs), and air and climate protection (CZK 8.8 bil., e.g. in reducing industrial emissions) and in waste management (CZK 4.7 bil., e.g. for the collection and transport, respectively the recovery and disposal of municipal waste).

According to the classification of the investing entity's economic activity (CZ–NACE), the greatest share of investments in 2020 were accounted for by the sectors of public administration and defence, and compulsory social security (35.6% of total investments) and water supply, including activities related to waste water, waste and sanitation (20.2% of total investments), followed by the energy sector, i.e. the production and distribution of electricity, gas, heat and air-conditioned air (19.7% of total investments) and the manufacturing industry (15.2% of total investments).

In terms of the breakdown by institutional sector into corporate and government sectors, private and public non-financial corporations invested CZK 19.6 bil. in 2020 and the government (central and regional) sector CZK 11.5 bil. As in previous years, the corporate sector has thus played a greater role in environmental protection investments, applying the "polluter pays" principle, where it is necessary to transfer the main responsibility for environmental protection to private entities.

In the case of **non-investment costs** or current expenditures, a long-term increasing trend can be seen. This was also confirmed in 2020, when these costs increased by CZK 0.6 bil. year-on-year (i.e. by 0.8%) to CZK 71.1 bil., and thus continued to form, in addition to investments, a substantial part of the expenditure on environmental protection monitored by the Czech Statistical Office. The largest volume of non-investment costs was spent on the consumption of materials and energy and on wages. As in previous years, in terms of the programme focus, the largest current expenditure was in waste management in 2020 (CZK 45.3 bil.), which, when combined with investment expenditures in this area, makes up the largest overall part of total expenditures on environmental protection) and in waste water management (CZK 14.6 bil.). Other cost-intensive areas are long-term air and climate protection (CZK 4.3 bil. in 2020), soil protection and remediation, and the protection of groundwater and surface water (CZK 3.5 bil.).

Public expenditure on environmental protection

Key question

What is the structure and volume of funds spent from national and international public sources on environmental protection?

Key messages

The volume of expenditure from both central sources (i.e. mainly from the state budget and state funds) and from territorial budgets increased year-on-year in 2020. In the case of environmental protection expenditure from central sources, growth was 14.8% to CZK 60.4 bil., and for expenditure from territorial budgets it was 9.8% to a total of CZK 44.9 bil. in 2020.

Priority areas of support in 2020 included water protection, biodiversity and landscape protection, waste management and, last but not least, air protection. In this area, the implementation of programmes aimed at supporting thermal insulation, energy savings and changes in heating technologies (e.g. the New Green Savings Programme and so-called boiler subsidies) continued in 2020.

Under the Operational Programme Environment, for the 2014–2020 programming period with a total allocation of EUR 3.3 bil. (i.e. around CZK 85.6 bil.) of total eligible expenditure, 19 new calls amounting to EUR 279.4 mil. (CZK 7.3 bil.) of total eligible expenditure were announced in 2020. Since the beginning of the programming period, the provision of subsidies for 9,122 applications totalling EUR 3.5 bil. (CZK 90.4 bil.) of total eligible expenditure were issued.

Assessment of the trend and state of the indicator

Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Public expenditure on environmental protection	↗	↗	↗	✓

Public sources of expenditure on environmental protection include both national sources, i.e. the state budget and state funds (central sources) and territorial budgets of regions and municipalities, as well as related funds from European or international sources[1].

As in other areas, in environmental protection the share of expenditure in gross domestic product is monitored. In 2020, both the volume of expenditure from central sources and the volume of expenditure from territorial budgets grew compared to the previous year. This growth was also reflected in an increase in the share of expenditure in GDP in 2020, in the case of expenditure from central sources by 0.15 percentage points to 1.07% of GDP (Chart 152) and for expenditure from territorial budgets by 0.08 percentage points to 0.79% of GDP (Chart 153).

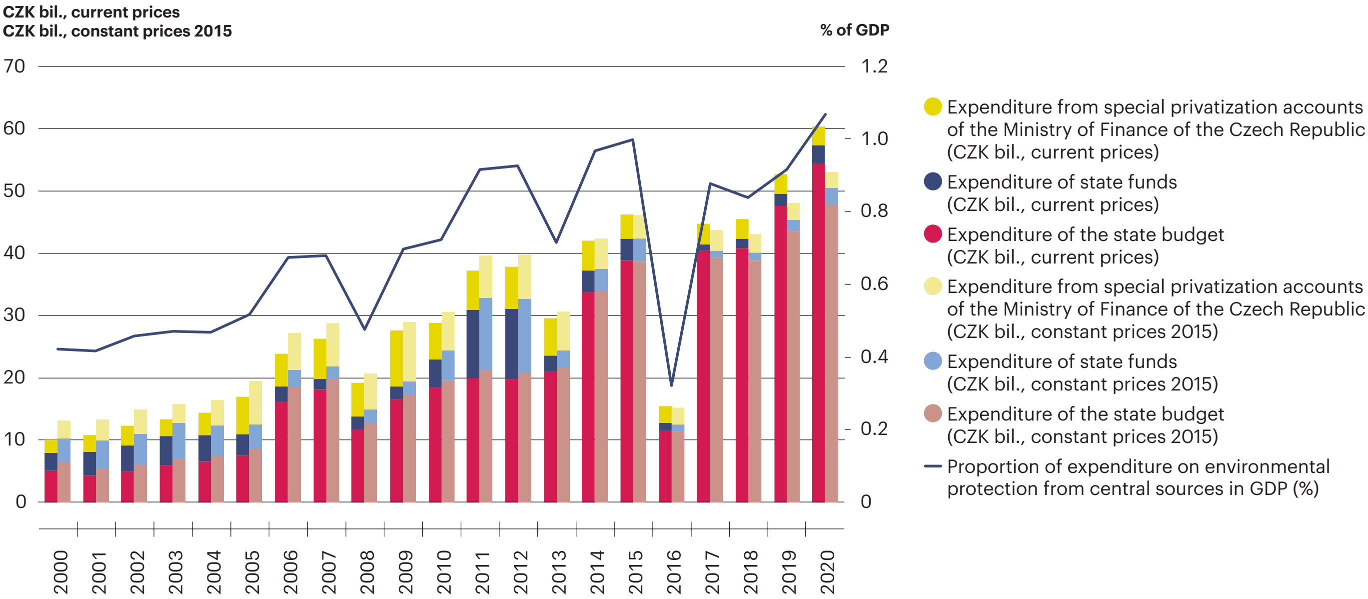
[1] Information concerning public expenditure is based on the budgetary structure of the Ministry of Finance of the Czech Republic, which also monitors the funds provided primarily for the purpose of creating and protecting the environment over the long term. Given that financial transfers (e.g. from the state budget, state funds, etc.) can also be a source of expenditure for territorial budgets, some of these expenditures are duplicated with expenditure from central sources or European funds. For this reason, expenditure from central sources, territorial budgets and European or international sources is assessed separately and cannot therefore be summarised.

In the long and medium term, after excluding the impact of price changes (i.e. in constant prices 2015), we can see a significantly increasing trend in the total volume of expenditure on environmental protection from both central sources and territorial budgets. This trend can also be confirmed in the case of central sources in comparison with the overall performance of the economy or GDP, in contrast to territorial budgets where the trend of the share in GDP is rather stagnant or only moderately increasing.

Expenditure on environmental protection from central sources in 2020 increased by 14.8% year-on-year to CZK 60.4 bil. (Chart 152). In particular, the volume of funds provided from the **state budget** increased (by 14.3% to CZK 54.4 bil., partly in connection with the implementation of the Operational Programme Environment 2014–2020. This is because resources from operational programmes financed from EU funds are interconnected with funds from national public sources in the form of co-financing or pre-financing of supported projects. Expenditure from **state funds**, of which the State Environmental Fund of the Czech Republic plays a crucial role, increased by 50.2% to CZK 3.0 bil.

Chart 152

Public expenditure on environmental protection from central sources in the Czech Republic [CZK bil., % GDP, current prices, constant prices 2015], 2000–2020



Data source: Ministry of Finance of the Czech Republic, Czech Statistical Office

The role of the **State Environmental Fund of the Czech Republic** is important in financing environmental protection – its importance is currently connected, inter alia, with the provision or administration of subsidies within national programmes, the Operational Programme Environment or the **New Green Savings Programme**[2]. This programme, running since 2014, falls within the scope of thermal insulation and energy saving programmes, respectively changes in heating technologies and measures to reduce greenhouse gas emissions. By the end of 2020, a total of 69,472 applications for support had been submitted in the individual calls of the programme, and 45,239 applications worth approximately CZK 10.0 bil. had already been paid out.

The State Environmental Fund of the Czech Republic also manages the **collection of environmental protection fees**. The purpose of this fee collection is to directly return the funds to environmental protection, meaning it is different from environmental taxes, where direct return is not a necessary condition. The fees are a source for the provision of support under the responsibility of the State Environmental Fund of the Czech Republic, which

[2] *The administrator and payment unit of the New Green Savings Programme is the Ministry of the Environment of the Czech Republic. The State Environmental Fund of the Czech Republic is entrusted with some administrative tasks, especially the selection and assessment of applications.*

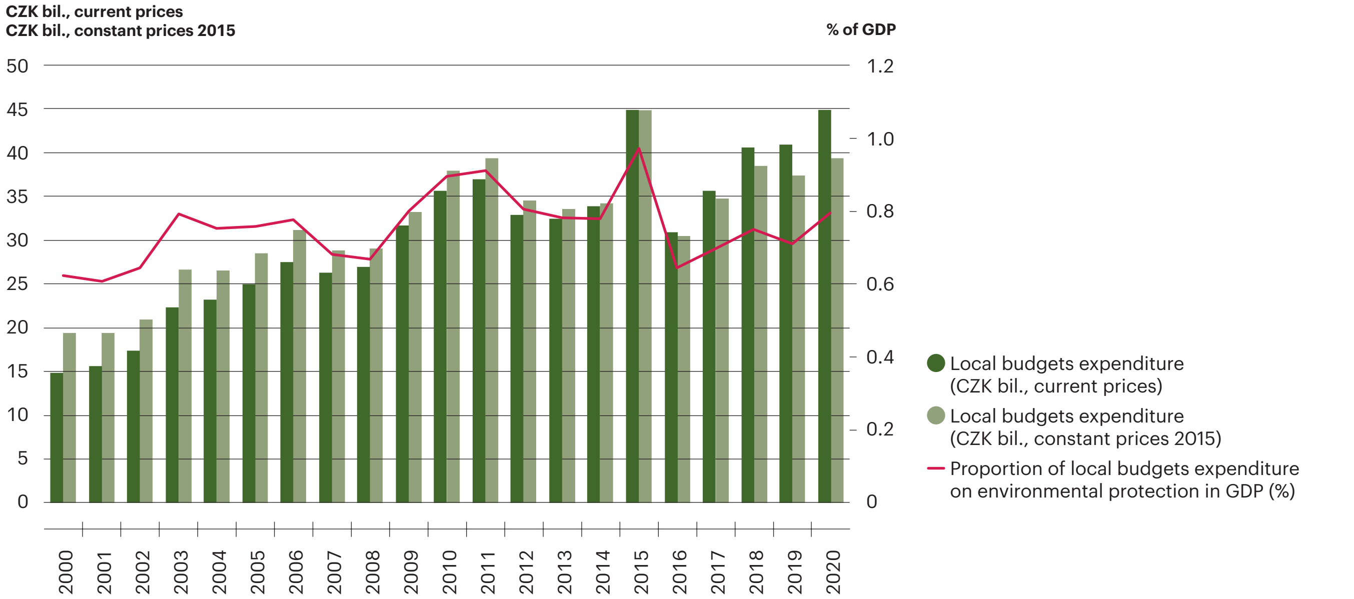
is drawn primarily in the form of loans, subsidies and payments of part of the interest on loans, and is directed mainly to priority environmental protection areas in the Czech Republic (i.e. water, biodiversity, landscape and air protection, and waste management). In 2020, the main sources of income of the State Environmental Fund of the Czech Republic from the collection of fees or levies were groundwater abstraction (a total of CZK 355.3 mil.), air pollution (CZK 291.2 mil.), the withdrawal of agricultural and forest land (CZK 254.8 mil.), the discharge of waste water into surface waters (CZK 227.2 mil.), and support for the collection, processing, recovery and disposal of selected car wrecks (CZK 110.5 mil.).

