Report

on the Environment of the Czech Republic

2022

cenia

Ministry of the Environment
of the Czech Republic

Drawn up by
Czech Environmental Information Agency

Overall editorial staff
L. Hejná and E. Koblížková

Authors
I. Baránková: chapter 3.1, 3.2; E. Čermáková: chapter Climate change in Czechia, 1.1, 1.3, 1.6, 3.1; M. Havránek: Assessment methodology for trends and state; T. Kochová: chapter Planetary boundaries, Opinions and attitudes of the Czech public; P. Lepičová: chapter 1.2, 1.3, 1.4, Assessment methodology for trends and state; J. Mertl: chapter Climate change in Czechia, 1.2, 1.4, 1.5, 1.6, 2.1, 2.2; J. Pokorný: chapter 1.5, 1.6, 2.2, Financing of environmental protection; J. Přech: chapter 3.1; M. Rollerová: chapter 1.2, 1.5, 2.1, 3.1; V. Vlčková: chapter 1.3, 1.6, 2.2.

The assessment has been prepared using data provided by the listed cooperating organizations.

Map outputs
V. Dastychová: chapter Climate change in Czechia – Figure 10, 11, chapter 1.1 – Figure 15, chapter 1.6 – Figure 22, 23, chapter 3.2 – Figure 37, 38, 39, 40; K. Horáková: chapter Climate change in Czechia – Figure 9, chapter 1.1 – Figure 12, chapter 1.3 – Figure 19, chapter 1.4 – Figure 17, chapter 1.6 – Figure 21, chapter 3.2 – Figure 35, 36.

Map created using data from ArcČR 500 v. 3.0. Thematic content created from data provided by the institutions listed as the data source for each map.

Authorised version

ISBN 978-80-7674-102-7

Published by
Czech Environmental Information Agency
Moskevská 1523/63, 101 00 Prague 10, info@cenia.cz, http://www.cenia.cz
Prague, 2023

Recommended citation
CENIA (2023). *Report on the Environment of the Czech Republic 2022*. Czech Environmental Information Agency.
Available from: https://www.cenia.cz/publikace/zpravy-o-zp/

List of cooperating organisations

Central Institute for Supervising and Testing in Agriculture
Czech Astronomical Society
Czech Geological Survey
Czech Hydrometeorological Institute
Czech Office for Surveying, Mapping and Cadastre
Czech Programme for the Endorsement of Forest Certification
Czech Society for Ornithology
Czech Statistical Office
CzechInvest
Energy Regulatory Office
Forest Management Institute
Forest Stewardship Council Czech Republic
Forestry and Game Management Research Institute
Charles University Environment Centre
Institute 2050
Institute of Agricultural Economics and Information
Institute of Public Health based in Ostrava
Institute of Public Health based in Ústí nad Labem
Institute of Sociology of the Czech Academy of Sciences, Public Opinion Research Centre
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 Transport of the Czech Republic
National Institute of Public Health
National Reference Laboratory for Environmental Noise
Nature Conservation Agency of the Czech Republic
Povodí Labe, state enterprise
Povodí Moravy, state enterprise
Povodí Odry, state enterprise
Povodí Ohře, state enterprise
Povodí Vltavy, state enterprise
Railway Administration, state enterprise
Research Institute for Soil and Water Conservation
Road and Motorway Directorate of the Czech Republic
Silva Tarouca Research Institute for Landscape and Ornamental Horticulture, public research institution
State Environmental Fund of the Czech Republic
T. G. Masaryk Water Research Institute, public research institution
Transport Research Centre

Table of Contents

Introduction

The Report on the Environment of the Czech Republic (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, and 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 and development of the environment in Czechia from all aspects based on data available for the year under assessment.

CENIA 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 2022 Report is presented in detail. Starting with the 2020 Report, 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 Czechia, Financing of environmental protection, Opinions and attitudes of the Czech public).

The 2022 Report was discussed and approved by the Government on 29 November 2023 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 2022 were not available or the data were only provisional. Information on data sets (the reasons for their unavailability and future updates) for which 2022 data were unavailable at the time of publication is provided in the relevant chapters.

The 2022 Report is also published electronically (https://www.cenia.cz, https://www.mzp.cz) together with the Statistical Environmental Yearbook of the Czech Republic 2022 and Reports on the Environment in the Regions of the Czech Republic 2022. Detailed data sources and visualisations are available on the Envirometr portal (https://www.envirometr.cz).

Key messages of the Report

The state of the Czech environment, especially in the areas of air, water and forests, remains unsatisfactory despite slight positive changes in recent years. In addition to sectors of the national economy, households and the manifestations of climate change affect the state of the environment. Intensive exploitation of natural resources puts pressure on ecosystems and biodiversity.

Czechia has made little progress towards meeting decarbonisation targets and towards climate neutrality under the Green Deal for Europe and European legislation. The ongoing achievement of the targets is influenced by developments in land use and forestry, as well as the energy and transport situation. The forests of Czechia continue to be affected by the bark beetle calamity and thus fail to fulfil their role in carbon storage. Adverse developments in climate change mitigation have also been influenced by the fact that the war in Ukraine and the energy crisis, which had an economic impact on the population, have interfered with decision-making on environmental and climate protection measures.

The year 2022 was the fifth warmest since 1961, with an above-average summer. High temperatures and erratic rainfall have led to the development of climatic, soil and hydrological drought in a large part of Czechia. The drought has led to an increased risk of fires, with the growing season fire danger index being the second highest since 2000. In July 2022, a fire occurred in the Bohemian Switzerland National Park, which was the largest vegetation fire in the history of Czechia.

A gradual decrease in the intensity of the bark beetle calamity can be observed in the forests. Since it began in 2015, total timber harvesting has been reduced for the second consecutive year in 2022, bringing the harvesting volume back to approximately 2018 levels. However, the share of incidental (calamitous) harvesting in total harvesting is still very high. The further development of the calamity will depend on the weather and the success of protection measures.

Although there has been a slight increase in the area of natural biotopes year on year, there has been a continuing decline in bird populations, which are the main indicator of biodiversity in forest and agricultural landscapes. The area of agricultural (mainly arable) land continues to decrease and the area of built-up areas is increasing. Soil is at risk of degradation due to intensive farming, low heterogeneity of the agricultural landscape and a high degree of ploughing.

Surface water quality has improved significantly since 2000, but has stagnated in the short term and a further reduction in pollution levels has been unsuccessful. Water quality continues to be rated as Class III (polluted water) in most sections of watercourses. Over the 2000–2022 period, the most significant reductions in ammonia nitrogen and total phosphorus in watercourses were achieved through the construction of new waste water treatment plants and improved technological treatment of waste water discharged from point sources.

Air emissions are decreasing, and small and mobile sources of air pollution are becoming more significant in the structure of emissions. A persistent problem is the high proportion of air emissions from household fuel consumption. This is mainly due to local heating with solid fuels. The share of the population affected by above-limit concentrations of air pollutants has been decreasing in the long term for most of the monitored pollutants, with slight year-to-year fluctuations, and is mostly minimal with respect to existing limits; however, taking into account the limits set by the WHO, the risk of exposure of the population to air pollution is still significant.

In the energy sector, the development of primary energy consumption for most fuels is moving towards the targets set, with a gradual shift away from solid fossil fuels and towards an increasing share of renewable sources. However, in 2022, due to the limited availability of natural gas and a significant increase in its price, electricity production from this source declined and was replaced by domestic lignite. The export character of the electricity market continues to persist.

Energy consumption in transport is on the rise. More than 90% of the energy consumed in transport comes from fossil fuels and decarbonisation in this sector is very slow. The gradual renewal and modernisation of the vehicle fleet is leading to a decrease in emissions of basic pollutants from transport. The use of alternative fuels and power in transport is growing, with a significant year-on-year increase in the number of registrations of battery electric passenger cars. However, the share of electric vehicles in the total passenger car fleet remains very low.

A positive aspect of the transition to a circular economy is that the overall waste management is still dominated by recovery, especially material recovery, which is in line with the current waste management hierarchy. In the area of municipal waste management, the main objective is to significantly reduce landfilling in favour of material recovery in particular, but a significant proportion of municipal waste is still landfilled.

Environmental protection, including addressing climate change, has long been financed from both national and European sources through operational programmes. These include in particular the Operational Programme Environment, the Rural Development Programme, and from 2021 also the Modernisation Fund and the Recovery and Resilience Facility for the implementation of the National Recovery Plan. An example of successful financing of environmental protection measures is the implementation of the New Green Savings, Dešťovka (Rainwater) and Boiler Subsidies programmes.

Climate change in Czechia

- The year 2022 was above normal in temperature and the 5th warmest since 1961. The number of summer and tropical days exceeded the 1990–2020 normal, with more than 30 tropical days occurring in the hottest areas of Czechia.
- Precipitation in 2022 was normal, with higher precipitation in relation to normal in Bohemia than in Moravia and Silesia. June and September were above normal in terms of precipitation, while March was very dry.
- The intensity and areal extent of climatic and soil drought were higher in 2022 than in 2020 and 2021. The annual cumulative moisture balance was only 42.4% of the 1981–2010 normal. In more than a fifth of Czechia, significant soil drought below 10% of the AWC persisted for a total of 28 days.
- The average growing season fire danger index in 2022 was the second highest since 2000. The highest risk of fires was in north-west Bohemia, in Polabí and in southern Moravia.
- In 2022, hydrological drought also became apparent. The average annual flow rate at the main profiles monitored in 2022 was less than 90% of the long-term average for the 1991–2020 period.

Water availability and quality

- Over the 2000–2022 period, the greatest reductions in pollution in Czech watercourses were achieved for $N\text{-}NH_4^+$ (a 73.9% decrease in average concentration) and P_{total} (a 40.0% decrease).
- In the water quality assessment according to Czech Technical Standard 75 7221, the prevailing quality class for the 2021–2022 biennium is Class III (polluted water).
- In the short term, despite the continuing positive trend in waste water treatment, the quality of watercourses is stagnating and there is no further significant reduction in pollution.
- 15.1% of the population is not yet connected to a sewerage system terminated with 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
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 abstractions by sector	↘	↘	~	~
Water consumption from the public water supply and water losses in the water supply network*				
Water consumption from the public water supply	↘	→	~	~
Water losses in the water supply network	↘	→	~	~

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Air quality

- Emissions of all the main pollutants (NO_X, VOC, SO_2, NH_3 and $PM_{2.5}$) into the air are decreasing, with the largest decreases of 70.8% for SO_2 and 47.3% for NO_X between 2005 and 2021[1].
- In the context of meeting the commitments (emission ceilings), it can be stated that unless there are significant changes in the current trend, the required emission reductions by 2025 and 2030 may not be achieved for all substances[2].
- The major contributions to air emissions of PM_{10}, $PM_{2.5}$, B(a)P, CO and VOC come from fuel consumption in households.
- Emissions of basic pollutants from transport are decreasing, with the most significant decreases registered in the 2000–2022 period for CO (by 84.0%) and VOC (by 78.9%), and only a slight

[1] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

[2] *However, according to the 2023 Projection of the CHMI, measures are set in such a way that the national emission reduction ceilings will be met in 2025 and 2030 without the need for additional measures (https://www.ceip.at/status-of-reporting-and-review-results/2023-submission). The emission balance of the whole time series was recalculated from the August 2023 CHMI data.*

decrease in PM emissions (by 20.3%). The decline is linked to the gradual renewal and modernisation of vehicles.

- PAH emissions from transport are increasing, following the growing trend of energy consumption in transport.
- The largest source of transport pollutant emissions is passenger car transport, with the highest share of emissions in 2022 being VOC (76.5%) and CO (76.3%).
- Some pollution limits are still being exceeded. In 2022, 1.7% of the territory of Czechia was defined as having exceeded at least one pollution limit without including ground-level ozone; 11.7% of the population lived in this area.
- In 2022, five smog situations were declared due to ozone threshold values being exceeded for a total of 53 hours.

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 household heating	~↗	↘	↘	✓
Emissions from transport*				
Emissions of basic pollutants from transport	↘	↘	↘	✓
PAH emissions from transport	↗	↗	~↗	✗
Air quality in terms of human health protection	~↗	↗	↗	~
Air quality in terms of vegetation and ecosystem protection	↗	↗	↗	~

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Exposure of the population and the environment to hazardous substances

- Emissions of POPs and heavy metals (with the exception of copper and PAHs) into the air have been decreasing over the long term, with a significant decrease for all substances in the short term, but a 5.4% increase in PAHs year-on-year.
- The main sources of POPs and heavy metals emissions in Czechia in 2021[3] were the household fuel consumption sector (97.3% of B(a)P emissions) and the public energy and heat production sector (86.8% of selenium and 46.0% of mercury emissions).
- Over the 2010–2022 period, remediation of 3,320 sites of old environmental burdens was completed, subject to compliance with the conditions of the remedial measures, and the remediation of 1,148 sites was completed in 2022.
- The incremental Evidence System of Contaminated Sites database contained 10,174 sites in 2022.

[3] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance of the whole time series was recalculated from the August 2023 CHMI data.*

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	↘	↘	↘	✓
Contaminated sites (evidence and remediation)	N/A	N/A	N/A	✓

Noise pollution and light pollution

- Urban agglomerations, especially Prague and Brno, have high noise pollution from road traffic. According to data from the 4th round of SNM in 2022, 6.4% of the population of the Prague agglomeration was exposed to noise above the limit value, 13.8% of the population is highly annoyed by noise and 4.2% of the population suffers from high sleep disturbance.
- CZK 452.4 mil. was invested in noise protection measures on road infrastructure in 2022. The development of the Czech motorway network and the construction of city bypasses continues, with a total of 21.2 km of motorways being put into operation and another 143.6 km of motorways under construction.
- Light pollution levels are worsening due to the increasing amount of illuminated surfaces and the use of light sources with inappropriate spectral characteristics. In Czechia, there is no territory that is not affected by the artificial brightness of the night sky.
- Objective measurements to monitor the evolution of light pollution over time in Czechia are not yet being carried out, but are the subject of a research project[4].

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 and the territory	N/A	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	~

Society preparedness for and resilience to emergencies

- In order to support preparedness for weather extremes or the impacts of climate change, approximately 1,600 projects worth CZK 12.3 bil. were approved in the 2014–2020 period.

[4] *Light pollution is the subject of a project by the TA CR: The impact of light pollution on sensitive species, ecosystems and landscapes, the results of which (including the measurement methodology and the resulting map of the Czech Republic) should be available by the end of 2024.*

Approximately 17,800 projects or events worth almost CZK 3 bil. were supported in the national programmes of the Ministry of the Environment of the Czech Republic, including the Dešťovka (Rainwater) programme and landscape care programmes. In the Ministry of Agriculture of the Czech Republic, approximately CZK 23.6 bil. was spent in the RDP and national programmes on the implementation of more than 2 000 measures in the field of flood protection and water retention in the landscape.

- In 2022, a total of 275 IWSS alerts were issued, of which 159 were forecast alerts and 116 warned of the imminent occurrence of a hazardous phenomenon. 87% of forecast alert information was successful or partially successful.
- In 2022, a total of 22,923 incidents requiring the intervention of the IRS units occurred in connection with natural disasters, in the vast majority of cases involving technical accidents. In the long term, the main cause of all events is high winds followed by floods, flash floods or rain.
- In 2022, insurers recorded more than 72 thous. events caused by natural disasters with a total loss of CZK 3.6 bil.
- In 2022, there were four major industrial accidents in Czechia, two explosions, an oil spill and a dust ignition.

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	N/A	N/A	N/A
Issuing alerts of the Integrated Warning Service System (IWSS)	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	↗	~	↘	~

Adapted settlements

- In 2022, 50 towns or municipal districts and 7 micro-regions or voluntary associations of municipalities had an adaptation strategy or plan in Czechia. The number of affected inhabitants living in the territory of these settlements was approximately 3.4 mil. In addition to these cities and municipalities, four regions were approved an adaptation strategy or plan.
- In total, 2,110 brownfields with a total area of 5,615.7 ha were newly registered in Czechia in the 2014–2022 period. In 2022, 174 sites with a total area of 279 ha were deactivated from the National Database of Brownfields due to sale or successful regeneration.
- In 2022, 69 implementers had LA21 in place at levels A–D (there were 112 entities when including the category Interested Parties). In the short-term trend, the number of LA21 implementers has

a decreasing tendency, but the quality of LA21 implementation is increasing, that is, the proportion of implementers that reach the highest LA21 implementation categories.

- All cities over 100,000 inhabitants had a verified Sustainable Urban Mobility Plan (SUMP) in 2022. Of the 20 largest cities in Czechia, 18 have a verified SUMP, while Hradec Králové and Opava have only a verified Strategic Urban Mobility Framework (SUMF).
- In the area of rainfall or greywater management in settlements, almost 200 projects were approved in the 2014–2022 period in the total amount of CZK 0.8 bil. of the total eligible expenditure (TEE), the implementation of which should retain more than 24 thous. m^3 of rainwater in the municipalities. Almost 9,800 projects were approved in Dešťovka (Rainwater) in 2017–2022, with a total support of about CZK 383 mil., and the total volume of storage tanks acquired with the support of this programme is approximately 48 thous. m^3.
- The representation of green areas and water areas in the defined urban area of settlements with a population of over 20 thous. is relatively high and in 2020[5] on average amounted to 76.0%. However, a significant part of the share of greenery in the total urban area of settlements is represented by low greenery (78.0% of the total area of greenery in settlements), the potential of which for increasing the adaptive capacity of settlements is low compared to high greenery.

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
Number of municipalities with adaptation plans	N/A	N/A	↗	~
Brownfields	N/A	N/A	N/A	~
Local Agenda 21*				
Number of LA21 implementers	↗	~↗	↘	~
Quality of LA21 implementation	~↗	~↗	↗	✓
Sustainable Urban Mobility Plans	N/A	N/A	↗	✓
Supported projects for the use of rainwater and grey water	N/A	N/A	↗	~
Green areas in cities	N/A	N/A	~↗	~

**In addition to a simple quantitative assessment of the implementation of LA21, it is necessary to assess the quality of its implementation in the settlements or areas concerned. Therefore, the assessment of the LA21 indicator is presented separately for the two partial (elementary) indicators.*

[5] *Data for 2021 and 2022 are not available at the time of publication. The new data will be available in the Report on the Environment of the Czech Republic 2023.*

Transition to climate neutrality

- Aggregate GHG emissions in Czechia, including LULUCF, decreased by 33.7% in the 1990–2021[6] period, with a stagnating trend in the last 5 years of this period. Czechia has so far made little progress in meeting its 2030 climate targets and moving towards climate neutrality. The current barriers to meeting the targets are the development of emissions in the land use and forestry sector (LULUCF), where the balance of emissions and sinks has been positive since 2018 due to the creation of large calamity areas and the reduction of timber stocks in forests, and the situation in transport.
- A positive development is registered in GHG emissions from the energy industry, which decreased by 24.6% in the 2016–2021 period.
- Transport is not yet decarbonised, with energy consumption in transport increasing by 69.3% between 2000 and 2022. Of the total transport energy consumption from combustion processes in 2022, 95.1% came from fossil non-renewable sources, 70.3% from diesel combustion. The development of energy consumption in transport is reflected in the increasing trend of greenhouse gas emissions from transport.
- In 2022, 5.0 thous. battery electric passenger vehicles were registered, representing a year-on-year increase in registrations of 70.3%. Despite the growth of electromobility in recent years, the share of clean, alternative fuel vehicles in the passenger car fleet remains negligible.
- Due to turbulent changes in energy commodity prices, the share of electricity generation from less available natural gas decreased in 2022 and was replaced by domestic lignite.
- The export character of foreign trade in electricity persists, with the share of the balance in domestic consumption increasing to 19.1% in 2022.
- The number of households heated with solid fuels is increasing in the short term.
- Czechia's energy import dependence is increasing significantly, reaching 40.2% in 2021[7].
- The production of heat from solid fossil fuels is gradually declining, while the share of renewable sources and biofuels is increasing significantly. The annual increase in renewable heat production in 2021[8] was 12.8%.
- The rate of increase in renewable electricity generation has slowed since 2014, with a 1.0% annual decline in 2022. The share of RES in electricity generation in 2022 was 12.4%, the target is to reach a share in the range of 18–25% by 2040.
- The target for the share of RES in gross final energy consumption is set at 22% by 2030; in 2021[9] this share was 17.7%.
- The share of RES in final energy consumption in transport in 2021[10] was 7.5%. The target of 10% RES energy in transport by 2020 was not met and the target of 14% RES energy in transport by 2030 is still very far away. Biofuels account for more than 90% of RES energy consumption in transport.

[6] *Data for 2022 are not available at the time of publication. The emission inventory for the UNFCCC is always available in April 24 months in arrears, i.e. in 2023 the last reported year is 2021.*

[7] *Data for 2022 are not available at the time of publication. They will be available no earlier than December 2023.*

[8] *Data for 2022 are not available at the time of publication. They will be available no earlier than December 2023.*

[9] *Data for 2022 are not available at the time of publication. They will be available no earlier than December 2023.*

[10] *Data for 2022 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 (including LULUCF)	↘ (green)	↝ (orange)	↝ (orange)	~ (orange)
Electricity and heat generation*				
Gross electricity generation	○ (green)	○ (green)	○ (green)	✗ (red)
Gross heat generation	N/A	○ (green)	○ (green)	N/A
Household heating by fuel	N/A	↝ (orange)	↝ (orange)	✗ (red)
Energy and fuel consumption in transport	↗ (red)	↗ (red)	↝ (orange)	✗ (red)
Energy intensity of the economy*				
Development of the energy intensity of the economy	N/A	↘ (green)	↘ (green)	~ (orange)
Structure of the PES	N/A	○ (orange)	○ (green)	~ (orange)
Energy efficiency	N/A	→ (orange)	↝ (orange)	✗ (red)
Import energy dependence	N/A	↗ (red)	↗ (red)	✓ (green)
Use of renewable energy sources	↗ (green)	↗ (green)	↗ (green)	✓ (green)
Consumption of RES in transport	↗ (green)	↗ (green)	↝ (orange)	~ (orange)

* Due to the heterogeneity of the topics 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 decreasing, reducing pressures on the environment, and has fallen by 44.6% between 2000–2021[11].
- In 2018[12], the share of secondary raw material production volume in direct material input was 8.3%.
- Total waste production has a significantly increasing trend in the medium and short term, as does the production of other waste. Municipal waste generation is increasing in the medium term. The production of packaging waste has a significantly increasing trend in the medium and short term.[13]

---

[11] *Data for 2022 are not available at the time of publication. They will be published at the end of 2023.*

[12] *Data for 2019–2022 are not available at the time of publication.*

[13] *Data for the year 2022 are not available at the time of publication.*

- In the medium term, there is a slight reduction in the generation of mixed municipal waste.[14]
- The number of licenses for the Czech ecolabel ESV, or ESS, has been decreasing in the long term, while the number of licenses for the European ecolabel EU Ecolabel is growing. In 2022, there were a total of 27 valid licenses to use the ESV/ESS ecolabel in Czechia, which corresponds to 43 certified products; in the case of the EU Ecolabel, there were also 27 licenses for 5,344 certified products.
- A positive aspect of the transition to a circular economy is that the overall waste management is dominated by waste recovery, especially material recovery, which is increasing in the medium and short term.[15]
- The main objective in the field of municipal waste management is to significantly reduce landfilling in favour of material recovery, yet almost half of municipal waste is still landfilled.[16]

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	↘	↘	↘	✓
Share of secondary raw materials production volume in direct material input	N/A	~	N/A	~
Waste generation	N/A	↗	↗	✗
Ecolabelling*				
Total number of valid Environmentally Friendly Product and Environmentally Friendly Service ecolabel licences	↘	↘	↘	✗
Total number of valid EU Ecolabel licences	↗	~	↗	✓
Waste treatment structure	N/A	○	○	✓
Municipal waste treatment	N/A	○	○	~

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Ecological stability of the landscape and sustainable land management

- There is a long-term increase in land development, which negatively affects water retention in the landscape. Between 2021 and 2022, the built-up area increased by 621 ha. Of the agricultural land, arable land decreased the most, by 11.2 thous. ha.
- Soil acidification and the depletion of alkaline nutrients is a limiting factor for forest soils. 97.2% of forest soils in the top mineral layer (0–30 cm) and 89.1% of forest soils in the bottom mineral layer (30–80 cm) fall into the categories of high and extreme threat of acidification.

[14] *Data for the year 2022 are not available at the time of publication.*

[15] *Data for the year 2022 are not available at the time of publication.*

[16] *Data for the year 2022 are not available at the time of publication.*

- Extensive soil loss due to erosion occurs annually. Potentially, 48.1% of agricultural land is threatened by water erosion, of which 13.4% by extreme erosion. 33.3% of agricultural land is threatened by wind erosion. A total of 266 erosion events were recorded in 2022, which is consistent with a balanced pattern of temperature and precipitation over the year.
- Mineral fertiliser consumption increased by 2.5% year-on-year to 106.8 kg of pure nutrients/ha^{-1} in 2022.
- The consumption of active substances in plant protection products has fallen by 13.0% since 2000. In 2022, it amounted to 3,745.2 t of active substances, i.e. 1.4% less than in 2021.
- The agricultural landscape is vulnerable to degradation due to excessive soil blocks and a high degree of ploughing; however, it is being grassed over and the average size of soil blocks decreased at an average rate of 0.8% per year between 2010 and 2022.
- Perennial crops, which can contribute significantly to increased biodiversity, occupy only 1.1% of the area of organically managed land in organic farming. Although the target for 2027 is a 10% increase over the 2021 baseline, there has not been a significant increase year-on-year.
- After a more significant decline in the extraction of construction and energy raw materials in 2020, influenced by the COVID-19 pandemic, their extraction increased again slightly, but this did not affect the long-term trend of decline in extraction.
- In 2022, large-scale logging continued after the bark beetle calamity. However, for the second year in a row since its commencement in 2015, the volume of harvesting undertaken in 2022 declined year-on-year to 25.1 mil. m^3 of wood excluding bark, bringing the volume of harvesting back to around the 2018 level. The share of incidental (calamitous) harvesting in total harvesting has decreased to 78.8%, which still represents a very high value indicating the course of the bark beetle calamity. In connection with large-scale logging, the timber stock declined and a large area of clearings was created. The ability of forests to absorb carbon dioxide from the atmosphere was thus temporarily reduced and forests are classified as a source of greenhouse gas emissions according to the methodology used to calculate the greenhouse gas balance.
- Damage to forest stands expressed as a percentage of defoliation remains high and trends are negative in the long term. In the category of older stands (60 years and older), the sum of defoliation classes 2–4 was 80.5% for conifers and 40.7% for deciduous trees. In younger stands (up to 59 years) the situation is more favourable, with 29.5% of conifers in classes 2–4 and 26.3% of deciduous trees.
- Forest regeneration is taking place in areas affected by the bark beetle calamity. The total restoration area in 2022 (50.1 thous. ha) was almost at the same level as the value in 2021 (49.8 thous. ha). At the same time, the area of natural regeneration reached a record 10.1 thous. ha and its share in the total area of forest regeneration rose to 20.2%.
- In the long term, it is possible to observe a gradual approach to a more natural (and stable) structure and species composition of forest stands. The share of deciduous trees increased to 28.7% in 2022. However, this process is slow due to the long production cycle of the forest and requires many years of intensive effort. 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, but in 2022 the ratio reversed again in favour of conifers, which were reforested on 20.2 thous. ha, at the expense of deciduous trees, which were reforested on 19.8 thous. ha. The most frequently planted tree species was still spruce (12.7 thous. ha).

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	○	○	○	✖
Quality of agricultural and forest soil*				
Quality of agricultural soil	N/A	N/A	N/A	N/A
Quality of forest soil	N/A	N/A	N/A	✖
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
Organic farming	↗	↗	↗	~
Average size of fields	N/A	↘	↘	✖
Forest health condition	↘	↘	→	✖
Sustainable forest management	→	↝	→	~
Species composition of forests	↗	↗	↗	✖

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Biodiversity

- Between 2000 and 2020[17], the area of unfragmented landscape decreased from 68.6% to 58.3% of Czechia.

[17] *Evaluated by the UAT polygon measurement method. Data for 2021–2022 are not available at the time of publication.*

- The abundance of common bird species has been declining over the long term, with the greatest decline recorded for farmland bird species, which decreased by 40.1% between 1982 and 2022.
- Climate change is having an increasing impact on the populations of common bird species in Czechia. This effect is manifested by an increase in the abundance of thermophilic species and a decline in species for which conditions in the Czech territory are deteriorating. Between 2010 and 2021[18], the impact of climate change on common bird species increased by 17.4%.
- The river network is still not being effectively made accessible. In 2022, 4 fish crossings were implemented.
- The total area of specially protected areas in Czechia, including both small-area and large-area SPAs, has increased by 224.7 ha since 2021. This increase was mainly due to the creation of new small-area SPAs.
- Of the 1,576 non-native plant species that occur or have been recorded in Czechia, 75 are considered invasive. Of the 278 non-native species, 113 are invasive.
- According to CITES, the number of exported specimens of protected species is increasing. The most balanced group of animals are birds (especially parrots), the second group are 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
Fragmentation of the landscape	↗	↗	↗	✕
State of species and habitats of Community importance	N/A	→	N/A	✕
State of bird species	↘	↘	N/A	✕
Common bird species*				
Abundance of all common bird species, forest bird species and 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	↘	↘	N/A	✕
Share of species on red lists among protected species	N/A	N/A	N/A	N/A
Specially protected areas and Natura 2000 sites	↗	↗	→	~
Share of habitats and species in Natura 2000 sites	N/A	N/A	N/A	N/A

[18] *Data for 2022 are not available at the time of publication.*

Non-native species in Czechia	N/A	N/A	N/A	N/A
International trade in endangered species protected under CITES	N/A	N/A	N/A	N/A
Breeding of endangered species in zoos	N/A	N/A	N/A	N/A

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Financing of environmental protection

- The volume of expenditure from central sources in 2022 rose to CZK 91.9 bil. year-on-year (i.e. to 1.35% of GDP) and the volume of expenditures from territorial budgets to CZK 49.8 bil. (i.e. to 0.73% of GDP). 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 insulation, energy savings and changes in heating technologies (e.g. the New Green Savings Programme or the so-called boiler subsidies) continued.
- In the second phase of the New Green Savings Programme, the so-called NGS 2021+, almost 86,500 applications amounting to CZK 18.0 bil. were registered by the end of 2022, of which about 34,600 applications worth over CZK 5.6 bil. were reimbursed.
- In the OP ENV 2014–2020, 4 new calls worth CZK 0.9 bil. of the TEE were announced in 2022. Since the beginning of the programming period, more than 160 calls for proposals have approved the provision of subsidies for 9,685 projects in the amount of CZK 93.0 bil. In 2022, a new OP ENV 2021–2027 was approved with a total allocation of EUR 2.4 bil. (CZK 58.2 bil.) of EU funds, or EUR 2.9 bil. (CZK 69.6 bil.) of the TEE. Further international funding for projects is also provided through the Modernisation Fund and the National Recovery Plan.
- The OP ENV also finances the so-called boiler subsidies; 107,000 replacements of solid fuel boilers were approved in 3 calls until the end of 2022, with a total volume of CZK 11.9 bil.
- Also, the RDP from the Ministry of Agriculture of the Czech Republic implemented support or measures that contribute to the improvement of the environment (e.g. agri-environmental-climatic measures or organic farming). Under these, CZK 9.2 bil. was paid out in 2022.

Opinions and attitudes of the Czech public

- Satisfaction with the state of the environment in their place of residence was expressed by 84% of respondents, and with the overall state of the environment in Czechia by 76% of respondents.
- In 2022, the highest ranked activities in environmental protection were those of municipal authorities (59% of responses) and environmental organisations (55% of responses).
- The only population group that does not live in a majority of insulated houses is the poor rural population (62%).
- The wealthiest suburbanites are the most likely to drive a car, with more than 54% of residents driving over 20 km a day.

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

Planetary boundaries

Humanity is currently in the Anthropocene, a proposed new geological epoch characterized by planetary systems being affected by human activities that have disrupted the stable state of planetary systems in the Holocene (the last 12,000 years), the only state of planetary systems for which there is evidence that it is capable of enabling a biosphere favourable to human development[19]. Rapid changes in planetary systems threaten critical ecosystem functions and are already having significant societal impacts. In addition, the risk of reaching tipping points that irreversibly destabilise planetary systems is increasing.

The main drivers of these changes are the unsustainable extraction and consumption of natural resources in human social and economic systems. Different social groups and countries are contributing to changes in planetary systems in different ways and are experiencing different impacts. Assessing safe and equitable boundaries is essential to ensure stable and resilient planetary systems and inclusive human development[20] (Box 1).

Box 1

The concept of planetary boundaries

Steffen et al., 2015[21] 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, which highlights the close and complex links between human society and the planet. This also emphasizes the seriousness of the environmental consequences and the responsibility of human functioning on the planet.

These are the following 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 change (newly divided into green – invisible water, retained in soil, plants, forests, etc., and the so-called blue water – visible water in rivers, lakes, etc.); atmospheric aerosol loading; novel entities (substances and chemical compounds developed by human society and harmful to the environment, e.g. GMOs, microplastics, pesticides, nuclear waste, etc.). 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 6 of the 9 planetary boundaries, namely the change in biosphere integrity; climate change; land-system change and biochemical flows, in addition to novel entities whose boundaries have been newly quantified, and freshwater use change[22]. In addition, for all planetary boundaries already identified as exceeded in the past (2009 and 2015) (change in biosphere integrity; climate change; land-system change and biogeochemical fluxes), the level of exceedance has increased further. Ocean acidification is also approaching its planetary boundary. On the other hand, stratospheric ozone has improved, with its decline halted and the ozone layer recovering. This is the result of measures taken as a result of the ratification of the 1987 Montreal Protocol.

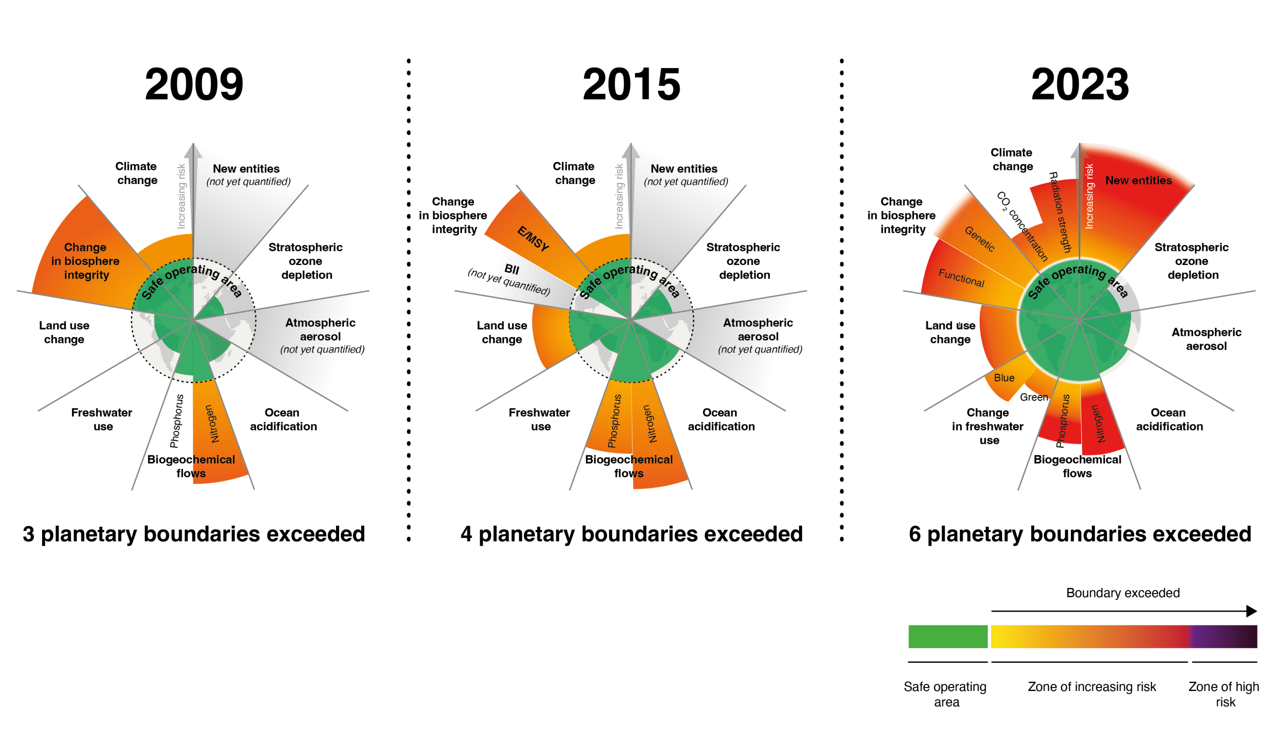
---

[19] *Steffen, W. et al., 2018: Trajectories of the Earth System in the Anthropocene,* Proceedings of the National Academy of Sciences*, 115.33, 8252–59, doi: https://doi.org/10.1073/pnas.1810141115.*

[20] *Rockström, J. et al., 2023: Safe and Just Earth System Boundaries,* Nature*, 619.7968, 102–11, doi: https://doi.org/10.1038/s41586-023-06083-8.*

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

[22] *Richardson, K. et al. 2023: Earth beyond six of nine planetary boundaries. Science Advances, Vol. 9, Issue 37, doi: 10.1126/sciadv.adh2458.*



Data source: adapted from Steffen, W. et al., 2015; Richardson, K. et al., 2023

Global population and economic growth, particularly in the second half of the 20th century, was 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, fertiliser use and water consumption. The global use of natural resources (biomass, ore and non-ore metals, fossil fuels) has more than tripled since the 1970s, and this growth is continuing. Moreover, the consumption of natural resources to meet the needs of the Earth's current population of 7.7 bil. is well beyond sustainable levels. The rate of natural resource use can be assessed using environmental footprint indicators (also called consumption-based indicators), which link environmental pressures and/or resource use to the final demand for goods and services. Thus, they make it possible to quantify the total environmental pressures resulting from the consumption of a country's population, regardless of where on Earth the production of these goods and services has caused the environmental pressures.

As a consequence of globalisation, for most developed economies, more than half of the environmental impact caused by their consumption does not occur within their borders. **Europe** is highly dependent on resources such as water, land-use products, biomass or other materials extracted or used outside its territory to meet its relatively high level of consumption. This means that much of the environmental impact associated with European consumption is caused in other parts of the world. In order for Europe not to exceed its share within the global planetary boundaries, the European footprint would need to be reduced by about 3 times for nitrogen losses, about 2 times for phosphorus losses, and in the case of land development, a reduction of almost twice as much would be needed[23].

Czechia is a net importer of materials and energy, so the impacts associated with materials extraction, greenhouse gas emissions and land use occur mostly abroad. In addition to the emissions produced in the country (domestic GHG emissions), it is also necessary to include the sum of GHG emissions from the production of goods and services consumed in the country (carbon footprint). The **carbon footprint** of

[23] *EEA/FOEN, 2020: Is Europe Living within the Limits of Our Planet? An assessment of Europe's environmental footprints in relation to planetary boundaries online: https://www.eea.europa.eu/publications/is-europe-living-within-the-planets-limits.*

Czechia has decreased by 33.1% from 1990 to 2018[24] and in 2018 it amounted to 123.7 mil. tonnes of CO_2 equivalent. The carbon footprint per capita (11.6 t CO_2 eq.) is thus approximately double in Czechia compared to the global average (6.2 t CO_2 eq.). The **material footprint**, which quantifies the amount of primary materials (biomass, fossil fuels, metal ores and non-metallic minerals) needed to meet a country's demand, increased by 25.7% in Czechia from 1990 to 2018. In 2018, it was 228.4 mil. tonnes, or 21.5 tonnes per capita (the global average is 12.5 tonnes per capita). The largest contributors to the material footprint in 2018 were non-metallic minerals (107.4 mil. tonnes), fossil fuels (49.6 mil. tonnes) and metal ores (19.1 mil. tonnes). Through its international trade relations, Czechia is also responsible for land use in almost every country in the world. Society uses land in many ways, including for agricultural production, forestry or urban and industrial areas. However, land take and intensive agriculture are limiting the ability of the area to function as part of an ecosystem, with serious impacts such as loss of biodiversity. The sum of land use caused by final consumption in Czechia is called the **land use footprint**. This footprint increased by 4.8% from 1990 to 2018 to 10.5 mil. ha, or 1.0 ha per capita, a value roughly equivalent to the global average (1.1 ha per capita). The disproportion between the ecological footprint (consumption of natural resources) of Czechia and its **biological capacity** (the ability of ecosystems to regenerate resources) causes a national ecological deficit of 130%. According to the **Biodiversity Intactness Index**, 61.5% of biodiversity remains in Czechia. In the context of planetary boundaries, 90% is considered a safe margin of safety for humanity. Crossing this threshold means that life in the area may require significant human intervention to make it habitable and productive.

The long-term outlook of Czechia and Europe as a whole in the field of environment and sustainable development is influenced by factors of various scales. These factors include global megatrends (Box 2), weak signals or emerging trends (Box 3), or wild development cards (Box 4). Czechia's ability to influence the development of these factors is limited, but their impact on its future development is significant.

Box 2

Global megatrend clusters

Global megatrends are large-scale social, economic, political, environmental, or technological changes that are slow to take shape but that, once established, have profound and lasting effects on many, if not most, human activities, processes, and perceptions. The uncertainties of potential future developments were taken into account in 6 thematic clusters:

- A growing, urbanising and migrating global population
- Climate change and global environmental degradation
- Increasing scarcity of and global competition for resources
- Acceleration of technological change
- Power shifts in the global economy and geopolitical landscape
- Diverse values, lifestyles and governance approaches

Data source: EEA, 2020[25]

[24] *Data for 2019–2022 are not available at the time of publication.*

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

Box 3

Weak signals and emerging trends

Weak signals or emerging trends are phenomena that occur at a rapid pace, are not yet clearly observable in the medium to long term and therefore usually allow for alternative interpretations of their potential impact on future developments. Their identification, tracking and subsequent analysis is carried out for different broad areas and selected topics according to the needs of the end user.

The following signals were identified under the theme of land use and the circular economy in 2022.
Signals for land use:

- Agrivoltaics and portable wind turbines – multi-purpose and flexible land use for the energy transition
- Rethinking the relationship between humans and nature – a shift from the current perception of nature to the "rights of nature"
- New food and feed from the oceans – land-independent food production
- Peripheral perspectives on land use – recognition of different practices and cultures in land use management

Signals for the circular economy:

- Energy transition in time
- The reality of the circular economy – challenges to prevailing concepts and thinking in the circular economy
- Rethinking biomaterials – are innovations needed?
- Geopolitics and the circular economy

Data source: ETC, 2022[26]

Box 4

Wild Development Cards

Wild development cards are events with very low probability and low predictability of occurrence, but which, if they occur, will have a very significant impact on future developments, both in the environment and in human society in all its aspects.

This could be, for example, **major technological changes**, **pollinator collapse** or **infectious disease outbreaks**.

Data source: EEA, 2020[27]

[26] *ETC ST, 2022: Emerging issues of policy relevance for land use and circular economy*

[27] *EEA, 2020: https://www.eea.europa.eu/articles/forward-looking-assessments-for-better*

Climate change in Czechia

Temperature and precipitation conditions

On the basis of temperature and precipitation trends, it is possible to analyse and describe climate change in Czechia. Hydrometeorological conditions also affect the state and economic stresses of the environment. They directly contribute to drought and hazardous runoff events, influence the dispersion of pollutants in the air and thus their atmospheric concentrations, affect the formation of ground-level ozone and the quantity and quality of surface and groundwater. In the economic sectors, temperature and precipitation conditions affect mainly agriculture, energy and water management. The increasing temperature extremes during the summer season pose significant risks to human health.

Key question

What were the temperature and precipitation conditions in Czechia in 2022?

Key messages

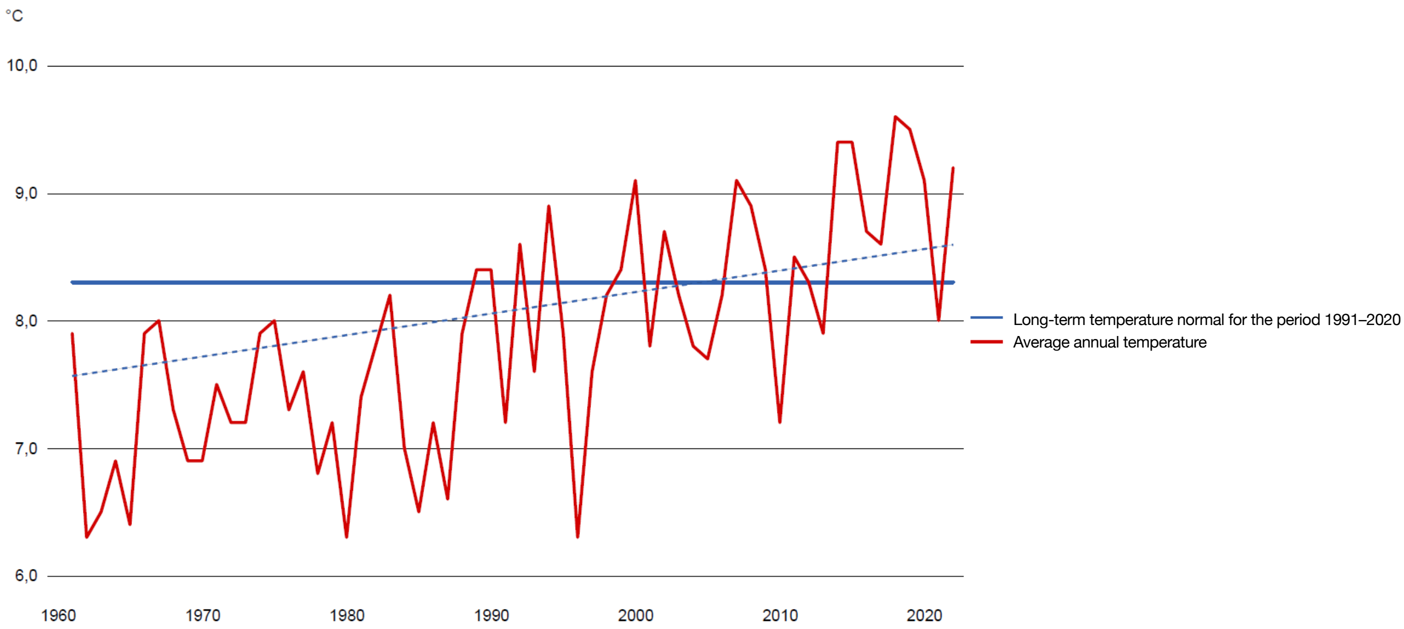
✓	The year 2022 was evaluated as normal in terms of precipitation, although the annual rainfall was only 93% of the 1991–2020 normal.
✗	The year 2022 was above normal in temperature and the 5th warmest since 1961. The annual number of summer and tropical days exceeded the normal range, with more than 30 tropical days recorded in the hottest regions of Czechia in 2022. A heatwave in 2022 occurred in Czechia on a total of 28 days, 13 days more than in the previous year.

Anomaly of average temperatures from the climatological normal

The year 2022 was **above normal** in Czechia, with the average annual air temperature (9.2 °C) 0.9 °C higher than the 1991–2020 normal. The year was the fifth warmest since 1961, with warmer temperatures occurring in 2014 and 2015 (average annual temperature 9.4 °C), 2019 (9.5 °C) and 2018 (9.6 °C). The growth of the average annual temperature in Czechia is statistically significant in the 1961–2022 period and according to the linear trend it amounts to +0.34 °C per decade. Of the ten warmest years since 1961, nine occurred in the period since 2000 (the exception being 1994 at number 9 on the list of warmest years), and the five warmest years of this period were not recorded until after 2010 (Chart 1).

Chart 1

Average annual air temperature in Czechia and normal annual average temperature 1991–2020 [°C], 1961–2022

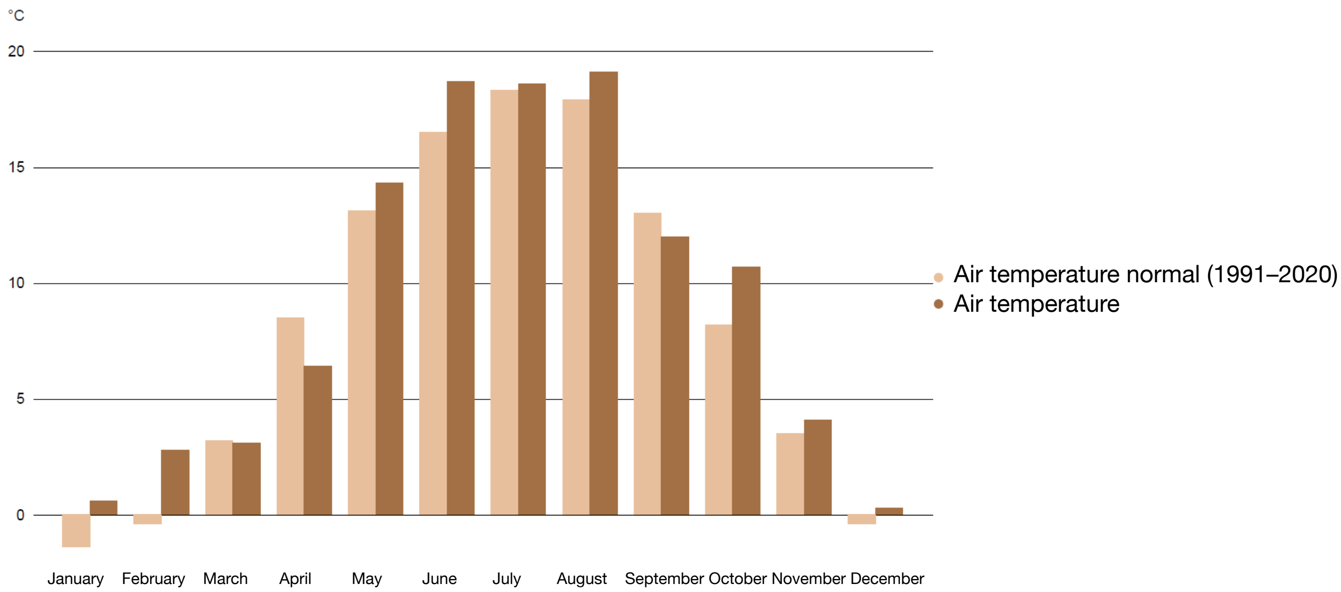


Data source: CHMI

In 2022, there were two months of strongly above-normal temperatures, June with an average air temperature of 18.7 °C (anomaly +2.2 °C) and October with an average temperature of 10.7 °C (anomaly +2.5 °C), Chart 2. The winter months of January and February (anomaly +2.0 and +3.2 °C) and May and August (anomaly +1.2 °C) were assessed as above-normal. April was a very cold month, with an average temperature of 6.4 °C (anomaly -2.1 °C) and according to the temperature extremes classification, it was rated as a strongly subnormal month. The other months were rated as temperature normal.

Chart 2

Average monthly air temperature in Czechia (territorial average) and normal average monthly temperature 1991–2020 [°C], 2022



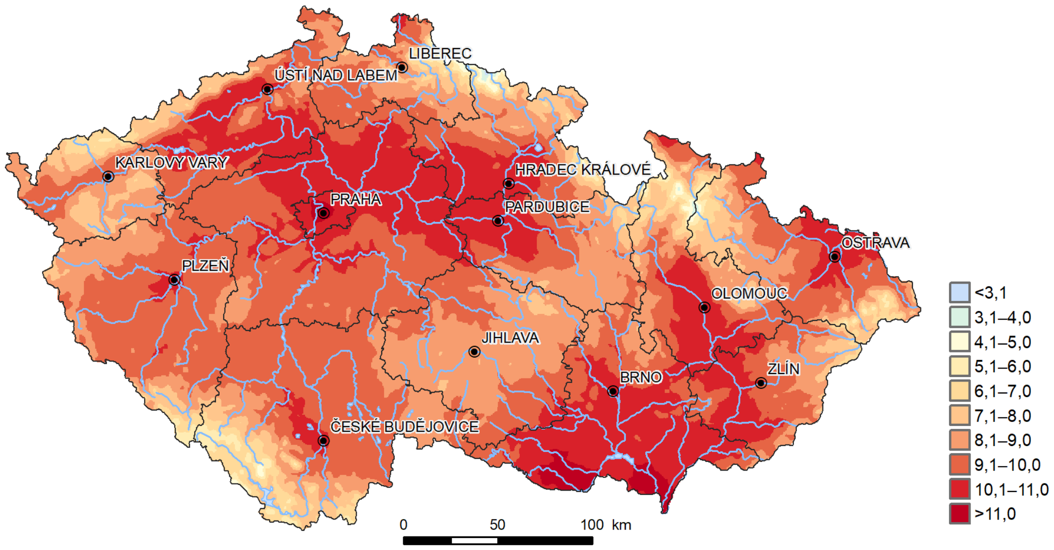
Data source: CHMI

In terms of **seasonal mean temperatures**, the greatest positive anomaly from the 1991–2020 normal was recorded in winter. The average air temperature for the 2021/2022 winter season, i.e. for the months of December 2021, January and February 2022 (1.3 °C) was 2.0 °C above normal. The turn of the year was particularly warm, as well as the period from 23. 1 to 24. 2, when daily average temperatures remained well above normal. The summer was also above normal (anomaly +1.2 °C), mainly due to a very warm June. The highest daily maximum temperature in 2022 was measured on 19. 6. 2022, when the temperature at the Husinec-Rež station rose to 39.0 °C. Together, spring and autumn were normal, with temperatures significantly fluctuating above and below normal during these periods.

The **distribution of average annual temperature** in Czechia is mainly determined by altitude (Fig. 1). Other influences are the degree of continentality of the climate, which increases from west to east and is manifested by warmer summers in the east, mainly in the South Moravian Region, and anthropogenic warming in urban agglomerations, the so-called urban heat islands. The warmest region in 2022 was the South Moravian Region with an annual average temperature of 10.2 °C (anomaly +0.8 °C), the coldest was the Karlovy Vary Region (annual average temperature 8.3 °C, anomaly +1.0 °C). According to the data from the CHMI station network, the highest average annual temperature in 2022 was recorded in the centre of Prague (Prague-Klementinum 12.6 °C) and in southern Moravia (Dyjákovice 11.3 °C). The lowest average annual temperature was in the Krkonoše Mountains (Luční bouda 2.7 °C).

<u>**Fig. 1**</u>

Annual average air temperature in Czechia [°C], 2022

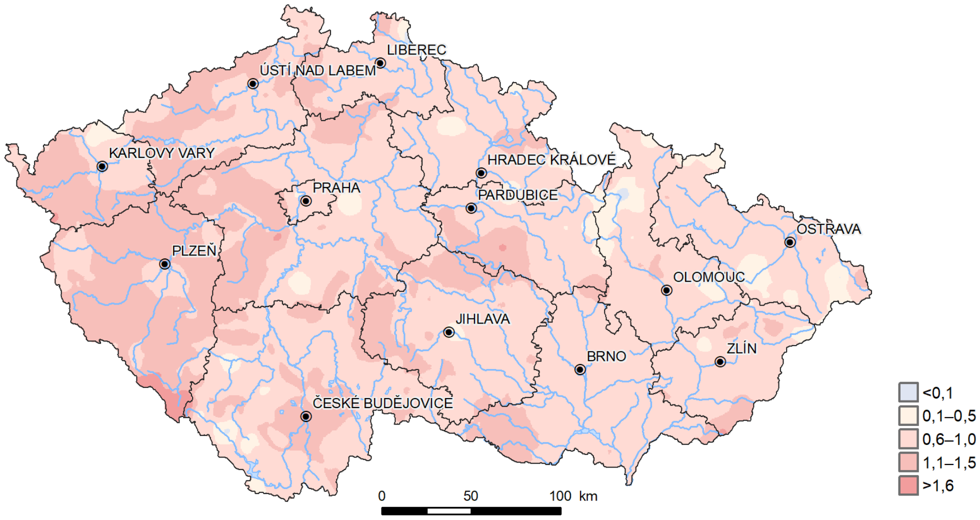


Data source: CHMI

The annual average air temperature in 2022 exceeded the 1991–2020 normal across Czechia (Fig. 2). The highest anomalies were recorded in the south-western part of the territory, in the Pilsen region the annual average temperature 9.1 °C was 1.1 °C higher than the long-term normal. The Moravian-Silesian region had the lowest positive anomaly of the average annual temperature (+0.6 °C).

Fig. 2

Anomaly of the average annual air temperature in Czechia from the 1991–2020 normal [°C], 2022



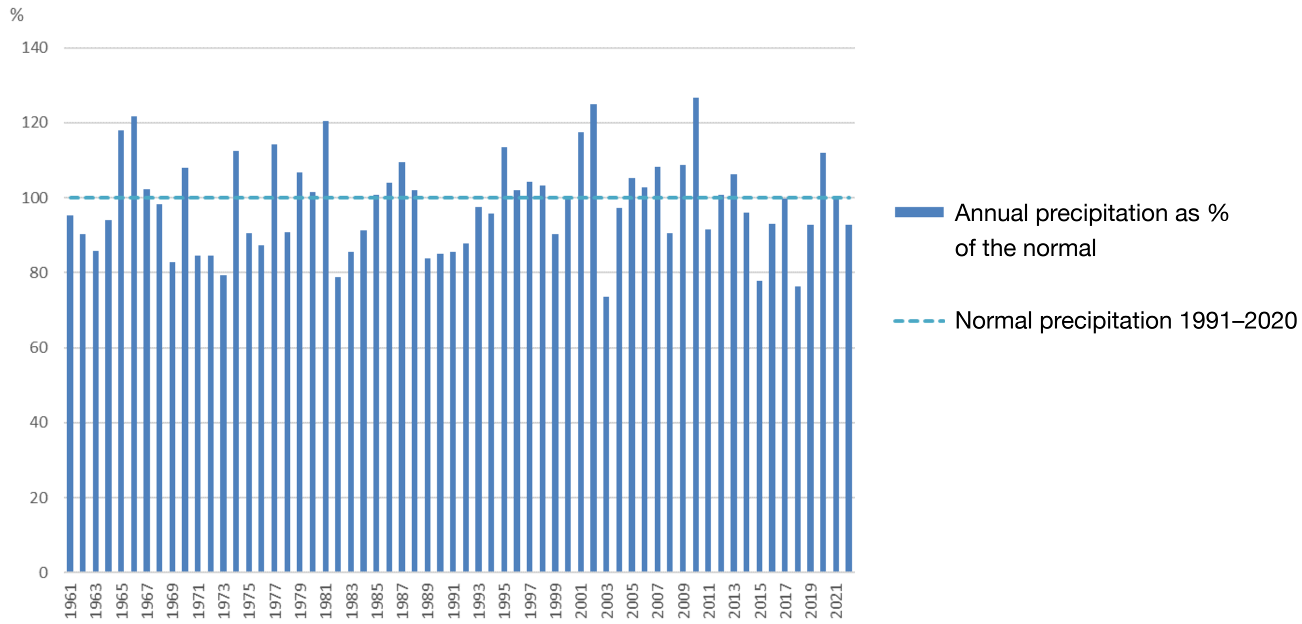
Data source: CHMI

Precipitation compared to the long-term normal

Precipitation totals in Czechia are highly variable in time and space. There is most precipitation in the summer months, mainly due to storm situations, while the least precipitation is in winter. A gradual change in the precipitation regime is under way, with a statistically significant increase in the number of days with higher precipitation totals, which are mainly caused by convective processes in the summer months. However, this precipitation activity is territorially very limited and so, despite locally high precipitation totals, parts of the territory may suffer from a lack of precipitation in the same period. Although the precipitation regime in Czechia is changing, annual precipitation totals fluctuate and do not show any statistically significant trend (Chart 3).

Chart 3

Annual precipitation as % of the 1991–2020 normal in Czechia [%], 1961–2022



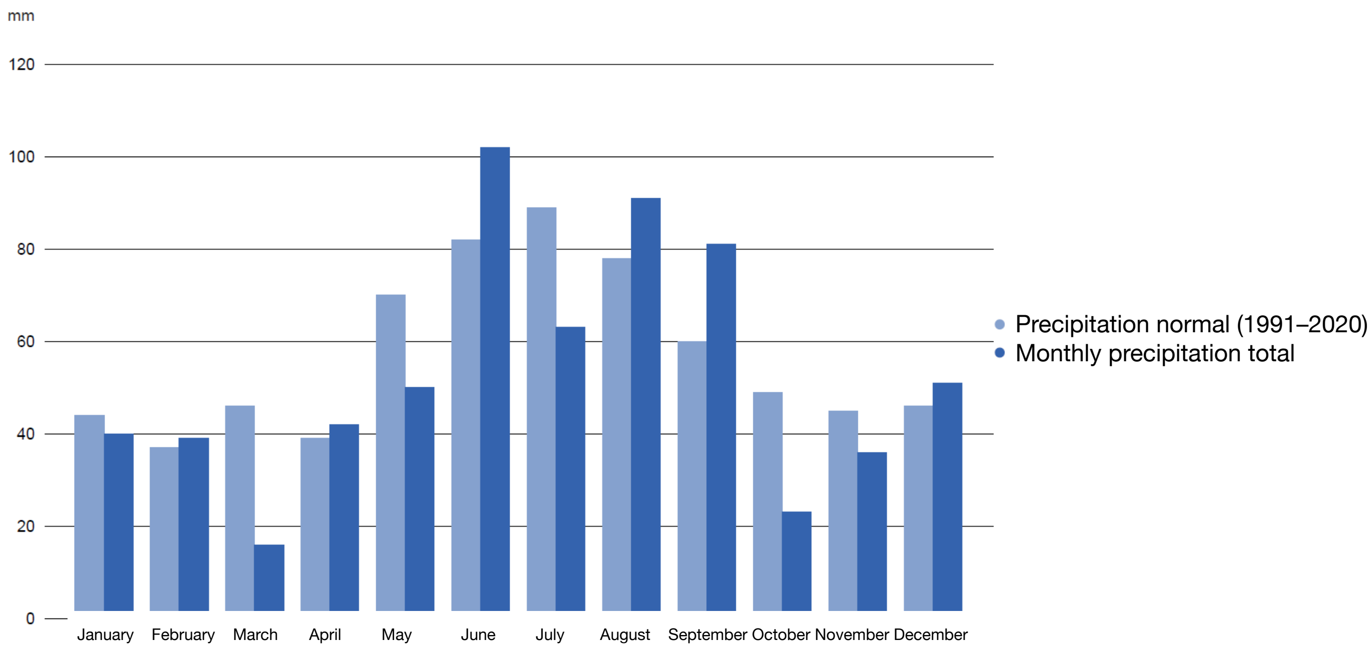
Data source: CHMI

The year 2022 was **normal** in Czechia in terms of precipitation, with an average annual precipitation of 634 mm, which is 93% of the 1991–2020 normal. Annual precipitation in 2022 was the same as in 2019 and the fourth lowest in the last ten years. The driest year during this period was 2018, with 522 mm of precipitation, and 2003 was even drier (504 mm of rain), which was the driest year since 1961.

There were only 4 months during the year that were not rated as normal precipitation (Chart 4). **Above normal precipitation** was recorded in June with 102 mm (124% of normal) and September with 81 mm (135% of normal). On the other hand, March was **very dry**, with an average of only 16 mm of precipitation (35% of normal), and was rated as significantly below normal. It was the third driest March since 1961. October was also **below normal** with a monthly **precipitation** of 23 mm (47% of normal).

Chart 4

Monthly precipitation in Czechia (territorial average) and normal monthly precipitation 1991–2020 [mm], 2022



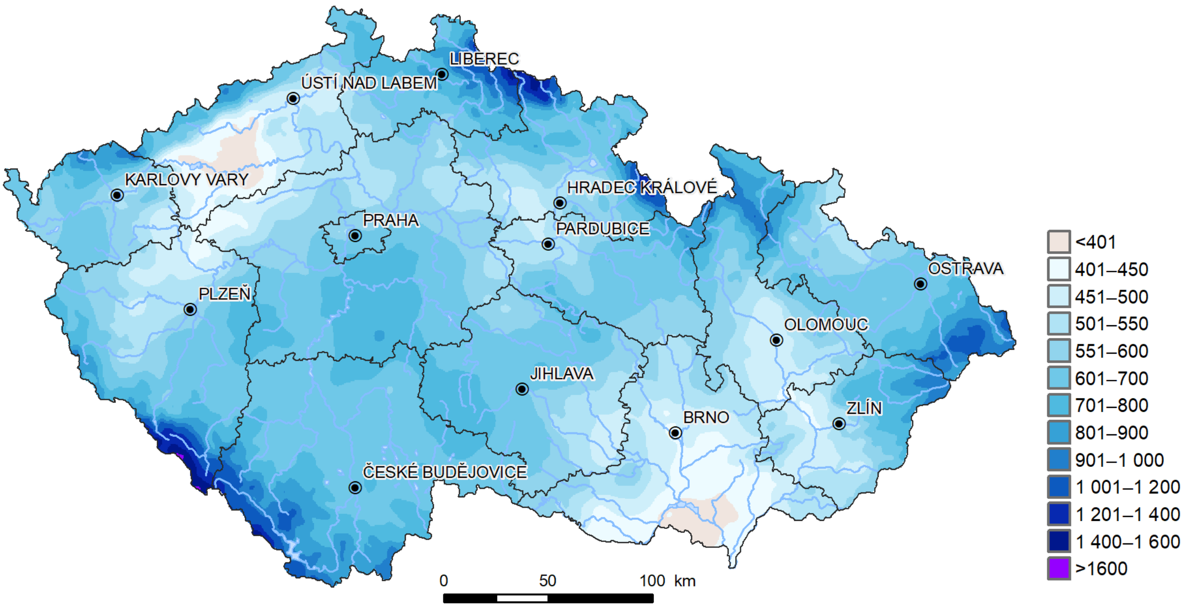
Data source: CHMI

High daily precipitation totals that triggered runoff response on watercourses occurred in the last decade of June. The highest values of daily (24-hour) precipitation were recorded on 24 June at the stations Praha-Komořany (109.7 mm) and Jíloviště in the district of Praha-západ (104.5 mm) and on 27 June at Katovice station in the Strakonice district (187.5 mm). It rained more heavily also on the 30 July, when the daily precipitation exceeded 50 mm at 10 stations of the CHMI, mostly in the eastern Czech Republic in the Beskydy region. Additional heavy precipitation associated with storm activity occurred in the second half of August, with daily precipitation totals greater than 100 mm recorded on 19 August by the station Holoubkov, Medový Újezd in the Rokycany district (102.4 mm) and on 20 August by the station Zdobnice in the Rychnov nad Kněžnou district (110.5 mm).

The average precipitation in **Bohemia** in 2022 was 656 mm (96% of normal), while in **Moravia and Silesia** it was 591 mm (85% of normal). Precipitation increases with altitude and is amplified by wind (Fig. 3). In the regional breakdown, the Liberec region had the highest precipitation in 2022 (753 mm), but only 89% of normal precipitation fell there, while the driest region was Ústí nad Labem with an annual precipitation of 524 mm (82% of normal), which reflects the leeward effect of the Ore Mountains against the prevailing westward flow. The highest annual precipitation totals in 2022 were recorded at Prášily station in Šumava (1,578.2 mm) and Labská bouda station in Krkonoše (1,530.8 mm), the lowest total was measured at Hřivice station in the Louny district (356.0 mm).

Fig. 3

Annual precipitation in Czechia [mm], 2022

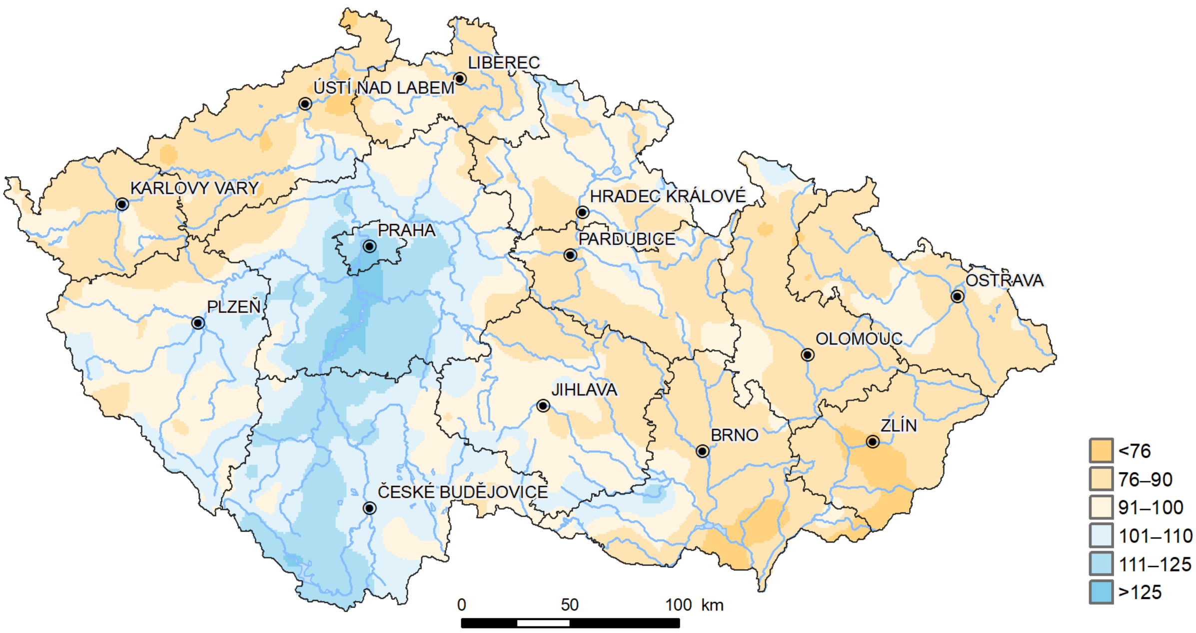


Data source: CHMI

Precipitation totals in most of Czechia did not reach the 1991–2020 normal in 2022, with the exception of a belt stretching from central Bohemia to the south and southwest (Fig. 4). The highest precipitation compared to normal was in the South Bohemian region (740 mm, i.e. 107% of normal) and Central Bohemia, including the city of Prague (106%). The lowest precipitation compared to normal was in the Zlín Region (612 mm, i.e. 79% of normal).

Fig. 4

Precipitation as % of the 1991–2020 normal in Czechia [%], 2022



Data source: CHMI

Number of summer days, tropical days and tropical nights

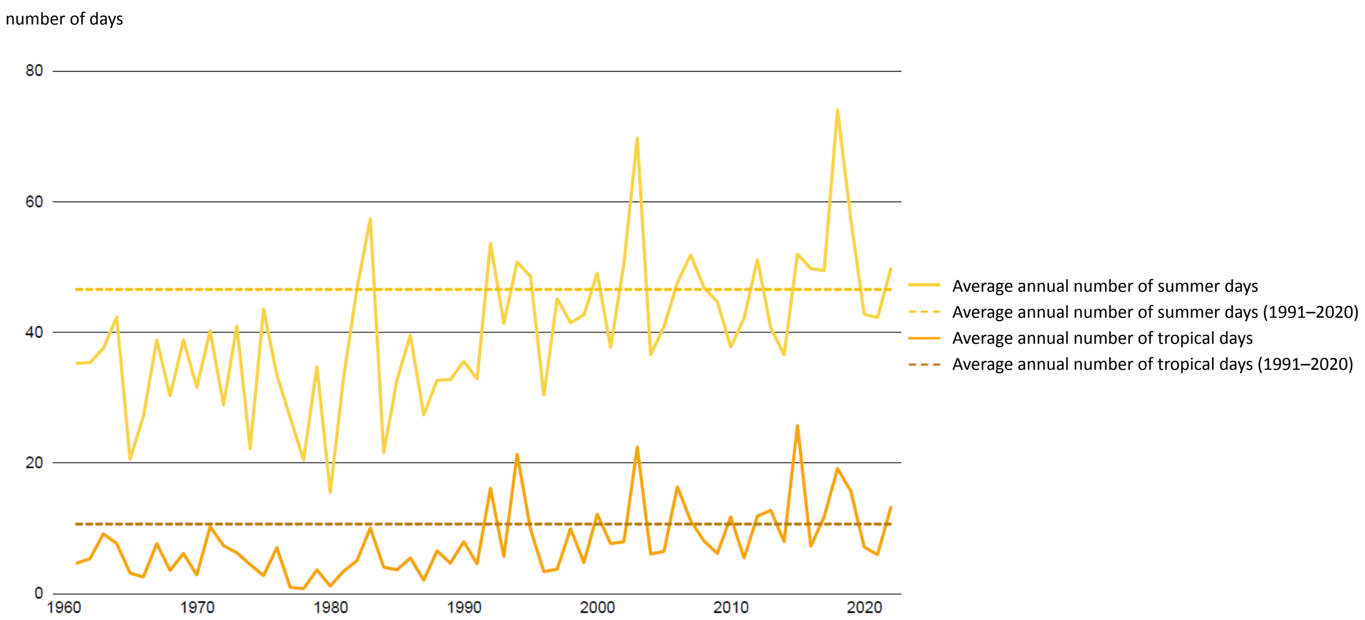
Among the climatological indices that allow us to monitor climate change are the number of so-called characteristic days. The occurrence of **summer days** (maximum daily temperature of 25 °C or more), **tropical days** (with a temperature of 30 °C or more) and **tropical nights** (when the temperature does not fall below 20 °C) describes the temperature conditions of the summer season and its temperature extremes. Tropical days are considered an indicator of the potential health effects of hot weather.

In 2022, Czechia experienced an average of 50 summer days (106.9% of 1991–2020 normal) and 13 tropical days (124.5% of normal), Chart 5. The highest number of summer days was recorded in the exceptionally warm year 2018 (74 days), while the highest number of tropical days (26) was registered in 2015.

The **annual number of summer and tropical days** is statistically significantly increasing, especially after 2000. According to the linear trend of the number of summer days in the period 1961–2022, the annual number of summer days is increasing at a rate of approximately 3.5 days per 10 years, while the number of tropical days is increasing at a rate of 1.5 days per 10 years. Comparing the decade 1981–1990, when the average number of tropical days was 5.2, and the decade 2011–2020, with an average of 12.4 tropical days per year, the number of tropical days has more than doubled in 30 years.

<u>Chart 5</u>

Number of summer and tropical days per year in Czechia (territorial average) [number of days], 1961–2022



Data source: CHMI

In 2022, most **summer and tropical days** were recorded at stations in the Lower Poohří and South Moravia. Doksany station (Litoměřice district) registered 90 summer days and 35 tropical days, Strážnice station (Hodonín district) 86 summer days and 32 tropical days.

Tropical nights, when the temperature does not fall below 20 °C, are rare in Czechia and are mainly associated with urban areas. In view of this fact, the territorial average of their occurrence is distorting, in 2022 it was only 0.6 tropical nights per year for the whole territory of Czechia; the normal for the 1991–2020 period is also 0.6 tropical nights per year. The most tropical nights in 2022 were recorded at the Prague-Klementinum station (9) in the centre of Prague. In recent years, the incidence of tropical nights outside urban areas has been increasing, with the Hošťálková-Maruška station in the Hostýn Hills (Zlín Region), located at an altitude of 664 m, recording a total of 7 tropical nights in 2022.

Total duration of heat waves

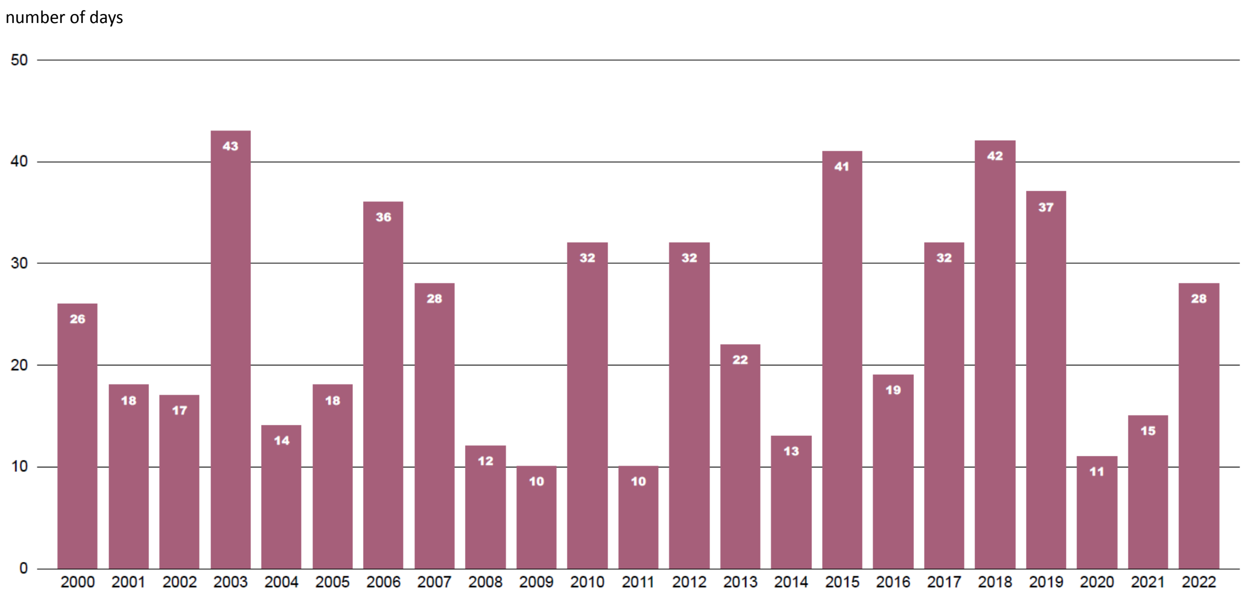
Extremely hot weather has, in the conditions in Czechia, the most serious potential health impacts of all climate change manifestations. Heat waves place a significant burden on the human body, especially for people suffering from cardiovascular diseases, older people, and people with impaired thermoregulation 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 (1991–2020) by more than 5 °C.

The total **duration of heat waves** in Czechia fluctuated in the 2000–2022 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 in the summer. The highest number of heat wave days[28] (i.e. when a heatwave occurred at least at one station in Czechia) during this period was registered in 2018 and 2015, when the summer was extremely warm and dry and heat waves were recorded on 42 and 41 days, respectively. In 2022, the total duration of heat waves was 28 days, 13 days more than in 2021.

Chart 6

Number of heat wave days per year in Czechia [number of days], 2000–2022



Data source: CHMI

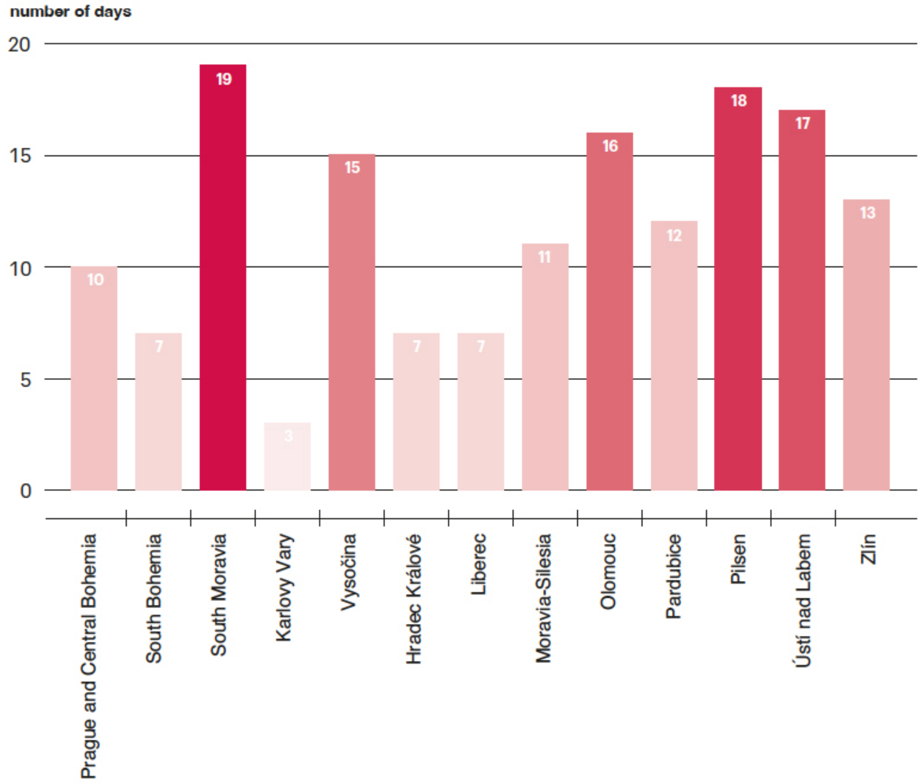
In a regional breakdown, the greatest total duration of heat waves in 2022 was recorded in the South Moravian and Pilsen regions (Chart 7). Of the individual stations, Plzeň-Bolevec (18 days), Doksany (17) and Strážnice (16) recorded the highest number of heat wave days in 2022.

---

[28] *It is not possible to calculate territorial averages for heat waves because they do not occur at higher altitudes and the data would be distorted. The occurrence of a heat wave at at least one station in a given region is considered. The cumulative occurrence of heat waves at a single location is reported only by station data.*

Chart 7

Duration of heat waves in the regions of Czechia [number of days], 2022



Data source: CHMI

Number of frosty, icy and arctic days

The occurrence of frosty[29], icy[30] and arctic[31] days characterizes the temperature conditions of the winter season and their development is an indicator of climate change. The increase in temperatures in the winter season, indicated by the decreasing numbers of frosty and icy days, has a negative effect on vegetation and ecosystems, causing disturbance of vegetation rest season, an increased incidence of forest and agricultural pests in the upcoming growing season, and a higher risk of drought due to lower water reserves in the snow cover.

The annual number of **frosty and icy days** in Czechia declined between 1961 and 2022, with a linear trend of 3.3 frosty days and 2.6 icy days per 10 years (Chart 8). In the last ten-year period 2011–2020, Czechia experienced an average of 104 frosty days per year (93.8% of the 1991–2020 normal) and 26 ice days (65.7% of the normal).

In 2022, a territorial average of 21 icy days (65.7% of normal) and 106 frosty days (96.0% of normal) were recorded. The fewest icy days occurred in 2020 (12 days) and 2015 (13 days), while the fewest frosty days occurred in 2014 (82 days). The highest numbers of frosty days occur in the so-called frost basins, where frost occurs even outside the winter season due to inverse temperature layering in the night and morning hours. In 2022, the highest number of frosty days was recorded by the stations Kořenov-Jizerka in the Jizera Mountains (202 frosty days) and Horská Kvilda in Šumava (202 frosty days). Most icy days are recorded on mountain ridges, namely the ridges of the Krkonoše Mountains (Luční bouda – 107 icy days in 2022) and the Hrubý Jeseník Mountains (Šerák – 97 icy days).

---

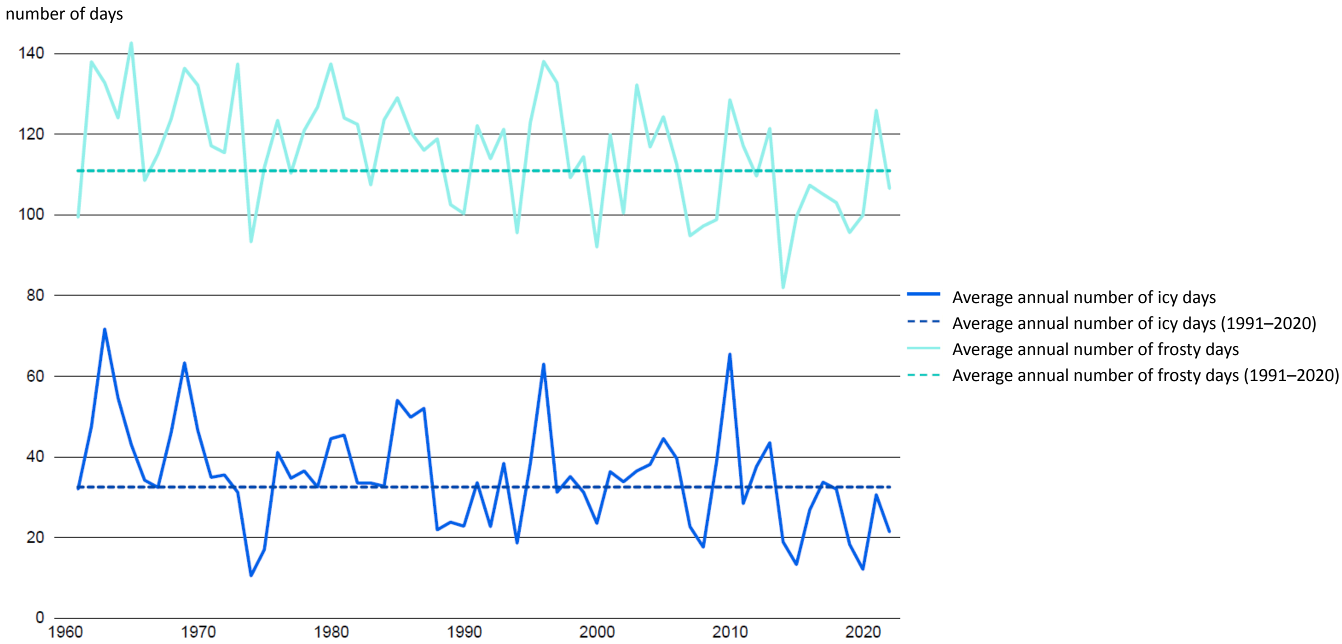
[29] TMI (minimum daily air temperature) < 0 °C

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

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

Chart 8

Number of frosty and icy days per year in Czechia (territorial average) [number of days], 1961–2022



Data source: CHMI

The occurrence of **arctic days** is quite unique in the Central European climate environment and it is not possible to identify any trend. In 2022, according to the territorial average, there were no arctic days in Czechia; the normal annual number of arctic days in the period 1991–2020 is 0.6 days per year. Only the mountain stations Luční bouda and Šerák recorded one arctic day in 2022.

Detailed visualisations and data

https://www.envirometr.cz/data

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

Drought is one of the most serious phenomena associated with climate change and can have major impacts on national economies and populations. Damage is also caused by flood situations, with the changing precipitation regime increasing the occurrence of so-called flash floods. This chapter describes the development of climatic and soil drought in Czechia in 2022 and its impact on run-off conditions and groundwater levels.

Key question

Was there any drought or flooding in the given year? What were the groundwater levels and run-off conditions in that year?

Key messages

~	According to the SPEI-6 index, Czechia as a whole experienced only mild drought in the 2022 growing season. Climatic and soil drought almost did not affect the South Bohemian Region.
✕	Compared to the previous two years 2020 and 2021, the climatic and soil drought parameters in 2022 have worsened significantly. The annual cumulative moisture balance was only 42.4% of the 1981–2010 normal, and more than a fifth of Czechia experienced significant soil drought below 10% of the AWC for a total of 28 days. The average growing season fire danger index in 2022 was the second highest since 2000. The highest risk of fires was in north-west Bohemia, in Polabí and in southern Moravia. In 2022, hydrological drought also became apparent. The average annual flow at the main profiles monitored in 2022 was less than 90% of the long-term average for the period 1991–2020.