In addition to the state budget and state funds, the funds of the defunct National Property Fund of the Czech Republic are a specific category of central financing sources in environmental protection, and are managed by the Ministry of Finance of the Czech Republic through its **special privatization accounts** and from which CZK 3.0 bil. was spent in 2020[3]. This expenditure is aimed at remedying old environmental damage incurred before privatisation and caused by the previous activities of enterprises, or at remedying environmental damage caused by the extraction of minerals and at revitalising the areas concerned.

The second main pillar of public expenditure on environmental protection is, in addition to central sources, funds from the **territorial budgets of municipalities and regions**, which are intended to finance actions that are implemented continuously on the basis of the competence of municipalities or regions. year-on-year there was expenditure growth of 9.8% in 2020 to a total of CZK 44.9 bil. (Chart 153).

Chart 153

Public expenditure on environmental protection from territorial budgets in the Czech Republic [CZK bil., % GDP current prices, constant prices 2015], 2000–2020



Data source: Ministry of Finance of the Czech Republic, Czech Statistical Office

[3] *Examples of this expenditure are funds intended for the remedy of consequences after chemical uranium mining in Stráž pod Ralskem, as well as funds for the Moravian-Silesian, South Moravian, Ústí nad Labem and Karlovy Vary regions intended for the remedy of environmental damage incurred before the privatization of mining companies in connection with the restructuring of the metallurgy sector, and for the revitalization of the affected areas.*

From the perspective of **programme focus**, the largest financial support from national sources was also directed to **air and climate protection** in 2020 (CZK 33.2 bil. from central sources, respectively CZK 2.7 bil. from territorial budgets), where the implementation of programmes aimed at supporting thermal insulation, energy savings and also changes in heating technologies to reduce air pollution from local furnaces using solid fuels and to reduce greenhouse gas emissions continued. This area includes, for example, the above-mentioned New Green Savings Programme and the so-called boiler subsidies paid to support boiler replacement (more on this programme in the paragraph below, which concerns the Operational Programme Environment 2014–2020).

Other priority areas of support included **water protection** (CZK 4.0 bil. from central sources, respectively CZK 15.8 bil. from territorial budgets), represented mainly by expenditure on the collection and treatment of waste water and solutions for sludge, as well as **biodiversity and landscape protection** (CZK 12.6 bil. from central sources, respectively CZK 12.1 bil. from territorial budgets), where the majority of the funds were spent on support for protected parts of nature. Important national programmes falling into this area of support include the Landscape Management Programme, the Natural Landscape Function Restoration Programme and the sub–programme Management of Inalienable State Property in Specially Protected Areas. Under these programmes, a total of CZK 364.7 mil. was disbursed in 2020. Another significant part of the funds was spent on biodiversity and landscape protection to ensure the society-wide functions of forests, especially through financial contributions from the budget chapter of the Ministry of Agriculture of the Czech Republic to mitigate the impacts of the bark beetle calamity, respectively to compensate for the damage caused in forests. In territorial budgets, attention was paid to biodiversity and landscape protection, with particular attention being paid to the appearance of municipalities and public greenery.

Last but not least, priority areas of public support included **waste management** (CZK 1.8 bil. from central sources, respectively CZK 13.7 bil. from territorial budgets), especially the collection and transport, respectively the recovery and disposal of municipal waste and waste prevention.

Public support for **environment-related research, development and innovation** is equally important. The total public expenditure on research, development and innovation in the 2000–2020 period from the state budget or state funds amounted to CZK 4.3 bil. Support for research, development and innovation in the Ministry of the Environment of the Czech Republic takes place in two ways: institutional (support for research organizations) and targeted (support for research projects).

As part of **institutional support**, CZK 268.0 mil. was disbursed in 2020. The Ministry of the Environment of the Czech Republic is a provider of institutional support for the long-term conceptual development of research organizations established by the Ministry of the Environment of the Czech Republic, while five departmental research organizations were recipients of this support in 2020. The amount of institutional support depends on the available funds for research, development and innovation in the budget chapter of the Ministry of the Environment of the Czech Republic.

Targeted support in the Ministry of the Environment of the Czech Republic takes place at two levels: international and national. At international level, for example, European partnerships were being prepared in 2020 under the EU's **Horizon Europe** programme. Partnerships are included in five areas, and the Czech Republic is interested in thematically engaging in biodiversity, water, energy and chemistry through the Ministry of the Environment of the Czech Republic.

National support was then implemented mainly through the **Environment for Life Programme** launched in 2019, which is administered by the Technology Agency of the Czech Republic and the sponsor of which – in terms of content – is the Ministry of the Environment of the Czech Republic. The priority areas of the programme are: 1. climate, 2. air protection, 3. waste and the circular economy, 4. protection of water, soil, the rock environment and other natural resources, 5. biodiversity, nature and landscape protection, 6. environmentally friendly society, a safe and resilient environment, specific tools for environmental protection and sustainable development. Total expenditure on the programme is expected to be CZK 4.5 bil., of which state budget expenditure will amount to CZK 3.8 bil. At least 50% of this volume is dedicated to research related to drought and other consequences and contexts of climate change. In public tenders announced by the end of 2020 with a total financial allocation of CZK 2.2 bil., 69 project proposals were supported. The Technology Agency of the Czech Republic financed, for example, successful projects from ERA-NET Cofund calls from the Environment for Life Programme. Specifically, these are ERA-NET Cofund BiodivClim (focused on biodiversity and climate change) and BiodivRestore (focused on the protection and restoration of damaged ecosystems) calls.

National targeted support also took place through other Technology Agency of the Czech Republic programmes. The research needs of the ministry were mainly covered through the Technology Agency of the Czech Republic "**BETA2**" programme (Public Procurement Programme in Research, Experimental Development and Innovation for the Needs of the State Administration). The main objective is to ensure environmental protection through the sustainable use of resources. Emphasis is placed on adaptation to climate change, on tools and technologies to monitor, prevent and mitigate environmental pressures and risks (including health risks), as well as on the protection of the natural and artificial environments. There is also further support to a lesser extent through other Technology Agency of the Czech Republic programmes and other providers. This includes, for example, the Technology Agency of the Czech Republic programme "EPSILON" which, among other things, also finances projects from the ERA-NET Cofund AquaticPollutants calls focused on pollution of water resources.

In addition to national environmental subsidy programmes, public expenditure on environmental protection has also been strengthened since 2004 thanks to **direct EU support and the possibility to co-finance projects from other foreign sources**. At present, these are mainly the Financial Mechanisms of the European Economic Area and Norway, the LIFE and Interreg programmes, and the Swiss-Czech Cooperation Programme. Of the European funds, the Operational Programme Environment is the strongest in terms of subsidies, and is the main source of financing in environmental protection from EU sources, and the Rural Development Programme, the aims of which include the restoration, preservation and improvement of natural ecosystems dependent on agriculture.

The total allocation of the **Operational Programme Environment 2014–2020** is EUR 3.3 bil. (CZK 85.6 bil.) of total eligible expenditure. From the beginning of the programming period to 31 December 2020, the Managing Authority of the Operational Programme Environment (Ministry of the Environment of the Czech Republic) announced 155 calls, of which 19 new calls were announced in 2020 with an allocation of EUR 279.4 mil. (CZK 7.3 bil.) of total eligible expenditure. A total of 14,082 project applications were registered in already closed calls from the beginning of the programming period to the end of 2020. Based on the subsequent recommendation of the selection committee, subsidies were approved for 9,326 applications totalling EUR 3.7 bil. (CZK 96.6 bil.) of total eligible expenditure and 9,122 legal acts totalling EUR 3.5 bil. (CZK 90.4 bil.) of total eligible expenditure. Of this, approximately EUR 1.9 bil. (CZK 50.6 bil.) of total eligible expenditure has been financed by the subsidy beneficiaries since the beginning of the programming period.

The Operational Programme Environment also finances the **so-called boiler subsidies**, while in 2019 the 3rd call for regions was announced with an allocation of approximately EUR 119.2 mil. (CZK 3.1 bil.) of total eligible expenditure. At the end of 2020, it was decided to increase the allocation of the call by another EUR 22.9 mil. (CZK 600.0 mil.). In all three calls, 101,000 solid fuel boiler replacements with a total volume of EUR 428.5 mil. (CZK 11.2 bil.) had been approved by the end of 2020.

The **Rural Development Programme 2014–2020** also implemented support contributing to improving the environment, including in particular agro-environmental-climate measures, organic farming measures, forestry-environmental and climate services and forest protection, Natura 2000 payments and payments for less-favoured areas. In these measures, CZK 9.8 bil. was disbursed from the Rural Development Programme 2014–2020 in 2020.

Financing in an international context

Key messages

Investments in environmental protection in the Czech Republic have long been above the EU27 average. The reason for the increased investments in the Czech Republic, supported by drawing from European funds, is primarily the need to meet the conditions and requirements set by the relevant European legislation and also the need to remedy the significant environmental burdens associated with the intensive industrial production and mining in the last century.

In 2019[4], total revenues from environmental taxes in the EU27 amounted to EUR 330.6 bil. (CZK 13.0 tril.), or 2.4 % of GDP of the whole EU27. In terms of the subject of taxation in the EU27, taxes on energy products, particularly significant in the Czech Republic, Luxembourg, Romania and Estonia, where they accounted for more than 90% of total revenues from environmental taxes, clearly prevailed, accounting for more than 2/3.

According to the OECD, total support for fossil fuels increased by 5% in 2019[5] year-on-year to USD 178 bil. (CZK 7.9 tril.), yet in the Czech Republic it fell, from CZK 5.4 bil. to CZK 3.6 bil. (i.e. 0.06% of GDP).

Investments in environmental protection in an international context

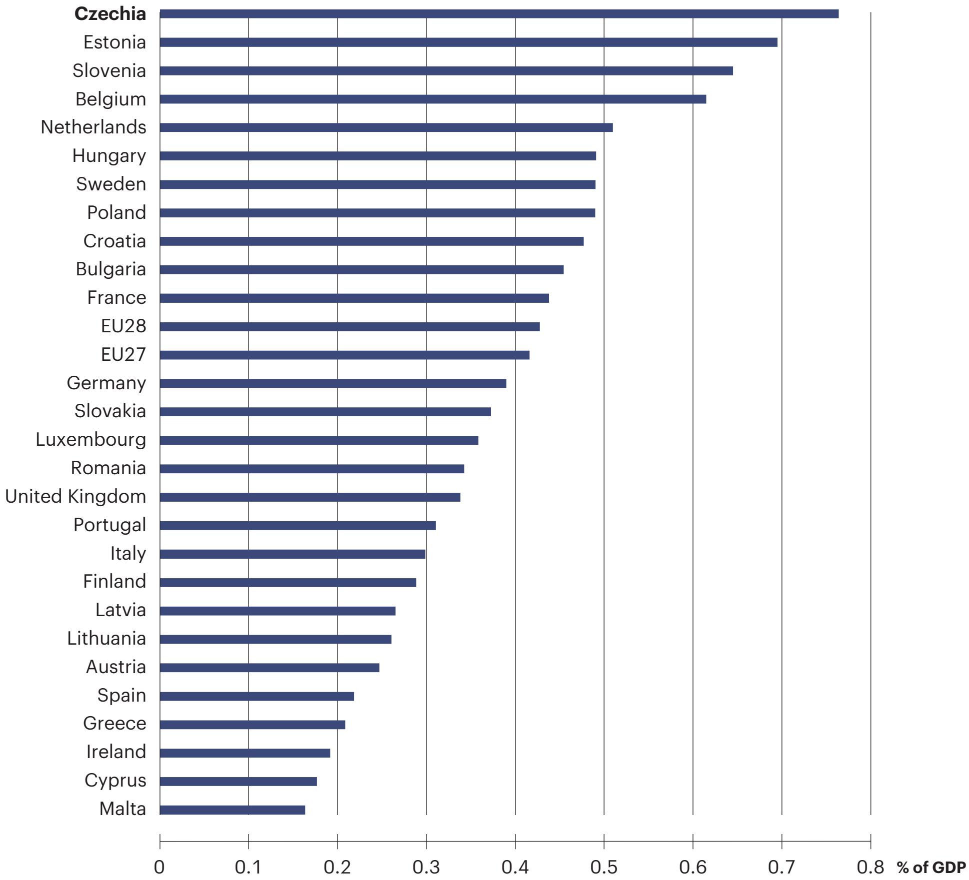
In an international comparison of **investments (investment expenditures)** in environmental protection in relation to GDP, we can state that Czech Republic investments by the public and corporate (industrial) sectors in environmental protection, compared to the EU27 average, are significantly above average, and actually the highest, of all EU27 countries (Chart 4).

This is mainly due to the fact that the Czech Republic, similarly to other Member States that joined the EU after 2003, is more intensively investing in environmental protection to meet the stricter requirements set by the relevant EU legislation. The increased investment is related to the need to address the significant environmental burdens caused by the intensive industrial production and mining at the end of the 20th century. The level of investment, especially in recent years, has been supported by the possibility of drawing from EU funds and other foreign subsidy sources.

[4, 5] *Data for the year 2020 are not available at the time of publication.*

Chart 154

Total investment in environmental protection (public and industrial sectors) in EU countries [% of GDP, current prices], 2018



Data for the years 2019 and 2020 are not available at the time of publication.

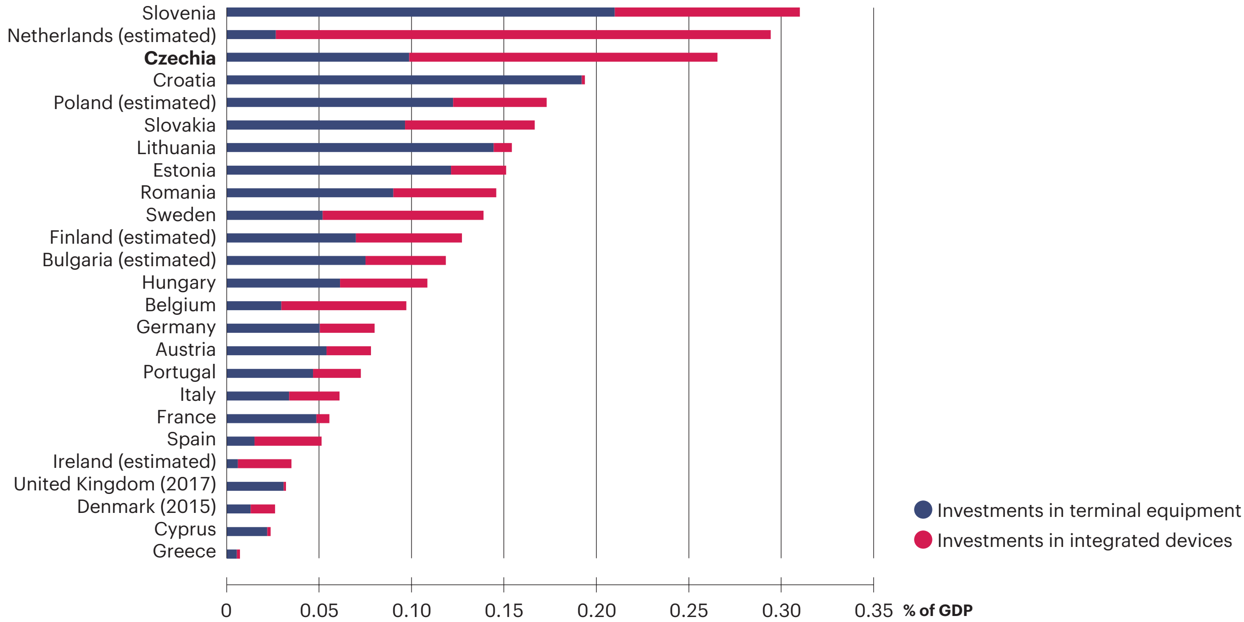
Data source: Eurostat

Investments in the industrial sector are crucial (Chart 5). These are usually above average in the case of new Member States, e.g. in Slovenia and the Czech Republic (over 0.25 % of GDP in current prices in 2018[6]), on the other hand many original EU15 Member States did not reach even 0.03% of GDP in current prices (Cyprus, Greece and the United Kingdom). Unlike in the Czech Republic, where in 2019 investments in **integrated devices**, i.e. to prevent pollution prevailed, in the majority of EU27 Member States investments were more focused on **terminal equipment**, meaning on pollution removal.

[6] *Data for the years 2019 and 2020 are not available at the time of publication.*

Chart 155

Investment in environmental protection in the industrial sector in EU countries [% of GDP, current prices], 2018



Data for the years 2019 and 2020 are not available at the time of publication.

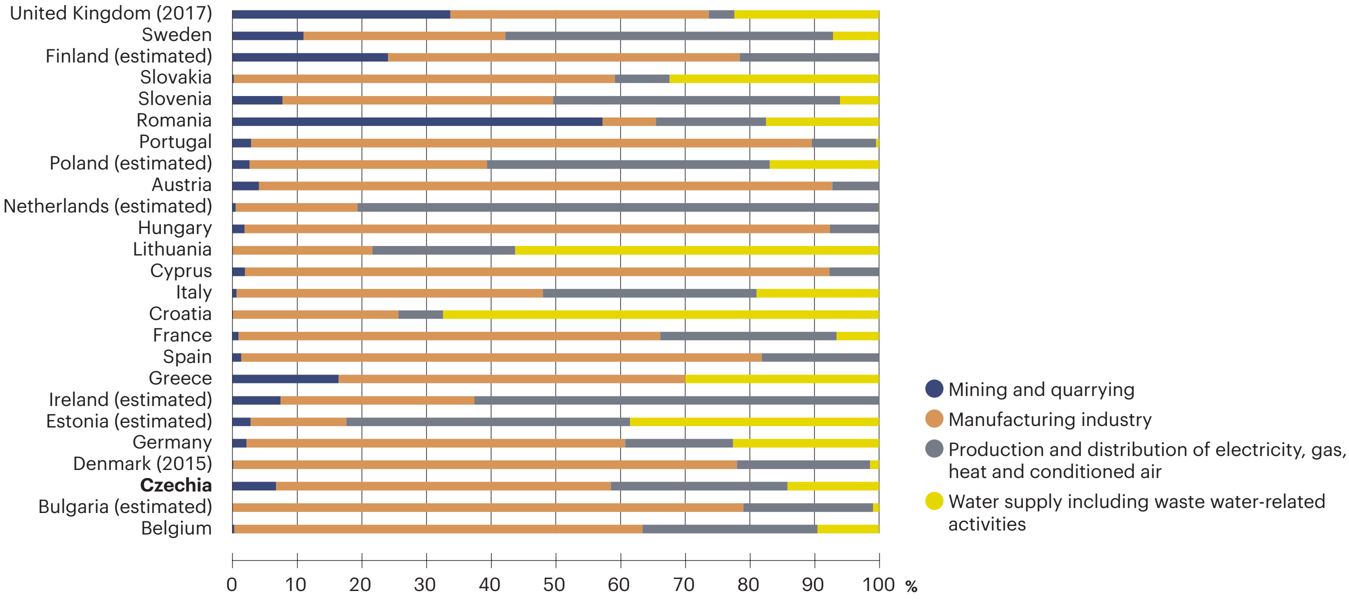
Data source: Eurostat

In terms of the representation of the main sectors of the industrial sector in the total Investments in environmental protection, in most EU27 Member States, including the Czech Republic, the **manufacturing industry** contributed the most, followed by the production and distribution of electricity, gas, heat and air-conditioned air, i.e. the public energy sector (Chart 156). From the perspective of the programme focus, in 2018[7] in the majority of EU27 Member States, including the Czech Republic, the largest investments were in **air and climate protection**, otherwise in waste water management (Chart 157).

[7] *Data for the years 2019 and 2020 are not available at the time of publication.*

Chart 156

Investments in environmental protection in the industrial sector by major industry in EU countries [%], 2018

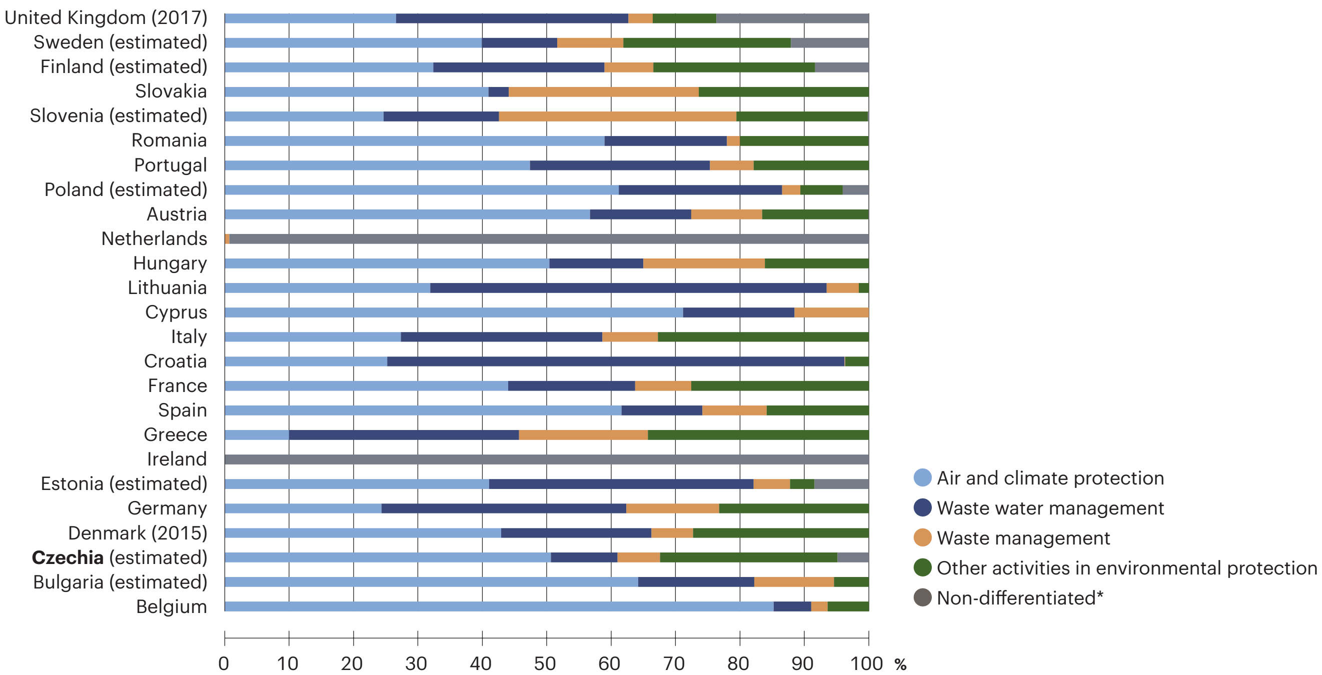


Data for the years 2019 and 2020 are not available at the time of publication.

Data source: Eurostat

Chart 157

Investments in environmental protection in the industrial sector by programme focus in EU countries [%], 2018



** Category listed due to the lack of detailed (or classified as individual (confidential)) data, when it was not possible to perform a breakdown into individual programme focus categories.*
Data for the years 2019 and 2020 are not available at the time of publication.