Duration of climatological drought periods

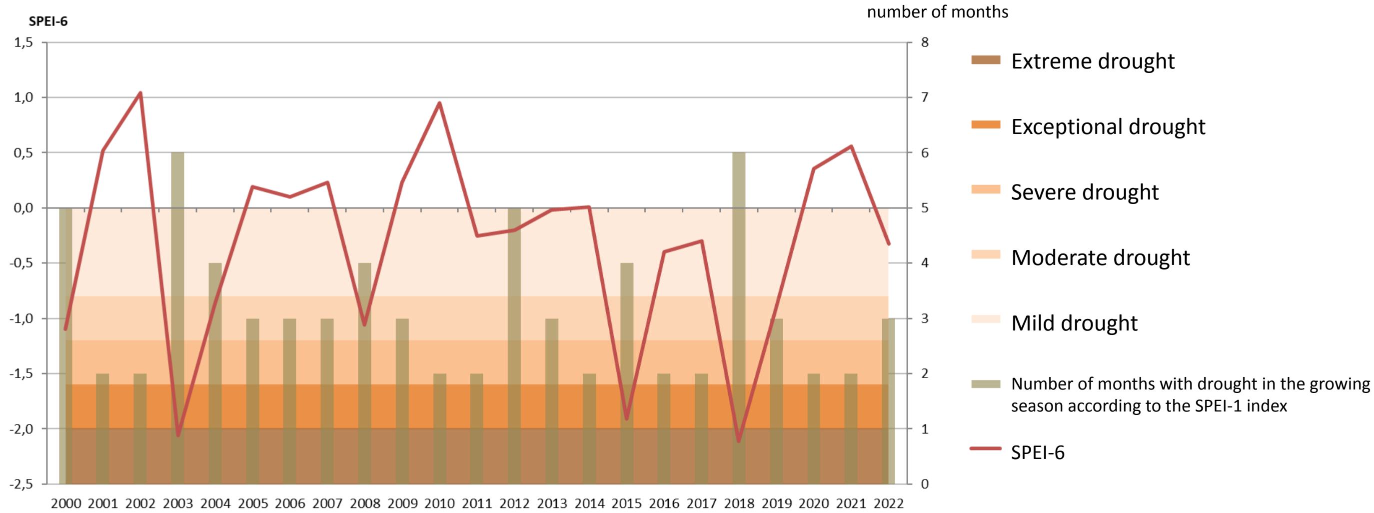
Climatological drought represents meteorological conditions (especially precipitation, air temperature and air humidity) that are unusual for the territory and lead to a lack of water in the territory, which can subsequently cause other forms of drought (hydrological, soil). Climatological drought must 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 average value of the **SPEI-6 index**[32] for the growing season (April–September) in Czechia during the 2000–2022 period fluctuated, with no trend (Chart 9). The driest years since 2000 were 2003 and 2018, when the SPEI-6 index for the whole Czech Republic indicated extreme drought. On the other hand, in the last 10 years, 2020 and 2021, when the SPEI-6 index was positive, were the years without an area-wide occurrence of climatic drought in the growing season. In terms of the overall average, Czechia experienced only a **mild drought** in 2022, with a SPEI-6 value of -0.32. According to the **SPEI-1**, drought in the growing season occurred in May, June and July. In all these months it was a weak drought, with the lowest SPEI-1 value in July at -0.78.

[32] *The Standardized Precipitation Evapotranspiration Index (SPEI) is an internationally used drought index that assesses the state and evolution of precipitation-evapotranspiration conditions. The calculation uses a standardization of the difference between precipitation and potential evapotranspiration for the period since 1961 using a statistical probability distribution. The most commonly used are the six-month accumulation of the SPEI-6 and the one-month accumulation of the SPEI-1.*

Chart 9

SPEI-6 index for the growing season (April–September), occurrence of individual drought categories according to this index and the number of months with climatic drought according to the SPEI-1 index in Czechia [SPEI-6, number of months], 2000–2022

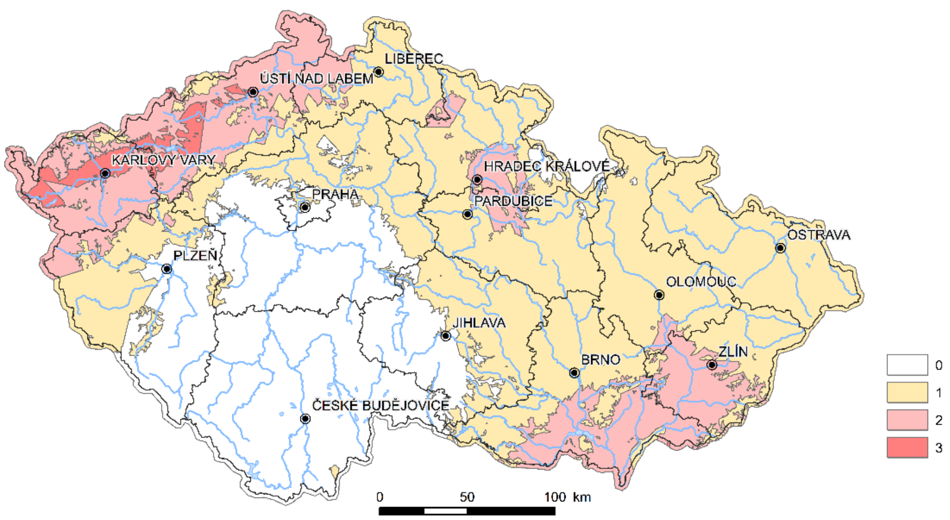


Data source: CHMI

According to the SPEI-6 index, the western and north-western parts of Bohemia as well as southern Moravia were most affected by drought in the 2022 growing season (Fig. 5). Moderate drought was recorded in these areas, and severe drought was recorded in the Podkrušnohorská basins. In other parts of Czechia there was only a slight drought; in the southern part of Bohemia with above-average precipitation there was no drought at all.

Fig. 5

SPEI-6 index for the growing season (April–September) in Czechia [SPEI-6], 2022

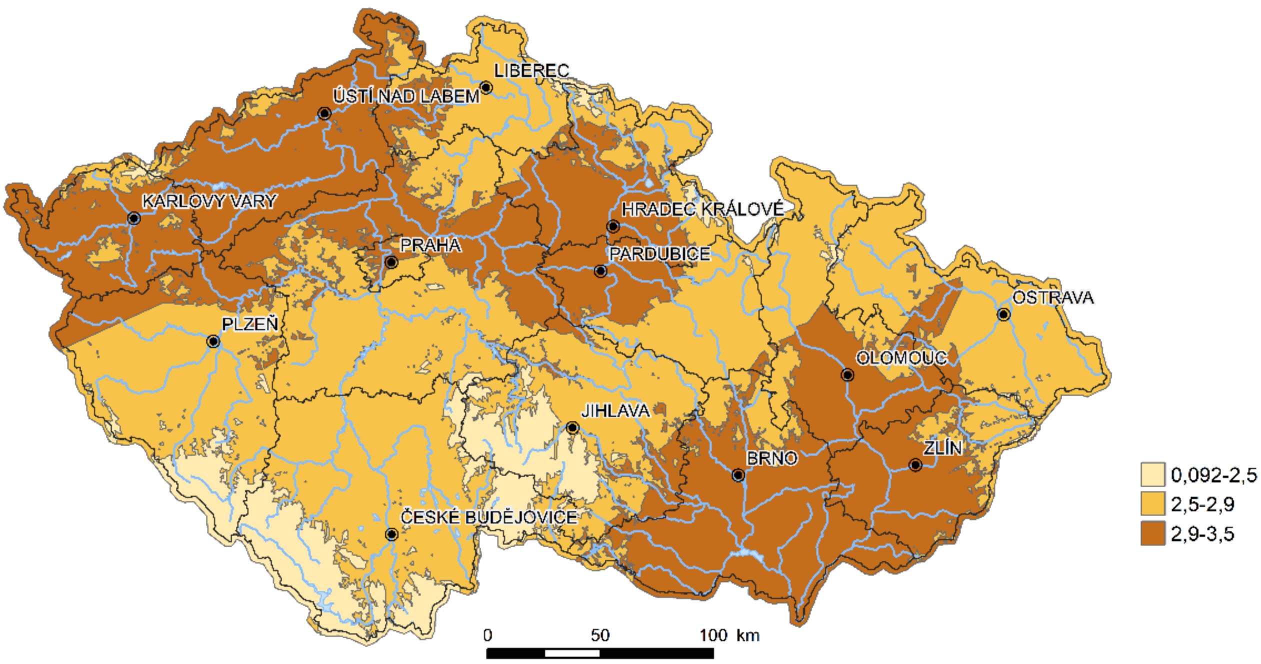


Data source: CHMI

The average **fire hazard index** (FHI) for the 2022 growing season (April–September) was 2.8, indicating a mild to moderate risk of wildfire. The average FHI in 2022 exceeded the 1981–2010 long-term average by 1.1 and was the second highest (after 2018) since 2000. According to FHI-1 values, there was an increased risk of wildfire In each month of the 2022 growing season (FHI-1 values above the 65th percentile of normal season values) in May, June, and July. Regionally, according to the FHI (Fig. 6), the highest risk of fires was almost in the whole of north-west Bohemia, in Polabí, southern Moravia and Haná.

Fig. 6

Fire hazard index (FHI), average value for the growing season (April–September) in Czechia, 2022



Data source: CHMI

Moisture balance of grassland

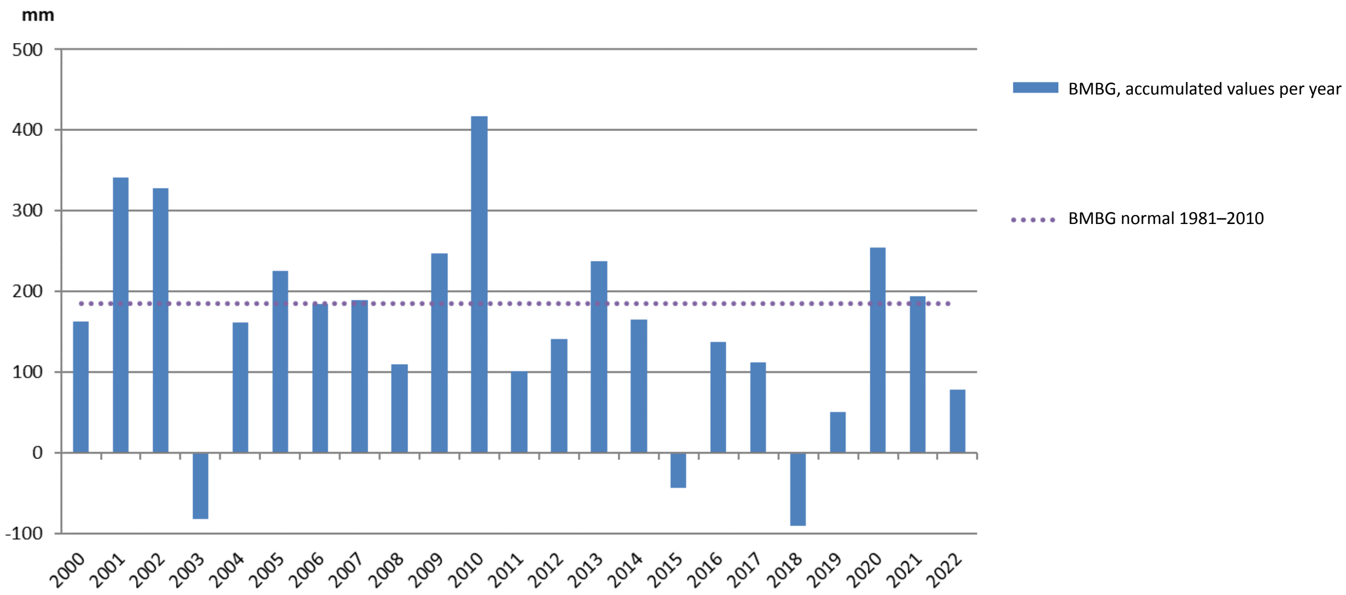
The **basic moisture balance of grassland** (BMBG) is the difference between precipitation and potential evapotranspiration. Positive BMBG is a prerequisite for sufficient soil moisture, when BMBG falls to negative values, climatic drought occurs, causing a decrease in soil moisture with consequent effects on agricultural production, water management and the risk of vegetation fires.

The **annual accumulated BMGB** in Czechia in the 2000–2022 period fluctuated according to the temperature and precipitation conditions of the given years, while the lowest (with a negative annual total) were in the very dry years 2003 and 2018. In these years, the significantly negative moisture balance also persisted for the longest period of time in a significant part of the territory. Specifically in 2018, a BMBG below -200 mm on more than 20% of the territory occurred for 161 days, and on at least 50% of the territory for 8 days. The flood years 2002 and 2010 belonged to very wet years with significantly above average moisture balance.

The **annual accumulated** BMBG in Czechia in 2022 was 78.7 mm, which is only 42.4% of the 1981–2010 normal (Chart 10). Compared to the previous years 2021 and 2020, when the moisture balance values were around normal, the moisture balance in 2022 was more negative due to temperature and precipitation conditions. Negative values of moisture balance below -200 mm occurred in more than 20% of Czechia for 8 days, values below -150 mm for 140 days.

<u>Chart 10</u>

Annual accumulated basic moisture balance of grassland and normal basic moisture balance in Czechia for the period 1981–2010 [mm], 2000–2022

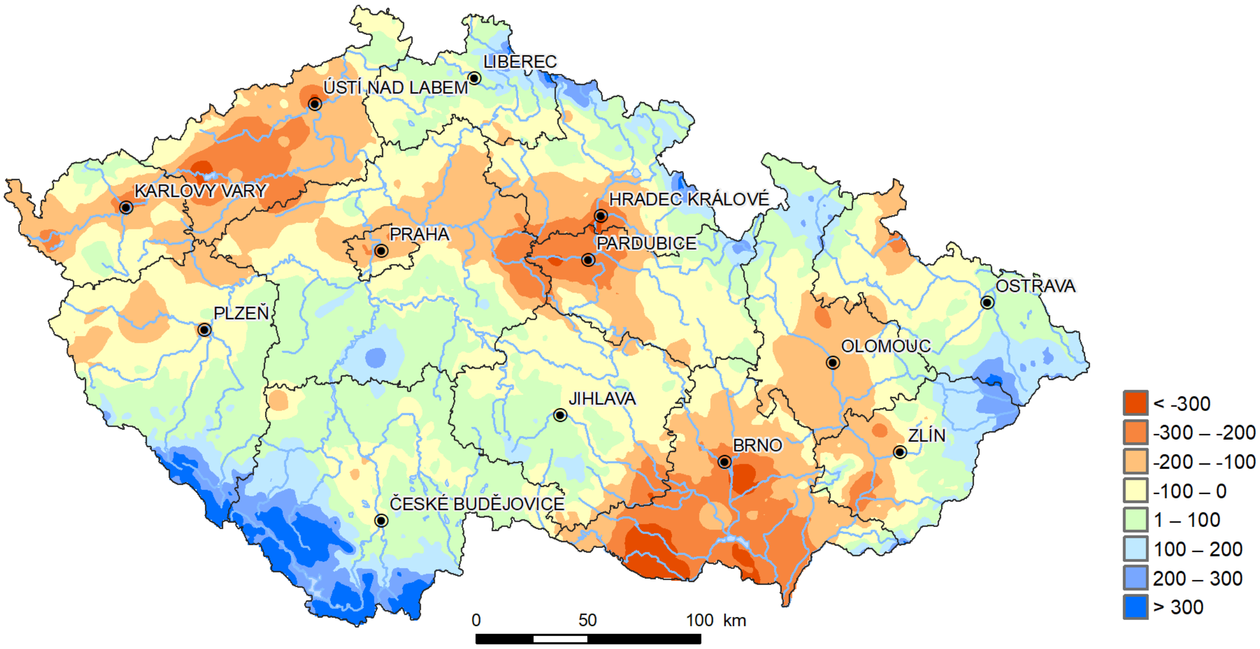


Data source: CHMI

A slight **decrease in moisture balance values** occurred due to lower precipitation and rising temperatures already at the end of February. This deficit of moisture balance further deepened and at the end of May the moisture balance was below -50 mm in most of Czechia. In the second half of June, due to precipitation, the moisture balance improved slightly in some areas, e.g. in Polabí and Poohří and also in Vysočina, but with the onset of warmer temperatures at the beginning of July, moisture balance values dropped significantly again. The exception was southern and south-western Bohemia, including Šumava, where the moisture balance remained significantly positive due to precipitation. Until mid-August, moisture balance values continued to decrease and in more than 60% of Czechia the values were below -100 mm. Values of moisture balance below -200 mm were observed in this period in Polabí, Poohří and Olomouc, in southern Moravia the moisture balance even dropped below -300 mm. These values were more than 100 mm below the long-term average. The unusual drought also affected mountain areas, with moisture balance values in the Ore Mountains, the Jizera Mountains and the Giant Mountains up to 200 mm lower than the long-term average at the end of the summer. By the end of the year, there was only a very slight increase in the moisture balance values, especially in the second half of September, but the unfavourable situation persisted especially in southern Moravia.

Fig. 7

Basic moisture balance of precipitation and potential evapotranspiration of grassland in Czechia [mm] for the growing season 1. 4. – 30. 9. 2022



Data source: CHMI

In total, for the whole **growing season of 2022** (April–September), a significantly negative moisture balance was observed in the northwestern part of Bohemia, in the central Polabí region, in southern Moravia and in Haná (Fig. 7), where the accumulated moisture balance values were at times lower than -200 mm. Positive values of the moisture balance were recorded mainly in Šumava and in the northern border mountains, however, with the exception of the Ore Mountains.

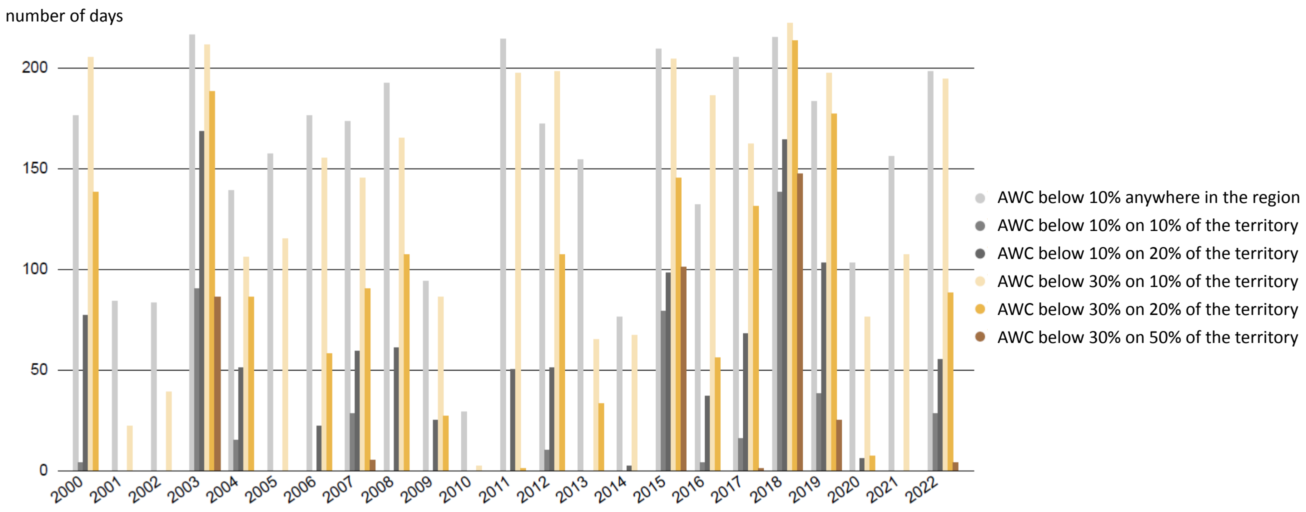
Available water capacity of the soil

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

Longer-term trends in the incidence of soil drought from 2000–2022 were based on the evolution of the moisture balance, with the most pronounced and widespread soil drought occurring in 2003 and 2018 (Chart 11). In 2022, Czechia experienced a more significant soil drought, unlike the previous years 2020 and 2021. Soil moisture values below 30% of the AWC occurred in at least 20% of Czechia on a total of 88 days, and significant soil drought below 10% of the AWC persisted in more than a fifth of Czechia on a total of 28 days. The worst situation was in the South Moravian Region, where a significant soil drought with soil moisture values below 10% of the AWC persisted on more than 20% of the territory for 59 days and on at least 10% of the territory for 100 days. Soil drought was almost non-existent in the South Bohemian Region in 2022.

Chart 11

Number of days with water reserves in the profile of medium-heavy soil below 30% of the available watercapacity (AWC) and below 10% of AWC in Czechia according to territorial criteria [number of days] 2000–2022

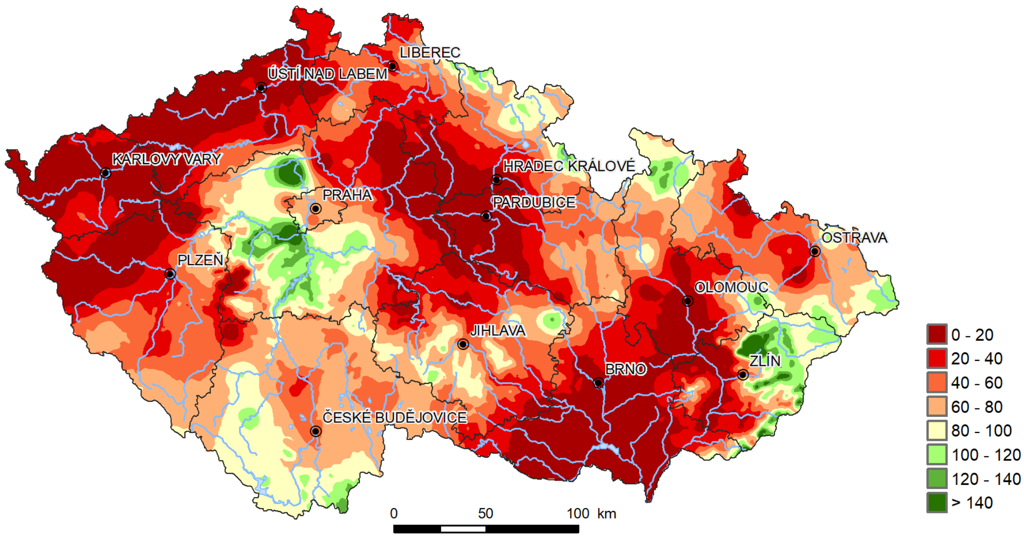


Data source: CHMI

The development of available water capacity of the soil in 2022 reflected the evolution of the moisture balance conditions with a decrease in soil moisture from the beginning of March. Water reserves in the soil dropped dramatically, especially in southern Moravia, Polabí and Poohří until the second half of June. After a temporary improvement due to heavier rainfall at the end of June and the first half of July, the decline in soil moisture continued and by mid-August, more than 80% of Czechia had an available water capacity of the soil of 50% or less. The areas with the lowest values below 10% of the AWC were South Moravia, East Bohemia and Polabí, the Ústí and Karlovy Vary regions and the northern half of the Pilsen region (Fig. 8). Soil moisture reserves in these areas were below 25% of the 1961–2010 long-term average. Subsequently, precipitation led to a significant improvement in soil moisture reserves and in most of Czechia the values continued to increase after the end of the summer. At the end of October, values below 50% of the AWC remained only in South Moravia, Haná, Polabí and Ústí nad Labem.

Fig. 8

Soil moisture reserves (AWC = 170 mm/m) in Czechia [% AWC], current state of the modelled value as of 15 August 2022



Data source: CHMI

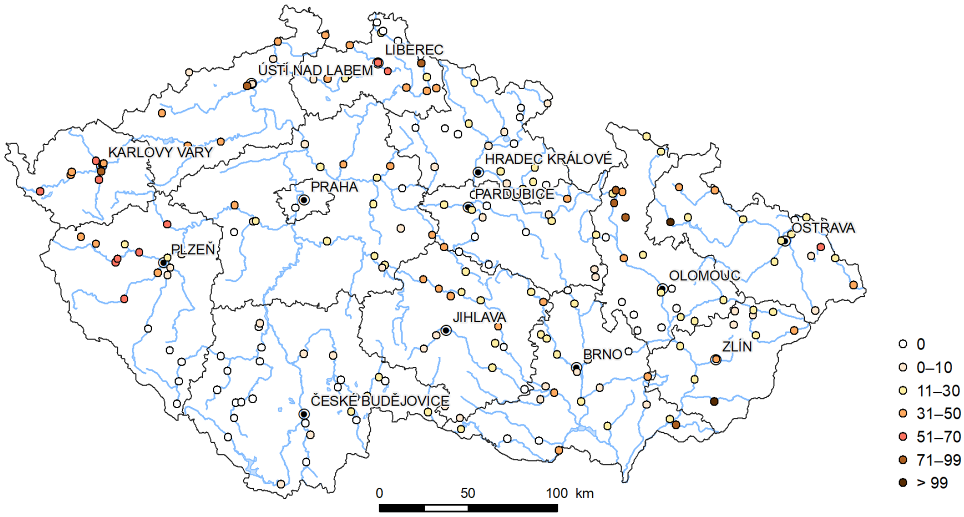
Abundance of water resources and duration of hydrological drought

Overall, 2022 was a mostly average or below average year from a hydrological perspective. In January and February, on watercourses draining mountainous areas until May, the watercourses were endowed with water from melting snow, which, together with precipitation and strong winds, repeatedly led to flood situations. On the other watercourses, the spring months were rather below average and more significant runoff events occurred only during the summer. During June, after extreme rainfall, streams in the upper Vltava and Berounka basins repeatedly overflowed, with significant rises on smaller tributaries of the Vltava in Prague. On Zlatý potok, the peak flow rate in late June reached a recurrence interval of Q20–50, which was also the highest (in terms of recurrence interval) flow rate achieved in all of 2022. Further significant rises were recorded in the last decade of August, again on the tributaries of the Vltava in Prague, in the Berounka basin and also in the Odra basin. By the end of the year, there were no more significant rises, the exception being the last decade of December, when all the snow that had built up until then melted away.

The **average annual flow** in 2022 ranged from 45% to 86% of the long-term average of 1991–2020, with the lowest flow rate on the Ivančice-Jihlava profile and the highest on the Louny-Ohře profile. Some watercourses experienced hydrological drought, which occurs when the Q_{355} flow rate is not reached. This is the flow rate that is met or exceeded on an average of 355 days per year and is important for maintaining the basic water management and ecological functions of the watercourse. Hydrological droughts lasting 50 days or more were recorded on 20 profiles, while hydrological droughts lasting 100 days or more were recorded on 2 profiles (out of a total of the 217 profiles monitored). The worst situation was on the Olšava stream in the Uherský Brod profile, where hydrological drought was recorded for 118 days (Fig. 9).

Fig. 9

Flow rate under the long-term 355-day flow rate in Czechia for the 1991–2020 period [number of days], 2022



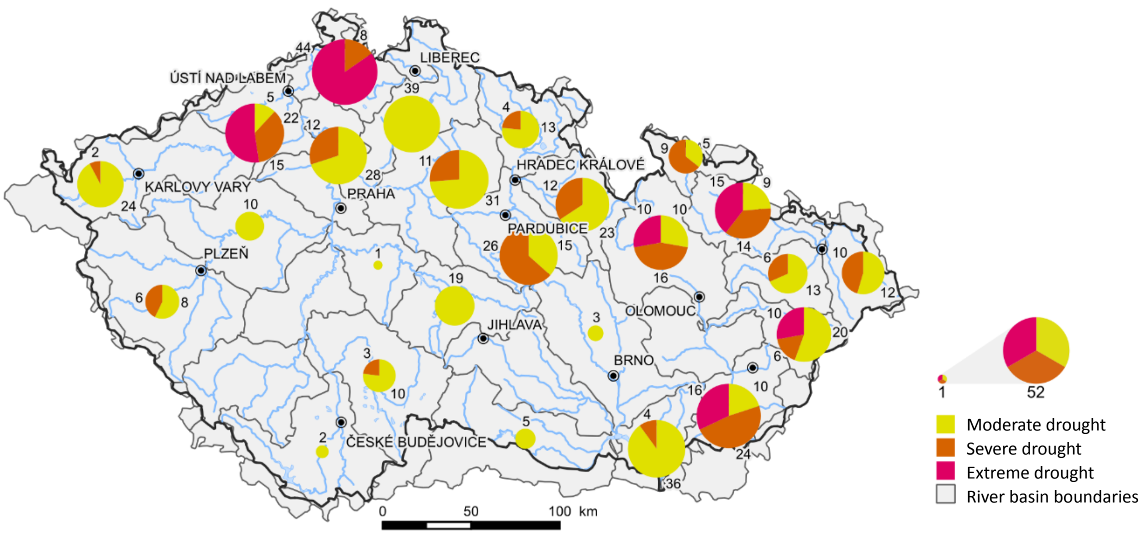
Data source: CHMI

Groundwater circulation in shallow wells and springs was rather subnormal in 2022 from an overall year perspective (Fig. 10, Fig. 11). There were temporal and regional fluctuations during the year. In **shallow wells,** levels severely to extremely below normal were reached throughout the year, mostly in wells in the Upper and Middle Elbe and Morava basins. The **yield of the springs** was extremely and severely below normal throughout the year with minor fluctuations in the basins of the Berounka, Upper and Middle Elbe, Ohře and Lower Elbe, Upper Oder, and Morava.

The state of **the deep aquifers** was worst in the summer months, especially in August, when the levels in 51% of the deep wells were severely or extremely below normal. In other months, levels were severely or extremely below normal in 26% to 50% of deep wells.

Fig. 10

Duration of drought in springs in Czechia [number of weeks], 2022

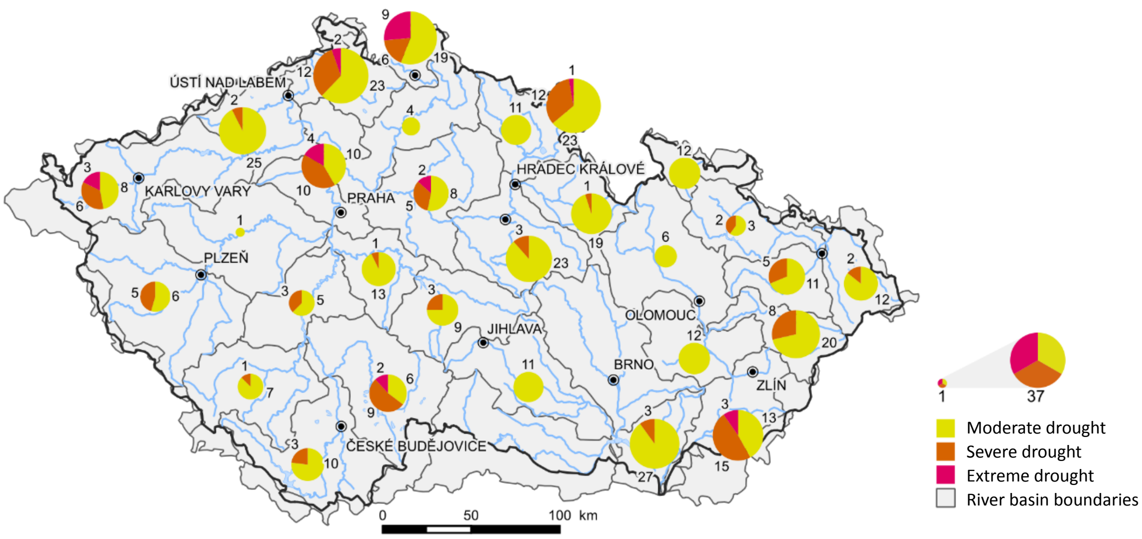


The data are aggregated per catchment and processed using the current drought index.

Data source: CHMI

Fig. 11

Duration of drought in shallow wells in Czechia [number of weeks], 2022



The data are aggregated per catchment and processed using the current drought index.

Data source: CHMI

Flooding

As a result of melting snow, the first months of the year saw rising water levels with numerous exceedances of flood activity levels, especially in the areas of watercourses draining mountainous areas. Flooding from snowmelt also occurred at the end of the year, when the last decade of December saw the melting of snow reserves that had built up in the first half of the month. In terms of magnitude and water levels, summer flood events dominated. In January, in response to the prolonged warming of the previous month, precipitation and the subsequent thawing of the snow cover, water levels in the first week of January rose most on the watercourses draining the Šumava, Krkonoše, Jizera and Eagle Mountains and the Jeseníky Mountains.

June was the richest month for flood events in the summer period. The month of August also brought a number of flood episodes due to intense rainfall and local storms, especially the second half of the month. In terms of the area distribution of the number of flood events, floods occurred most frequently in southern and south-eastern Bohemia, in eastern Moravia and Silesia and in Prague and its surroundings. In terms of the frequency of flood events, increases were generally most pronounced in June and August. There were a total of 72 occurrences of **flood events** reaching **flood level 3** in 2022.

At the beginning of the year, FAL 3 was exceeded on the Otava in Rejštejn and Sušice, on the Elbe in the Stanovice, Vestřev, Les Království and Brod profiles, as well as on the Stěnava in the Meziměstí and Otovice profiles and on the Hvozdnice in Jakartovice.

In the summer months, FAL 3 was reached on several profiles of the Botič River, as well as on the Blanice River (profiles Poddvorský Mlýn, Blanický Mlýn), Stonávka River (profile Hradiště), Klabava River (profile Hrádek), Pitkovický Brook (profile Kuří) and Bystřice River (profile Bystřička nad nádrží).

Detailed visualisations and data

https://www.envirometr.cz/data

1. Environment and health

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. Leakages from sewers can also be a source of groundwater pollution. 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 livingorganisms, 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 Communityaction 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 fromagricultural 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 connection of municipalities with over 2,000 PE to a WWTP

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 Decree No. 401/2015 Coll., on indicators and values of permissible surface water and waste water pollution, requirement 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 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 2000–2022 period, the best reductions in pollution in Czech watercourses were achieved for $N\text{-}NH_4^+$ (73.9% decrease in average concentration) and P_{total} (a 40.0% decrease).
	In the water quality assessment according to Czech Technical Standard 75 7221, the prevailing quality class for the 2021–2022 biennium is Class III (polluted water).
	Over the last five years, the quality of watercourses has stagnated and there has been no further significant reduction in pollution.

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				

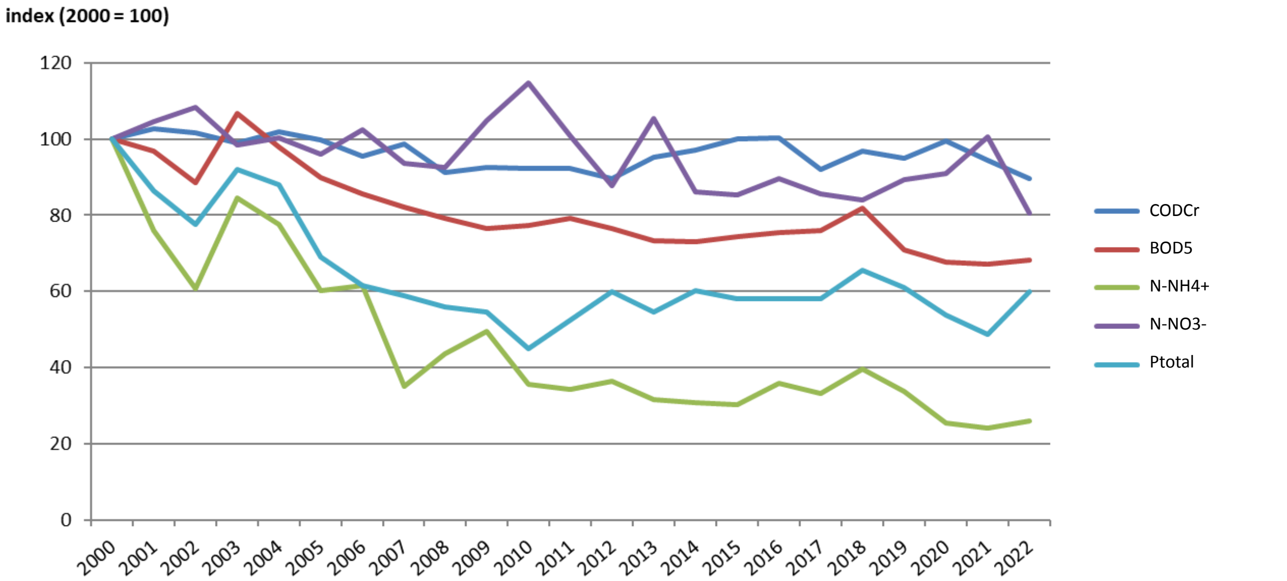
Water quality in watercourses

Water quality in watercourses in Czechia is monitored on 1,024 representative river profiles, with 124 profiles being used for the assessment. For the assessment of the 2000–2022 period, the **basic indicators COD_{Cr}, BOD_5, $N\text{-}NH_4^+$, $N\text{-}NO_3$ and P_{total} were selected**. Over the 2000–2022 period, the highest reductions in pollution in Czech watercourses were achieved for $N\text{-}NH_4^+$ (73.9% decrease in average concentration) and P_{total} (a decrease of 40.0%), Chart 12. The average ammonia nitrogen concentration reached 0.129 $mg.l^{-1}$ in 2022. The decline is mainly due to more efficient waste water treatment and a decline in livestock production. The total phosphorus concentration in 2022 reached an average value of 0.172 $mg.l^{-1}$. 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. On the basis of these basic indicators, a water quality map of watercourses for the 2021–2022 biennium has been developed, where individual watercourse sections are classified into five quality classes (Fig. 12). For the selected profiles[33] of the water quality monitoring network in watercourses, 23% of the profiles were classified as Class I and II with unpolluted or slightly polluted water, 42% of the profiles were classified as Class III with polluted water, 28% of the profiles were classified as Class IV with heavily polluted water and 7% of the profiles were classified as Class V with very heavily polluted water.

[33] *The resulting proportion of profiles was evaluated on the basis of data measured in the profiles, the evaluation of which further enters into the elaboration of the water quality map of the watercourses.*

Chart 12

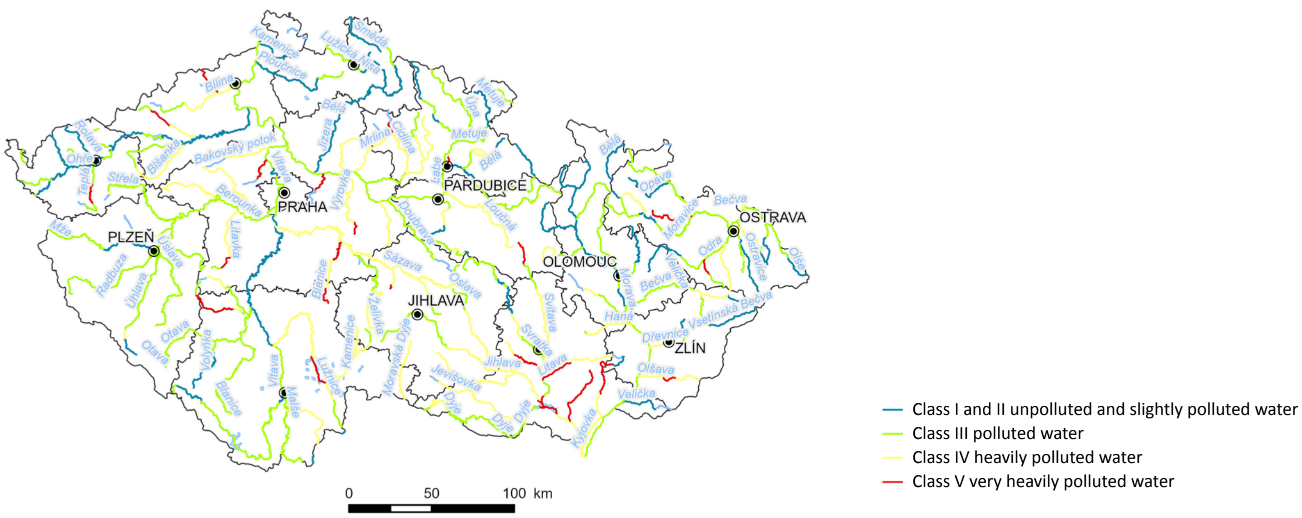
Trend in pollution concentration indicators in watercourses in Czechia [index, 2000 = 100], 2000–2022



Data source: CHMI from the s.e. Povodí

Fig. 12

Water quality in watercourses in Czechia, 2021–2022



Data source: T.G.M. WRI

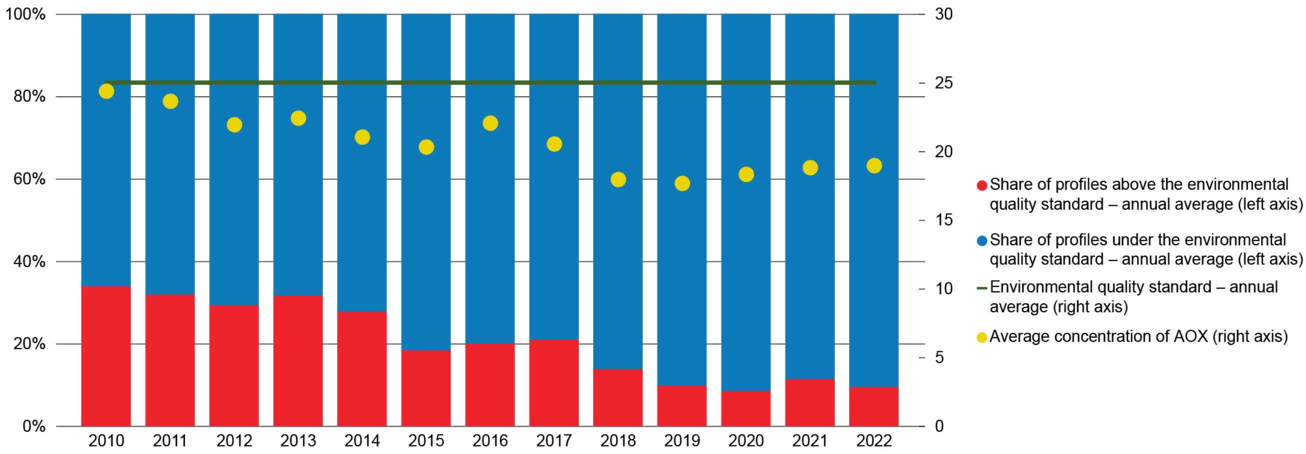
The assessment of **water quality in watercourses** for the 2010–2022 period was carried out for several indicators listed in Government Regulation No. 401/2015 Coll. These are COD_{Cr}, BOD_5, total organic carbon (TOC), $N\text{-}NO_3^-$, $N\text{-}NH_4^+$, total phosphorus (P_{total}) and thermotolerant 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.

The proportion of profiles that exceeded the EQS-AA for **COD_{Cr}** ranges from 6% (in 2017) to 15% (in 2015) over the reporting period. **BOD_5** values did not differ significantly during the period under review and exceeded the EQS-AA in 10–17% of the profiles. The proportion of profiles exceeding the EQS-AA for **TOC**

(total organic carbon) ranges from 8% (in 2010) to 15% (in 2020). **N-NO_3^-** concentrations show a steady state since 2014, with a slight decrease compared to 2010. The proportion of profiles exceeding the EQS-AA was highest in 2010 (23%) and 4% in 2022. The average **N-NH_4^+** concentrations show a slight decrease with small fluctuations during the period under review. In 2022, the proportion of profiles exceeding the EQS-AA was 10.6%. Average **total phosphorus** concentrations are above the EQS-AA for almost the entire period under review (except for 2010 and 2021). The proportion of profiles exceeding the EQS-AA is in the range of 35–45% (43.9% in 2022). **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 4 years this was only 8–14% of the profiles (Chart 13). No trend can be observed for **benzo(ghi)perylene** (due to the very low EQS-AA limit), in 2022 the proportion of profiles above the EQS-AA was 25%.

<u>Chart 13</u>

Share of profiles in Czechia where the environmental quality standard – annual average limit for AOX was exceeded [%] and average concentration [μg.l^{-1}], 2010–2022



Data source: CHMI

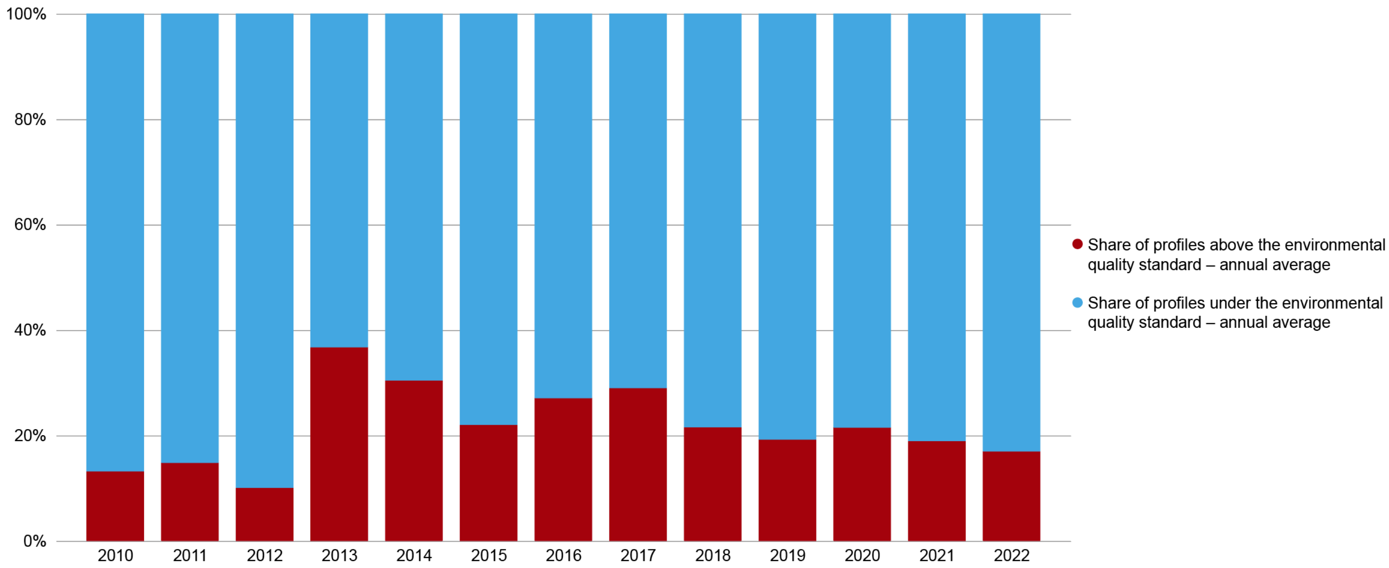
The maximum values for dissolved **mercury** were at or slightly below the EQS-MPC in 2011, 2013, 2018, 2020, 2021 and 2022. In other years, the environmental quality standard-MPC was exceeded in 1–15% of profiles. The EQS-AA for dissolved **lead** was exceeded only in 2020, where 1 profile exceeded the limit value almost twice. Dissolved **cadmium** exceeded the EQS-AA limit values only on 1–3 profiles. In 2014, 2015, 2017, 2020, 2021 and 2022, no concentration above the limit value was detected in any of the monitored profiles.

Thermotolerant coliforms are evaluated according to EQS-P90 (40 KTJ.ml^{-1}). This value was exceeded on a significant number of profiles in the assessment period, in 2022 it was 53% of profiles.

For the sum of pesticides, the proportion of profiles exceeding the EQS-AA ranged between 10.1–36.7% in the period under review (lowest in 2012 (10.1%), highest in 2013 (36.7%)). In 2022, the proportion of profiles above the EQS-AA was 17.0% (Chart 14).

Chart 14

Share of profiles where the environmental quality standard – annual average limit for the sum of pesticides was exceeded [%], 2010–2022



In 2022, the methodology was changed and the time series 2010–2022 was recalculated.

Data source: CHMI

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. Since 2016, the representation of the most polluted profiles (Class IV and V) has been around 40% in total.

Significant amounts of **pharmaceuticals and their metabolites** enter surface waters from municipal sources. For the year 2022, the monitoring results of the Povodí companies were processed from a total of 355 profiles (a total of 2,910 samples) for 80 individual substances, of which 68 were confirmed to be present. The results are also consistent with the monitoring setup of these substances by the individual Povodí companies. Where a broader spectrum of substances is monitored, pharmaceuticals are found more frequently. Similar to 2021, the occurrence of pharmaceuticals was most significant in smaller streams that drain large settlements. Pharmaceuticals were found in 332 profiles (93.5% of the profiles monitored) in a total of 2,626 samples (90.2% of the samples). The most frequently found substances were oxypurinol (gout drug), telmisartan (antihypertensive), oxazepam (antidepressant), metformin (diabetes drug), gabapentin (antiepileptic, analgesic), tramadol (analgesic), diclofenac (antirheumatic, analgesic), jomeprol (contrast agent), valsartan (antihypertensive), ibuprofen and its metabolites 2-hydroxy and carboxy (analgesic, antipyretic, antiphlogistic), carbamazepine (antiepileptic), metoprolol (antihypertensive), hydrochlorothiazide (diuretic), venlafaxine (antidepressant), paracetamol (analgesic, antipyretic), the antibiotics clarithromycin and sulfamethoxazole, irbesartan (antihypertensive), sulfapyridine (antibiotic), fexofenadine (antihistamine), naproxen (analgesic), iopromide (contrast agent) and furosemide (diuretic).

In accordance with Directive 2013/39/EU amending Directive 2008/105/EC, the assessment of mercury in fish muscle (European chub) was carried out on 15 profiles and in fish fry on 22 profiles. The EQS for mercury (0.020 $mg.kg^{-1}$) was exceeded in all fish muscle profiles in both 2010 and 2022, with fish fry exceeding the value in 67% of profiles in 2022 (compared to 95% in 2021). The EQS value for PBDEs in fish muscle is 0.0085 $\mu g.kg^{-1}$ and was exceeded at all profiles monitored during the assessment period. The EQS for PBDE in fish fry is 9.1 $\mu g.kg^{-1}$ and was exceeded in 43% of the profiles monitored in 2022 (25% of the profiles in 2010). The EQS for benzo(a)pyrene is 5 $\mu g.kg^{-1}$ and was exceeded in 2022 in 30% of benthic profiles (70% of profiles in 2012). The EQS for fluoranthene is 30 $\mu g.kg^{-1}$ and was exceeded for benthos in 2012 for 50% of the profiles and in 2022 for 43% of the profiles.

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**[34] 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 chemical state of water 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

As part of the monitoring of the quality of surface water used for outdoor bathing, a total of 280 sites were monitored in the 2022 recreational season, of which 45.7% were classified as category I quality, i.e. water suitable for bathing (53.2% in 2021). The proportion of sites classified as quality category II was 18.6%. Bathing bans were issued due to excessive cyanobacteria at 15 sites (5.4% of sites) and 34 sites (12.1% of sites) were designated as unsuitable for bathing.

[34] *The evaluation is carried out at six-year intervals (2015, 2021, 2027). The above assessment for the 3rd planning period is based on monitoring data from 2016–2018, 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

The number of selected shallow boreholes where the groundwater limit was exceeded in at least one of the selected indicators was 177; 119 deep boreholes exceeded the limit as well as 85 springs.

Significant contamination in groundwater was detected in 2022 for the sum of pesticides, with a total of 209 sites (126 shallow well sites exceeded the limit, 43 deep well sites exceeded the limit, and 40 spring sites exceeded the limit).

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

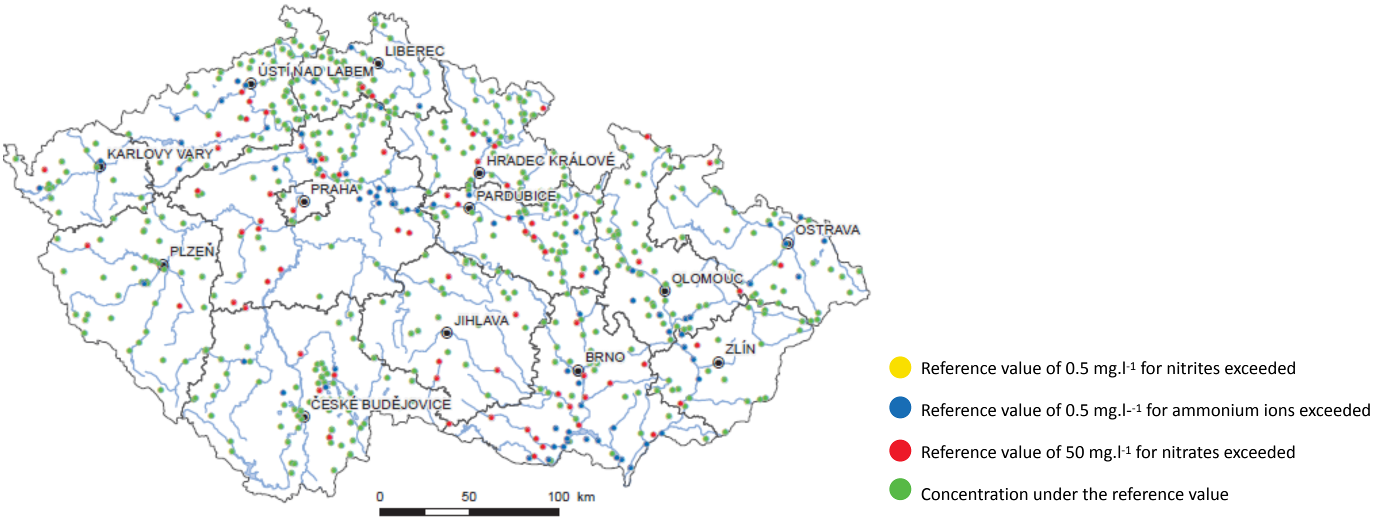
Water quality is also monitored and assessed annually for **groundwater** on the basis of Decree of the Ministryof the Environment of the Czech Republic and the Ministry of Agriculture of the Czech Republic No. 5/2011 Coll. In 2022, 704 sites were monitored in the State groundwater quality monitoring network, including 202 springs, 226 shallow wells, and 276 deep wells. The number of shallow wells where groundwater limits were exceeded in at least one indicator was 177, for deep wells the limit was exceeded at 119 sites, and for springs at 85 sites[35]. The results of the groundwater quality assessment for 2022 did not change significantly compared to previous years due to the slow dynamics of changes in groundwater chemistry.

In 2022, 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** (11.4% of above-limit samples) and **nitrates** (10.4% of above-limit samples), Fig. 133. For nitrite, the above limit samples range between 0.1–0.4%. There have been no significant changes in nitrogen concentrations since 2010.

[35] *Evaluation 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).*

Fig. 13

Concentration of nitrogenous substances in groundwater in Czechia [mg.l^{1}], 2022

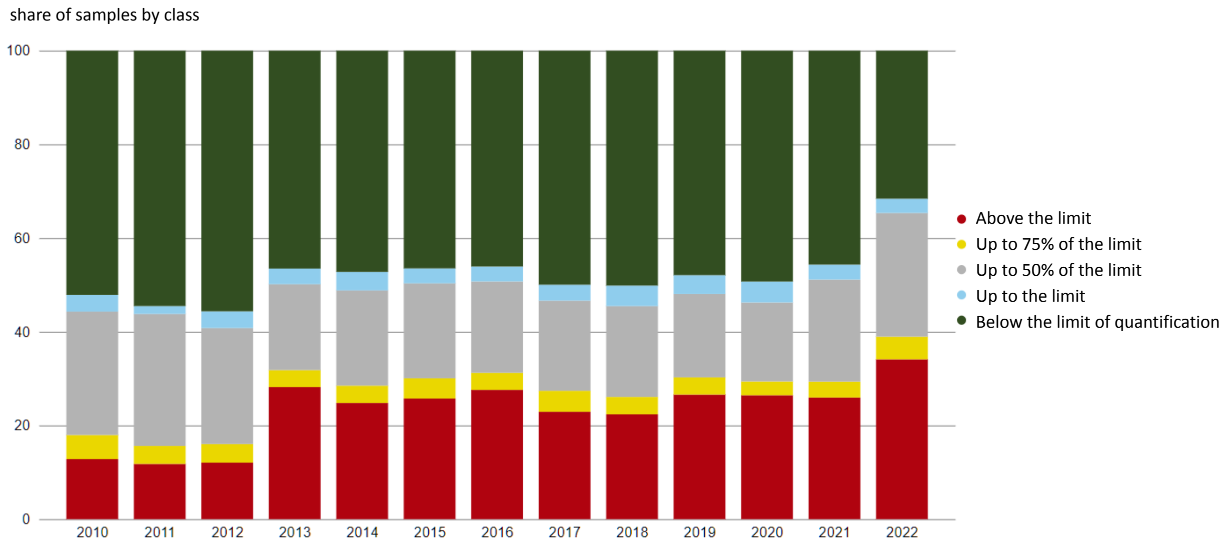


Data source: CHMI

Of organic substances, **pesticides** are the main pollutants (Fig. 144). 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 an increased number of 34.1% of above limit samples in 2022 for the indicator sum of pesticides with a quality standard of 0.5 $\mu g.l^{-1}$ (Chart 15). 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 and the inclusion of the most problematic metabolite chloridazone desphenyl, which resulted in a significant change in the number of above-limit values for the sum of pesticides. Groundwater samples with above-limit pesticide concentrations were mostly collected at shallow wells. In 2022, a total of 209 sites were found to exceed the sum of pesticides (126 shallow wells, 43 deep wells, and 40 springs).

Chart 15

Shares of set values for the sum of pesticides indicator in groundwater in Czechia [%], 2010–2022



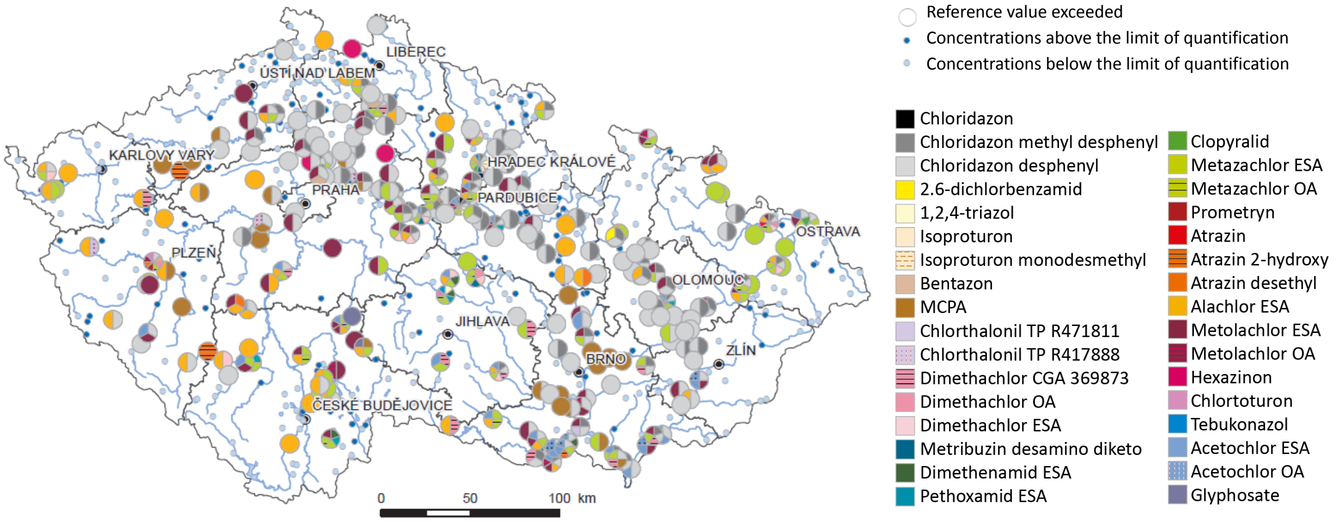
Maximum number of pesticide group substances monitored: in 2010 (85), in 2011 (85), in 2012 (85), in 2013 (156), in 2014 (162), in 2015 (140), in 2016 (135), in 2017 (138), in 2018 (150), in 2019 (195) and in 2020 (196), in 2021 (163), in 2022 (164).

Data source: CHMI

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.

Fig. 14

Pesticide concentrations in groundwater in Czechia [$\mu g.l^{-1}$], 2022



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: CHMI

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**[36] 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.

[36] *The evaluation is carried out at six-year intervals (2015, 2021, 2027).*

1.1.3. Drinking water supply to the population

Key messages

✓	The proportion of the population connected to the public water supply system has increased compared to 2000, from 87.1% to 95.6%.

Assessment of the trend and state of indicators

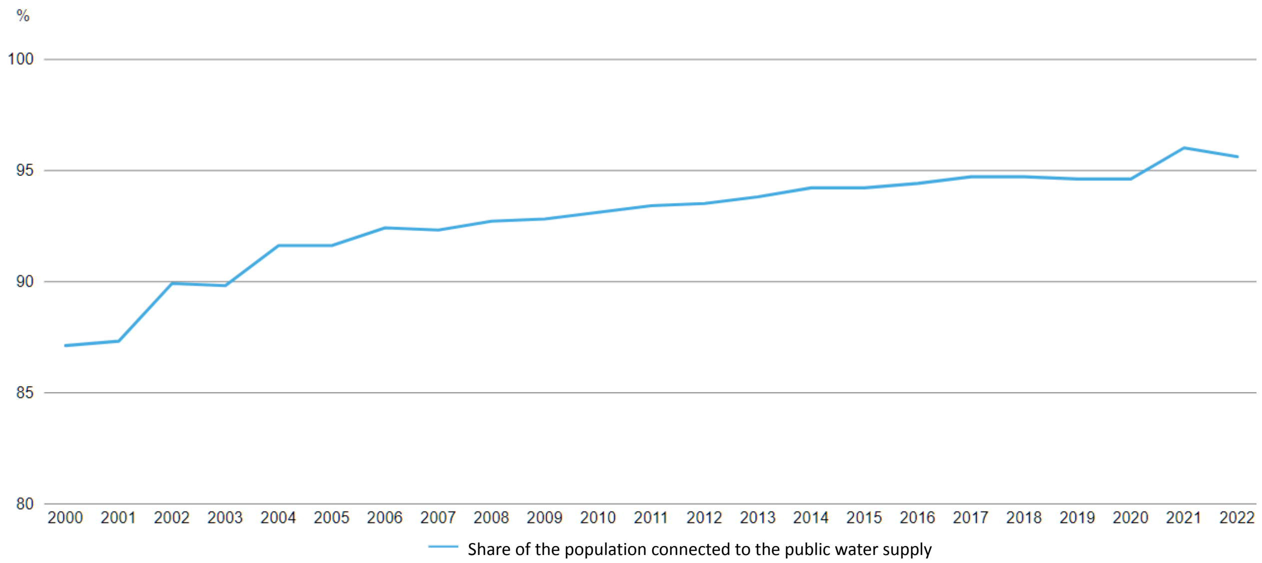
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Population supplied with water from the public water supply	↗	↗	↗	✓

Population supplied with water from the public water supply

The water management infrastructure has been developing over the long term, and is being revitalised, whilethe **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 95.6%. Year-on-year, there was a slight decline of 0.4 percentage points. (Chart 16). The target of 96.7% of the population connected to the public water supply, set by the Strategy of the Ministry of Agriculture of Czechia with a View to 2030, will probably be met in 2023 if the current trend is maintained.

Chart 16

Share of the population connected to the public water supply in Czechia [%], 2000–2022



Data source: CZSO

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 2022, a total of 2,915 WWTPs were operated in Czechia, of which 58.2% had tertiary treatment.
~	15.1% of the population is not yet connected to a sewer system terminated with a WWTP.

Assessment of the trend and state of indicators

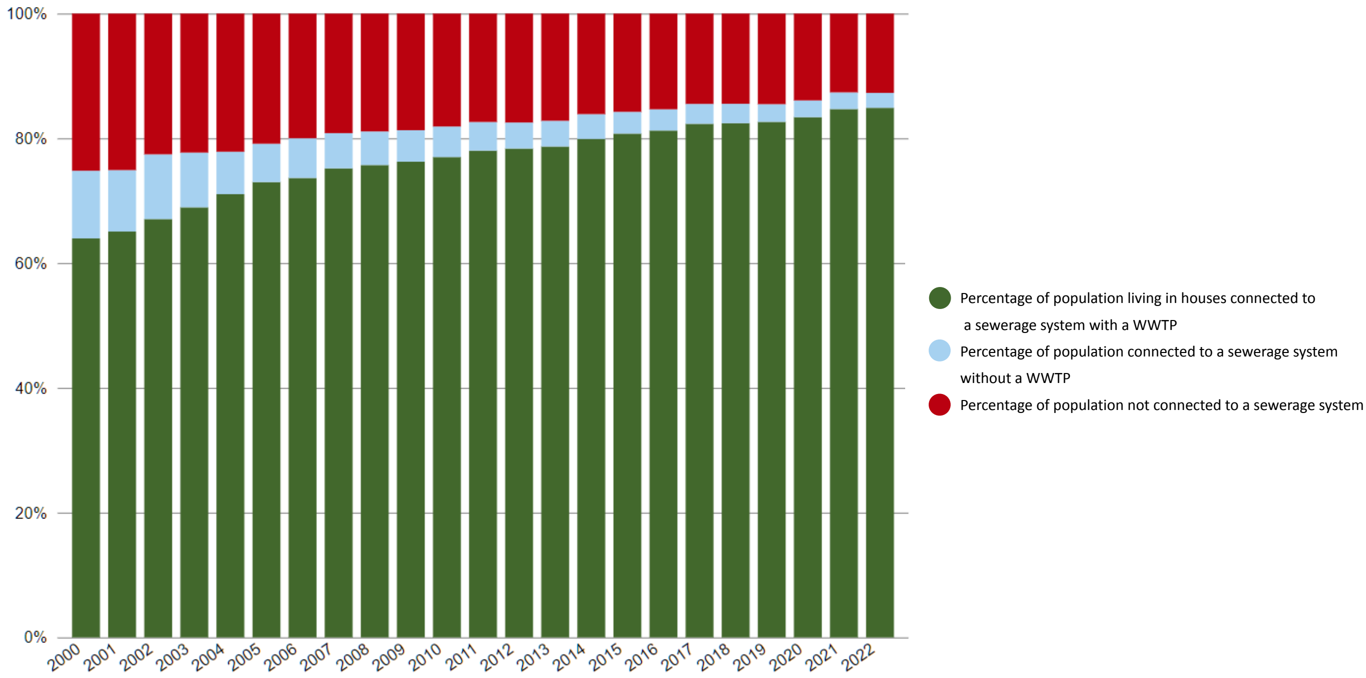
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Waste water treatment	↗	↗	↗	✓
Waste water discharge	↘	↘	→	~

Waste water treatment

The **share of the Czech population of connected to a sewerage network** in 2022 was 87.3% (Chart 17), while the share of the population connected to a sewerage system with a WWTP was 84.9% (84.7% in 2021). Compared to 2000, the share of the population connected to a sewerage system with a WWTP increased by 21 percentage points. Despite the initial significant development of the water management infrastructure from 2000, which was influenced mainly by Czechia'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. 15.1% 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 17

Percentage of population connected to sewerage systems and sewerage systems terminating in a waste water treatment plant in Czechia [%], 2000–2022

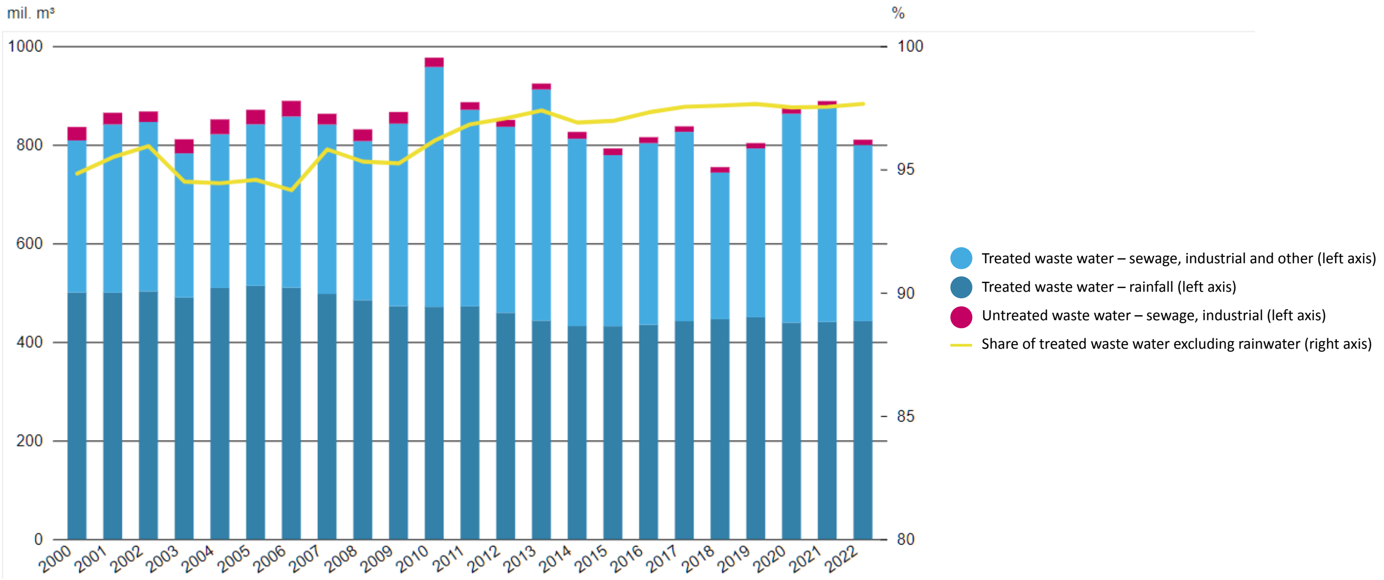


Data source: CZSO

The total **volume of water discharged into a public sewerage system**, which includes charged rainwater, was 524.0 mil. m^3 in 2022, so there was no year-on-year fluctuation. Of this, the volume of water discharged to public sewers excluding rainwater in 2021 was 453.0 mil. m^3 (442.4 mil. m^3 treated and 10.6 mil. m^3 untreated, Chart 18). **The share of treated waste water from water discharged to sewers has been high for a long time (94–98% since 2000).** 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. 357.4 mil. m^3 of rainwater was treated in 2022.

Chart 18

Treatment of waste water discharged into sewerage systems in Czechia [mil. m³, %], 2000–2022



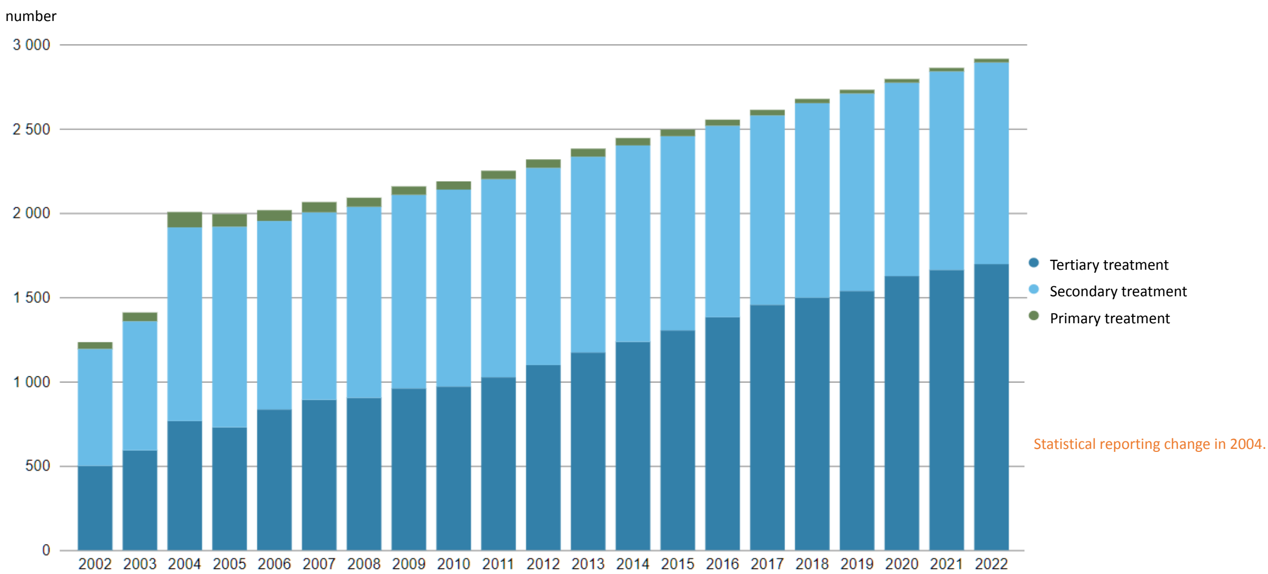
Up to and including 2003, the data are only for the sewers of the main operators. Since 2004, the number of respondents has been expanded. The given time series of selected indicators is influenced by changes in the statistical survey and the consequence of the gradual transformation of former water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

Data source: CZSO

There were 2,915 **WWTPs for public use** in 2022. The number of WWTPs increased by 1.9% year-on-year (Chart 19). Due to the construction and reconstruction of WWTPs, the total number of WWTPs with nitrogen and/or phosphorus removal (tertiary treatment) in Czechia increased by 34 WWTPs compared to 2021 to 1,697. Only 22 treatment plants with purely mechanical treatment remain in 2022.

Chart 19

Waste water treatment plants by level of waste water treatment in Czechia [number], 2002–2022



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

Data source: CZSO

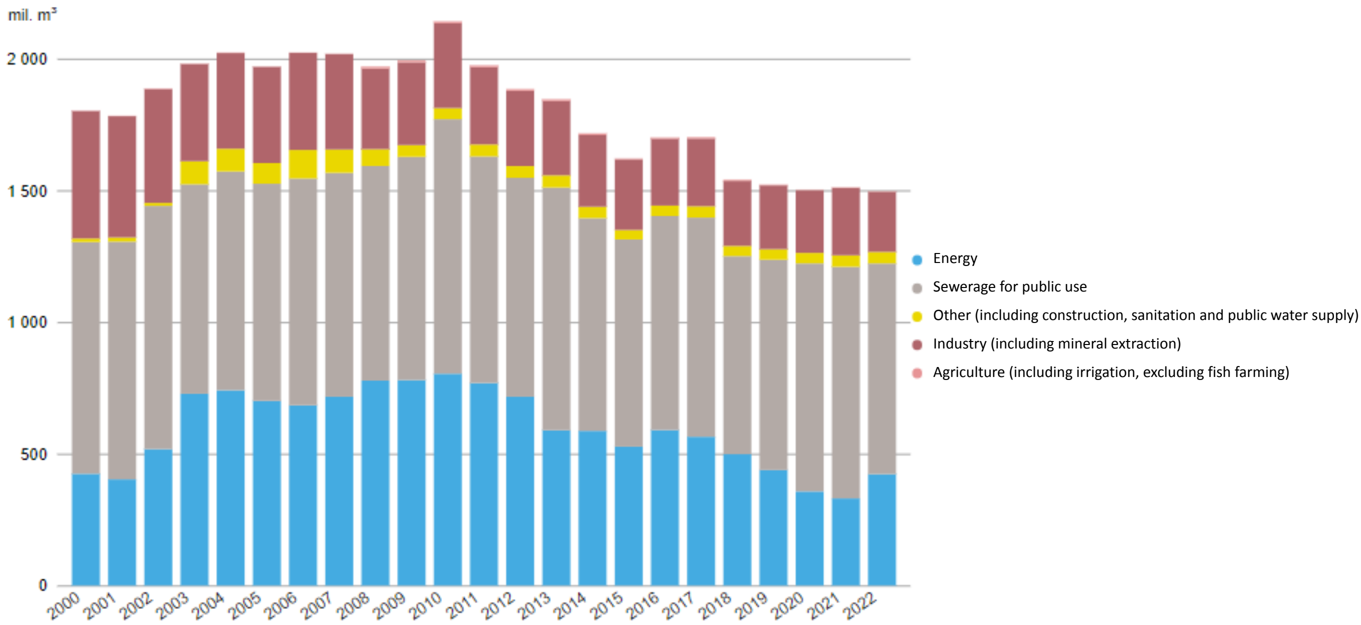
The **average efficiency of WWTPs** (the amount of pollution removed) is very high in Czechia thanks to the WWTP modernisation and reconstruction, and this has led to a reduction in the number of WWTPs with only mechanical treatment. For the monitored indicators, the values did not change significantly year-on-year. The efficiency was 98.6% for BOD_5 in 2022, for P_{total} 86.6%, for COD_{Cr} 94.8% and for N_{total} 81.2%.

Waste water discharge

Since 2000, the **total volume of waste water discharged** has fallen by 16.7% to 1 496.9 mil. m³ (Chart 20). 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.

<u>Chart 20</u>

Quantity of waste water discharged into surface waters in Czechia [mil. m³], 2000–2022



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

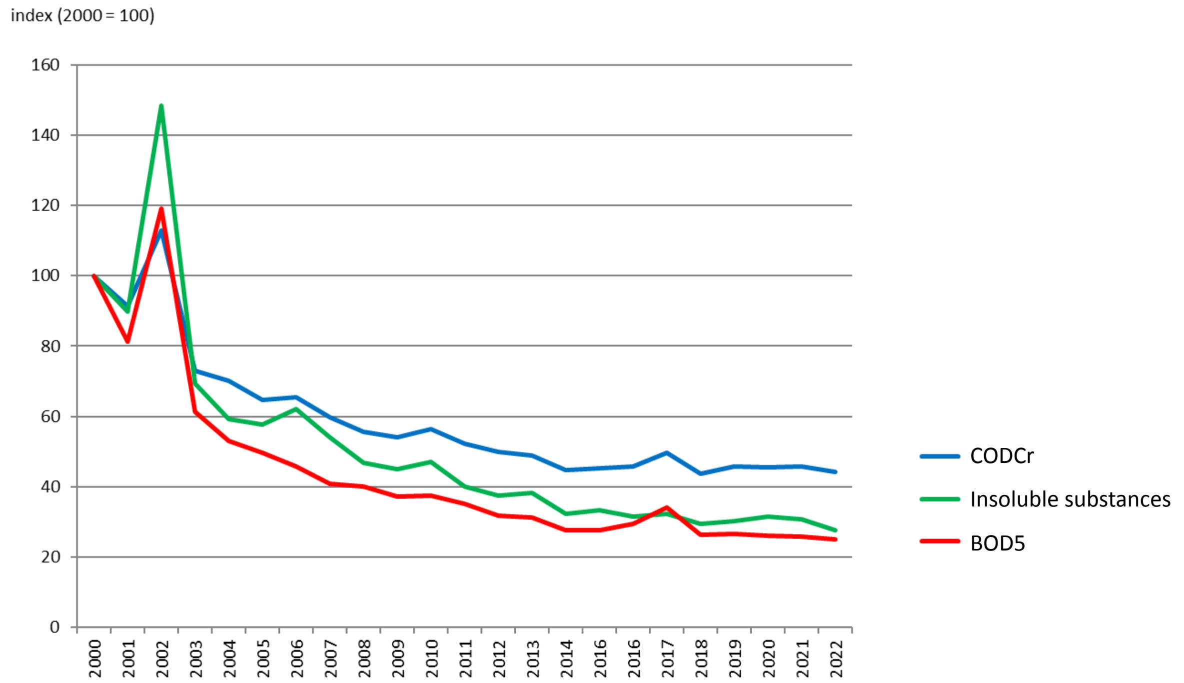
Data source: state enterprise Povodí, T.G.M. WRI, CZSO

The **structure of discharged waste water** reflects the structure of water users. The largest shares in 2022 were taken by public sewerage, with 53.5%, and energy, with 28.3%. Waste water from industry accounted for 15.2%, the other category 2.9%, and wastewater from agriculture accounting for only 0.1%. A significant decrease was recorded for discharged waste water from industry (by 10.9%) compared to 2021. From 2011 to 2021, there was a gradual decline in discharged waste water from the energy sector, driven by a reduction in electricity generation from steam power plants and a decline in heat generation from fossil fuels, and conversely, an increasing use of RES for electricity and heat generation. However, there has been a year-on-year increase in the volume of discharges from the energy sector due to increased abstraction. Agriculture is a significant source of surface pollution; substances used in agricultural activities (fertilisers, pesticides) are 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. Discharged municipal waste water (sewerage for public use), which represents significant point sources of pollution (mainly organic), decreased year-on-year by 9.0%.

Monitoring the **amount of pollution in discharged waste water** is particularly important because it significantly affects the quality of surface and groundwater. Since 2000, the quantity of discharged pollution has been on a downward trend (due to more rigorous waste water treatment), with minor fluctuations (there was a significant deviation in 2002 caused by the extreme flooding in that year), Chart 21. Since 2000, **BOD_5** has decreased to 30.7% of 2000 pollution levels and **COD_{Cr}** has decreased to 48.5% of 2000 pollution levels. In 2022, there is a 3.6% year-on-year decrease for BOD_5, a 3.4% decrease for COD_{Cr} and a 10.2% decrease for **suspended solids**.

Chart 21

Pollution discharged from point sources in the BOD_5, COD_{Cr} and suspended solids indicators in Czechia [index, 2000 = 100], 2000–2022

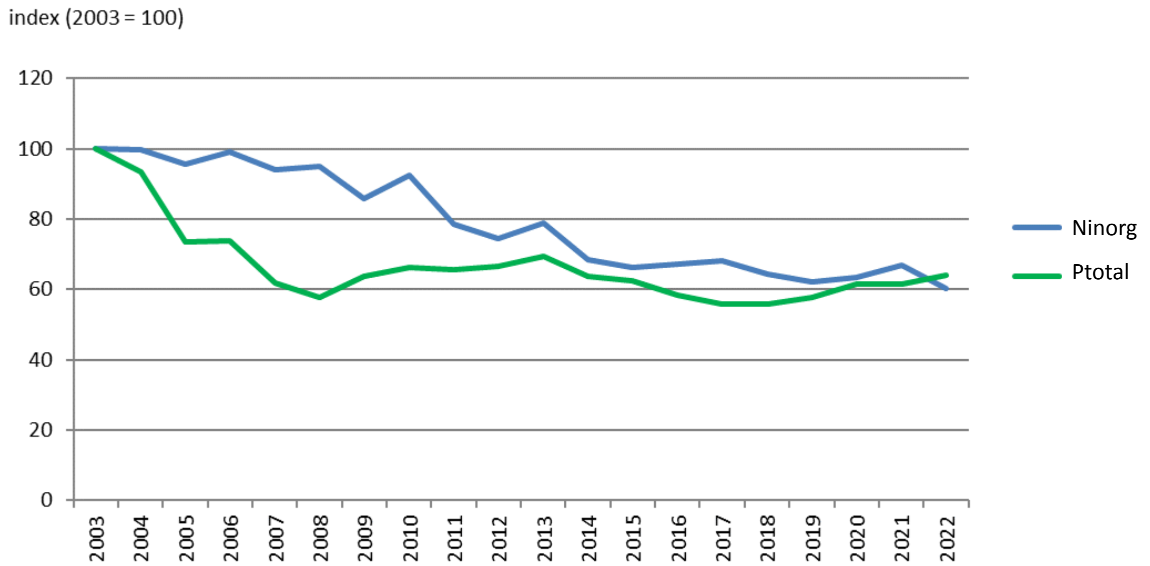


Source: state enterprise Povodí, T.G.M. WRI, CZSO

Nitrogen ($N_{inorg.}$) saw a 9.7% year-on-year decrease in the volume of pollution discharged, while phosphorus (P_{total}) saw a 2.6% increase (Chart 22). In the longer term, $N_{inorg.}$ and P_{total} have decreased by 39.7% and 40.2% 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 of new and intensified WWTPs, while it is further influenced by a reduction of phosphates used in detergents.

Chart 22

Pollution discharged from point sources in the $N_{inorg.}$ and P_{total} Indicators in Czechia [index, 2003 = 100], 2003–2022



Source: state enterprise Povodí, T.G.M. WRI, CZSO

1.1.5. Efficient use of water

Key question

Are water resources in Czechia used efficiently and sustainably?

Key messages

✓	Total water abstracted has fallen by 24.3% since 2000.
~	In 2022, total water abstraction was 1,445.9 mil. m³, an increase of 7.2% compared to 2021.

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 abstractions by sector	↘	↘	~↗	~
Water consumption from the public water supply and water losses in the water supply network*				
Water consumption from the public water supply	↘	→	~↗	~
Water losses in the water supply network	↘	→	~↗	~

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

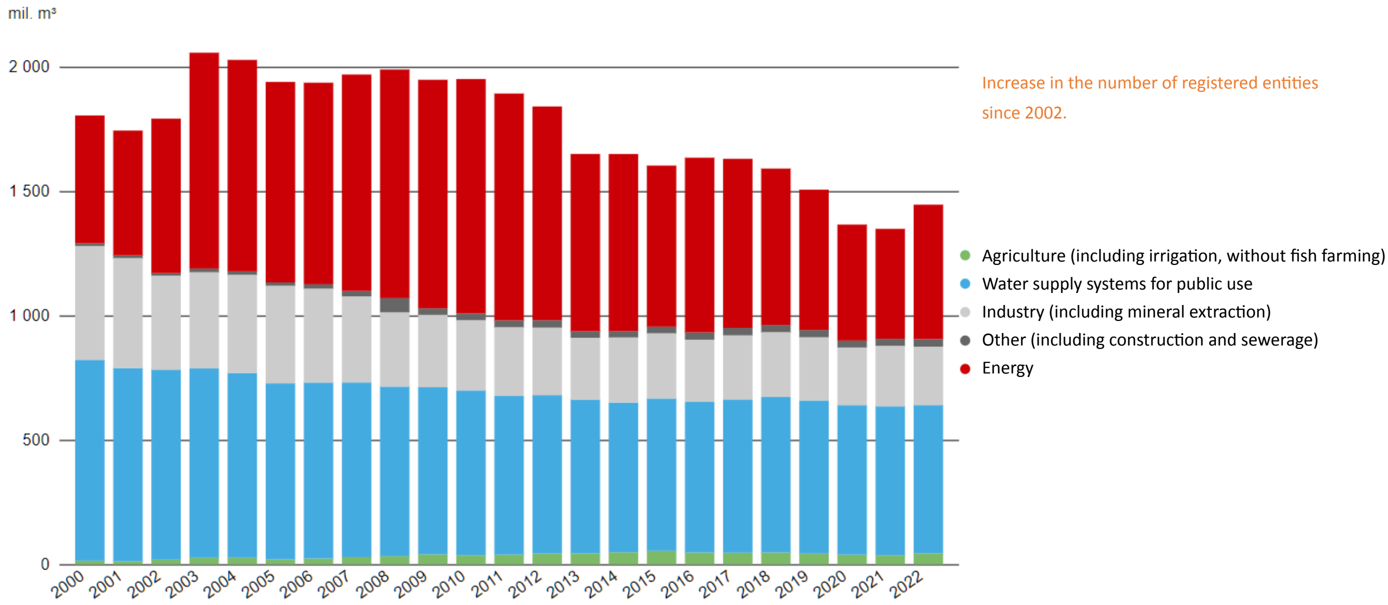
Groundwater and surface water abstractions by sector

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 19.9% since 2000. In 2022, total water abstraction was 1,445.9 mil. m³, an increase of 7.2% compared to 2021.

The highest abstraction was for public water supply, accounting for 41.2% of total abstraction in 2022. The energy sector was another major customer, accounting for 37.4% of total abstraction. Industry was the third-most-important water user, accounting for 16.3% of total water abstraction in 2022. Water abstraction for agriculture and other sectors including construction and waste water activities together accounted for 5.1% of total water abstraction in 2022. There was a year-on-year increase in total abstraction in the energy sector (up 22.3%), due to an increase in electricity generation from steam and nuclear power plants (Chart 23).

Chart 23

Total water abstraction by sector in Czechia [mil. m³], 2000–2022



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.

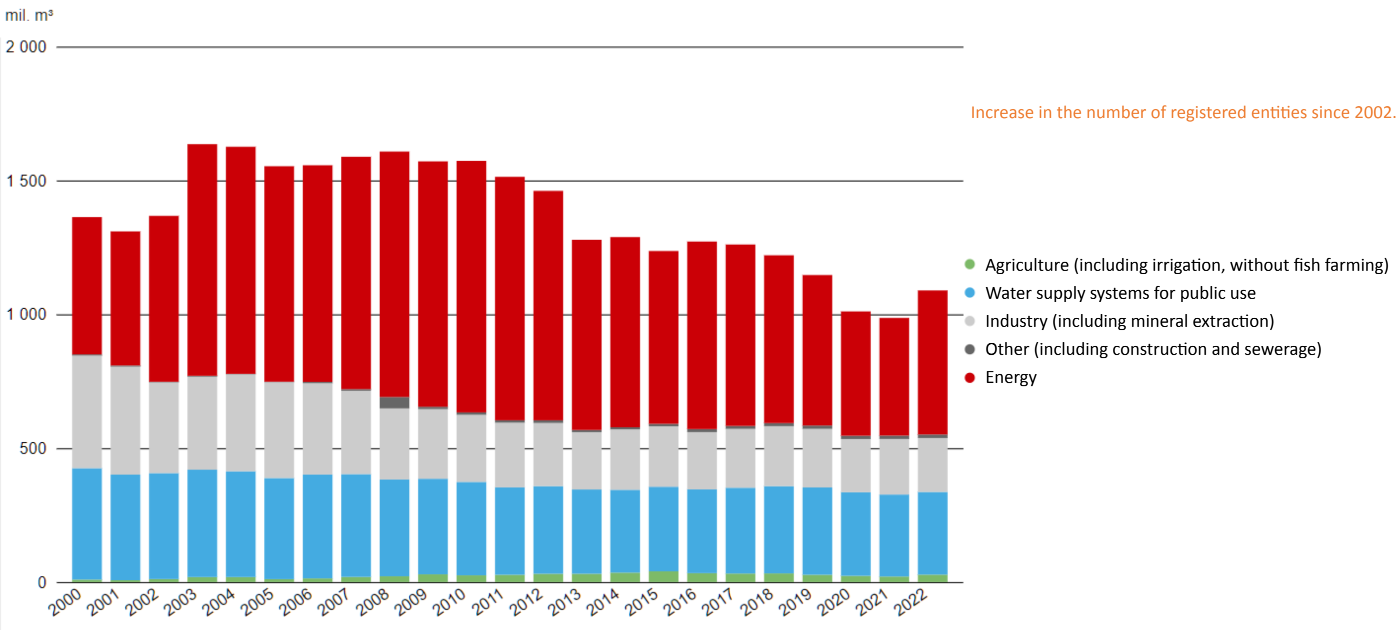
Data source: state enterprise Povodí, T.G.M. WRI, CZSO

The majority of abstraction is from surface water (1 089.5 mil. m³, i.e. 75.3% of total abstraction in 2022), with a smaller part from groundwater (356.5 mil. m³, i.e. 24.7% of total abstraction in 2022). When dividing the total abstraction into **surface and groundwater abstractions** (Chart 24, Chart 25), there are noticeable differences in the representation of individual economic sectors in total water abstraction.

A significant part of the water abstracted is intended for drinking water production. In 2022, 584.3 mil. m³ of water was produced. **Drinking water** billed to households and other customers amounted to 478.1 mil. m³, of which households accounted for 68.8%. The volume of billed water did not change significantly year-on-year (Chart 26). In 2022, 95.6% of the population was supplied with water from the public water supply.

Chart 24

Surface water abstraction by sector in Czechia [mil. m³], 2000–2022

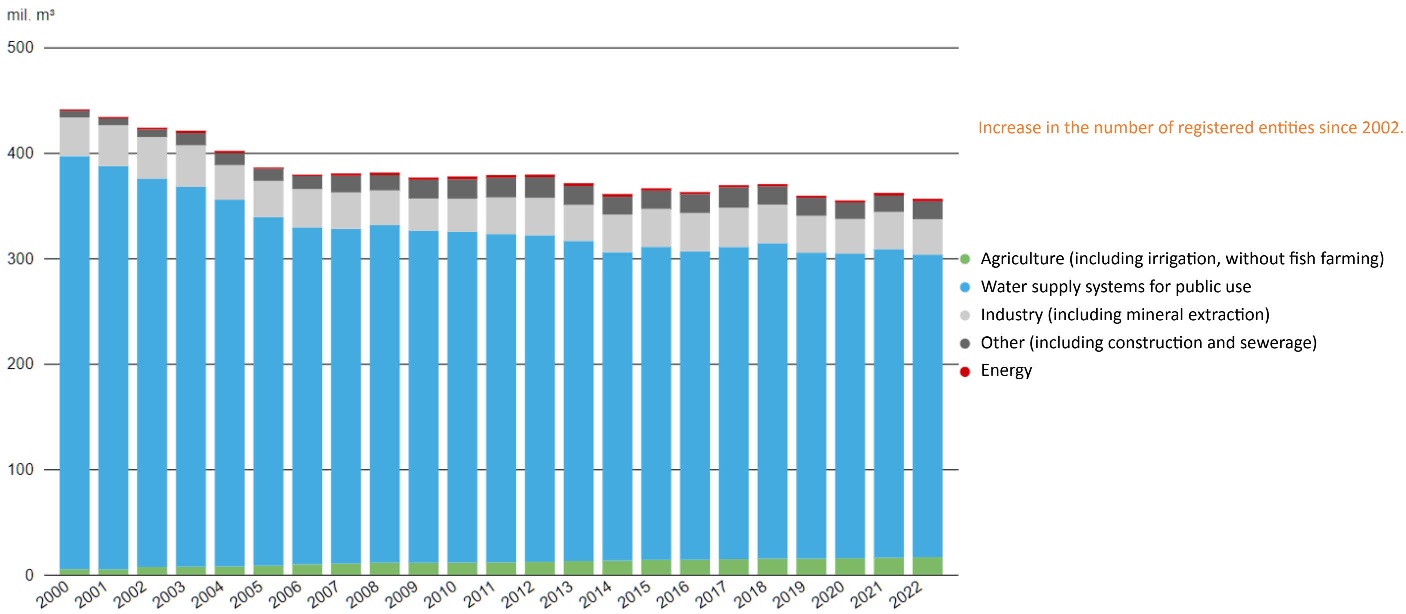


Until 2001, water abstraction exceeding 15 000 m³ per year or 1 250 m³ per month was recorded. Since 2002, water abstraction by customers above 6 000 m³ per year or 500 m³ per month has been recorded – in accordance with Section 10 of Ministry of Agriculture of the Czech Republic Decree No. 431/2001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

Data source: state enterprise Povodí, T.G.M. WRI, CZSO

Chart 25

Groundwater abstraction by sector in Czechia [mil. m³], 2000–2022

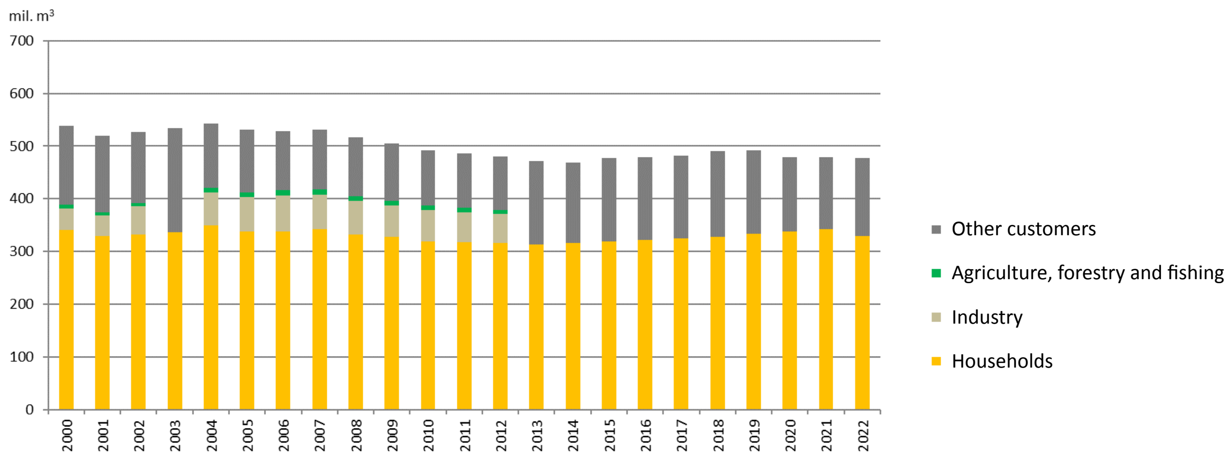


Until 2001, water abstraction exceeding 15 000 m³ per year or 1 250 m³ per month was recorded. Since 2002, water abstraction by customers above 6000 m³ per year or 500 m³ per month has been recorded – in accordance with Section 10 of Ministry of Agriculture of the Czech Republic Decree No. 431/2001 Coll.

Data source: state enterprise Povodí, T.G.M. WRI, CZSO

Chart 26

Use of drinking water from public water supply systems by individual groups of customers in Czechia [mil. m³], 2000–2022



Until 2003, data are given only for the main operators. In 2003 and since 2013, the reporting of billed waterhas 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: CZSO

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

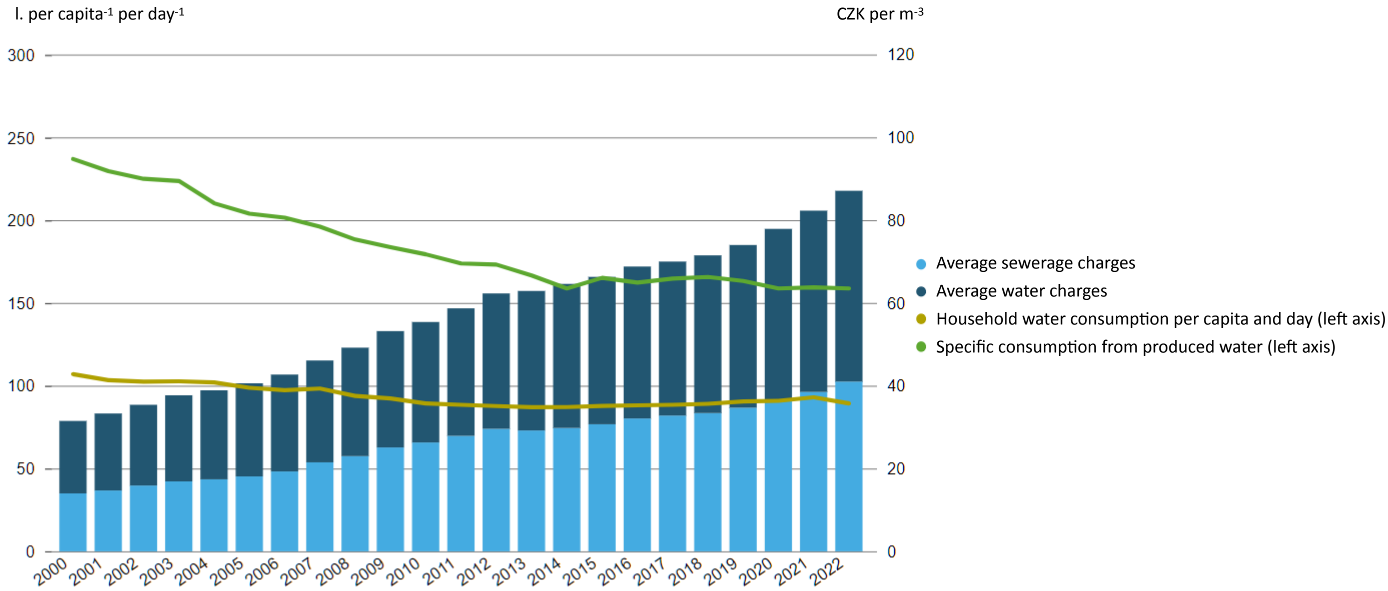
There has been a slight year-on-year decrease in **water losses in the water supply network**, both in absolute terms (from 86 501 thous. m³ to 84 432 thous. m³) and as a share of the total volume of water produced for realisation (from 15.0% in 2021 to 14.7% in 2022). Losses of drinking water in the water supply network are caused by accidents and leaks from 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, remaining at a similar level year-on-year (Chart 27). Households saw a slight decrease of 3.9% year-on-year, with 89.5 l per capita per day consumed by households in 2022.

The upward trend in **water and sewerage prices** continued in 2022, with average water and sewerage prices reaching CZK 46.1 per m³ excluding VAT and CZK 41.0 per m³ excluding VAT (Chart 27).

Chart 27

Water consumption in Czechia [l.person^{-1}.day^{-1}] and the price of water [CZK.m^{-3}], 2000–2022



Up to and including 2003, water price data are given only for the main operators; from 2004 onwards, waterprice 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 m³ since 2013 is not fully comparable with the preceding years.

Data source: CZSO

1.1.6. Water availability and quality in an international context

Key messages

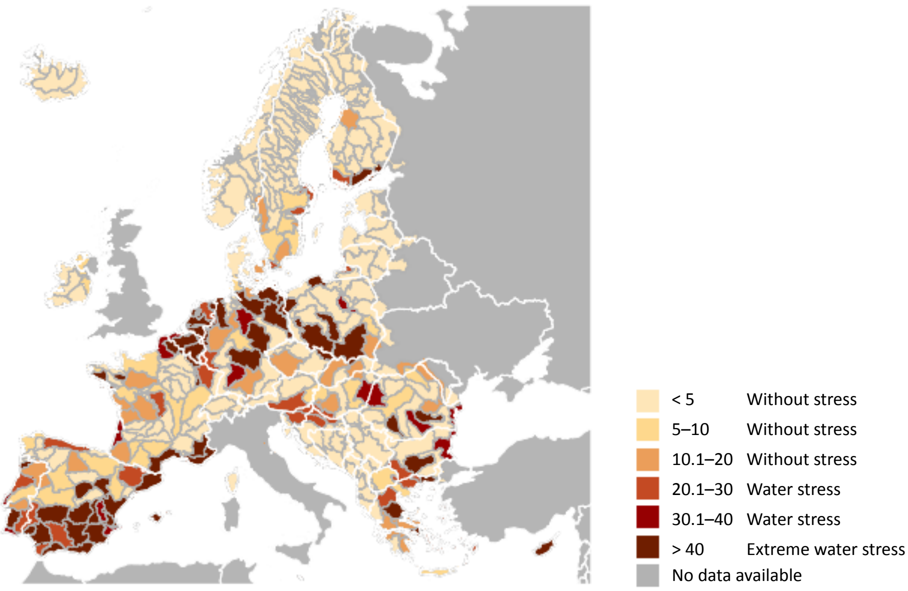
~	In the 2022 bathing season, 79.3% of bathing areas in EU Member States had excellent water quality (76.9% in Czechia).

In the 2022 bathing season, 7,139 **inland bathing water areas** in EU Member States were assessed according to Directive 2006/7/EC24 of the European Parliament and of the Council, of which 79.3% had excellent water quality. Czechia had 76.9% of sites with excellent water quality.

Access to water resources is strongly dependent on the geographical location and physical and geographic conditions of each country. High water stress was found in most of the Iberian and Peloponnesian basins, as well as in the Vezera, the Meuse, the Oder and the Balearic Islands. In general, water scarcity is felt more often in southern Europe, especially in summer due to higher abstraction for agriculture, water supply, tourism and lower rainfall. The situation is also similar on Mediterranean islands such as the Balearic Islands, Crete and Sicily, where intensive agriculture combined with drought results in high levels of water stress (Fig. 15).

Fig. 15

Water scarcity in Europe as measured by the WEI [%], summer 2019



Data for 2020–2022 are not available at the time of publication.

Data source: EEA

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 values for pollutants and the long-term reduction of air pollution burden. 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. At present, the most important air pollutants in Czechia are suspended particulate matter, benzo(a)pyrene, nitrogen oxides and ground-level ozone, which are concentrated both in small settlements where households burn solid fuels and in industrial and transport congested areas. 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

- determining the method of assessment and management of ambient air quality
- introducing limit values for suspended particulate matter PM_{10} and $PM_{2.5}$, sulphur dioxide, nitrogen dioxide and oxides of nitrogen, lead, benzene, carbon monoxide and ozone

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

- the introduction of target values for concentrations of arsenic, cadmium, nickel and benzo(a)pyrene in ambient air in order 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

National Emissions Reduction Programme of the Czech Republic

- providing in particular for measures to reduce the amount of emissions of certain pollutants into the air and thus to remedy the unsatisfactory state of the air

1.2.1. Emissions of air pollutants

Key question

Is the reduction in pollutant emissions sufficient for Czechia 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 does household heating affect emissions of air pollutant? How are pollutant emissions from different modes of transport evolving?

Key messages

	Emissions of all main pollutants (NO_X, VOCs, SO_2, NH_3 and $PM_{2.5}$) into the air are decreasing in the short term. Emissions of main pollutants from transport are decreasing, with the most significant decreases registered for VOC and CO emissions. The decline is linked to the modernisation of the road vehicle fleet.
	In the context of meeting emission ceilings, it can be concluded that unless there are significant changes in the current trend, the required emission reductions by 2025 and 2030 may not be achieved for all substances. PM emissions from transport fell by only 20.3% between 2000 and 2022.
	The major contributions to air emissions of PM_{10}, $PM_{2.5}$, B(a)P, CO and VOC come from fuel consumption in households. PAH emissions from transport have been steadily increasing due to the growth in energy consumption in transport, doubling since 2000. Diesel passenger cars, including those meeting the highest EURO 4–6 emission standards, account for 83.8% of total NO_x emissions from passenger cars in 2022, although the number of registered diesel vehicles is 1.1 mil. lower than the number of petrol vehicles.

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 household heating				
Emissions from transport*				
Emissions of basic pollutants from transport				
PAH emissions from transport				

** Due to the heterogeneity of the topics on which the construction of the indicator is based, an assessment of partial (elementary) indicators is given.*

Emissions of selected air pollutants

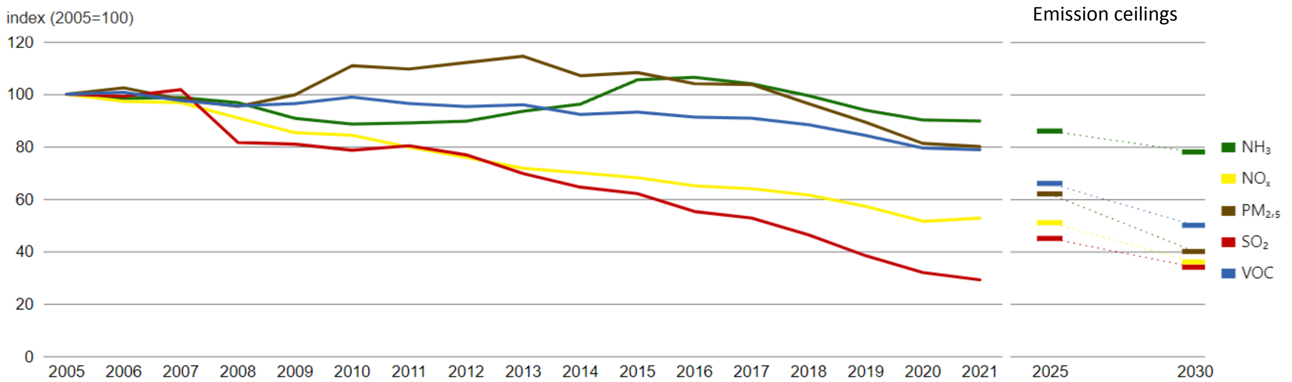
Emissions of the main air pollutants (including NO_X, SO_2, NH_3, VOC, $PM_{2.5}$ and also PM_{10}, CO and B(a)P) are related to the way households heat their homes, the intensity of road transport and the structure of the national economy (GDP generation structure and industrial sectoral structure), as well as the success of the implementation of air pollution reduction measures.

Emissions of selected air pollutants (pollutants with national emission reduction ceilings – NO_X, SO_2, NH_3, VOCs, $PM_{2.5}$) are decreasing in the short term and for most pollutants also in the long term. The long-term trend for $PM_{2.5}$ and the medium- and long-term trend for NH_3 are unclear. 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. The decline in pollutant emissions in subsequent years was supported by innovative developments in all sectors, a reduction in the material and energy intensity of the economy, and the obligation to comply with legislative requirements for emissions from air pollution sources.

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 **national emission ceilings**, assumes a percentage reduction in emissions compared to 2005 values. The latest national emissions balance[37] shows that unless there are significant changes in the current trend (additional or already set measures), the required emission reductions for both 2025 and 2030 may not be achieved for all substances (Chart 28). However, according to the 2023 Projection[38] of the CHMI, measures are set in such a way that the national emission ceilings will be met even without additional measures.

Chart 28

Emissions of selected pollutants in Czechia and national emission ceilings for 2025 and 2030 [index, 2005 = 100], 2005–2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance of the whole time series was recalculated from the August 2023 CHMI data.

Data source: CHMI

SO_2 and NO_X emissions are decreasing over the long term (SO_2 by 70.8%, NO_X by 47.3% between 2005 and 2021[39]) 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 an increase in electricity generation in nuclear power plants, as well as electricity generation from renewable energy sources, play an important role. In the short term, the dynamics of the

---

[37] *The emission balance of the whole time series was recalculated from the August 2023 CZMÚ data.*

[38] *2023 Projection to meet national emission reduction commitments, more at: [https://www.ceip.at/status-of-reporting-and-review-results/2023-submission.](https://www.ceip.at/status-of-reporting-and-review-results/2023-submission)*

[39] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance of the whole time series was recalculated from the August 2023 CHMI data.*

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.

The long-term development of **NH_3 emissions** (a decrease of only 10.2% between 2005 and 2021[40]) is mainly related to Czechia's agricultural policy (and the long-term decline in livestock numbers also contributes). Although NH_3 emissions are decreasing, the dynamics are not as pronounced as for other pollutants.

In the long term,[41] **$PM_{2.5}$, PM_{10}** and **VOC emissions** decreased by 20%, 21.3% and 21.2% respectively in the 2005–2021 period. However, the situation in individual years is directly influenced by the meteorological conditions in the respective heating season and is also significantly influenced by the type of fuel used in household heating systems. The long-term decline in **CO emissions** (by 13.3% between 2005 and 2021) is linked to trends in transport and 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.

The most important groups of emission sources differ according to pollutants (Chart 29). For NO_X emissions in 2021[42], transport was the main source (31.0%), as well as the public energy and heat generation sector (21.5%). VOC emissions came from both household fuel consumption (56.4%) and production processes without combustion (20.4%). In the case of SO_2 emissions, the majority of emitters were the public energy and heat sector (40.0%), household fuel consumption (25.2%) and industrial energy (23.0%). NH_3 emissions were mainly from the agricultural sector (95.2%). For suspended particulate matter in the PM_{10} and $PM_{2.5}$ size fractions, household fuel consumption (household heating) was the dominant source in 2021, accounting for 83.7% of total emissions for $PM_{2.5}$ and 70.0% of total emissions for PM_{10}. In the case of CO emissions, household fuel consumption was also a major source (69.7%).

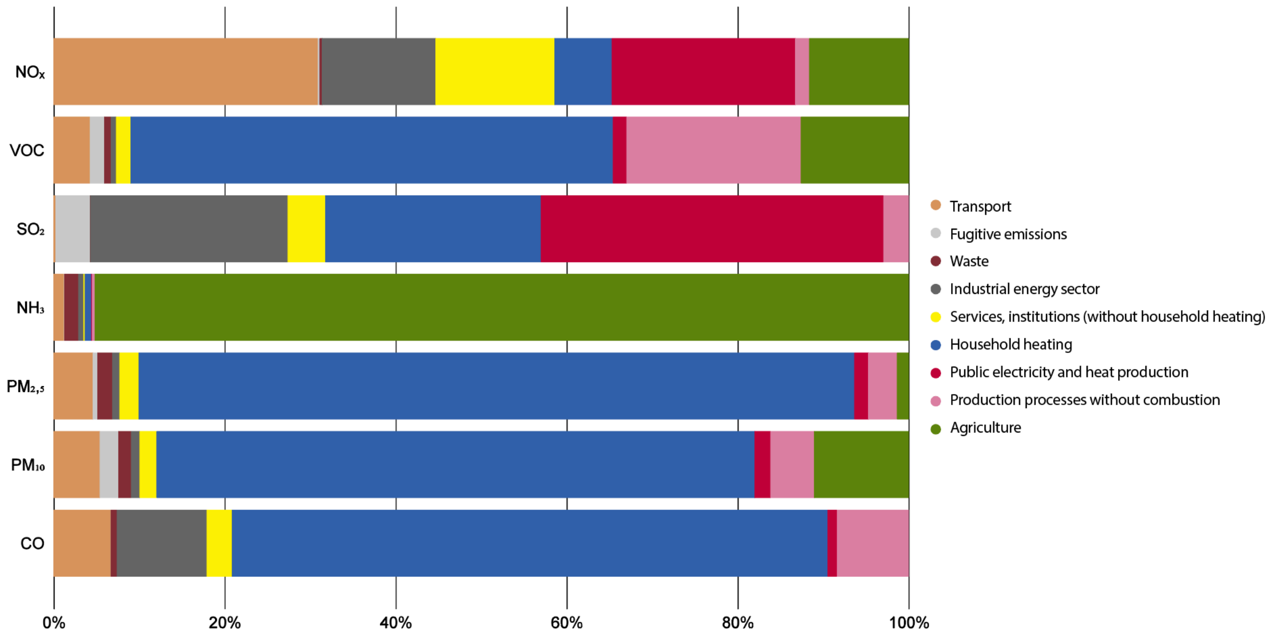
[40] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

[41] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

[42] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

Chart 29

Sources of emissions of selected pollutants by sector in Czechia [%], 2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance was recalculated from the CHMI data in August 2023.

Data source: CHMI

Emissions from household heating

Household heating[43] has a major impact on air quality in settlements, as emissions from local heating plants in particular tend to be emitted from lower chimneys than emissions from industrial plants. They are therefore unable to disperse in the ambient air and can endanger the population in higher concentrations.

The composition and quantity of emissions is strongly influenced by the choice of fuels and the way domestic boilers are operated in local heating systems. Particularly problematic is the combustion of solid fuels (coal, wood), where domestic boilers and stoves produce significant amounts of particulate matter, polycyclic aromatic hydrocarbons and other substances that have a negative impact on the health of the population due to imperfect combustion.

The second important factor affecting heating emissions is the **course and duration of the heating season**. The heating season is characterised by the unit of the heating degree day, which is given by the product of the number of heating days and the difference between the average indoor and outdoor temperature. Thus, the diurnal rates show how cold or warm it was for a certain period of time and how much energy is needed to heat the buildings. If the heating season is colder, heating emissions can increase proportionally and vice versa.

[43] *The category of emissions from household heating includes all emissions from fuel consumption in households, including, for example, emissions from cooking and hot water heating.*

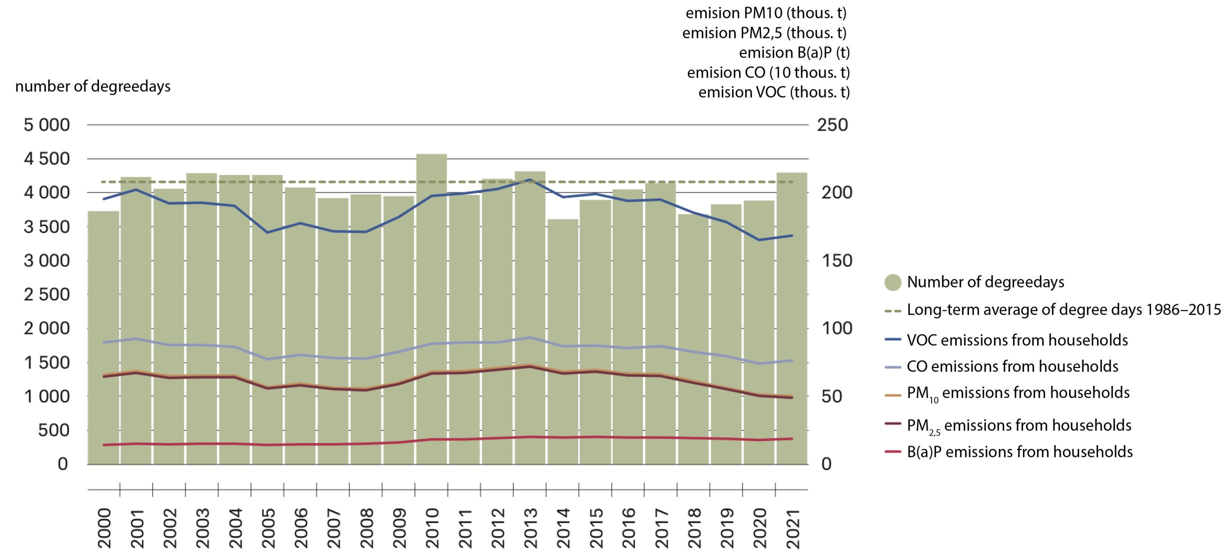
In 2021[44] the heating season was at 4,300 degree days, which is higher than the 1986–2015 long-term average, and implies a cooler season with greater heating demand. The year 2021 was also cooler compared to the previous year 2020.

Despite this, **PM_{10} emissions from household fuel consumption in** 2021[45] decreased by 1.8% year-on-year to 50.4 thous. tonnes, accounting for 70.0% of total PM_{10} emissions. **$PM_{2.5}$ emissions** from households also decreased by 1.8% year-on-year to 49.3 thous. tonnes and their share of total $PM_{2.5}$ emissions in 2021 was 83.7%. In contrast, **B(a)P emissions** from households increased by 4.0% year-on-year to 18.7 t. Their share of total B(a)P emissions is substantial, at 97.3% in 2021. **CO emissions** from households in 2021 reached 763.0 thous. tonnes, an increase of 3.0% year-on-year and a share of 76.3% of total emissions. **VOC emissions** from households increased by 1.7% year-on-year to 168.2 thous. tonnes in 2021, accounting for 56.4% of total VOC emissions.

The high levels of pollutant emissions from households are the reason why household heating is a focus of attention in subsidy programmes, as there is potential to further reduce air emissions. Currently, it is possible to draw support for the replacement of solid fuel boilers from the so-called boiler subsidies.

Chart 30

Comparison of heating season characteristics with emissions from household heating in Czechia [number of degree days, 10 thous. t, thous. t, t], 2000–2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024.

Data source: CHMI

Emissions from transport

Transport is a significant source of air pollutants and a factor affecting air quality, especially in urban agglomerations. **Emissions of the main pollutants from transport** (NO_x, VOC, CO and PM) have declined over the 2000–2022 period (Chart 31), with the most significant long-term downward trend observed for CO (by 3.8% per year) and VOC (by 3.5% per year). This favourable development can be linked to the renewal and modernisation of the vehicle fleet, in which the proportion of vehicles complying with higher EURO emission standards increased, and at the end of the period also vehicles using alternative fuels and power. Overall, NO_x emissions from transport decreased by 43.1%, VOC emissions by 78.9%, CO by 84.0%

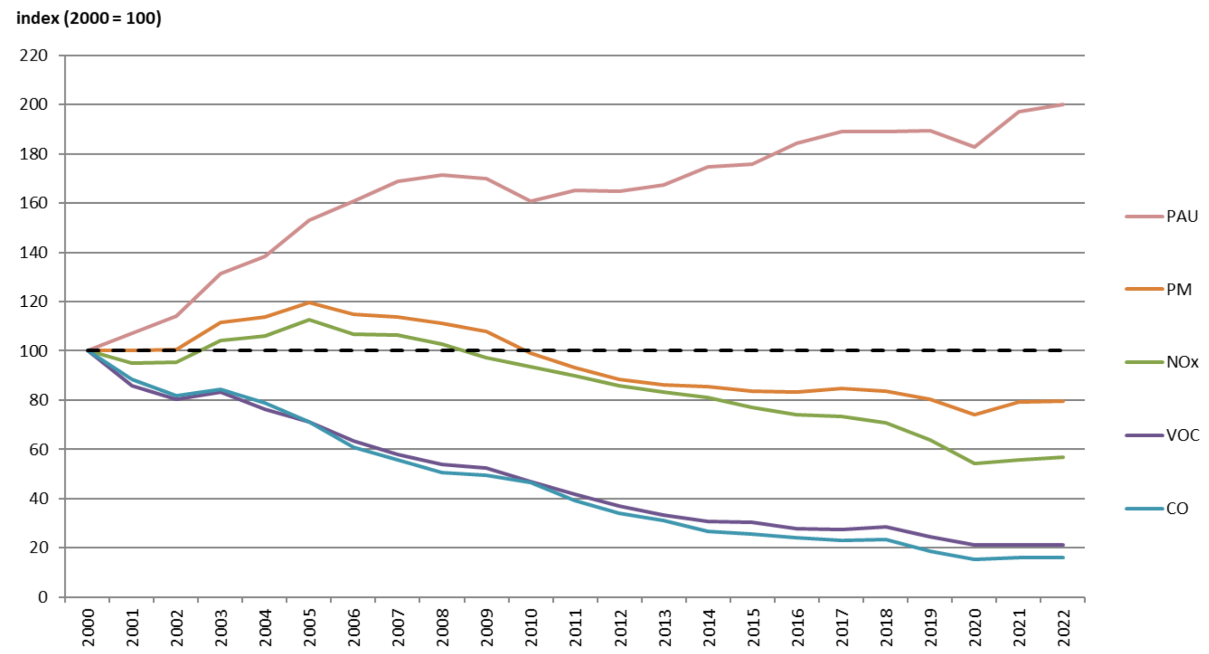
[44] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

[45] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

and suspended particulate matter (PM) by 20.3% between 2000 and 2022. **Emissions of polycyclic aromatic hydrocarbons (PAHs)**, which pose serious health risks, rose between 2000 and 2022 as energy and fuel consumption in transport increased. Overall, emissions of PAH increased by 100.0% in the period under review, i.e. they doubled.

Chart 31

Development of pollutant emissions from transport [index, 2000 = 100], 2000–2022



Data source: Transport Research Centre

The development of emissions during the period under review was subject to fluctuations influenced by fluctuations in the performance of the economy, which were reflected in the evolution of freight and road transport performance, as well as changes in the road vehicle fleet. At the beginning of the 21st century, during a period of economic growth, the share of more emission-intensive diesel power in the passenger car fleet increased, which affected the development of NO_x and PM emissions in particular. In the case of **PM emissions**, the overall lower relative decrease is also linked to the fact that PM emissions are also produced from processes without combustion (road dust resuspension, tyre and brake abrasion), which are only minimally affected by the technological modernisation of the fleet.

Towards the end of the period, in 2020 and 2021, emissions trends were influenced by the **impact of the COVID-19 pandemic** on transport. This effect is also evident in the year-on-year comparison of 2022 versus 2021, when the level of VOC, CO and PM emissions from transport changed only slightly (+-1% at most), while NO_x emissions increased by 2.1%. The year-on-year growth in NO_x emissions was mainly due to the development of emissions from aviation, which increased by 68.2%. Emissions from passenger car transport rose by only 0.7%, even though IAD performance increased by 3.7% to its highest level since 2000. This has continued the decline in the emission intensity of IADs per unit of transport capacity.

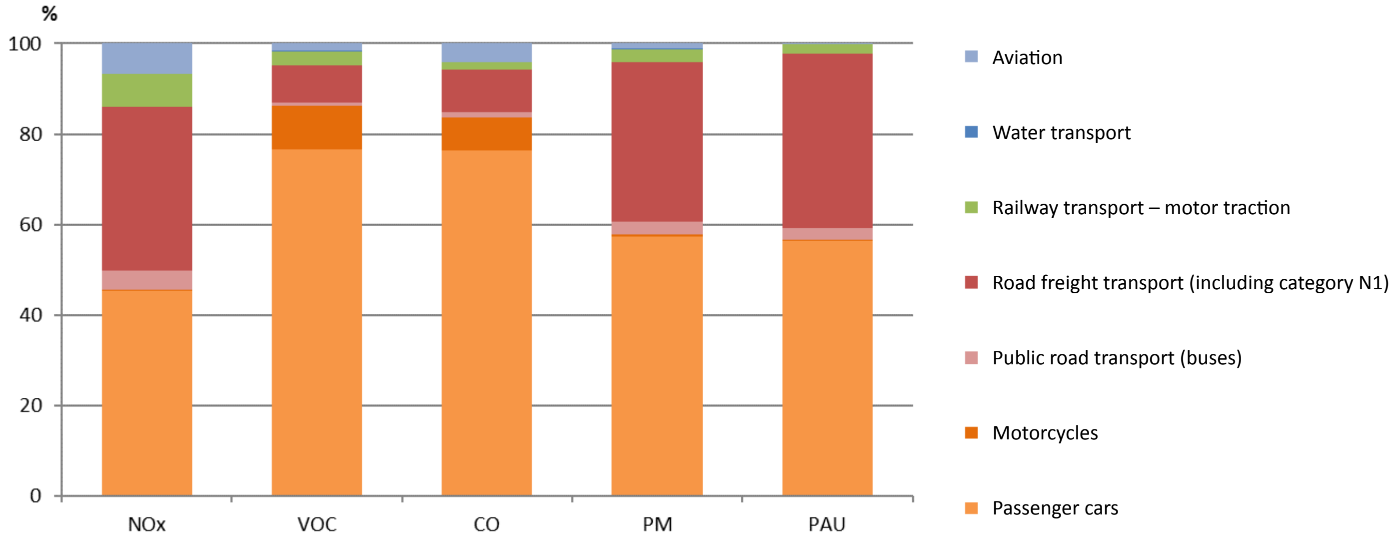
The most important category of transport emissions sources for all monitored substances is **passenger car transport** (Chart 32), with the highest shares (according to 2022 data) of VOC (76.5%) and CO (76.3%) emissions. This is due to the low transport and energy efficiency of individual transport compared to public transport and the high share of passenger car transport in the total passenger transport output (71.3% in 2022).

Diesel passenger cars accounted for 83.8% of NO_x emissions from passenger car transport in 2022, although there were about 1.1 mil. fewer registered diesel vehicles than petrol vehicles. Diesel is more emissions-intensive than petrol, and the higher utilisation (mileage) of diesel vehicles, which are often part of company fleets, also has an impact on emissions.

Road freight transport accounted for about one third of total NO_x, PM and PAH emissions from transport in 2022. Of the **non-road modes of transport**, rail transport accounted for 7.1% of NO_x emissions, and air transport accounted for 6.6% of NO_x emissions from transport. The emission inventory includes only aircraft taking off and landing in Czechia, not flights over Czechia.

Chart 32

Structure of pollutant emissions from transport by mode of transport in Czechia [%], 2022



Data source: Transport Research Centre

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

✓	In recent years, the limit values for PM_{10} and $PM_{2.5}$ are exceeded only over a minimal area of the territory.
~	Some immission limits are still being exceeded. In 2022, 1.7% of the territory of Czechia was defined as having exceeded at least one immission limit without including ground-level ozone; 11.7% of the population lived in this area.
✗	In 2022, five smog situations were declared due to ozone thresholds value being exceeded for a total of 53 hours.

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
Air quality in terms of human health protection	↝	↗	↗	~
Air quality in terms of vegetation and ecosystem protection	↗	↗	↗	~

Air quality in terms of human health protection

Air pollution is one of the factors that affect human health, and its effects can be seen even at very low concentrations of 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 transport. The last five years have had very good dispersion conditions compared to the long-term average (from 2012–2021), and at the same time, with the exception of 2021, 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, the modernisation of the composition of combustion equipment in households (the boiler subsidy effect) and the gradual renewal of the vehicle fleet.

In 2022, 1.7% of the territory of Czechia was defined as having **exceeded** at least one **limit value**[46] without including ground-level ozone, with 11.7% of the population living in this territory. The Moravian-Silesian, Olomouc and Zlín regions remain the most polluted (Fig. 16). The limit values for ground-level ozone were exceeded only over a minimal area of the territory in 2022, as in the previous year.

In 2022, five smog situations were announced due to ozone limit values being exceeded with a total duration of 53 hours (over two days in four regions/agglomerations). No smog situation was announced due to limit values for suspended particulate matter PM_{10} being exceeded. Very good dispersion conditions

[46] *Act No. 201/2012 Coll., on Air Protection, as amended, Annex No. 1, Part 1.–3. (Limit values for sulphur dioxide, nitrogen dioxide, carbon monoxide, suspended particulates, benzene, lead, benzo(a)pyrene, arsenic, cadmium, nickel)*

prevailed, especially in early 2022 (above-normal temperatures in January and February 2022 associated with lower emissions from local heating plants, normal precipitation important for atmospheric self-cleaning, and good dispersion conditions with occasional strong winds in February). In 2022, there were 87.7% of days with good dispersion conditions (the average from 2012–2021 is 82.4%).

Fig. 16

Areas within Czechia with exceeding of the human health protection limit values for selected groups of substances [%], 2022

Data source: CHMI

The limit values for **suspended PM_{10} and $PM_{2.5}$ particulate matter** are exceeded in Czechia on a long-term basis, however, only in a small area of the territory. 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 affects the intensity of household heating. The limit value for the daily average concentration of PM_{10} (Chart 33) was exceeded in only 0.02% of the territory in 2022 (0.1% in 2021); 0.03% of the Czech population was exposed to above-limit concentrations in the assessed year. 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 $\mu g.m^{-3}$ for the annual average concentration of $PM_{2.5}$ came into effect, which was exceeded in only 0.03% of the territory in 2022 (Chart 33) with 0.1% of the Czech population being exposed to above-limit concentrations in this assessed year. However, taking into account the limits set by the WHO, the risk to the population from air quality is still significant.

The severity of **population exposure to suspended particles** depends on the concentration of suspended particles, their size, shape and chemical composition. 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, approximately 1.7% for the nation

as a whole in 2022 (Tab. 1), with vulnerable people (long-term sick or elderly) always being the most affected.

Tab. 1

Increase in total annual premature mortality due to PM_{10} for the whole of Czechia and for urban unburdened areas [%], 2010–2022

PM_{10} (75% $PM_{2.5}$ fraction)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	%												
Mean estimate for Czechia	5.8	6.5	5.7	5.6	5.4	4.3	3.2	4.3	4.9	2.5	1.2	1.7	1.7
Mean estimate for the normal urban environment	4.2	5.6	4.7	4.7	4.6	3.6	3.0	3.9	4.2	1.9	1.0	1.6	1.3

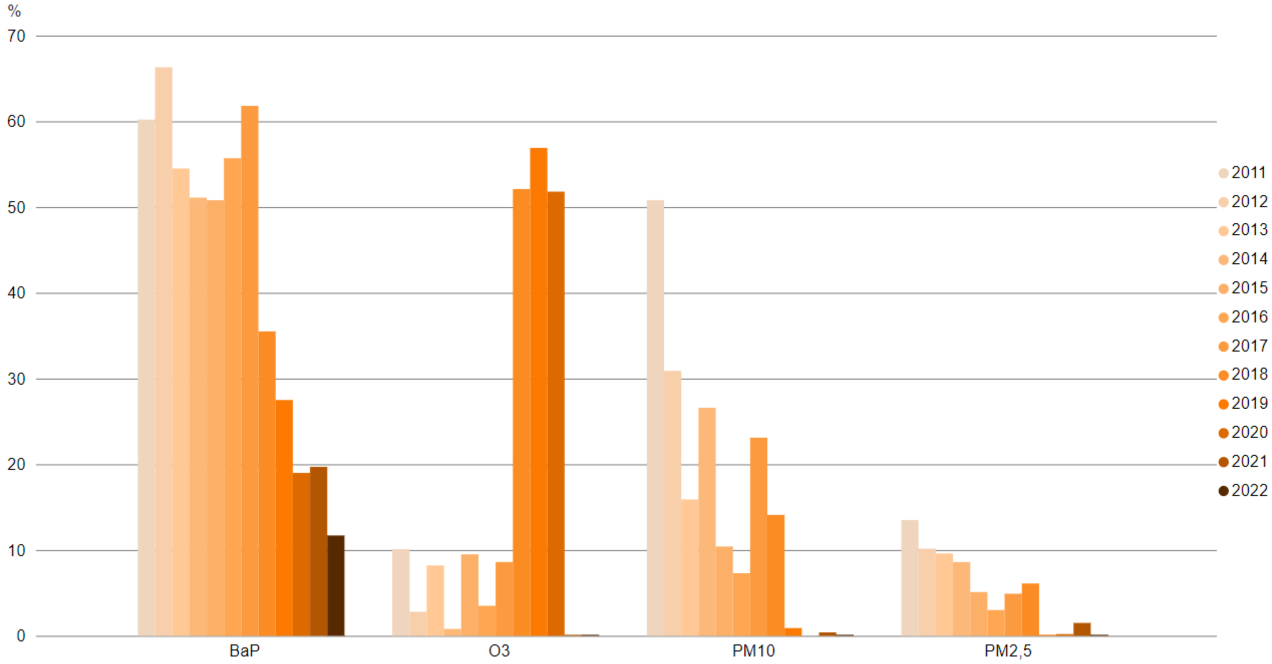
An indicator of the health effects of long-term exposure is an estimate of the number of premature deaths for the adult population over 30 years of age, excluding external causes of death (accidents, suicide, etc.). The increase in total mortality was calculated from measured values in Czechia and from estimated values in urban unburdened localities. 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 for 75% of Czechia was used. As of 2021, the updated WHO Guide Lines are in force, with 15 $\mu g.m^{-3}$ for PM_{10} (originally 20 $\mu g.m^{-3}$). Therefore, in the diction of these WHO Guide Lines, values from 2010 onwards have been back-calculated.

Data source: Institute of Public Health based in Ostrava, ID No.: 71009396, Institute of Public Health based in Ústí nad Labem, ID No.: 71009361 and the National Institute of Public Health, ID No.: 75010330

Benzo(a)pyrene (B(a)P) is described as the most problematic pollutant in Czechia, being produced by imperfect combustion and mostly bound to the fine fraction of suspended $PM_{2.5}$ particulate in the air. High concentrations are achieved in industrial locations, but above-limit concentrations are found in the long term, especially in small settlements with solid fuel heating. In 2022, the emission limit for B(a)P was exceeded in 1.7% of the territory where 11.7% of the population lived (Chart 33). Concentrations of B(a)P show a significant annual trend with peaks in winter due to worsening dispersion conditions and pollution from local household heating. B(a)P has been shown to be mainly carcinogenic. The theoretical estimate of the probability of developing cancer under lifetime exposure to measured B(a)P concentrations in Czechia as of 2022 ranges from 3 to 53 persons per 100 000 lifetime-exposed inhabitants, depending on the type of urban location.

Chart 33

Proportion of the population of Czechia exposed to above-limit concentrations of pollutants [%], 2011–2022



B(a)P annual average – annual average greater than 1 ng.m^{-3}

O_3 daily average – the 26th highest value in the last 3 years of the maximum daily 8-hour moving average greater than 120 µg.m^{-3}

PM_{10} daily average – 36th highest daily average value greater than 50 µg.m^{-3}

$PM_{2.5}$ annual average – annual average greater than 20 µg.m^{-3}

In 2020, a stricter immission limit of 20 µg.m^{-3} for the annual average concentration of $PM_{2.5}$ came into force.

Data source: CHMI

The existence of ozone (O_3) 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 (VOCs, 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. Its concentrations are mainly influenced by the nature of meteorological conditions (intensity and duration of sunshine, air temperature and precipitation). The years 2018–2020 were very favourable for ground-level ozone formation due to high temperatures in the summer months (Chart 33). In 2022, only 0.2% of the territory exceeded the limit value for the protection of human health for ozone, and 0.02% of the population was exposed to concentrations above the limit, the same as in the previous year.

High concentrations of **nitrogen oxides** (NO_X) cause respiratory problems, especially in congested areas. In 2022, the limit value for NO_2 was again not exceeded. Neither daily nor hourly **sulphur dioxide** (SO_2) limit values were exceeded at any site in 2022, nor were the immission limits set for arsenic, cadmium, lead, nickel and carbon monoxide (CO) exceeded. High concentrations of NO_X, SO_2, VOCs and CO cause respiratory problems, aggravate asthma and are associated with an increase in overall, cardiovascular and respiratory mortality, and also adversely affect the nervous system.

Air quality in terms of ecosystem and vegetation protection

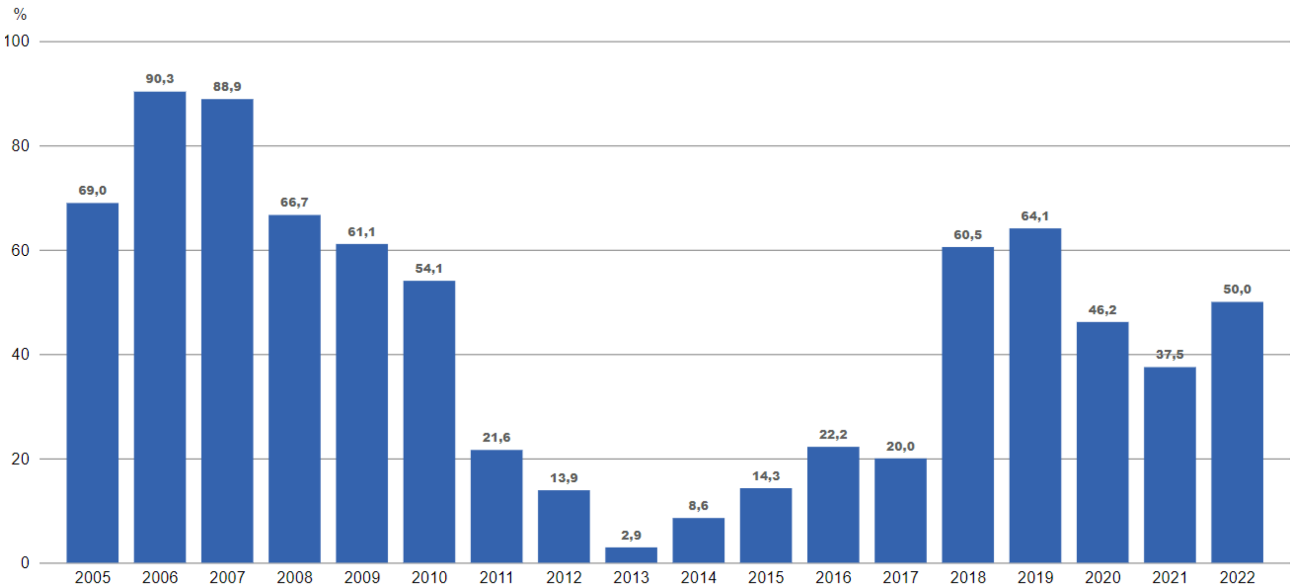
Air pollution together with atmospheric deposition has a negative impact both on humans and on ecosystems and vegetation. Atmospheric deposition and ground-level ozone both reduce the resistance of vegetation to external influences and also affect the water regime and biodiversity.

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) were exceeded at 50% of stations in Czechia in 2022 (calculated as an average for 2018–2022, Chart 34). The year-to-year changes in the AOT40 exposure index are influenced not only by the cumulative emissions of ozone precursors, but mainly by meteorological conditions between May and July.

Other limit values for the protection of ecosystems and vegetation for SO_2 and NO_X were not exceeded in 2022.

Chart 34

Percentage of stations where the limit values expressed as AOT40 (5-year average) for ecosystem and vegetation protection in Czechia was exceeded [%], 2005–2022



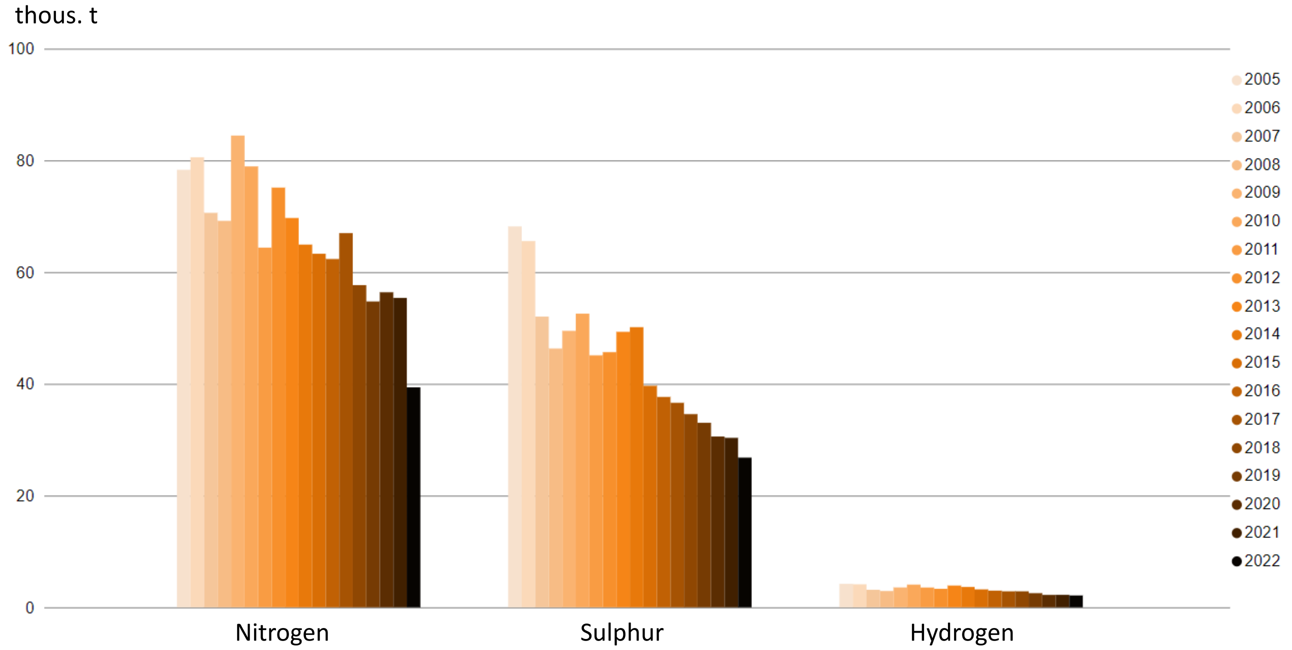
Data source: CHMI

Atmospheric deposition is a process that contributes significantly 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, especially water and soil, thereby reducing the resilience of vegetation to external influences and also affecting the water regime and biodiversity. Despite the long-term decline in pollutants (Chart 35), 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[47] were recorded in the Ore Mountains and the Ostrava region.

[47] *More information on the development of sulphur deposition is available in the 30 YEARS OF THE ENVIRONMENT of the independent Czech Republic storymap (https://landcover.cenia.cz/30letceskeprirody/).*

Chart 35

Trend in the total atmospheric deposition of sulphur, nitrogen and hydrogen ions in Czechia [thous. t], 2005–2022



Data source: CHMI

Air quality in an international context

Key messages

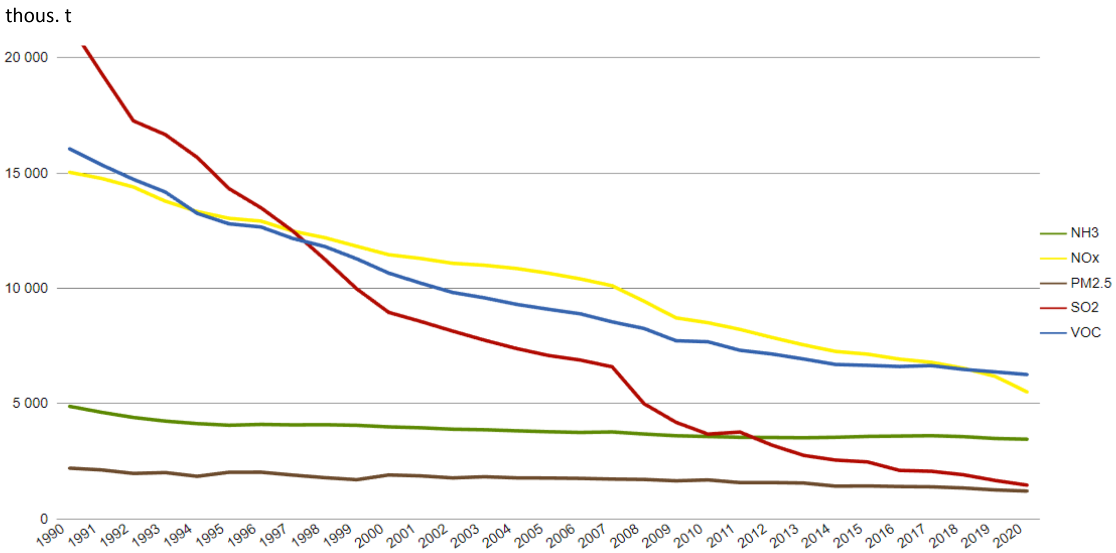
	Emissions of all major air pollutants are falling in the EU27.
	Air pollution is the biggest environmental health risk in Europe (EEA, 2023) and has a significant impact on the health of European populations, especially in urban areas.
	In the EU27, 15 countries need to reduce emissions by more than 30% for at least one pollutant to meet long-term commitments. In 2021 more than 10% of the urban population in the EU27 was exposed to concentrations above the limit for suspended PM_{10} or ground-level ozone (O_3) or benzo(a)pyrene.

Emissions of pollutants in an international context

Emissions of air pollutants in Europe are falling, with significant reductions in SO_2 emissions in the EU27 of 93.3% between 1990 and 2020[48] (Chart 36), while NO_X and VOC emissions more than halved (NO_X by 63.5%, VOC by 61.1%). $PM_{2.5}$ emissions decreased by 45.6%. Overall, ammonia emissions have only decreased by 29.4%, but have stagnated since 2010 (increasing between 2005 and 2020 in Latvia, Luxembourg, Austria, Lithuania, Ireland and Spain). Significant reductions in national emissions of selected air pollutants are required for many countries (fulfilling the commitments of Directive 2016/2284 of the European Parliament and of the Council), with 15 countries needing to reduce emissions by more than 30% for at least one pollutant (more than 50% needing to be reduced in: Malta for NO_X, Hungary and Romania for $PM_{2.5}$ and Cyprus for SO_2). If the EU is to meet its long-term emission reduction commitments, greater efforts are needed, particularly in the transport, energy and agriculture sectors.

Chart 36

Emissions of the main pollutants SO_2, VOC, NO_X, NH_3 and $PM_{2.5}$ in the EU27 [thous. t], 1990–2020



Data for 2021 and 2022 are not available at the time of publication.

Data source: EEA

48 *Data for 2021 and 2022 are not available at the time of publication.*

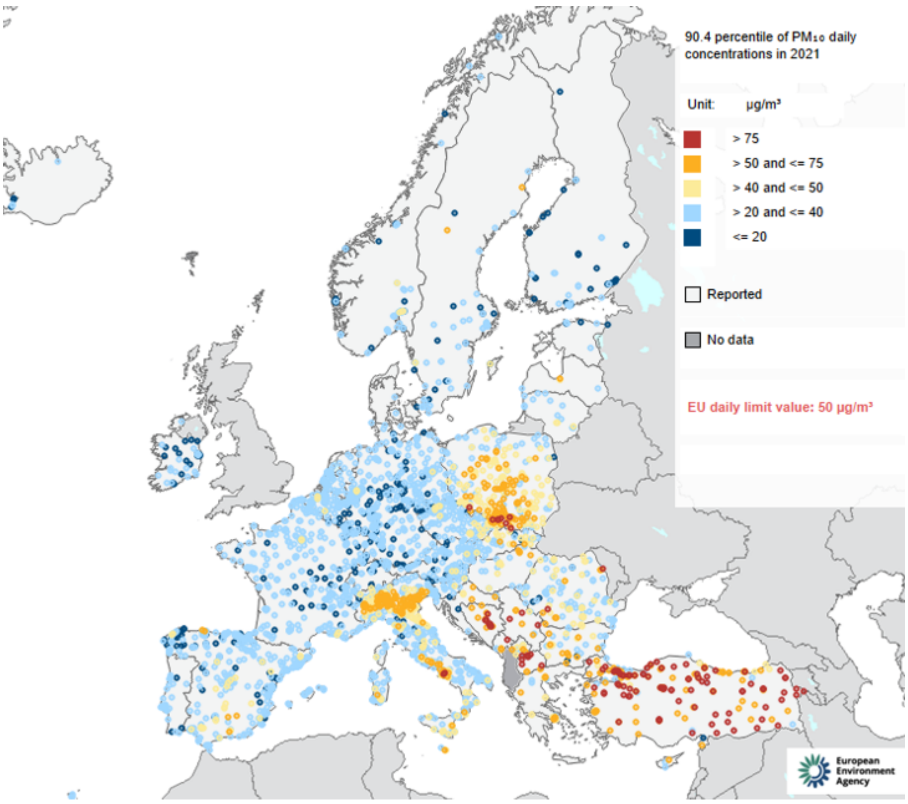
Air quality in an international context

Air quality in Europe is gradually improving, partly thanks to pollutant emissions falling. The most risky substances include suspended PM_{10} and $PM_{2.5}$ fractions, ground-level ozone O_3 and also 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. Yet air pollution is considered the leading cause of premature death and disease in Europe, where 97% of the urban population is still exposed to concentrations of air pollutants that exceed the World Health Organisation (WHO)[49] air quality recommendations.

The exceeding of limit values in Europe continued in 2021[50], with more than 10% of the urban population in the EU27 exposed to above-limit concentrations of PM_{10}, ground-level ozone (O_3) or benzo(a)pyrene. Concentrations above the daily limit for PM_{10} are observed mainly in Italy, Poland and Eastern European countries (Fig. 17). In most countries of Central and Eastern Europe, solid fuels such as coal are widely used for household heating and in some industrial facilities and power plants. The Po Plain in northern Italy is a densely populated and industrialised area with specific meteorological and geographical conditions that favour the accumulation of air pollutants in the atmosphere.

Fig. 17

Average daily concentration of PM_{10} in Europe [$\mu g.m^{-3}$], 2021



The 90.4 percentile of daily average PM_{10} concentrations is reported, representing the 36th highest exceedance value, i.e., the established limit value. Data for 2022 are not available at the time of publication.

Data source: EEA

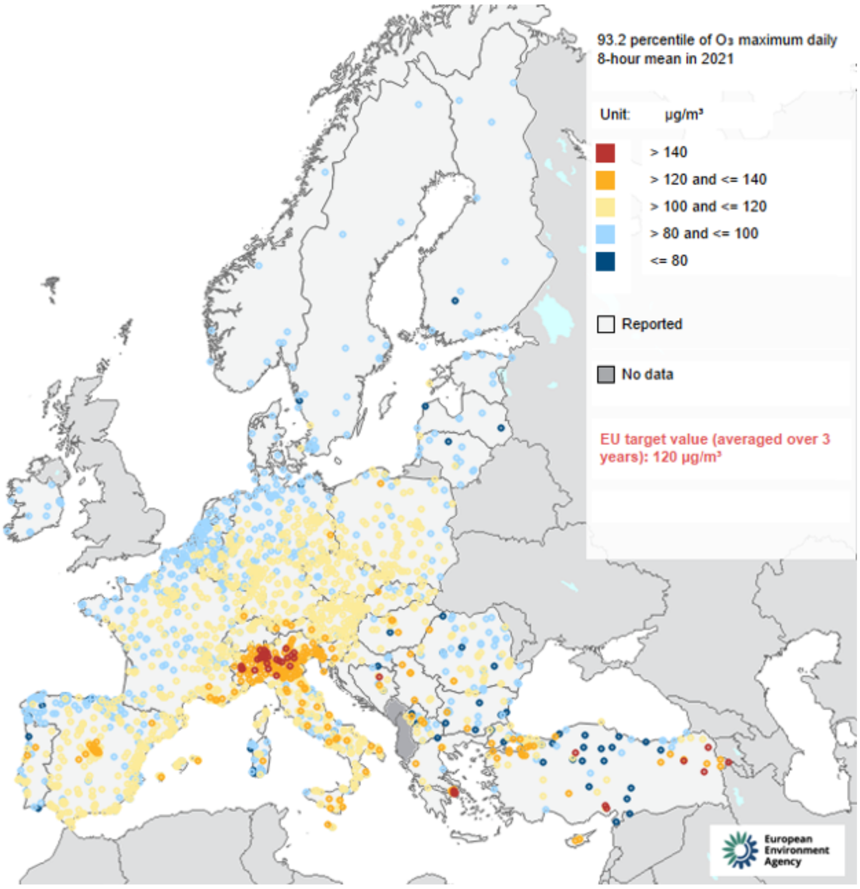
[49] *More at: WHO global air quality guidelines(https://apps.who.int/iris/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1&isAllowed=y)*

[50] *Data for 2022 are not available at the time of publication.*

The highest ground-level ozone concentrations in 2021[51] were found in some Mediterranean (mainly Italy) and Balkan countries (Fig. 18). 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 and, due to climate change, suitable meteorological conditions for ground-level ozone formation occur more frequently. Levels above the ozone threshold target of 120 µg.m^{-3} were reported by 22 countries (including 16 EU Member States) out of 35 reporting EEA countries.

Fig. 18

Average daily maximum 8-hour O_3 concentration in Europe [µg.m^{-3}], 2021



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 2022 are not available at the time of publication.

Data source: EEA

Detailed visualisations and data

https://www.envirometr.cz/data

[51] *Data for 2022 are not available at the time of publication.*

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 of 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 both heavy metals and POPs (except PAHs) have been decreasing in the long term, and the decline is even more significant in the short term.
✗	POPs contamination of the environment is an ongoing problem due to their persistence.

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	↘	↘	↘	✓

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

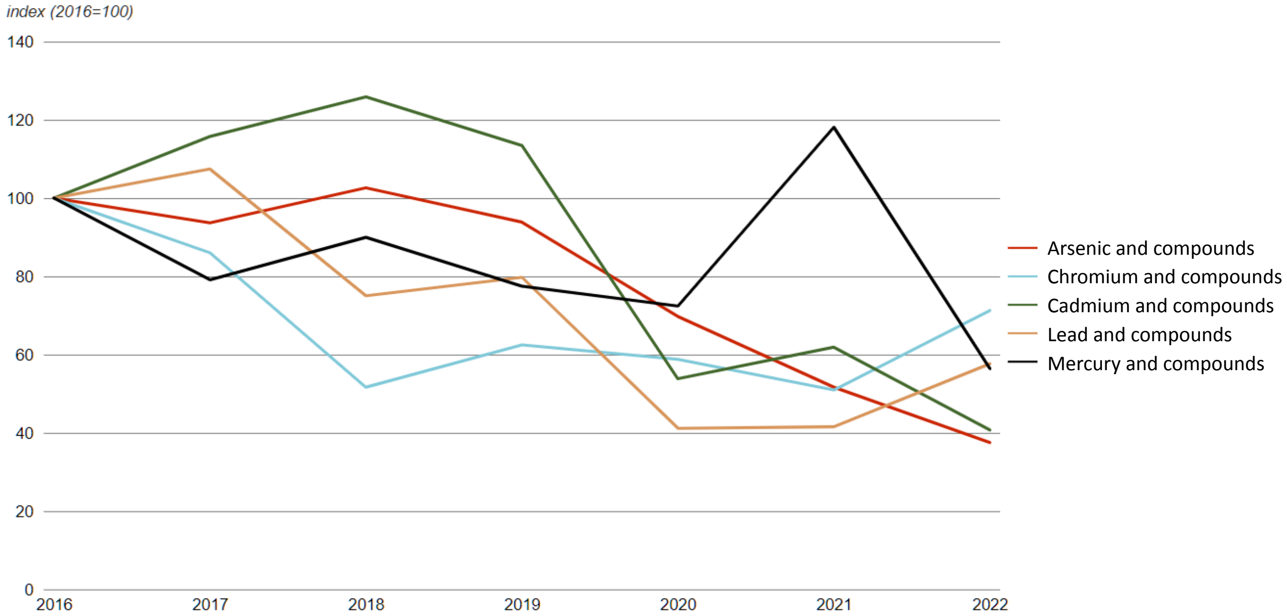
For the reporting year 2022, 1,343 releases to water, land and air were reported to the **Integrated Pollution Register (IPR)** (of which 1,109 were above-limit, meaning that the threshold value was exceeded in these cases). There were 228 reports of releases into water only (212 of which were above-limit).

The number of substances reported in above-limit amounts reported released into water was 23. In terms of releases into water, a total of 687.7 $kg.yr^{-1}$ of arsenic and its compounds, 973.0 $kg.yr^{-1}$ of chromium and its compounds, 34.8 $kg.yr^{-1}$ of cadmium and its compounds, 330.7 $kg.yr^{-1}$ of lead and its compounds, and 37.0 $kg.yr^{-1}$ of mercury and its compounds were reported in 2022 (Chart 37). There were no reports of releases into soil in 2022. The number of reports containing releases into air was 1,115 (of which 897 were above-limit).

Releases into air of selected hazardous chemicals are processed under indicators 1.2.1 Emissions of air pollutants (Air emissions of selected pollutants, Emissions from transport and Emissions from household heating).

Chart 37

Amount of reported releases of selected heavy metals into water reported to the IPR in Czechia [index, 2016 = 100], 2016–2022



Data source: IPR

Air emissions of heavy metals and POPs

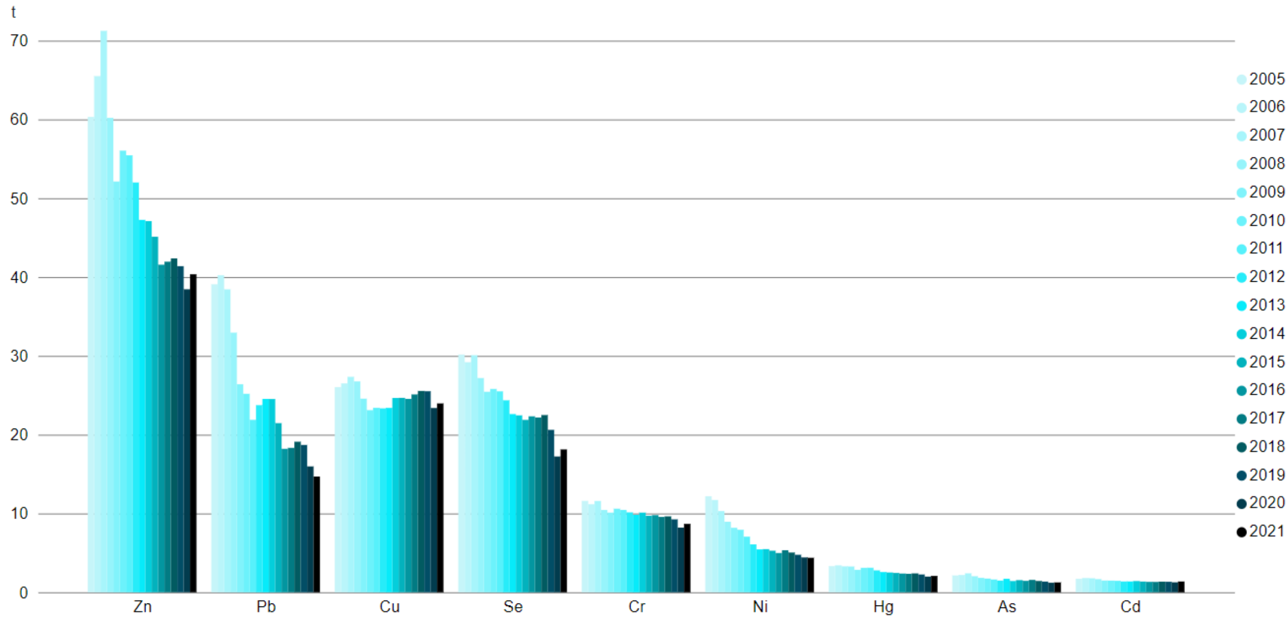
Heavy metals are metals with a specific density of more than 4.5 g.cm^{-3}. They are bound in most fossil fuels, from which they are released during the combustion process. Heavy metals have carcinogenic and mutagenic properties and their danger lies mainly in their possible transfer to environmental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

Emissions of heavy metals have been declining over the long term, despite the fluctuations between years 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 do not show a significant trend in relation to the development of transport performance. Over the 1990–2021[52] period, emissions of arsenic (down 96.8%), lead (down 89.6%) and nickel (down 78.6%) showed the largest decreases. In the medium term, lead and nickel emissions have declined the most (Chart 38).

[52] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

Chart 38

Air emissions of heavy metals in Czechia [t], 2005–2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024.

Data source: CHMI

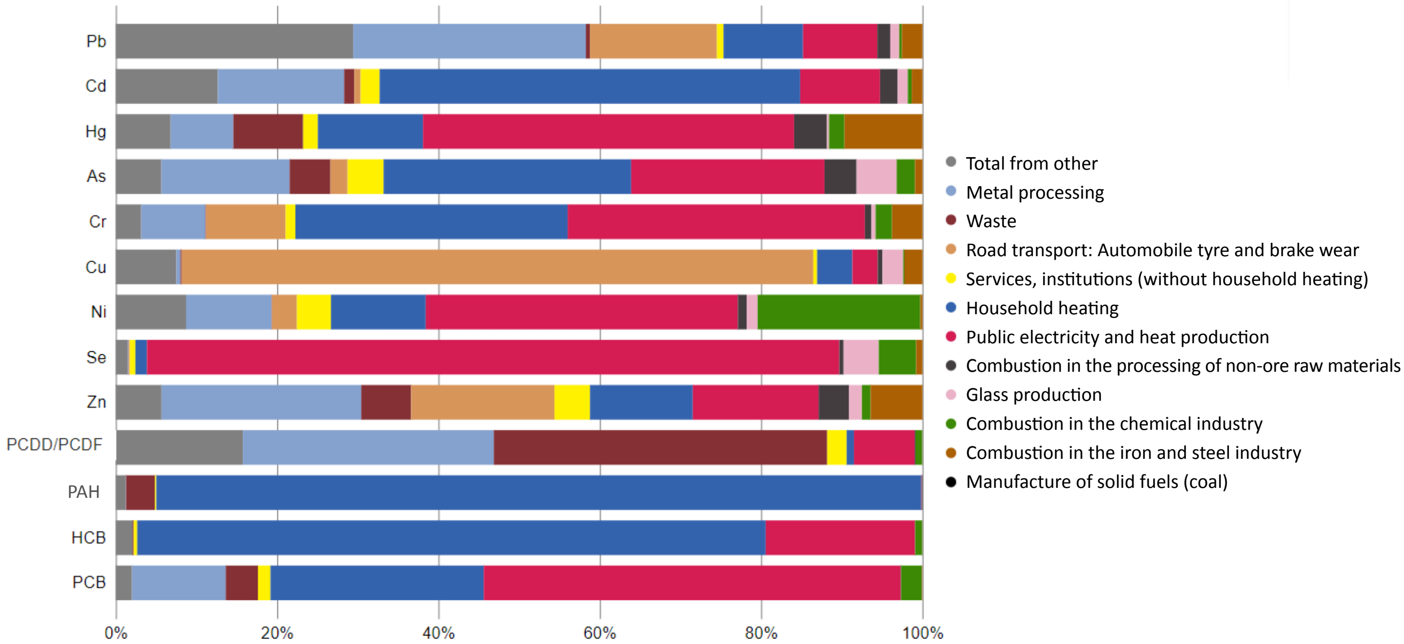
The main **sources of heavy metal emissions** (Chart 39) in Czechia in 2021[53] included the public energy and heat sector (85.8% of the selenium and 46.0% of the mercury emissions), local household heating (52.1% of cadmium, 33.8% of chromium and 30.7% of arsenic emissions), tyre and brake wear (78.3% of copper emissions) and metal processing (28.9% of lead and 24.8% of zinc 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. 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. Czechia is one of the countries that has 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.

[53] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024.*

Chart 39

Sources of air emissions of selected heavy metals and POPs in Czechia [%], 2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance was recalculated from the CHMI data in August 2023.

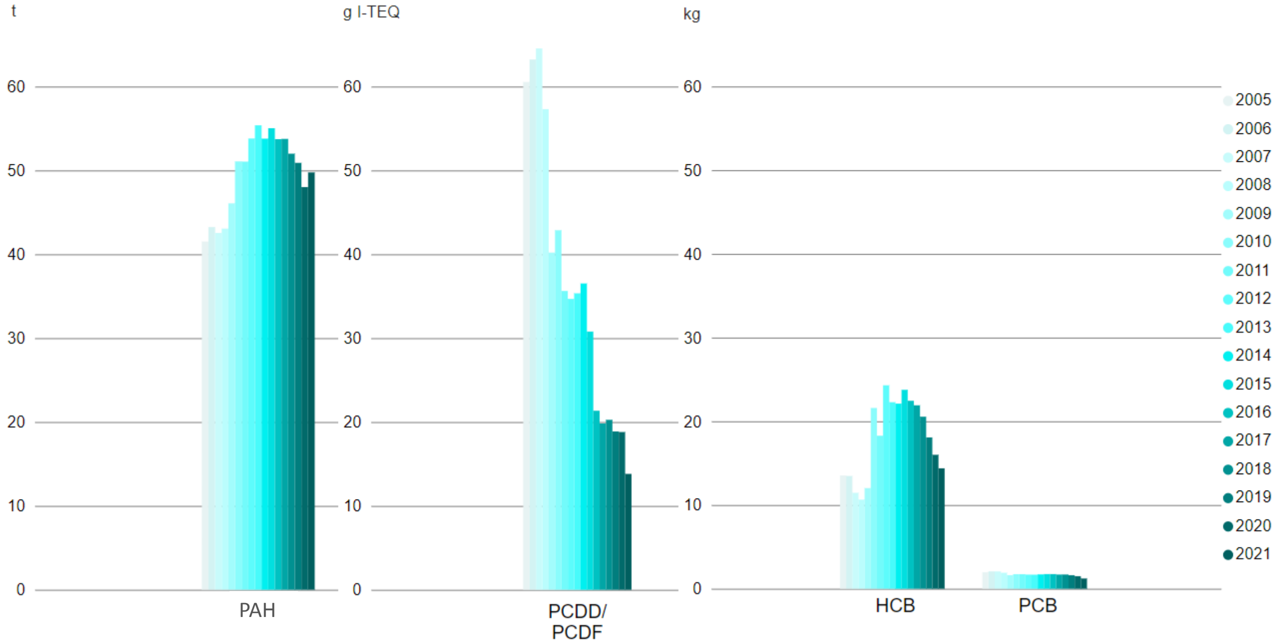
Data source: CHMI

Combustion processes are a major **source of POPs** (Chart 39). In the case of polycyclic aromatic hydrocarbons (PAHs), polychlorinated dioxins and furans (PCDDs/PCDFs) and hexachlorobenzene (HCB), local heating is the main source. The concentration of benzo(a)pyrene (B(a)P), which belongs to the PAH group, shows a significant annual trend with peaks in winter (due to worsening dispersion conditions and pollution from local household heating). The overwhelmingly dominant source of B(a)P emissions is household heating (97.3% in 2021[54]). In the case of PCBs, the main source of emissions is the public energy and heat sector (51.7%). The development of individual groups of POPs substances is volatile, but overall emissions of all these substances have a downward trend, with the exception of PAHs, which have an increasing long-term trend. In the short term, the downward trend for all substances is significant, although PAHs showed an annual increase of 5.4%. The most significant long-term reduction since 1990 was achieved for the HCB group, by 97.2%. In the medium (Chart 40) and short term, PCDDs/PCDFs decreased the most.

[54] *Data for the year 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance was recalculated from the CHMI data in August 2023.*

Chart 40

POPs emissions in Czechia [t, g I-TEQ, kg], 2005–2021



Data for 2022 are not available at the time of publication. They will be published no earlier than February 2024. The emission balance was recalculated from the CHMI data in August 2023.

Data source: CHMI

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 2010–2022 period, the remediation of 3,320 sites of old environmental burdens was completed, subject to compliance with the conditions of the remedial measures, while the remediation of 1,148 sites was completed in 2022.
~	The incremental Evidence System of Contaminated Sites database contained 10,174 sites in 2022.

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
Contaminated sites (evidence and remediation)	N/A	N/A	N/A	✓

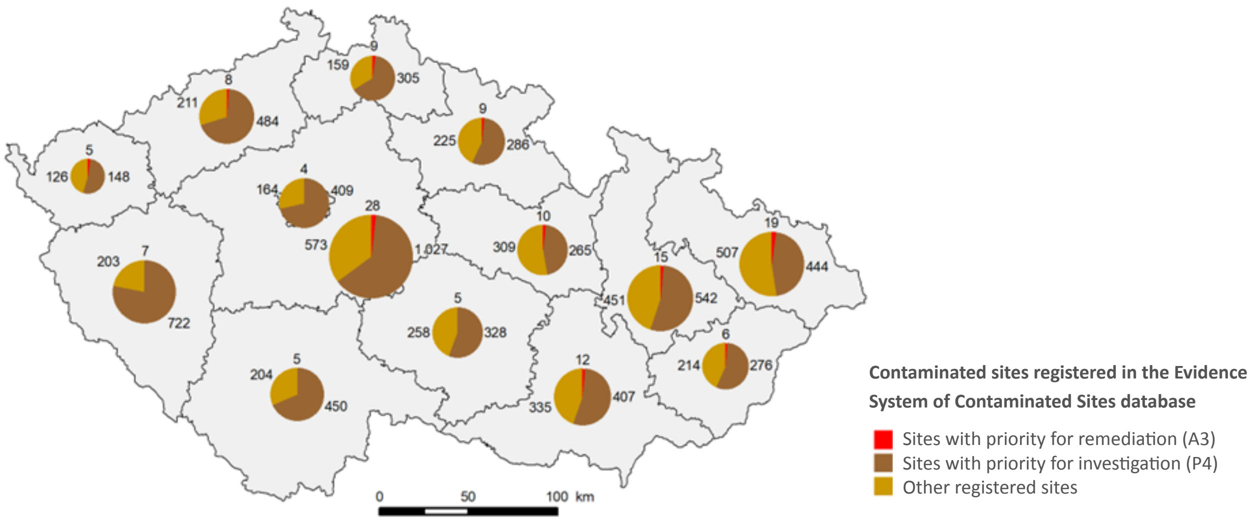
Contaminated sites (evidence and remediation)

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. through remediation of the affected sites. The total **number of old contaminated sites** in Czechia is not precisely known, as these sites are continuously mapped and inventoried. Subsequent remediation will reduce their numbers and potential risks to ecosystems and human health. The Evidence System of Contaminated Sites (ESCS) is therefore an incremental database, containing 10,174[55] contaminated sites in 2022. Most of the contaminated sites registered in the ESCS are located in the Central Bohemian, Olomouc and Moravian-Silesian regions (Fig. 19). These are mostly former industrial buildings, landfills, filling stations, etc.

[55] *From 2020 onwards, the total number of sites is indicated without excluded sites.*

Fig. 19

Number of contaminated sites registered in the ESCS in Czechia, 2022



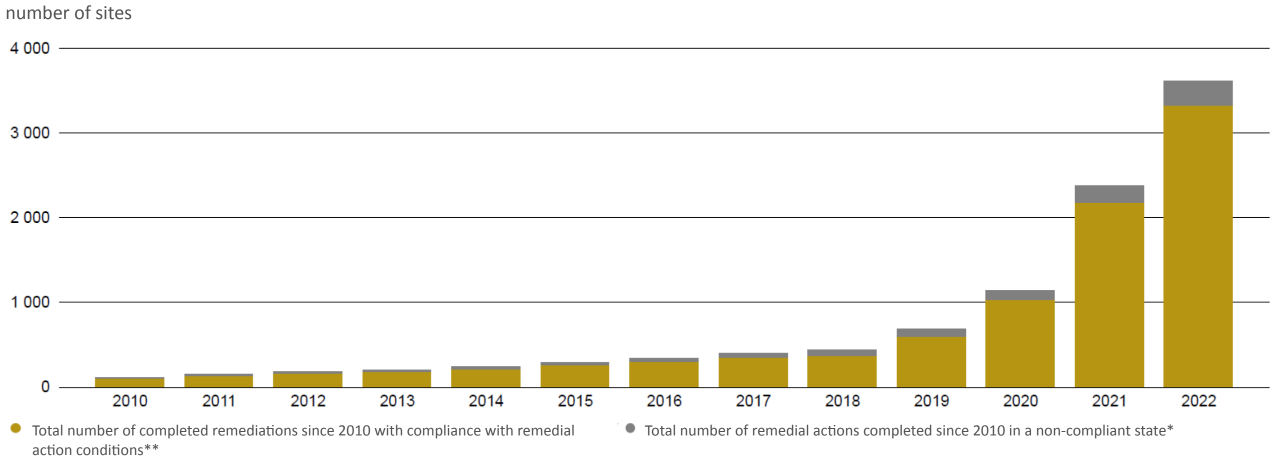
Sites with priority for remediation (A3) and sites with priority for investigation (P4) are determined according to valid methodological instruction of the Ministry of Environment of the Czech Republic No. 1/2011.

Data source: MoE

In the period 2010–2022, **the remediation** of 3,320 contaminated sites was completed with compliance with remedial action conditions (including a total of 1,148 sites in 2022), and a further 285 remedial actions were completed in unsatisfactory condition (including a total of 85 sites in 2022), Chart 41.

Chart 41

Number of contaminated sites with completed remediation registered in the ESCS in Czechia, cumulatively for the period 2010–2022



** 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 ESCS 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 (NICS) 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. In 2020 and 2021, Phase 2 of the National Inventory of Contaminated Sites project was even more intensive. In the beginning of 2022, the NICS project funded by the OP ENV was *officially closed. Since the end of the project, no more sites annotated within the NICS are being added to the database. Records in the database are continuously updated in accordance with the methodology according to the current activities on individual sites.*

Data source: MoE

The remediation of contaminated sites in Czechia 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. In 2022, the first call in the programming period of Operational Programme Environment 2021–2027, specific objective 1.6, took place.

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

Key messages

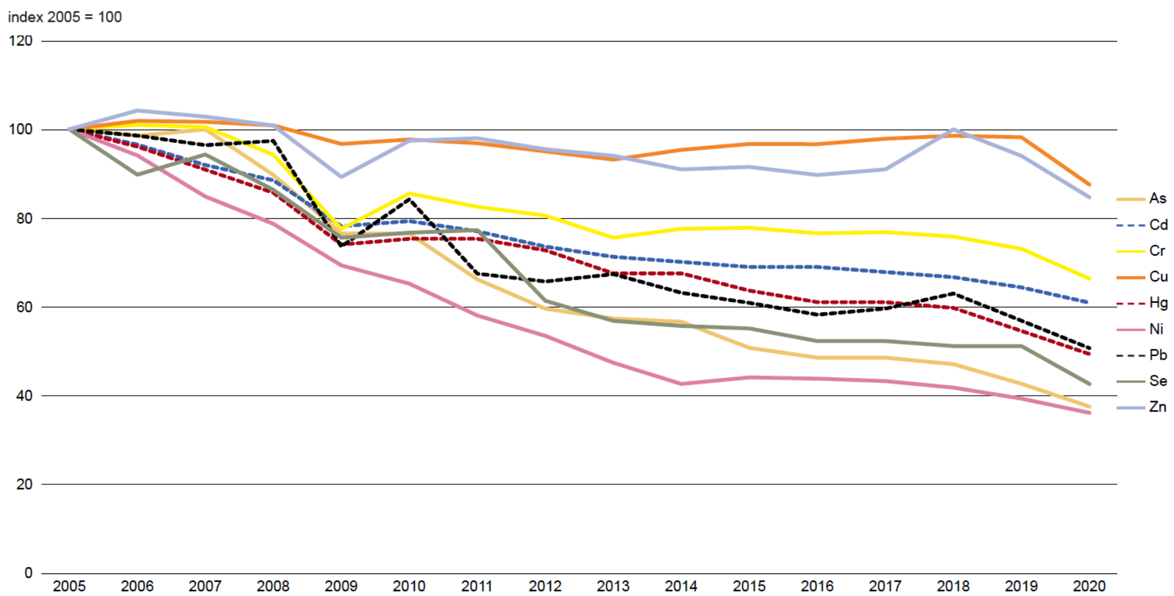
✓	Since 1990, emissions of persistent organic pollutants (POPs) have decreased significantly in the EU27.
~	Exceedances of limit values for heavy metals occur only locally in Europe, in areas with specific industrial production.

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 2020, cadmium and mercury emissions[56] had fallen (Chart 42) to about a third to a quarter of 1990 levels. This is thanks to the shift to more environmentally friendly energy sources in many countries, especially from coal to gas. Lead emissions decreased by 95.6%, a decrease that can be attributed mainly to the reduction in 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 2020[57] Germany, Italy and Poland were the largest contributors to heavy metal emissions, together accounting for around half of the EU27 total for all three priority heavy metals (Cd, Hg and Pb).

Chart 42

Trend in emissions of heavy metals in the EU27 [index, 2005 = 100], 2005–2020



Data for 2021 and 2022 are not available at the time of publication.

Data source: EEA

Since 1990, **emissions of persistent organic pollutants** (POPs) have decreased significantly in the EU27 (Chart 43). As of 2020, hexachlorobenzene (HCB) has decreased by 97.7%, polychlorinated biphenyls (PCBs) by 60.2%, dioxins and furans (PCDDs/PCDFs) by 76.9% and polycyclic aromatic hydrocarbons (PAHs) by

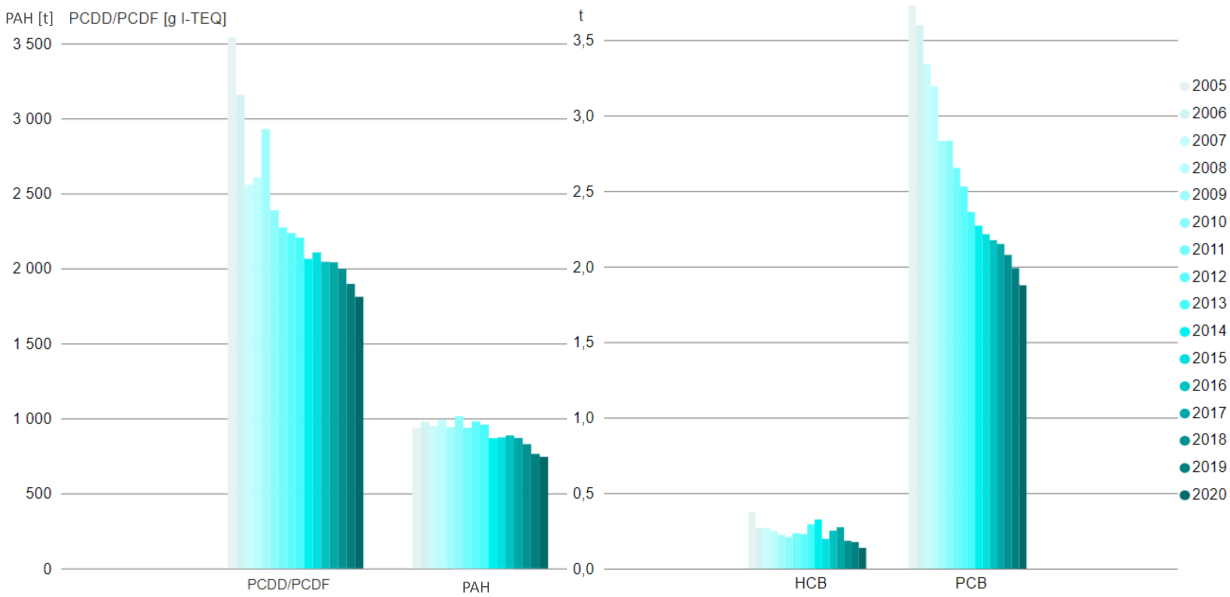
[56] *Data for 2021 and 2022 are not available at the time of publication.*

[57] *Data for 2021 and 2022 are not available at the time of publication.*

48.6%[58]. The decline was particularly significant in the industrial production, public electricity and heat generation and waste sectors. However, the industrial production sector remains a significant source of POPs. In 2020[59], Poland had the largest share of dioxins and furans (16.1%) and PAHs (32.1%) emissions in the EU27, with France (16.3%) and Finland (15.6%) accounting for the largest share of HCB emissions. Croatia emitted the most PCB emissions (33.8%).