Data source: Eurostat

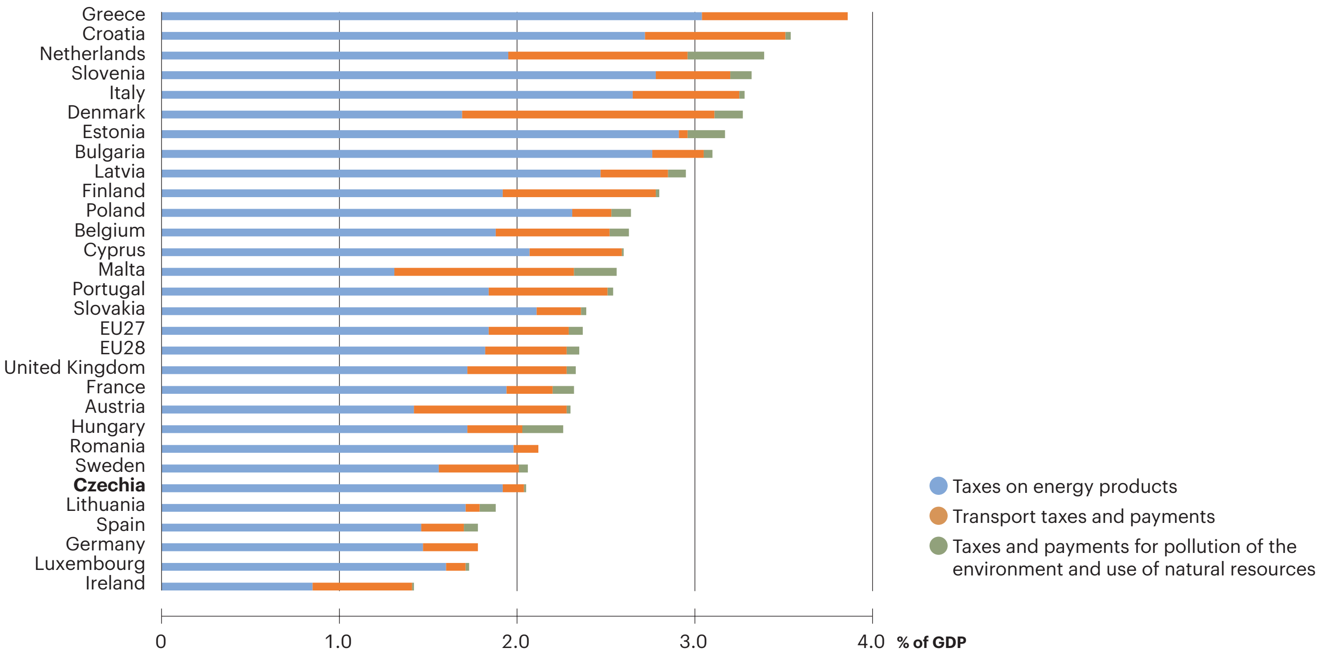
Revenues from environmental taxes and levies in an international context

Total revenues from **environmental taxes** in the EU27 in 2019[8] amounted to EUR 330.6 bil. (CZK 13.0 tril.), i.e. 2.4% of GDP, respectively 5.9% of government revenues from taxes and social contributions for the EU27 as a whole. In 2019, revenues from environmental taxes were about EUR 113.0 bil. higher than in 2002, but in terms of GDP the revenue share fell slightly from 2.6% to 2.4% of GDP.

In an EU27 international comparison, the Czech Republic has below-average revenues from environmental taxes (2.1% of GDP, Chart 158).

Chart 158

Environmental taxes by main group in EU countries [% of GDP, current prices], 2019



Data for the year 2020 are not available at the time of publication.

Data source: Eurostat

The level of environmental taxation in European countries must be assessed in the context of the configuration of the taxation system. For example, low revenues from environmental taxes may signal either relatively low environmental tax rates with resulting lower collection (as is the case, for example, in the Czech Republic), or high tax rates that may lead to lower consumption of related products or activities. On the other hand, higher environmental tax revenue may be due to a low tax rate that encourages non-residents to purchase taxed products cross-border (as is the case, for example, with petrol or diesel).

In terms of the subject of taxation, **taxes on energy products**[9] clearly prevailed, which, in addition to taxes on electricity, gas and solid fuels, include taxes on fuels. These accounted for 77.9% of total EU27 environmental tax revenues in 2019. Energy taxes were particularly significant in the Czech Republic, Luxembourg, Romania and Estonia, where they accounted for more than 90% of total revenues from environmental taxes. **Transport taxes and payments** (e.g. for vehicle registration, access to city centres, etc.) were the second most important contribution to total environmental tax revenues in 2019 (18.9% in the EU27). **Taxes and payments for environmental pollution and the use of natural resources** accounted for a relatively small share (3.2%) of total environmental tax revenues in the EU27 in 2019. This category of environmental taxes groups together various taxes or payments levied, for example, on pollution and water abstraction or on landfilling of waste. In many European countries, these taxes were introduced after 2010, which is reflected in their low collection levels so far.

[8] *Data for the year 2020 are not available at the time of publication.*

[9] *For Eurostat's methodology on environmental taxes, see here: https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax_esms.htm.*

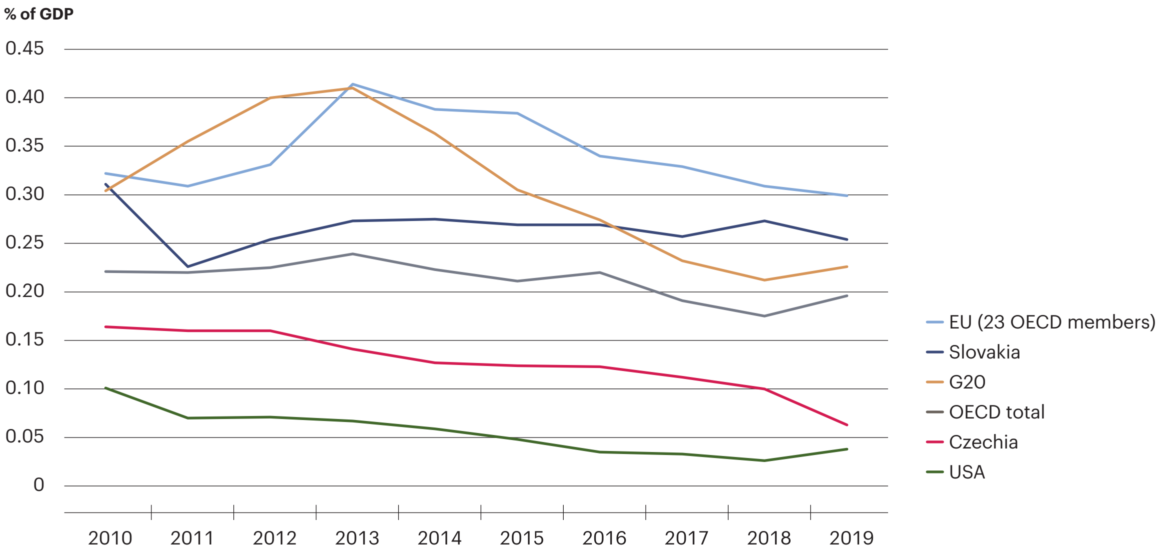
Total support for fossil fuels in an international context

An OECD analysis of budget transfers, tax breaks and spending programmes focused on the production and use of fossil fuels, i.e. coal, oil, gas and other petroleum products, in 50 national economies, shows that **total support for fossil fuels** increased by 5% year-on-year in 2019[10] to USD 178 bil. (CZK 7.9 tril.)[11], ending the previous five-year downward trend[12]. The analysis is based on an overview of fossil fuel support measures, which documents more than 1,300 government measures providing support for the production and consumption of fossil fuels. Within the EU27, an average of more than EUR 55 bil. (around CZK 1.4 tril.) per year was provided to support fossil fuels by national governments between 2014 and 2019.

Compared to OECD, respectively G20, averages, support for fossil fuels in the Czech Republic decreased in 2019 from CZK 5.4 bil. to CZK 3.6 bil. (i.e. to 0.06% of GDP, Chart 159), and overall this support amounted to CZK 57.4 bil. in the 2010–2019 period.

Chart 159

Total support for fossil fuels in selected OECD countries [% of GDP, current prices], 2010–2019



Data for the year 2020 are not available at the time of publication.

Data source: OECD

The largest share of support, almost 48%, was directed to natural gas in the Czech Republic, unlike most other countries, respectively international averages, where the consumption and production of petroleum products was most supported (Chart 160). In the Czech Republic, the support was mostly provided in the form of an exemption from energy tax for certain fuels (e.g. natural gas, solid fuels and petroleum products) and a specific purpose (i.e. heating, agriculture, selected industrial processes) and also through refunds of excise duties on diesel fuel used for agricultural purposes. Further support is provided to mining companies to finance programmes for the remediation of contaminated sites after the extraction of raw materials.

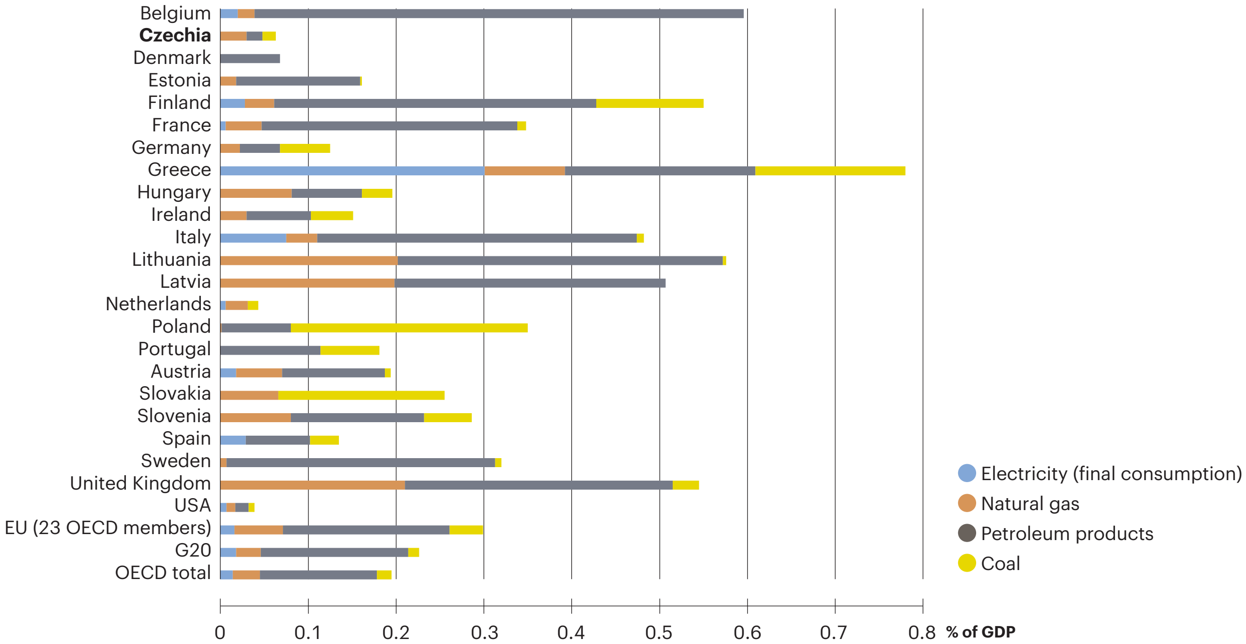
[10] *Data for the year 2020 are not available at the time of publication.*

[11] *See more here: https://www.oecd.org/fossil-fuels/.*

[12] *However, according to the International Energy Agency (IEA), there was a year-on-year global (i.e. for 81 economies) decline of 18% to USD 475 bil. in 2019, mainly due to the fall in average fuel prices and thus the related subsidies. This means the decline does not reflect a real effort to phase out fossil fuel subsidies.*