Chart 43

Trend in POPs in the EU27 [t, g I-TEQ], 2005–2020



Data for 2021 and 2022 are not available at the time of publication.

Data source: EEA

---

[58] *Data for 2021 and 2022 are not available at the time of publication.*

[59] *Data for 2021 and 2022 are not available at the time of publication.*

Contaminated sites in an international context

In selected European countries, 2.5 mil. potentially **contaminated sites**[60] were estimated as of 2011 [61], of which 45% (about 1.1 mil. sites) have already been identified[62]. 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 legacy environmental burdens was €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[63].

Detailed visualisations and data

https://www.envirometr.cz/data

---

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

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

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

[63] *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.*

1.4. Noise pollution and light pollution

Noise is an important indicator of environmental quality and a factor affecting human health. 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 subsequent health complications associated with sleep deprivation. The most serious health effects related to noise are those on the hearing organ and the cardiovascular system.

Light pollution generates adverse effects on humans, animal and plant species – especially by disrupting their natural biorhythms and affecting the behaviour of individuals, species and entire communities. It is mainly caused by the inappropriate use of artificial light at night, which is developmentally linked to darkness for living organisms, allowing either regeneration or activity. Currently, there are no legislative limit values for light pollution in Czechia, except for a blanket ban on the placement of uncovered light sources in national parks.

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)

- 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

Decree No 315/2018 Coll., on strategic noise mapping, as amended by Decree No 55/2022 Coll.

- setting limit values for noise indicators for individual noise source categories
- determination of noise mapping methodology and calculation algorithms for noise indicators

Decree No. 561/2006 Coll., establishing a list of agglomerations for the purposes of noise assessment and reduction

- delineation of agglomeration areas for the purposes of noise mapping

1.4.1. Noise pollution burden of the population

Key question

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

Key messages

✓	CZK 452.4 mil. was invested in noise protection measures on road infrastructure in 2022. Despite the year-on-year decline in total investment, this is the third highest investment volume since 2013. The development of the Czech motorway network and the construction of city bypasses continues, with a total of 21.2 km of motorways being put into operation and another 143.6 km of motorways under construction.
~	Noise pollution trends cannot be assessed due to changes in the noise mapping methodology; the numbers of exposed inhabitants did not change significantly between SNM rounds 3 and 4.
✗	Urban agglomerations, especially Prague and Brno, have high noise pollution from road traffic. In the Prague agglomeration, 6.4% of the population is exposed to noise above the limit value, 13.8% of the population is highly annoyed by noise and 4.2% of the population suffers from high sleep disturbance.

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	N/A	~
Noise protection measures in transport and development of transport infrastructure	N/A	↗	↗	✓

** Due to the development of the noise mapping methodology, the data are not comparable between the different SNM rounds and thus it is not possible to assess noise pollution trends.*

Noise pollution burden of the population

According to the results of the 4th round of the SNM[64], the most important source of **noise pollution** in Czechia is road transport, which causes noise pollution especially in urban agglomerations with a population of over 100 thous. In total, 2.2 mil. people (approximately 20% of the population) in Czechia were identified as being exposed to **all-day (24-hour)** road traffic **noise burdens** above 55 dB. Of this number, 210.6 thous. people were exposed to noise pollution above the limit value, and action plans to reduce noise pollution are being prepared for the affected areas. More than two thirds of the population exposed above the limit value (70.8%) live in urban agglomerations. The number of people highly annoyed by road traffic noise, for whom noise exposure causes health risks, was found to be 496.6 thous., of which 72.6% are inhabitants of urban agglomerations. 272.1 thous. inhabitants (68.9% in agglomerations) are exposed to **road traffic noise at night** (between 10 pm and 6 am) exceeding the limit value of 60 dB, and 162.2 thous. inhabitants are

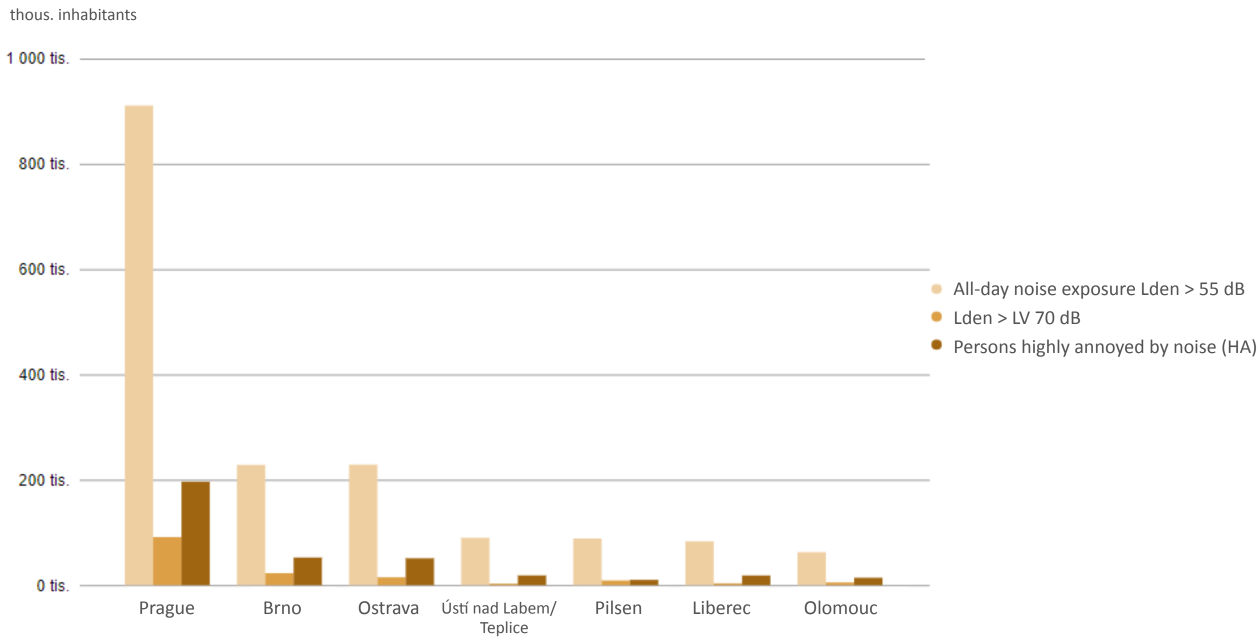
64 The data are collected in accordance with the requirements of Directive 2002/49/EC of the European Parliament and of the Council on the assessment and management of environmental noise at five-year intervals. SNM round 4 describes the noise situation in 2018–2022.

exposed to noise pollution causing significant sleep disturbance with a risk of health effects, of which 69.8% in urban agglomerations.

The **Prague agglomeration** is the most affected by road traffic noise pollution, where 91.3 thous. people (6.4% of the agglomeration's population) are exposed to all-day noise above the 70 dB limit value and 13.8% of the population is highly annoyed by noise (Chart 44). Prague is also significantly affected by noise pollution at night, with 7.2% of the population entering the noise mapping exposed to night-time noise above the 60 dB limit and 4.2% of the population suffering from high sleep disturbance (Chart 45). The Brno agglomeration also has an above-average noise pollution burden in terms of the monitored noise indicators. On the contrary, the most favourable situation in terms of day and night noise pollution from road transport was found in the agglomerations of Ústí n. L./Teplice and Liberec.

Chart 44

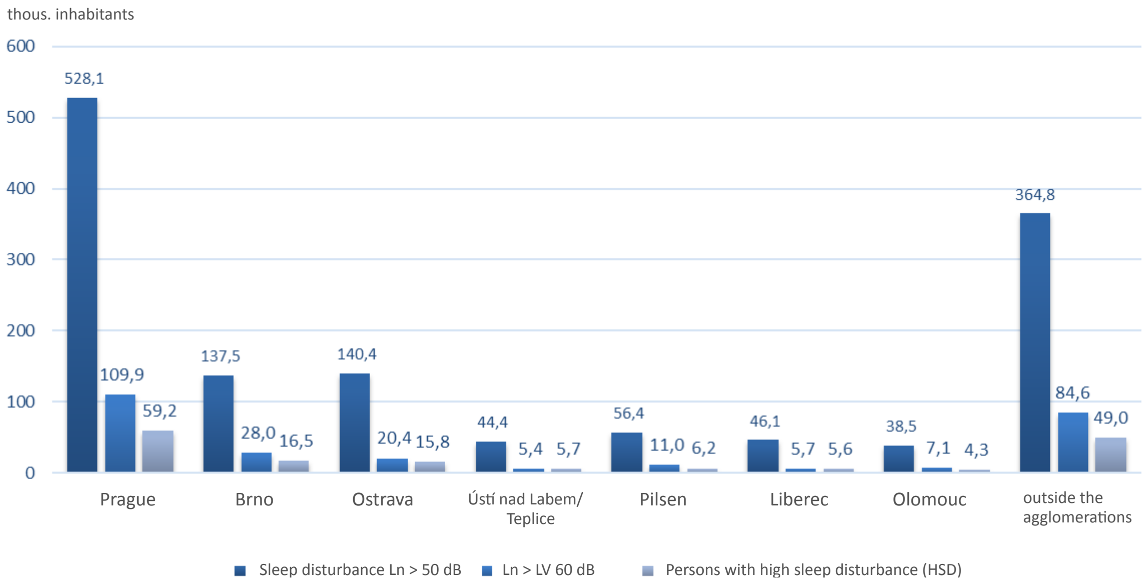
Number of inhabitants of urban agglomerations exposed to all-day (24-hour) noise pollution from road transport in Czechia [thous. inhabitants], 2022



Data source: NRL

Chart 45

Number of inhabitants exposed to night-time (22–06 h) road traffic noise pollution in agglomerations in Czechia [thous. inhabitants], 2022

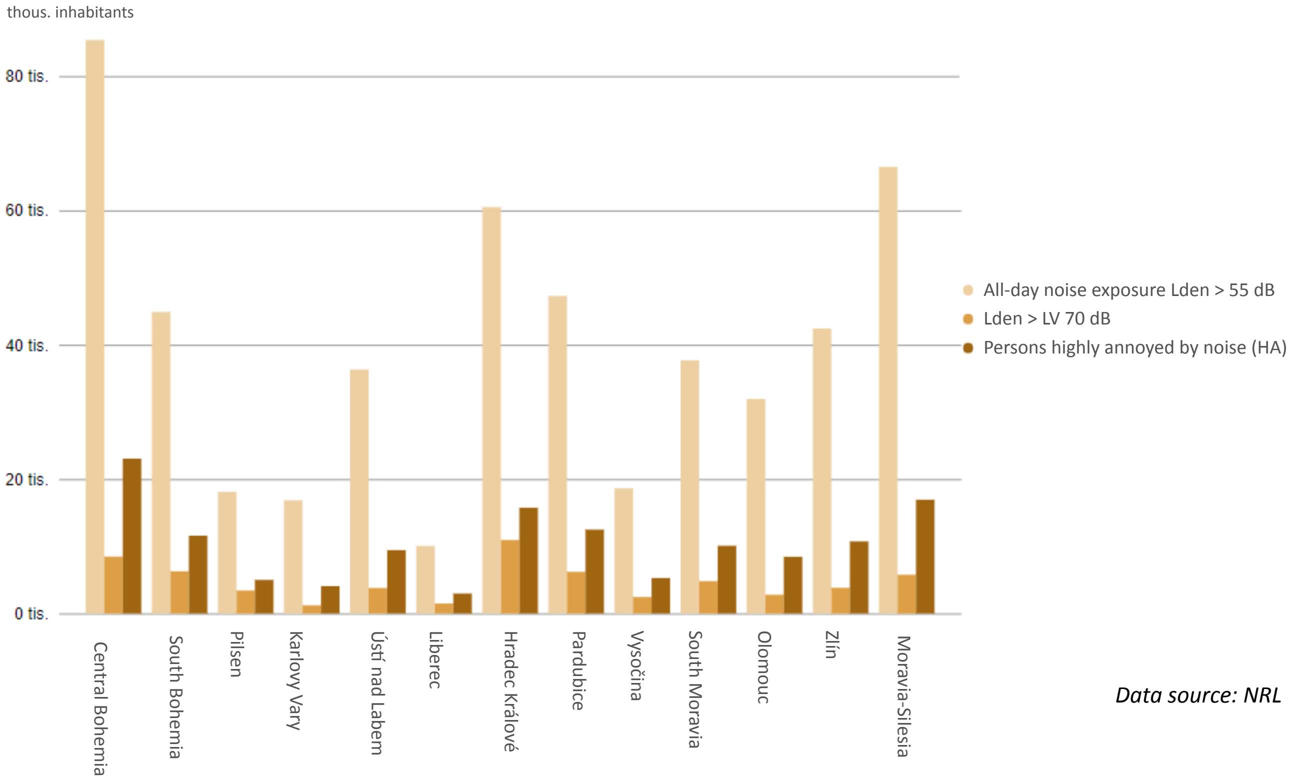


Data source: NRL

Outside urban agglomerations, noise pollution from road traffic is monitored according to the requirements of the legislation only in the vicinity of roads with traffic intensity above 3 mil. vehicles per year. Among the **regions of Czechia**, the highest number of people exposed to all-day noise pollution above the limit value was identified in the Hradec Králové Region (10.9 thous.) and the Central Bohemian Region (8.5 thous.), Chart 46. The Central Bohemian Region also has the highest number of people highly annoyed by road traffic noise (23.1 thous.), the situation in the region is affected by high road traffic intensity due to the central location of the region on transit routes and the catchment area of Prague for daily commuting to Prague. In the Hradec Králové Region, a significant share of the total number of exposed persons is occupied by the city of Hradec Králové, which just barely fails to meet the criteria for an urban agglomeration and is therefore not evaluated separately. Outside the Ostrava agglomeration, the Moravian-Silesian Region also has a significant noise burden. These regions also have a high number of exposed people according to the night noise burden indicators (L_n, HSD). The region with the lowest number of people exposed to high noise pollution outside agglomerations is the Karlovy Vary Region, and also (except for the Liberec agglomeration) the Liberec Region. The lower noise pollution is linked to the geographical location of these regions and their sparser population.

Chart 46

Number of inhabitants of regions of Czechia (outside agglomerations) exposed to all-day (24-hour) noise pollution from road transport above the limit value [thous. of inhabitants], 2022



Data source: NRL

According to the requirements of the legislation, noise pollution from **railway transport** is monitored only in the vicinity of main railway lines, which are used by more than 30,000 trains per year. According to the current results, 194.1 thous. inhabitants in Czechia are exposed to daily noise pollution from railway transport (exposure above 55 dB), of which 9.4 thous. inhabitants are above the limit value of 70 dB. About two-thirds of the total population affected by rail noise lives outside urban agglomerations (cities have more noise protection measures on the lines and trains run at lower speeds). A total of 5.1 thous. inhabitants are exposed to night noise from railways above the 65 dB limit value, noise from main railways causes high sleep disturbance for 35.6 thous. inhabitants. Among the regions of Czechia, the Central Bohemian, Ústí nad Labem and Pardubice regions, through which the corridor railway lines with high traffic intensity pass, have the highest noise pollution from railways.

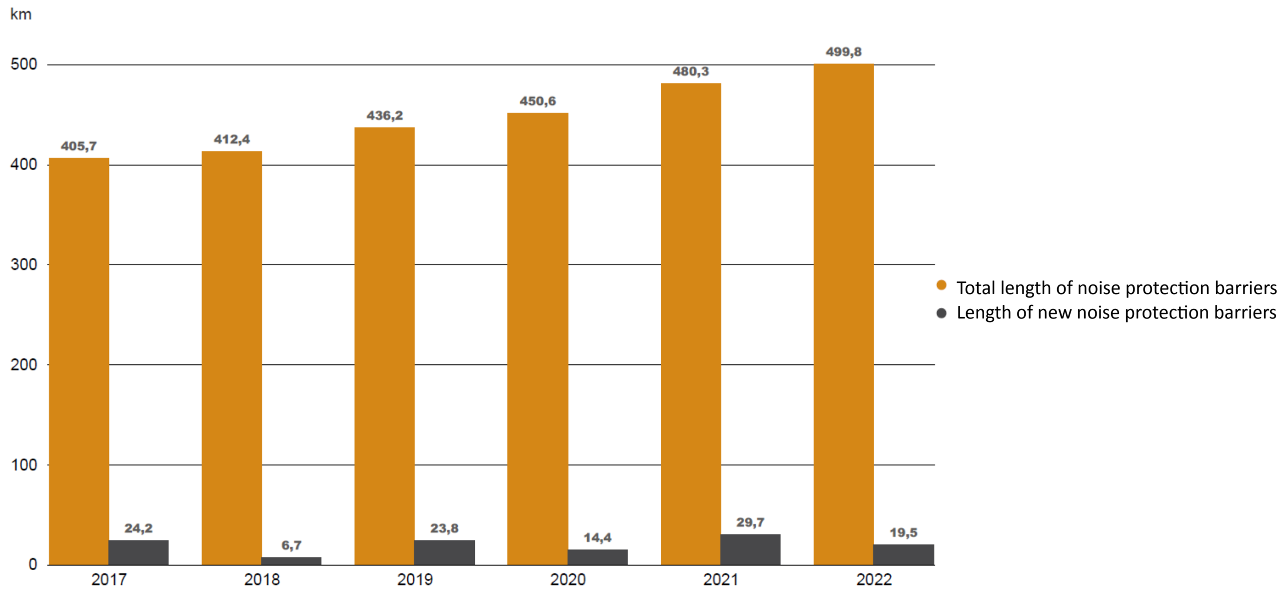
Noise protection measures in transport and development of transport infrastructure

Noise protection measures are taken to reduce the noise pollution of the population. On the road infrastructure, this includes the construction of noise barriers, the modification of road surfaces by laying low-noise surfaces and so-called individual noise protection measures, which include the noise insulation of facades and windows of exposed buildings. Noise pollution from transit traffic is also reduced by the diversion of traffic away from settlements through the construction of new sections of motorways and bypasses.

In 2022, CZK 452.4 mil. was **invested** in noise protection measures on road infrastructure managed by the Directorate of Roads and Motorways, which is 21.5% lower than in the previous year. The amount of investment varies according to the length of the newly constructed roads, where noise protection measures are part of the construction budget. The total length of noise barriers in 2022 reached 499.8 km, with 19.5 km of noise barriers added year-on-year (Chart 47).

<u>Chart 47</u>

Length of registered noise barriers on the road network in Czechia under the management of the Regional Directorate of Transport [km], 2017–2022

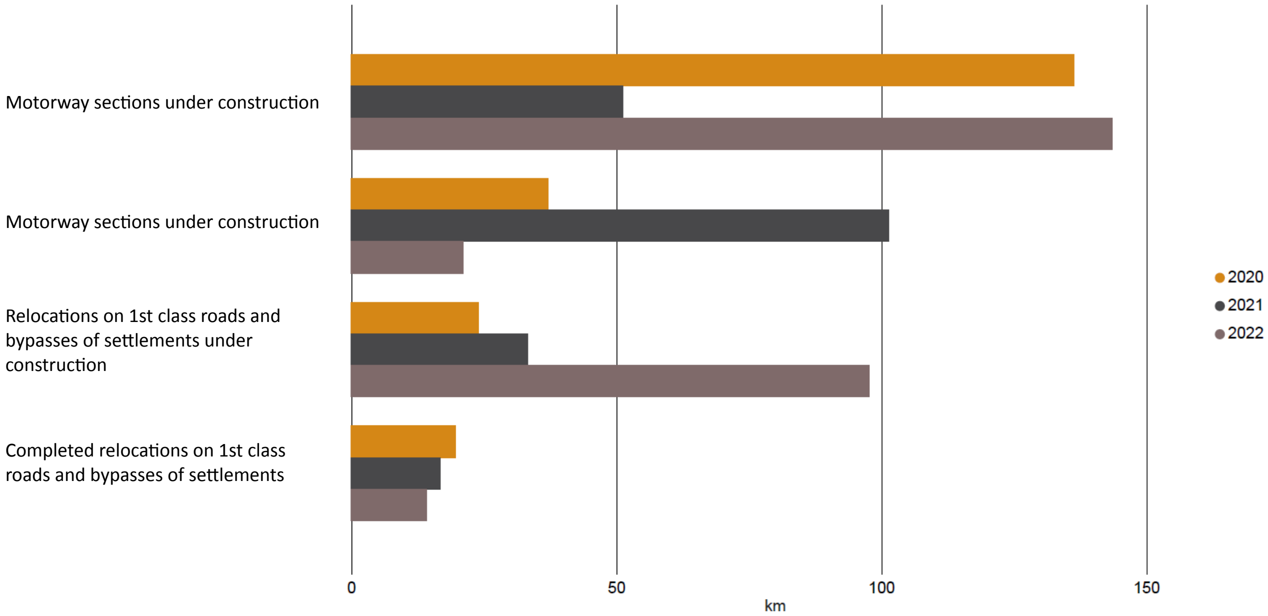


Data source: DRM

Czechia**'s motorway network** has been expanded by a total of 5 sections in 2022 with a total length of 21.2 km (Chart 48). The longest motorway section put into operation was the D35 Časy-Ostrov motorway section in the Pardubice Region, with a length of 14.7 km and investment costs of CZK 3.2 bil. In the Moravian-Silesian Region, the first stage of the Frýdek-Místek bypass on the D48 motorway was put into operation, including the connection of the D56 motorway (to Ostrava) to the D48 motorway (the total length of both constructions was 6.5 km, the investment costs were CZK 4.3 bil.). A total of 20 other motorway sections with a total length of 143.6 km were under construction in 2022, especially the D3 motorway (the České Budějovice bypass and the Třebonín-Kaplice section), D4, D48 and D55. A total of 7 bypasses, relocations and intersections of settlements with a total length of 14.2 km were put into operation on 1st class roads, the investment costs amounted to CZK 1.76 bil. These included the Chýnov bypass on the I/19 road in the Tábor district in the South Bohemian Region, the second stage of the Mělník bypass on the I/9 and I/16 roads and the relocation of the I/3 road (E55) in Olbramovice in the Central Bohemian Region. A total of 97.7 km of bypasses and relocations were under construction on a total of 23 sites.

Chart 48

Commissioned and completed sections of motorways and relocations and bypasses of 1st class roads in Czechia [km], 2020–2022



Data source: DRM

The investment costs spent on the implementation of **noise protection measures on the railway** in 2022 amounted to CZK 56.5 mil., of which CZK 55.2 mil. was spent on the construction of noise barriers and CZK 1.2 mil. on individual noise protection measures. The amount of investment in 2022 was less than half of that in 2021 (CZK 139.8 mil.), but more than double compared to 2020. The year-to-year fluctuations in the volume of investment are due to the progress of construction of the corridor sections that are most equipped with noise protection measures. The non-investment costs of noise protection measures on the railway are connected with the grinding of the rail tops; in 2022 the total length of the ground sections was 57.4 km, and the total costs amounted to CZK 14.1 mil.

1.4.2. Brightness of the night sky

Key question

What is the extent of light pollution in Czechia?

Key messages

~	Objective measurements for tracking the development of light pollution in Czechia over time are not yet being carried out, but are the subject of a research project.
✕	Light pollution levels are worsening due to the increasing amount of illuminated surfaces and the use of light sources with inappropriate spectral characteristics. In Czechia, there is no territory that is not affected by the artificial brightness of the night sky.

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
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. It is typically created by directing light into undesirable areas (e.g. the sky, open landscape or into windows), by illumination outside of 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.

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. There has been a certain shift in this direction with the publication of the original Czech technical standard CSN 36 0459 Limitation of undesirable effects of outdoor lighting, the anchoring into legislation of which is underway.

A suitable measure for assessing the level of light pollution is the **brightness**[65] **of the night sky**. The overall brightness of the night sky is a combination of natural light sources and artificial light scattered in the Earth's atmosphere. The brightness of the sky is influenced both by the light sources themselves (their quantity, location and parameters) and by the conditions in which the light propagates (the amount of greenery, snow cover, the amount and type of aerosols (smog, haze), the width of streets, the height of buildings, cloud cover, etc.). In Czechia, however, we can no longer find any area that is not affected by artificial brightness, because light spreads tens or even hundreds of kilometres away due to scattering in the air.

The latest publication on light pollution, the 2022 Review and Assessment of Available Information on Light Pollution in Europe[66], uses **satellite data** from the Visible Infrared Imaging Radiometer Suite **(VIIRS)** as two-

---

[65] *Brightness is a photometric quantity and can be defined as the luminous flux per unit solid angle per unit area of the source.*

[66] *Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8. ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.*

year averages of the amount of light emitted from the Earth's surface into space (only externally corrected data) **to assess the brightness of the night sky**. Two limit values were chosen to assess the level of light pollution: 2 $nW.cm^{-2}.sr^{-1}$ (below this level only a low ecological impact can be expected) and 0.5 $nW.cm^{-2}.sr^{-1}$ (the lowest light emission measurable by VIIRS, where artificial light can no longer be distinguished from natural night light).

Tab. 2

Change in night sky brightness between 2014–2015 and 2020–2021 two-year averages[67] in Czechia [%]

Limit value	Increase in the area of the territory with an exceeded limit value	Decrease in the area of the territory with an exceeded limit value
0.5 $nW.cm^{-2}.sr^{-1}$	9.5%	2.2%
2 $nW.cm^{-2}.sr^{-1}$	2.3%	0.5%

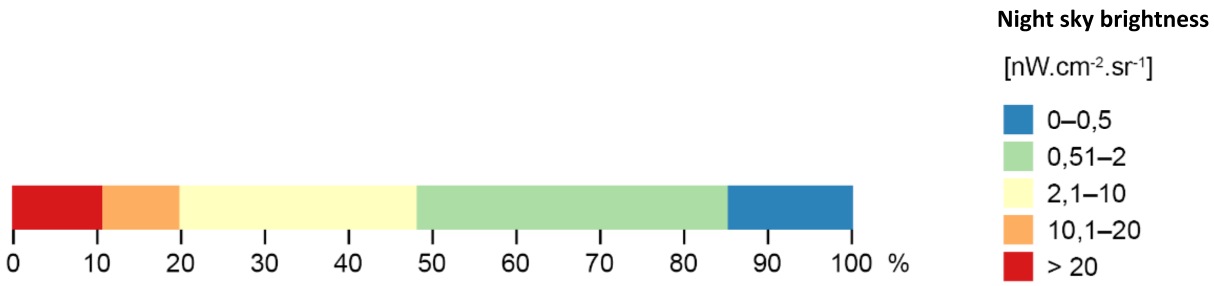
Data source: Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8). ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.

The current level of light pollution is steadily worsening due to the increasing amount of light sources or illuminated areas (Tab. 2). The area of Czechia at the minimum limit value of 0.5 $nW.cm^{-2}.sr^{-1}$ increased by 7.3% between 2014 and 2021 (i.e. 9.5% of the territory of Czechia deteriorated and 2.2% of the area of Czechia improved). Of course, large cities have the most artificial brightness in the night sky, especially the centre of Prague. Brightness above 20 $nW.cm^{-2}.sr^{-1}$ was recorded in approximately 12% of Czechia in 2021 (Chart 49). The broader surroundings of Prague, Brno, Pilsen, Ostrava, Olomouc, České Budějovice and many other cities also shine brightly. Approximately 53% of Czechia is rated as having a low ecological impact of light pollution, which corresponds to the typical light emission level for small villages or sparsely populated areas (areas with values below 2 $nW.cm^{-2}.sr^{-1}$, Figure 49). In terms of light pollution, the best situation is in the northern part of Sumava, then in the mountain areas and rural areas of the southwestern part of Czechia and the Bohemian-Moravian Highlands, which is approximately 15% of the area with values below 0.5 $nW.cm^{-2}.sr^{-1}$. In such areas there are also so-called dark-sky areas, which aim 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 Pilsen and Karlovy Vary). Since 2016, a dark-sky park in the Podyjí national park is being prepared.

[67] *Data for 2022 are not available at the time of publication.*

Chart 49

Night sky brightness in the two-year average 2020–2021[68] in Czechia [% of area]



Data source: Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8). ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.

The inappropriate type of artificial lighting, and especially the lack of difference between day and night light intensity, results in a disruption of **circadian rhythms** (the natural cycles of hormonal processes dependent on the alternation of light and dark parts of the day), 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). Nocturnal exposure to light radiation leads to insufficient regeneration of the human body during sleep, and suppresses production of the hormone melatonin (which 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.

In addition to the extent of the illuminated areas, the **level of light pollution** is also influenced by the type of light source used. In particular, LED-based sources producing cold white light (with a CCT > 3 000 K) are more energy efficient than warm white sources (with CCT < 3 000 K) and thus can be cheaper to operate. However, their spectral composition contains a high proportion of blue light, which is a strong biological activator. 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. To this end, projects for the reconstruction or modification of public lighting systems that include a requirement for the maximum CCT used are financially supported. For municipalities in NP, or PLA, such calls are announced by the Ministry of the Environment of the Czech Republic under the National Programme Environment or the Modernization Fund. Municipalities outside specially protected areas can obtain funding from the EFEKT programme of the National Recovery Plan from the Ministry of Industry and Trade of the Czech Republic.

[68] *Data for 2022 are not available at the time of publication.*

Light pollution in an international context

Key messages

~	There is currently no common policy in EU Member States to regulate light pollution.
✕	An increasing trend in light emissions can be observed in EEA38 over the last 8 years (2014–2021), especially at low levels of light pollution.

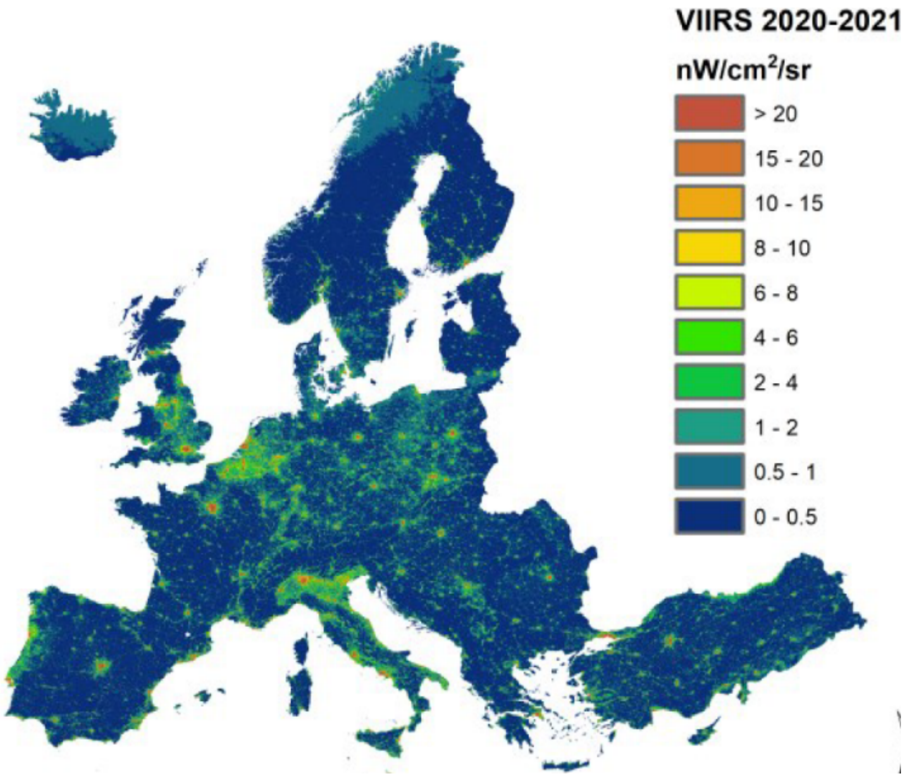
Light pollution in an international context

There is currently no common EU policy to regulate light pollution. However, some countries, such as France, Croatia, Slovenia and Czechia, have partial or comprehensive legislation (legislative or regulatory) limiting light emissions, as do regions in Italy or Spain.

According to the Review and Assessment of Available Information on Light Pollution in Europe[69] , most light emissions in Europe are in the range of 2–6 $nW.cm^{-2}.sr^{-1}$, which is typical for sparsely populated rural and suburban areas. Extremely high levels of 20–35 $nW.cm^{-2}.sr^{-1}$ can be identified in major cities such as Paris, London or Berlin (Fig. 20). The differences between rural and urban regions are obvious.

Fig. 20

Brightness of the night sky in the two-year average 2020–2021 in EEA38 [$nW.cm^{-2}.sr^{-1}$]



Data for 2022 are not available at the time of publication.

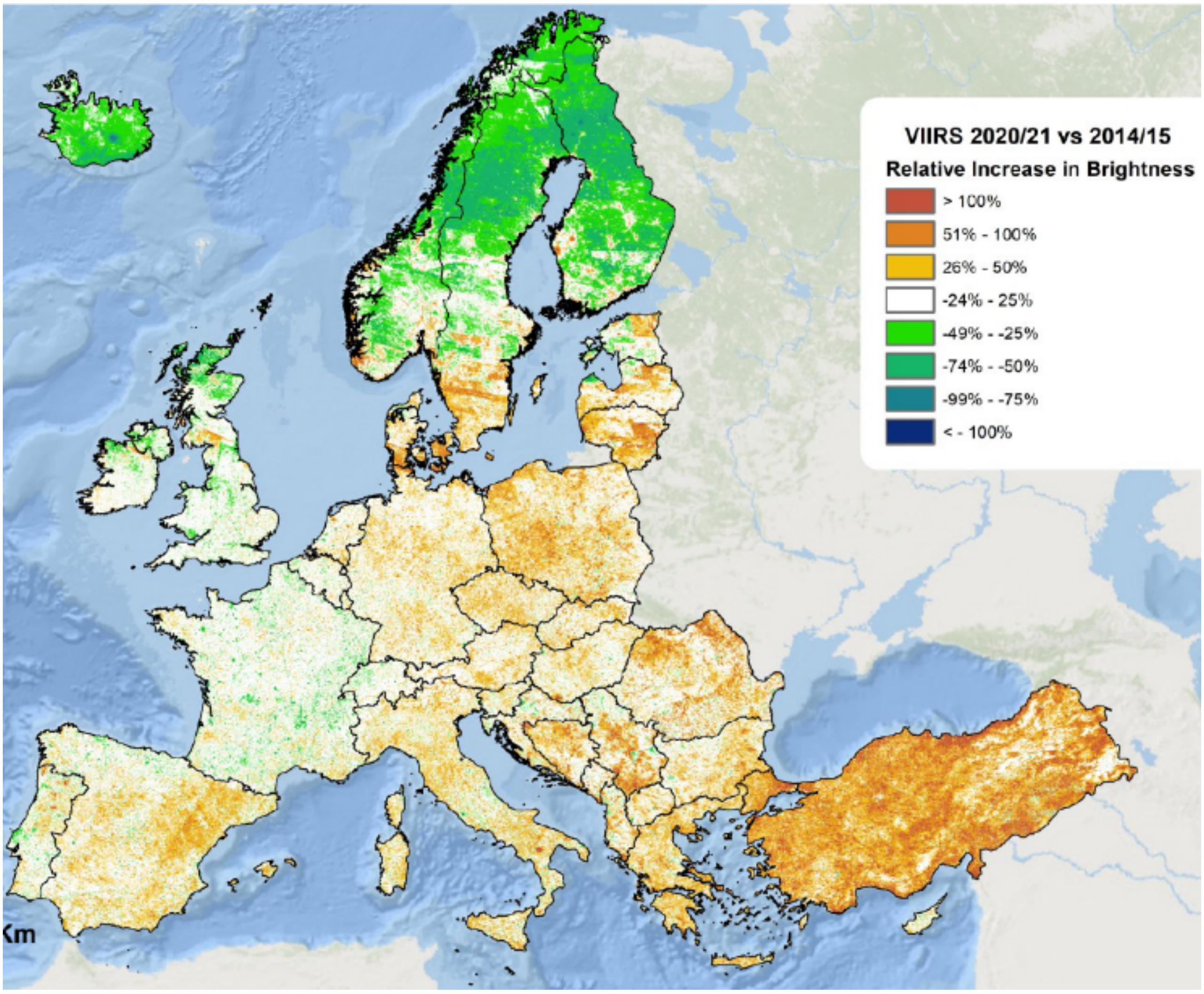
Data source: Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8). ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.

[69] *Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8). ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.*

The differences in brightness between the most recent (2020–2021[70]) and the first (2014–2015) period quantify the change in anthropogenic light exposure of the Earth's surface over the last eight years in Europe (Fig. 21). While the Netherlands, Luxembourg, Poland and Belgium saw the largest increases in brightness over the period, decreases in light pollution were evident for Iceland, Ireland and France. Overall, however, there is an increasing trend in light emissions, especially at low levels. The decrease in light emissions in northern Europe can be attributed to natural phenomena (e.g. bias in VIIRS aurora measurements) rather than a decrease in artificial light emissions. The upward trend in average light pollution in EEA38 is noticeable, especially after 2019.

Fig. 21

Change in night sky brightness between 2014–2015 and 2020–2021 two-year averages in EEA38 [%]



Data for 2022 are not available at the time of publication.

Data source: Widmer, K., Beloconi, A., Marnane, I., Vounatsou, P. (2022). Review and Assessment of Available Information on Light Pollution in Europe (Eionet Report – ETC HE 2022/8). ISBN 978-82-93970-08-8. ETC HE c/o NILU, Kjeller, Norway.

Detailed visualisations and data

https://www.envirometr.cz/data

[70] *Data for 2022 are not available at the time of publication.*

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 preventive 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 (IRS) 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, IRS units, and citizens themselves play a significant role. 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 2030 with a view to 2050

- strategic objective of increasing the preparedness and resilience of society to emergencies and crisis situations (i.e. increasing preparedness, resilience and adaptation to weather extremes and minimising the negative impacts of emergencies and crisis situations of anthropogenic and natural origin)

Strategy of Environmental Security of the Czech Republic 2021–2030 with a view to 2050

- 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 2025 with a view to 2030

- increasing the level of preparedness of the population for situations threatening life, health, property and the environment and strengthening the capabilities of individual components of the population protection system

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 2021+

- effective solutions to environmental problems associated with large population concentrations and the adaptation of agglomerations 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 2022, a total of 275 IWSS alerts were issued, of which 159 were forecast alerts and 116 warned of the imminent occurrence of a hazardous phenomenon. 87% of forecast alert information was successful or partially successful.
✗	Thunderstorms and heavy rain were only successfully detected by IWSS warnings in about 50% of the cases, and the warnings were largely underestimated.

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	N/A	N/A	N/A
Issuing alerts of the Integrated Warning Service System (IWSS)*	N/A	N/A	N/A	✓

** It is not possible or meaningful to set a trend for the operation of the 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 the 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 (OP ENV) at the Ministry of the Environment of the Czech Republic or through the designated national programmes for flood prevention and the Rural Development Programme (RDP), 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 **OP ENV 2014–2020**, flood protection and water retention were the main focus of priority axis 1 (improving water quality and reducing the risk of floods) in the supported areas 1.3 (ensuring flood protection within town limits and rainwater management) and 1.4 (support for preventive flood protection measures). By the end of 2022, more than 220 projects in supported area 1.3. worth CZK 1.8 bil. of the TEE were approved, while in area 1.4 it was about 690 projects worth CZK 2.5 bil. 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 OP ENV 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 the TEE have been approved. 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 for the purpose of maintaining water in the open landscape, with a total volume of CZK 469.6 mil. of the TEE have been approved. In total, approximately 1,600 projects with a total volume of CZK 12.3 bil. were approved in the 2014–2020 OP ENV by the end of 2022.

In 2022, the European Commission approved the **OP ENV for the programming period 2021–2027** with a total allocation of EUR 2.4 bil. (CZK 58.2 bil.) of EU funds, or EUR 2.9 bil. (CZK 69.6 bil.) of the TEE. The main areas of support include support for adaptation to climate change with an allocation of over CZK 10.2 bil. In 2022, the first calls were launched and the first applications were approved (32 legal acts were issued for CZK 4.4 bil. of the TEE.

Since 2017, the issue of drought has also been addressed through the subsidy programme **Dešťovka** (Rainwater) announced in the National Programme Environment (NP ENV). The aim of the 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 almost 9,800 projects had been approved by 2022 with a total support amount of about CZK 383 mil. The NP ENV also supports activities related to climate measures listed in Tab. 3.

Tab. 3

Overview of projects approved in the National Programme Environment including allocation and amount of support in Czechia [number, CZK mil.] 2015[71]–2022

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
1.4.B Project preparation for projects focused on the implementation of close-to-nature flood protection measures	100	11	14.0
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	1,500	977	1,370.9
1.7.A Development of regional drought and water scarcity management plans	9	13	6.0
1.8.A Implementation of flood protection measures with extensive use of nature elements in the urbanized area (financed from the NRP)	762.0	1	762.0
4.2.E Project preparation for projects focused on revitalisation and renaturation of watercourses, restoration of ecostabilisation functions of aquatic and water-bound ecosystems and implementation of close-to-nature measures aimed at slowing surface water runoff and erosion protection	100	27	30.2

Data source: State Environmental Fund of the Czech Republic

Adaptation measures to mitigate the impacts of climate change are also addressed by the national subsidy programme of the Ministry of the Environment of the Czech Republic, **the Landscape Management Programme**, and in particular its Sub-programme B for improving the preserved natural and landscape environment, where 6,569 actions with a total volume of CZK 351.7 mil. were supported between 2014 and 2021. Another programme is the **Natural Landscape Function Restoration Programme**, where it is possible to draw funds to mitigate the impacts of climate change on water, forest and non-forest ecosystems. Between 2014 and 2021, more than CZK 134.2 mil. was spent on more than 1,000 actions under this programme.

At the Ministry of Agriculture of the Czech Republic, measures to mitigate the negative impacts of climate change (i.e. especially in the area of flood control measures and water retention in the landscape in relation to drought) were implemented from more than 10 national programmes, and in particular from the RDP as a transnational source (Tab. 4). The national programmes of the Ministry of Agriculture of the Czech Republic financed the implementation of more than 2,000 measures or structures in these areas in the years 2014–2022, which will protect assets worth more than CZK 2.1 bil. and about 85 thous. inhabitants. The total amount of funds disbursed from the national programmes managed by the MoA in 2014–2022 was over CZK 16.6 bil. It is also important to mention land consolidation (complex or simple) financed mainly from the RDP, which contribute to the elimination of the negative impacts of climate change,

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

especially in terms of reducing the adverse effects of floods and droughts and addressing runoff conditions in the landscape. Complex and simple land consolidation has been carried out on almost 39.6% of the agricultural land fund (about 1.7 mil. ha), and land consolidation is underway on another 12.4% of agricultural land. Between 2014 and 2022, CZK 2.6 bil. was spent as part of land consolidation on the implementation of anti-erosion, hydrological and ecological measures. The RDP also finances agri-environmental-climatic measures (AECM), specifically in the area of landscape care; approximately CZK 2.4 bil. was spent on these measures in 2014–2022, while in 2022 the measures were implemented on 22.2 thous. ha of agricultural land. In the area of forest protection (support for investments in the development of forest areas, improving forest viability and forest-environmental and climate measures), CZK 2.0 bil. was spent from the RDP in the 2014–2022 period.

Tab. 4

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 [mil. 2014–2022]

Programme	**Funds reimbursed** [CZK mil.] by 2022
Flood prevention III and IV (emphasis on implementation of measures with retention effect)*	5,288.0
Support for measures on small watercourses and small reservoirs (from 2016), incl. Phase II	3,449.2
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)	912.8
Support for measures to mitigate the negative impacts of drought and water scarcity	1,113.8
Supporting the competitiveness of the agri-food complex – Irrigation I and II	557.3
Construction and renewal of water supply and sewerage infrastructure (to 2015), Construction and technical improvement of water supply and sewerage infrastructure I and II**	4,233.6
Vlachovice – settlement of rights to immovable property affected by the planned construction of a waterworks	520.0
Settlement of rights to immovable property affected by the planned implementation of a comprehensive drought solution in the Rakovník region	206.9
Skalička – purchase of land for the implementation of the Skalička waterworks	182.6
Support for the planting of ameliorative and strengthening trees according to the Forestry Act	56.8
Support for the non-productive functions of fishing grounds	46.0
Total national resources	16,633.3
Rural Development Programme 2014–2020*** – implementation of land consolidation in total	13,381.4
of which anti-erosion measures	407.0
of which water management measures	1,778.5
of which environmental measures	377.0

of which roads and other (operational and technical activities)	10,819.1
Rural Development Programme 2014–2020 – AECM (grassing of arable land, biogas plantations, concentrated runoff paths)	2,409.3
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	2,024.1
Total European resources (excluding land consolidation in the category "roads and other")	6,995.9

** 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: MoA

In addition to the Ministry of the Environment 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** and the **Ministry of Industry and Trade of the Czech Republic**. The MRD administers the **IROP**, 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 or 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 IRS for dealing with emergencies related to climate change and accidents involving hazardous substances. A total of 871 projects were submitted in seven calls for proposals with a total volume of CZK 15.9 bil. of the TEE; by the end of 2021[72], a total of 474 projects worth CZK 4.0 bil. were completed and reimbursed.

In connection with the prevention of negative impacts of drought on industrial enterprises, the MIT announced a new call from the **OP EIC** programme with a total allocation of CZK 130 mil. in 2021. It has also prepared a methodology aimed at preparing an assessment of the water management of industrial enterprises (the so-called water audit). The benefits of the water audit should be in particular the more careful handling of water and water resources by companies. The MIT will support new technologies and processes to enable water recycling in manufacturing plants, as well as the installation of closed circulation circuits and processes to optimise water consumption within a separate production process. In 2022, the MIT announced a call under the National Recovery Plan (NRP) aimed at water conservation in enterprises. Approximately CZK 350 mil. was distributed to the supported projects. The projects mainly focus on water recycling in the production process, rainwater harvesting and the installation of closed circulation circuits.

The development of financial support for measures to protect against 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 drought issues, 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 (IWSS)

The **Integrated Warning Service System (IWSS)** alerts for hazardous meteorological and hydrological phenomena are issued in accordance with the World Meteorological Organisation (WMO) recommendations and are transmitted to the European Meteoalarm system (www.meteoalarm.org). The

[72] *Data for 2022 are not available at the time of publication.*

purpose of the issued reports is to warn the public, the state administration and economic entities about the risk of occurrence of hazardous phenomena in time, thus reducing their consequences or possibly supporting the effective elimination of the consequences that have already occurred. The IWSS 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 IWSS is partly the fulfilment of the Flood Reporting and Forecasting Service (FRFS), which the CHMI provides under Section 73 of Act 254/2001 Coll. (Water Act).

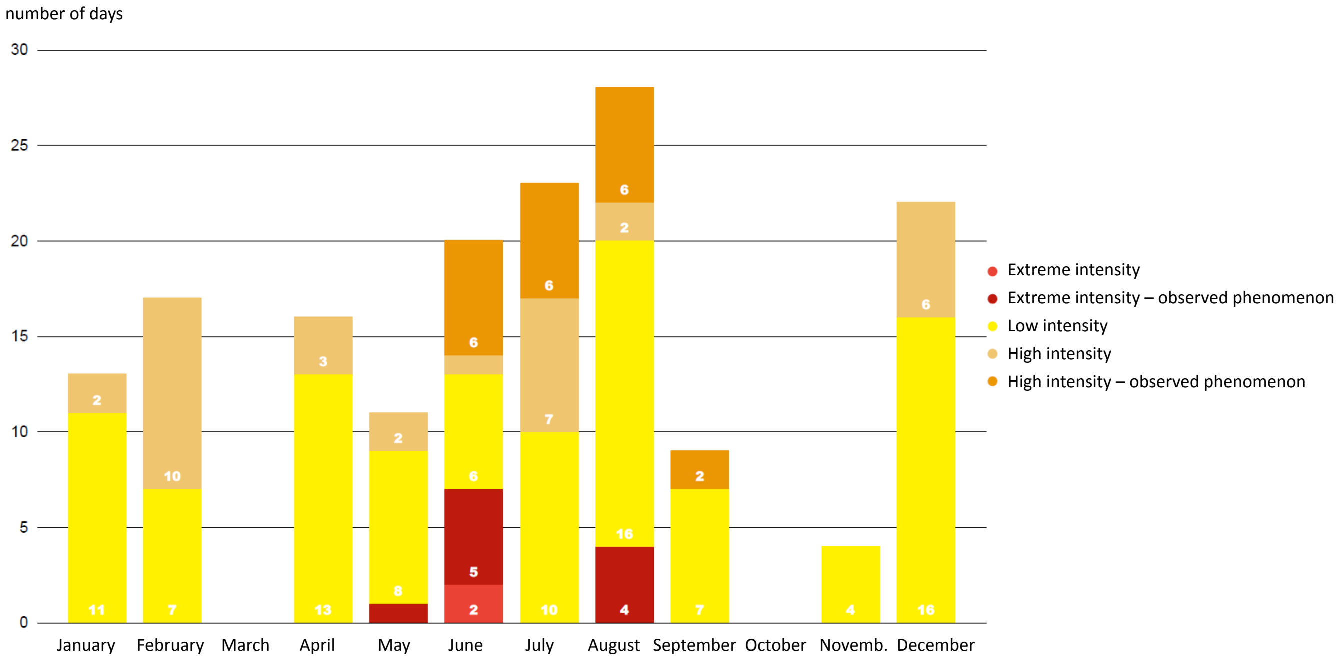
Alerts are issued according to the criteria set for each group of hazardous phenomena. The **probability of occurrence** (for most phenomena, a warning is issued at a probability of more than 50%) and the **intensity of the phenomenon** (low, high, extreme) are determined for each phenomenon. The combination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

In 2022, a total of **275 IWSS alerts** were issued, of which 159 were forecast warnings and 116 warned of the imminent occurrence of a hazardous phenomenon. There were 249 warnings against **meteorological phenomena** (of which 156 were forecast warnings), 26 warnings concerned only hydrological phenomena.

Meteorological warnings were in effect for a total of 163 days in 2022, or 45% of the days in the year. **Low-intensity** warnings prevailed and were in effect for a total of 98 days (Chart 50). Warnings for **high intensity** phenomena were in force on 53 days in total, of which information about the occurrence of a dangerous phenomenon was issued on 20 days. Warnings for phenomena with the highest, **extreme intensity** were issued mainly in the summer period and were valid for a total of 12 days. In June, these were warnings for extremely high temperatures (18 and 19 June) and extremely strong storms (24 and 29 June), warnings against extreme precipitation and extremely strong storms were issued for 4 days in August (only IOHP, FWI were issued at a lower intensity level).

Chart 50

Number of days with warning (FWI, IOHP) in Czechia according to the highest intensity in each month of the year [number of days], 2022

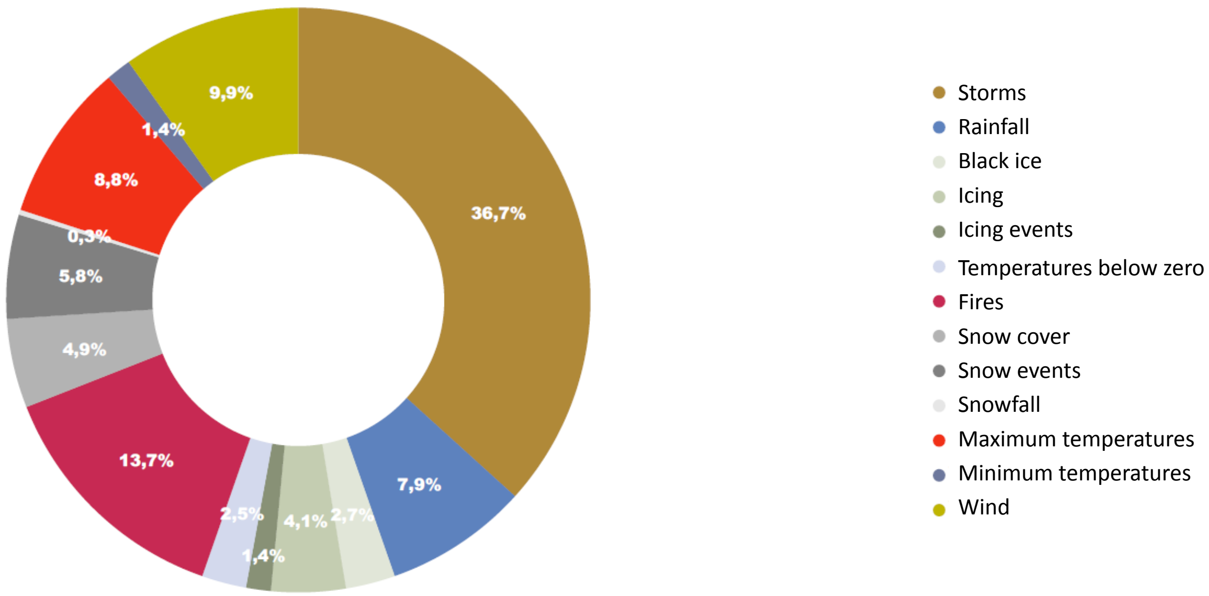


Data source: CHMI

Thunderstorms were the most frequent **group of phenomena** in the alerts in 2022, with a frequency of occurrence in the alerts of 36.7% (Chart 51), with a significant portion of these occurrences representing information on the imminent occurrence of the phenomenon (IOHP). When converted to the total number of warnings (warnings can be issued for more than one phenomenon at the same time), 53.8% of the weather warnings (FWI and IOHP) were for thunderstorms. Other frequently occurring groups of events in the alerts were fires (20.1% of alerts), high winds and high temperatures. These statistics do not take into account the duration of warnings or hazardous phenomena, only the representation of hazardous phenomena in warnings.

Chart 51

Representation of groups of hazardous phenomena in FWI and IOHP alerts for meteorological phenomena in Czechia [% of the total number of occurrences of phenomena in alerts], 2022

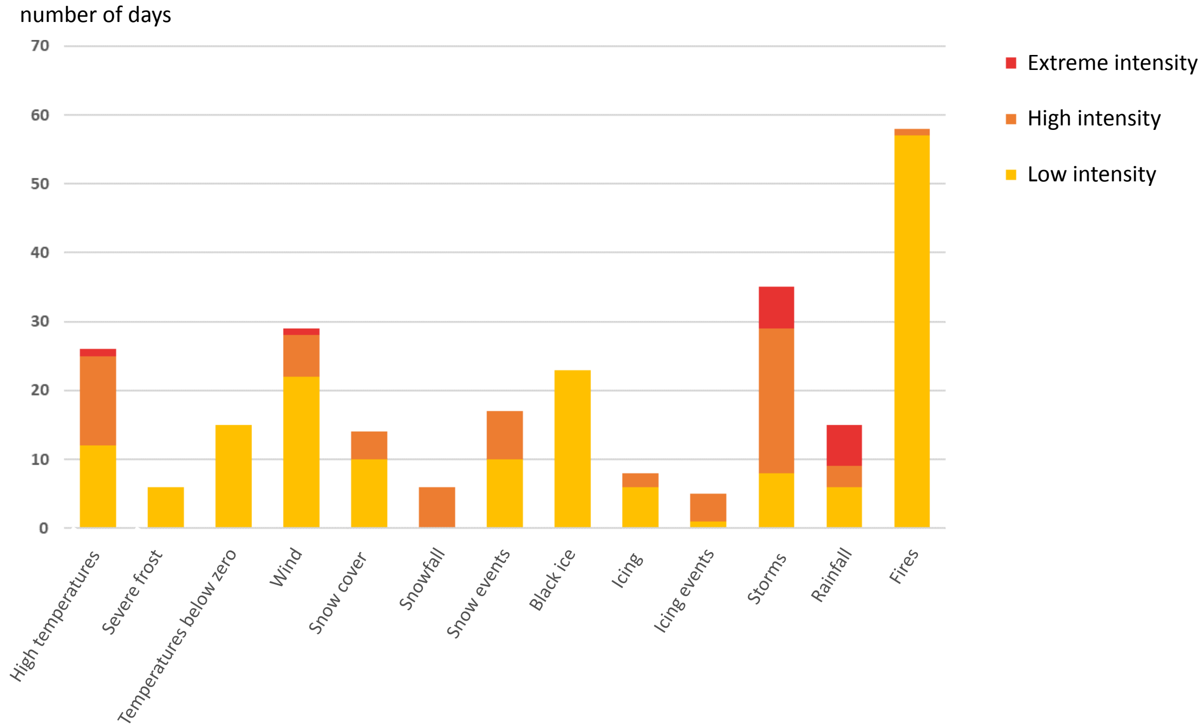


Data source: CHMI

Observed hazardous events meeting the criteria for IWSS alerts occurred on a total of 163 days in 2022, almost every day in August (29 days), with very frequent hazardous events in July (22 days) and June (20 days). The total number of days with hazardous phenomena and with a valid warning was the same in 2022, but small deviations between the number of days with a warning and the observed phenomena occurred in different months of the year. The highest number of days with hazardous phenomena not covered by alerts was in April (19 days with the phenomenon, 16 days with a warning), while in May, September and December, warnings were in force for more days than the number of days with the actual occurrence of the phenomenon. According to the groups of observed hazardous phenomena (Chart 52), the fire hazard was the longest (58 days), mostly of low intensity. Storms meeting the IWSS criteria occurred on a total of 35 days and high winds on 29 days.

Chart 52

Number of days with observed hazardous events meeting IWSS alert criteria in Czechia [number of days], 2022



The data shown in the chart cannot be added together, as several groups of dangerous phenomena can occur on the same day.

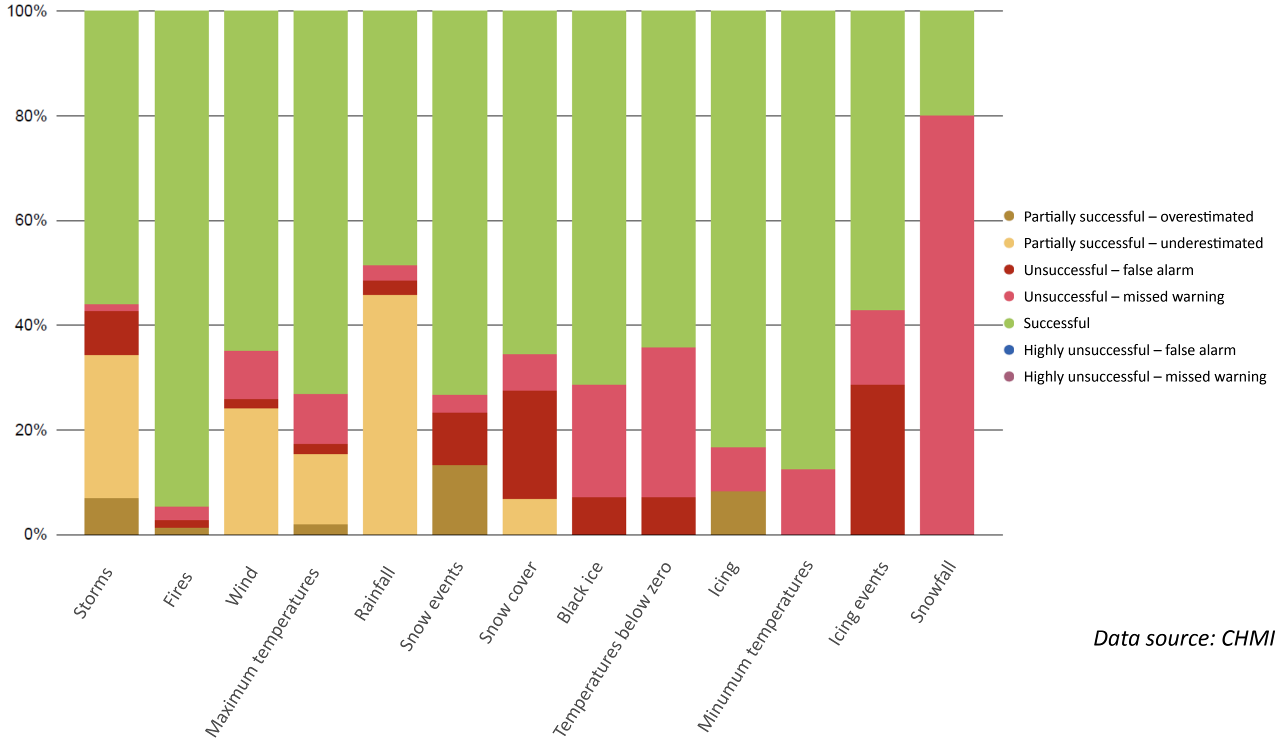
Data source: CHMI

According to the **evaluation of the success rate of IWSS alerts**, which is carried out by comparing alerts and recorded hazardous phenomena, 67.6% of alerts were evaluated as successful and 19.2% as partially successful. The partially successful alerts were in most cases underestimated (warnings were given for a lower intensity of the phenomenon than actually occurred). For failed alerts (13.2% of alerts), there was an almost even split between missed alerts and false alarms (no lower intensity phenomenon occurred). No alerts were assessed as very unsuccessful (missing alert or false alarm for the highest intensity level) in 2022.

In terms of **hazard groups**, fire hazards were the most successfully detected by alerts in 2022 (Chart 53) (94.6% of alerts were successful), with relatively high success rates also recorded for extreme temperatures (high temperatures and severe frost), snow events, ice and icing. On the other hand, warnings for heavy rain (48.6% of successful warnings) and thunderstorms (55.9% of successful warnings) were problematic in terms of forecasting and warning; a significant proportion of warnings for these phenomena were underestimated. The lowest warning success rate was for heavy snowfall (only 1 successful warning out of 5, i.e. 20%), but here the small number of events assessed may distort the situation.

Chart 53

Evaluation of the success rate of issuing IWSS alerts in Czechia by hazard group (FWI) [% of evaluated events], 2022



Data source: CHMI

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. Although restrictive public relations measures were in place for most regional Fire Rescue Services in the first half of 2022, this year can be viewed as the beginning of a gradual return to the normal pre-COVID regime.
	In 2022, a total of 22,923 events requiring intervention by the IRS 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 2022, insurers recorded more than 72 thous. claims caused by natural disasters with a total loss of CZK 3.6 bil. Since 2006, insurance companies have recorded a total of about 1.3 mil. insurance events caused by natural disasters with total damage of CZK 60.8 bil.

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 IRS 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 IRS 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 or massive icing, as well as emergencies caused by human activity, such as accidents associated with releases of hazardous substances.

In 2022, there were a total of 22,923 incidents related to natural disasters requiring 28,914 related interventions involving 27,219 fire protection units. The situation was similar to the previous year 2021. Within the IRS, these interventions in 2022 required the cooperation of the Czech Police for 3,954 interventions and the Emergency Medical Services for 254 interventions. In the vast majority of cases, these were technical accidents[73], of which there were 22,271, while the remainder were traffic accidents (485),

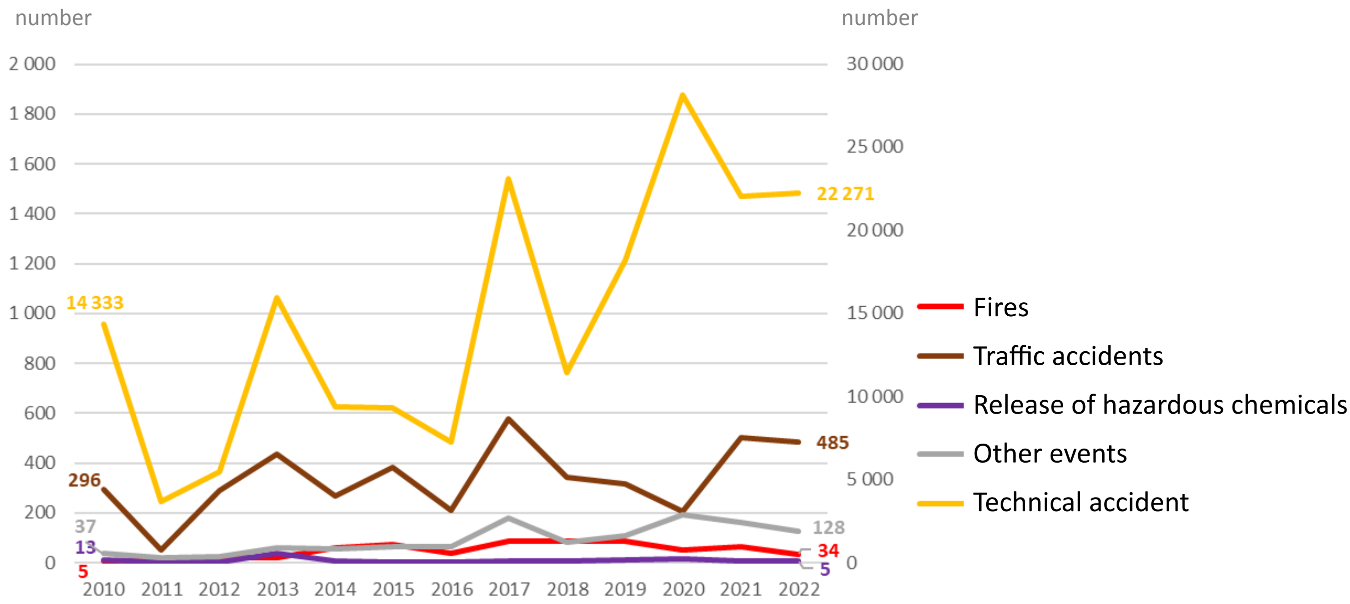
[73] *A technical accident means intervention at an event leading to the removal of a hazard or hazardous condition (e.g. intervention in the event of the destruction of objects, disposal of fallen trees and electrical wires, ventilation of premises, rescue of people and animals, etc.).*

other[74] events (128), fires (34) and releases of hazardous chemicals (5) resulting from natural disasters. 2 people died, 215 were injured and 1,136 were evacuated as a result of natural disasters in 2022. Damage caused by fires due to natural disasters amounted to CZK 4.8 mil. On the other hand, a total of 271 people were rescued, and the value saved in the case of fires amounted to CZK 15.5 mil.

In terms of developments since 2010 (Chart 54), we can note an increase in the number of technical accidents, mainly related to strong winds. High winds, together with floods, inundation or rain, have long been the dominant causes of all events (Chart 55). The exception is traffic accidents, where the increase is mainly due to snow and ice.

<u>Chart 54</u>

Number of incidents related to natural disasters in Czechia, 2010–2022

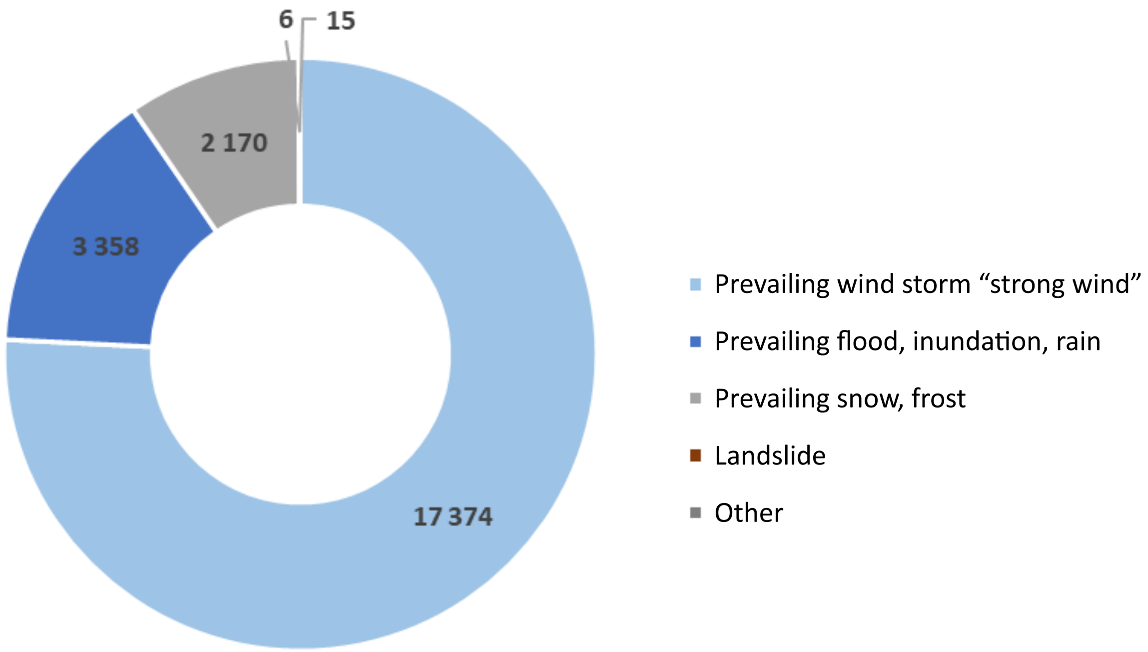


Data source: MoI – General Directorate of the Fire Rescue Service of the Czech Republic

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

Chart 55

Representation of individual natural disasters in the total number of events in Czechia [number], 2022



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

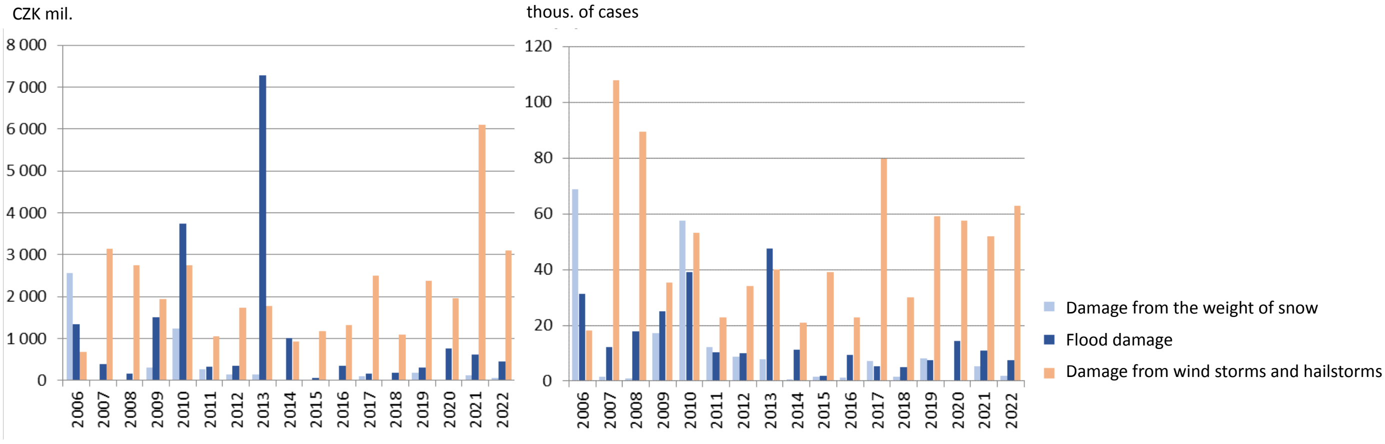
Given the growing importance of climate change risks, the 2014–2020 programming period has seen a significant increase in subsidy support from European funds, particularly through the Integrated Regional Operational Programme (IROP). Specifically, a total of CZK 4.9 bil. has been allocated to support the Fire Rescue Service or the IROP, 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 IROP were directed to increasing the resilience of professional and voluntary fire stations to drought, hurricanes and wind storms, snowfalls or 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 IRS in Czechia.

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 damages caused by wind storms, hailstorms and the weight of snow (Chart 56). Within these statistics, there are fluctuations in both the volumes and numbers of cases of damage related to extraordinary natural events, 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). The list must also include the last extraordinary natural event of 2021 in the form of a storm associated with a destructive tornado in the Břeclav and Hodonín regions and a downburst in Stebno. Since 2006, insurers have recorded almost 1.3 mil. insurance events caused by the above-mentioned natural events, with a total damage of CZK 60.8 bil., of which more than 72 thous. events with damage of CZK 3.6 bil. in 2022. Wind storms and hailstorms have long been the largest contributors to both the number of claims and total damage.

Chart 56

Insurance events in natural disaster insurance in the Czech Republic [CZK mil., thous. of cases], 2006–2022



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 Czech conditions represents the most serious manifestation of climate change, with the greatest potential impacts not only on biodiversity but also on the population and the economy. Although drought has not been as much of a problem in the last 2–3 years as it was in, for example, the extremely dry year of 2018, its economic consequences can be long-term. This is particularly evident in the case of forests, where extensive logging and subsequent reforestation continues to take place after the bark beetle calamity, caused primarily by excessive drought. In this context, between 2015 and 2022, 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 12.9 bil. Longer periods of high temperatures and low rainfall also increase the likelihood of fires and their rapid spread. In 2022, the largest vegetation fire in the history of Czechia occurred, specifically on the territory of the Czech Switzerland National Park. This large fire, which affected about 1.1 thous. hectares of land, caused direct damage of about CZK 150 mil., other financial losses (more than CZK 300 mil.) were caused by the fire to entities operating in the tourism industry.

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, develops **strategies 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 strategies are 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 that they are unable to restore the relevant assets with their own resources.

In the 2005–2022 period, recovery strategies were developed mainly in the context of devastating floods, wind storms or hurricanes. The total amount of damage (represented by total restoration costs) caused by these floods or inundations amounted to approximately CZK 44 bil. in the 2005–2022 period, with no exceptional flooding or inundation occurring between 2014 and 2022. 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 connection with a tornado in Moravia in 2021, damage to private and public property was estimated at CZK 6.9 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" or "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 Disasters", "Živel" or "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 more than CZK 140 mil.

Preventive and educational activities for population protection and crisis management

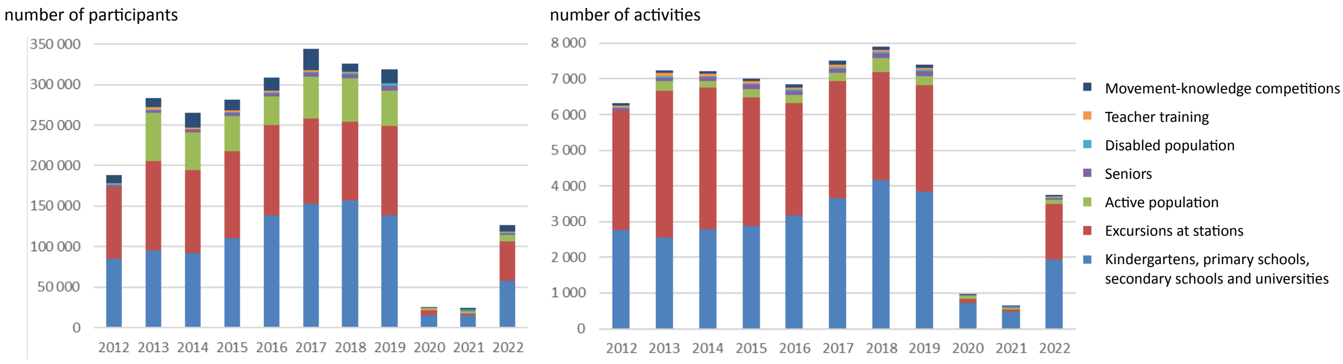
Preventive and educational activities related to public protection and crisis management include the issue of the protection of people in relation to common risks and emergencies. The guarantor of population protection, fire prevention and the Integrated Rescue System is the Fire Rescue Service of the 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, with 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 57) shows that the years 2020 and 2021 were quite exceptional in terms of measures related to the spread of **COVID-19** and therefore cannot be assessed in comparison with the previous period. Although restrictive public contact measures for most regional Fire Rescue Services in 2022 were in place until the end of April, and for some until June, this year can be seen as the beginning of a gradual return to the normal pre-COVID regime.

Chart 57

Preventive and educational activities in the field of the protection of people from common risks and emergencies in Czechia [number of participants, number of activities], 2012–2022



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

Discussions, lectures and preventive education programmes continued to be held in **schools**, and the organisation of suburban camps for pupils in the first grade of primary schools continued to grow. The equipment of fire stations was also improved for the purposes of lectures and excursions (multimedia classrooms, educational corners). In 2022, more than 50 different movement, art and literary competitions were organized. Knowledge competitions and various quizzes on the topics of public protection, fire prevention and the IRS are also held on websites and social networks.

The Fire Rescue Service of the Czech Republic has long been striving to **prepare teachers** to teach the topic of population protection during common risks and emergencies in schools and also to prepare school management for emergencies. It supports this training through its accredited courses and other activities. Furthermore, the accreditation of the MEYS was extended in 2022 for courses entitled Protection of People From Common Risks and Emergencies – Primary and Secondary Education.

Education for **people of working age** successfully continued, especially through discussions, workshops andcourses. 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 example, Population Protection Techniques and Volunteer Fire Brigade Prevention Officers courses for them.

Particular attention continued to be paid to **the elderly and disabled**, who represent 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 2022, **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 also effective tools for disseminating information to citizens. In 2022, a total of 396 educational contributions were made by the media through radio, 306 through television, 965 through print media and 2,002 through social 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 due to the spread of COVID-19, we can assume a future trend of further increasing interest by the population.

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

~	In 2022, there were four major industrial accidents in Czechia, two explosions, an oil spill and a dust ignition.

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
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 to provide a high level of protection for citizens, communities and the environment. The Act on the Prevention of Major Accidents[75] 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 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 to the environment or otherwise hazardous.

In Czechia, a total of 210 facilities were included in the major accident prevention system in 2022, of which 94 facilities were in Group A and 116 facilities in Group B. These were mostly chemical plants or production plants where hazardous substances are handled, but also, for example, fuel or chemical warehouses.

During 2022, four major accidents occurred in Czechia, two of which were in the Pardubice Region (at two different facilities). At Synthesia, coal dust ignited and exploded in the conveyor belt area, causing one serious injury and property damage. Furthermore, NC dust was ignited at Explosia (damage to technology only). Another accident occurred in the Ústí nad Labem region, where an explosion and subsequent fire occurred at the Litvínov refinery, which was fully under control within 20 minutes. Neither the explosion nor the subsequent localised fire caused any damage to the environment and the safe operation of other production units was not affected. The fourth accident occurred on the territory of the Central Bohemian Region in the central oil tank farm in Nelahozeves. The pipeline branch leaked 15.5 m^3 of oil into the

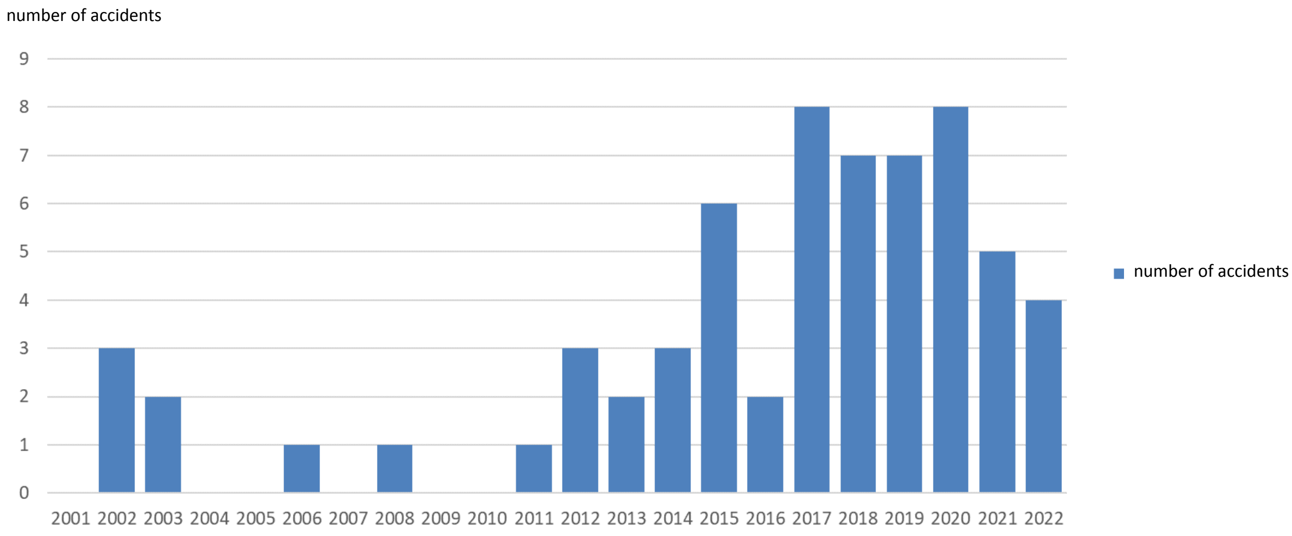
[75] *Act No. 224/2015 Coll., of 12 August 2015, on the Prevention of Major Accidents Caused by Selected Hazardous Chemical Substances or Chemical Mixtures and on the Amendment to Act No. 634/2004 Coll., on Administrative Fees, as amended (Act on the Prevention of Major Accidents)*

surrounding terrain. Part of the oil was successfully pumped out of the field and returned to the system; the total leakage into the soil was approximately 8.5 m^3.

The number of major accidents has fluctuated since 2001, but 2017–2020 saw the highest number of accidents. In the last two years, accidents have been successfully prevented and are decreasing (Chart 58).

Chart 58

Number of major accidents reported in Czechia, 2001–2022



Data source: MoE

Detailed visualisations and data

https://www.envirometr.cz/data

1.6. Adapted settlements

Urban settlements represent 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 Czechia. 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 2030 with a view to 2050

- effective adaptation of settlements to climate change risks
- conceptual development of settlements, preferential use of brownfields and already used areas
- an established water management system, including rainwater in settlements
- increasing the quality of green infrastructure contributing to the improvement of the microclimate in settlements

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 urbanised areas for the manifestations of climate change by transitioning to passive and close-to-passive standards for new buildings and thorough renovation of existing buildings, supporting the technical adaptation of buildings through legislative standards and norms

Spatial Development Policy of the Czech Republic (in the version binding from 1 September 2021)

- creating conditions for the development, use of potential and multifunctional use of abandoned premises and areas (so-called brownfields of industrial, agricultural, military and other origin, including the area of former military bases)
- creating conditions for increasing the natural retention of rainwater in the territory and using nature-based measures for the retention and storage of surface water where possible with regard to the settlement structure and cultural landscape, as one of the adaptation measures in the event of climate change impacts
- in the territory, 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 and droughts; taking into account the management of rainwater in the definition of build-up areas
- use of the built-up area economically (support for redevelopment through revitalisation and remediation of the area) and ensuring the protection of the undeveloped area (especially agricultural and forest land) and the preservation of public greenery, including the minimisation of its fragmentation
- in cooperation with the municipalities concerned, designating the land necessary for the creation of continuous areas of publicly accessible greenery in development areas and development axes and their protection from development in specific areas where the landscape is negatively affected by human activity, using its natural renewal

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, 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 2021+

- efficient use of the built-up area, limiting the development of open countryside caused by the growth of metropolitan areas, expanding and connecting areas and masses of green space in the built-up area and improving the efficiency of water and energy management in metropolitan areas
- effective solutions to environmental problems associated with the concentration of large populations and the adaptation of agglomerations to climate change

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 2022, 50 towns or municipal districts and 7 micro-regions or voluntary associations of municipalities in Czechia had an adaptation strategy or plan (or a non-binding "roadmap" for adaptation). The number of affected inhabitants living in the territory of these settlements was approximately 3.4 mil. A growing number of cities and municipalities are becoming aware of the crucial importance of adaptation to climate change for their future development. In addition to these cities and municipalities, four regions, including Prague, have also been approved adaptation strategies or plans.

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
Number of municipalities with adaptation plans	N/A	N/A	↗	~

Number of municipalities with adaptation plans

Adaptation to the impacts of climate change in settlements and in urban areas is a complex cross-sectoral environmental issue that has been at the forefront of strategic documents at national and local level in recent years. 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)[76]. However, an increasing number of cities and municipalities are already 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. This corresponds to the relatively high increase in the last two years of cities and municipalities that have developed or approved their own adaptation strategy or plan enabling the **implementation of specific adaptation measures in planning practice**.

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 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 are much more effective and cheaper than future solutions to problems such as damage caused by flash floods, overheating of buildings and public transport, or lack of water resources.

The **first adaptation strategies** of 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 NP ENV, which aimed, among other things, to support the involvement of municipalities in the Covenant of Mayors

---

[76] *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.*

(hereinafter referred to as the "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, a municipality is obliged to prepare a Sustainable Energy and Climate Action Plan (SECAP) within two years. Although 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 2022, 50 towns, or urban districts, and 7 micro-regions or voluntary associations of municipalities bringing together another 200 municipalities had an **adaptation strategy or plan** (or a non-binding "roadmap" for adaptation) prepared in Czechia, while the number of affected inhabitants living on the territory of these settlements amounted to about 3.4 mil. In addition to these cities and municipalities, four regions, including Prague and Mendel University in Brno, have also been approved adaptation strategies or plans. However, the issue of adaptation to climate change is at least partially addressed by the Smart City concept, which has been developed by 14 cities, either independently or in addition to an adaptation strategy or plan that was already developed. Transport, greenery and energy are the central themes of 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. Rainwater or grey water management is also a new issue that most cities are beginning to address.

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 the adaptation strategy. In the planning phase, towns and cities are mainly confronted with issues relating to property rights and coordination between districts, authorities or 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 integration into the strategic and investment plans of 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; in 2022, 174 sites with a total area of 279 ha were deactivated from the National Database of Brownfields due to sale or successful regeneration. Sustainable development of settlements is also supported by the implementation of LA21. 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. A comprehensive assessment of the development of towns and municipalities in terms of sustainable development principles was introduced and the process of assessment of LA21 implementation was 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. All cities over 100k population had a verified SUMP in 2022. Of the 20 largest cities in Czechia, 18 have a verified SUMP, Hradec Králové and Opava have a verified SUMF.
~	In total, 2,110 brownfields with a total area of 5,615.7 ha were newly registered in Czechia in the 2014–2022 period.
✗	The lower categories of LA21 implementation show 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 LA21 implementation. The indicative target of the SEP 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*				
Number of LA21 implementers	↗	~↗	↘	~
Quality of LA21 implementation	~↗	~↗	↗	✓
Sustainable Urban Mobility Plans	N/A	N/A	↗	✓

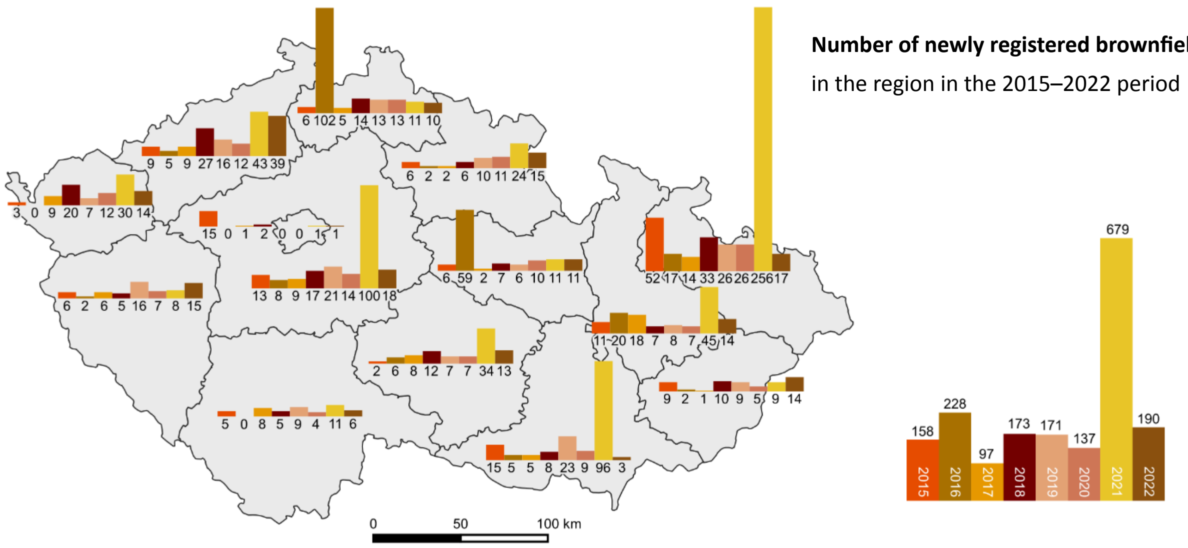
** In addition to a simple quantitative assessment of the implementation of LA21, it is necessary to assess the quality of its implementation in the settlements or areas concerned. Therefore, the assessment of the LA21 indicator is presented separately for the two partial (elementary) indicators.*

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, 2,110 brownfields with a total area of 5,615.7 ha **were registered** in this database in the 2014–2022 period. The largest number of new brownfields being entered into the database in the 2014–2022 period occurred in 2021, when 679 sites were entered (Fig. 22) with a total area of 2,070.5 ha. In 2022, a total of 190 brownfields with a total area of 260.3 ha were newly registered in Czechia.

Fig. 22

New brownfields entered into the National Database of Brownfields by regions of Czechia [number], 2015–2022



The jump in the number of new sites added in 2021 was due to a major update of all the data in the National Database of Brownfields. In 2022, updating and more detailed mapping continued, and data from several internal CzechInvest databases were consolidated. New data from the Business Environment Passport Survey were integrated into the database. The National Database of Brownfields currently provides the most up-to-date data on the state of the brownfield environment in Czechia, which is verified by field mapping.

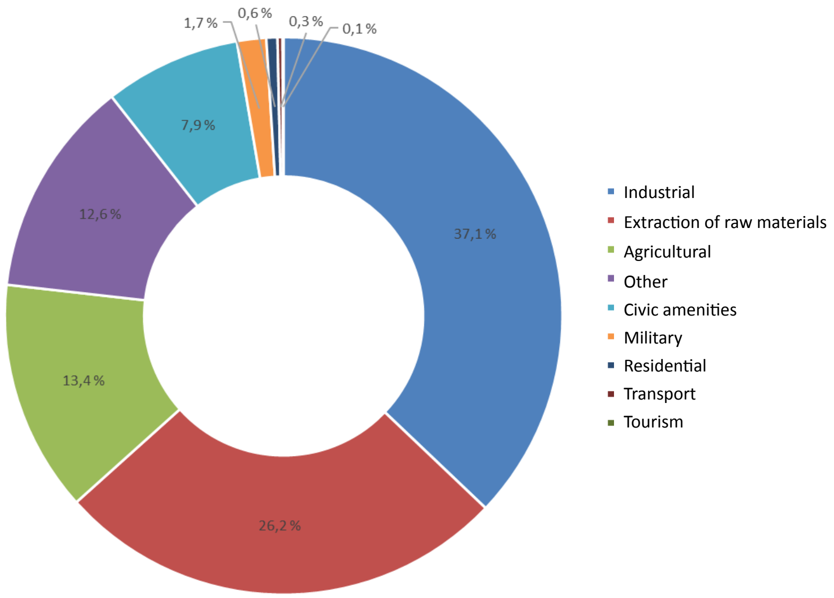
Data source: CzechInvest

The largest area of newly registered brownfields was recorded in the Central Bohemian Region (651.4 ha) in 2014, in 2022 in the Ústí nad Labem Region (85.1 ha) with 39 objects and also in the Moravian-Silesian Region (58.0 ha) with 17 objects.

In 2022, the predominant new brownfields were **those previously used for** industrial purposes (37.1% of the area of new brownfields) and those previously used for the extraction of raw materials (26.2%), Chart 59.

Chart 59

Newly entered brownfields in Czechia by previous use [% of total area], 2022



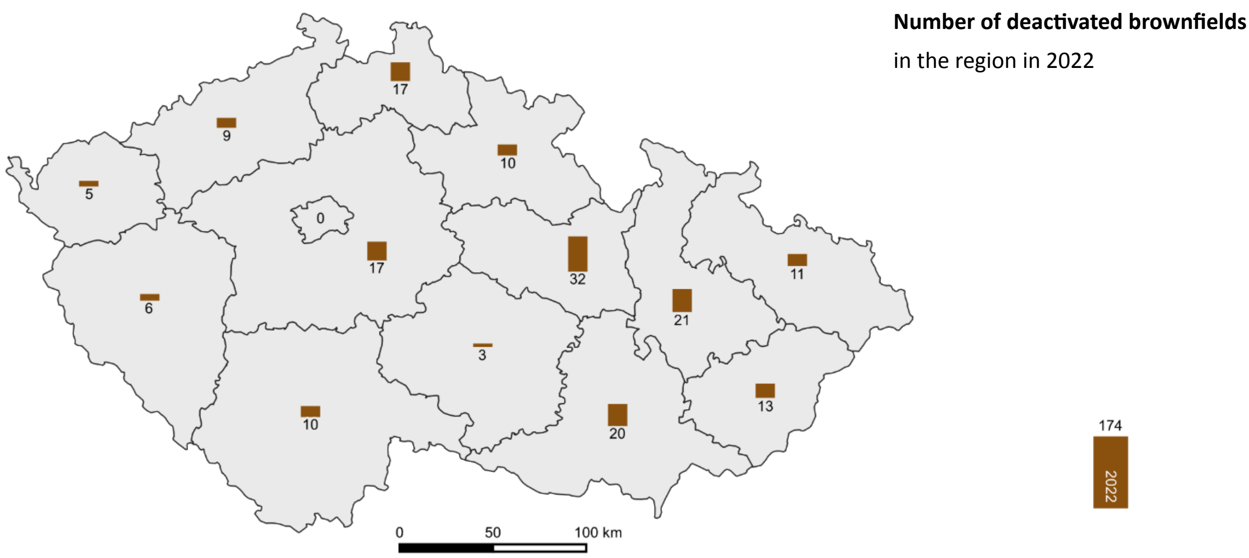
Data source: CzechInvest

At the end of 2022, a total of 4,377 sites with a total area of 13,351 ha were registered in the National Database of Brownfields, with the largest number of brownfields registered in 2022 in the Moravian-Silesian (674 sites) and Ústí nad Labem regions (500 sites).

Brownfields in Czechia are being **regenerated**; in 2022, 174 sites with a total area of 279 ha were deactivated from the National Database of Brownfields due to sale or successful regeneration, including through subsidy programmes (in 2021, 157 sites with a total area of 342 ha). Most brownfields were deactivated in 2022 in the regions of Pardubice (32 sites), Olomouc (21 sites) and South Moravia (20 sites), Fig. 23. It is necessary to continue to support the regeneration of brownfields so they can potentially be used in the future.

Fig. 23

Brownfields deactivated from the National Database of Brownfields due to sale or successful regeneration by regions of Czechia [number], 2022



Data source: CzechInvest

Local Agenda 21

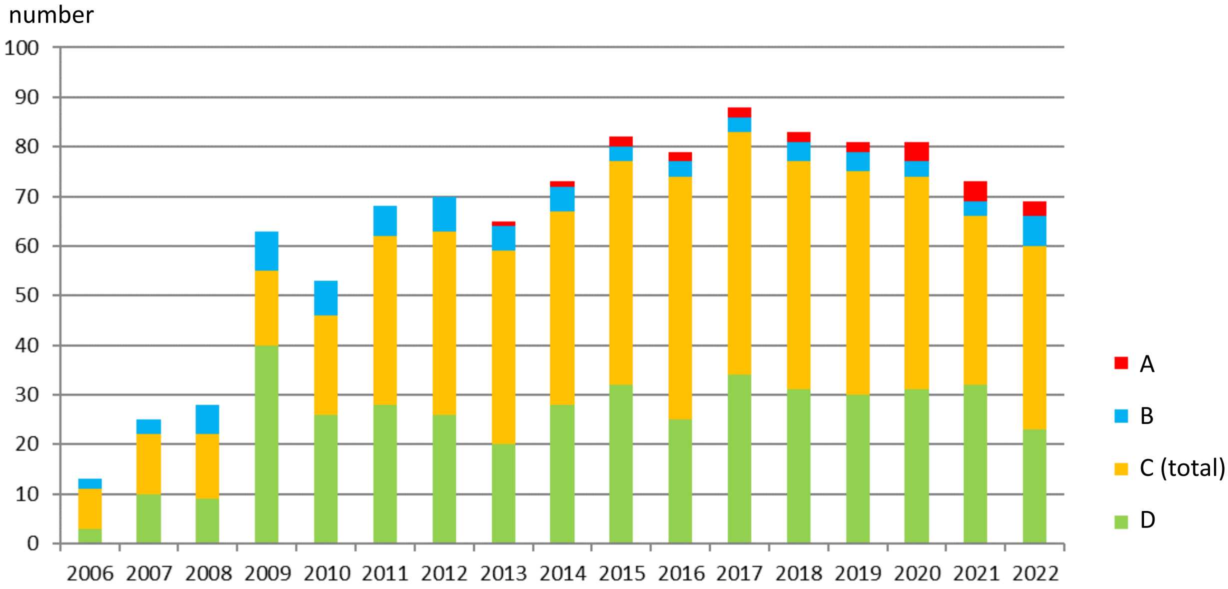
Local Agenda 21 (hereafter "LA21") is a **voluntary tool**. It is a state-guaranteed programme to support the sustainable development of municipalities and regions. This tool is based on close cooperation by the relevant authorities not only with commercial entities and associations operating in the 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 LA21 implementers is discussed and approved by the LA21 Working Group of the Government Council for Sustainable Development, which is also an advisory body to the Minister of the Environment. LA21 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 LA21 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 LA21 implementation, each implementer starts at the level of "Interested Party" and progresses through levels D, C, B up to the highest level A. The evaluation methodology for each group of implementers (municipalities, small municipalities, regions, associations of municipalities and LAGs) is tailored to their competences, size and position within the local government. How fast and how far each implementer progresses is up to them[77]. Since the beginning of its monitoring in Czechia (i.e. since 2006), the voluntary LA21 tool has been associated with a number of successes at different levels and areas of Czech society. Nevertheless, like any tool or concept, it still has reserves and challenges, to which efforts are continuously made to respond.

In 2022, 69 implementers had LA21 in place at levels A–D (there were 112 entities including the category Interested Party). **In the long term**, i.e. over the last 15 years, we can see an upward trend in the number of implementers, 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 LA21 implementers has shown a downward trend (Chart 60). If the current trends continue, the **targets for the number of implementers** set in the 2030 SEP (500 registered entities) **will not be met**. 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 fulfil more demanding criteria and tasks in the transition to the next phases of LA21 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.

[77] *More information on LA21 is available at https://ma21.cenia.cz/.*

Chart 60

Overview of LA21 implementers in Czechia by level of achievement [number], 2006–2022



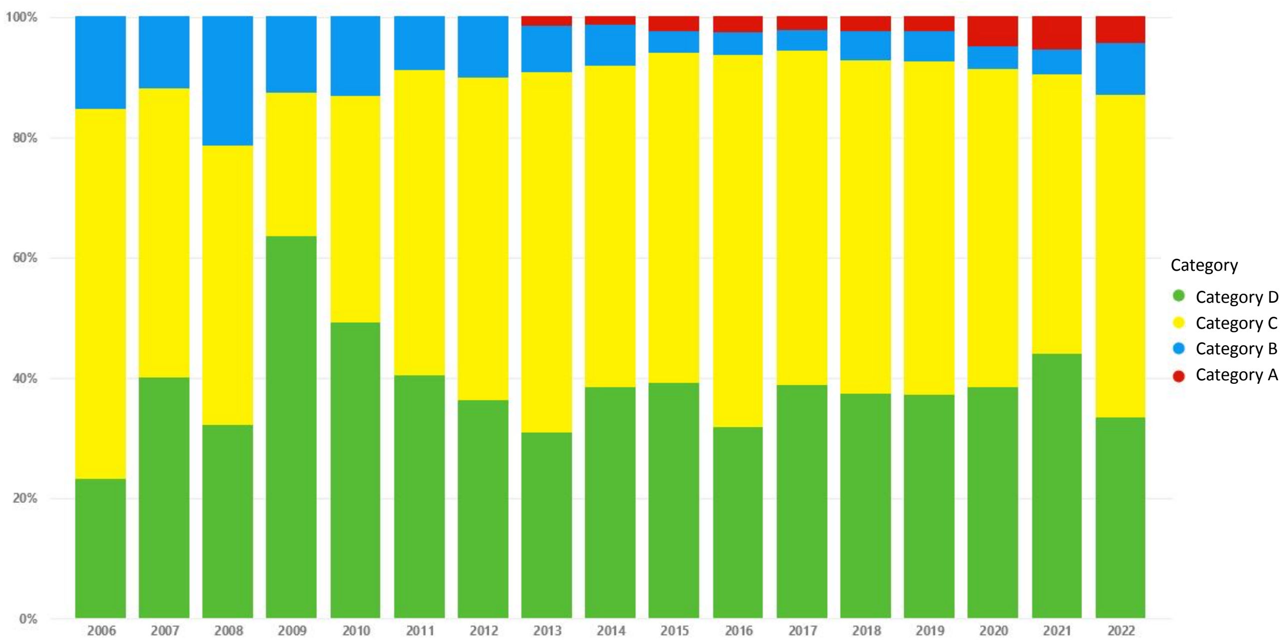
Shown in the chart without the category "Interested Party". In the case of level C, several sub-levels can be distinguished from 2017 onwards, i.e. C, C, C** and C***.*

Data source: CENIA

The **quality of LA21 implementation has been increasing** over the long term, that is, the number or proportion of implementers achieving the highest LA21 categories is increasing (Chart 61). In 2022, this trend was maintained, although a number of municipalities saw a change in political representation during the year based on the results of the local elections. The highest category A was achieved or maintained by 3 implementers (the cities of Chrudim, Jihlava and Prague 14). In the second highest category there were 6 implementers (the towns of Kopřivnice, Rožnov pod Radhoštěm and Velké Meziříčí, the municipalities of Prague 10 and Prague 12 and the small municipality of Bory). The active involvement of Prague's municipal districts as well as the advancement of the small municipality of Bory to Category B in 2022 are positive. An important factor influencing this positive trend is the targeted methodological support of implementers and experts, which CENIA has intensified considerably in recent years. In addition to the financial support from the Ministry of the Environment of the Czech Republic and methodological support provided by 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 development of LA21.

Chart 61

Share of individual categories of LA21 implementers in the total number in Czechia [%], 2006–2022



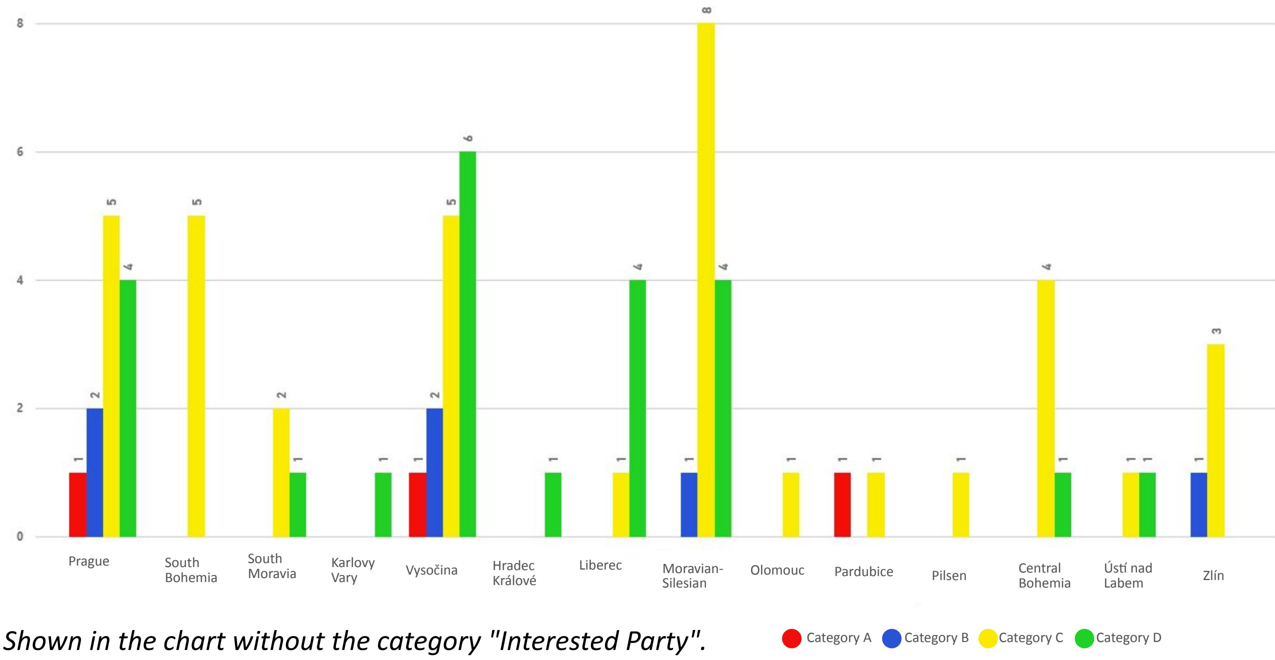
Shown in the chart without the category "Interested Party".

Data source: CENIA

An important support for the development of LA21 in the regions is the **involvement of the regions**. The regional authorities involved in the implementation provide significant methodological and financial support to the municipalities in their region. The most active and successful in this respect is the Vysočina Region, followed by the Moravian-Silesian Region (Chart 62). In the capital city of Prague, an important partner of LA21 is the Prague Institute of Planning and Development, which, in addition to data support, provides methodical support to municipal districts in the area of cooperation with the public.

Chart 62

Participation in LA21 by category in individual regions of Czechia [number], 2022



Shown in the chart without the category "Interested Party".

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 implementation of LA21. 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. If mutual cooperation works 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 Chrudim, Prague 14, Rožnov pod Radhoštěm or Kopřivnice. In this case, it is evident that LA21 implementers who have reached a higher level of implementation have a greater ambition to continue and improve further. Support of the local political representation is crucial for the successful implementation of LA21 in a municipality or region. **Sustainable development is a long-term process**, the goals of which go far beyond a four-year term and often require systemic measures that are not visible in the short term. Systematic and well-designed outreach to regional policy makers can demonstrate the merits of this tool for ensuring sustainable development at regional and local level.

Sustainable Urban Mobility Plans

The purpose of **Sustainable Urban Mobility Plans** (SUMPs) 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. The development and implementation of the SUMP takes place within the framework of the **Concept of Urban and Active Mobility for the period 2021–2030**, approved by the Government in January 2021, for 6 size categories of cities A–F. Category A is the city of Prague, category B is Brno and Ostrava, other categories are defined by the smallest number of inhabitants, namely 75 thous. (category C), 42 thous. (category D), 25 thous. (category E) and under 25 thous. inhabitants (category F).

The SUMP focuses not only on addressing transport issues, but also on influencing and satisfying mobility. The SUMP has been prepared according to the **Methodology for the Preparation of Sustainable Urban Mobility Plans of the Czech Republic** (TRC, 2015). One of the conditions for funding urban projects from the OP T and IROP in the 2014–2020 programming period was to have either a full-fledged SUMP or a simplified version known as SUMF (Sustainable Urban Mobility Framework), which focuses on public transport, in place after 2020. In September 2021, the new **Sustainable Urban Mobility Plan Methodology SUMP 2.0**[78], which was developed as an output of the TA CR project MOBILMAN – Human Dimension of Sustainable Urban and Regional Mobility Plans, was submitted for final comments and certification. This methodology was certified by the Ministry of Transport of the Czech Republic in January 2022.

The process of SUMP and SUMF 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. The SUMP and SUMF approval process is carried out by the Commission for the Assessment of Urban Mobility Documents (CAUMD), which is appointed by the 1st Deputy Minister of Transport.

By the end of 2022, a total of 30 sustainable mobility documents had **been submitted to the CAUMD for discussion**, 15 as SUMPs and 5 as SUMFs (Tab. 5). So far, 29 projects have **been verified**, 26 of them as SUMPs. Although the cities of Liberec and Jablonec n. N., Ústí n. L., Pardubice and Zlín submitted a proposal for a SUMF, the final verified document was a full-fledged SUMP. Only the proposals of the towns of Opava and Přerov, originally submitted as SUMP, were verified as SUMF, as not all the requirements defined by the Methodology were met. The document of the city of Karviná was ready for approval in 2022, while the SUMPs of the cities of Chomutov, Mladá Boleslav and Otrokovice were under preparation. Among smaller towns, the SUMP of Milevsko in the South Bohemian Region (8.1 thous. inhabitants) was verified.

[78] *More at: https://www.mdcr.cz/Dokumenty/Veda-a-vyzkum/Certifikovane-metodiky/Ostatni-metodiky/Metodika-planu-udrzitelne-mestske-mobility-SUMP-2*

Tab. 5

Overview of the preparation and verification of Sustainable Urban Mobility Plans (SUMP) and Strategic Urban Mobility Frameworks (SUMF) in Czechia, 2017–2022

Town/City	Population	Initially discussed at the CAUMD	Verification state achieved
Prague	1,335,084	10/2018	SUMP
Brno	382,405	10/2018	SUMP
Ostrava	284,982	07/2017	SUMP
Pilsen	175,219	04/2017	SUMP
Liberec Jablonec n. N.	104,261 45,317	04/2018	SUMP
Olomouc	100,514	07/2018	SUMP
České Budějovice	94,229	07/2018	SUMP
Ústí nad Labem	91,982	05/2019	SUMP
Hradec Králové	92,683	02/2018	SUMF
Pardubice	91,755	04/2018	SUMP
Zlín	74,478	07/2018	SUMP
Havířov	70,165	01/2019	SUMP
Kladno	68,896	07/2019	SUMP
Most Litvínov	65,341 23,489	04/2018	SUMP
Opava	55,996	07/2017	SUMF
Frýdek-Místek	55,006	12/2019	SUMP
Jihlava	51,125	10/2018	SUMP
Teplice	49,705	10/2019	SUMP
Děčín	47,951	01/2020	SUMP
Chomutov	48,349	Under preparation	
Karlovy Vary	48,319	09/2022	SUMP
Mladá Boleslav	44,327	Submitted, pending approval	
Prostějov	43,381	11/2022	SUMP
Přerov	42,451	02/2018	SUMF
Kopřivnice	21,657	2019	SUMP
Kroměříž	28,360	2019	SUMP
Litoměřice	23,623	2018	SUMP
Milevsko	8,185	2020	SUMP
Otrokovice	17,592	Under preparation	
Písek	30,379	2020	SUMP
Třebíč	35,107	2019	SUMP
Karviná	53,522	03/2023	SUMP

Currently, **all cities in Czechia above 100 thous. inhabitants** (Prague, Brno, Ostrava, Pilsen, Liberec and Olomouc) have a verified SUMP. Of the 20 largest cities in Czechia, only Hradec Králové and Opava have a verified SUMF, the other cities have a SUMP. The total population of cities with an approved SUMP or SUMF reached 3.37 mil. at the end of 2022, which is roughly one-third of the country's population.

1.6.3. Water management system in settlements

Key question

How is rainfall and greywater management supported in settlements?

Key messages

✓	The management of rainwater and greywater is financially supported mainly by subsidies through the OP ENV 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 indicators

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 the 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 sector. This title was announced in 2017 and is financed from the national funds of the State Environmental Fund of the Czech Republic under the National Environment Programme (NP ENV). A total of CZK 540 mil. has been allocated in the two calls so far, while almost 9,800 projects with a total support amount of about CZK 383 mil. have been approved by 2022. 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 (almost

9,700 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 programme is approximately 48,000 m^3.

The Dešťovka programme for owners and builders of detached houses, recreational houses and apartment buildings is included from October 2021 under the New Green Savings subsidy programme, funded by the National Recovery Plan under the calls for detached houses and apartment buildings. In 2022, more than 860 projects for the construction of storage tanks with a volume of about 6.6 thous. m^3 were approved for the purpose of storing and using rainwater or greywater for more than CZK 38 mil. In November 2021, a call for proposals was announced through the National Programme Environment (NP ENV) aimed at supporting efficient management of rainwater in the built-up area of municipalities and intended for listed public entities and other legal entities. The call allocation for this type of measure is CZK 992 mil. In 2022, 155 projects worth CZK 785 mil. were approved in this call.

Rainwater management measures are also supported by **European funds under OP ENV** 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"**[79]**).** The total allocation of the supported area 1.3 was approx. CZK 2.9 bil. and calls were regularly issued for activities related to the management of rainwater in urban areas. In 2020, the 144th call, the so-called "Big Rainwater", was announced with a total allocation of CZK 1 bil., which was followed in 2021 by the 159th call with an allocation of CZK 0.5 bil. By the end of 2022, almost 200 projects had been approved for activity 1.3.2 for a total amount of CZK 0.8 bil. of the TEE, the implementation of which should retain approximately 24 thous. m^3 of rainwater in the municipal built-up area. The issue is also addressed in the follow-up OP ENV 2021–2027, where the 19th call (Rainwater and flood protection measures) with an allocation of CZK 2.5 bil. was announced under specific objective 1.3 Adaptation to climate change in 2022. In the area of the implementation of measure 1.3.4, which is intended, among other things, to slow down runoff, one project worth CZK 2.1 mil. of the TEE for the collection, retention and storage of rainwater was recommended for funding in 2022.

Legislatively, the issue of rainwater management is addressed in particular by **Act No. 254/2001 Coll., on Water and on Amendments to Certain Acts (the 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 not to prevent any increase in the amount of rainwater discharged through sewerage systems, but to actively reduce it.

Partial requirements for rainwater management are then set out in selected implementing legislation to **Act No. 183/2006 Coll., on spatial planning and building regulations (Building Act)**. Within the framework of **Decree No. 501/2006 Coll., on general requirements for land use**, there are, among other things, requirements for the definition of the building land so that the management of rainwater is ensured on it:

- its accumulation with subsequent use, infiltration or evaporation, if hydrogeological conditions, the size of the land and its prospective use allow it and if the surrounding buildings or land are not endangered by infiltration,
- by discharge to surface waters via rainwater drainage, unless its accumulation with subsequent use, infiltration or evaporation is not possible, or
- its regulated discharge to the sewerage system, if discharge to surface water is not possible.

At the same time, **Act No. 274/2001 Coll., on water supply and sewerage for public use and on amendments to certain acts (Act on water supply and sewerage)** introduced a payment for the volume of rainwater discharged, which motivates the owners of buildings to manage rainwater, because when they are disconnected from the public sewerage system, the payment is cancelled or reduced. However, the

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

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.

1.6.4. Quality of green spaces 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 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 indicators

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 the 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 a 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 an important role 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.

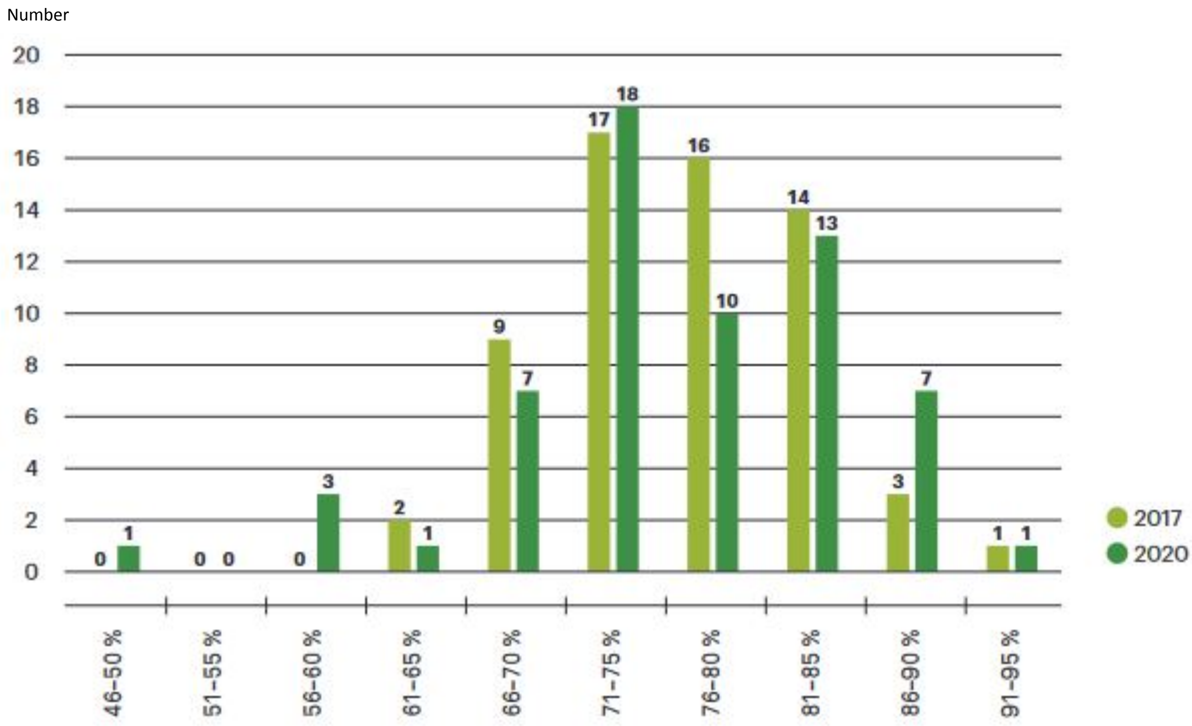
The "Green Areas in Cities" indicator characterizes the **representation of green areas in settlements and water areas in the urban area** of all 61 cities in Czechia with over 20 thous. inhabitants (i.e. including regional cities), based on the classification of remote sensing data[80]. The share of green areas (forest land, protected areas (Large-area and Small-area Specially Protected Areas), floodplains – polders, waterlogged areas, permanent grassland – meadows and pastures, urban parks with greenery, roofs covered with greenery (so-called green roofs), ecoducts, watercourses and their riparian vegetation and water areas) in

[80] *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 the development class, 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.*

2020 ranged from 45.7% (Havířov) to 91.9% (Trutnov) of the total urban area (Chart 63), with an average share of 76.0%. Compared to the last measurement in 2017, there have been more significant changes, especially in the 76–80% 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" 86–90% category.

Chart 63

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



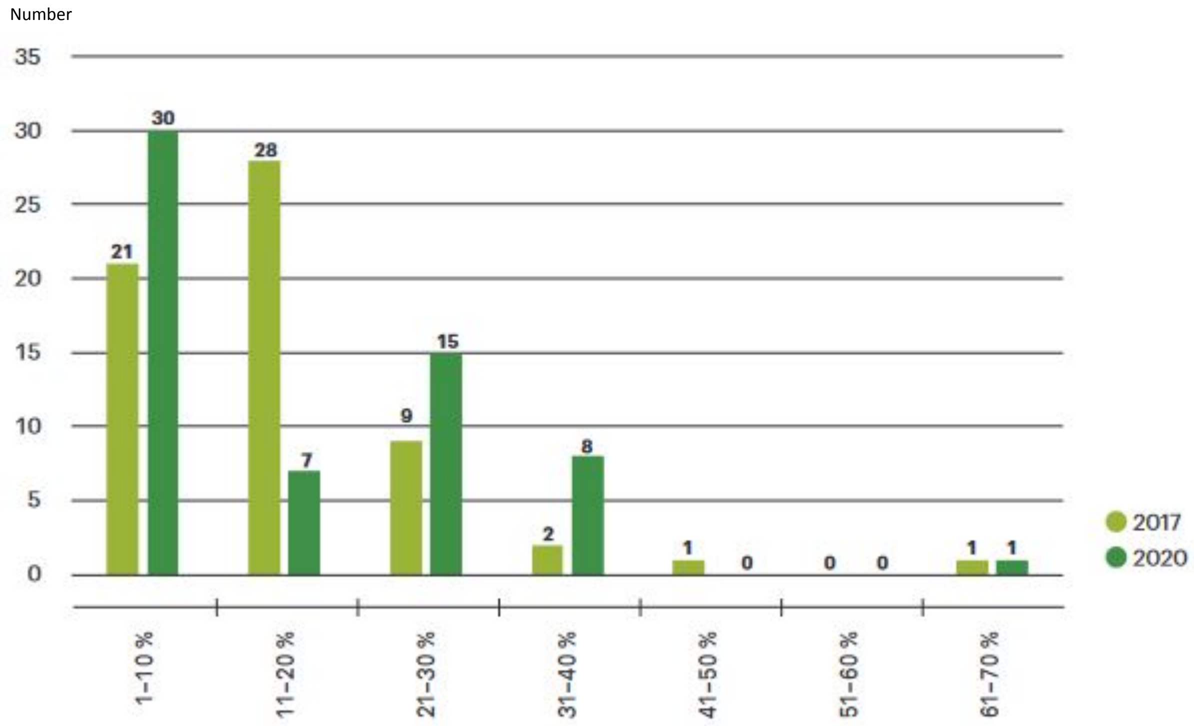
Data for 2021 and 2022 are not available at the time of publication.

Data source: Sentinel-2, CZSO

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 green space** (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 green area in the total area was identified in Karlovy Vary (25.7%), while the highest was in Přerov (75.6%). In contrast, **high 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 high greenery only between 1% and 20% of the total urban area (Chart 64).

<u>Chart 64</u>

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



Data for 2021 and 2022 are not available at the time of publication.

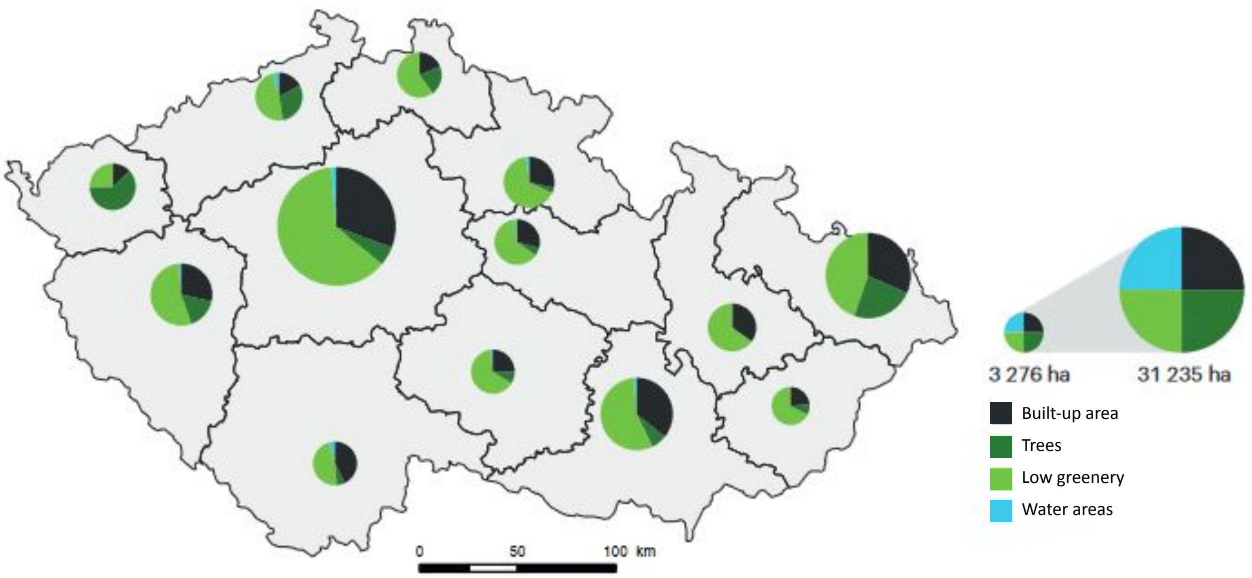
Data source: Sentinel-2, CZSO

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 the 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%).

A specific category of monitored settlements is represented by **regional cities**. Among the regional cities of Czechia in 2020, greenery (trees and low greenery) accounted for the largest share of the urban area of Karlovy Vary (86.7%), followed by 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, Fig. 24. 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.

Fig. 24

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



Data for 2021 and 2022 are not available at the time of publication.

Data source: Sentinel-2, CZSO

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.

Detailed visualisations and data

https://www.envirometr.cz/data

2. Climate neutral and circular economy

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 effects 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 agreement formulates a long-term climate protection target 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.

Overview of selected related strategic and legislative documents

Paris Agreement

- contribute to keeping the increase in global average temperature well below the 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 GHG 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

Fit for 55 legislative package

- a package of interlinked proposals that will translate the 55% greenhouse gas emissions reduction target into EU legislation
- the package includes amendments to 8 existing and the proposal of 5 new initiatives in the areas of climate, energy, transport, buildings, land use and forestry

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 sources

- a Europe-wide target of 32% of renewable energy sources in gross final energy consumption by 2030
- achieving a 14% share of energy from RES in final energy consumption in transport by 2030

2.1.1. Greenhouse gas emissions

Key question

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

Key messages

	Over the period 2016–2021 , GHG emissions from the energy sector fell by 24.6%, the category with the highest share of total emissions. Gross electricity generation in 2022 fell by 0.5% year-on-year. The production of heat from solid fossil fuels is gradually declining, while the share of renewable sources and biofuels is increasing significantly. The number of registered alternatively powered passenger cars in 2022 increased by 41.3% year-on-year to 15.3 thous. vehicles, while registrations of battery electric passenger cars increased by 70.3%.
	Aggregated GHG emissions, including LULUCF, decreased by 33.7% between 1990 and 2021, but this decrease is not yet sufficient to meet the targets under European legislation and national strategy documents.
	Total greenhouse gas emissions in Czechia increased by 2.1% between 2016 and 2021, due to unfavourable emission balances and declines in the LULUCF sector affected by the bark beetle calamity in forests. Due to turbulent changes in energy commodity prices, the trend of a decreasing share of solid fuels in electricity generation has been reversed. The share of electricity generation from less available natural gas has decreased and it has been partially replaced by domestic lignite. The export character of foreign trade in electricity persists, with the share of the balance in domestic consumption increasing to 19.1% in 2022. After a long-term decline in the number of households heated with solid fuels, their number has been on the rise again over the last five years. Energy consumption in transport increased by 77.9% between 2000 and 2022, with 95.5% of transport energy consumption coming from fossil fuels. The share of electric and hybrid vehicles in the passenger car fleet is still less than 0.5%.

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 (including LULUCF)	↘	~↗	~↗	~
Electricity and heat generation*				
Gross electricity generation	○	○	○	✕
Gross heat generation	N/A	○	○	N/A
Household heating by fuel	N/A	~↗	~↗	✕
Energy and fuel consumption in transport	↗	↗	~↗	✕

** 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

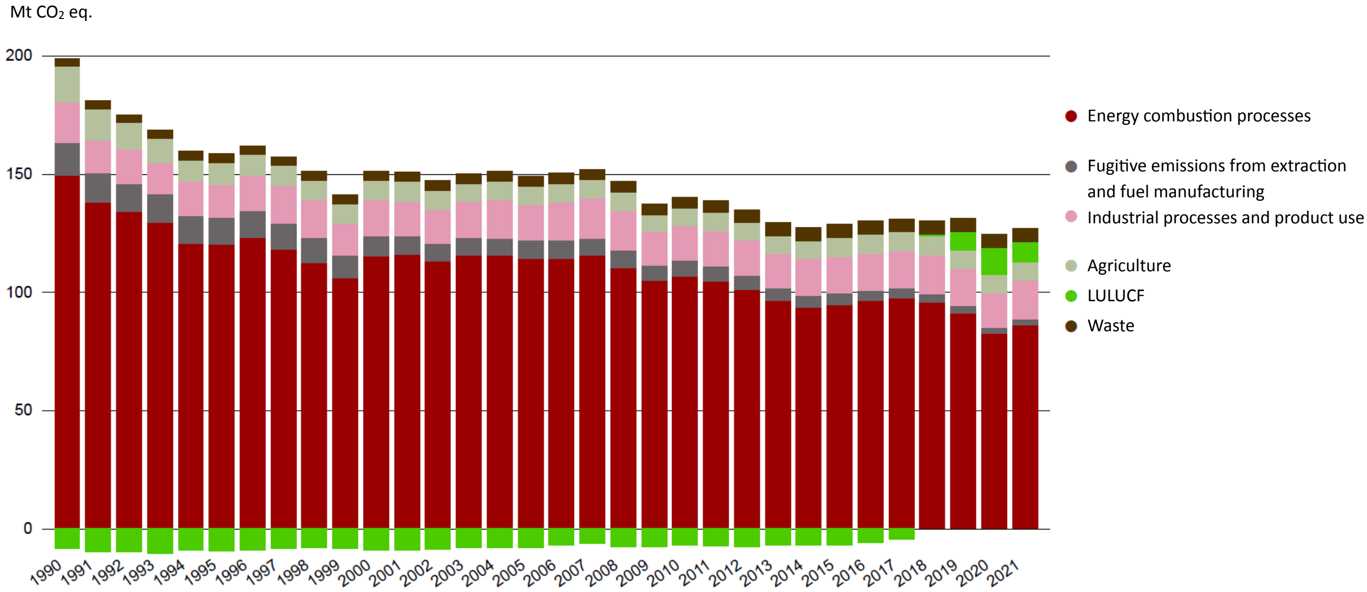
Aggregate GHG emissions in Czechia (including the LULUCF sector and indirect CO_2 emissions) decreased by 33.7% to 127.4 Mt CO_2 eq. (Chart 65). Emissions increased by 2.1% between 2016 and 2021[81], mainly due to unfavourable emissions trends and declines in the LULUCF sector (land use, land-use change and forestry). There was also a 1.9% year-on-year increase in emissions between 2020 and 2021, but this was driven by the COVID-19 pandemic. Meeting the EU-wide target contained in the Green Deal for Europe and subsequent European legislation, according to which emissions are to fall by 55% by 2030 compared to the 1990 benchmark, is thus still far from being achieved in Czechia.

Total emissions **excluding the LULUCF sector** (including indirect emissions) have fallen by 40.7% since 1990 and by 9.0% in the last 5 years. Since 2005, the year to which the targets of the current Czech Climate Protection Policy (CPP) apply, emissions have fallen by 20.7% (31.0 Mt CO_2 eq.) by 2021. Meeting the 44 Mt reduction target by 2030 is therefore not unrealistic, but the CPP is being updated and the targets will be changed in relation to current EU commitments and relevant legislation.

[81] *Data for 2022 are not available at the time of publication. The emissions inventory for the UNFCCC is always available in April 24 months in arrears, i.e. in 2023 the last reported year is 2021.*

Chart 65

Aggregated greenhouse gas emissions in Czechia by sector [Mt CO_2 eq.], 1990–2021



Data for 2022 are not available due to the timing of the emissions inventory.

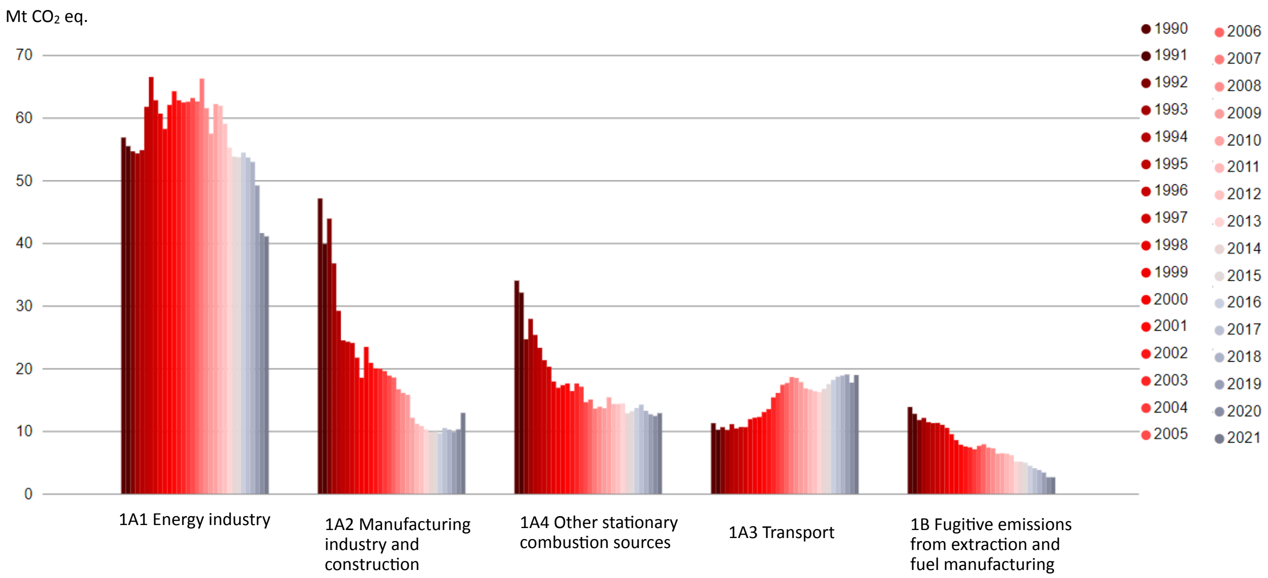
Data source: CHMI

Emissions from **combustion processes** (sector 1A), with a share of 72.3% of total emissions excluding LULUCF in 2021, decreased by 42.4% between 1990 and 2021 and were the main driver of the decline in total emissions over this period. Emissions from **energy industry** (sector 1A1), mainly comprising public power and heat generation, decreased by 24.6% (13.4 Mt CO_2 eq.) between 2016 and 2021, Chart 66. Changes in the energy mix during this period towards a higher share of RES and low-carbon energy sources have been reflected in the evolution of emissions. Emissions from the **industrial energy sector** (sector 1A2) declined mainly in the 1990s in relation to industrial restructuring, but currently emissions from this sector are flat with a significant annual increase of 25.6% from 2020–2021, but was largely influenced by the impact of the COVID-19 pandemic on the economy and thus on industry.

The trend in GHG emissions from **transport** continues to be unfavourable, increasing by 68.3% between 1990 and 2021 and by 4.2% in the last 5 years of the period, with a spike in 2020. Transport is currently the 3rd largest source of GHG emissions (16.0% of emissions excluding LULUCF) after public energy and heat production and manufacturing. Most transport emissions come from passenger car transport (58.0% of transport CO_2 emissions in 2021), due to its high energy intensity and the slow uptake of alternative fuels and propulsion. Among **other source categories**, emissions from agriculture are stagnating and emissions from waste are increasing slowly and steadily (71.8% since 1990, 2.8% over the last 5 years). However, the volume of emissions from waste (4.8% of emissions excluding LULUCF) is small and has little impact on overall trends.

Chart 66

Emissions from individual energy process categories in Czechia [Mt CO_2 eq.], 1990–2021



Data for 2022 are not available due to the timing of the emissions inventory.

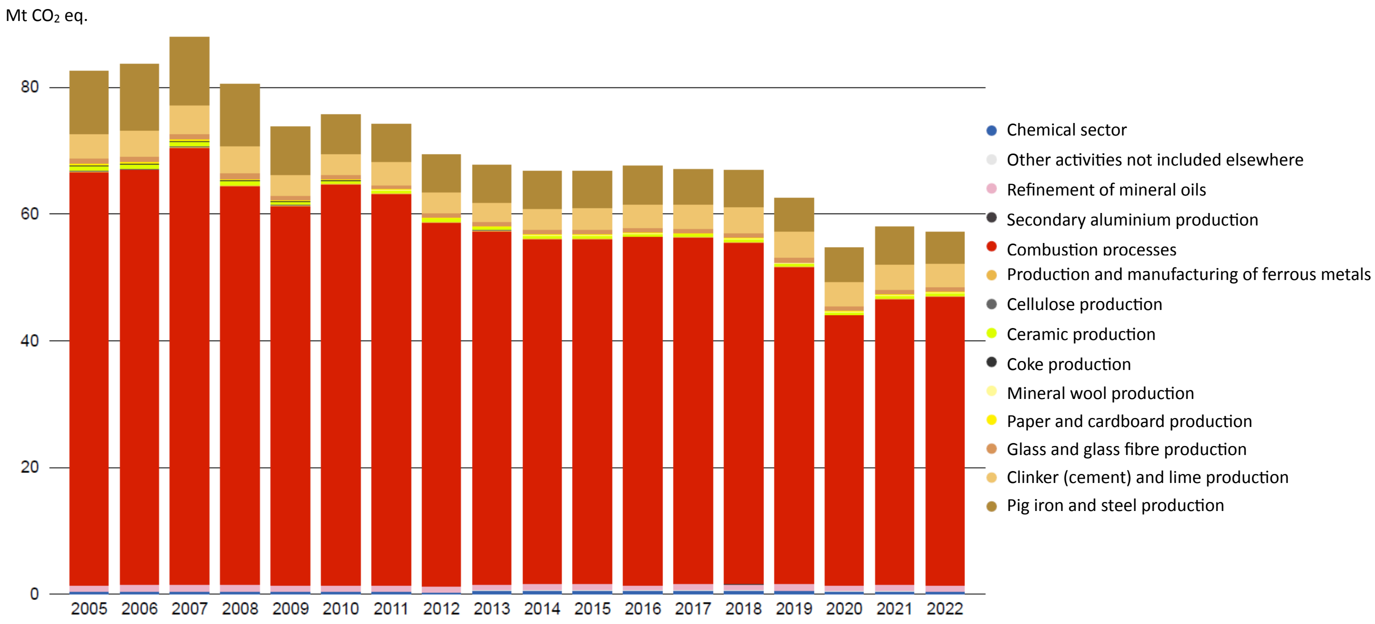
Data source: CHMI

In the **land use, land use change and forestry** (LULUCF) sector, the balance of emissions and sinks has increased significantly from negative to positive values in the last 5 years under assessment, in relation to a temporary reduction in forest stocks caused by a record volume of incidental logging triggered by the bark beetle calamity. The balance reached its highest positive value in 2020 at 11.3 Mt CO_2 eq., while in 2021 the bark beetle calamity stabilised slightly and the balance was 8.4 Mt CO_2 eq. Developments in LULUCF, and specifically developments in forests, make it very difficult to meet Czechia's targets for aggregate GHG emissions. According to the newly adopted legislation under the Fit for 55 package, Czechia is not on track to meet the target of achieving a balance of emissions and sinks of -1,228 kt CO_2 eq. by 2030.

Greenhouse gas emissions from installations covered by the **European Emissions Trading Scheme (EU-ETS)** fell by 30.8% between 2005 and 2022 to 57.0 Mt CO_2 eq. (Chart 67). Over the last 5 years, emissions have fallen by 14.8%, with year-on-year emissions stagnating as the economy gradually recovers from the COVID period. The gradual decline in the volume of emission allowances allocated for free and the increase in allowance prices have a positive impact on emissions. In the long term, installations in the combustion category have the highest share of emissions from EU-ETS installations (80.0% in 2022). Other major activity categories within the EU-ETS are iron and steel production (8.7% in 2022) and cement and lime production (4.6%).

Chart 67

Emissions in Czechia from individual categories of installations covered by the EU-ETS [Mt CO_2 eq.], 2005–2022



Data source: CHMI

Non EU-ETS emissions in Czechia falling under the scope of the Effort Sharing Regulation (ESR) decreased by 9.5% between 2005 and 2021 to 61.2 Mt CO_2 eq. Year-on-year 2020–2021 emissions increased by 3.6%, with the spike driven by the impact of the COVID-19 pandemic. The main sources of emissions in this category are households, transport and other small stationary and area sources (agriculture, waste, etc.), which are mostly difficult to control. According to the latest amendment to Regulation (EU) 2023/857, all EU countries are to contribute to a 40% reduction in EU emissions in the ESR by 2030 compared to 2005 levels, with the target for Czechia increased to 26%. The current trend in emissions, which according to linear regression parameters is 0.6% per year relative to the 2005 reference year, is not on its way to meeting the 2030 target.

Electricity and heat production

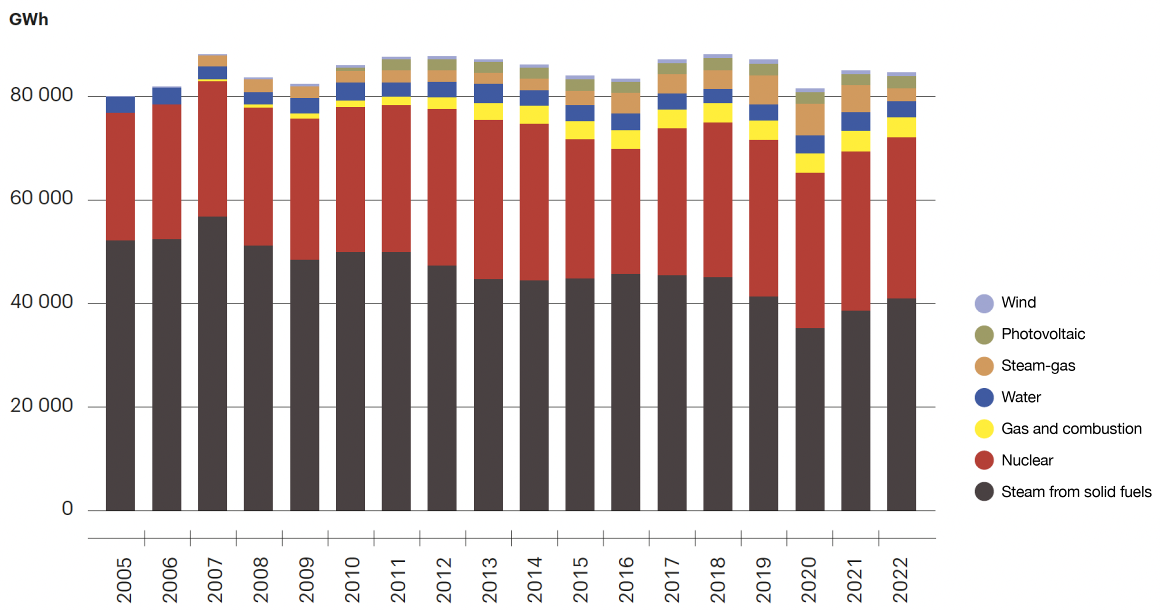
The composition of resources that enter into electricity and heat production is influenced by the stock of available domestic energy resources, the situation in foreign trade in fuels and also the current energy policy, which regulates the conditions for their use. The amount of electricity and heat generated is then determined by the current demand and consumption on the domestic and foreign markets.

Gross electricity generation in 2022 reached 84,503.1 GWh, a year-on-year decline of 0.5%. In terms of the different types of power plants (Chart 68), the largest share of electricity generation in 2022 was from solid fuel-fired steam power plants[82] (48.5%). The second most important category is nuclear power plants, which generated 36.7% of the electricity. Other sources generate electricity on a smaller scale, namely gas and combustion (4.6%), hydroelectric (3.6%), steam (3.0%), photovoltaic (2.7%) and wind power plants (0.8%).

[82] *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 ERO statistics and includes thermal power plants that burn mainly lignite in the Czech Republic. Nuclear power plants are listed in a separate category.*

Chart 68

Electricity generation by type of power plant in Czechia [GWh], 2005–2022



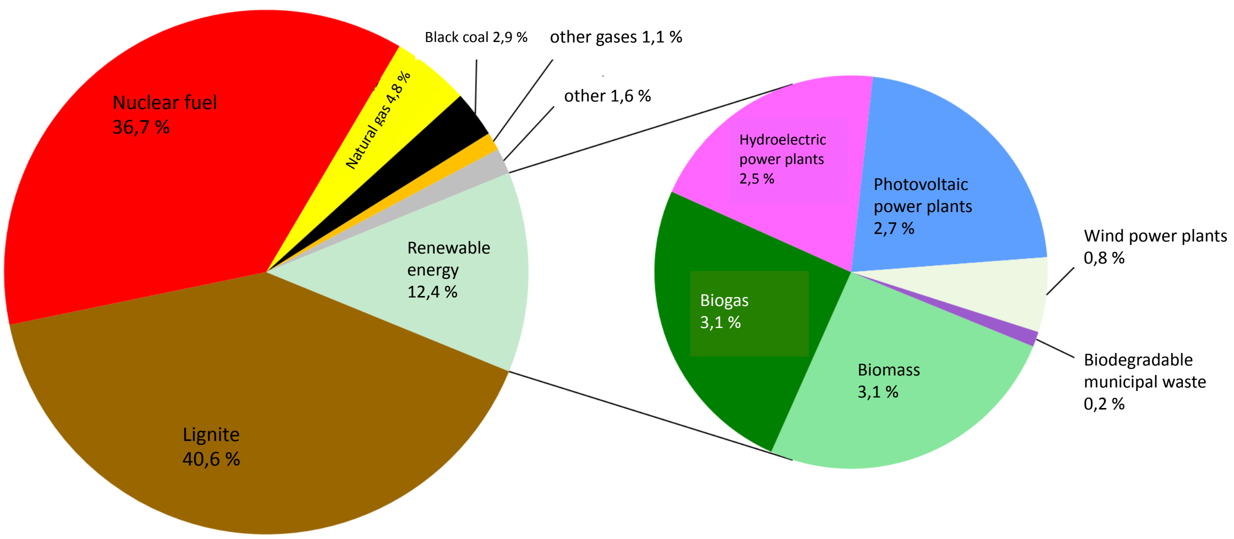
Data source: ERO

In terms of fuels (Chart 69), Czechia generated most of its electricity from lignite (40.6%) and nuclear fuel (36.7%) in 2022. Renewable energy sources accounted for 12.4% of electricity generation, with a relatively even mix of biomass (3.1%), biogas (3.1%), photovoltaics (2.7%) and hydroelectricity (2.5%). Wind power plants generated electricity to a lesser extent (0.8%), while the least electricity was generated from biodegradable municipal waste (BDMW, 0.2%). Natural gas had a share of 4.8% in 2022, down 42.2% year-on-year. The reason for the decline is the sudden significant increase in the price of natural gas and the uncertainty in its availability, which is why it has been replaced in electricity generation by more affordable domestic lignite.

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

Chart 69

Structure of electricity generation by fuel in Czechia [%], 2022

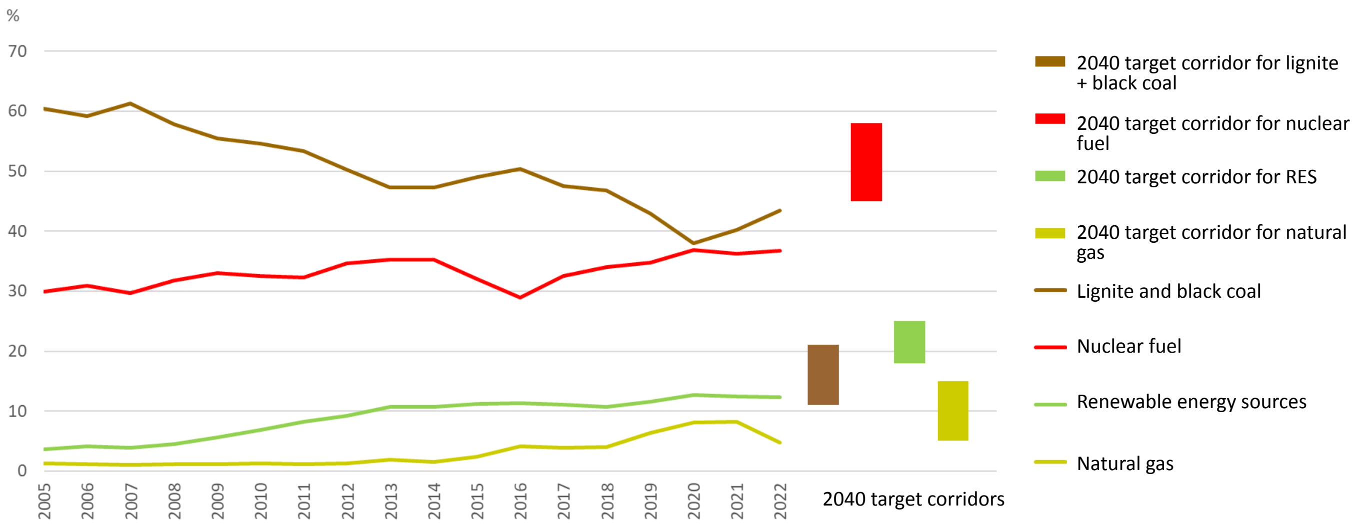


Data source: ERO

The **structure of electricity generation** is determined by the strategic documents in force (SEC, SEP), which set targets for 2040. At present, this structure is not fully implemented, but is slowly changing. It is influenced by the situation in the energy sector, foreign energy trade and political pressures. The share of coal has been gradually decreasing and the share of renewables increasing, but the last two years have seen a change in trends for both sources due to turbulent changes in the energy market (Chart 70). Electricity generation in nuclear power plants has been stable in the long term, but to meet the target share of nuclear fuel for electricity generation, it is necessary to increase the generation capacity of nuclear power plants.

<u>**Chart 70**</u>

Share of electricity generation by fuel type in Czechia [%], 2005–2022

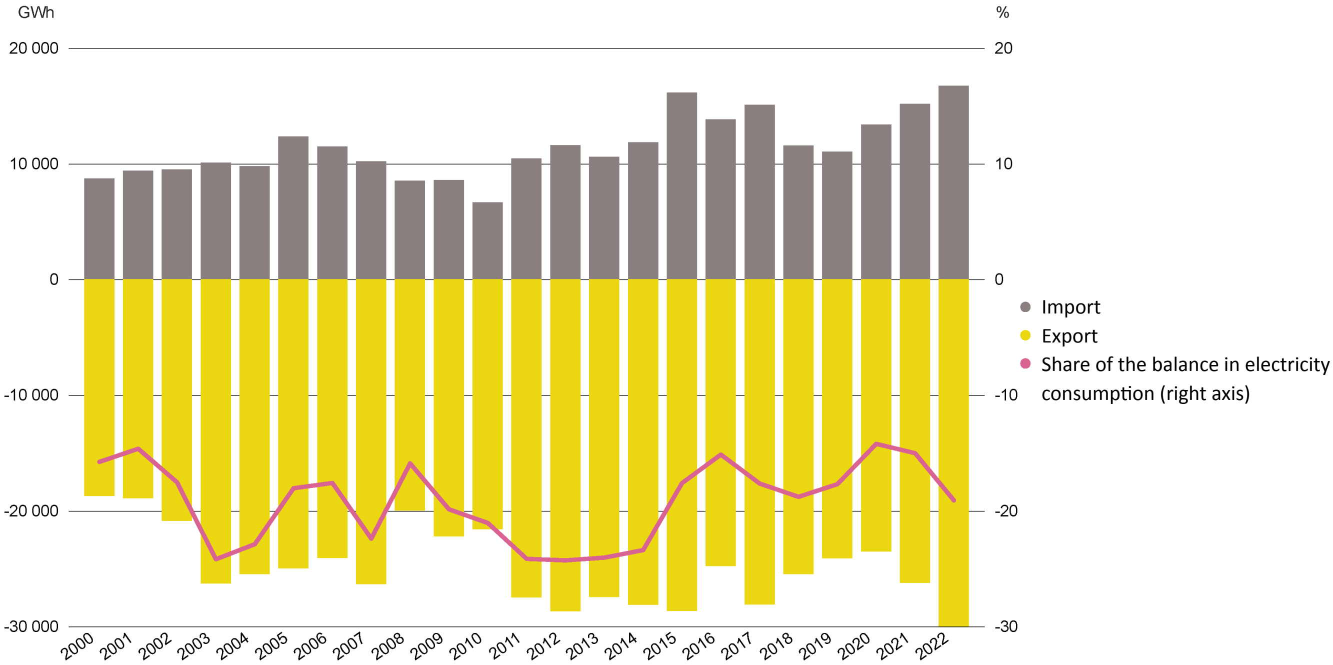


Data source: ERO

In foreign trade in electricity, Czechia remains export-oriented (Chart 71). In 2022, 30,254.9 GWh of electricity was exported, while imports amounted to 16,726.1 GWh. The foreign balance was thus negative at 13 528.8 GWh, 22.2% more than in the previous year. With total electricity generation of 84,503.1 GWh in 2022, the share of exports in generation was 16.0%. One of the strategy points of the currently valid State Energy Concept of the Czech Republic is a gradual decline in electricity exports and maintaining the balance in the range of +/-10% of domestic consumption until 2040. In 2022, the domestic electricity consumption amounted to 70 764.2 GWh, thus the share of the balance in consumption reached 19.1%.

Chart 71

Electricity imports and exports and the share of the balance in consumption in Czechia [TWh, %], 2000–2022



Data source: ERO

Heat generation includes the generation of heat for sale, i.e. for heat supply systems (HSS), as well as the generation of heat in domestic boilers, housing cooperatives, etc. The total amount of heat generated has been steadily decreasing, but in 2021[83] it increased by 7.8% year-on-year to 119.9 PJ (Chart 72). This was due to the cold heating season, which was the third coldest in the 2010–2021 period. It was matched by an increase in the consumption of heat for heating.

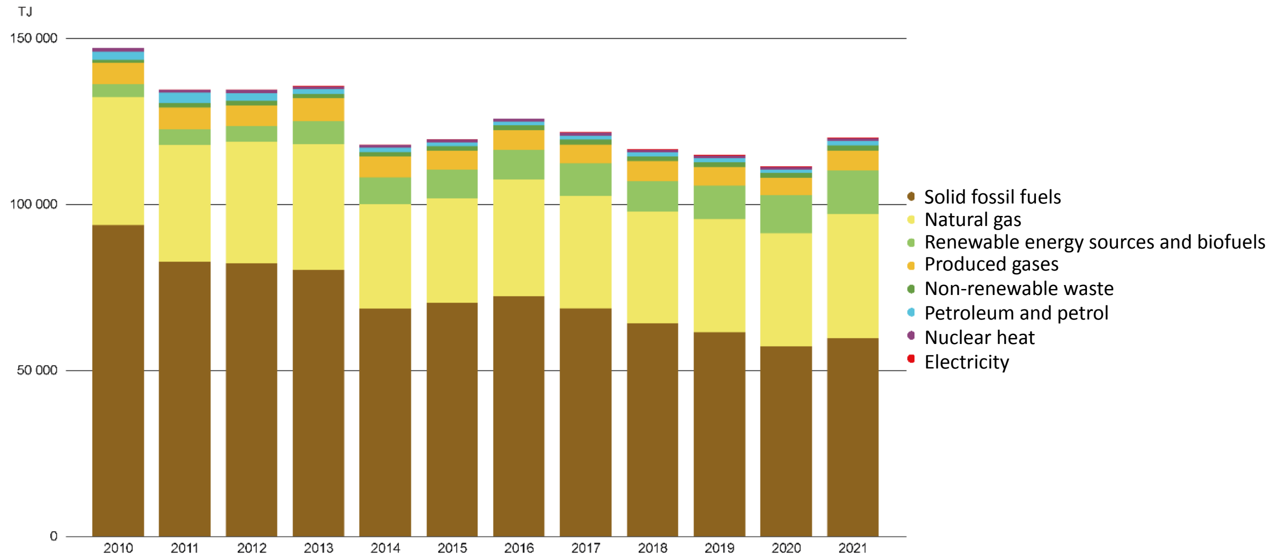
In 2021, heat was mainly generated from solid fossil fuels (49.8%), which mainly includes lignite (38.0%) and black thermal coal (11.8%). Natural gas is the second major source, accounting for 31.1%. Heat production increased year-on-year for most fuels except for non-renewable waste.

Heat generation from solid fossil fuels is gradually declining, with its share falling from 63.7% in 2010 to 49.8% in 2021. In contrast, the share of renewable sources and biofuels grew significantly (from 2.6% to 10.9% between 2010 and 2021).

[83] *Data for 2022 are not available at the time of publication.*

<u>Chart 72</u>

Gross heat generation by fuel type in Czechia [PJ], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: MIT

Household heating by fuel

The way households are heated is influenced by several factors. The main ones include the availability of heating systems, the availability and prices of fuels, but also the comfort of operation and the possibility of regulating the heating equipment. In Czechia, the **structure of household heating** also varies significantly between individual 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 2020[84], 4,365,388 households were registered in Czechia. In these households, the most common heat source (Chart 73) was **natural gas** (37.8% of households) and **district heating** (36.9%). The number of housing units heated using these two methods is steadily increasing and we consider them environmentally friendly. Solid fuels (coal and wood) are used for heating by 15.8% of households. These fuels are often combined, with availability and price playing a large role in households' choice of fuel However, the quality of fuel usually decreases with its price, so residents often turn to less environmentally friendly fuels in an effort to save on heating costs. This then has a major impact on the emissions of pollutants from heating.

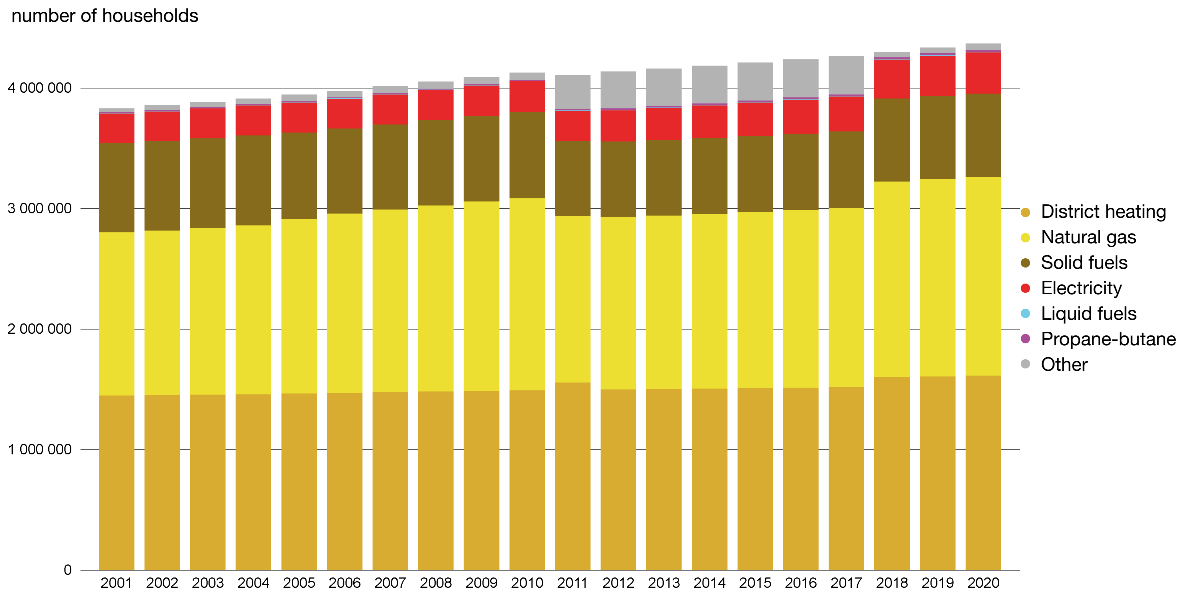
In the long term, the number of households heated with solid fuels declined by 6.5% between 2001 and 2020, but in the medium term it started to grow again slightly from 2011 onwards, with an increase of 9.0% in the last five years 2016–2020. There was only a slight increase of 0.3% year-on-year in 2020, but this represents 1,881 households newly heated with solid fuels. 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.

---

[84] *Data for 2021 and 2022 are not available at the time of publication. The 2021 Census of Population, Houses and Apartments was carried out and the results will be available no earlier than September 2023.*

Chart 73

Predominant heating method of permanently occupied dwellings in Czechia [thous. of households], 2001–2020



Data for 2021 and 2022 are not available at the time of publication. The 2021 Census of Population, Houses and Apartments was carried out and the results will be available no earlier than September 2023.

Data source: CHMI

In 2021[85] households produced a total of 332.8 PJ of heat, which was 9.8% more than in the previous year. This is related to the colder heating season, when more heating was needed. **In terms of fuel consumption** (Chart 74), most heat was produced in households from biomass, which includes mainly firewood, wood briquettes or pellets (28.8%, 96.0 PJ), and natural gas (26.2%, 87.2 PJ). While biomass consumption is growing, natural gas consumption is slightly decreasing and has been rather stagnant in recent years. However, household consumption of natural gas also includes cooking gas and water heating. The situation is similar for electricity (18.7%, 62.1 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.

The district heating system supplies only 13.7% of the energy to households, although 36.9% of households are heated by district heating. 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" is on a steady downward trend, producing 30.1 PJ of heat in 2021, representing 9.1% 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.

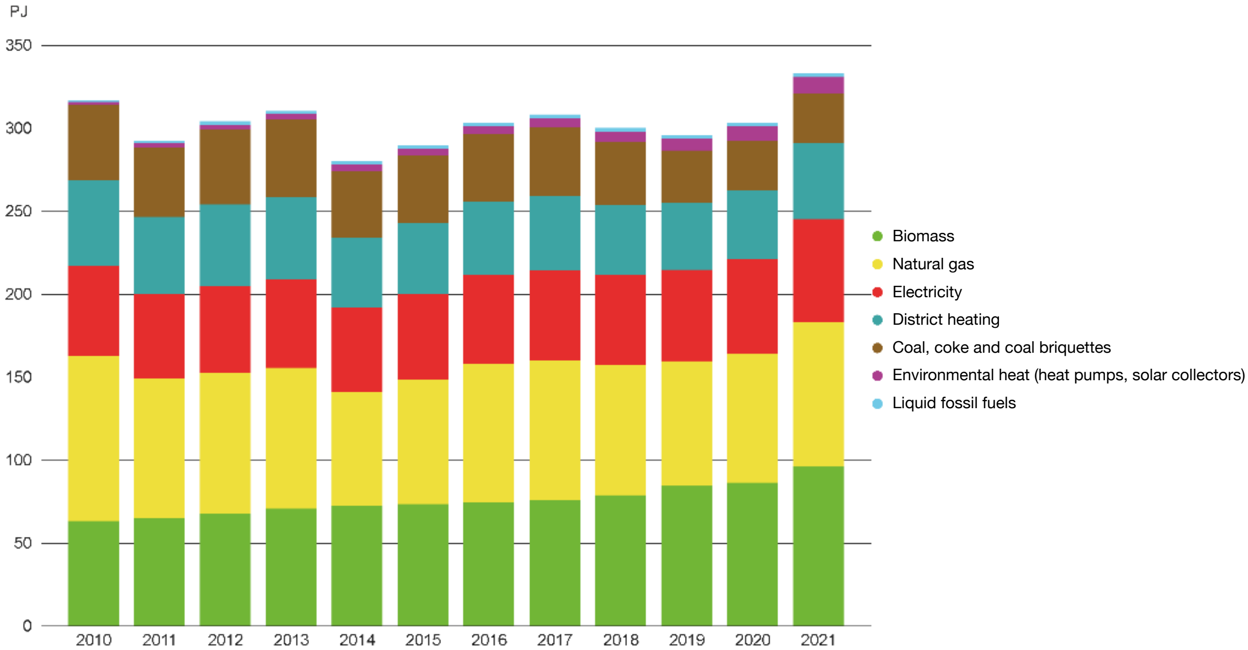
Local heating with solid fossil fuels and biomass is a significant source of emissions, accounting for more than a third of total domestic heat generation. Emissions from domestic heating are described in more detail in chapter 2.1.1.

---

[85] *Data for 2022 are not available at the time of publication.*

Chart 74

Household fuel consumption in Czechia [PJ], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: MIT

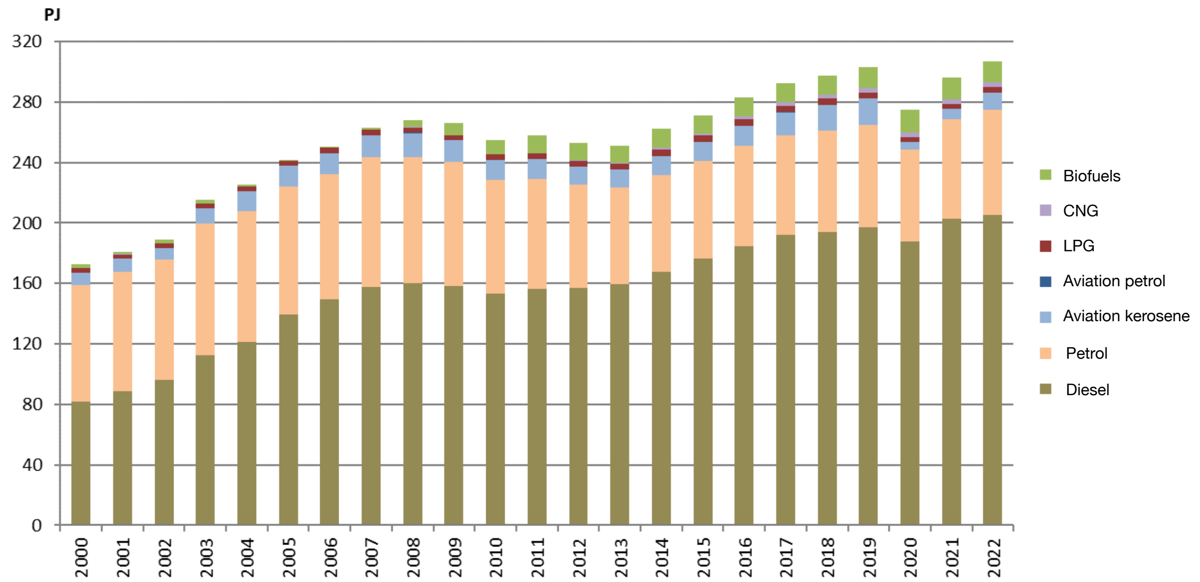
Energy and fuel consumption in transport

Energy consumption in transport increased by 77.9% between 2000 and 2022, and by 3.5% year-on-year to 306.9 PJ in 2022, the highest level of energy consumption in transport since 2000 (Chart 75). These data include energy consumption from combustion processes; according to ERO data, electricity consumption in transport in 2022 was 713.8 GWh (approx. 2.6 PJ) and did not change significantly year-on-year. The increasing trend of energy consumption in transport is statistically significant in the long term, reaching +2.9% per year compared to the 2000 value. There are already larger fluctuations in energy consumption in the medium (10-year) and short-term (5-year) horizons associated with fluctuations in the performance of the economy in 2020 and 2021 related to the COVID-19 pandemic.

Energy in transport comes largely from **fossil, non-renewable sources**, which accounted for 95.5% of total transport energy consumption in 2022. Of the individual fuels, **diesel consumption** accounted for the largest share of total energy consumption, amounting to 4.7 mil. t (216.0 PJ) in 2022, including bio-based components, corresponding to 70.4% of total energy consumption. Diesel consumption has risen steeply since 2000, in line with the growth in road freight transport and the share of diesel vehicles in the passenger car fleet, increasing by 159.6%, i.e. roughly 2.5 times, between 2000 and 2022. In the last 5 years evaluated, diesel consumption has rather stagnated and fluctuated according to the development in freight transport.

Chart 75

Energy consumption in transport by fuel in Czechia [PJ], 2000–2022



Motor petrol and diesel fuel without bio-based components (listed separately).

Data source: Transport Research Centre

The development of **petrol consumption** has been less dynamic than diesel consumption after 2000, with overall consumption of this fuel falling by 17.2% to 1.7 mil. tonnes (including bio-based) between 2000 and 2022. The decline in petrol demand, driven by changes in the structure of the passenger car fleet, has gradually stopped and we have seen a slight increase in petrol consumption in recent years, with a 4.9% year-on-year increase in 2022. The consumption of **aviation kerosene** (kerosene) follows the development of air transport with a dramatic drop in the COVID year 2020, in 2022 it amounted to 274.0 thous. t. The consumption of **LPG** in the COVID years decreased significantly. In recent years, it has been on the rise. **CNG** consumption experienced a sharp, exponential growth between 2010–2018, and currently CNG consumption is stagnating at 91.0 mil. m^3 in 2022.

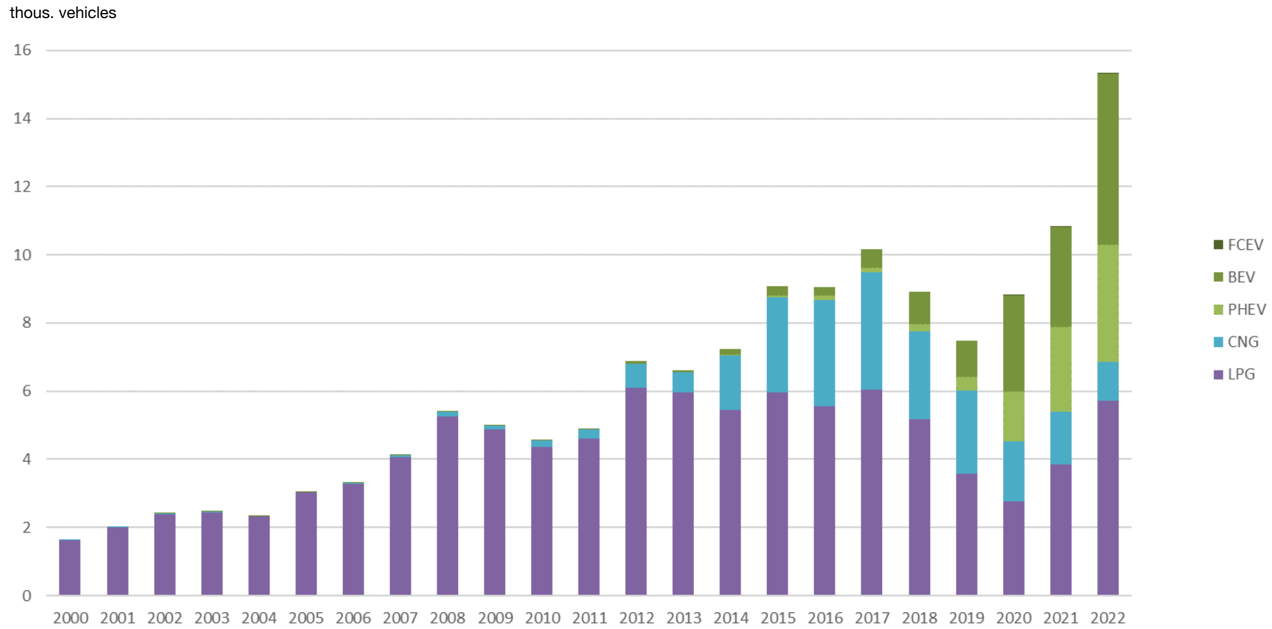
The largest energy consumer and the least energy efficient mode of transport is **passenger car transport**, which accounted for 57.1% of total transport energy consumption from fuel combustion in 2022. Road freight transport accounted for about one third of the total energy consumption (34.2%) and road transport as a whole accounted for 95.2% of transport energy consumption.

Reducing the environmental impact of transport and the gradual decarbonisation of transport as part of the transition to climate neutrality should be ensured by the increasing use of alternative fuels and propulsion, which is strategically enshrined in the National Clean Mobility Plan (CNMP).

In 2022, 15.3 thous. M1 (passenger car) **clean alternative fuel** vehicles were registered, representing a year-on-year increase in registrations of 41.3% (Chart 76). The number of **battery electric vehicles** (BEVs) in the M1 category was 5,020 in 2022, with a year-on-year increase of 70.3%. Of this number, 3 764 vehicles were new (74.9%) and 1 256 vehicles were used. 3,444 **plug-in hybrids** were registered, up 38.3% year-on-year, of which 2,986 (86.7%) were new. The use of hydrogen and fuel cells is still quite marginal, with 3 M1 fuel cell vehicles (FCEVs) registered in 2022, bringing the total number of vehicles on the register to 12.

Chart 76

Passenger car registrations (M1 vehicles) by category of clean alternative fuel and year of last registration in Czechia [thous. of vehicles], 2000–2022

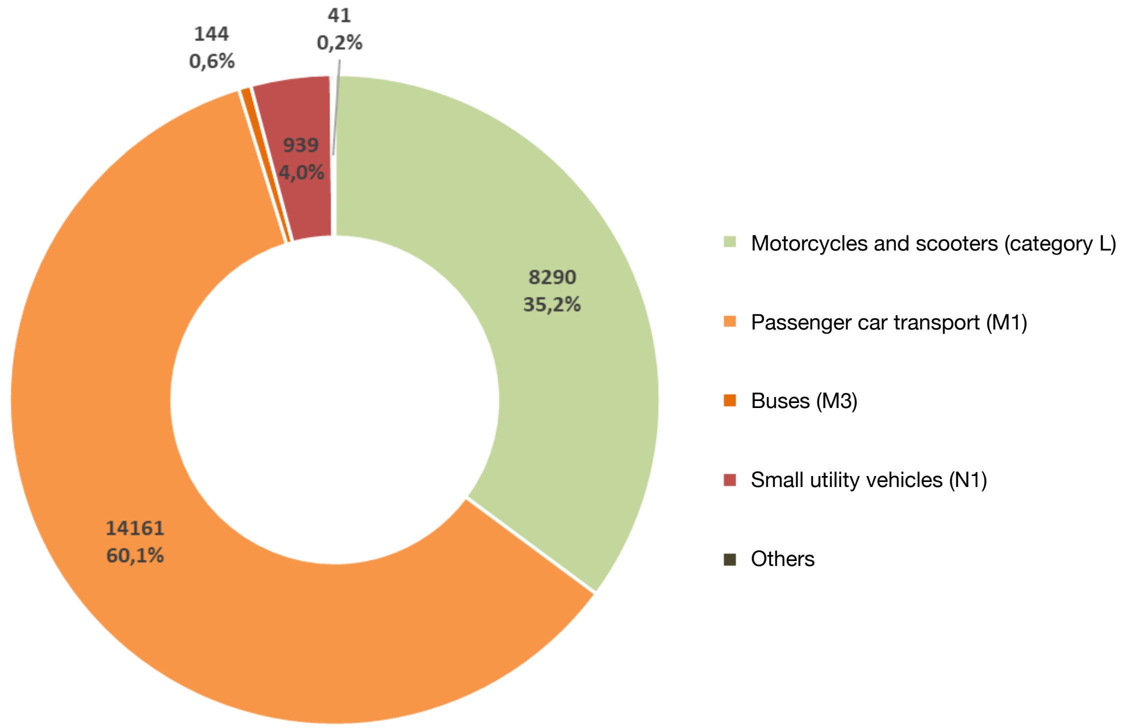


Data source: Transport Research Centre (https://www.cistadoprava.cz), input data source MoT – Central Vehicle Register

Overall, by the end of 2022, there were 170.6 thous. registered clean **alternative fuel** vehicles (of all categories) in Czechia, assessed according to the NAP CM, which increased by 11.6% year-on-year. The highest share of clean vehicles in the fleet was **LPG vehicles** (63.9%), the share of electric vehicles (BEV and PHEV) was 18.8%. There were 23,575 **Battery Electric Vehicles (BEVs)** in 2022 in total in the register, of which 14,161 (60.1%) were passenger cars (Chart 77), 35.2% electric motorcycles and scooters of all categories and 4.2% trucks, mostly N1 (light commercial vehicles up to 3.5 t). There were 144 registered electric buses, which represents less than 1% of the total number of registered buses. Most of these vehicles are used by transport companies in urban public transport, where there are extensive plans for further development of the use of electric buses, e.g. Prague.

Chart 77

Battery electric vehicle (BEV) fleet by vehicle category in Czechia [%], 2022



Vehicle category numbering lists are available on the website of the MoT.

Data source: Transport Research Centre (https://www.cistadoprava.cz), input data source MoT – Central Vehicle Register

The **share of electric vehicles in the passenger car fleet** remains very small, with BEVs accounting for 0.22% of the M1 fleet (6.3 mil. vehicles in total) and PHEVs 0.13% at the end of 2022. By comparison, the share of petrol and diesel power was 57.6% and 39.8% respectively. The low shares of electric propulsion in the vehicle fleet are due to the short and less dynamic development of electromobility compared to the EU, which can be demonstrated by the share of BEVs and PHEVs in new vehicle registrations. In 2022, new battery electric passenger cars in Czechia accounted for 2.1% and PHEVs 1.8% of total new passenger car registrations, compared to 12.1% and 9.5% for BEVs and PHEVs respectively in the EU27. Czechia is about 3–4 years behind the EU27 average in the share of new passenger electric vehicles.

2.1.2. Energy efficiency[86]

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 structure of primary energy sources still differs from the 2040 target values, with solid and liquid fuels having a higher share and renewables and nuclear having a lower share. Natural gas is the only source that has so far reached the target. The energy intensity of the economy is declining, however, due to the development of the economy after the COVID-19 pandemic, it increased by 2.1% year-on-year to 342.4 MJ.CZK thous.$^{-1}$ in 2021.
✗	Czechia's energy import dependence is increasing significantly, reaching 40.2% in 2021.