Chart 160

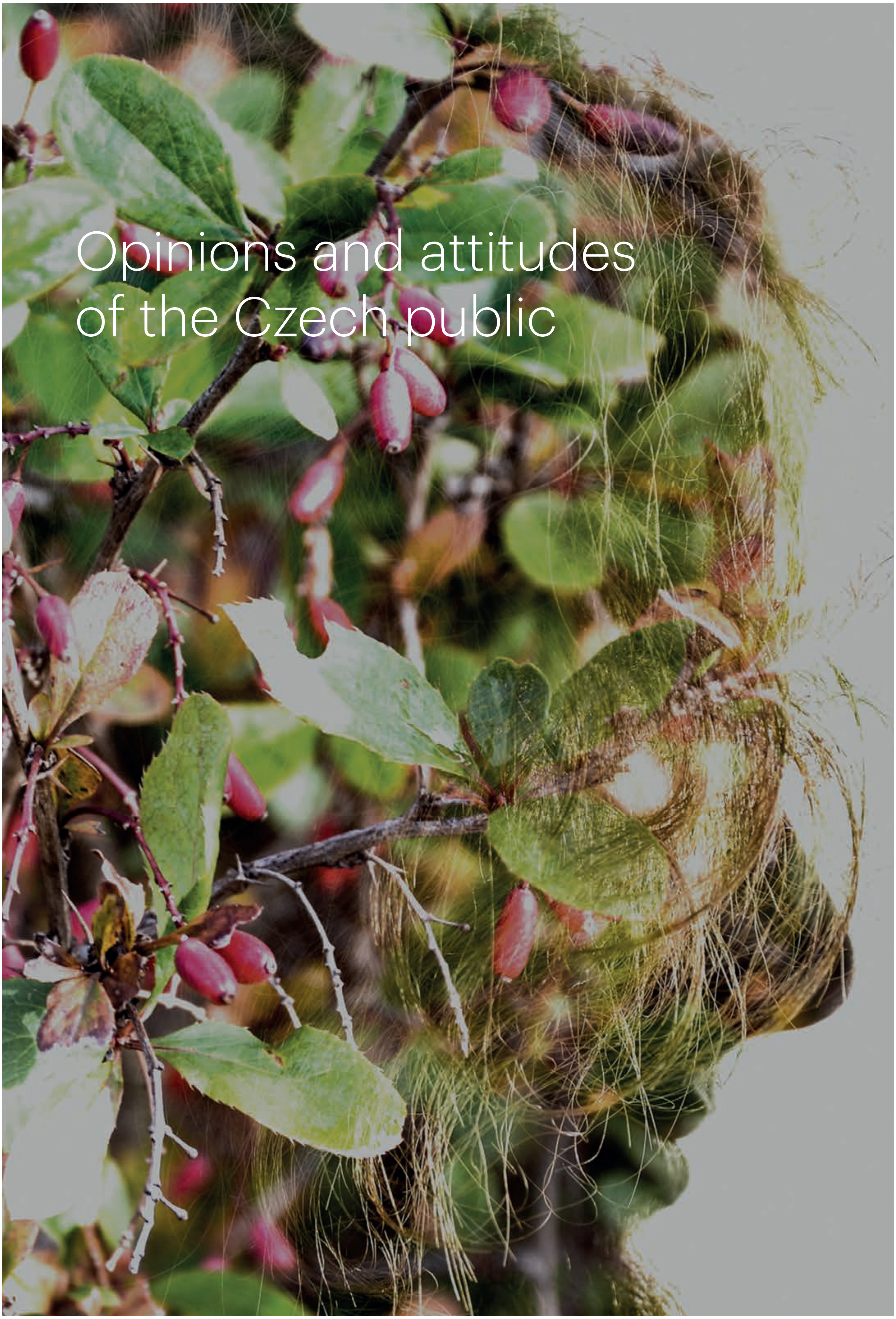
Support for fossil fuels by type of fuel supported in OECD and G20 countries [% of GDP, current prices], 2019



Data for the year 2020 are not available at the time of publication.

Data source: OECD

The European Commission has called on EU Member States to phase out financial support for fossil fuels and to present concrete plans for this phaseout in individual national climate and energy plans. The European Investment Bank, one of the EU's main financial institutions, then decided to stop providing loans for fossil fuel-fired power plants, effective from 2022.


Opinions and attitudes
of the Czech public

Opinions and attitudes of the Czech public

The findings of representative surveys of public opinion fundamentally complement the assessment of the state and development of the environment.

Regular representative survey of public opinion on Czech society's relationship with the environment

Interest in information about the environment in Czechia

Current sociological surveys by the Centre for Public Opinion Research from 2020 show that less than two-thirds of the Czech public (65%) are interested in information about the environment, Chart 161. The results did not change significantly statistically compared to the previous survey from 2019. In the long term, the proportion of those interested in environmental information is gradually growing, and is now at the highest value for the entire reporting period since 2002.

Chart 161

Interest in information about the environment in the Czech Republic [%], 2011–2020

Question asked: Are you interested in information about the environment in the Czech Republic?

Data source: Public Opinion Research Centre, Institute of Sociology, Academy of Sciences of the Czech Republic

As regards the **assessment of sufficient or insufficient information on the state of the environment**, the opinion of the Czech public on this issue was not clear-cut in 2020, as statistically comparable shares of respondents were of the opinion that there is enough information (47%) but also a lack of information (48%). The remaining 5% of respondents could not answer clearly. Compared to the previous survey from 2019, the share of those who think there is sufficient information on the state of the environment in Czechia increased statistically significantly (by 9 percentage points), while at the same time the share of those who think there is not enough decreased (by 8 percentage points).

Satisfaction with the environment in Czechia and in the place of residence

In terms of the state of the environment in 2020, respondents rated the state in their place of residence better than the overall situation in Czechia. Satisfaction with the state of the environment **in the place of residence** was expressed by 70% of respondents, but satisfaction with the state of the environment **in the whole of Czechia** by a little more than half (53%), Chart 162. Satisfaction with the state of the environment in the place of residence is stable (since the beginning of monitoring in 2002) for at least 70% of respondents (except for 2004 and 2010), and there was no shift compared to 2019. Satisfaction with the state of the environment throughout Czechia gradually grew with slight deviations from the beginning of the monitoring until 2017, when it reached its maximum, but by 2018 a decrease in the proportion of satisfied citizens was recorded.

Chart 162

Satisfaction with the environment in the Czech Republic and in the place of residence [%], 2020

Question asked: How satisfied are you with the environment in our country in general and in the place where you live?

Data source: Public Opinion Research Centre, Institute of Sociology, Academy of Sciences of the Czech Republic

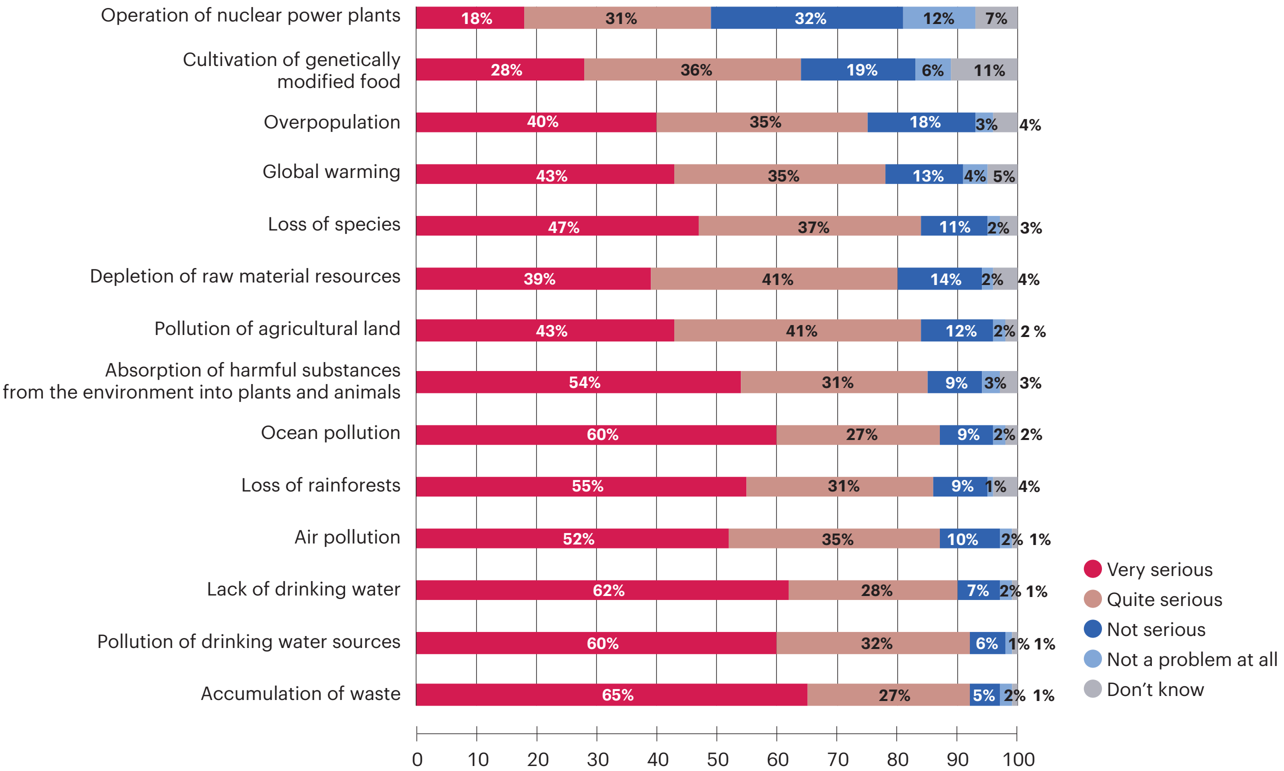
Perception of global problems

As part of the assessment of **global phenomena**, it was found in 2020 that Czech citizens consider the most serious problems to be the accumulation of waste, pollution or lack of drinking water, air pollution, the loss of rainforests, and ocean pollution, and these were identified as a very or rather serious problem by approximately 9 out of 10 respondents. The most pressing problem seems to be the accumulation of waste, for which almost two-thirds (65%) of respondents chose the extreme option, i.e. that it is a very serious problem (Chart 163).

In the long term, since the beginning of the surveys in 2002, it has been clear that there have been no significant changes in the opinion of the Czech public on various types of global problems, and opinions have thus remained relatively stable throughout the monitoring period. In the long term, the accumulation of waste and pollution of drinking water have been identified as the most serious problems, and these have been joined in recent years by a lack of drinking water.

Chart 163

Severity of global problems [%], 2020



Question asked: How would you rate these phenomena? a) loss of tropical rainforests, b) pollution of drinking water – lakes, groundwater, c) accumulation of waste, d) operation of nuclear power plants, e) pollution, degradation of agricultural land, f) loss of plant and animal species, g) global warming, h) lack of drinking water, i) depletion of raw material resources, j) overpopulation, k) cultivation of genetically modified food, l) air pollution, m) ocean pollution, n) absorption of harmful substances from the environment into plants and animals people then eat.

Data source: Public Opinion Research Centre, Institute of Sociology, Academy of Sciences of the Czech Republic

Irregular representative survey of public opinion on Czech society's relationship with the environment

Czech public opinion on climate change

Totally 73% of the Czech public identify with **ideas of nature and environmental protection**, and overall a gradual increase in sympathy for nature and environmental protection can be observed (Czech Climate 2021, Krajhanzl et al., 2021[13]). The most attractive media topic of the thirty offered is nature; this topic is definitely of interest to 33% of the public, 48% of the public is rather interested, only 5% of the public negates it, while the remaining respondents did make any definite comment. The topic of the environment is definitely of interest to 21% of the public, while 48% of the public is relatively interested (10% negates it). The topic of climate change follows some way behind, with 13% definitely interested and 39% relatively interested (18% not interested). By comparison, politics (41% of the public) or the private lives of famous people (22%) or other topics attract much less interest.

More than three quarters of the Czech public (76%) are aware that **climate change is already under way** (Chart 164) despite the fact that the knowledge base of the Czech public on climate issues, both in terms of understanding climate change and in terms of greenhouse gas emissions and energy in Czechia, is very weak (the most important example is that only 7% of respondents know that Czechia produces more greenhouse gas emissions per capita than India, China or the United Kingdom). However, more than 70% strongly or relatively strongly agree that the main cause of climate change is the so-called anthropogenic influences. In addition, the proportion of respondents who have noticed manifestations of climate change has increased significantly, from approximately 40% in 2015 to 64% of the Czech public in 2021. On the contrary, the share of those who have not seen any changes fell sharply from about 33% to 4%. For more than 51%, tackling climate change is extremely or highly urgent, while for 32% it is moderately urgent. For themselves personally, approximately 40% of the population considers it extremely or very important.

Chart 164

Belief in the existence of climate change [%], 2021

Question asked: Which of the following statements about global climate change is closest to your own opinion?