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 PES	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 objective of the current State Energy Concept of the Czech Republic (SEC) is to achieve a diversified mix of primary energy sources (PES) 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 PES still differs from these targets, with solid and liquid fuels having a higher share and renewable and nuclear sources having a lower share (Chart 78). Natural gas is the only source whose share has reached the target.

[86] *Data for 2022 are not available at the time of publication.*

The largest share in the energy mix (30.0%) in Czechia in 2021 was accounted for by **solid fossil fuels** (lignite and coal), the mining of which is traditional in Czechia due to its rich reserves. This share is declining along with the efforts to decarbonise the energy sector and solid fossil fuels are gradually being replaced by more environmentally friendly sources. The current downward trend in the share of solid fuels suggests that the target corridor set by the SEC will be reached by 2040.

Oil and petroleum products accounted for 22.0% in 2021. The SEC target is to reduce their share to values in the range of 14–17%, but the trend of the share of liquid fuels is going in the opposite direction, with their share in the energy mix slightly increasing.

Natural gas consumption fluctuates, but with an increasing trend. In 2020, its share in the PES mix reached the target corridor (18–25%) and remained there in 2021, when its share was 18.4%.

Nuclear energy accounted for 18.0% of the energy mix in 2021. The current SEC foresees an increase in the share of nuclear power in PES to 25–33%. On the basis of this report, the National Action Plan for the Development of Nuclear Energy in the Czech Republic was drawn up, which elaborates further development of these sources in Czechia, including the construction of new nuclear blocks to increase the existing capacity.

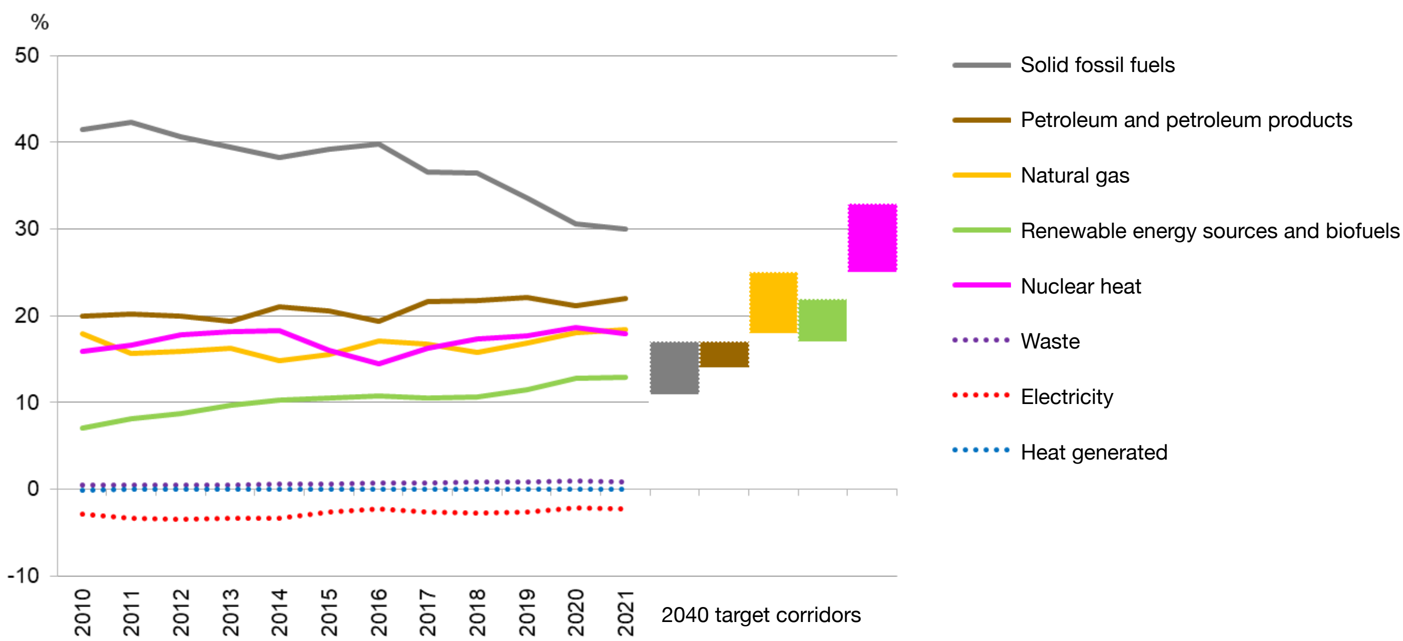
The share of **renewable energy sources and biofuels** in the structure of PES in 2021 was 13.0%. This category has a significantly increasing trend and it can be assumed that the set targets for the share of RES can be achieved by 2030.

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 0.9% of the PES structure in 2021. No target values have been set for it in the Energy Policy.

The **generated heat** and **electricity** categories are specific in that their generation comes from other primary sources. They have negative values in the PES balance sheet (electricity -2.24% in 2021, generated heat -0.0013%), as they are subject to foreign trade and their exports outweigh imports. The primary source of heat in Czechia could be e.g. geothermal energy, but it is not yet used in Czechia.

Chart 78

Share of primary energy sources in Czechia and target corridors for 2040 [%], 2010–2021



Data for 2022 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).

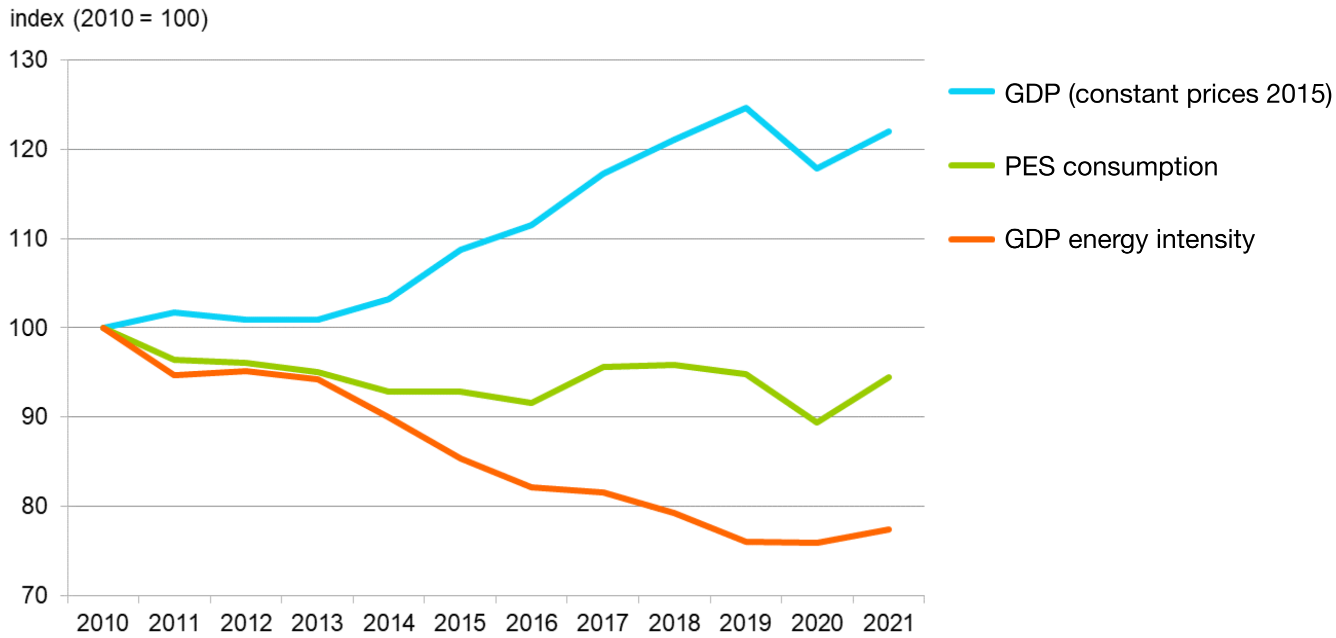
Data source: MIT

The **energy intensity of the economy** represents the energy consumption of the national economy and its overall energy efficiency. It is 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, independence and self-sufficiency.

The energy intensity values of the Czech economy have been steadily declining (Chart 79), but in 2020 they were affected by measures against the COVID-19 pandemic, when both the consumption of PES and GDP fell significantly. In 2021, the economy was on its way to recovering (annual GDP growth of 3.6%), but the consumption of primary energy sources was growing faster (5.7% year-on-year). As a consequence of this development, the energy intensity of the economy increased by 2.1% year-on-year to 342.4 MJ.CZK thous.$^{-1}$.

Chart 79

GDP energy intensity in Czechia [index, 2010 = 100], 2010–2021



Data for 2022 are not available at the time of publication.

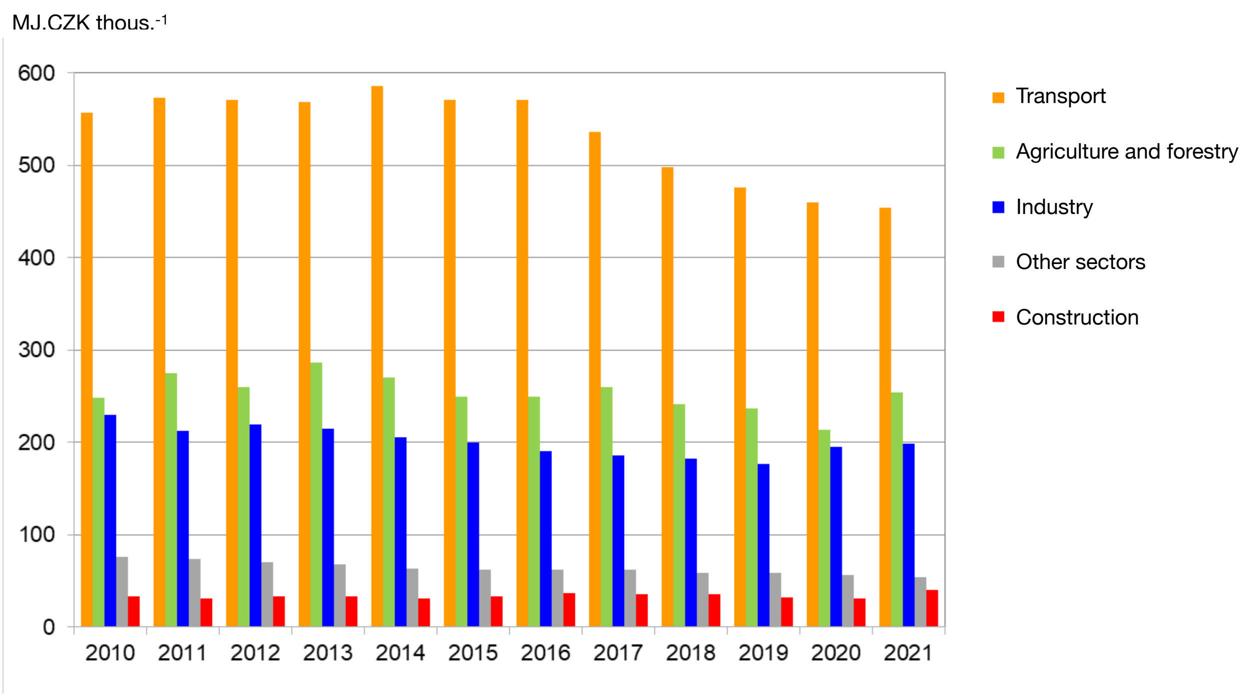
Data source: CZSO, MIT

When comparing the **energy intensity of different sectors** of the national economy (Chart 80), 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 passenger car transport, which makes no contribution to economic performance. Over the 2010–2021 period, energy intensity declined in all sectors. The largest decline was in transport (by 17.3%), followed by industry (by 15.3%) and then agriculture and forestry (by 14.0%). It also decreased in the Other sectors category, by 26.0%.

Between 2020 and 2021, there was a decrease in energy intensity for all sectors except industry, which was affected by measures in 2020 due to the COVID-19 pandemic. Its energy intensity then increased by 10.6% year-on-year. Efforts to reduce energy intensity are driven by social, economic and legislative pressures and in all areas of human activity.

Chart 80

Energy intensity of individual sectors in Czechia [MJ.CZK thous.-1], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: CZSO, MIT

Energy efficiency

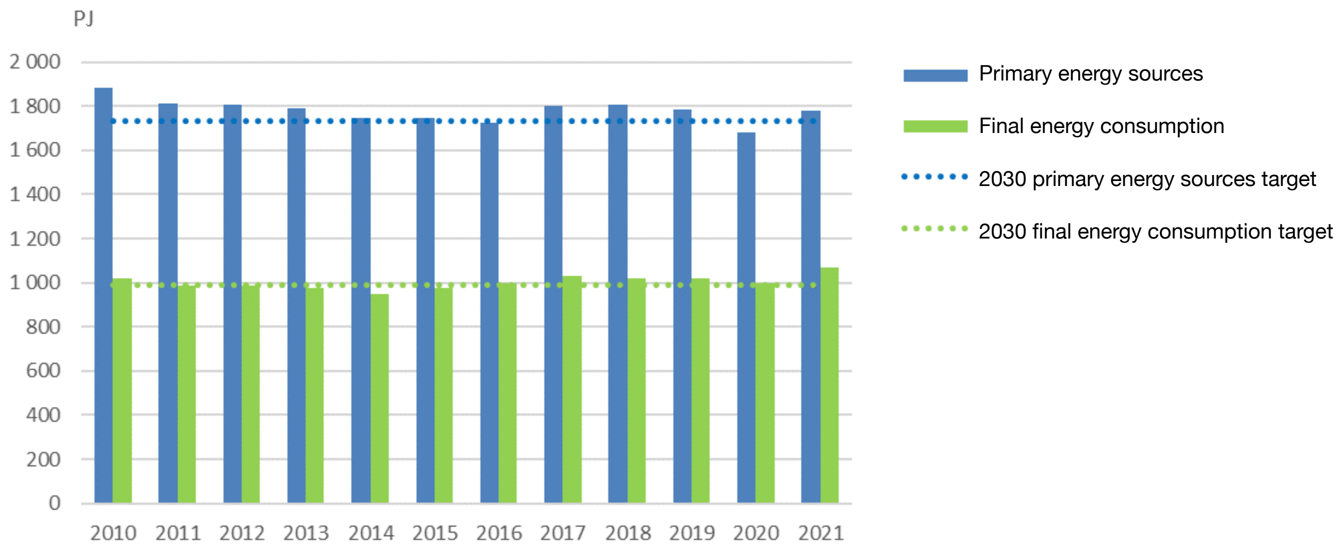
The **energy efficiency** indicator tracks energy consumption and savings. Within the framework of energy efficiency, targets have been set for non-transferable primary energy sources (PES) of 1 855 PJ by 2020 and 1 735 PJ by 2030. Further targets were set for the maximum final energy consumption, which should not exceed 1 060 PJ in 2020 and 990 PJ in 2030. Both targets set for 2020 have been successfully met and Czechia is now moving towards more stringent targets for 2030.

The consumption of primary energy sources (PES) is fluctuating with a slightly decreasing trend. In 2021, the value of the PES was 1,777.5 PJ, which was 5.7% more than in the previous year 2020. However, this was affected by the measures related to the COVID-19 pandemic and the consumption of PES decreased significantly as a result. It then rose again in 2021, reaching a value 0.3% lower than in 2019 (Chart 81).

Final energy consumption in 2021 also increased by 6.9% year-on-year, reaching 1 067.5 PJ. However, in contrast to the consumption of PES, this variable fluctuates with a slightly increasing trend and achieving a decrease below the 990 PJ target set for 2030 will require further efforts.

Chart 81

PES consumption and final energy consumption compared to 2020 and 2030 targets in Czechia [PJ], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: MIT

Import energy dependence

The availability of energy and energy resources is a fundamental condition for the functioning of society. The **import energy dependence** indicator measures the extent to which an economy is forced to rely on importing energy or energy sources to meet its energy needs. Maximum self-sufficiency and independence from external sources is advantageous, as it guarantees energy security.

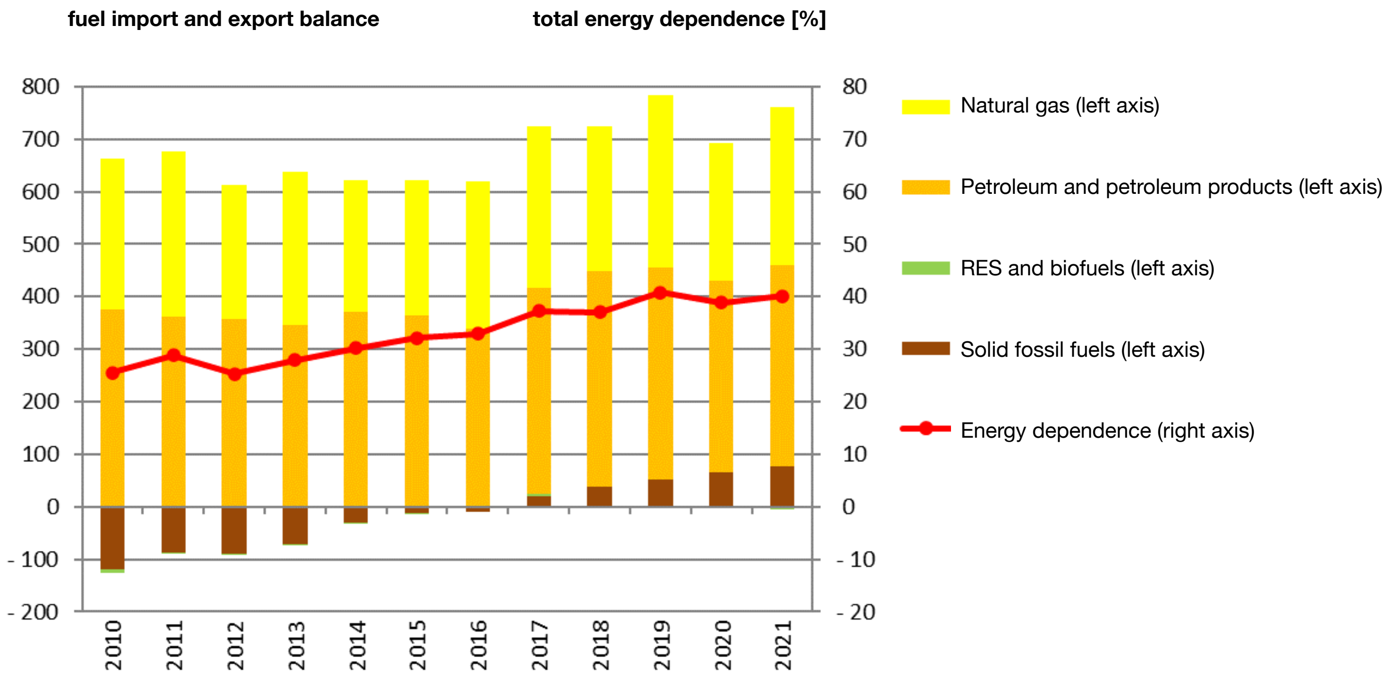
Czechia has historically been self-sufficient in solid fossil fuels thanks to its domestic reserves of lignite and black thermal coal. However, since 2017, due to the decline in production, domestic consumption has exceeded production and some of it has to be imported from abroad. In the case of natural gas and oil, Czechia is almost exclusively dependent on foreign trade, and we also import nuclear fuel for nuclear power plants. In contrast, renewable energy sources are a domestic resource and contribute to energy security and independence.

Czechia is characterised by a relatively high energy import dependence on Russia, which reached 25.4% in 2021. We also import energy raw materials from Poland (6.9%), Germany (3.4%), Kazakhstan (3.0%) and other countries.

Czechia has set a target of not exceeding 65% energy import dependence by 2030 and 70% by 2040. In 2021, this share was 40.2% (Chart 82), but it is growing significantly. If this trend were to continue at the current rate, the 65% value would be exceeded in 2037 and 70% in 2041.

Chart 82

Balance of exports and imports of individual fuels, import energy dependence of Czechia [PJ, %], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: MIT

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

✓	The generation of heat from renewable energy sources is growing at a significant rate, with a 12.8% year-on-year increase in 2021 .
~	The rate of increase in electricity generation from renewable sources has slowed since 2014, with a 1.0% annual decline in 2022. The consumption of RES in transport in Czechia has an increasing tendency in the long term. The share of RES in electricity generation in 2022 was 12.4%, the target is to achieve a share in the range of 18–25% by 2040. In Czechia, biofuels account for more than 90% of RES energy consumption in transport. The target for the share of RES in gross final energy consumption is set at 22%; in 2021 this share was 17.7%. The target of 10% RES energy in transport by 2020 was not met. In 2021, Directive 2018/2021/EC (RED II) came into force, according to which the share of RES in energy consumption in transport in Czechia dropped to 7.5% due to methodological changes in the calculation. Meeting the target of 14% of energy from RES by 2030 thus remains distant.

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
Use of renewable energy sources	↗	↗	↗	~
Consumption of RES in transport	↗	↗	~↗	~

Renewable energy sources

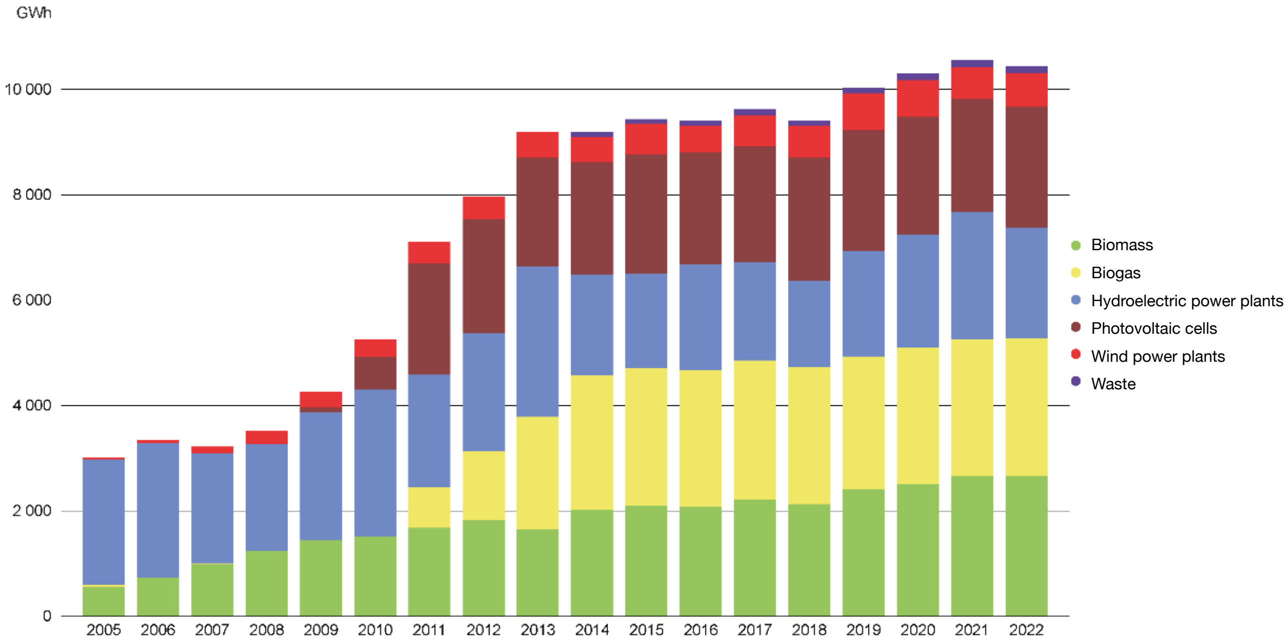
Renewable energy sources include wind energy, solar energy, potential water energy, geothermal energy and biomass energy. Although these are inexhaustible resources, their availability is limited in time and space due to their dependence on climatic, meteorological and geographical conditions. The generation 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 between 2008 and 2013, 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 83) and the year-on-year increase is no longer as steep. In 2022, there was even a 1.0% year-on-year decline in electricity generation from renewable energy sources to 10,437.4 GWh.

In terms of sources, electricity production from RES is quite diverse and their share is relatively balanced. In 2022, most of the electricity from renewable energy sources will be generated from biomass (25.5%, 2,659.3 GWh), followed by biogas (25.1%, 2,615.1 GWh), photovoltaics (22.0%, 2,298.3 GWh) and hydroelectric power (20.1%, 2,093.5 GWh, excluding pumped storage hydropower plants). There was less electricity generation from wind power plants (6.1%, 641.3 GWh) and from waste (1.2%, 129.7 GWh).

Chart 83

Electricity generation from RES in Czechia [GWh], 2003–2022



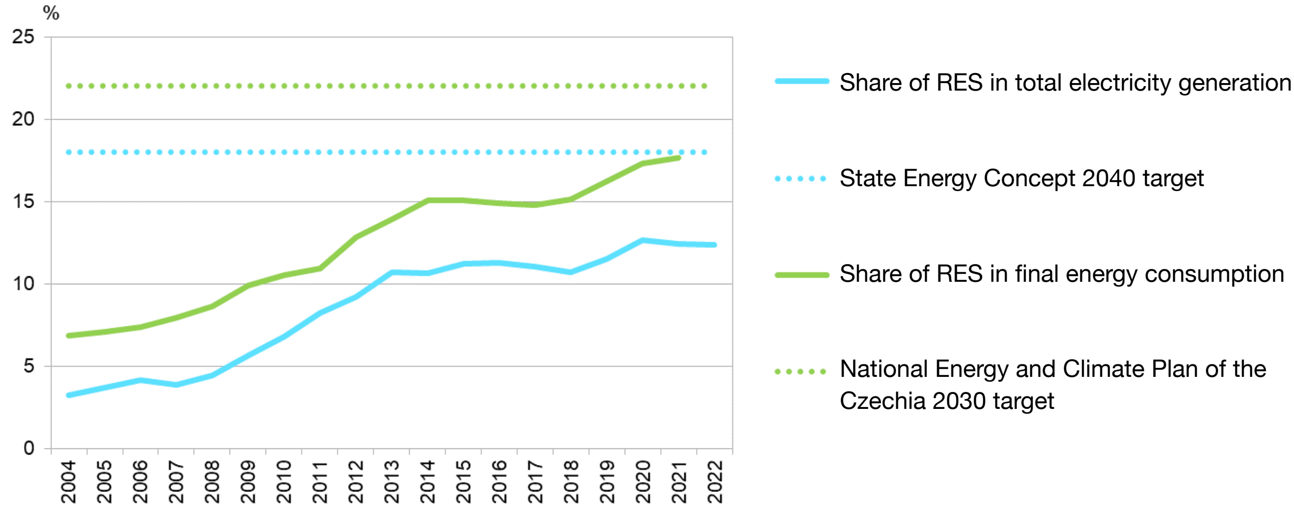
Data source: ERO

There are two binding targets for electricity from renewable energy sources in Czechia. The first follows from the National Energy and Climate Plan of the Czech Republic (NECP) and sets a target **share of RES in gross final energy consumption** of 22% by 2030. In 2021 this share was 17.7% (Chart 84). Another goal, set by the State Energy Concept (SEC), is to achieve a share of RES in electricity generation in the range of 18–25% by 2040. In 2022, this share was 12.4%. If the rate of growth of electricity production from RES is maintained, we can assume that both targets will be met within the given deadlines.

Furthermore, a sectoral indicative (non-binding) target for heating and cooling by 2030 is set on the basis of Directive 2018/2001/EC. This is based on increasing the share of energy from RES in heating and cooling by 1.1 p.p. and 1.3 p.p. per year respectively (without or with waste heat). It can be said that this target is also being met, with the share of renewable energy sources in heating and cooling reaching 24.2% in 2021, up from 14.1% in 2010.

Chart 84

RES targets and their fulfilment in Czechia [%], 2004–2022



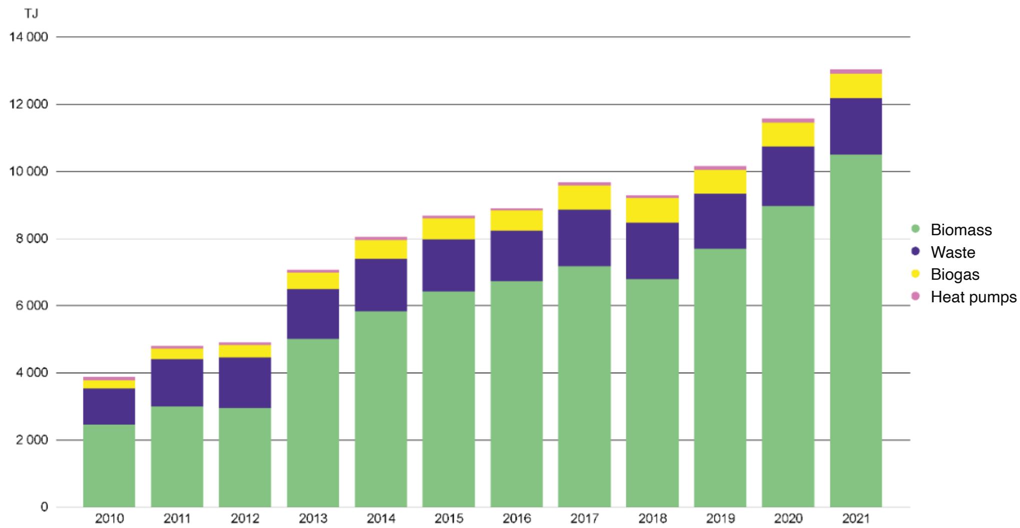
Data for the share of RES in final energy consumption for 2022 are not available at the time of publication.

Data source: ERO, MIT

Heat generation[87] **from renewable sources** grew at a significant rate in the 2010–2021[88] (Chart 85) period. In total, 13,029.7 TJ was produced in this category in 2021, a significant year-on-year increase of 12.8%. The largest share of heat generation from RES is biomass, which accounted for 80.5% in 2021. Other heat sources are waste (heat from waste incinerators, 12.9%), biogas (5.7%) and heat pumps (0.9%).

Chart 85

Gross heat production from RES and biofuels in Czechia [TJ], 2010–2021



Data for 2022 are not available at the time of publication.

Data source: MIT

[87] *The generation of heat includes the production of heat for sale, i.e. for heat supply systems (HSS), as well as the generation of heat in domestic boiler houses, housing associations, etc.*

[88] *Data for 2022 are not available at the time of publication.*

Consumption of RES in transport

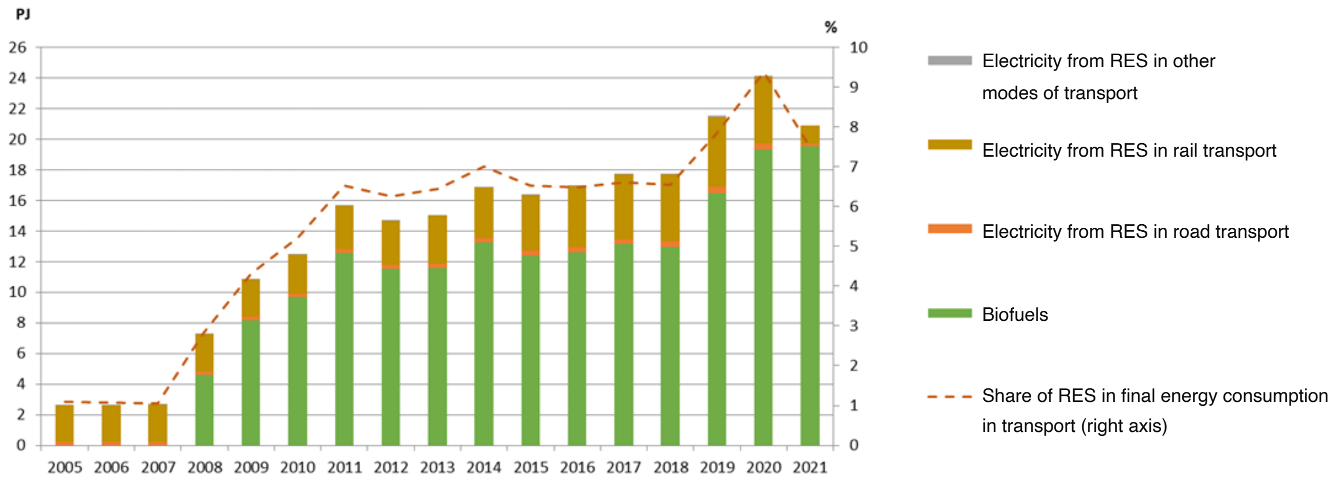
The growing **use of RES in transport** is a crucial tool for reducing the dependence of transport on fossil energy sources and for supporting the move towards a climate-neutral economy. Binding targets for the share of RES in final energy consumption in transport by 2020 were set by Directive 2009/28/EC. This Directive has been replaced by Directive 2018/2021/EC (RED II), according to which the share of RES in transport is to increase to 14% by 2030.

According to SHARES data[89], **RES energy consumption** in transport had an increasing tendency in the 2005–2021 period, with some fluctuations due to variations in total energy consumption in transport (Chart 86). RES consumption and RES share are calculated according to the methodology set out in the European legislation in force for the year in question, which sets out rules for the inclusion of biofuels (e.g. limits the inclusion of 1st generation biofuels produced from crops grown on agricultural land, and on the contrary favours biofuels produced from waste and non-food biomass) and for the calculation of the RES share of electricity consumption. In 2021, the RED II directive came into force, which contains a different way of calculating the consumption of electricity produced from RES in transport (taking into account the national energy mix instead of the European one and lower multipliers for road and rail transport), and the data for 2021 were calculated according to this directive.

During the period of effectiveness of Directive 2009/28/EC, the highest share of RES in final energy consumption in transport was reached in 2020, at 9.4% (24.2 PJ). In 2021, already according to the RED II Directive, the share of RES consumption in transport decreased to 7.5% of final energy consumption in transport, RES energy consumption decreased to 21.0 PJ. Biofuels had the highest share in RES energy consumption (93.4%), while electricity consumption in rail transport accounted for 5.7% and only 0.7% in road transport. If the method of calculation of RES energy in transport according to the RED II Directive were applied for 2020, the RES energy consumption in transport would be 20.6 PJ and the RES share would be 7.4%. The year-on-year comparison using a comparable methodology thus shows a stagnation of RES energy consumption in transport.

Chart 86

Energy consumption from RES in transport and share of RES in final energy consumption in transport in Czechia [PJ, %], 2005–2021



Data for 2022 are not available at the time of publication. Data up to 2020 are calculated according to the provisions of Directive 2009/28/EC, in 2021 according to Directive (EU)2018/2001 (RED II).

Data source: MIT, Eurostat

[89] *SHARES (Short Assessment of Renewable Energy Sources) methodology, see in accordance with Directive 2009/28/EC and Directive (EU)2018/2001 (RED II). SHARES data for 2022 are not available.*

The most important source of energy from RES in Czechia is **biofuels**, the consumption of which is mostly covered by domestic production. Biofuels are mainly consumed as part of the mandatory reduction of greenhouse gas emissions from delivered fuels. **Consumption of FAME**, a bio-based diesel component, increased by 80.2% to 331.9 thous. tonnes in the 2010–2022 period, with the growth in FAME consumption driven by the growth in diesel consumption over the period. After 2020, FAME consumption stagnated, falling by 6.2% year-on-year. Domestic production accounted for 73.0% of FAME consumption in 2022. **Consumption of bioethanol**, a bio-based gasoline component, has increased by 24.2% since 2010, but after 2014, bioethanol consumption fluctuated and declined towards the end of the period, falling by 7.7% year-on-year to 86.8 thous. tonnes in 2022.

Greenhouse gas emissions and their economic factors in an international context[90]

Key messages

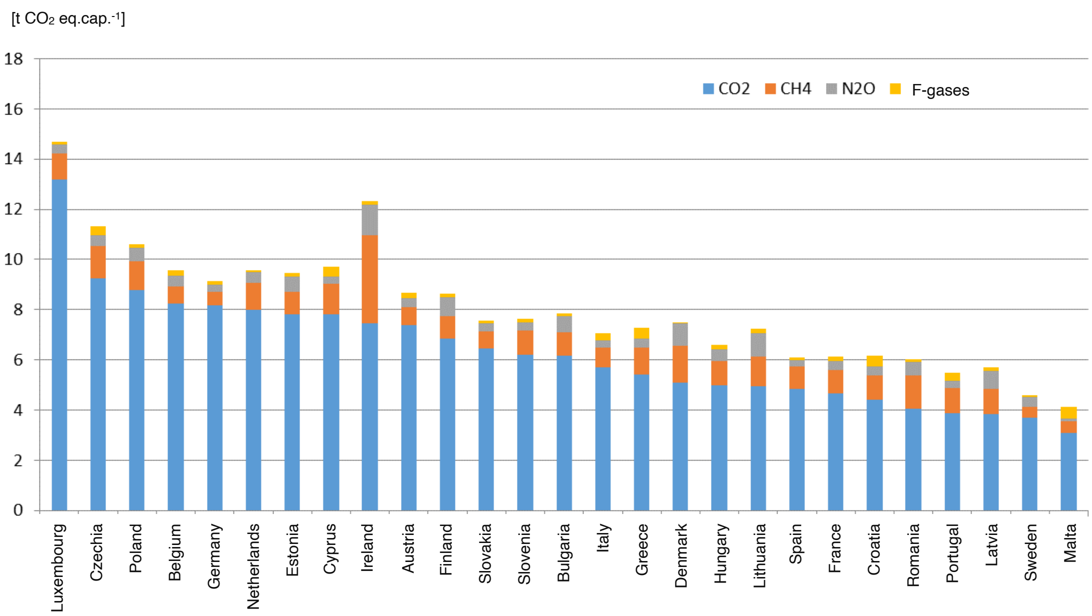
✓	The energy intensity of the EU27 economy decreased by 30.8% between 2010 and 2021. All Member States experienced a decline.
~	The share of renewable energy sources in final consumption in the EU27 is growing, reaching 21.8% in 2021, with a binding target for the EU as a whole of 32% by 2030.
✗	Greenhouse gas emissions per capita were the third highest in the EU27 in 2021.

Greenhouse gas emissions in an international context

Per capita GHG emissions in Czechia (11.3 t CO_2 eq.capita^{-1}, excluding LULUCF, including indirect emissions) were the third highest in the EU27 in 2021 after Luxembourg and Ireland and 56.2% higher than the EU27-wide emissions (7.3 CO_2 eq.capita^{-1}), Chart 87. The high emissions intensity of Czechia is due to the nature of the economy with a high share of industry in GDP and the continued high share of fossil fuels in the energy mix and in the structure of energy consumption in transport.

<u>**Chart 87**</u>

Greenhouse gas emissions per capita in EU27 countries [t CO_2 eq.cap.$^{-1}$], 2021



Data for 2022 are not available at the time of publication.

Source: EEA

Energy intensity of the economy in an international context

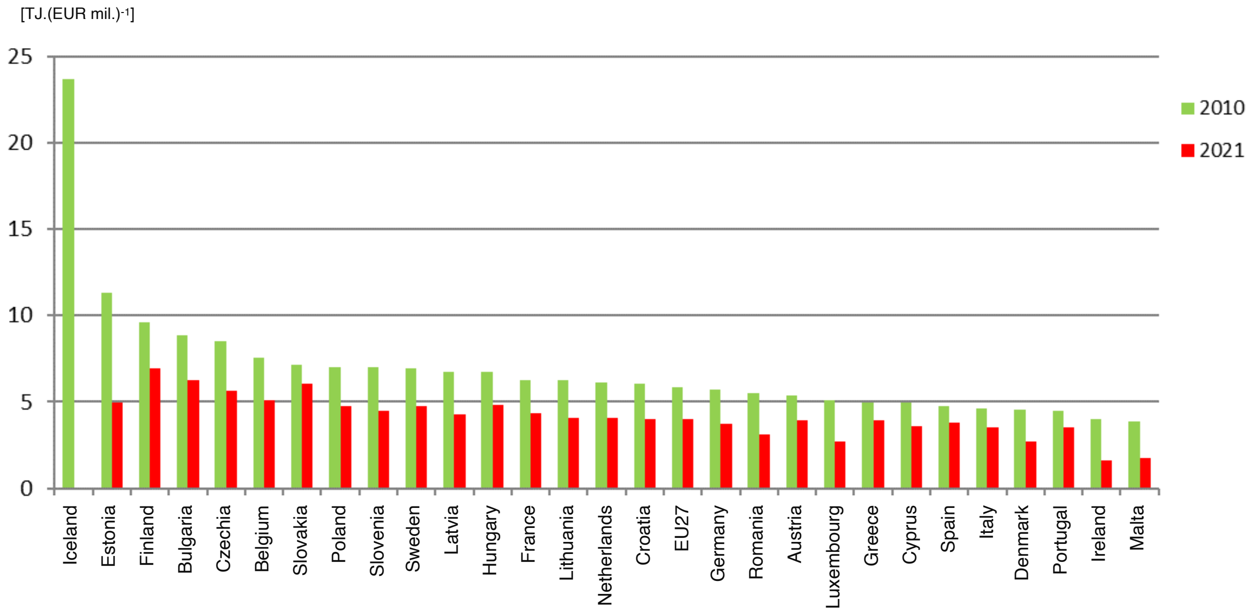
The energy intensity of the EU27 economy (Chart 88) is decreasing. Over the 2010–2021 period, its value fell from 5.8 to 4.0 TJ. EUR)$^{-1}$, i.e. by 30.8%. This trend is influenced by improvements in energy efficiency, both in energy generation and at the end-user level. National economies are undergoing changes, including, for example, a shift from energy-intensive to less energy-intensive industries, or an increase in the share of

[90] *Data for 2022 are not available at the time of publication.*

services in GDP. All EU27 countries reported a decline in the energy intensity of their economies over the 2010–2021 period. In Czechia, the energy intensity of the economy has decreased from 8.6 to 5.7 TJ (EUR mil.)$^{-1}$, i.e. by 34.3%, yet it is still 49.5% higher than the EU27 average. The main reason for this is the significant position of the energy-intensive industry in Czechia's GDP.

<u>Chart 88</u>

Energy intensity of the economy in EU27 countries [TJ.(EUR mil.)$^{-1}$], 2010, 2021



Data for 2022 are not available at the time of publication.

Source: Eurostat

Renewable energy in an international context

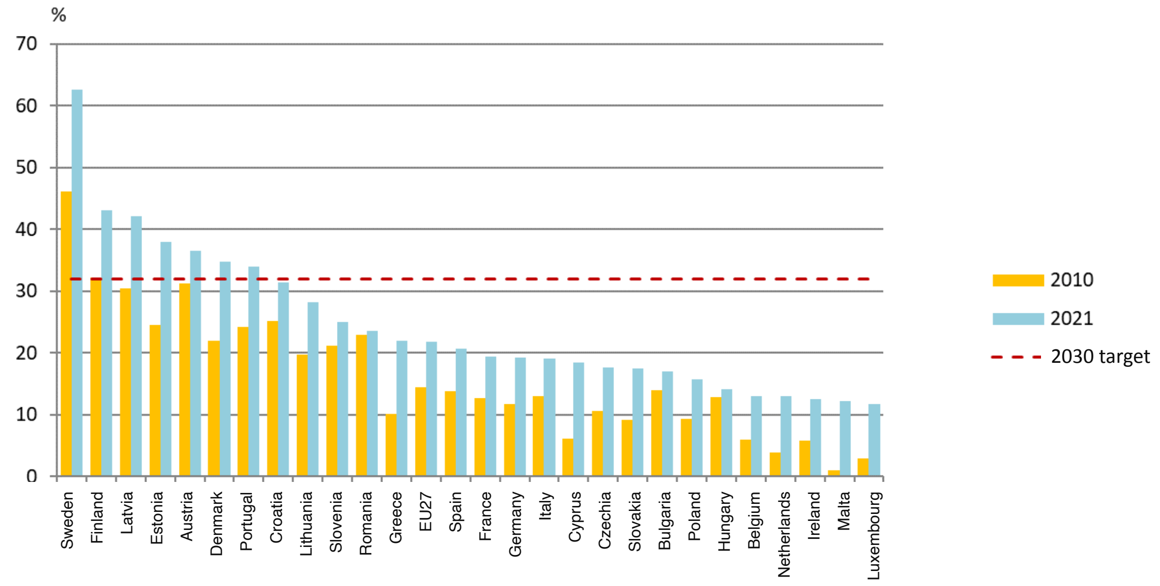
Increasing the share of renewable energy in different sectors of the economy is a key building block for achieving the EU's energy and climate targets. EU Member States have been set a target of 20% of electricity generation from renewable sources in final energy consumption by 2020. This goal was achieved and the EU is now moving towards other goals.

The Renewable Energy Directive 2018/2001/EU has set a **binding renewable energy target for the EU as a whole** of at least 32% **by 2030**.

In 2021, the share of renewable energy sources in final consumption in the EU27 reached 21.8%, with six countries meeting the 32% target (Chart 89). This represents an increase of 7.4 percentage points compared to the EU indicator of 14.4% in 2010, but further efforts are needed to meet the more ambitious 2030 targets.

Chart 89

Share of renewable energy sources in final energy consumption in EU27 countries and 2030 target [%], 2010, 2021



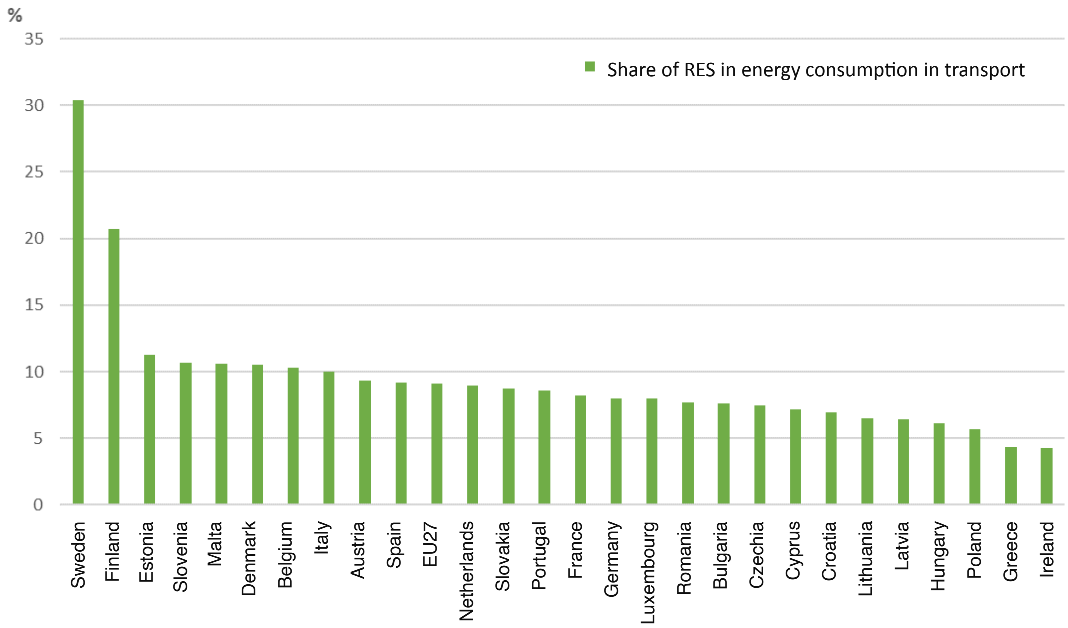
Data for 2022 are not available at the time of publication.

Source: Eurostat

The **share of RES in transport energy consumption** in 2021 in Czechia (7.5%) was lower than the EU27 average (9.1%). The highest shares in the EU27 were in the Scandinavian countries Sweden and Finland (Chart 90), which make significant use of renewable energy sources and have developed electromobility, and Austria (9.4%) in the Central European region. The lower share of RES in transport in Czechia is due to an energy mix with a continuing high share of fossil fuels and also to a lower use of alternative fuels and propulsion in transport compared to Western and Northern Europe.

Chart 90

Share of RES energy in final energy consumption in transport in EU27 countries [%], 2021



Data for 2022 are not available at the time of publication.

Source: Eurostat

2.2. Transition to a circular economy

The circular economy uses waste as a resource for further recovery (material, energy), which makes it possible to reduce 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 evaluated 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 central 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

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

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

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 landfilling 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

Act No. 541/2020 Coll., on waste

- increasing the level of preparation for reuse and recycling of municipal waste to at least 55% of the total weight of municipal waste generated in Czechia by 2025 (60% by 2030, 65% by 2035)
- disposing of no more than 10% of the total weight of municipal waste generated in Czechia in 2035 and subsequent years by landfilling
- recovering no more than 25% of the total weight of municipal waste generated in Czechia in 2035 and subsequent years

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 economy is declining, reducing pressures on the environment, and has fallen by 44.6% between 2000 and 2021.
	In 2018, the share of secondary raw material production volume in direct material input was 8.3%. The development of material intensity only achieves a relative decoupling; due to the nature of the Czech economy, there is no absolute decoupling of GDP and material consumption.

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				
Share of secondary raw materials production volume in direct material input	N/A		N/A	

Material intensity of the economy

The **material intensity of the** Czech **economy** has been declining over the long term, falling by 44.6% between 2000 and 2021[91] (Chart 91). Declining material intensity indicates a reduction in the economy's demand for raw materials and supplies as a result of increasing efficiency in converting material inputs into economic output.

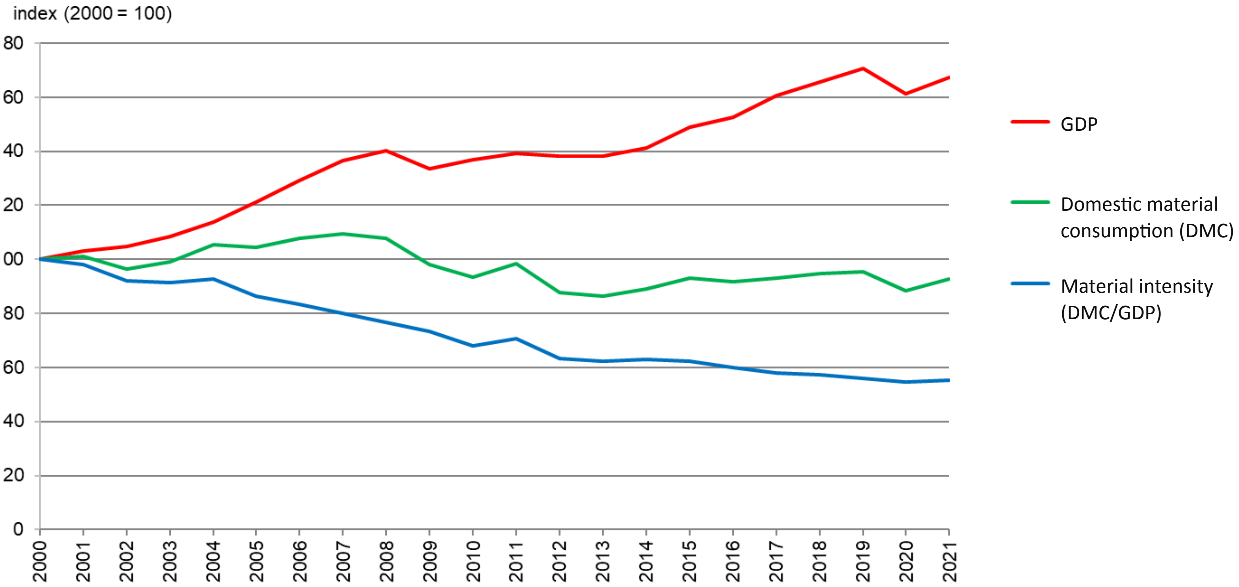
The **downward trend in material intensity** is statistically significant in the long run, with material intensity declining at an average rate of 2.1% per year over the period 2000–2021 relative to the baseline in 2000. Even in the medium (last 10 years) and short term, the downward trend in material intensity is identifiable (by 2.2% and 1.5% per year respectively).

The **2020/2021 year-on-year comparison** is specific and not very telling for the long-term evolution of material intensity, as 2020 was significantly affected by the COVID-19 pandemic and 2021 saw a gradual growth of the economy, but still with a number of pandemic measures. GDP grew by 3.6% year-on-year, while DMC growth was 4.8%. As a consequence, material intensity increased by 1.2% year-on-year and there was no decoupling due to the specific circumstances described above.

[91] *Data for 2022 are not available at the time of publication.*

Chart 91

Development of material intensity of the economy, domestic material consumption and GDP in Czechia [index: 2000 = 100], 2000–2021



Data for 2022 are not available at the time of publication.

Data source: CZSO

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 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 reduces the pressures from agriculture on water quality and ecosystems.

Share of secondary raw materials production volume in direct material input

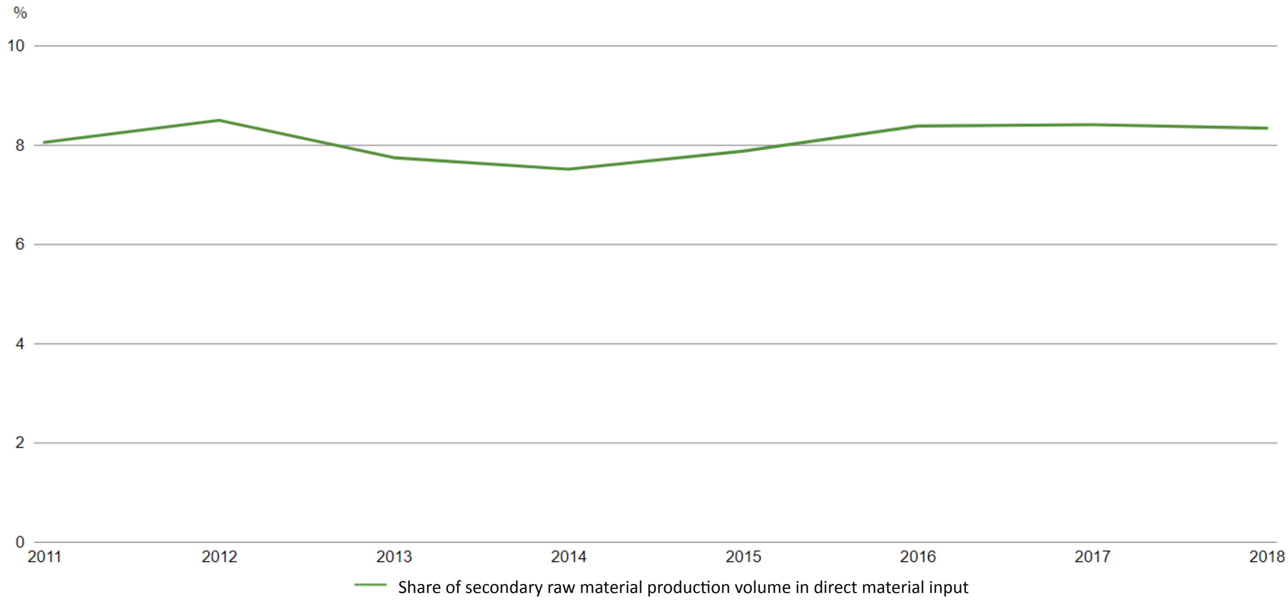
The indicator shows the relative size of secondary raw material production to the total material input into the economy. Direct material input measures the input of materials used in the economy, i.e. all materials that have economic value and are used for production and consumption.

In 2018[92], the share of secondary raw material production volume in direct material input was 8.3% and since 2011, when this share was 8.0%, a rather fluctuating trend with no major variations can be observed in the medium term (Chart 92). 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 (e.g. by introducing closed recycling systems for reusable materials).

[92] *Data for 2019–2022 are not available at the time of publication.*

Chart 92

Share of secondary raw materials production volume in direct material input in Czechia [%], 2011–2018



Data for 2019–2022 are not available at the time of publication.

Data source: CZSO

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 other 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.
✓	In the medium term, there is a slight reduction in the generation of mixed municipal waste.
~	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 decreasing trend in the number of licences for the Czech EFP or EFS ecolabel, while the number of EU Ecolabel licences is increasing. In 2022, a communication campaign for ecolabels was launched with the aim to actively promote ecolabels and ecolabel holders, including certified products and services.

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	↗	↗	✕
Ecolabelling*				
Total number of valid Environmentally Friendly Product and Environmentally Friendly Service ecolabel licences	↘	↘	↘	✕
Total number of valid EU Ecolabel licences	↗	~	↗	✓

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

Waste production[93]

Currently, a key trend in waste management is the move towards a **circular economy**, whereby material flows are closed in long cycles and the emphasis is on waste prevention, product reuse, recycling and conversion to energy instead of mineral extraction and landfilling.

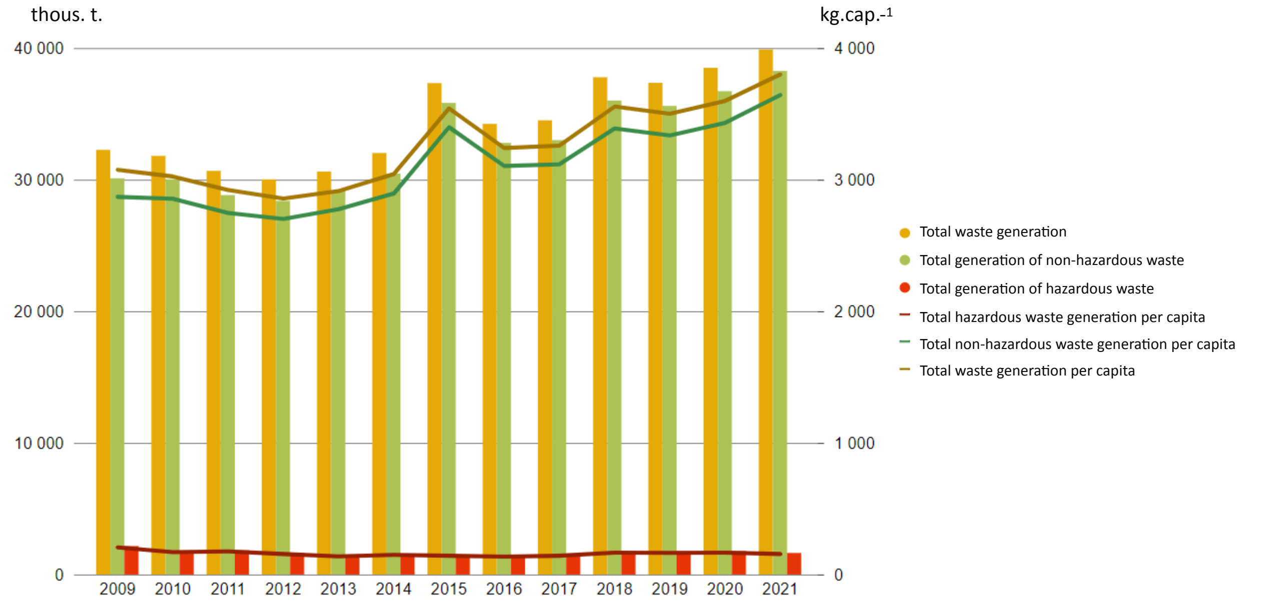
Total waste generation (the sum of total generation of other and hazardous waste) increased by 23.6% between 2009 and 2021 and by 3.6% between 2020 and 2021 to 39,896.6 thous. tonnes (Chart 93). In the medium and short term, it has a strong upward trend. It is possible to reduce the generation of waste 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 2021 was 3,799.4 $kg.capita^{-1}$. **The total generation of non-hazardous waste** accounts for a significant share (95.9% in 2021) of total waste generation. This is mainly influenced by the generation of construction and demolition waste. Between 2009 and 2021, the total

[93] *Data for 2022 are not available at the time of publication.*

generation of other waste increased by 27.1% and by 4.2% between 2020 and 2021 to 38,259.8 thous. tonnes. The total per capita generation of other waste in 2021 was 3,643.5 kg.capita^{-1}. **Hazardous waste** accounted for 4.1% of total waste generation in 2021. The value of this share has fallen from 6.7% since 2009. In the 2009–2021 period, the total generation of hazardous waste decreased by 24.3% and by 8.1% year-on-year in 2020–2021 to a total of 1,636.7 thous. tonnes. The total production of hazardous waste per capita in 2021 was 155.9 kg.capita^{-1}. This waste can be prevented by reducing the hazardous substances in products.

<u>Chart 93</u>

Total generation of waste, non-hazardous and hazardous waste in Czechia [thous. t.], total generation of waste, non-hazardous and hazardous waste per capita in Czechia [kg.cap.$^{-1}$], 2009–2021



Data for 2022 are not available at the time of publication.
The data were determined according to the methodology Mathematical expression of the calculation of the "OH indicator system" valid for the given year.
The CZSO is the source of data on the population of Czechia (mean).

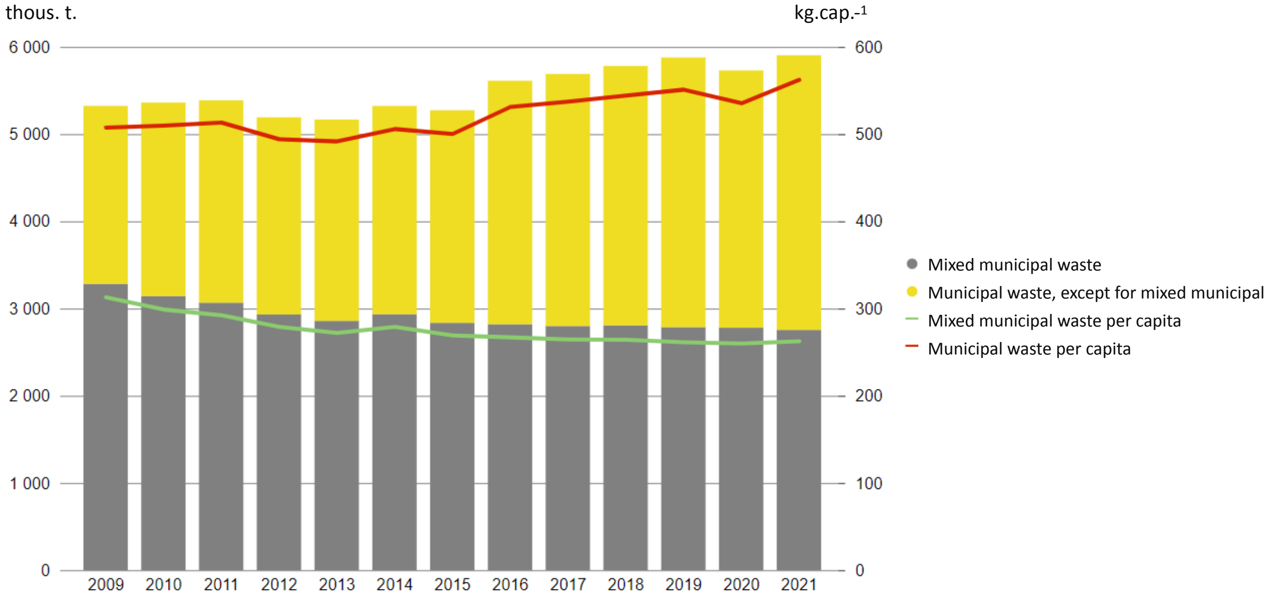
Data source: CENIA, CZSO

Total municipal waste generation[94] increased by 3.0% year-on-year to 5,904.4 thous. tonnes in the 2020–2021 period (Chart 94). This represents a 10.9% increase since 2009. It also represents an increase in the medium term. The total per capita production of municipal waste in 2021 was 562.3 kg.capita^{-1}. On the positive side, there is a slight reduction in the **generation of mixed municipal waste** in the medium term. Between 2009 and 2021, the generation of mixed municipal waste decreased by 16.1% and by 0.9% between 2020 and 2021 to a total of 2,755.9 thous. t. The total generation of mixed municipal waste per capita in 2021 was 262.4 kg.capita^{-1}.

[94] *Due to a change in the methodology, waste catalogue numbers 20 02 02 (soil and stones) and 20 03 06 (sewage treatment waste) are not included in the total municipal waste generation from 2020 onwards.*

Chart 94

Total generation of municipal waste in Czechia [thous. t], per capita generation of municipal and mixed municipal waste in Czechia [kg.cap.-1], 2009–2021



Data for 2022 are not available at the time of publication.

The data were determined according to the methodology Mathematical expression of the calculation of the "OH indicator system" valid for the given year.

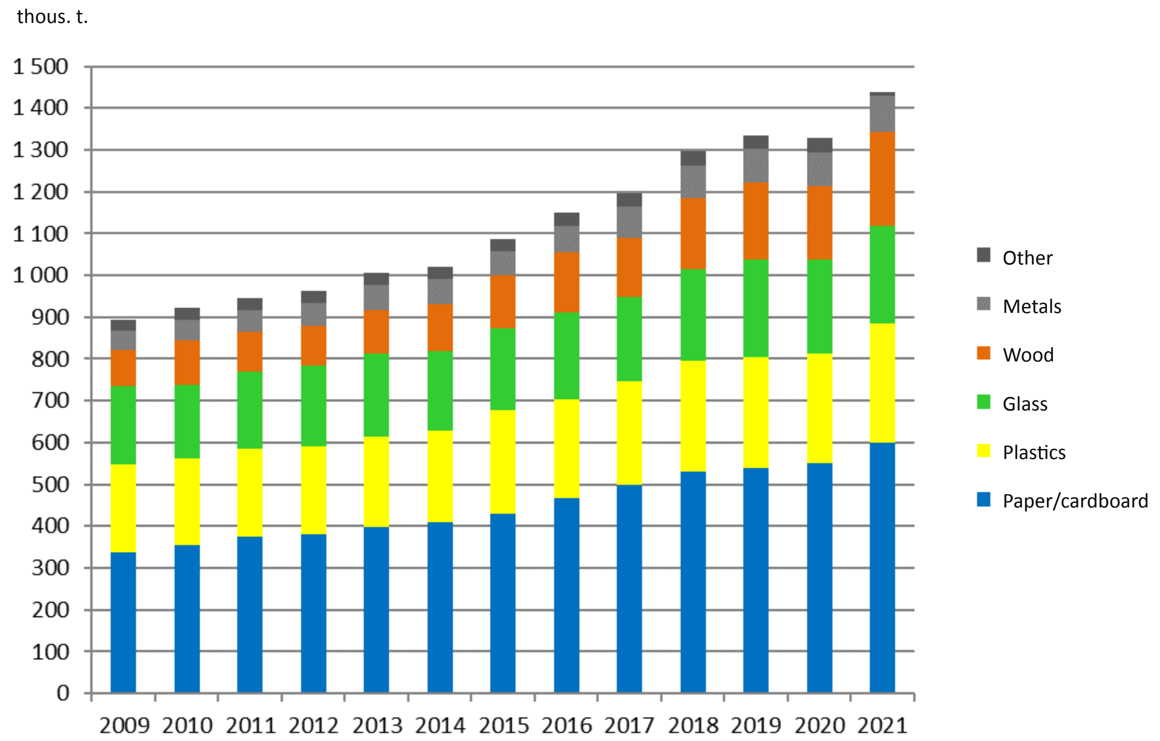
The CZSO is the source of data on the population of Czechia (mean).

Data source: CENIA, CZSO

One of the most characteristic manifestations of a consumer society is the increasing **generation of packaging waste**. Between 2009 and 2021, the generation of packaging waste increased by 60.7% (Chart 95). In 2021, 1,437.1 thous. tonnes of packaging waste were generated in Czechia, an increase of 8.2% compared to 2020. 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 (41.7% in 2021), distantly followed by plastics (19.8%) and glass (16.3%).

Chart 95

Packaging waste generated and material structure of packaging waste in Czechia [thous. t], 2009–2021



Data for 2022 are not available at the time of publication.

Data source: MoE

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. Ecolabels are awarded after a comprehensive verification of the entire product life cycle, certified products or services can be identified by a simple and easy-to-remember symbol, the so-called ecolabel logo.

The **EU Ecolabel** is the European Union's official label for environmental excellence. In this respect, the only purely Czech, separate labels are the **Environmentally Friendly Product (EFP)** and the **Environmentally Friendly Service (EFS) labels**, which are guaranteed by the Ministry of the Environment. It is up to the applicant whether they want to certify their product with the national label, the EU label or both.

In 2022, there were a total of 27 **valid licenses** to use the Czech EFP/EFS ecolabel in Czechia, which corresponds to 43 certified products; in the case of the EU Ecolabel, there were also 27 licenses for 5,344 certified products. In terms of long-term development, we can observe a downward trend in the number of licences for the Czech EFP or EFS ecolabel, while the number of EU Ecolabel licences is increasing, despite fluctuations over the last 10 years (Chart 96). It is therefore clear that, if current trends are maintained, the EFP/EFS ecolabel will not achieve the target set for 2030 (100 valid licences), unlike the EU Ecolabel where the target of 25 valid licences has already been achieved. The **criteria for eco-label certification** are continuously updated according to the latest knowledge and available technologies, so that the ecolabel remains a symbol of environmental excellence. Only 10–20% of environmentally friendly products obtain the ecolabel.

A communication campaign on ecolabels was launched in **2022**. The aim of the infocampaign is to actively promote the ecolabel and ecolabel holders including certified products and services through websites, social networks and outdoor campaigns and promotions. The campaign also focuses on point-of-sale support and an extensive media campaign on TV, print and radio (e.g. interviews on CNN Prima News). In the next phase, the campaign will focus on recruitment marketing targeted at manufacturers (direct mailing, call centre).

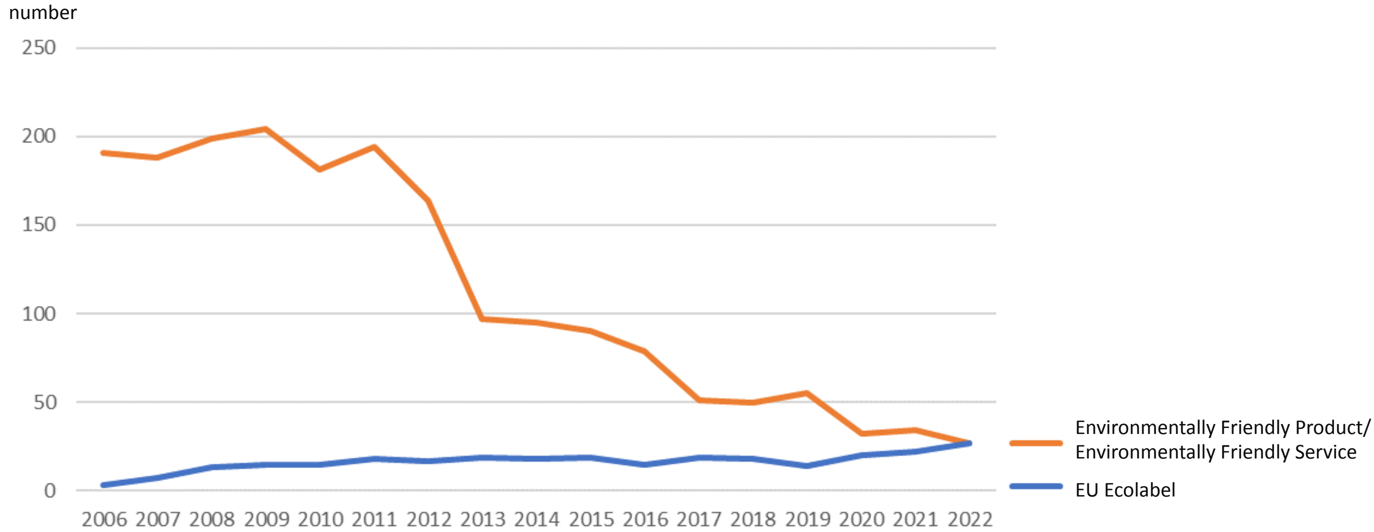
Companies can use the ecolabel in their marketing and communication, while consumers, public procurers and company purchasers can use it as a guide when buying more environmentally friendly goods and services.

Ekolífek has become an ecolabel ambassador, explaining the ecolabel criteria and other complicated topics in the certification process in a simplified manner and covering the entire communication.

Manufacturers and service providers who receive the ecolabel for their products from CENIA become members of the premium group of eco-producers and their products are automatically included in the catalogue of products and services on the official website www.ekoznacka.cz. They can also present themselves, among other things, at official events in which CENIA participates. It goes without saying that ecolabels can also be used for self-promotional purposes.

Chart 96

Valid EFP/EFS and EU Ecolabel licences in Czechia [number], 2006–2022



Data source: CENIA

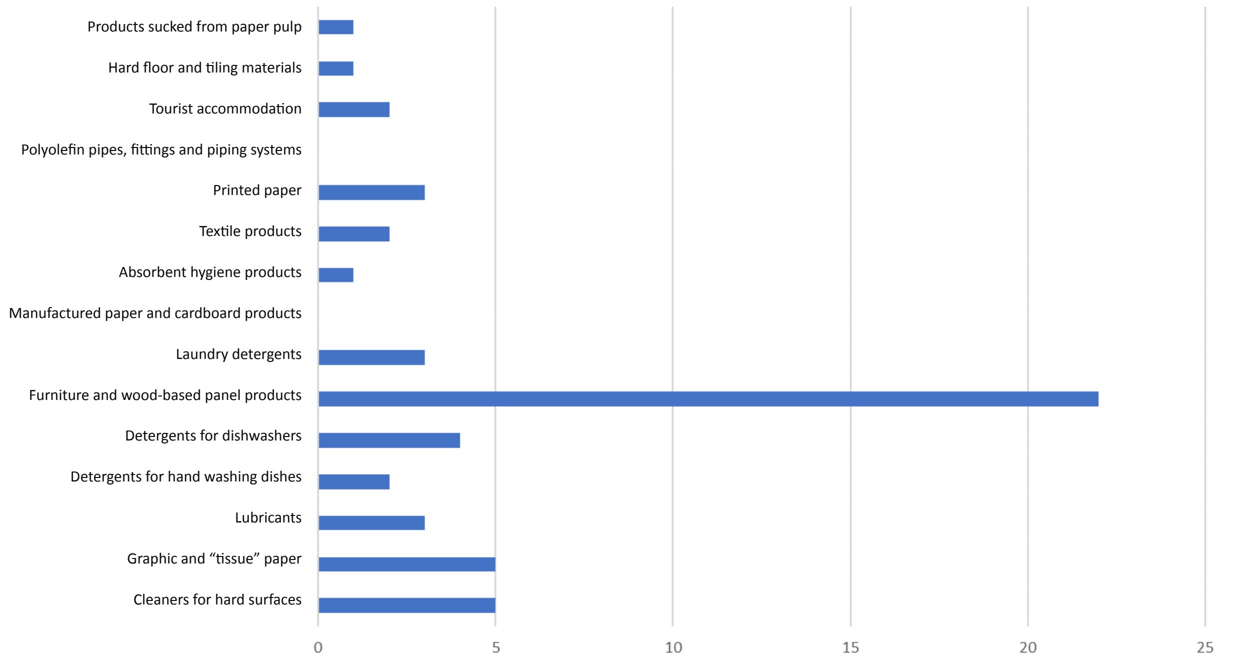
From 1 January 2021, there is a legal **obligation** in Czechia **for socially and environmentally responsible public procurement** (according to the amendment to Act No. 134/2016 Coll., on Public Procurement, as amended).

Environmental impact, sustainable development, life cycle of the supply, service and other aspects must therefore be taken into account in public procurement. Products and services with the ecolabel may thus have a competitive advantage in the public procurement process due to the legal obligation of environmentally responsible procurement.

In 2022, 19 new **licenses for both ecolabels** were granted **in the categories of** lubricants, cleaning products, textile products, printed paper, and products sucked from paper pulp (Chart 97). In other categories such as laundry and cleaning products or absorbent hygiene products, new products were certified under existing licences. Most of the applicants for certification are currently from the categories of cleaning and detergents, furniture and paper.

Chart 97

Valid EFP/EFS and EU Ecolabel licences by category in Czechia [number], 2022



Data source: CENIA

2.2.3. Compliance with the waste treatment hierarchy[95]

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 and short term.
	The main target in the field of municipal waste treatment is to significantly reduce landfilling in favour of material recovery, 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 98). Between 2009 and 2021, the share of **materially recovered** waste to total waste generation, which in 2021 amounted to 39 896.6 thous. tonnes, increased from 72.5% to 83.6%, despite the annual 2020–2021 decrease from 86.2% to 83.6%. The amount of waste material recovered in 2021 was 33 351.7 thous. tonnes.

Only a small part of the total waste generation is **used for energy recovery**. Between 2009 and 2021, the share of waste recovered for energy recovery increased from 2.2% to 3.4%, despite a decrease from 3.6% to 3.4% between 2020 and 2021. The amount of waste recovered for energy recovery in 2021 was 1,373.8 thous. tonnes.

The most common method of waste disposal is disposal at or below ground level, i.e. **landfilling**. This is a persistent and significant problem in Czechia. Since 2009, the landfill share fell from 14.6% to 9.6% in 2021 and from 9.8% to 9.6% in the 2020–2021 year-on-year comparison. In 2021, the amount of waste disposed of by landfilling was 3,836.3 thous. tonnes.

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 (especially legislative[96]) tools for this gradual change, which can significantly help the transition to a circular economy.

---

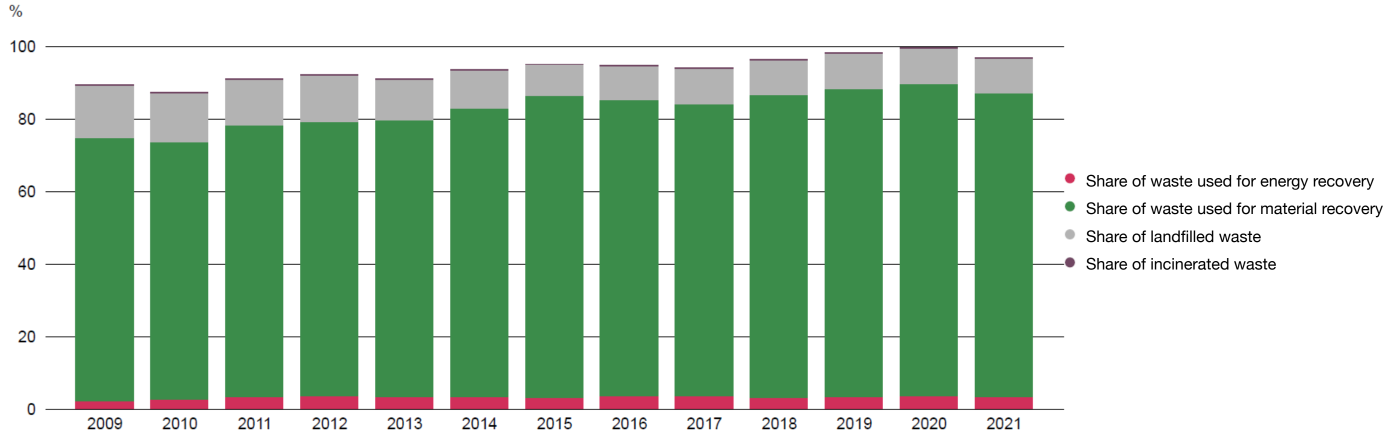
[95] *Data for 2022 are not available at the time of publication.*

[96] *In the context of the transition to a circular economy, active legislative support for material recycling is necessary, as the preparation and transition to systems supporting the circular economy are very time-consuming and problematic without such support (as shown by cases from other countries).*

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. About 0.2% of the waste generated each year is incinerated, a negligible share compared to landfilling. In 2021, the amount of waste incinerated was 86.1 thous. tonnes.

Chart 98

Share of selected waste treatment methods in total waste generation in Czechia [%], 2009–2021



Data for 2022 are not available at the time of publication.
The data were determined according to the methodology Mathematical expression of the calculation of the "OH indicator system" valid for the given year.

Data source: CENIA

Municipal waste treatment[97]

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, since 2009, the share of municipal waste landfilled in total municipal waste production, which was 5 904.4 thous. tonnes in 2021, has decreased from 64.0% to 47.6% in 2021 and from 47.8% to 47.6% between 2020 and 2021 (Chart 99). However, in the short term (since 2017) there has been an increase. In 2021, the amount of municipal waste disposed of by landfilling was 2,813.1 thous. tonnes.

Diversion from landfilling is increasing the share of municipal waste used for **material recovery**, which increased from 22.7% since 2009 to 37.5% in 2021, despite a year-on-year 2020–2021 reduction from 38.6% to 37.5%. In the medium term, this share has a significantly increasing trend. The amount of material recovery of municipal waste in 2021 was 2,215.5 thous. tonnes.

At the same time, the importance of **energy recovery** from municipal waste has increased from 6.0% to 12.1% in 2021 compared to 2009. However, between 2020 and 2021, the share of municipal waste used for energy recovery fell from 12.6% to 12.1%. In 2021, the amount of energy recovery of municipal waste was 712.6 thous. tonnes.

The situation is diametrically different for **incineration** (unlike in the energy recovery of municipal waste, municipal waste is only disposed of by incineration, i.e. it is not used in any way), through which an almost negligible amount of municipal waste is treated (3.5 thous. tonnes in 2021). In this case, the percentage share of municipal waste incinerated is almost zero (0.06% in 2021).

Nevertheless, the municipal waste treatment situation in Czechia is not satisfactory, with municipal waste landfilling above the EU28 average and recycling below the average. The aim is to reduce the share of

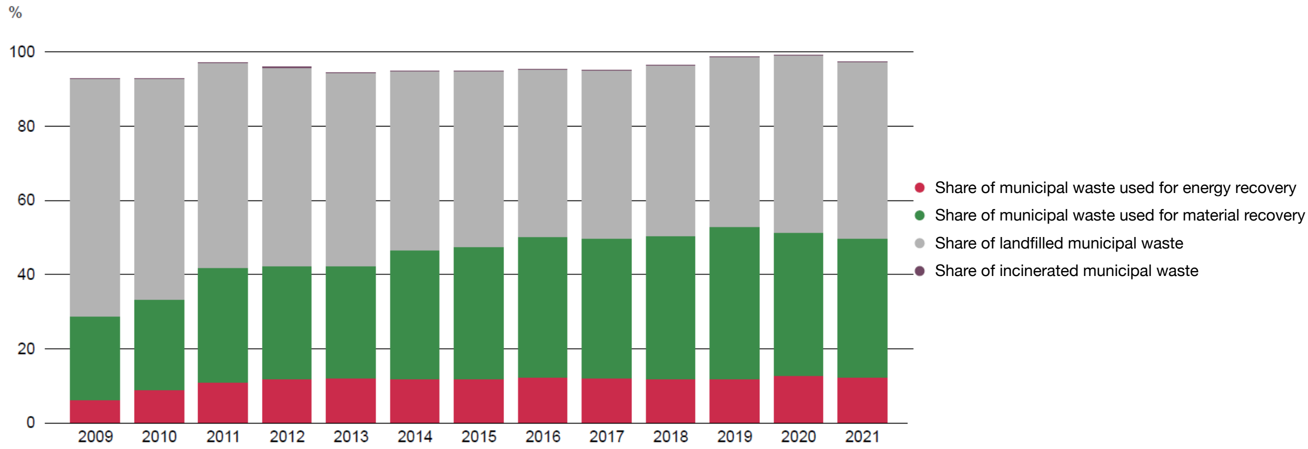
---

[97] *Due to a change in the methodology, waste catalogue numbers 20 02 02 (soil and stones) and 20 03 06 (sewage treatment waste) are not included in municipal waste treatment and total municipal waste generation from 2020 onwards.*

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 the principles of circular economy associated with the need to meet the European circular economy objectives[98]. If the current trend continues, achieving the 2025, 2030 and 2035 targets for municipal waste recycling, 2035 municipal waste landfilling and 2035 municipal waste energy recovery will be challenging.

Chart 99

Share of selected municipal waste treatment methods in total municipal waste generation in Czechia [%], 2009–2021



Data for 2022 are not available at the time of publication.
The data were determined according to the methodology Mathematical expression of the calculation of the "OH indicator system" valid for the given year.

Data source: CENIA

Detailed visualisations and data

https://www.envirometr.cz/data

[98] *The targets for municipal waste are set out in Act No. 541/2020 Coll., on waste.*

The transition to a circular economy in an international context

Key messages

~	In terms of the number of products certified with the EU Ecolabel, Czechia performs above average within the EU (7th position), while the number of EU Ecolabel licences granted is average (15th position).
✕	The material intensity of Czechia is above average compared to other EU27 countries.

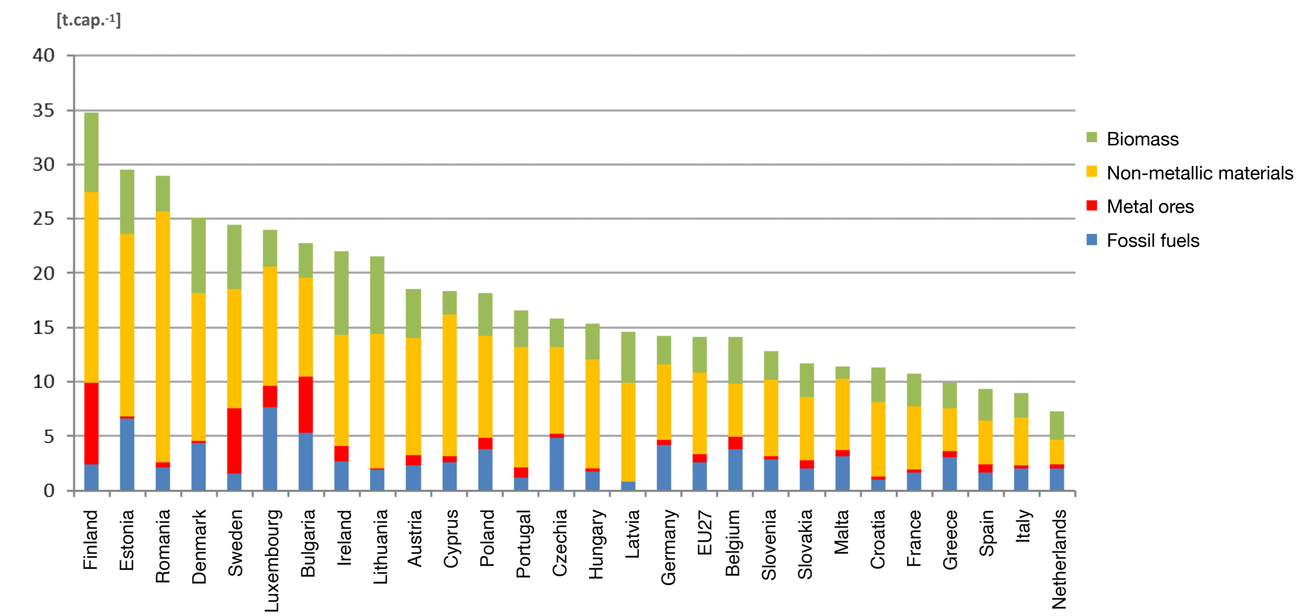
Material intensity of the economy in an international context

Czechia has slightly above-average indicators of material flows per capita and per unit of GDP, given the nature of the economy and its export orientation. However, with the decline in material intensity, Czechia is gradually approaching the EU27 average.

Domestic material consumption per capita in Czechia in 2021[99] was 15.8 t per capita, which is 11.8% above the EU27 average (Chart 100). Countries with high mining and consumption of metal ores and non-metallic materials (Finland, Estonia, Romania) have the highest per capita material consumption, while Hungary and Slovakia have lower per capita DMC than Czechia. The material intensity of the Czech economy (0.53 t.1 000 PPS^{-1}) was 22.4% higher than the average material intensity of the EU27 countries (Chart 101). The highest material intensity is found in economically weaker countries with high extraction and consumption of raw materials and materials (e.g. Romania, Bulgaria); Czechia's position in terms of material intensity is one of the best among Central European countries with a similar economy.

<u>Chart 100</u>

Domestic material consumption per capita by material category, international comparison [$t.cap.^{-1}$], 2021



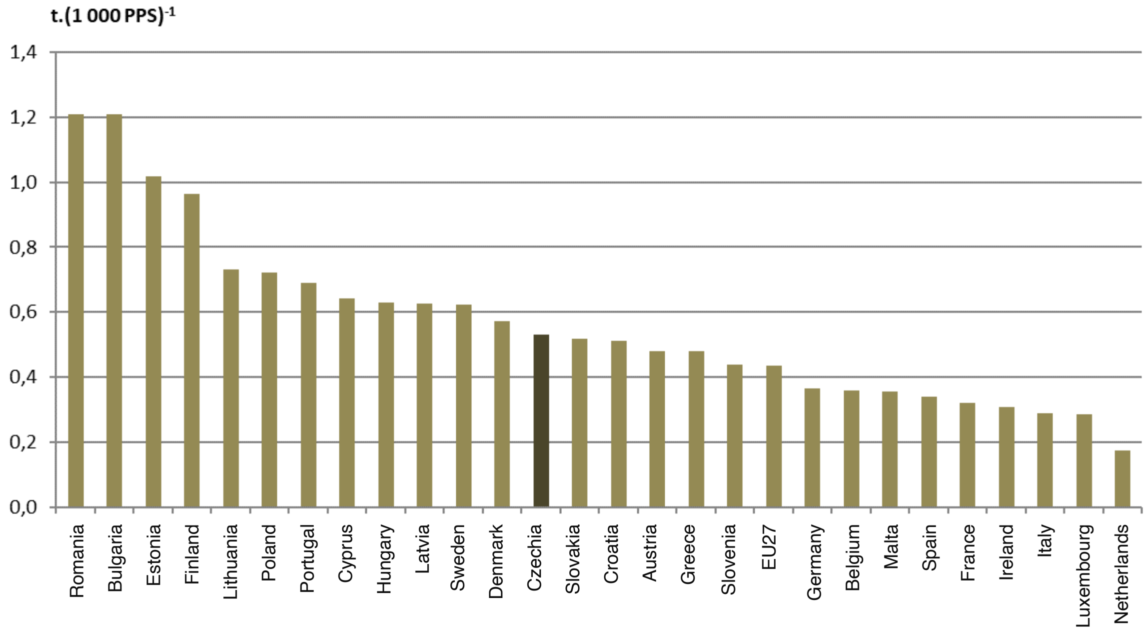
Data for 2022 are not available at the time of publication.

Data source: Eurostat

[99] *Data for 2022 are not available at the time of publication.*

Chart 101

Material intensity of the economy, international comparison [t.(1,000 PPS)-1], 2021



Data for 2022 are not available at the time of publication.

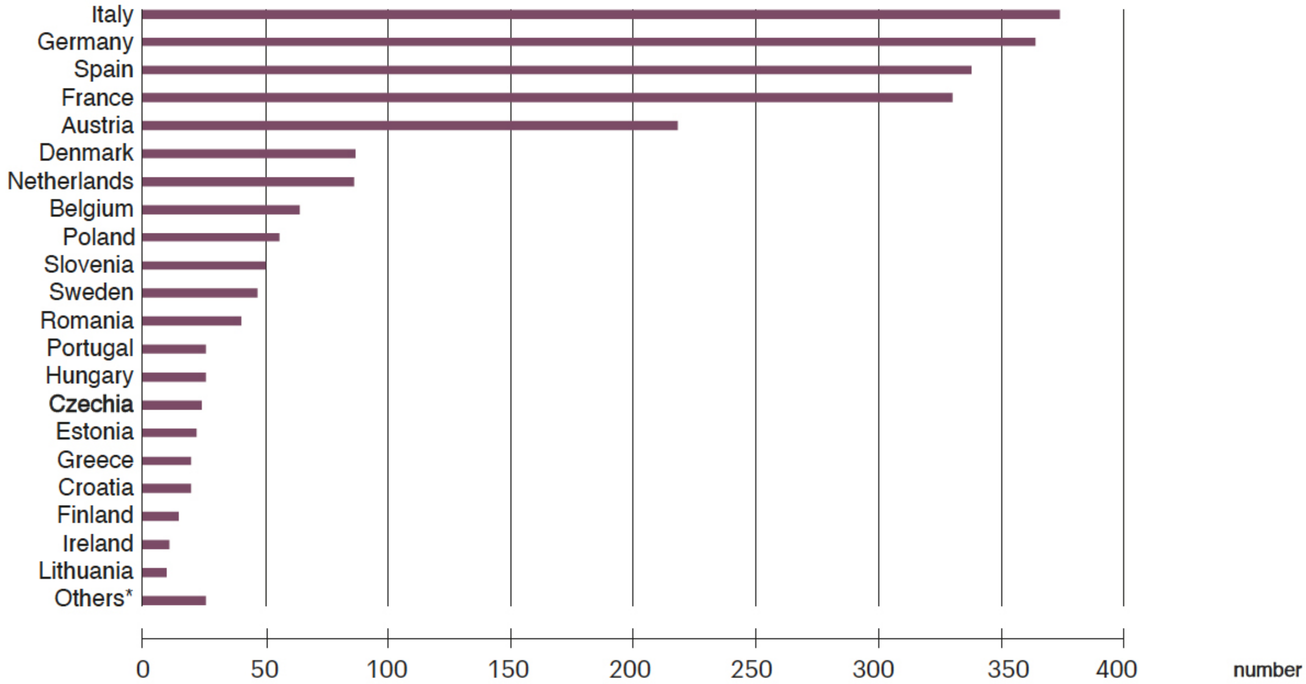
Data source: Eurostat

Ecolabelling in an 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 2,270 valid licences have been granted for 69,378 certified products and services as of September 2022. Czechia ranked 15th in the number of licenses (Chart 102) and 7th in the number of certified products and services (Chart 103) among all European countries. As of September 2022, there were 24 valid licenses in Czechia, corresponding to 5,179 certified products and services.

Chart 102

Valid licences by EU country [number], September 2022

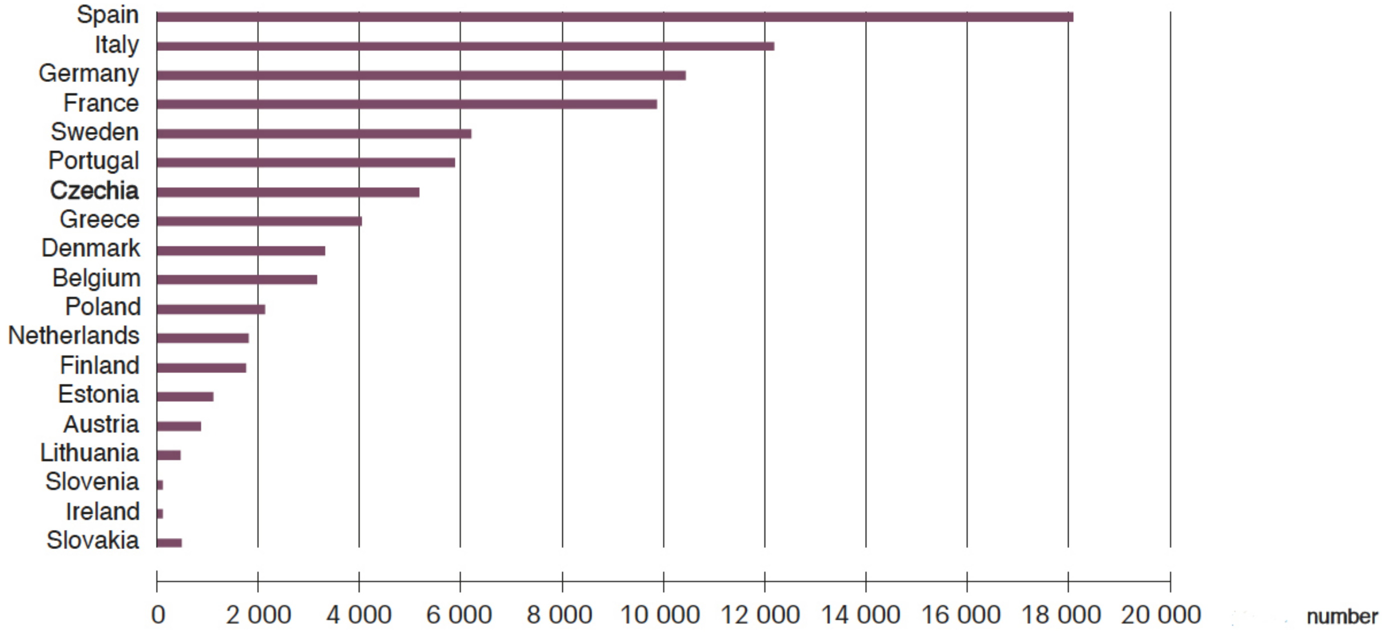


** Others: 6 countries with less than 10 valid licences.*

Data source: Ecolabel.eu

Chart 103

Certified products and services in EU countries [number], September 2022



** Others: 9 countries with less than 100 certified products and services.*

Data source: Ecolabel.eu

Detailed visualisations and data

https://www.envirometr.cz/data

3. Nature and landscape

3.1. Ecological stability of the landscape and sustainable land management

Intensive agriculture, urbanisation and failure to comply with the principles of sustainable management of natural resources is leading to a loss of biodiversity, which is essential for maintaining the ecological stability of the landscape and its natural 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 current management methods. These processes are to a large extent influenced by agricultural and forestry activities, especially the non-observance of the principles of good agricultural practice and sustainable forest management, inter alia as a result of the past cultivation of unstable monoculture forests which are currently impacted by a widespread calamity. Inappropriate watercourse modifications, changes in land use, soil degradation, inappropriate farming practices, extensive drainage of fields and meadows and the expansion of built-up areas have resulted in a reduction in the water retention capacity of the landscape, which is important for securing water resources. Adaptation to increasing weather extremes in the face of ongoing human-induced climate change is also key to sustainable land use[100].

Overview of selected related strategic and legislative documents

EU Environment Action Programme 2030

- sets out the EU's vision of living well and within planetary boundaries by 2050, the priority targets for 2030 and the conditions needed to achieve them
- following the Green Deal for Europe, aims to accelerate the transition to a resource-efficient, climate-neutral economy, recognising that human well-being and prosperity depend on healthy ecosystems

EU Biodiversity Strategy 2030

- a long-term plan to protect nature and reverse ecosystem degradation
- the aim is to put Europe's biodiversity on the road to recovery by 2030

EU Forest Strategy 2030

- sets out a vision and actions to increase the quantity and quality of EU forests and strengthen their resilience
- the aim is to adapt Europe's forests to new conditions, weather extremes and the high uncertainty caused by climate change

EU Soil Strategy 2030

- sets out a framework and specific measures to protect and restore land and ensure its sustainable use
- sets a vision and targets for achieving healthy soil by 2050

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

---

[100] *See the report of the Intergovernmental Panel on Climate Change (IPCC). More at: https://www.ipcc.ch/report/ar6/syr/resources/spm-headline-statements*

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

Strategy on Adaptation to Climate Change 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 (in the version binding from 1. 9. 2021)

- economical use of built-up areas (support for redevelopment through revitalisation and remediation of the area) and ensuring the protection of undeveloped land (especially agricultural and forest land) and the preservation of public greenery, including the minimisation of its fragmentation

Action Plan of the Czech Republic for the Development of Organic Agriculture in 2021–2027

- sets targets for the development of organic farming and the promotion of organic food production

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

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 and Additions 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

✕	There is a long-term increase in land development, which negatively affects water retention in the landscape. Between 2021 and 2022, the built-up area increased by 621 ha. Of the agricultural land, arable land decreased the most, by 11.2 thous. ha.

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 BPEJ 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.

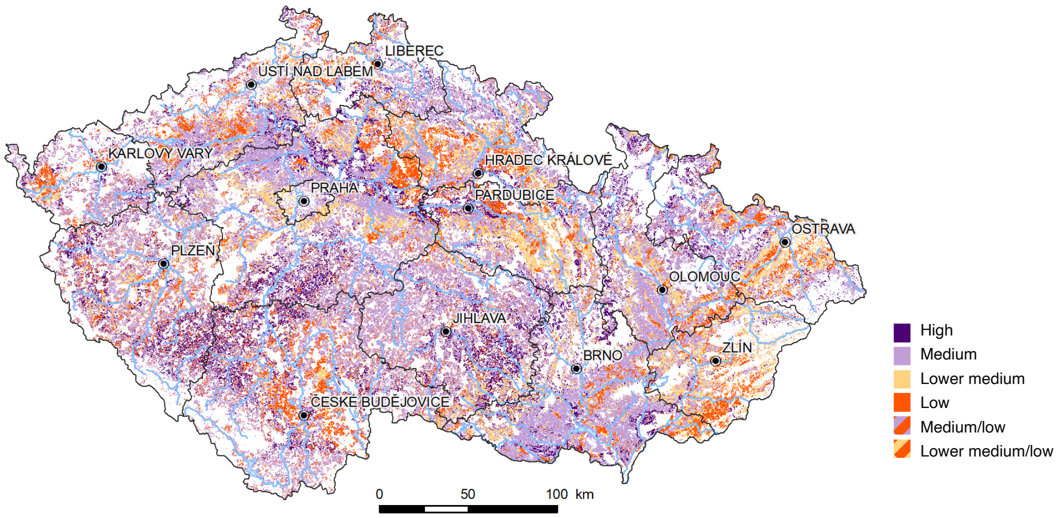
Low infiltration capacity: Soils with an impermeable layer less than 50 cm deep or a water table less than 60 cm deep. This also includes soils with an impermeable layer or groundwater level more than 100 cm deep whose saturated hydraulic conductivity is less than 0.004 mm per second.

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 38.7% in 2022 (Fig. 25). Dual soil groups (medium/low and lower medium/low infiltration capacity) accounted for a total of 1.5% of agricultural soils.

Fig. 25

Infiltration capacity of agricultural soils in Czechia, 2022



Data source: Research Institute for Soil and Water Conservation

Increasing water retention in the landscape is supported by water regime revitalisations, which include the removal of drainage systems, particularly **in forest communities of selected wetland areas**. As a result of the revitalisation measures, a system of small and large dikes is constructed to slow down or eliminate the flow of water from the wetland, supplemented by the method of incorporation. The siltation and overgrowth of the drainage channels gradually leads to the destruction of the entire drainage system and the subsequent restoration of the wetland habitat.

As part of the project for the revitalization of the water regime in selected wetland areas of the KRNAP, funded by the OP ENV, a total of 24 sites had been revitalised by the end of 2022. So far, more than 40 km of drainage ditches have been blocked. In the Šumava National Park, revitalisation works were carried out in 2022 within the framework of the international LIFE for MIRES project with the aim of restoring the natural water regime at 14 sites with a total area of 660 ha. In addition, 7.6 km of streams were restored in 2022. A total of 55 km of drainage canals were closed. Including previous construction seasons, a total area of 1,250 ha of originally drained and damaged wetlands was revitalised in the Šumava NP by the end of 2022 and a total of 25 km of streams were restored.

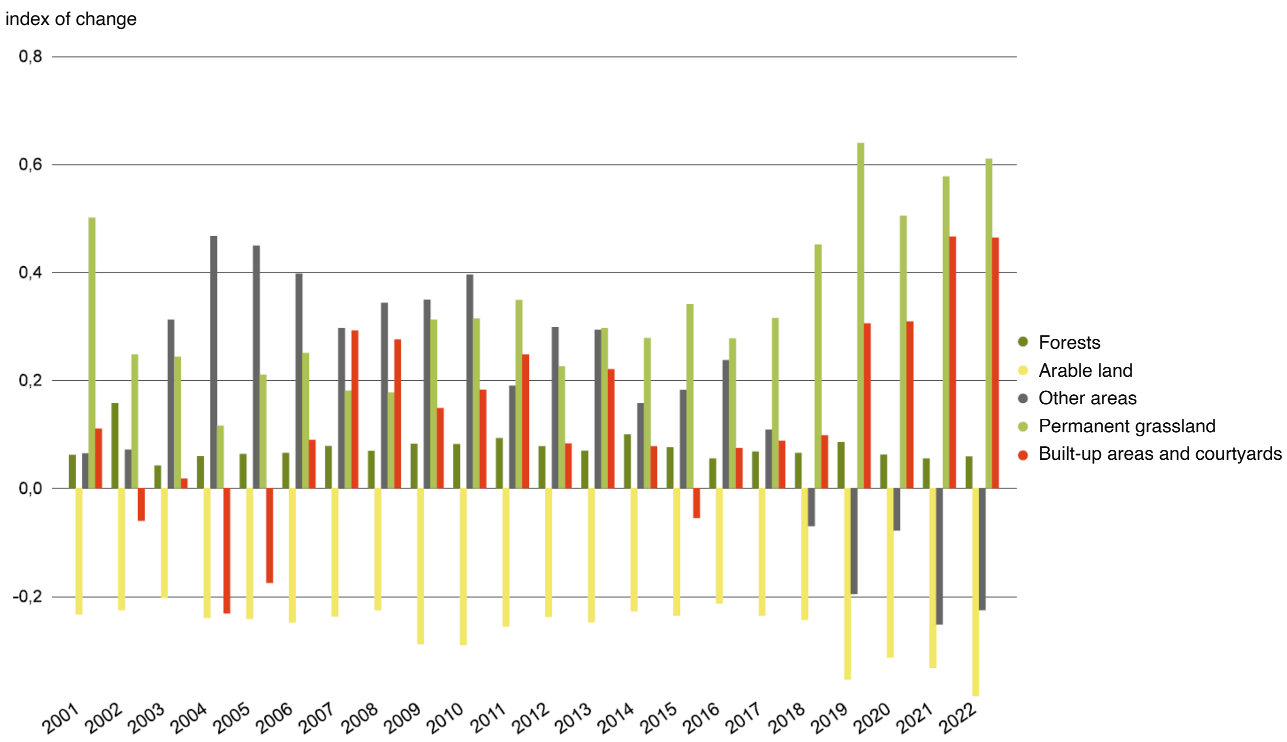
Land use

Water retention in the landscape is fundamentally influenced by land use, especially the proportion of paved areas and agricultural management. Within land use, **agricultural land** has been declining in the long term, with a decline of 2.1 thous. ha (0.05%) in 2022. Since 2000, this decline has amounted to 83.3 thous. ha, i.e. 1.9%. This loss was mainly due to conversion to built-up areas. Overall, the area of **arable land** decreased by 11.2 thous. ha in 2022. In total, 5.6% of arable land has been lost since 2000. The most significant process causing the loss of arable land was its conversion to **permanent grassland**, which increased by 73.8 thous. ha (7.7%) between 2000 and 2022. Hop farms and orchards have also been declining within agricultural land for a long time. The area of **forests** has also increased by 1.6 thous. ha year-on-year, with an increase of 43 thous. ha since 2000.

The area of **built-up land** has been growing for a long time. In the 2000–2022 period, a total of 3 997 ha was built up and in 2022; the built-up area increased by 621 ha (0.5%) year-on-year, Chart 104). Associated with this is the increase in impermeable surfaces (preventing the infiltration of rainwater into the soil), which increased from 2.31% in 2006 to 2.39% of Czechia's land area in 2015 (Chart 105).

Chart 104

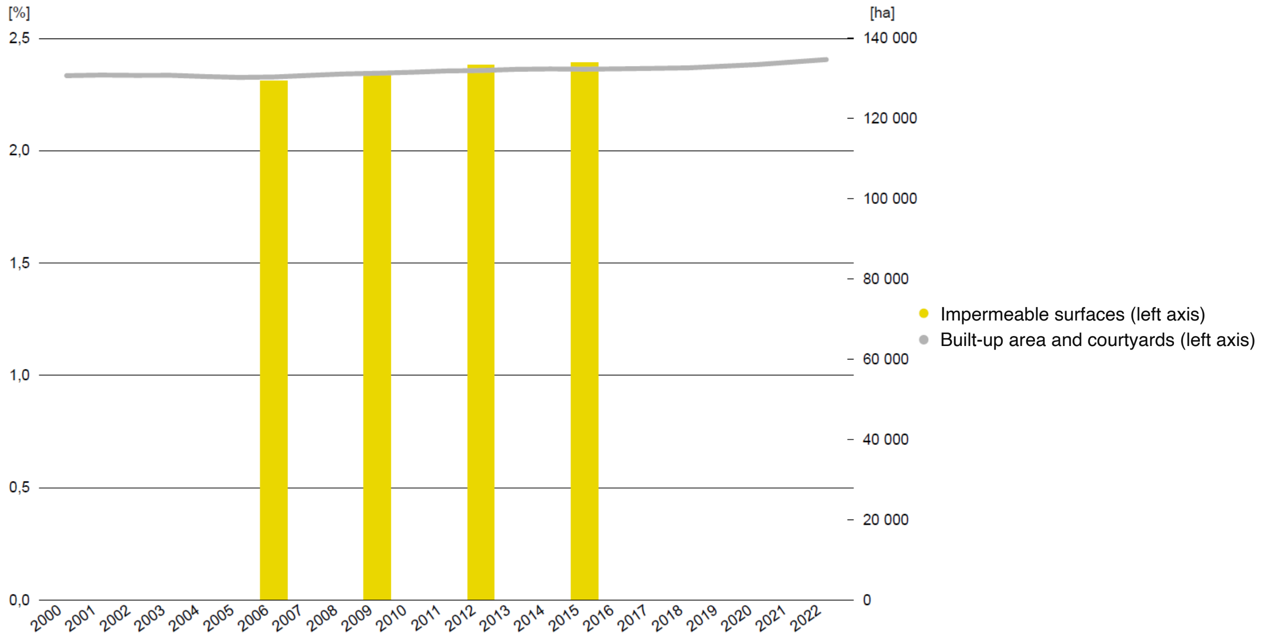
Land use in Czechia [annual % change], 2001–2022



Data source: COSC

Chart 105

Built-up area and impermeable surfaces in Czechia [%, ha], 2000–2022



Data source: COSC, EEA

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 active substances in plant protection products has fallen by 13.0% since 2000. In 2022, it amounted to 3 745.2 t of active substances, i.e. 1.4% less than in 2021.
~	After a more significant decline in the extraction of construction and energy raw materials in 2020, influenced by the COVID-19 pandemic, their extraction increased again slightly, but this does not affect the long-term trend of decline in extraction.
✗	Soil acidification and the depletion of alkaline nutrients is a limiting factor for forest soils. 97.2% of forest soils in the top mineral layer (0–30 cm) and 89.1% of forest soils in the bottom mineral layer (30–80 cm) fall into the categories of high and extreme threat of acidification. There is extensive annual soil loss through erosion. Potentially, 48.1% of agricultural land is threatened by water erosion, of which 13.4% by extreme erosion. 33.3% of agricultural land is threatened by wind erosion. A total of 266 erosion events were recorded in 2022, which corresponds to a balanced pattern of temperature and precipitation over the course of the year. Mineral fertiliser consumption increased by 2.5% year-on-year to 106.8 kg net nutrients per ha in 2022.

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	N/A
Quality of forest soil	N/A	N/A	N/A	✗
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.*

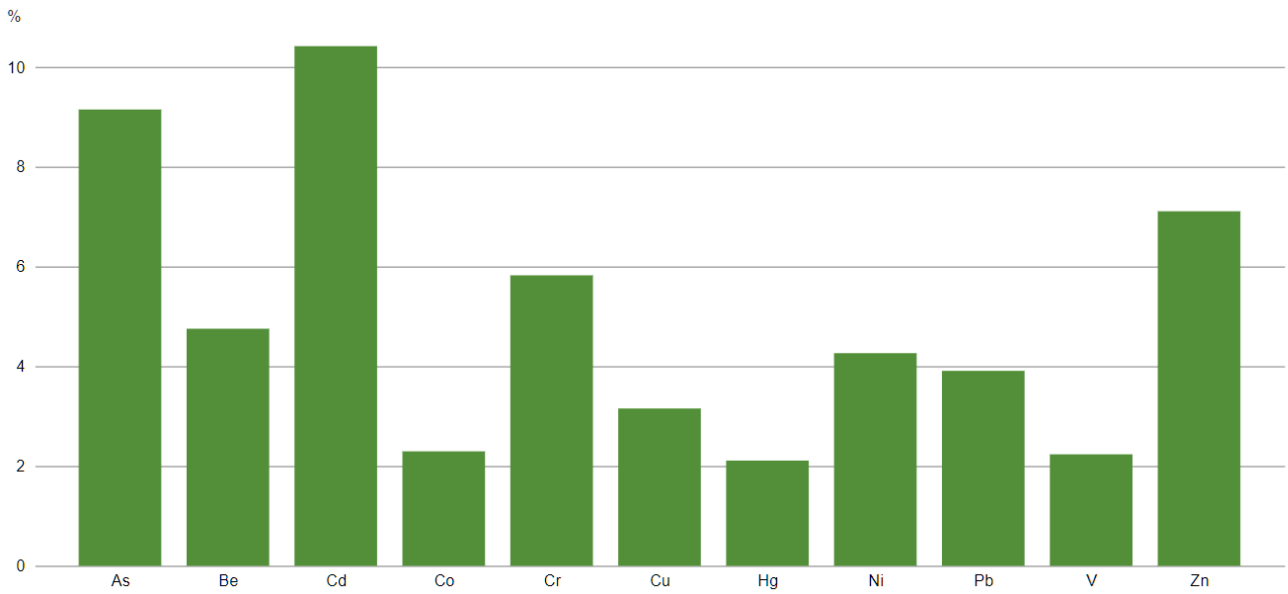
Quality of agricultural and forest soil

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 – BSM), 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 BSM 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 106), cadmium was the most problematic in the 1998–2022 period, with 10.7% 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 (9.1%), chromium (5.7%), zinc (7.4%) and beryllium (4.7%).

Chart 106

Share of soil samples exceeding the preventive values for element content in leachate of aqua regia in Czechia [%], 1998–2022



The preventive values for the above-mentioned hazardous substances are set by Decree No. 153/2016 Coll.

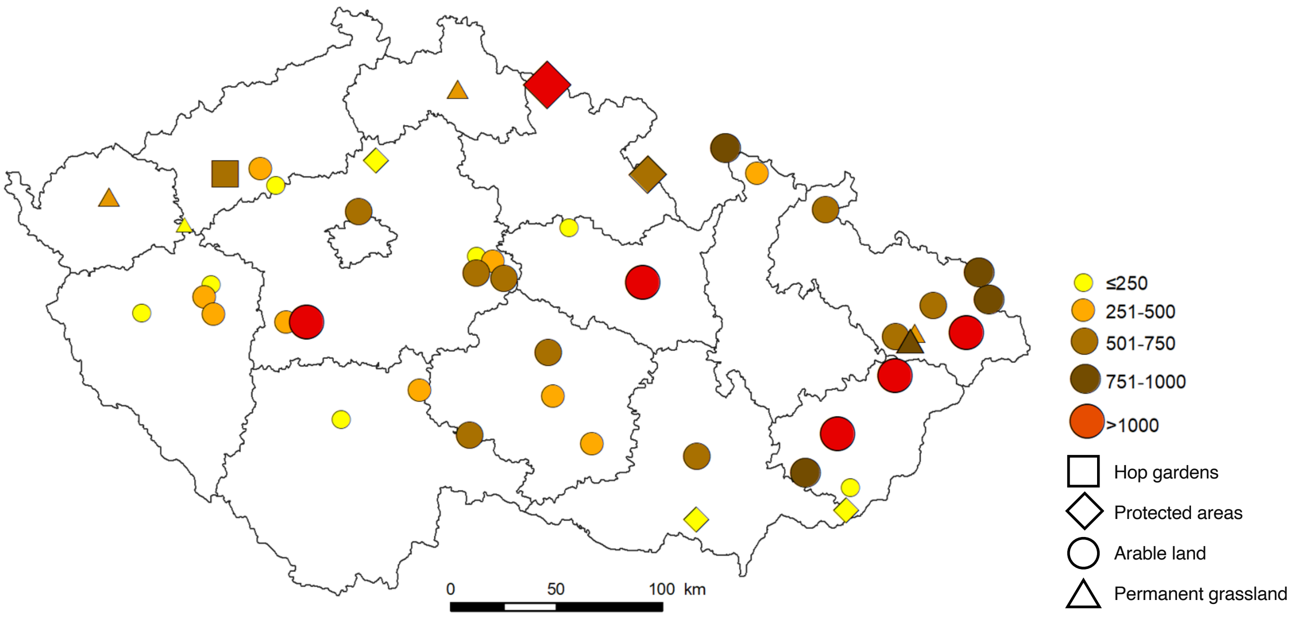
Data source: Central Institute for Supervising and Testing in Agriculture

Organic pollutants are determined annually at the same 40 selected BSM monitoring sites and 5 sites in protected areas (KRNAP, Kokořínsko, Pálava, White Carpathians, Eagle Mountains) from the topsoil perspective. In 2022, the preventive value was exceeded for PCBs, PAHs, HCB and DDT. The preventive value for HCH 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 five selected arable land observation sites and in one sample from a site in a protected area (Fig. 26).

DDT levels were exceeded at four sites. The limit for PCBs in arable land was exceeded at two monitoring sites in 2022 and for HCB at one site.

Fig. 26

Sum of 12 PAHs in topsoil of agricultural soils (at BSMs) in Czechia [μg.kg^{-1} dry weight], 2022



Based on samples from 40 selected monitoring sites and 5 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.

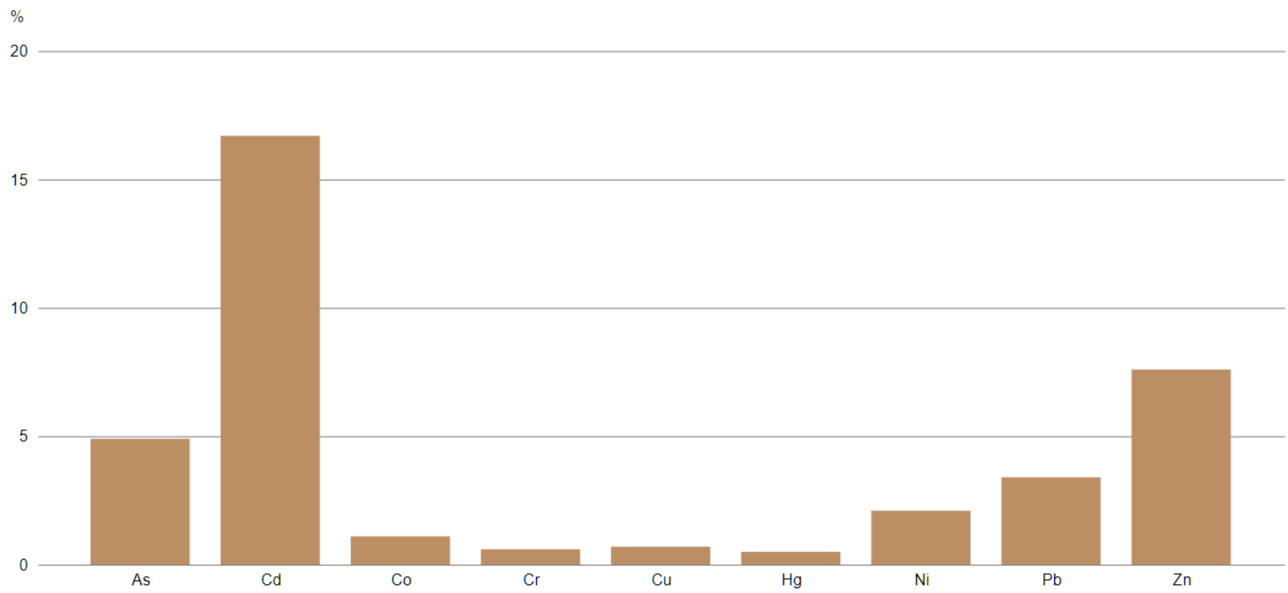
Data source: Central Institute for Supervising and Testing in Agriculture

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. A total of 638 sediment samples were assessed for the 1995–2022 period. The highest percentage of samples exceeding the limit values was recorded for PAHs (17.0% overall) and cadmium (17.0% of samples). 5% to 8% of the samples were found to be above the limit for arsenic, zinc and DDT, (Chart 107).

As part of the soil quality assessment, the pH value is also determined. The average soil reaction value for agricultural soil in Czechia for the 2017–2022 period was 6.0 pH (slightly acidic). The organic matter content of soils is also monitored, with 55.8% of agricultural land in 2022 having organic matter content in the low to lower medium category. The low humus content in the soil is influenced by intensive agricultural management with a predominance of mineral fertilizer application and low use of manure and compost. Erosion also contributes significantly to dehumidification.

Chart 107

Percentage of pond and river sediment samples exceeding limit values in Czechia [%], 1995–2022



Results of long-term monitoring of soil inputs (sediments). Hazardous elements 1995–2022, approximately 640 samples.

Data source: Central Institute for Supervising and Testing in Agriculture

The limiting factor of **forest land** 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. Due to natural conditions, most forest soils in Czechia are relatively poor in alkaline nutrients. In the past, forest soils were also 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[101]. According to data obtained using spatial models[102], 97.2% of forest soils in the top mineral layer (0–30 cm) and 89.1% of forest soils in the bottom mineral layer (30–80 cm) fall into the categories of high and extreme acidification risk, Fig. 27. The unfavourable state 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 in the damage system.

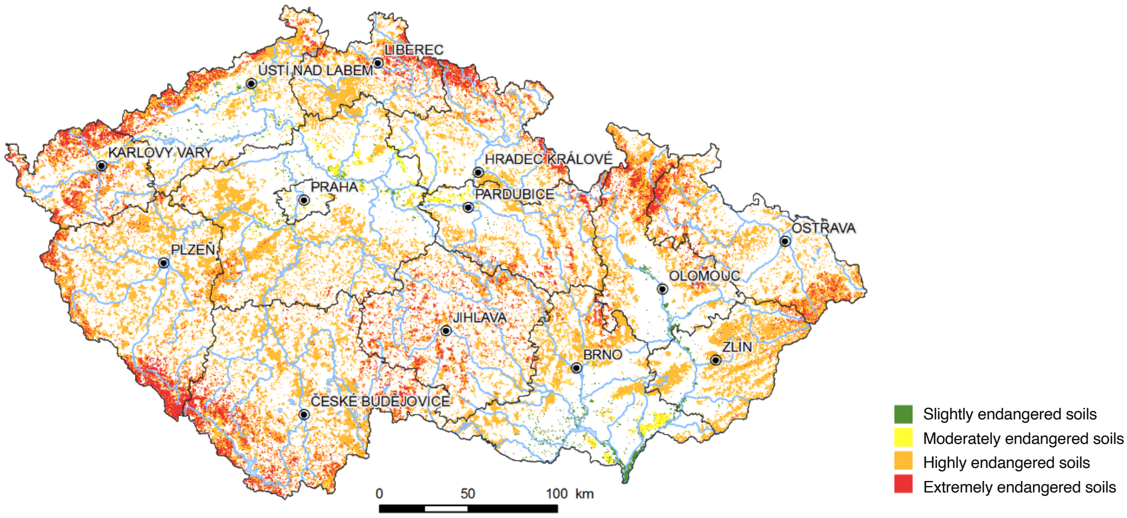
---

[101] *Šrámek V., Jurkovská L., Fadrhonsová V., Hellebrandová-Neudertová K., 2013: Chemistry of forest soils of the Czech Republic 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.*

[102] *Komprdová K. et al., 2021: Chemical properties of the top mineral layers of forest soils and threats to forest soils from acidification and nutrient degradation, a set of maps. Forestry and Game Management Research Institute Available from: https://www.vulhm.cz/files/uploads/2022/01/Chemicke%20vlastnosti%20%20svrchnich%20mineralnich%20vrstev%20lesnich%20pud%20a%20ohrozeni%20lesnich%20pud%20acidifikaci%20a%20nutricni%20degradaci_b.pdf*

Fig. 27

Acidification threat to forest soils in Czechia, 2021



Data for 2022 are not available at the time of publication.

Data source: Forestry and Game Management Research Institute

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. This process 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 very slow soil formation processes (it is estimated that the formation time of a 1 cm soil layer 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. tonnes 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[103]. 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 hectare 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 silting up of water reservoirs. Accelerated erosion is mainly caused by the cultivation of crops prone to erosion, monocultures, low amount 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 localised, high-intensity rainfall following periods of drought.

Water erosion, expressed by long-term potential soil loss (G)[104] higher than 2.1 t. per ha per year (i.e. above the lower limit of moderately endangered land), threatens 48.1% of the agricultural land fund (ALF), while

---

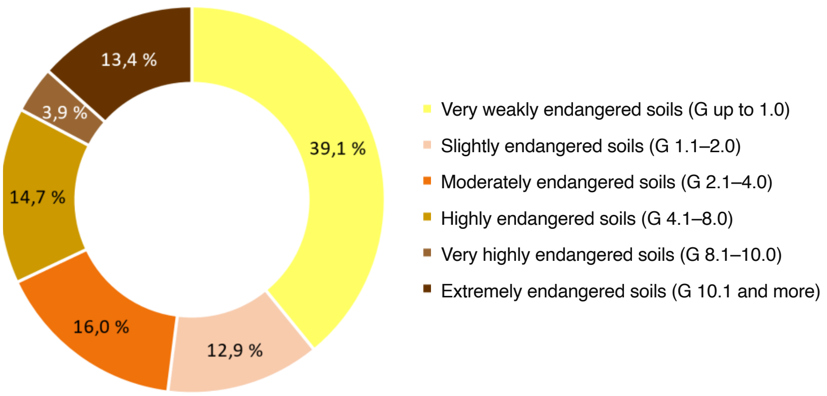
[103] *Panagos P., Standardi G., Borrelli P., Lugato E., Montanarella L., Bosello F. Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models. LandDegrad Dev. 2018; 29: 471–484. https://doi.org/10.1002/ldr.2879.*

[104] *The calculation of the average long-term soil loss G is based on the Universal Soil Loss Equation (USLE): G = R × K × L × S × C × 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 erosioncontrol practices efficiency rate (P).*

13.4% is at extreme risk (G higher than 10.1 t. per ha per year), Chart 108. The areas bordering the Moravian valleys and hills and uplands of Czechia are extremely endangered by water erosion in the long term (Fig. 28). 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 108

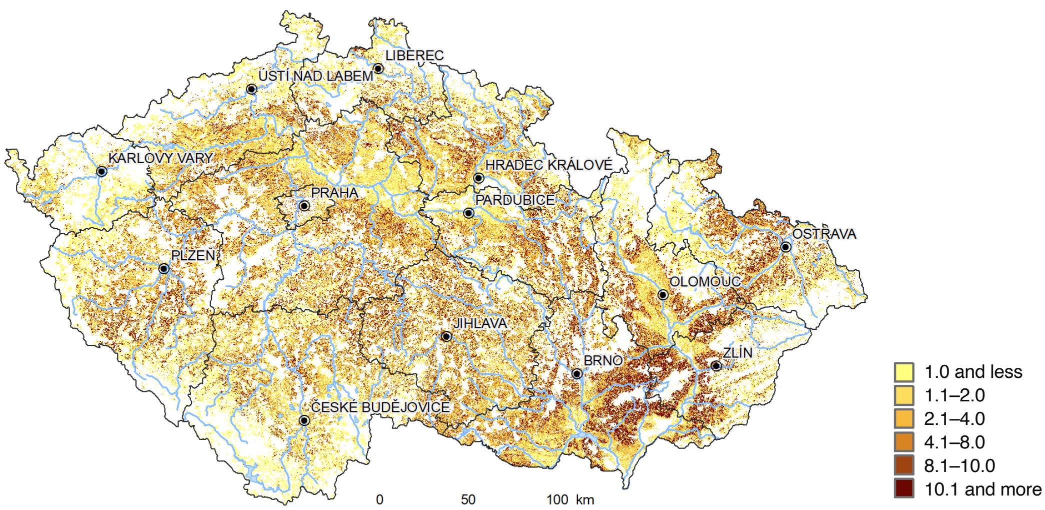
Potential vulnerability of agricultural land to water erosion expressed as the long-term average soil loss G in Czechia [% of agricultural land fund], 2022



Data source: Research Institute for Soil and Water Conservation

Fig. 28

Potential vulnerability of agricultural land to water erosion expressed by the long-term average soil loss G in Czechia [$t.ha^{-1}.year^{-1}$], 2022

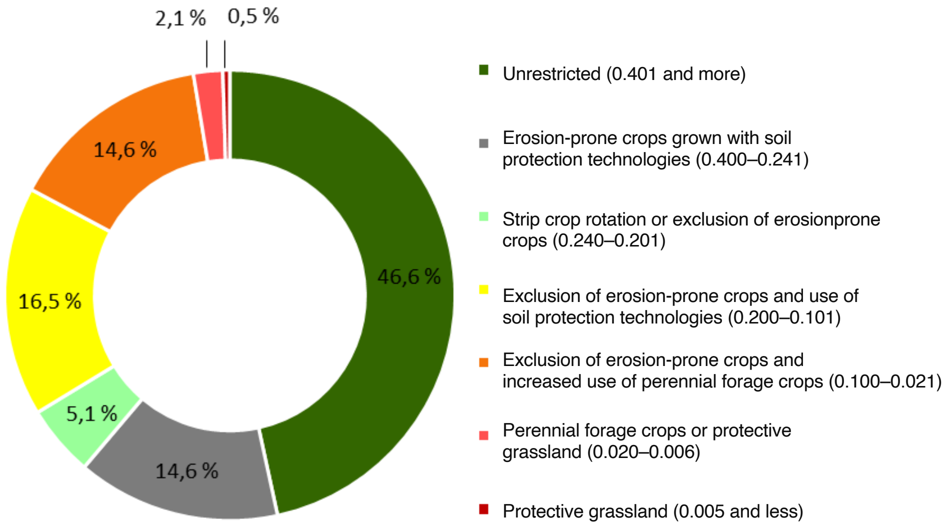


Data source: Research Institute for Soil and Water Conservation

The level of water erosion risk can also be expressed as the maximum admissible value of the protective vegetation influence factor and erosion control measures ($C_p.P_p$)[105]. 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 2022, erosion-prone crops could be grown on 66.3% of the area, of which 46.6% could be grown without restrictions and 14.6% with soil protection technologies (Chart 109). The cultivation of erosion-prone plants was conditioned by strip crop rotation on 5.1% of the area. The exclusion of erosion-prone crops was recommended for 31.1% of the area. Of this, 16.5% of the area included a recommendation to use soil conservation technologies and 14.6% included a higher proportion of perennial forage crops. On the remaining 2.6% 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, 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 (Fig. 29). 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.

<u>Chart 109</u>

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 Czechia [% of agricultural land fund], 2022

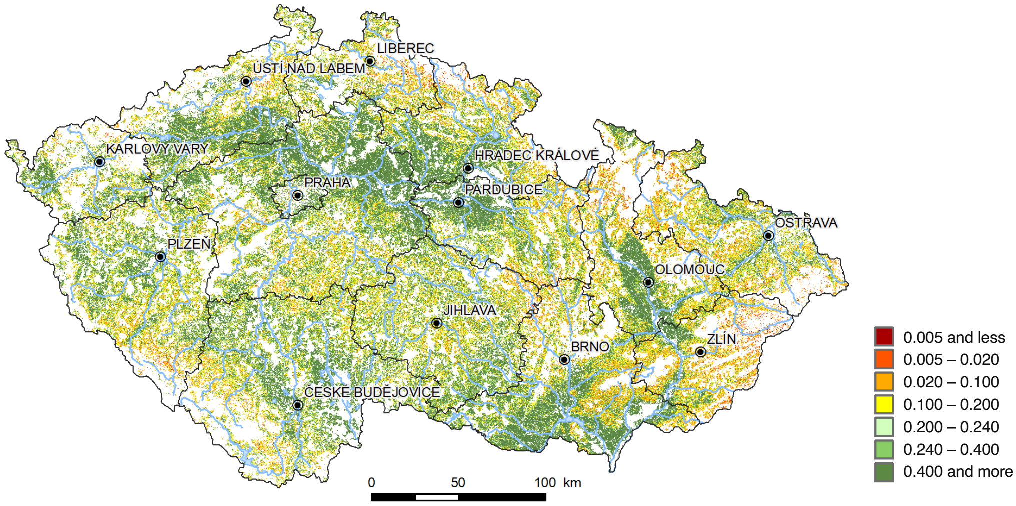


Data source: Research Institute for Soil and Water Conservation

[105] *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 (Gp), 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 (Pp).*

Fig. 29

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 Czechia, 2022

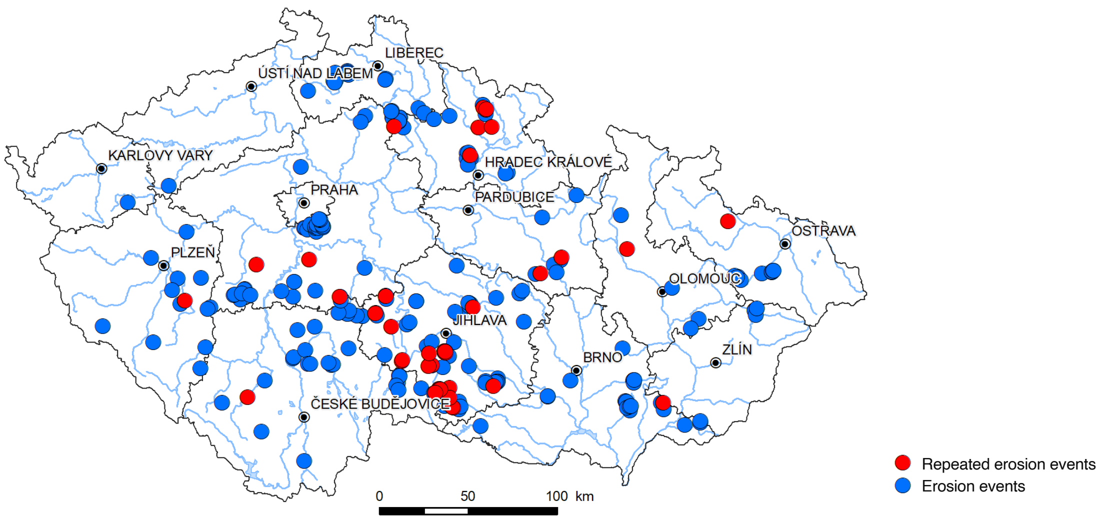


Data source: Research Institute for Soil and Water Conservation

The **number of recorded erosion events** (266)[106] was average in 2022 due to the balance of temperatures and precipitation throughout the year, similar to 2021. In the long term, the highest number of erosion events (24.7% in 2022, Fig. 30) occurs in the Vysočina Region, most often in areas with maize (46.5% of recorded erosion events). However, the introduction of effective soil conservation technologies should be carried out regardless of the type of crop. The majority of erosion events occur on parts of soil blocks without applied soil conservation technologies, and especially on soils without cover with no crop growth yet incorporated. Thus, measures to increase soil roughness and soil cover, to root the soil and to increase the stability of soil aggregates at the time of sowing the main crop are key.

Fig. 30

Recorded erosion events on agricultural land in Czechia, 2022



Data source: Research Institute for Soil and Water Conservation

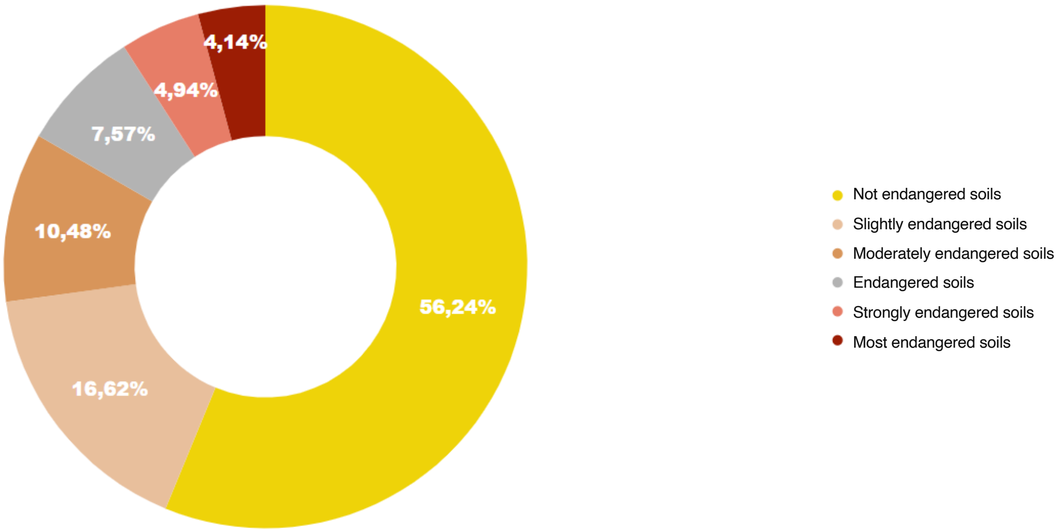
---

106 *An overview of recorded erosion events is available on the web portal for monitoring agricultural soil erosion: https://me.vumop.cz/app/*

In 2022, 33.3% of agricultural land was potentially endangered **by wind erosion**[107] and of this, 4.1% were the most endangered soils, located mainly in South Moravia and Polabí (Chart 110, Fig. 31). 56.2% of 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.).

Chart 110

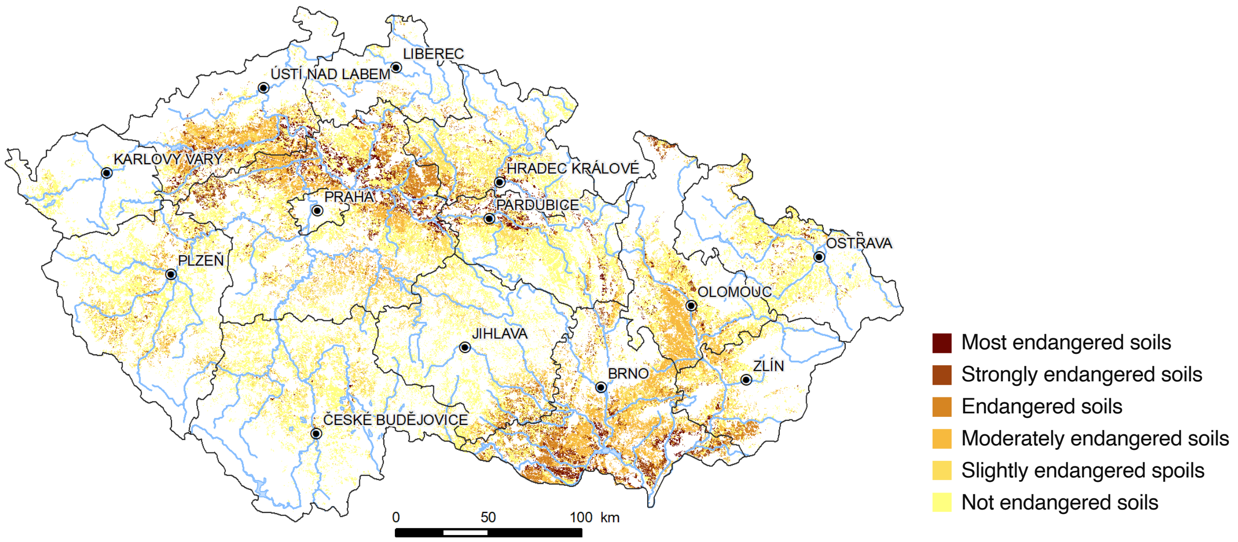
Potential vulnerability of agricultural land to wind erosion in Czechia [% of agricultural land fund], 2022



Data source: Research Institute for Soil and Water Conservation

Fig. 31

Potential vulnerability of agricultural land to wind erosion in Czechia, 2022



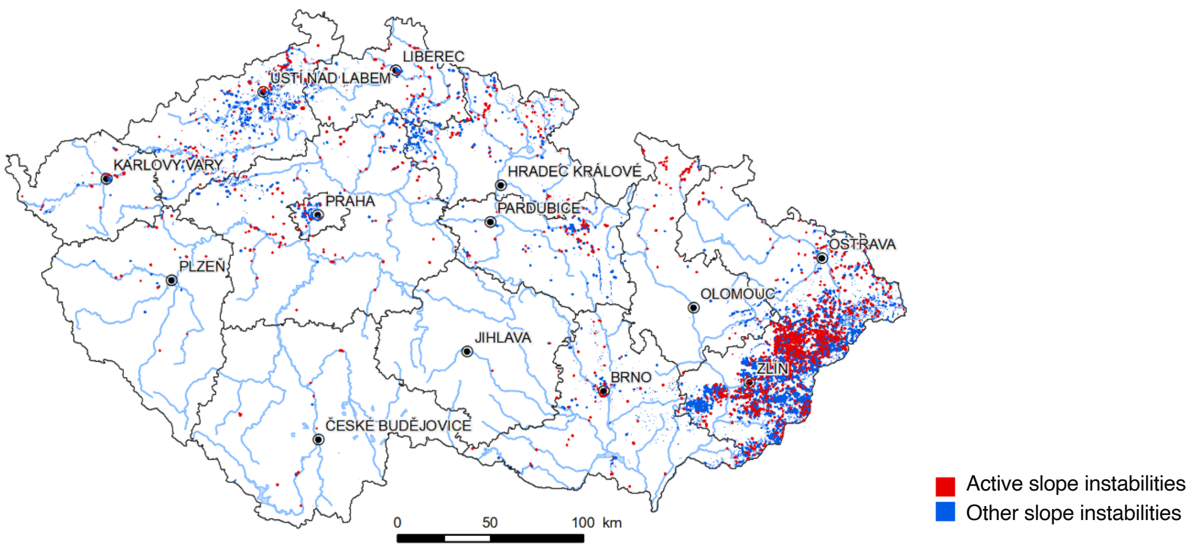
Data source: Research Institute for Soil and Water Conservation

[107] *The methodology of 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 resultingassessment 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 (Fig. 32). In 2022, a total of 23,172 slope instability objects were registered in the Register of Slope Instabilities of Czechia. The total area of landslides was 93.4 thous. ha, of which active landslides, considered the most serious sources of risk, accounted for 4.4 thous. ha. The area of slope instabilities has been increasing for a long time 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[108].

Fig. 32

Landslides and other dangerous slope instabilities in Czechia, 2022



Data source: CGS

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.

Consumption of fertilisers and plant protection products

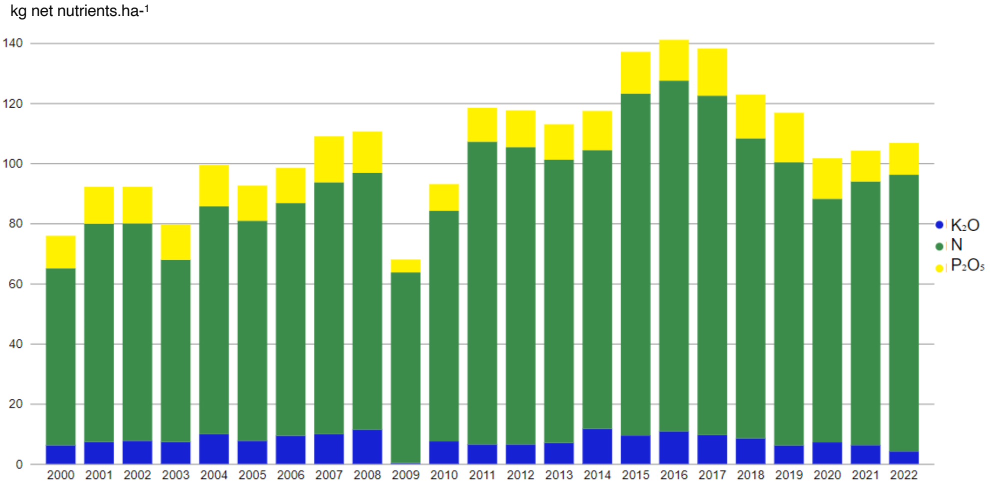
Compared to 2000, the **consumption of mineral fertilisers** has increased gradually (by 40.7%). There was a downward trend from 2017 to 2021. However, a slight increase of 2.5% compared to the previous year to 106.8 kg net nutrients per ha occurred in 2022 (Chart 111). An increase was recorded compared to 2021 in the consumption of nitrogen fertilisers, by 4.9% to 92.0 kg per ha, and in the consumption of phosphate fertilisers (by 3.5% to 10.6 kg per ha). Potassium fertiliser consumption fell by 32.9% year-on-year to 4.2 kg

[108] *As of 31 December 2022, 20% of the territory of the Czech Republic has been mapped.*

per ha. In terms of the composition of mineral fertiliser consumption, nitrogen fertilisers clearly predominate, accounting for 86.1% 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 111

Mineral fertiliser consumption in Czechia [kg net nutrients.ha^{-1}],2000–2022

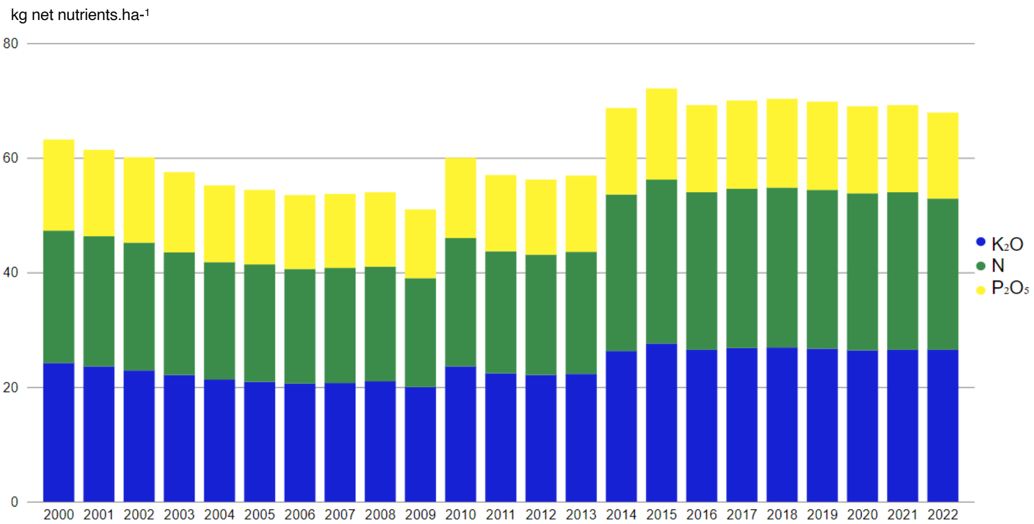


Source: MoA

Manure consumption has remained relatively flat since 2014 (Chart 112). In 2022, 26.4 kg of N, 15.0 kg of P_2O_5 and 26.5 kg of 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 2022, the total net nutrient input from manure and organic fertilisers was 67.9 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 112

Consumption of manure and organic fertilizers in Czechia [kg net nutrients.ha^{-1}],2000–2022



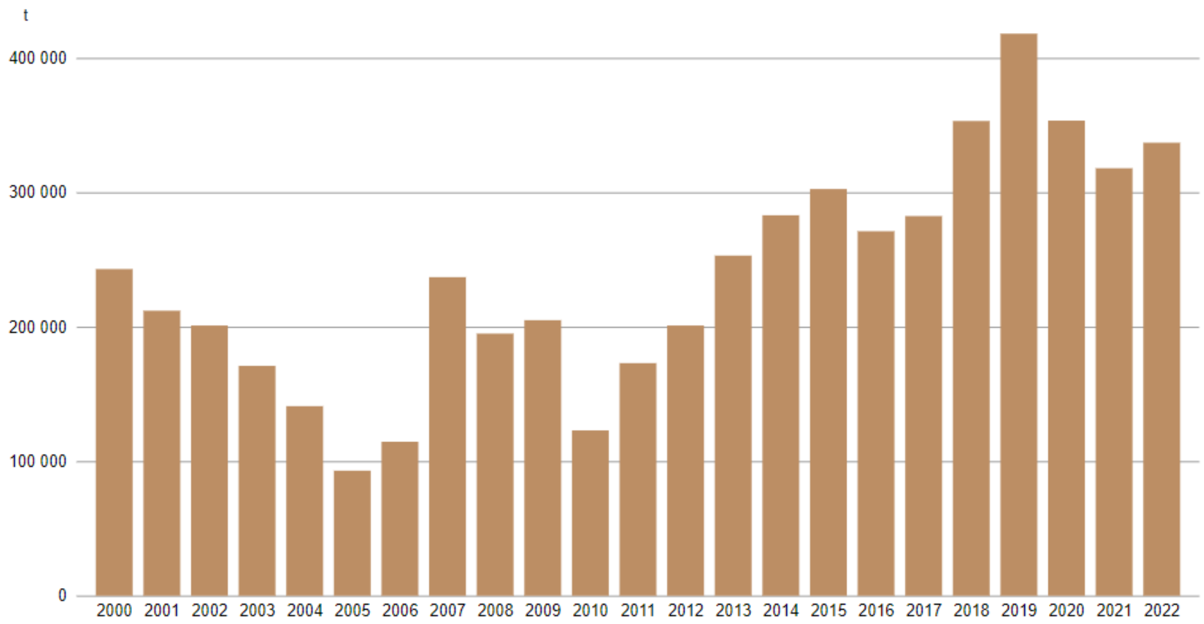
Since 2014, the nutrient input in the digestate is also counted. At the same time, part of the manure (mainly slurry, but also dung) is deducted, forming the feedstock for biogas plants.

Source: MoA

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 2022, a total of 337.0 thous. tonnes of calcium compounds were consumed. This resulted in a year-on-year increase of 6.0% (Chart 113). 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 2016–2021 period[109] was 6.0 pH (i.e. slightly acidic). The share of alkaline soils (with a pH higher than 7.2) was only 11.5% of the agricultural land area, the share of soils with neutral pH was 15.2%, and 73.3% of soils had weakly to extremely acidic soil reaction in the period under review.

Chart 113

Consumption of calcium compounds in Czechia [t], 2000–2022



Source: MoA

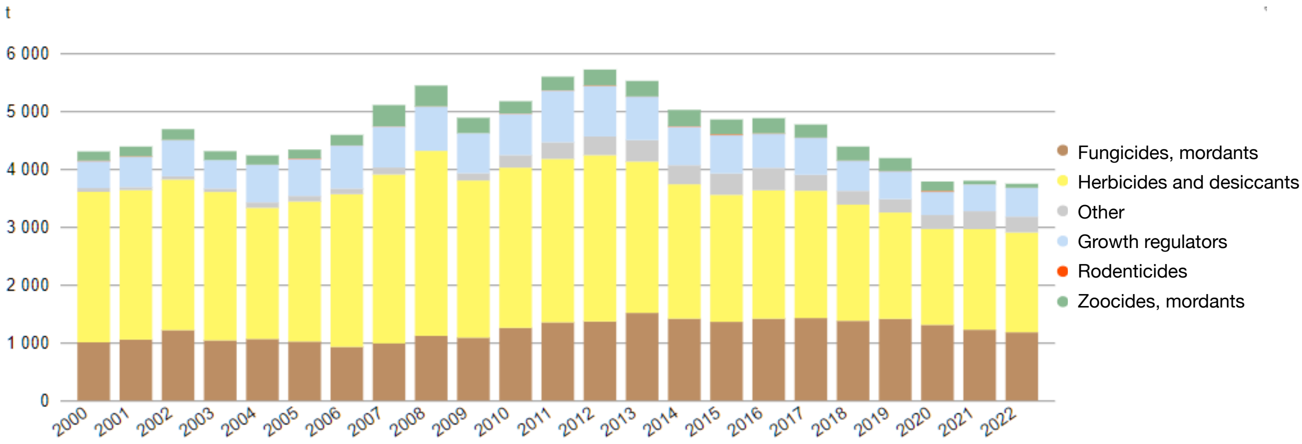
The consumption of plant protection products is influenced by the actual occurrence of crop diseases and pests in a given year, and this varies according to the weather patterns during the year. The consumption of active substances in plant protection products has fallen by 13.0% since 2000. In 2022, it amounted to 3,745.2 t of active substances, 1.4% less than in 2021 (Chart 114). Herbicides and desiccants accounted for the largest share of total consumption (40.0%), followed by fungicides and mordants (31.5%) and growth regulators (13.3%).

---

109 *Data for the year 2022 are not available at the time of publication.*

Chart 114

Consumption of active substances in plant protection products and other products by purpose of use in Czechia [t of active substance], 2000–2022



**Other – excipients, repellents, mineral oils, etc.*

Source: Central Institute for Supervising and Testing in Agriculture

In the individual categories of plant protection products, there were no major changes in consumption year-on-year. Year-on-year growth was recorded in the consumption of active substances in the category of **zoocides and mordants** (by 10.8%). As regards the consumption of insecticide-based active substances, there was a slight increase in consumption, which can be attributed to the banning of chlorpyrifos, chlorpyrifos-methyl and imidacloprid active substances in previous years, with the effect of increasing the consumption of pyrethroid-based active substances, which have lower efficacy and require repeated applications. The ban on the above-mentioned substances, together with the termination of the active substance indoxacarb in 2022, thus contributes to increased inputs, as these substances are widely used in field crops for the control of insect pests of rapeseed and viral vectors in cereal crops, the pressure of which is increasing year by year.

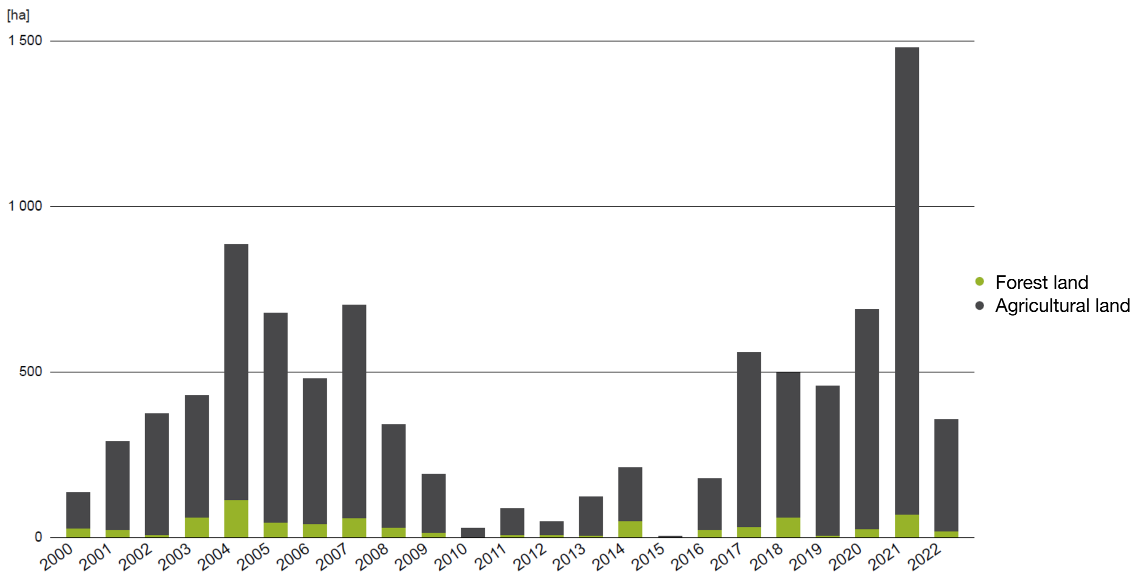
Excessive use of plant protection products, as well as mineral fertilisers, contributes to the deterioration of soil quality, a decline in the biodiversity of soil micro-organisms and negative impacts on the quality of surface and groundwater. Measures and targets to reduce the adverse effects of plant protection products are defined in the National Action Plan for the Safe Use of Pesticides in the Czech Republic for 2018–2022.

Land take

Soils are also degraded by land take for road infrastructure construction. In 2022, a total of 355.74 ha of agricultural and forest land was taken for road infrastructure (Chart 115).

Chart 115

Land take for road infrastructure in Czechia [ha], 2000–2021



Data source: Transport Research Centre

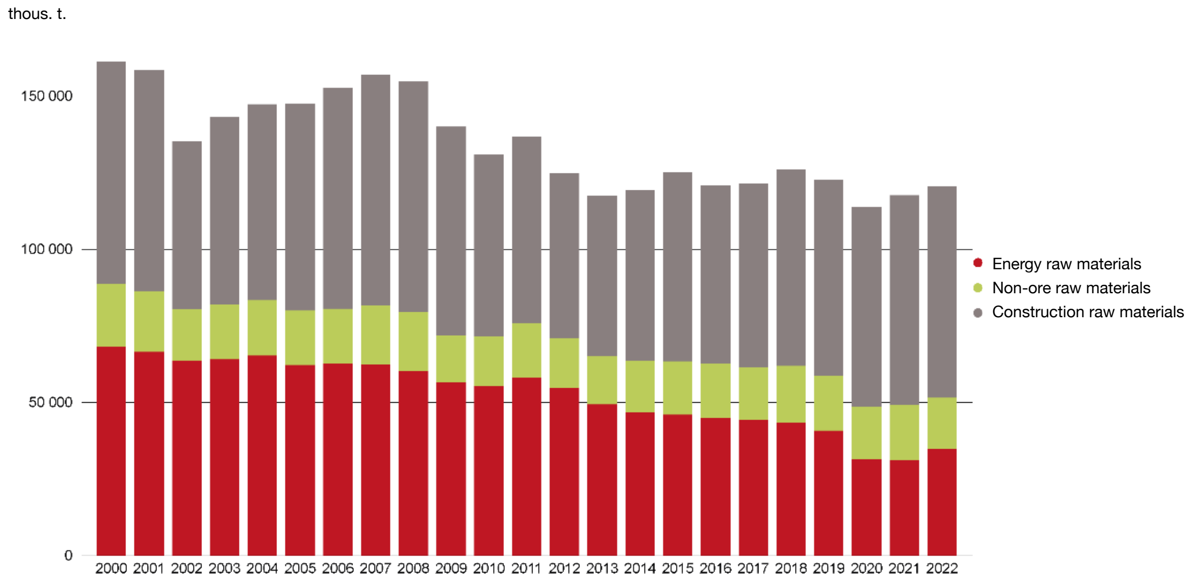
Mineral extraction and reclamation

Extraction of mineral resources can cause significant soil degradation as it moves large volumes of rock in the extracted deposits. However, the extraction of raw materials is essential for providing materials and energy for industry, construction and other sectors of the economy. Thanks to the rich deposits in the territory, mining in Czechia has a long tradition dating back to the Middle Ages.

All raw material extraction can be divided into four basic groups: energy raw materials, construction raw materials, non-ore raw materials and ores. In Czechia, construction and energy raw materials are extracted in the largest volumes, and non-ore raw materials to a lesser extent (Chart 116). Ore extraction is no longer carried out on the territory of Czechia; being terminated for economic reasons in the 1990s. This extraction was for iron ore and non-ferrous metal ores.

Chart 116

Mineral extraction in Czechia [thous. t], 2000–2022

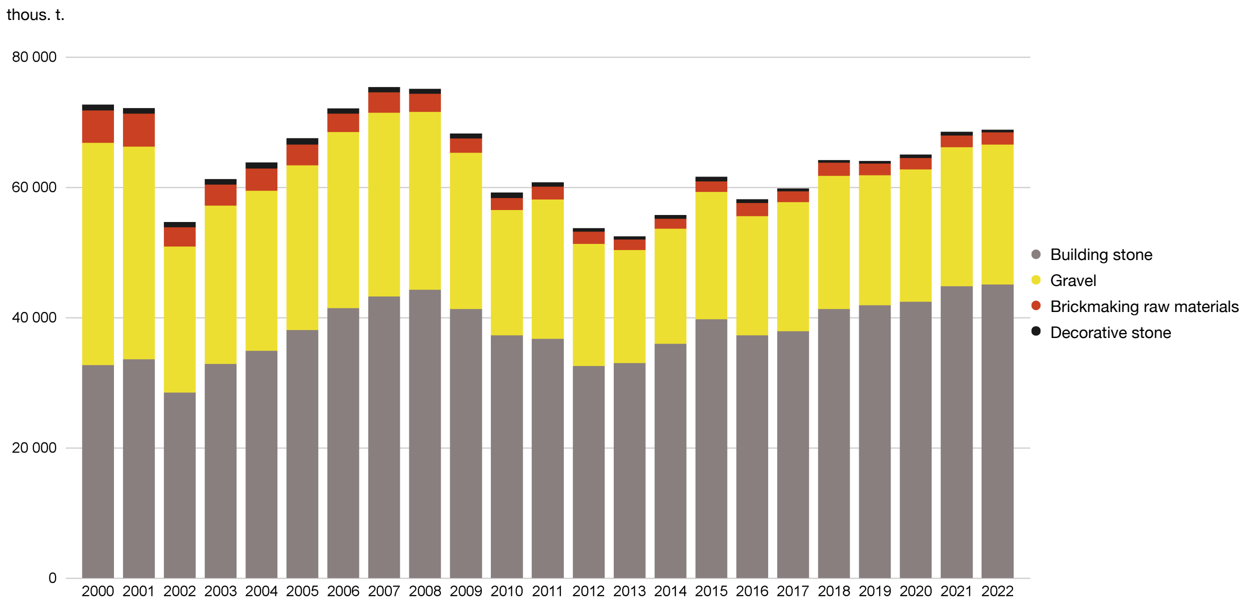


Data source: CGS

The extraction of **construction raw materials** includes mainly building stone and gravel, and to a lesser extent brickmaking and decorative stone materials (Chart 117). The volume of construction raw materials extraction in 2022 was 68.8 mil. tonnes, an increase of 0.5% year-on-year, 5.3% 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 117

Extraction of construction raw materials in Czechia [thous. t], 2000–2022



Data source: CGS

Of **energy raw materials,** coal is mainly extracted (Chart 118) in Czechia. Lignite is extracted at the surface 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 domestic consumption, but since 2017, the decline in coal extraction has meant imports of these raw materials from abroad have outweighed exports.

In 2022, 33.4 mil. tonnes of **brown coal** were extracted, which is 14.1% more than in the previous year. The year-on-year increase was the result of shortages and high natural gas prices, which led to increased use of coal-fired power plant capacity. While extraction in 2022 surpassed the 2020 and 2021 results affected by the COVID-19 pandemic, this is only a short-term blip that does not affect the long-term trend of declining extraction.

However, **hard coal** extraction continues to decline, falling by 92.5% from 2000 to 2022, and by 30.0% year-on-year to 1.3 mil. t. **Lignite** extraction in 2000 was 453.0 thous. t, but its extraction gradually declined and since 2010 this raw material is no longer extracted in Czechia.

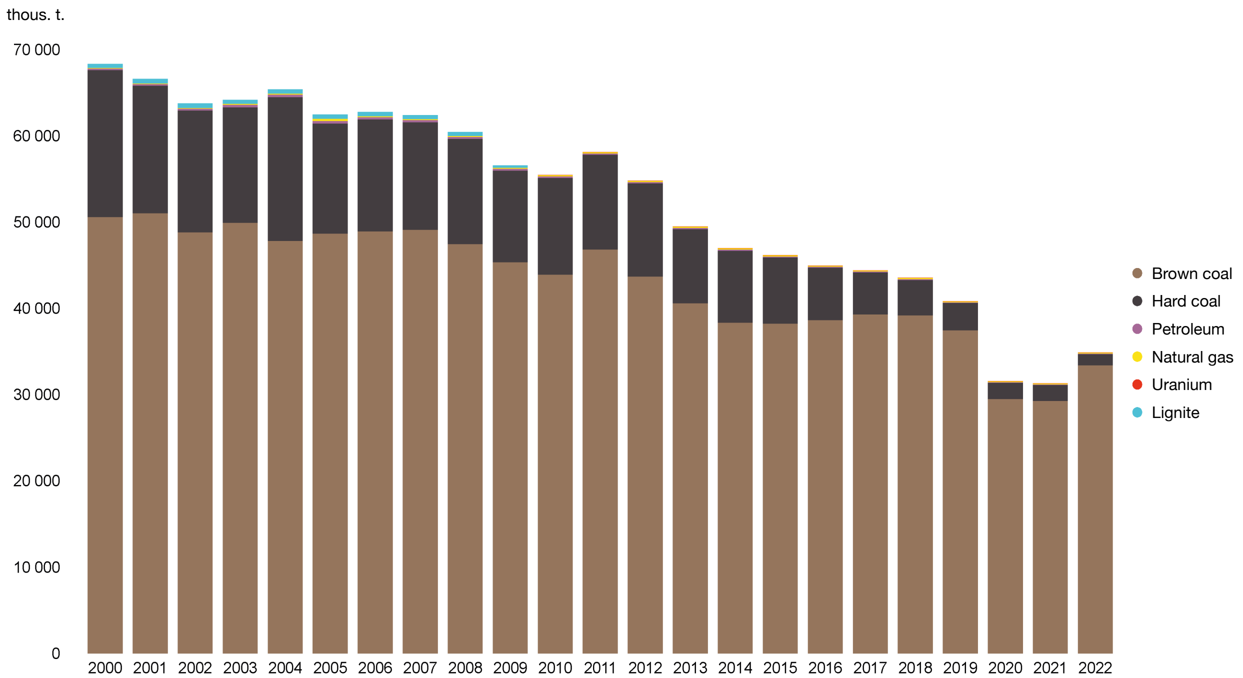
In Czechia, **oil** is extracted in South Moravia in the Vienna Basin and to a lesser extent in the Moravian-Silesian Region in the Carpathian Foothills deposit area. Oil extraction accounts for approximately 1.5% of domestic consumption. Oil extraction fell by 55.3% in the 2000–2022 period, with a year-on-year decline of 8.9% between 2021 and 2022 to 75.1 thous. t.

Natural gas resources are located in the areas of South and North Moravia and, as with oil, are insufficient. Domestic production covers approximately 2.5% of domestic natural gas consumption. In 2022, 164.9 mil. m^3 (120.4 thous. t) of natural gas were extracted, which is 39.7% more than in 2000 and 8.0% more than in 2021.

After the closure of the last uranium mine, Rožná, in 2017, **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 21 t between 2000 and 2022 (a 95.8% decrease), with a 22.2% annual decrease in 2022.

Chart 118

Extraction of energy raw materials in Czechia [thous. t], 2000–2022



Data source: CGS

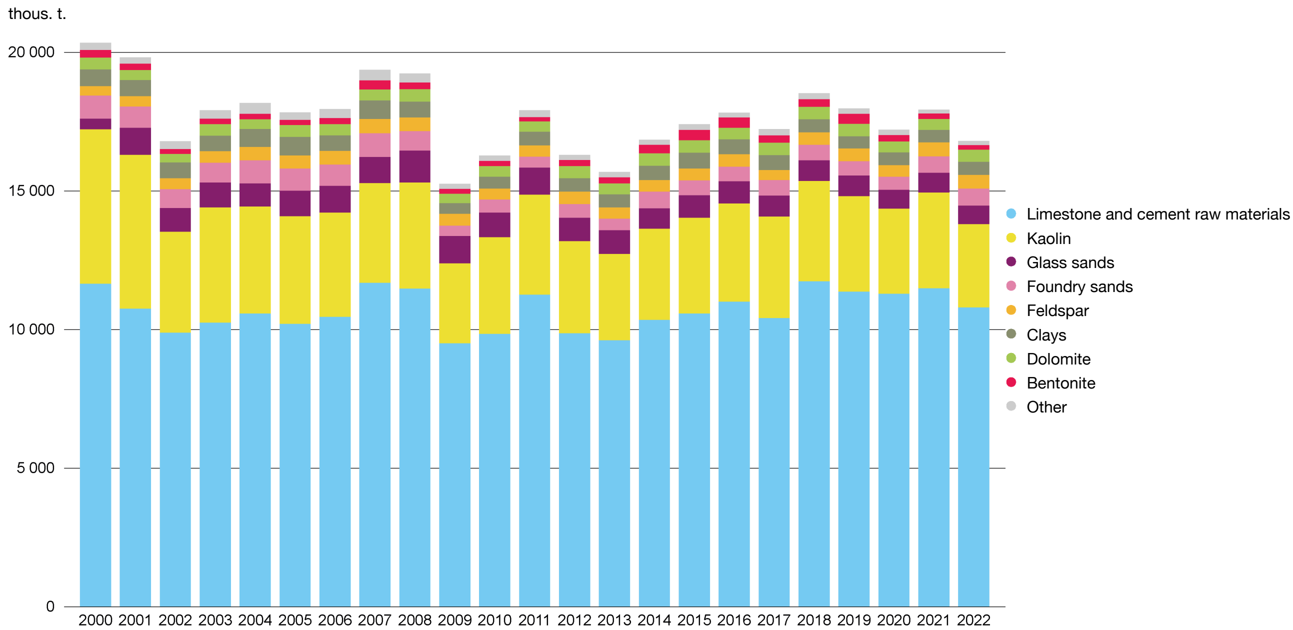
The term **"minerals"** refers to what we may call "industrial minerals". They are used in industry or are extracted from non-metals or their compounds.

Limestone and cement raw materials are used in the construction industry. Their extraction fluctuates, with 10.8 mil. tonnes produced in 2022, a 6.1% 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 5th in global kaolin extraction, its share in global production is approximately 7%. In 2022, kaolin production in Czechia was 3.0 mil. t.

Mineral extraction in Czechia fluctuated in the 2000–2022 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 2021–2022 period was 6.3%, but this is a significant decline of 17.4% from 2000 (Chart 119).

Chart 119

Mineral extraction in Czechia [thous. t], 2000–2022



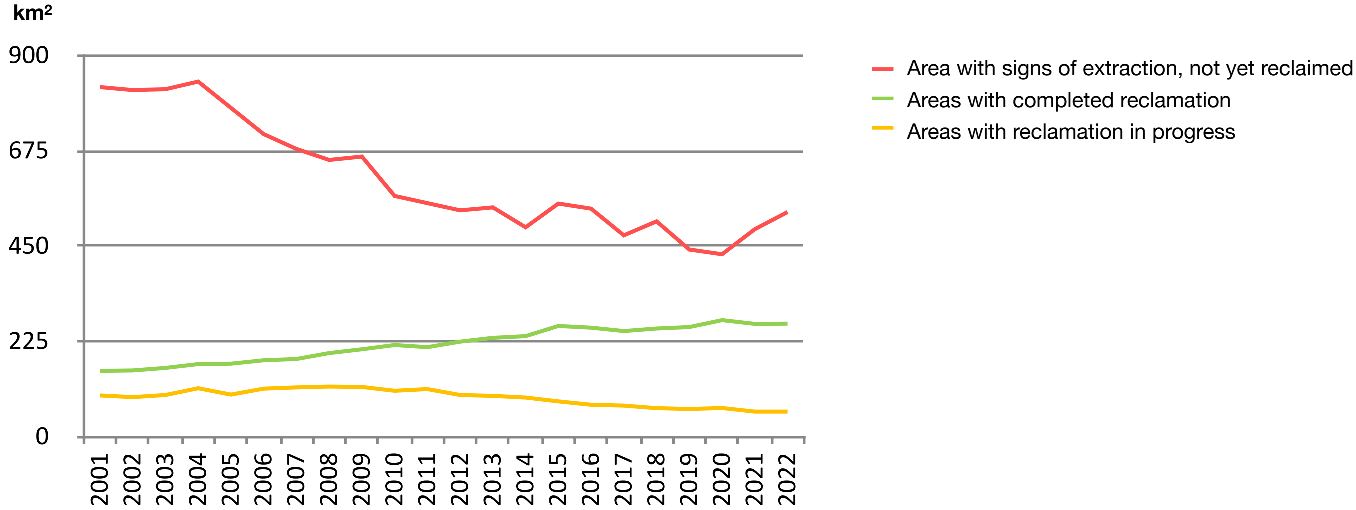
Data source: CGS

Mineral extraction has a **significant impact on the environment**, as it affects the natural environment, disturbs the landscape and conditions for the existence of animals and plants, and degrades the quality of surface and groundwater. It is therefore necessary 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 (Chart 120) has been gradually decreasing since 2001, but has increased slightly in the last two years as extraction of construction raw materials increased in 2021 and then of energy raw materials in 2022. In 2022, there were a total of 530.0 km^2 of unreclaimed land (825 km^2 in 2001). By contrast, in 2022 there were 266.5 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 120

Reclamation after mineral extraction in Czechia [km²], 2001–2022



Data source: CGS

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

✓	Forest regeneration is taking place in areas affected by the bark beetle calamity. The total area of regeneration in 2022 (50.1 thous. ha) was almost at the same level as the value in 2021 (49.8 thous. ha), while the area of natural regeneration reached a record 10.1 thous. ha and its share of the total area of forest regeneration rose to 20.2%; the long-term trend continues to fluctuate.
~	The agricultural landscape is vulnerable to degradation due to excessive soil blocks and a high degree of ploughing; however, it is being grassed over and the average size of soil blocks decreased at an average rate of 0.8% per year between 2010 and 2022. In the long term, it is possible to observe a gradual approach to a more natural (and stable) structure and species composition of forest stands. The share of deciduous trees increased to 28.7% in 2022. However, this process is slow due to the long production cycle of the forest and requires many years of intensive effort. 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; however, in 2022, the ratio reversed again in favour of conifers, which were reforested on 20.2 thous. ha, at the expense of deciduous trees, which were reforested on 19.8 thous. ha. The most frequently planted tree species was still spruce (12.7 thous. ha).
✗	Damage to forest stands expressed as a percentage of defoliation remains high and trends are negative in the long term. In the category of older stands (60 years and older), the sum of defoliation classes 2–4 was 80.5% for conifers and 40.7% for deciduous trees. In younger stands (up to 59 years) the situation is more favourable, with 29.5% of conifers in classes 2–4 and 26.3% of deciduous trees. In 2022, large-scale logging continued after the bark beetle calamity. However, for the second year in a row since it began in 2015, the volume of logging carried out decreased year-on-year to 25.1 mil. m^3 of wood without bark, bringing the volume of logging back to approximately the 2018 level. The share of incidental (calamity-related) logging in total logging decreased to 78.8%, which is still a very high value indicating the course of the bark beetle calamity. Large areas of clearings have been created by large-scale logging, so forests temporarily capture greenhouse gases at a reduced rate and, according to the methodology used to calculate greenhouse gas balances, forests are identified as a source of greenhouse gas emissions. Permanent crops, which can make a significant contribution to increased biodiversity, occupy only 1.1% of the area of organically managed land in organic farming and, despite the target of a 10% increase by 2027 compared to the initial year 2021, there has been no significant year-on-year increase.

Assessment of the trend and state of indicators

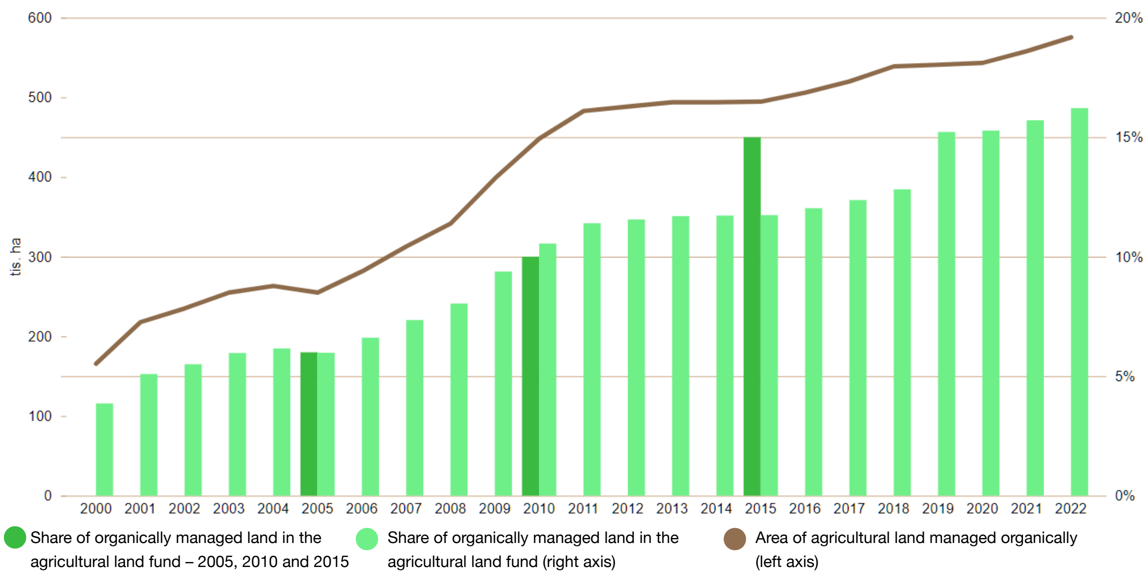
Indicator	Long-term trend (15 years and more)	Medium-term trend (10 years)	Short-term trend (5 years)	State
Organic farming	↗	↗	↗	~
Average size of fields	N/A	↘	↘	✕
Forest health condition	↘	↘	→	✕
Sustainable forest management	→	~	→	~
Species composition of forests	↗	↗	↗	✕

Organic farming

Organic farming is one way to maintain and improve soil fertility and ecological functions. The area of **organically managed land** (Chart 121) has increased significantly since 2000 thanks to subsidy support, from 165.7 thous. ha to 575.5 thous. ha in 2022, with a year-on-year increase of 17.3 thous. ha in organically farmed land. The share of organically managed land in the agricultural land fund (ALF) registered in the LPIS in 2022 was 16.2%.