Data source: Czech Climate 2021 (Krajhanzl et al., 2021)

[13] *Krajhanzl, J. et al. (2021): Czech Climate 2021. Map of Czech public opinion on climate change. Department of Environmental Studies at Masaryk University Faculty of Social Studies, in cooperation with Green Dock, z.s.*

However, in the interests of climate protection, the inhabitants of Czechia have a very low **willingness to pay** higher taxes (for 9%, against 71%, the remainder are neither willing nor unwilling), to pay higher prices (for 14%, against 62%), or to lower their standard of living (for 23%, against 47%). On the contrary, 55% of the population has a relatively high willingness to change their way of life.

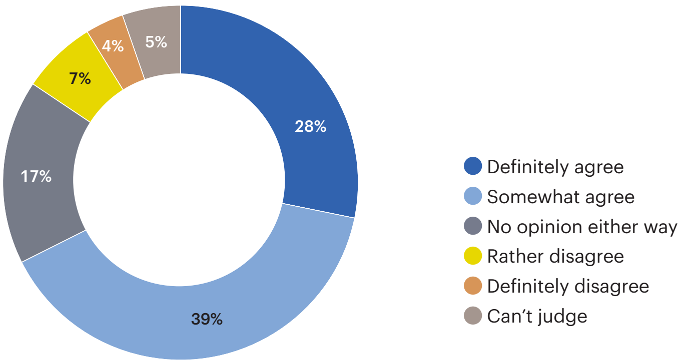
For more than two-thirds of the Czech public (68%) it is important that the Czech Republic takes **measures against climate change** (Chart 165). Two-thirds of the public also state that the Czech Republic should reduce greenhouse gas emissions regardless of emissions reductions in other countries (Chart 166). However, there is uncertainty about energy sources, respectively about the replacement of electricity generation from coal-fired power plants with nuclear energy or renewable energy sources. A total of 39% of the Czech public would replace coal sources with renewable energy sources, 24% of the Czech public would like to invest half and half in renewable energy sources and nuclear sources, 20% are inclined towards nuclear sources and 17% cannot answer. And despite the fact that Czechia has long been one of the largest exporters of electricity, 64% of the Czech public would prefer a balance between exports and imports. At the same time, the majority of the population agrees with the target of achieving carbon neutrality in Czechia, despite the fact that in total more than half do not have an opinion on the target of carbon neutrality or on a date to achieve it. The opinions of the Czech public on the issue of withdrawal from coal are very similar to those on carbon neutrality, meaning almost half agree with the end of coal, almost a fifth disagree, about a quarter hesitate, and more than a tenth do not know.

On the question of whether to invest in **mitigation or adaptation measures**, the Czech public does not have an unequivocal opinion. About half would like to invest half and half in adaptation and mitigation. The rest of the public is more inclined to invest in mitigation (22%) than adaptation (9%). The vast majority consider it most important to restrict polluters and develop new technologies.

From the point of view of acceptance of climate protection policies, the majority of the Czech public considers most acceptable those measures that support a healthy landscape, and economic support for renewable energy sources and energy-efficient buildings, while educational and awareness-raising activities for climate protection are also supported by over half. On the other hand, people reject measures that would represent increased costs for households and an anticipated reduction in living standards.

Chart 165

Importance of taking action against climate change [%], 2021

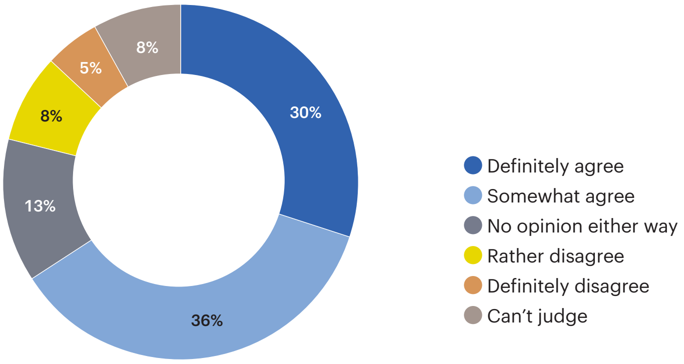


Question asked: Do you agree or disagree with the following statements? Is it important for the Czech Republic to take measures against climate change?

Data source: Czech Climate 2021 (Krajhanzl et al., 2021)

Chart 166

Reducing greenhouse gas emissions in the Czech Republic regardless of other countries



Question asked: Do you agree or disagree that the Czech Republic should reduce greenhouse gas emissions regardless of whether other countries do so?

Data source: Czech Climate 2021 (Krajhanzl et al., 2021)

Assessment methodology for trends and state

Each chapter includes an assessment of the state and trend at the level of the strategic objectives of the State Environmental Policy 2030 according to the relevant indicators of the Report on the Environment of the Czech Republic (clear graphics supplemented with graphs, possibly maps and a brief text assessment).

The assessment methodology is based on the statistical analysis of trends (linear regression parameters – trend direction and the statistical significance value) and is used in cases where a homogeneous time series is clearly defined (data for each year without any major change in the data reporting methodology). In the case of structural indicators, the expert estimation method is used (see 2B).

Time horizon of the trend:

Trend	Period
Short-term	last 5 years
Medium-term	last 10 years
Long-term	last 15 years and over[14]

The assessment is carried out on three levels:

1) Trend at the level of individual quantities

The assessment of individual quantities of a given indicator (e.g. NO_X emission quantity) is made on the basis of linear regression parameters (linear regression equation Y = ax + c, R^2 = {0,1}).

The time series is converted into an index (percentage) series where the assessed trend start is 100 (e.g. the long-term trend of NO_X emissions in 1990 = 100). The values of *a* and R^2 are calculated for each variable.

The *value a* is a linear trend direction that expresses how a quantity has been decreasing or rising since the beginning of the measurement. It is a dimensionless number comparable across all other quantities since it is not dependent on absolute values (the index series removes the influence of units and the actual sizes of numbers), and describes the trend curve from the linear regression parameters. The *value a* indicates the change in % per year.

R^2 is the significance value (determination, R^2 = {0,1}). R^2 expresses whether the trend is really linear. To assess the significant trend, R^2 needs to be greater than 0.8.

The resulting values are converted into the verbal assessment table and used in the text of the assessment of individual quantities, i.e. the result of the calculation is a numerical value used as a basis for verbal assessment in the text.

Value of the *index a* (linear trend direction)	Verbal assessment in the text
0 to +/- 0.5% per year	stagnation
+/- 0.5 to +/- 1% per year	slightly upward/downward trend, gradual trend
+/- 1 to +/- 3% per year	upward/downward trend
+/- 3 to +/- 10% per year	significantly upward/downward trend
over +/-10% per year	very significantly upward/downward trend

[14] *For a time series in a long-term trend, a minimum of 15 years (but no earlier than 1990) is required.*

2) Trend and indicator state

2A) The trend of individual indicators is assessed on the basis of determining the trend of individual datasets, but the exact (mathematical) method is not deployed for aggregating the individual trends due to the differences between these datasets. The aggregate trend or state is assessed using the expert estimation method based on the aggregation of the assessment of indicators composed of several time series of individual quantities, which are displayed in the graphical elements of the assessed indicators.

Graphical representation of the aggregate trend		
↗ Positive upward trend	→ Stagnation	↗ Negative upward trend
↘ Positive downward trend	∿ Fluctuating trend	↘ Negative downward trend
N/A The trend cannot be determined		

2B) Assessment of structural indicators is without determination of the trend (e.g. structure of municipal waste management, land use, etc.). The aggregate development or state is assessed using the expert estimation method based on the aggregation of the assessment of indicators composed of several time series of individual quantities, displayed in the graphical elements of the assessed indicators.

Graphical representation of the trend in the structure indicator		
Positive trend	Neutral trend	Negative trend

2C) Assessment of the state – expert estimation method using the achievement of the set target.
The state is assessed using the expert estimation method based on the distance from the set target in the given year. If a target is not set, the general trend is assessed to see whether the development is heading in the right direction and whether the advancement is adequate.

Graphical representation of the state assessment		
✓ Good state	∼ Neutral state	✕ Bad state

Achieving targets set out in strategic documents

Distance to target is determined for the indicators where a quantifiable target value is available and the current development shows a linear trend. The achievement of a numerical target is expressed in the form of years to target, i.e. how long it will take to reach (in which year we will reach) the target if the trend continues, or when the target would probably be achieved with the current development without additional measures. These are not scenarios but only an extension of the current trend – see the previous chapter Assessment methodology for trends and state. The linear regression method is used to determine the number of years required for achieving the target value. Target achievement is constructed from the long-term trend (the last 20 years) if data are available.

- If the calculated target achievement is the same or a lower year than the set target year, the trend is assessed positively (the trend is heading towards target achievement).
- Neutral assessment (uncertain target achievement) is defined as target achievement with a shifted target cut-off value within the normal time series variance (i.e. target value +/- standard deviation). The greater the time from the set target, the greater the possibility of accepting uncertainty (variance).
- If the trend is not heading to the target, or the calculated year of achieving the target is much later than the set target year, the trend is assessed negatively (far from the target).
- If the calculation of the target achievement year cannot be determined because of an opposite trend or low R^2 time series confidence value or because of a fundamental change in the data methodology, the trend is assessed N/A.

Graphical representation of the target achievement assessment		
Heading towards target achievement	Uncertain target achievement	Far from the target
N/A The target achievement year cannot be determined		

1.1 Water availability and quality

Overview of related targets 1.1.3 Supply of drinking water to the population

Set target	Set for year	Achieved in year	Fulfilment of target
96.7% of the population connected to the public water supply	2030	2023	✓
89% of the population living in houses connected to the sewerage system	2030	2024	✓

1.2 Air quality

Overview of related targets 1.2.1 Pollutant emissions

Set target	Set for year	Achieved in year	Fulfilment of target
49% reduction in NO_x emissions compared to 2005	2025	2023	✓
64% reduction in NO_x emissions compared to 2005	2030	2029	✓
34% reduction in VOC emissions compared to 2005	2025	2026	~
50% reduction in VOC emissions compared to 2005	2030	2035	✗
55% reduction in SO_2 emissions compared to 2005	2025	2020	✓
66% reduction in SO_2 emissions compared to 2005	2030	2022	✓
14% reduction in NH_3 emissions compared to 2005	2025	2021	✓
22% reduction in NH_3 emissions compared to 2005	2030	2028	✓
38% reduction in $PM_{2.5}$ emissions compared to 2005	2025	2042	✗
60% reduction in $PM_{2.5}$ emissions compared to 2005	2030	2060	✗

However, the scenario forecasts from the Czech Hydrometeorological Institute are different, where, according to the 2021 Emission Balance under the WM scenario, the emission ceilings will not be exceeded in 2025, with the exception of NH_3, but the ceilings are expected to be exceeded in 2030. Therefore, efforts are being made to implement additional policies and measures (WaM scenario) for compliance with the ceilings in 2030.

1.6 Adapted settlements

Overview of related targets 1.6.2 Conceptual development of settlements and use of brownfields

Set target	Set for year	Achieved in year	Fulfilment of target
Increase in the total number to 500 registered entities in Local Agenda 21	2030	2068	✗

2.1 Transition to climate neutrality

Overview of related targets 2.1.1 Greenhouse gas emissions

Set target	Set for year	Achieved in year	Fulfilment of target
Decrease in greenhouse gas emissions by 44 Mt CO_2 eq. compared to 2005 (Climate Protection Policy target)	2030	2033	~
Reduction in greenhouse gas emissions by at least 55% compared to 1990 (EU NDC target)	2030	2057	✗
Electricity generation from nuclear fuel in the range of 46–58%	2040	N/A	✗
Electricity generation from lignite and black coal in the range of 11–21%	2040	2036	✓
Electricity generation from natural gas in the range of 5–15%	2040	2010	✓
Electricity generation from renewable and secondary resources in the range of 18–25%	2040	2028	✓
Gradual loss of electricity exports and maintenance of the balance in the range of +/-10% of domestic consumption	2040	N/A	✗

Overview of related targets 2.1.2 Energy efficiency

Set target	Set for year	Achieved in year	Fulfilment of target
Share of nuclear fuel in the primary energy sources' structure 25–33%	2040	N/A *	✗
Share of solid fuels in the primary energy sources' structure 11–17%	2040	2043	~
Share of gaseous fuels in the primary energy sources' structure 18–25%	2040	N/A **	✗
Share of liquid fuels in the primary energy sources' structure 14–17%	2040	N/A **	✗
Share of renewable and secondary resources in the primary energy sources' structure 17–22%	2040	2032	✓
Energy import dependency will not exceed 65%	2030	2035	✓
Energy import dependency will not exceed 70%	2040	2038	~
Primary energy sources consumption will not exceed 1,735 PJ	2030	2023	✓
Final energy consumption will not exceed 990 PJ	2030	N/A **	~

** However, the current energy strategy of the Czech Republic envisages the construction of new nuclear power plants, the commissioning of which will significantly increase the share of nuclear energy in the primary energy sources structure.*
*** The current trend is in the opposite direction, it is not possible to assess the year of achievement.*

Overview of related targets 2.1.3 Use of renewable energy sources

Set target	Set for year	Achieved in year	Fulfilment of target
Share of renewable energy sources in gross final energy consumption 22%	2030	2029	✓
Share of renewable energy sources in electricity generation in the range of 18–25%	2040	2028	✓
Share of renewable energy sources in final energy consumption in transport 14%	2030	2031	~

2.2 Transition to a circular economy

Overview of related targets 2.2.2 Waste prevention

Set target	Set for year	Achieved in year	Fulfilment of target
Total number of 100 valid Environmentally Friendly Product or Environmentally Friendly Service eco–label licenses	2030	N/A*	✗
Total number of 25 valid EU Ecolabel licences	2030	2027	✓

** With the current steadily decreasing trend, it is not possible to set a deadline for achieving the target, respectively the target is unachievable.*

Overview of related targets 2.2.3 Compliance with the waste treatment hierarchy

Set target	Set for year	Achieved in year	Fulfilment of target
Increase in the municipal waste recycling rate to 55%	2025	N/A*	✗
Increase in the municipal waste recycling rate to 60%	2030	N/A*	✗
Increase in the municipal waste recycling rate to 65%	2035	N/A*	✓
Reduction in the municipal waste landfilling rate to 10%	2035	N/A*	✗

** Due to significant changes arising from the readjustment of the waste management system in connection with the new waste legislation valid from 2021, the linear trend is not anticipated to continue.*

3.1 Ecological stability of the landscape and sustainable landscape management

Overview of related targets 3.1.3 Non-production functions and ecosystem services of the landscape

Set target	Set for year	Achieved in year	Fulfilment of target
Slowing down the loss of the agricultural land fund to 0.25% of the agricultural land fund for the 2020–2030 period	2030	N/A*	✗
Achieving the recommended share of deciduous trees in forests 35.6%	–	2048	

** At the current rate of land occupation, growth of built-up areas and decline of agricultural land, it is not possible to set a deadline for achieving the target, respectively the target is unachievable.*

Terminological dictionary

Acidification. Is a process by 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 fund. The agricultural land fund consists of farmland, i.e. arable land, hop fields, vineyards, gardens, orchards, meadows, pastures (hereinafter "agricultural land") and land which has been and is to continue to be farmed but is temporarily not cultivated (hereinafter "land temporarily not cultivated"). The agricultural land fund also includes ponds for fish farming and water poultry farming and non-agricultural land needed to ensure agricultural production, such as dirt roads, land with equipment important for field irrigation, irrigation water reservoirs, drainage ditches, dams used to protect against waterlogging or flooding, protective terraces against erosion, etc.
Air pollution. Pollutants in the environment.
Alkaline nutrients. Cations of calcium, magnesium, sodium and potassium in the sorption complex in the soil.
AOT40. The emissions limit for ground-level ozone from the point of view of the protection of ecosystems and vegetation. This is the accumulated exposure above the threshold ozone concentration of 40 ppb. AOT40 cumulative ozone exposure is calculated as the sum of the differences between the hourly ozone concentration and the threshold level of 40 ppb (= 80 μg per m^3) for each hour that this threshold is exceeded. The AOT40 is calculated from ozone concentrations measured every day between 08.00 and 20.00 CET for a period of three months from May to July.
AOX. Adsorbable organically bound halogens. AOX is a summary indicator and is expressed through chlorides as the equivalent mass of chlorine, bromine and iodine contained in organic compounds (e.g. trichloromethane, chlorobenzenes, chlorophenols, etc.) which adsorb onto activated carbon under certain conditions. The main source of these substances is the chemical industry. These substances are poorly degradable, not very soluble in water, and soluble in fats and oils, so they accumulate well in adipose tissues.
Assimilation organs. Parts of plants primarily providing photosynthesis (most often leaves, needles).
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 to fossil fuels.
Biotope. The set of all biotic and abiotic agents which together form the environment of a certain organism or group of organisms. There are 157 natural biotope types in the Czech Republic, and these are defined in the Catalogue of Biotopes of the Czech Republic. The basic biotope groups consist of watercourses and reservoirs, wetlands and river-bank vegetation, springs and peat bogs, rocks, rubble and caves, forest-free alpine areas, secondary turfs and heathlands, shrubs and forests.
BMW. Biodegradable municipal waste is the biodegradable component of municipal waste subject to anaerobic or aerobic decomposition, such as food and garden waste, as well as paper and cardboard.
BOD_5. Five-day biochemical oxygen demand. BOD_5 is the amount of oxygen consumed by micro-organisms for the biochemical oxidation of organic matter over five days under aerobic conditions at 20°C. It is therefore an indirect indicator of the amount of biodegradable organic pollution in water.
BPEJ (farmland classification). Farmland classification is a five-digit numerical code related to agricultural land. It expresses the main soil and climatic conditions that affect the productive capacity of agricultural land and its economic valuation.
Brownfields. Real estate (land, buildings, premises) that is not used, is neglected and possibly contaminated, that cannot be used effectively without overall regeneration, and originates as a remnant of industrial, agricultural, residential, military or other activities. Brownfields are often located in the centres of cities and municipalities and represent a major problem for their sustainable development. The cost of the revitalization of these areas is in most cases so high that it exceeds the real financial possibilities of the owners and so they continue to decay and represent a burden on their surroundings.

Calcium fertilizers. The source of calcium for the production of calcium fertilizers is calcareous and magnesium-calcium rocks, which in nature were formed mostly secondarily from calcium released from minerals. Waste materials from industry – saturation sludge, cement dusts, phenolic lime, etc., and natural calcium fertilizers of local importance – are other sources of calcium fertilizers. Calcium masses are used for fertilization either directly (or after mechanical treatment) or in the form of fertilizers produced by a chemical process (burning limestone, quicklime extinguishing, etc.).

Circular economy. A sustainable development strategy that creates functional and healthy relationships between nature and human society. By perfectly closing material flows in long-lasting cycles, it counters the existing linear system where raw materials are converted into products, sold and then incinerated or landfilled at the end of their lives. It represents a comprehensive system optimizing production processes and technologies, and the consumption and treatment of natural resources and waste. Instead of extracting minerals and adding landfills, it promotes waste prevention, product reuse, recycling and conversion into energy.

Climatic conditions (climate). This is the long-term characteristic weather regime conditioned by the energy balance, atmospheric circulation, the character of the active surface, and human intervention. Climate is an important component of the natural conditions of a particular place, influencing the character of the landscape and its usability for anthropogenic activities. It is geographically conditioned, and is influenced by latitude, altitude and the degree of influence of the ocean.

Climatological normal. A special kind of average used in climatology to assess the state and development of climatological elements (e.g. air temperature, precipitation, air pressure and others). The length of the normal period is 30 years according to WMO recommendations, and the currently used normal period is 1981–2010.

CO_2 eq. Carbon dioxide emission equivalent, a quantity used to aggregate greenhouse gas emissions. This expresses the unit of any greenhouse gas converted to the radiative forcing efficiency of CO_2, which is calculated as 1, a coefficient of 25 is used for CH_4, and 298 for N_2O. F–gases have a radiative forcing efficiency an order of magnitude higher than CO_2.

COD_{Cr}. Chemical oxygen demand determined using the dichromate method. COD_{Cr} is the amount of oxygen consumed for the oxidation of organic substances (including biochemically non-degradable substances) in water by an oxidizing agent – potassium dichromate – under standard conditions (two-hour boiling in an environment of 50% acid in the presence of a catalyst). It is therefore an indirect indicator of the amount of all organic pollution in the water.

Combined cycle power plants. Gas is first incinerated in a gas combustion turbine, where the first part of the electricity is produced. The resulting hot combustion products also produce steam in the boiler, and this is directed to the steam turbine, which produces the second part of the electricity. This double production significantly increases the energy efficiency of the facility.

Contaminated site. Serious contamination of the rock environment, groundwater or surface water, soil or building structures and soil air, which has occurred due to the improper handling of hazardous substances in the past and which endangers human health and the environment. The identified contamination can only be considered an old environmental burden if the source of the contamination no longer exists or is unknown, and this rule must also be respected in the case of the legal successor of the originator of the contamination. Contaminated sites can be of various natures – they can be landfill sites, industrial and agricultural sites, small businesses, unsecured warehouses of hazardous substances, former military bases, areas affected by the extraction of mineral resources, or abandoned and closed repositories of mining waste that present serious risks.

Decade. In climatology, this term refers to a set of ten consecutive days in a month. The first decade always begins on the first day of the month, and so each month is divided into three decades. In general usage, a decade is a set of ten consecutive years.

Decoupling. Separation of the curve of economic development and the development of environmental burdens. With decoupling, the specific load per unit of economic output is reduced. This may be absolute (the output of the economy is growing, the burden is decreasing) or relative (the output of the economy is growing, but the burden is growing at a smaller rate).

Defoliation. The relative loss of the assimilation apparatus in the crown of the tree compared to a healthy tree growing in the same vegetation and habitat conditions.

Degree day. A unit characterizing the heating season. This is the product of the number of heating days and the difference in the average indoor and outdoor temperatures. It thus shows how cold or warm it has been for a certain period of time and how much energy has been needed to heat buildings.

Domestic material consumption (DMC). This is calculated as the annual quantity of raw materials extracted from the domestic territory 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 the ecosystem to compensate for changes caused by external factors and to maintain its natural properties and functions.
Ecological valence. The ability of an organism to exist in a certain range of conditions, i.e. conditions to which the organism is able to adapt.
Ecosystem services. The benefits that people derive from ecosystems. These are divided into productive services (food, wood mass, pharmaceuticals, energy), regulatory services (regulation of flooding, droughts and diseases, soil degradation), support services (soil formation and nutrient cycle), and cultural services (recreational, spiritual and other non-material values).
Ecotype. A genetically distinguishable part (population) of a species showing adaptability to a given environment.
Erosion. A complex process involving soil surface erosion, transport, and re-settling of released soil particles. Under normal conditions, this process is natural, gradual, and fully in accordance with the soil-forming process. However, human activity creates trigger conditions for the so-called anthropogenically conditioned accelerated erosion of agricultural land.
EU ETS. The European system for trading with greenhouse gas emissions allowances. It is one of the key EU policy instruments to reduce greenhouse gas emissions. The system includes large industrial and energy companies, while its legislative basis is 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 entry from the atmosphere. Human activity can cause excessive eutrophication. Sources of nutrients include the flushing of fertilizers from agricultural land, the discharge of sewage, fish farming, air pollution, etc. In aquatic ecosystems, excessive eutrophication leads to excessive growth of cyanobacteria and algae and, consequently, to a lack of oxygen. Eutrophication of the soil leads to the disruption of the original communities.
Evidence System of Contaminated Sites. Evidence System of Contaminated Sites is a public database that contains information about sites where old environmental burdens, respectively contaminated sites, are located. In 2019, the original Evidence System of Contaminated Sites database was merged with the Territorial analytical documents list and then with other databases of other ministries that recorded old environmental burdens or contaminated sites within their competence. Indications of the potential presence of a contaminated site were also added to the database after being selected by CENIA as part of the National Inventory of Contaminated Sites project that involved the study of maps from remote surveys.
Frost day. A day when the minimum daily air temperature is below 0°C.
Fungicides. Plant protection products intended to kill fungi.
Gas and combustion power plants. Energy is generated by burning gas in a gas combustion turbine or motor directly rotated by the combustion products and, with them, also a generator on a common or geared shaft.
Government institutions. All institutional units whose authority extends either to the entire economic territory of the Czech Republic (central government institutions, e.g. ministries and state funds) or to a certain defined territory of the Czech Republic (local government institutions, e.g. territorial self-governing units represented by regional and municipal authorities or associations of municipalities).
Hazardous waste. Waste exhibiting at least one of the hazardous properties listed in the annex to the directly applicable European Union regulation on hazardous properties of waste (Commission Regulation (EU) No. 1357/2014 of 18 December 2014 replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives).
Heat wave. A continuous period of 3 days or more when the maximum daily air temperature in the summer period exceeds the long-term average of the maximum daily air temperature for the given locality recorded in a normal period (1981–2010) by more than 5°C.
Herbicides. Products intended to destroy undesirable plants, e.g. weeds or invasive plants.
Hydroelectric power plants. Electricity is generated by converting the potential energy of water so that the water spins a turbine that drives an electric generator.
Ice day. A day when the maximum daily air temperature does not rise above 0°C and there is frost all day.
Impermeable surfaces. In particular, artificial surfaces such as roads, pavements, parking lots, airports, ports, and handling areas covered with materials that do not let water through such as asphalt, concrete, paving and roofing.
Indirect greenhouse gas emissions. Emissions of CO_2 and N_2O produced by a chemical reaction in the atmosphere from NO_x, NH_3, CO and NMVOC. These emissions are therefore quantified within the emission inventories and are part of the national emission balance.
Insecticides. Plant protection products intended to kill insects.

Investments in environmental protection (= investment expenditure). Investment expenditure in environmental protection includes all expenditure for the acquisition of tangible fixed assets incurred by reporting units for the acquisition of tangible fixed assets (through purchases or their own activities), together with the total value of tangible fixed assets acquired in the form of gratuitous acquisition or transfer under the relevant legislation, or by reallocation from personal to business use.
Landscape fragmentation. Dividing integrated parts of the landscape into smaller parts, leading to a decrease in its ecological stability.
LULUCF. Categories of greenhouse gas emissions and sinks from land use, land-use change and forestry. This category is usually negative for countries with high forest cover and low logging, and positive for countries with low forest cover where there are rapid landscape changes in the direction towards a cultural landscape.
Manure. Fertilizers in the form of the faeces of breeding animals (stable fertilizers), including plant residues such as compost, straw, stalks and green manure. The main component of manure is organic substances of plant or animal origin (carbohydrates, cellulose, amino acids, proteins, etc.). In addition to these substances, manure also contains nutrients (N, P, K, Ca, Mg, etc.).
Megatrend. Long-term transformation processes that in the longer term affect human thinking, activities, the organization of society and the future reality of the world.
Mineral fertilizers (inorganic, industrial, chemical fertilizers). Fertilisers containing nutrients in the form of inorganic compounds obtained by extraction and/or by physical and/or chemical industrial processes.
Mixed municipal waste. Waste that remains after the separation of recoverable components and hazardous components from municipal waste is sometimes also called "residual" waste.
Monoculture. A stand consisting of one species of plant. This is typical for intensive agriculture and forestry.
Municipal waste. This is all waste generated in a municipality during the activities of natural persons that is listed as municipal waste in the Waste Catalogue, with the exception of waste generated by legal persons or natural persons authorized to conduct business.
Non-financial private enterprises. All non-financial corporations not controlled by government institutions, i.e. that are privately owned. These are commercial enterprises, public benefit enterprises and non-profit institutions providing services to non-financial enterprises (associations of entrepreneurs, etc.).
Non-financial public enterprises. All non-financial corporations controlled by government institutions. These are mainly state-owned enterprises and enterprises with a predominant participation by the state (commercial enterprises), the Fund of Market Regulation (or the State Agricultural Intervention Fund), the Support and Guarantee Farm and Forestry Fund and contributory organizations, public benefit and public law companies that are market producers.
Non-hazardous waste. Waste not exhibiting any of the hazardous properties listed in the annex to the directly applicable European Union regulation on hazardous properties of waste (Commission Regulation (EU) No. 1357/2014 of 18 December 2014 replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives).
Non-investment costs in environmental protection. Current or operating expenditure, including wage costs, payments for material and energy consumption, repairs and maintenance, etc., and payments for services where the main purpose is the prevention, reduction, modification or elimination of pollution and pollutants or other environmental degradation, based on the production process of the enterprise.
Normality of temperatures and precipitation. This indicates to what extent the course of temperatures and precipitation in the assessed period is different from the climatological normal (1981–2010) and with what probability (repetition time) the measured temperatures and precipitation values occur. Values of temperature deviations from the normal, and a proportion of precipitation to normal between the 25th and 75th percentiles are referred to as normal, values between the 25th and 10th as subnormal, between the 75th and 90th percentiles as above normal, values below the 10th and above the 90th percentiles as strongly below/above normal, and values below the 2nd and above the 98th percentiles as exceptionally below/above normal. Statistically, a normal year (month) occurs once every two years, while an exceptionally below/above normal year occurs once every 50 years.
Nuclear power plants. In principle, these are steam power plants with nuclear reactors instead of steam boilers, and obtain energy by converting it from the binding energy of heavy element (uranium 235 or plutonium 239) nuclei.
PCB. Polychlorinated biphenyls is the collective name for 209 chemically related substances (congeners) that differ in the number and position of chlorine atoms bound to the biphenyl molecule. They were formerly widely used commercially. Their production was prohibited due to their ability to persist and bioaccumulate. The most serious 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 sustainable forest management principles.
PES. Primary energy sources. Primary energy sources are the sum of domestic or imported energy sources expressed in energy units. Primary energy sources are one of the basic energy balance indicators.
Photovoltaic power plants. These obtain energy from solar radiation through conversion using the photoelectric effect principle.
Physical trade balance (PTB). The balance between physical imports of raw materials, materials and products, and physical exports. With the growing positive balance, material dependence on foreign countries (as a whole or in a given material group) increases, while a negative balance is indicative of an export character of the economy in a given material group and the excess of domestic production (mining) over consumption.
POPs. Persistent organic substances are substances that remain in the environment for a long time. They accumulate in the fatty tissues of animals and enter the human body through food chains. They can cause reproductive disorders, affect hormonal and immune functions, and increase the risk of cancer in very small doses.
Q_{355}. The flow rate of a watercourse that is reached or exceeded on average 355 days a year.
Red lists. The Red Lists list species of plants, animals or fungi that are disappearing, declining or existentially endangered for various reasons.
RES. Renewable energy sources. We call these sources “renewable” because they are constantly renewed through sunlight and other processes. Direct solar radiation and some of its indirect forms are an “inexhaustible” energy source from the point of view of human existence. RES include wind energy, solar energy, geothermal energy, water energy, soil energy, air energy, biomass energy, landfill gas energy, sludge gas energy and biogas energy.
Rodenticides. Chemicals intended for rodent control.
SEC. The State Energy Concept defines the priorities and targets of the Czech Republic in the energy sector, and describes the specific implementation tools of the State’s energy policy. The State Energy Concept is one of the basic components of the economic policy of the Czech Republic.
Solid fuel steam power plants. Steam power plants generally use water vapour to drive an electric power generator, with the water vapour being obtained by heating water by the combustion of fuels or a nuclear reaction. In this document, however, the solid fuel steam power plant category is taken from Energy Regulatory Office statistics (where it is referred to as the “steam” category) and includes thermal power plants that burn mainly lignite in this country. Nuclear power plants are then listed in a separate category.
Stocking density. This is calculated as the ratio of the actual circular base of a forest stand to the table base. This thus shows the use of the growth environment of forest stands.
Sub-crown precipitation. Rainwater trapped under the crowns of trees. This is enriched with substances trapped on the surface of the leaves.
Summer day. A day on which the maximum daily air temperature reaches or exceeds 25°C.
Suspended particles. Solid or liquid particles that, due to negligible stall velocity, persist for a long time in the atmosphere. Particulate matter in the air is a significant human health risk factor.
Territorial temperatures and precipitation totals. Values of meteorological elements related to a particular territory, representing the mean value of that element in that territory.
Total eligible expenditure. In the context of the Operational Programme Environment, this is the sum of funds from the Cohesion Fund, European Regional Development Fund, other (national) public sources and private sources of financing.
Transport performance. The number of people transported or the weight of transported goods per kilometre. This is measured in so-called 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. A method for determining areas that are not fragmented by traffic, i.e. areas bounded by roads with a traffic intensity higher than 1,000 vehicles per 24 hours or by multi-track railways, and which have an area of more than 100 km^2.
Waste. Any movable thing that a person discards or has the intention or obligation to dispose of.
Weak signal. A potentially emerging problem or factor that does not seem particularly important in the present, but may become a trigger for significant events in the future.
Wind turbines. The wind spins an electric generator via a propeller, producing electricity.
Zoocides. Products for the protection of plants from animals that may damage them.

List of abbreviations

AOT40 Accumulated Ozone exposure over a Threshold of 40 ppb
B(a)P benzo(a)pyrene
BAT Best Available Techniques
BOD_5 biochemical oxygen demand over five days
BPEJ farmland classification
BS saturation of the sorption complex of soils with bases
BSM basal soil monitoring
c.p. current prices
CENIA Czech Environmental Information Agency
CNG compressed natural gas
COD_{Cr} chemical oxygen demand by potassium dichromate
COD_{Mn} chemical oxygen demand by potassium permanganate
CORINE Coordination of Information on the Environment
CSO Czech Society for Ornithology
CZ-NACE Statistical Classification of Economic Activities in the European Community (Nomenclature statistique des activités économiques dans la Communauté européenne)
DDT dichlorodiphenyltrichloroethane
DEU Domestic Extraction Used
DMC Domestic Material Consumption
DNA deoxyribonucleic acid
DOC Dissolved Organic Carbon
EEA European Environment Agency
EEA33 28 Member States of the European Union (EU) and 5 other member states
EEA39 28 Member States of the European Union (EU) and 5 other member states and 6 cooperating countries of the European Environment Agency (EEA)
EQS-AA Environmental Quality Standard – Annual Average
EQS-MPC Environmental Quality Standard – Maximum Permissible Concentration
EU European Union
EU27 Member States of the European Union (without the United Kingdom)
EU28 Member States of the European Union (including the United Kingdom)
EU-ETS European Union Emissions Trading System
Eurostat European Statistical Office
FSC Forest Stewardship Council certification system
G20 Group of Twenty (20 largest economies in the world)
GAEC Good Agricultural and Environmental Conditions
GAESC Good agricultural and environmental soil condition
GDP gross domestic product
HA High Annoyance
HCB hexachlorobenzene
HCH hexachlorocyclohexane
HSD High Sleep Disturbance
JRC Joint Research Centre
KRNAP Krkonoše National Park
LC level crossing
LPIS Land Parcel Identification System
LULUCF Land Use, Land-use Change and Forestry
NP national park
NRL National Reference Laboratory for Municipal Noise
OECD Organisation for Economic Co-operation and Development
PA priority axis

PAHs polycyclic aromatic hydrocarbons
PCBs polychlorinated biphenyls
PEFC Programme for the Endorsement of Forest Certification Schemes certification system
PES primary energy sources
PLA Protected Landscape Area
PM particulate matter
RES renewable energy sources
s.e. state enterprise
SHARES Short Assessment of Renewable Energy Sources
SPA Specially Protected Area
SUMF Sustainable Urban Mobility Framework
SUMP Sustainable Urban Mobility Plan Transport Research Centre, a public research institution
UNFCCC United Nations Framework Convention on Climate Change
USLE Universal Soil Loss Equation
VOC volatile organic compound
WEI Water Exploitation Index
WWTP waste water treatment plant

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