Chart 121

Area and share of organically managed land in agricultural land in Czechia [thous. ha, %], 2000–2022



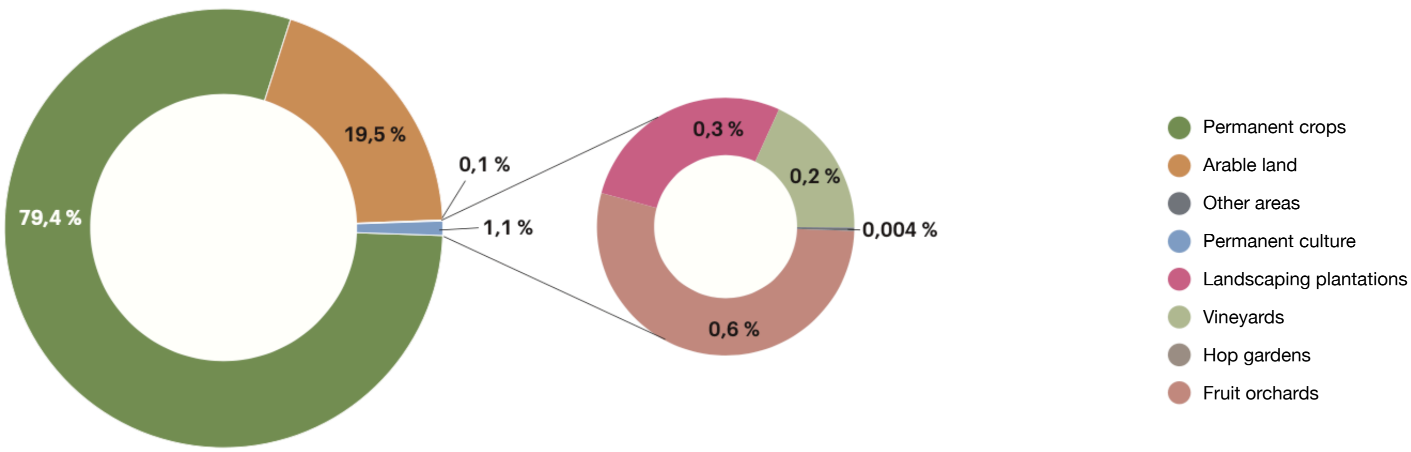
Until 2018 (inclusive) the share of organically managed land in the total agricultural land in the ALF is calculated, from 2019 it is the share of organically managed land in relation to the total land in the ALF registered in the LPIS.

Source: Institute of Agricultural Economics and Information

The largest share of the **structure of organically managed land** is permanent grassland (PG), which in 2022 occupied 79.4% (457.0 thous. ha), followed by arable land, which occupied 19.5% (112.0 thous. ha) in 2022, Chart 122. Although the area of organically farmed arable land is slowly growing, the target of achieving a 30% share of arable land in the ALF set out in the Action Plan for Organic Farming in 2021–2027 will not be met if the current trend is maintained. The rest of the area of organically managed land is made up of permanent crops (vineyards, orchards, hop farms) with a share of 1.1%, and other areas (0.1%). 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 sustainable management and use of agricultural land.

<u>Chart 122</u>

Structure of the land fund in organic farming in Czechia [%], 2022



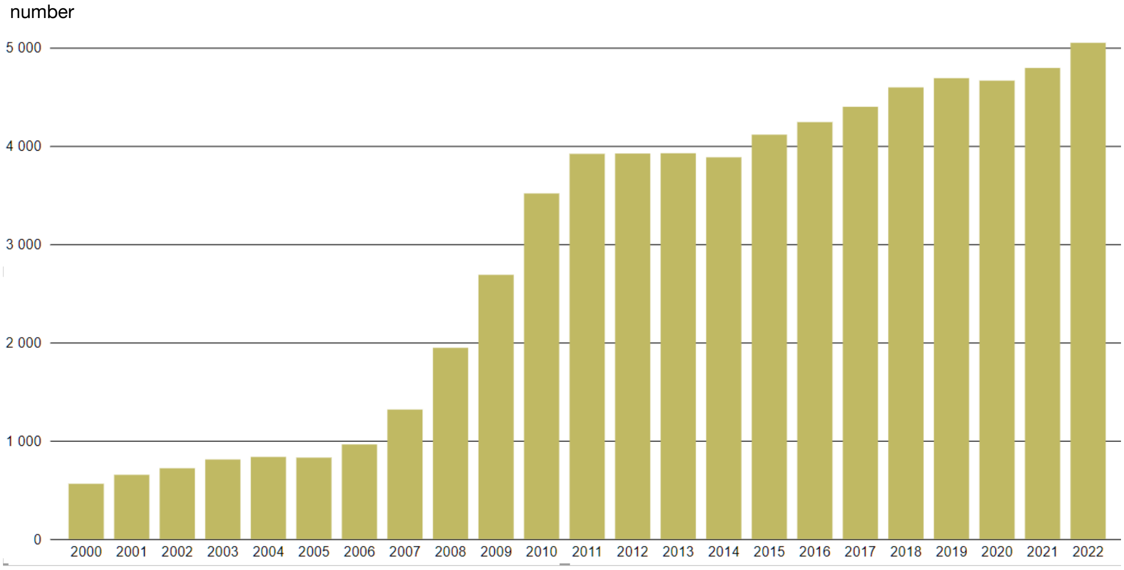
The category Other areas includes areas of fast-growing trees and nurseries, wooded land and ponds.

Source: Institute of Agricultural Economics and Information

Since 2000, the number of **organic farming entities (ecofarms)** farming according to established organic principles increased significantly, from 563 to 5,050 entities in 2022 (Chart 123). After a period when the number of eco-farms stagnated between 2011 and 2014, mainly due to the closure of the entry of new applicants into the title "Organic farming" under agri-environmental measures since 2011, the number of eco-farms has been growing again since 2015. In 2022, 265 more eco-farms were registered than in 2021. The total number of organically reared animals was 439.3 thous. head in 2022, while cattle farming significantly predominated with a share of 63.7%.

Chart 123

Number of organic farming entities in Czechia [number], 2000–2022

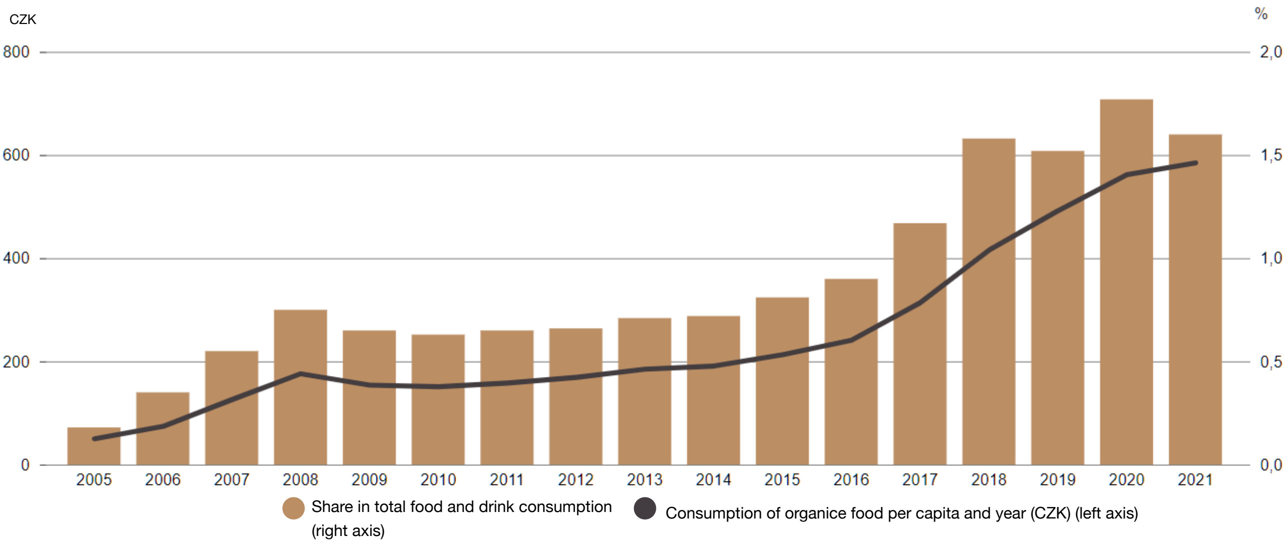


Source: Institute of Agricultural Economics and Information

The number of **organic food producers** has also been increasing in the long term. While in 2001 there were 75 organic food producers, in 2021[110] there were 990 producers. Despite the growing trend, the Czech organic food market is still underdeveloped – the average annual per capita consumption of organic food in 2021 was CZK 585 and the share of organic food in total food and beverage consumption was 1.6% (Chart 124). Apart from the still relatively high average price of organic food, this is mainly due to the underdeveloped marketing and distribution network for organic products, as well as the underdeveloped processing sector. A large share of organic food is imported, with distributor imports accounting for around 59% in 2021.

Chart 124

Organic food consumption in Czechia [CZK, % of total food and beverage consumption], 2005–2021



Data for 2022 are not available at the time of publication.

Data source: Institute of Agricultural Economics and Information

110 *Data for 2022 are not available at the time of publication.*

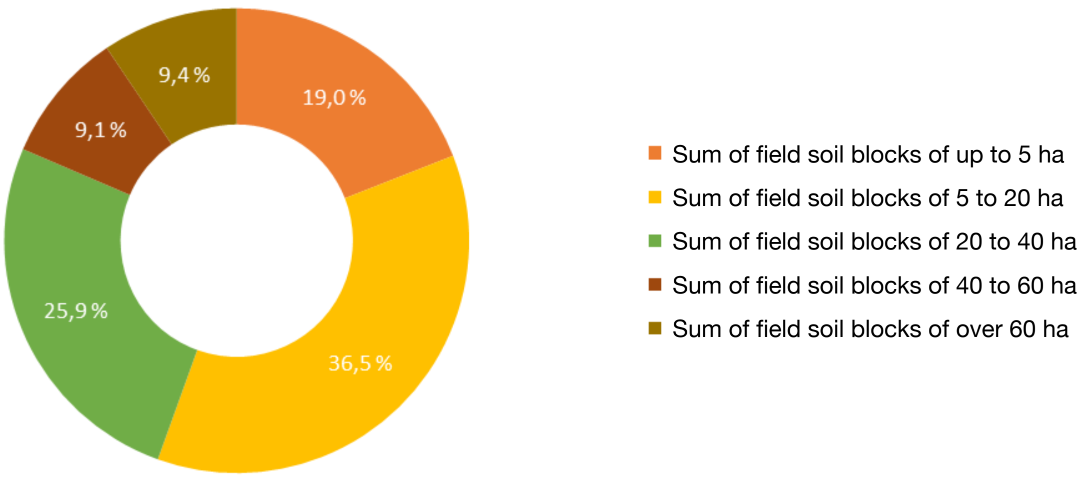
Average size of fields

Czechia has one of the largest fields in Central Europe[111], a result of the collectivisation and intensification of agriculture that took place in the 1940s and especially in the 1950s[112]. 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 relatively 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 large fields on agricultural ecosystems can also be compounded by inappropriate management of individual soil blocks, 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 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 grassing are suitable solutions).

While in 1948 the average size of a field soil block was 0.23 ha, in 2022 the average size of **field soil blocks** (FSB)[113] was 5.5 ha. However, the average size of the FSB has been declining, decreasing by an average of 0.8% per year between 2010 and 2022. In 2022, there were a total of 644.0 thous. FSB in Czechia with a total area of 3 548.2 thous. ha (Chart 125). The largest part of this area (36.5%) was represented by FSBs in the 5–20 ha category. There are 3,952 ha of the largest FSBs of 60 ha or more, and these cover an area of 335.0 thous. ha (19.4%). The representation of FSBs depends on the type of agricultural and settlement structure in each region. The largest FSBs are in the Karlovy Vary Region (average 7.9 ha) and the smallest in the Liberec Region (average 3.7 ha).

Chart 125

Proportion of size categories of field blocks in the total area of agricultural land in Czechia [%], 2022



Data source: MoA

111 *Lesiv, Myroslava, et al. Estimating the global distribution of field size using crowdsourcing. Global change biology. 2019. 174–186. https://doi.org/10.1111/gcb.14492*

112 *Lerman, Zvi. Agriculture in transition economies: from common heritage to divergence. Agricultural economics. 2001. 95–114. https://doi.org/10.1111/j.1574-0862.2001.tb00057.x*

113 *A FSB 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 field and on which a natural or legal person carries out agricultural activity on its 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.*

According to the LPIS public land register database from 2022, the most highly represented **categories of agricultural land** are arable land (68.8%) and permanent grassland (28.4%). The area of all other categories together amounts to 2.8% of the total agricultural soil area. Within agricultural land, there is a noticeable decrease in arable land and an increase in the area of permanent grassland (PG). In the 2005–2021 period, the total area of registered grassland in LPIS increased by 146.7 thous. ha (17.0%). However, in 2022 it slightly decreased year-on-year (by 2.8 thous. ha; 0.3%). Grassing is supported by the state subsidy policy and the application of the principles of the Common Agricultural Policy 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.

Landscape elements are also an important part of the agricultural landscape, contributing to the preservation of biodiversity, having an important anti-erosion function and co-creating its character. In 2022, ecologically significant elements (ESE) occurring within agricultural land with a total area of 13.1 thous. ha (0.4% of agricultural land) were registered in LPIS.

Forest health condition

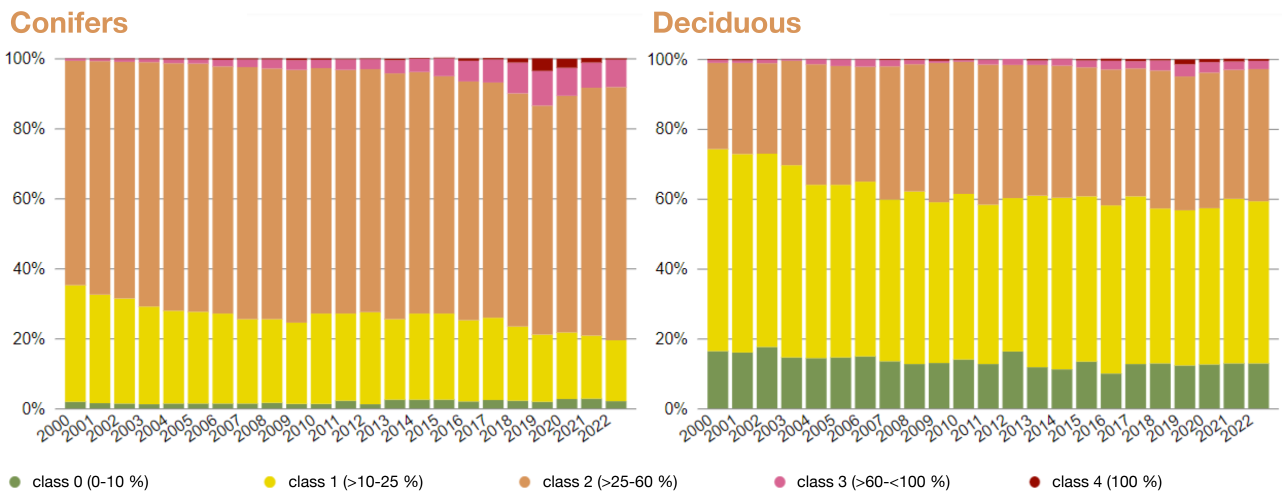
In the long term, forest land covers roughly one third of Czechia's territory and is expanding slightly. **Forest ecosystems** are thus an important element for the whole landscape, and forestry is an important economic sector. Moreover, as a renewable resource, wood has significant potential in the transition to sustainable production and consumption systems. 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. However, the current species composition and the age and spatial structure of some forests, particularly the large spruce monocultures established in the past, pose an increased risk of climate change impacts.

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 (0–4), of which classes 2–4 indicate significant tree damage.

In 2022, 80.5% of conifers and 40.7% of deciduous trees (Chart 126) were classified in the **defoliation classes** 2–4 for older stands (60 years and older) and 29.5% of conifers and 26.3% of deciduous trees for younger stands (up to 59 years), Chart 127. In older stands, defoliation in the sum of classes 2–4 for conifers is highest for pine (94.0% in 2022), followed by larch (88.2%) and spruce (68.9%), Chart 128. Among deciduous trees, oak showed a significant defoliation rate in class 2–4, with a total of 66.7% of the assessed trees, while this value was 12.8% for beech. For conifer stands aged up to 59 years, the situation is again least favourable for pine, which accounted for 79.0% of trees in the sum of classes 2–4 in 2022. A more favourable situation compared to older stands is observed in the case of spruce (only 8.7% in classes 2–4). In deciduous stands, even in the younger age category, oak (41.9% in classes 2–4) has a higher defoliation rate than beech (4.9%).

Chart 126

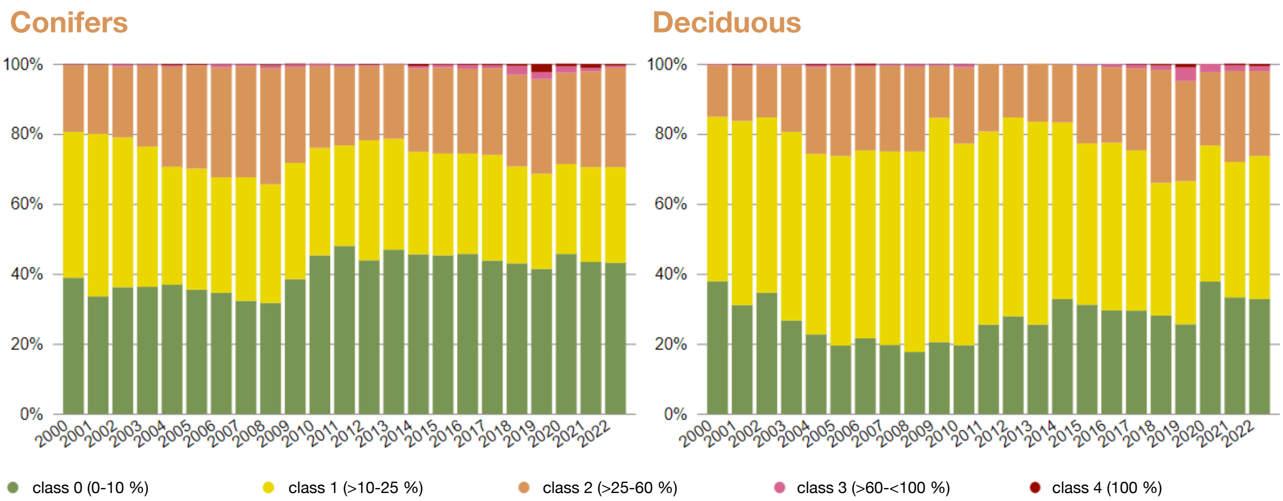
Defoliation of older conifer and deciduous stands (60 years and older) in Czechia by class [%], 2000–2022



Data source: Forestry and Game Management Research Institute

Chart 127

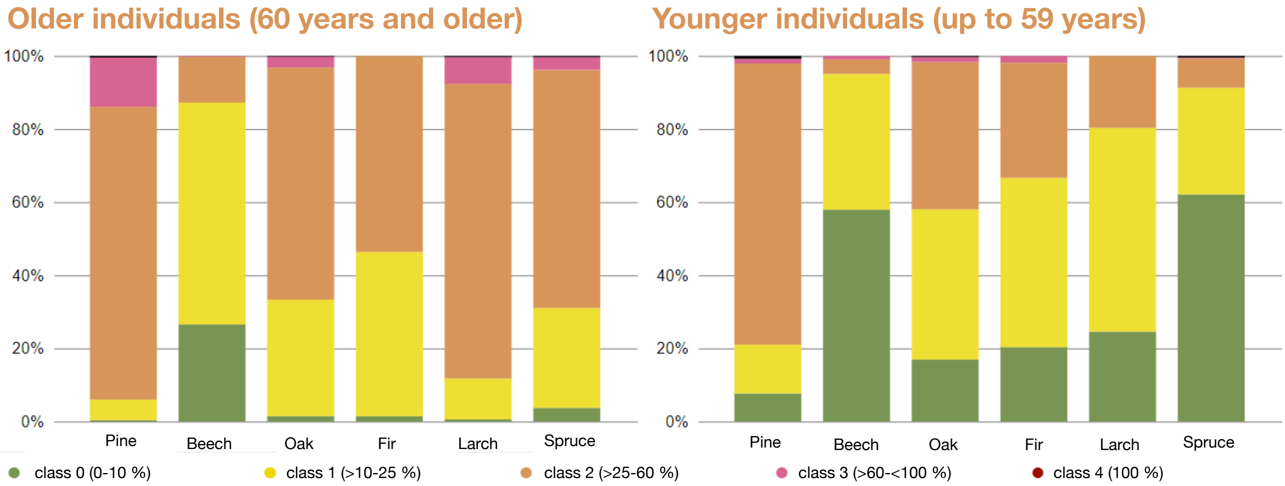
Defoliation of younger conifer and deciduous stands (up to 59 years) in Czechia by class [%], 2000–2022



Data source: Forestry and Game Management Research Institute

Chart 128

Defoliation of basic tree species in Czechia by class [%], 2022



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 the leaching of alkaline nutrients due to soil acidification. Since 1989, the air pollution situation has improved significantly thanks to the installation of 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 impacted mainly by **the effects of climate change**, such as drought, strong winds and the lengthening of the growing season. The most affected stands are spruce forests suffering from the continuing gradation of the spruce bark beetle. In addition, many forest stands are characterised by an inappropriate species composition with a predominance of pastoral farming. High defoliation rates and a diverging trend in the representation of defoliation classes mean that the long-term health of forest stands remains unsatisfactory.

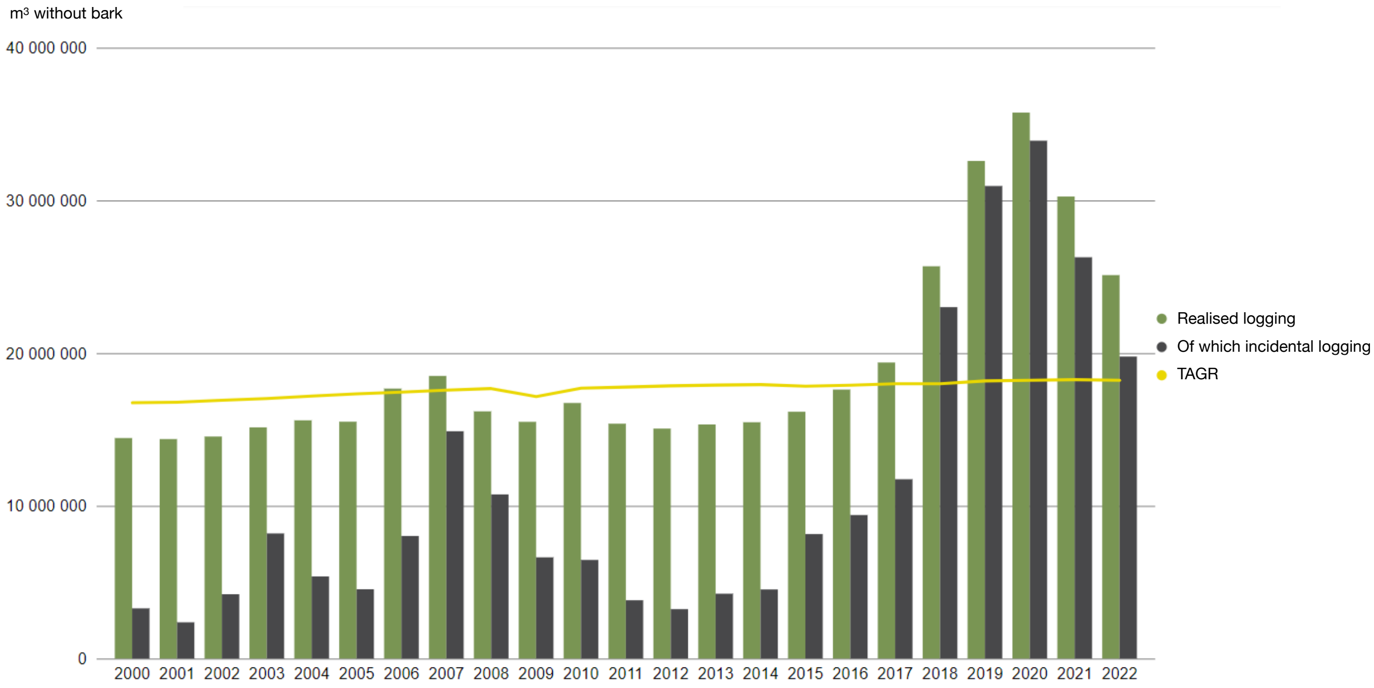
In 2022, relatively large-scale **logging** continued after the bark beetle calamity. However, for the second year in a row since it began in 2015, the volume of logging undertaken has declined year-on-year, from 30.3 mil. m^3 of wood without bark in 2021 to 25.1 mil. m^3 of wood without bark, bringing the volume of logging back to around the 2018 level (Chart 129). The share of incidental (calamity-related) logging in total timber harvesting in 2022 has decreased from 86.9% to 78.8% compared to 2021, which is still a very high value indicating the course of the bark beetle calamity. The volume of **incidental logging** in 2022 was 19.8 mil. m^3 of wood without bark (Chart 130). Due to the ongoing bark beetle calamity, most of the incidental logging was insect-related logging (11.5 mil. m^3 of wood without bark). The timber harvest in 2022 was 5.9 mil. m^3 of wood without bark, which can be considered an average value in the context of previous years. The largest bark beetle calamity in Czechia to date, which began in 2015 in North Moravia in the Jeseníky region and gradually spread to other areas, culminated in 2020, when the volume of timber logging reached a historic high of 35.8 mil. m^3 of wood without bark. The volume of insect-related incidental logging in 2020 (26.2 mil. m^3 of wood without bark) was almost the same as the total volume of insect-related logging for the whole 1990–2012 period (26.0 mil. m^3 of wood without bark). The most affected regions were Vysočina, Olomouc, and the Moravian-Silesian region in the Jeseníky area. Furthermore, areas around Dačice in the South Bohemian Region, Děčín in the Ústí nad Labem Region, and parts of the Beskydy Mountains were significantly affected. 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.

The total logging volume in 2022 again significantly exceeded the **total average growth rate** (TAGR), which has been increasing slightly since 2000, and was 18.2 mil. m^3 of wood without bark in 2022 (Chart 129). 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 possibilities. The record logging in recent years has had an impact on the total timber stock, which has been decreasing since 2019 and will amount to 689.1 mil. m^3 of wood without bark in 2022[114]. In addition to the impact on ecosystems and economic losses, massive tree felling also affects the overall carbon balance of forests. While in the previous period Czech forests were carbon sinks, since 2018 the carbon storage in biomass has temporarily decreased due to the decline in forest stocks and according to the methodology used for calculating the GHG balance, forests are identified as a source of GHG emissions. Restoring the carbon storage capacity of forest ecosystems is therefore a priority for the coming period. However, long-term soil carbon storage occurs primarily in natural forest ecosystems. In the long term, it is therefore important to support this function by introducing nature-friendly farming methods. In areas with high logging volumes, a large number of so-called calamity clearings have recently been created, which worsen the conditions for forest regeneration. The total area of clearings more than tripled between 2017 and 2021, decreasing by 11.6% year-on-year to 67.7 thous. ha in 2022. Based on the analysis of aerial photographs, 41.0% of clearings are over 1.5 ha in size.

[114] *The total stock of timber also decreased according to estimates based on data from the project Monitoring the State and Development of Forest Ecosystems (MSDFE), which since 2016 has been following the second cycle of the National Forest Inventory in the Czech Republic 2011–2015 (NFI2). More at: https://nil.uhul.cz/downloads/vysledky_projektu_nil3/2020_03_12_odhad_zasob_drivi_09_2019.pdf*

Chart 129

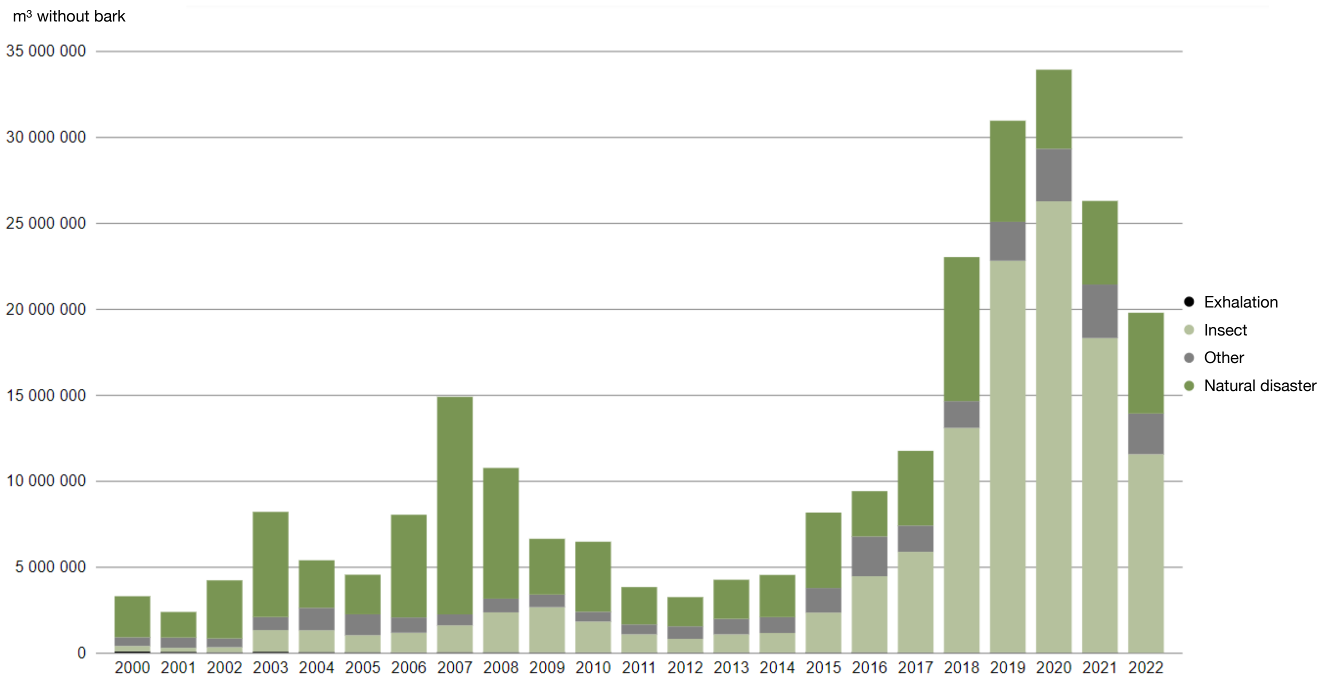
Comparison of realised timber logging with total average growth rate (TAGR) in Czechia [m³ without bark], 2000–2022



Data source: CZSO, FMI

Chart 130

Incidental logging by cause in Czechia [m³ without bark], 2000–2022



Data source: CZSO

Sustainable forest management

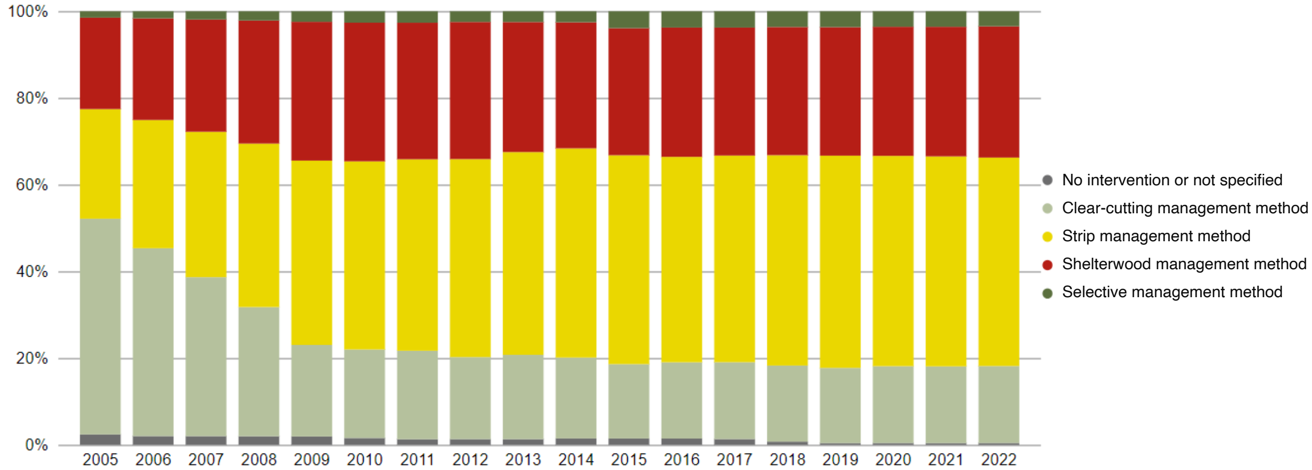
According to their predominant function, forests are classified into the commercial, protective, or special-purpose **forest categories**. The majority (74.0%) of forest ecosystems in Czechia are commercial forests, the main mission of which is sustainable management ensuring the fulfilment of all ecosystem services, including the production of timber as a sustainable renewable raw material. The share of commercial forests, whose main function is timber production, has been declining steadily over the long term (76.7% in 2000 to 74.0% in 2022). In contrast, the share of special-purpose forests, which are located e.g. in protected areas or have a primary recreational function, increased from 19.8% to 24.0% over the same period. The share of protective forests, where logging would have adverse effects, is decreasing, at 2.1% in 2022, 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 these forests to the effects of climate change and improving their productive and non-productive functions can be achieved by using nature-friendly management practices and maintaining a diverse forest structure.

Management methods can be considered close to nature when they make maximum use of the creative forces of nature to achieve the goal of forest management, respect habitat conditions and their economic measures are carried out in accordance with natural processes and the condition of the stands. According to data from forest management plans (FMP)[115], grazing farming methods (shelterwood, strip, clear-cutting) are used almost exclusively. The most used method is strip (48.1% 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 131). The second most-frequently used management method is the shelterwood method (30.3% 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 (17.8% of forest stands), which because of incidental logging can lead to the creation of such clearings as a result of random logging, 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 (3.5% of stands), where logging for the purpose of regeneration and reforestation is not differentiated in time and space 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 FMPs has been stable since 2010.

[115] *The data from the proposition part of the FMPs are influenced by the owner's economic intentions and may not correspond to the actual representation of individual management methods.*

Chart 131

Area of forests in Czechia by management type according to the forest management plan [%], 2005–2022



The data from the proposition part of the FMPs are influenced by the owner's economic intentions and may not correspond to the actual representation of the individual management methods.

Data source: Forest Management Institute

The long-term application of predominantly glade management methods has resulted in a significant predominance of simple-structured forest stands (81.1% of forests)[116] at the level of the lowest units of the spatial distribution of the forest (stand groups). At the same time, however, the size of deliberate restoration elements is gradually decreasing to the current average of about 0.35 ha, which leads to a group differentiation in the area and age of these forest stands. 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 with very short regeneration periods 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 24.8 m^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.

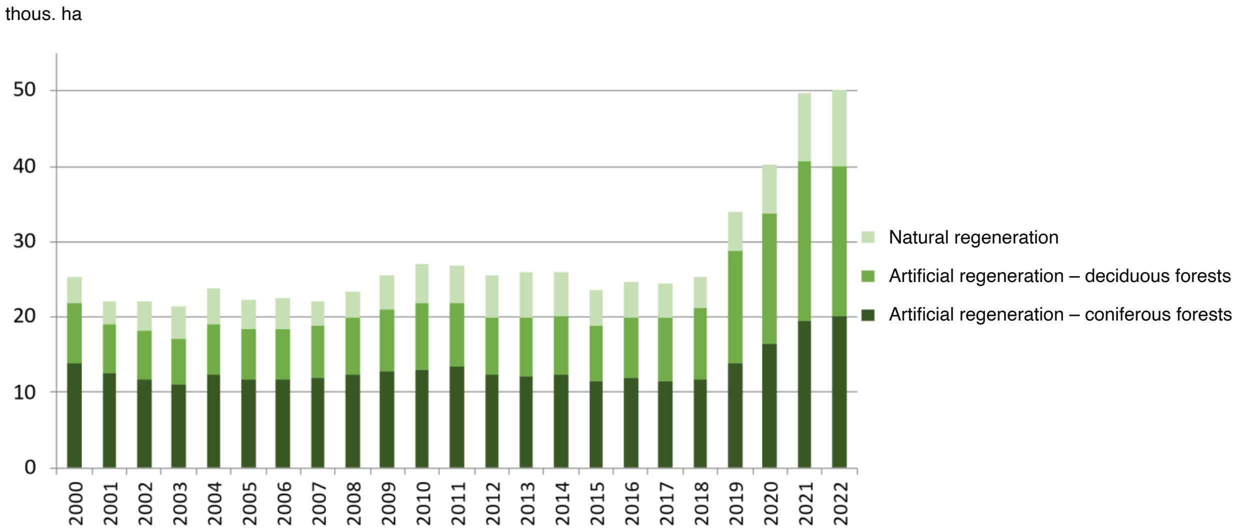
One of the principles of nature-close management is the use of **natural regeneration** in genetically suitable stands. The total area of regeneration in 2022 (50.1 thous. ha) was almost at the same level as the value in 2021 ((49.8 thous. ha)), which corresponds to the also highest recorded logging in recent years in connection with the bark beetle calamity (Chart 132). Most of this regeneration has consisted of artificial afforestation. The long-term trend in the share of natural regeneration in the total regeneration is fluctuating, but the area of natural regeneration is increasing in the long term. Its area has increased from 3.4 thous. ha in 2000 to a record 10.1 thous. ha in 2022, and its share of the total area of regeneration in that year reached 20.2%. 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.

---

[116] *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 Brandýs nad Labem, 2019 [cit. 12 7 2023]. ISBN 978-80-88184-24-9. Available from: https://nil.uhul.cz/downloads/2019_kniha_nil2_web.pdf.*

Chart 132

Forest regeneration in Czechia [thous. ha], 2000–2022



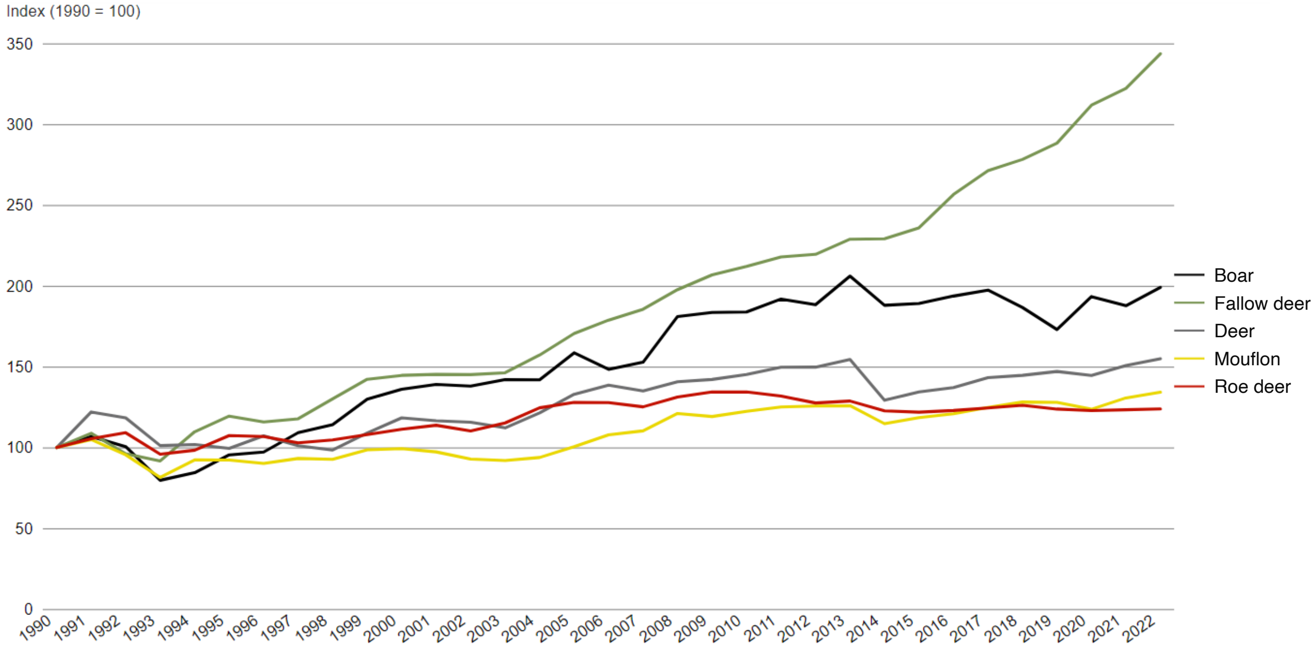
Since 2002, changes in the methodology mean that shelterwood regeneration has also been included in natural regeneration (originally only regeneration in clearings was counted).

Data source: CZSO

A range of management measures, both forestry and hunting, are necessary to promote natural and artificial forest regeneration. For hunting measures, it is particularly necessary to comply with the ungulate breeding and hunting plan, especially in view of the persistent extensive damage caused by these animals by gnawing on established forest crops and natural regeneration, as well as on agricultural crops and land. In the long-term trend, the abundance of all monitored game species is increasing, especially for fallow deer, which more than doubled in the 2000–2022 period. Deer have been the most abundant game in the long term, with a spring count of 293,600 in 2022 (Chart 133). The recorded damage caused by game has increased significantly in recent years, from CZK 25.0 mil. in 2018 to CZK 54.3 mil. in 2022. 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. Damage caused by wildlife can also be reduced by establishing fields and grazing areas. Among forestry measures, it is worth mentioning the consistent protection of the forest and the early growing of stands in relation to tree species.

Chart 133

Spring stocks of selected game species in Czechia [index, 1990 = 100], 1990–2022



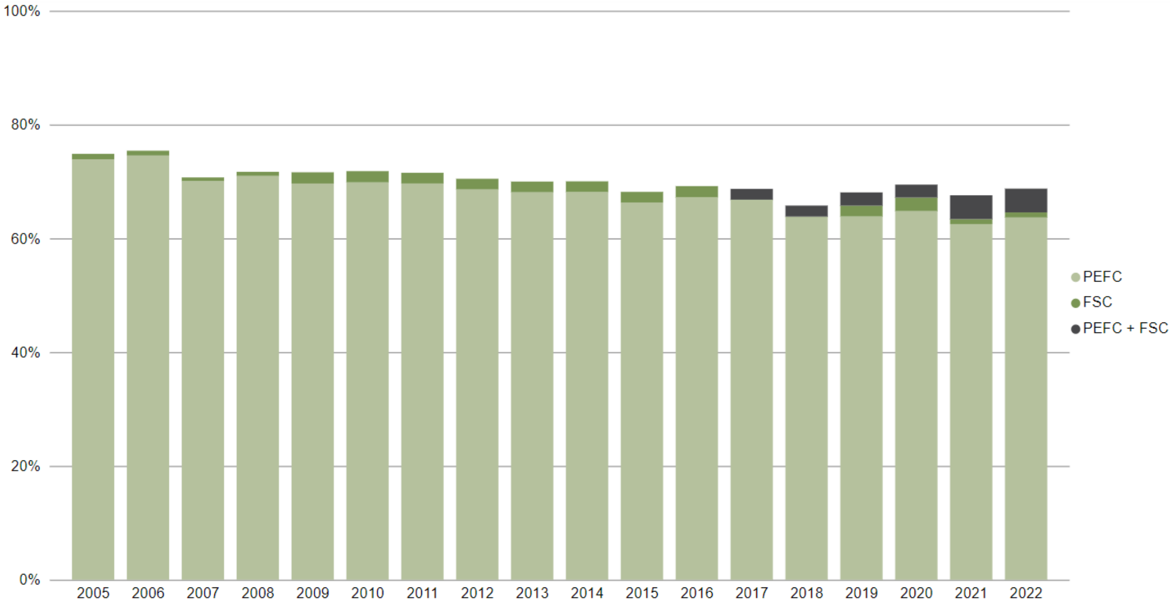
State as of 31 March of the given year.

Data source: CZSO

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 2022, 67.9% of forest land has PEFC certification and 5.1% under FSC, the standards of which place higher demands on some aspects of sustainable management (Chart 134). Most forest land with FSC certification also had PEFC certification. In total, 68.8% of forest land was certified in 2022.

Chart 134

Percentage of forest land with PEFC and FSC certification in the total area of forest land area in Czechia [%], 2005–2022



Since 2017, PEFC and FSC have been jointly surveying the area of forests with both certifications (PEFC + FSC).

Data source: FSC, PEFC

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[117]. 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 elevations. The most natural tree composition is achieved in mountain areas where the natural abundance of Norway spruce is high[118].

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 has been slowly increasing since 2000, rising from 22.3% to 29.5% in 2022 (Chart 135). In terms of the representation of individual tree species, spruce is the most abundant tree species in the long term, although its share in the total forest composition has been steadily decreasing, from 54.0% to 46.8% in the 2000–2022 period. A further

---

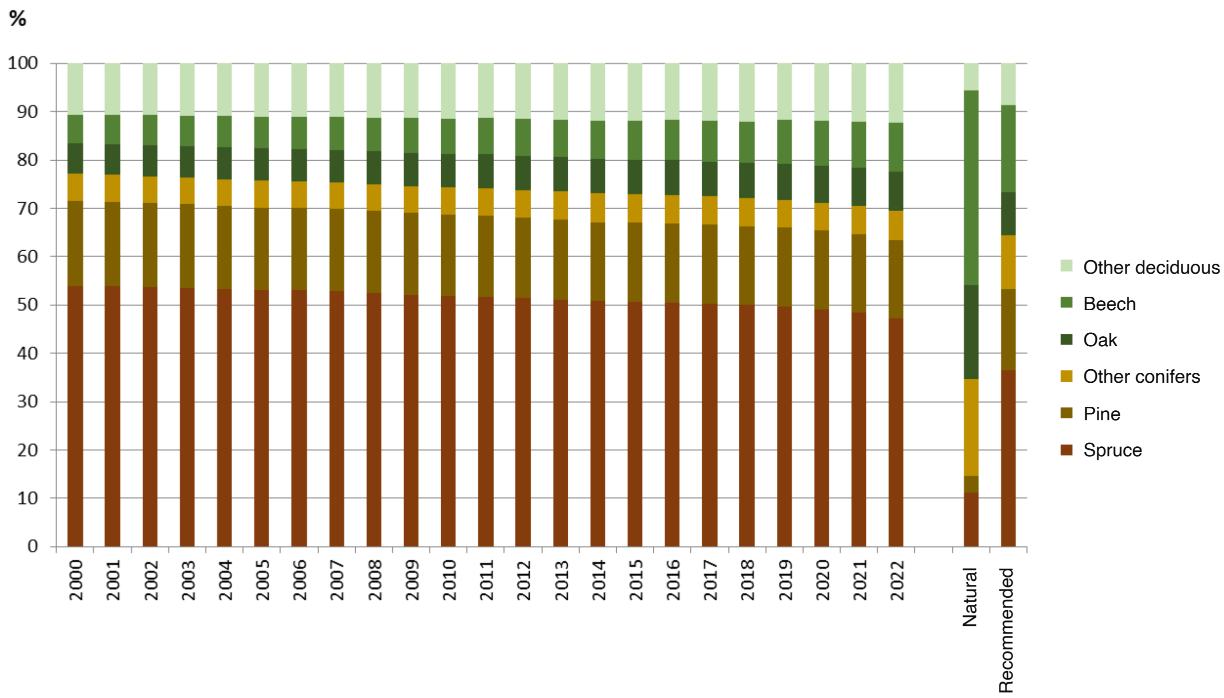
[117] *ADOLT R., eds., 2020: Estimation of timber stocks in forests in the Czech Republic based on MSDFE data from 2019 [online]. Brandýs nad Labem: Forest Management Institute Brandýs nad Labem, 2020 [cit. 12 7 2023]. Available from: https://nil.uhul.cz/downloads/vysledky_projektu_nil3/2020_05_18_zasoby_drivi_ssvle_2019.pdf.*

[118] *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 Brandýs nad Labem, 2019 [cit. 12 7 2023]. ISBN 978-80-88184-24-9. Available from: https://nil.uhul.cz/downloads/2019_kniha_nil2_web.pdf.*

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 2022 it accounted for 1.3%, 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, which, however, has increased only slightly from 6.0% to 9.6% in the 2000–2022 period. Slower growth has also been recorded for oak, which has increased from 6.3% since 2000 to 7.8% in 2022.

Chart 135

Species composition of forests in Czechia, reconstructed natural and recommended composition [%], 2000–2022



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 and 2021, when a record 21.2 thous. ha were regenerated with deciduous trees and 19.5 thous. ha with conifers. However, in 2022, the ratio reversed again in favour of conifers, which covered 20.2 thous. ha, at the expense of deciduous trees, which covered 19.8 thous. ha. The most frequently planted tree species was spruce (12.7 thous. ha; 12.1 thous. ha in 2021), followed by beech (8.0 thous. ha; 9.8 thous. ha in 2021) and oak (6.0 thous. ha; 6.9 thous. ha in 2021). In addition, the bark beetle calamity, which peaked in 2020, will be reflected in a further reduction in conifer representation. In 2022, conifers accounted for 91.8% of the recorded volume of timber logging.

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 the age class IV in particular (13.1% in 2022), correlating with the ongoing bark beetle calamity, which has mainly affected the aforementioned monoculture stands.

On the other hand, since 1990, there has been a steady increase in the area of older to over-aged stands in age class VII and VIII (121+ years). In 2022, 9.3% of the area of forest land was in this class. 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.
✗	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 2021, 27.2% of coniferous and 30.0% of deciduous trees in Europe were in defoliation classes 2–4.

Forests in an international context

Forests cover around 35% of Europe and are expanding slightly. 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 (Fig. 33). In 2021[119], 27.2% of coniferous and 30.0% of deciduous trees in Europe were in defoliation classes 2–4[120]. 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 in the long term. This is a worrying finding, particularly in the context of ongoing climate change and the failure to reduce nitrogen deposition.

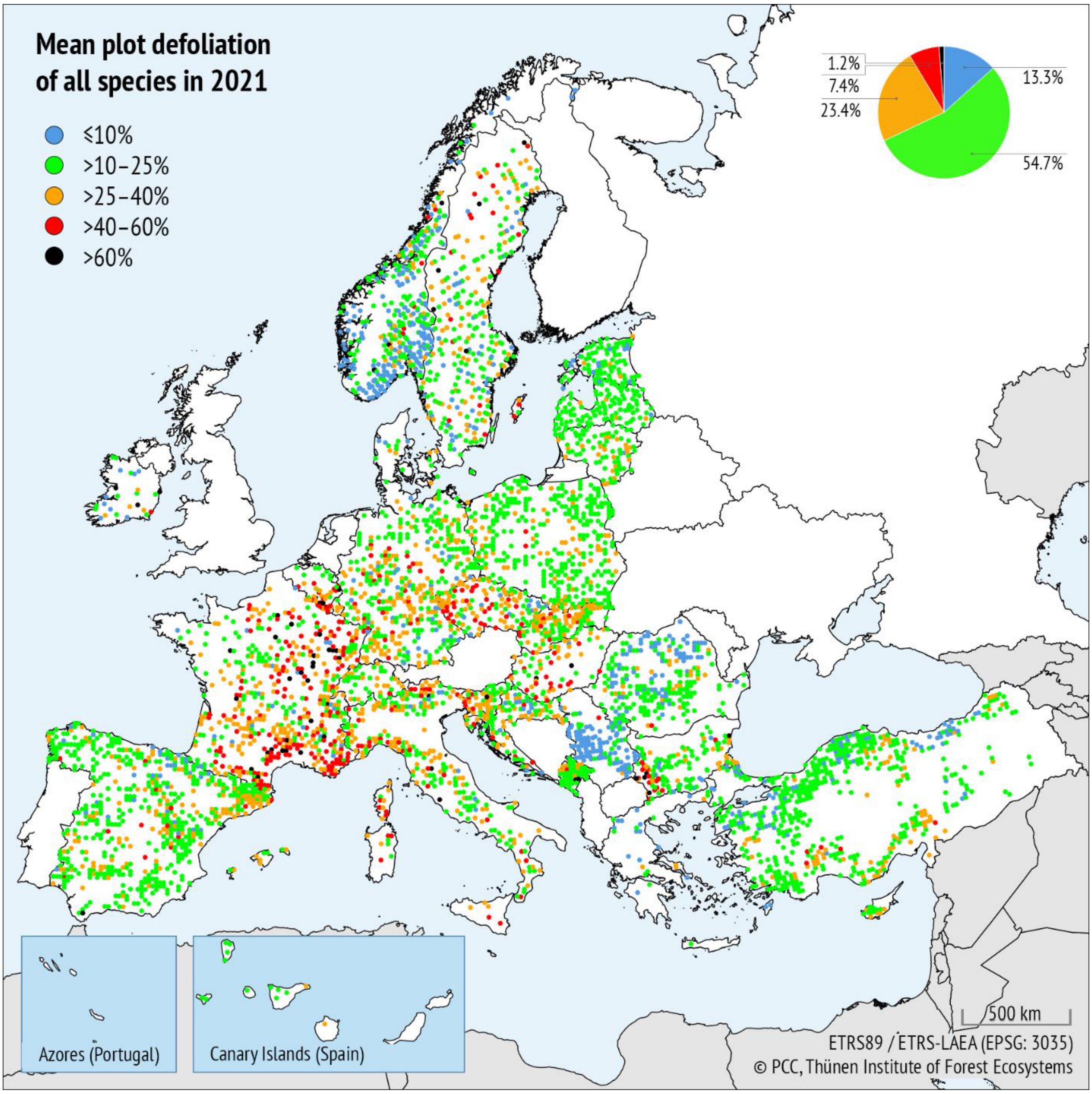
---

[119] *Data for the year 2022 are not available at the time of publication.*

[120] *Michel A., Kirchner T., Prescher A-K., Schwärzel K., editors. Forest Condition in Europe: The 2022 Assessment. ICP Forests Technical Report under the UNECE Convention on Long-range Transboundary Air Pollution (Air Convention). Eberswalde: Thünen Institute. 2022. https://doi.org/10.3220/ICPTR1656330928000*

Fig. 33

Defoliation in the main monitoring plots of all tree species in Europe [%], 2021



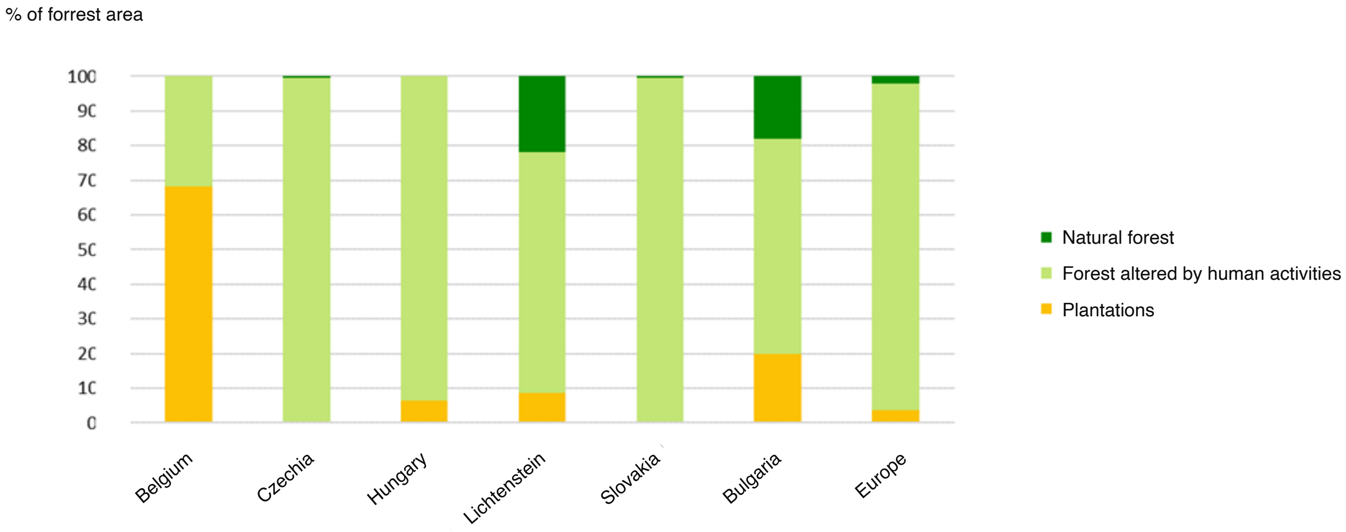
Data for 2022 are not available at the time of publication.

Data source: ICP Forests

In Europe, the proportion of **natural forests** not affected by human activity is 2.2% of the total forest area. In Czechia, this share is 0.4% (Chart 136). This low level is due to the long-term use of Europe's forests and land for commercial purposes. The highest share of native forests is found in Lichtenstein, Bulgaria and Georgia. By contrast, the highest share of plantations is found in the United Kingdom, Ireland and Belgium. Monocultures account for an average of 15.4% of forests in Czechia and 32.8% across Europe. 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 that are naturally composed of only one or two species (e.g. northern pine forests, subalpine spruce forests) have been included in the European average.

Chart 136

Share of forests affected by human activities in selected European countries [% of forest area], 2020



A forest altered by human activity 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 (10–60 years). The wood from forest plantations is mostly used to produce paper, pulp, particleboard, or firewood.

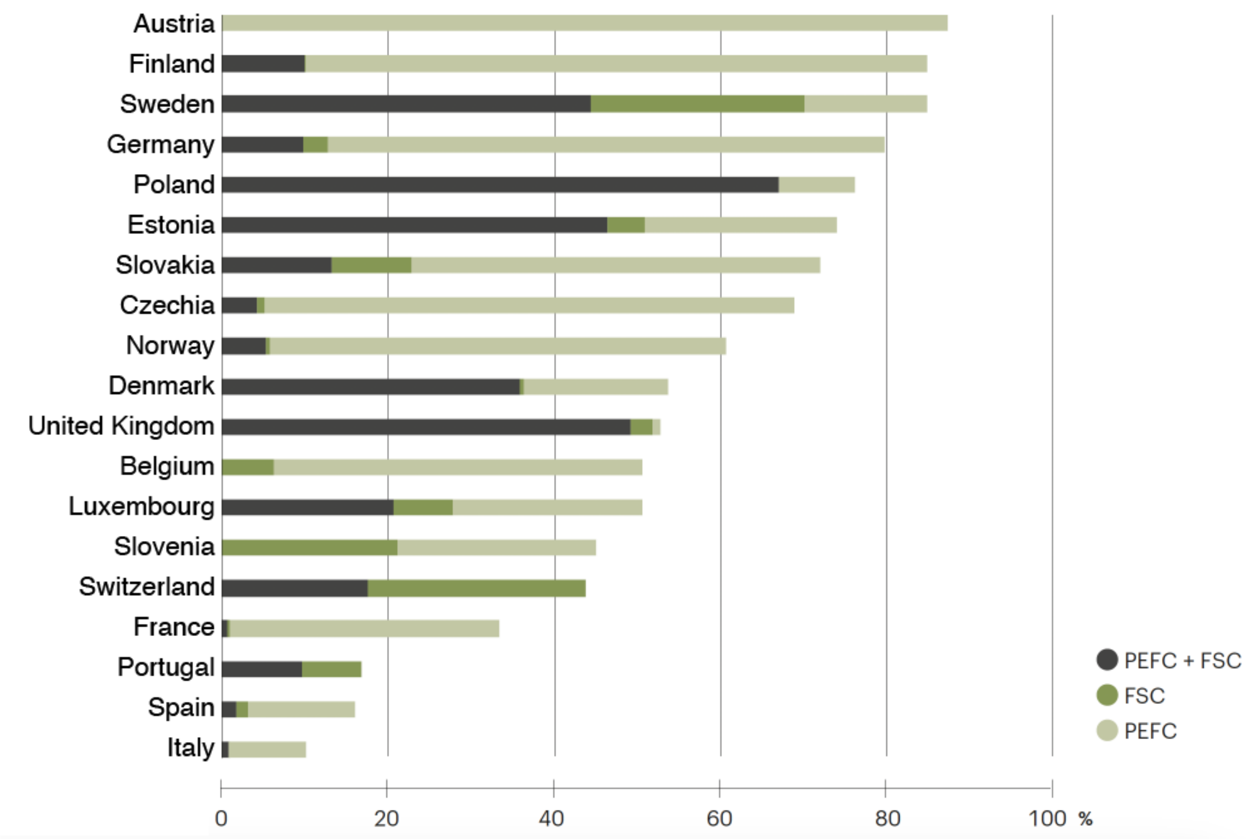
Data for 2021 and 2022 are not available at the time of publication.

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 total forest area in selected EU countries in 2022 was highest in Austria (87.4%), Finland and Sweden (84.8%). On the other hand, the lowest shares were in Italy (10.0%) and Spain (15.9%). Czechia was above average in Europe with 68.8%, mainly thanks to its high share of PEFC-certified forests (Chart 137).

Chart 137

Share of PEFC and FSC certified forests in total forest area in selected European countries [%], 2022



Since 2017, PEFC and FSC have been jointly surveying forest areas with both certifications (PEFC + FSC).

Data source: PEFC, FSC, Eurostat

Soil erosion in an international context

Most EU soils are subject to **degradation** due to erosion, pollution, nutrient loss, loss of organic carbon, loss of biodiversity, compaction, salinisation or land cover. Only 39.0% of the EU's land can be considered healthy. Losses related to land degradation in the EU are estimated at more than EUR 50 bil. per year. The share of degraded land in the total land area was 6% in 2015[121] [122]in Czechia, and compared to other European countries this value was below average.

According to the latest available model data (Fig. 34), 90.3% of the EU28 was at risk of water erosion in 2016[123] (about 394.1 mil. ha out of a total area of 436.6 mil. ha). The average soil loss on agricultural land in the EU is approximately 3.07 $t.ha^{-1}.year^{-1}$. 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

---

[121] *Data for 2016–2022 are not available at the time of publication.*

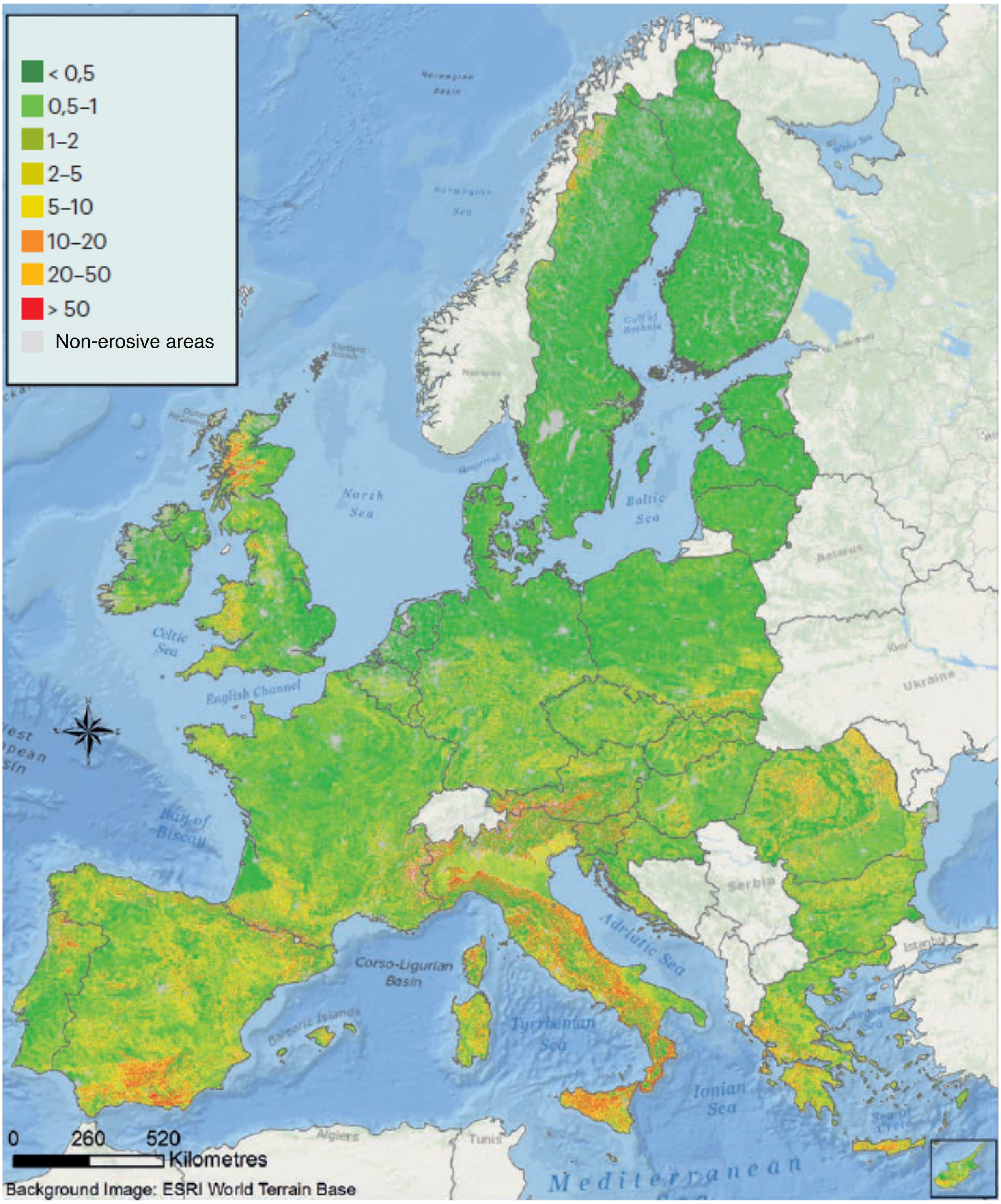
[122] *This is a calculation under the international SDG indicator 15.3.1, for which data on land cover, soil productivity and soil carbon stocks were used. Available from: https://landportal.org/node/52267*

[123] *Data for 2017–2022 are not available at the time of publication.*

use. Soil loss from water erosion is projected to increase by 13–22.5% in the EU and UK by 2050 compared to the 2016 baseline year[124].

Fig. 34

Soil water erosion in Europe determined by the RUSLE2015 model [t.ha^{-1}.year^{-1}], 2016



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

---

[124] *Panos Panagos, Cristiano Ballabio, Mihaly Himics, Simone Scarpa, Francis Matthews, Mariia Bogonos, Jean Poesen, Pasquale Borrelli: Projections of Soil Loss by Water Erosion in Europe by 2050, Environmental Science & Policy, 124 (2021), 380-92. Available from: https://doi.org/10.1016/j.envsci.2021.07.012.*

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 underway.

Data for the years 2017–2022 are not available at the time of publication.

Data source: JRC

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 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. [125]. 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%). In Czechia, the figure is 0.1%.

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.

Agriculture in an international context

Although organic farming is developing in the EU27 thanks to European subsidy funds, conventional farming still prevails. Organically managed farmland accounted for 9.9% of total cultivated land in the EU27 in 2021[126]. With a share of 15.6% in 2021, Czechia is now among the countries with an above-average share of organically managed land (Chart 138). Even in terms of consumption of mineral fertilisers and plant protection products, Czechia's position in 2021[127] was also favourable compared other EU27 countries, i.e. it was below the European average.

---

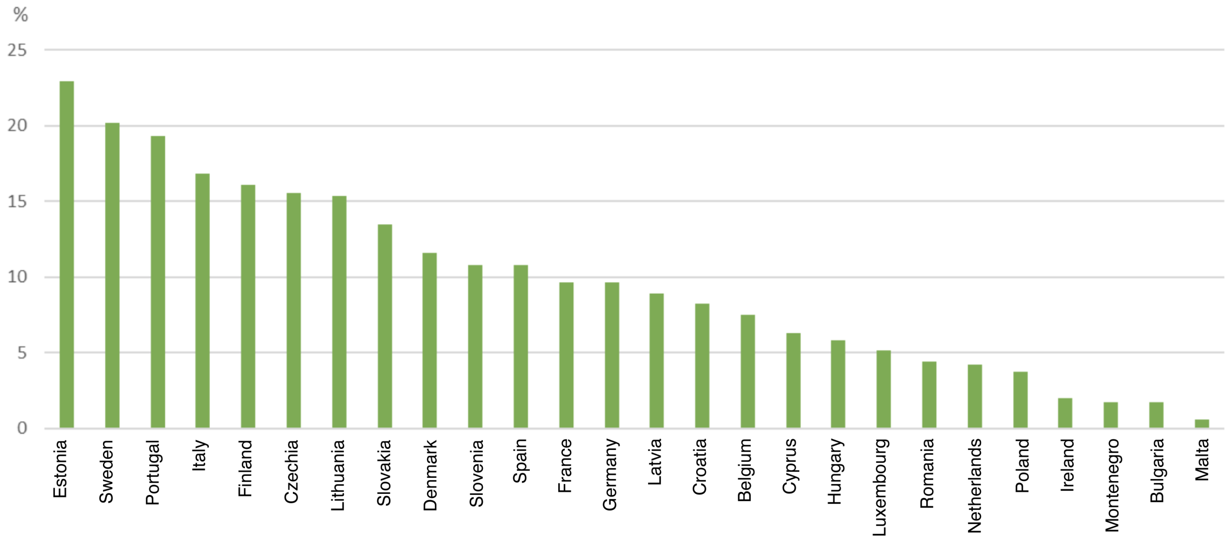
[125] *Panagos P., Standardi G., Borrelli P., Lugato E., Montanarella L., Bosello F. Cost of agricultural productivity loss due to soil erosion in the European Union: From direct cost evaluation approaches to the use of macroeconomic models. LandDegrad Dev. 2018; 29: 471–484. Available from: https://doi.org/10.1002/ldr.2879.*

[126] *Data for the year 2022 are not available at the time of publication.*

[127] *Data for the year 2022 are not available at the time of publication.*

Chart 138

Share of organically farmed agricultural land in total cultivated agricultural land in EU countries [%], 2021



Data for 2022 are not available at the time of publication.

Data source: Eurostat

Detailed visualisations and data

https://www.envirometr.cz/data

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[128].

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

Convention on Biological Diversity and the Khun-Ming-Montreal Global Biodiversity Framework
- the protection of biological diversity at all levels and the sustainable use of its components

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- regulating international trade in certain rare species of wild fauna and flora to prevent overexploitation

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

Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
- 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 the 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) 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction or introduction and spread of invasive alien species
- setting basic rules for the most problematic invasive species from an EU perspective

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

[128] *See the report of the Intergovernmental Panel on Climate Change (IPCC). More at: https://www.ipcc.ch/report/ar6/syr/resources/spm-headline-statements*

- setting the principles of land protection, fines and the process of removing land from the fund

Biodiversity Strategy of the Czech Republic 2016–2025 and the State Programme for Nature and Landscape Conservation of the Czech Republic for the period 2020–2025

- determining a comprehensive strategy for biological protection in the Czech Republic

Action Plan for addressing priority pathways for the spread of invasive alien species in the Czech Republic (2023)

- an action plan aimed at reducing the most important ways in which invasive alien species spread

National Strategy for Tackling Illegal Killing and Poisoning of Wildlife in the Czech Republic 2020–2030

- strategies to implement recommendations adopted under international conservation conventions that specifically address the issue of the illegal killing and poisoning of animals

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

Priority Action Framework for Natura 2000 in the Czech Republic for the period 2021–2027

- determining the financing of measures for the implementation of Natura 2000

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 and 2020 period, the area of unfragmented landscape decreased from 68.6% to 58.3% of the territory in Czechia. The abundance of common bird species has been declining for a long time, with the greatest decline recorded in farmland bird species, which decreased by 40.1% in the 1982–2022 period. Climate change is also having a long-term effect on the species composition of avifauna, with a 17.4% increase of the climate indicator between 2010 and 2021. The river network is still not being effectively made accessible. In 2022, 4 fish crossings were implemented.

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	↘	↘	N/A	✗
Common bird species*				
Abundance of all common bird species, forest bird species and farmland bird species	↘	↘	↘	✗
Indicator of the impact of climate change on common bird species	↗	↗	↗	✗
State of plant, animal and fungi species according to the red lists	↘	↘	N/A	✗

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

Fragmentation of the landscape

Landscape fragmentation leads to the loss of original habitat qualities and connectivity important for animal migration. According to the assessment using UAT polygons[129], between 2000 and 2020[130], the area of unfragmented landscape decreased by 15% from 54.1 thous. km^2 in 2000 (68.6% of the Czech territory) to

[129] *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. Within the methodology, the national border is considered a physical barrier, so the calculation does not respect cross-border polygons and the actual UAT area is therefore slightly different.*

[130] *Data for 2021 and 2022 are not available at the time of publication.*

47.8 thous. km^2 (60.6% of the Czech territory) in 2016 and further decreased to 46.0 thous. km^2 in 2020 (58.3% of the Czech territory). According to the new methodology for calculating UAT, which includes the entire area of transboundary polygons, the area of unfragmented landscape decreased by 2.4% between 2016 and 2020 from 49.2 thous. km^2 in 2016 (62.4% of the territory) to 47.3 thous. km^2 in 2020 (60.0% of the territory).

To synchronise the methodology with the EEA, the Effective Mesh Size (EMS;M_{eff}) method is used to assess fragmentation from 2022 onwards. The EMS is proportional to the probability of connecting two randomly selected points in the landscape. This probability is then converted to the size of the area or mesh – the effective size of the network. The EMS unit is the unit of area (km^2). The higher the EMS value (mesh size), the lower the fragmentation rate (Tab. 6, Fig. 35).

Tab. 6

Landscape fragmentation in Czechia using the EMS method [km^2], 2016–2022

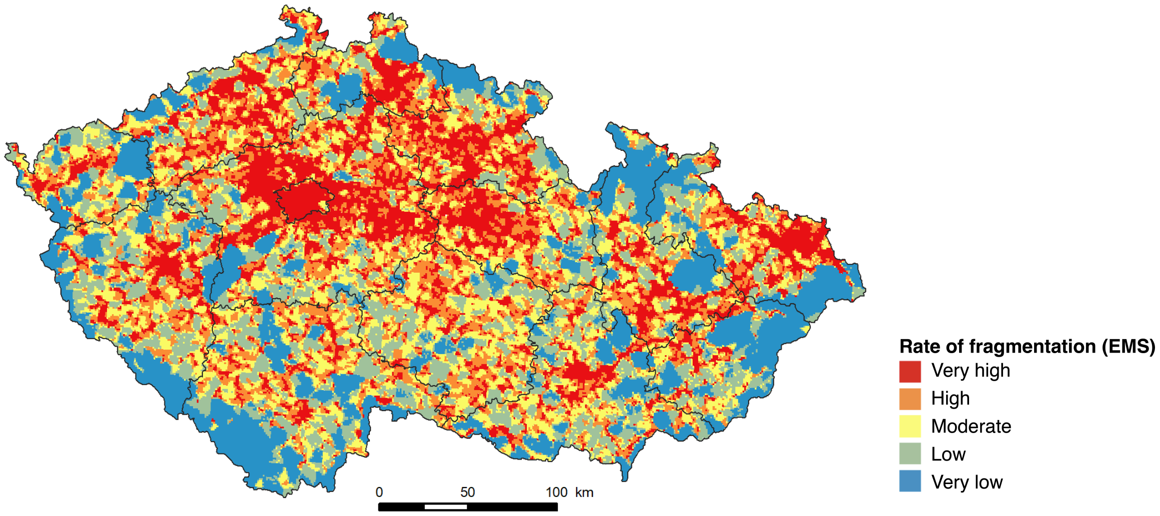
	2016	2018	2020	2022
Median	15.52	15.53	15.46	15.43
Average	38.20	37.30	37.25	37.13
STD	70.69	66.92	66.92	66.80

The results of the analysis of the period 2016–2022 (Tab. 6, Fig. 36) show that the average effective mesh size in Czechia has gradually decreased from 38.2 km^2 to 37.1 km^2, with the median value (which is not affected by outliers and reflects a value greater than or equal to half of the values in the population) hovering around 15 km^2 and decreasing slightly throughout the period under review. This has led to an overall increase in fragmentation, mainly due to the gradual construction of the motorway and road network, or the expansion of built-up areas. Nevertheless, fragmentation rates have declined in a number of places. This was mainly due to the transfer of some public roads to the category of non-public roads.

The most fragmented areas include the surroundings of large settlements (Central and Eastern Bohemia, Liberec, Pilsen, Ostrava, Brno, Olomouc and Ústí nad Labem) and areas along major transport routes. For many species of animals, **roads** are a significant and often insurmountable barrier. The barrier effect of new roads is largely mitigated by compensatory measures (ecoducts, underpasses, etc.) for animal migration. However, there is no systematic monitoring of their functionality. On the other hand, the least fragmented areas are the peripheral areas of the peripheral mountain ranges, areas of current and former military settlements, larger forest complexes, or areas with thinner settlement and transport infrastructure.

Fig. 35

Landscape fragmentation in Czechia, 2022

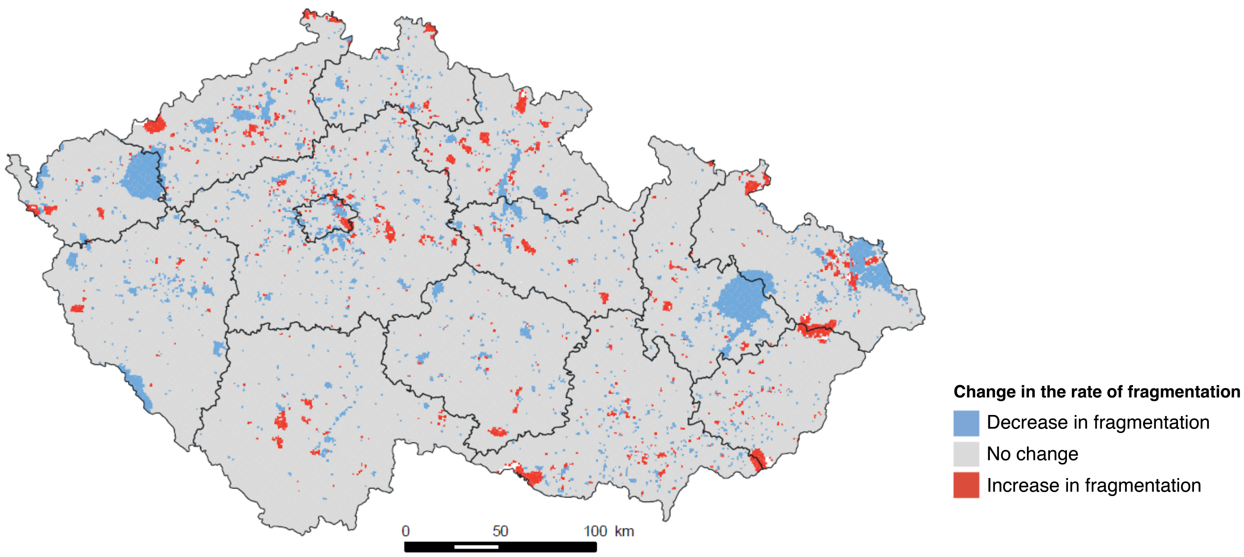


Evaluated by the Effective Mesh Size (EMS) method. EMS values express the imaginary probability of two randomly located points in the landscape meeting. The higher the EMS values, the lower the level of landscape fragmentation (and vice versa). For units of the regular grid that are located within larger unfragmented areas, this is practically the size of the unfragmented areas.

Data source: Silva Tarouca Research Institute for Landscape and Ornamental Horticulture

Fig. 36

Landscape fragmentation rate in Czechia, change between 2016–2022



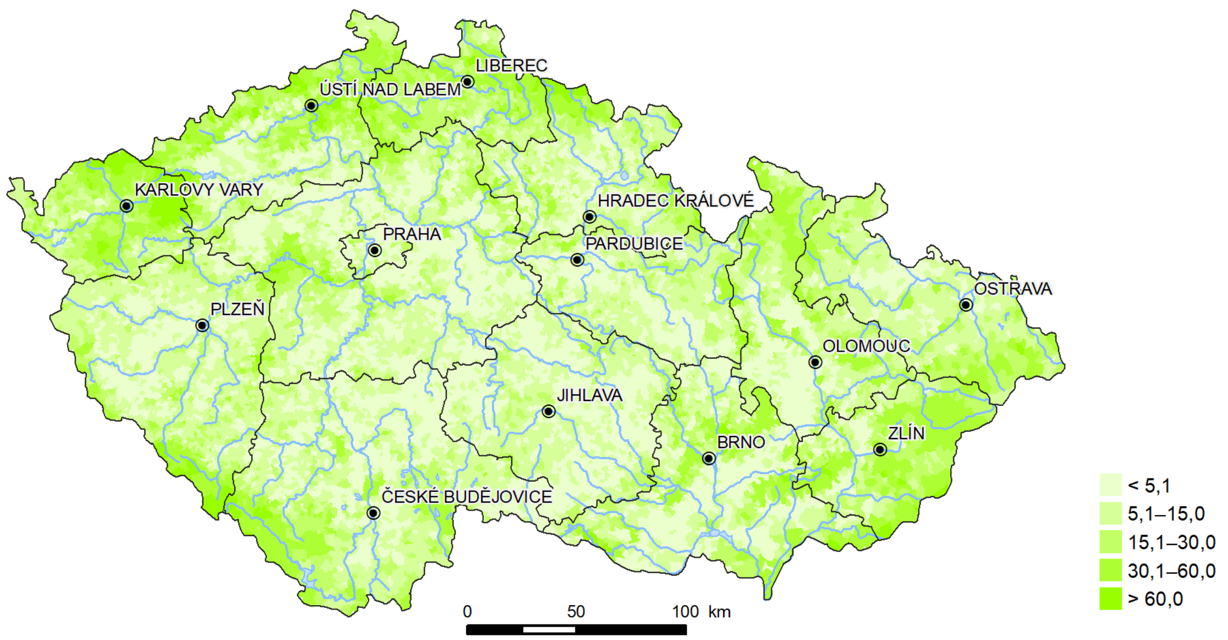
Evaluated by the Effective Mesh Size (EMS) method. EMS values express the imaginary probability of two randomly located points in the landscape meeting. The higher the EMS values, the lower the level of landscape fragmentation (and vice versa). For units of the regular grid that are located within larger unfragmented areas, this is practically the size of the unfragmented areas.

Data source: Silva Tarouca Research Institute for Landscape and Ornamental Horticulture

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 15.6% in 2022 (the area of natural biotopes increased by 13.6 thous. ha year-on-year). Areas with the 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 SPAs (Fig. 37).

Fig. 37

Share of natural biotopes in the area of cadastral territories in Czechia [%], 2022



Data source: NCA CR

The NCA CR project "TSES Plan in PLA" contributes to greater connectivity of valuable natural biotopes and to the definition of areas for their development, within the framework of which revisions of the territorial system of ecological stability (TSES) plans are gradually being carried out in 20 PLAs with the addition of new ones and with targeted extension of selected components of TSES defined according to the biotope access.

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, inappropriate fisheries management, 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[131] fish species and the partial to complete disappearance of specialised diadromous[132] fish species. Fish-eating predators, such as the river otter *(Lutra lutra*) and the great cormorant *(Phalacrocorax carbo*), also have a significant impact on the population size. 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. To preserve and strengthen populations linked to the need for migration, and to implement the River Network

[131] *Species of fish that prefer to live in water with higher flow rates.*

[132] *Species of fish that migrate between salt and fresh water.*

Improvement Concept, proposals for the construction of fish crossings have been under preparation since 2010[133].

A total of 34 "concept" watercourses (19 international and 15 watercourses of national importance) were assessed in the last update of **the River Network Improvement Concept** in 2020, some of which were planned to be implemented by 2021 (subject of assessment). A total of 798 cross barriers (584 barriers in international and 214 barriers in watercourses of national importance) were located on these watercourses. Here, the construction of 161 fish crossings (152 in international and 9 in watercourses of national importance) has been planned, of which 22 measures have been implemented so far (12 fish crossings and 10 other measures to restore the migratory permeability of the watercourse).

In 2022, 4 fish crossings were implemented. The implementation of the planned measures continues to fail to make the river network in 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.

State of species and habitats of Community importance [134]

The **overall state of each assessed species** of plant or animal consists of 4 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.

The **overall state of species of Community importance** has slightly improved in the last monitoring period (2013–2018)[135]. Based on the results from 2013–2018, 59.8% of animal species are in a poor or unfavourable state, compared to 66.5% in 2007–2012. However, despite this improvement, the overall status of species of European importance is not good and largely reflects the state of endangered species in Czechia, the overall state of biodiversity in Czechia and the overall state of the Czech landscape in general. **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 assessment periods (while this was 19.2% in the first assessment period 2000–2006), while 70.4% of species in the 2007–2012 period and 66.7% of species in 2013–2018 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, followed by 30.0% in the 2007–2012 period and 32.5% in the 2013–2018 period. Overall, the status 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 2007–2012 and 16.0% in 2000–2006). A change in the methodological approach, but also the actual distribution of some species (e.g. the Yellow-bellied Woodpecker) or the discovery of previously unknown localities of many species thanks to high monitoring

---

133 *Slavíková, A., et al. 2020 River Network Improvement Concept in the Czech Republic, update 2020. Prague: Ministry of the Environment, 2020.*

134 *Species of Community importance and similar habitats are designated by European Community 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.*

135 *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

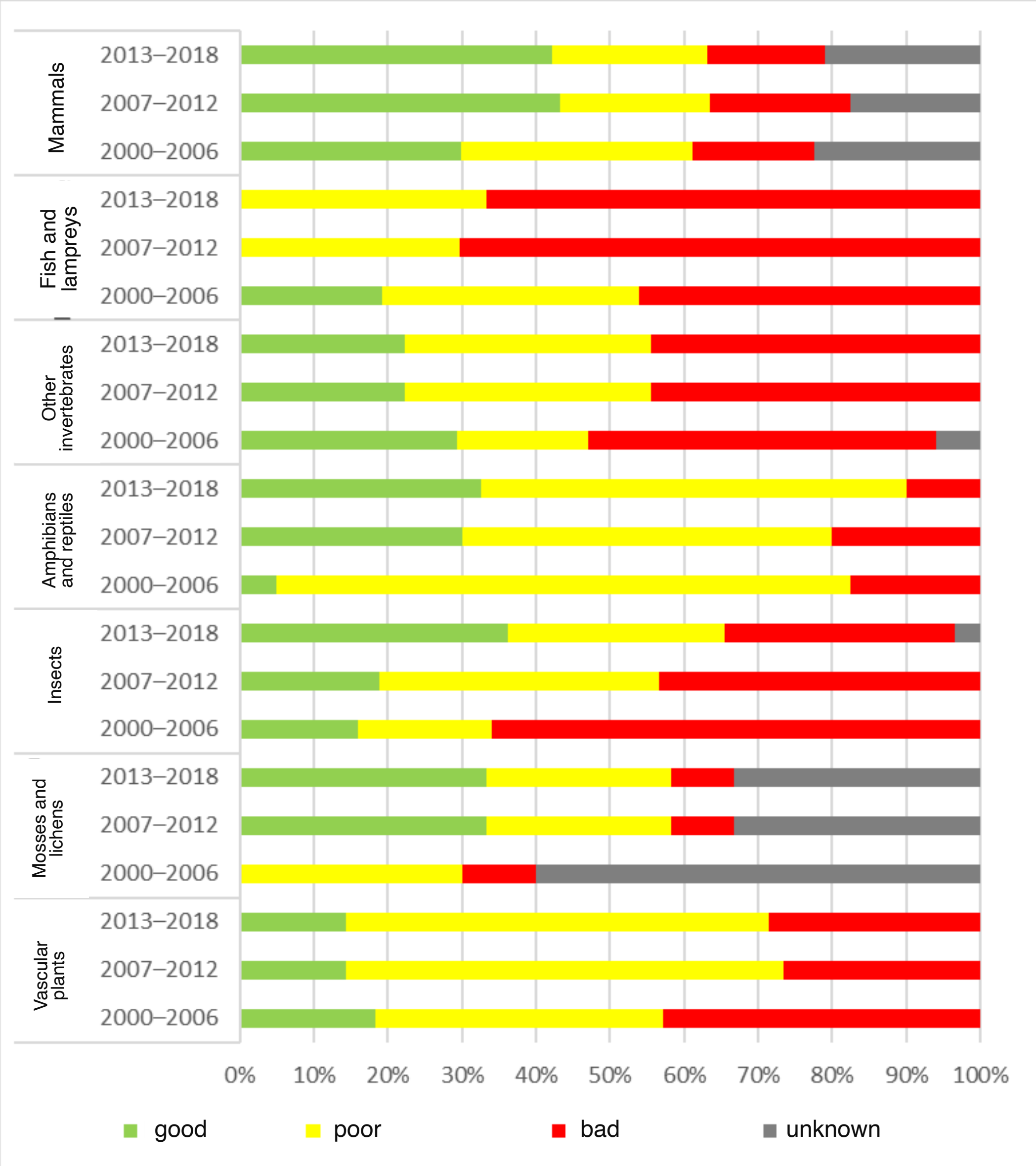
efforts played a role in this. At the same time, there has been a significant decline in the number of species assessed as in a bad status (from 66.0% in 2000–2006 and 43.4% in 2007–2012 to 31.0% in 2013–2018). It can therefore be concluded that the situation of most of the insect species of Community importance is relatively stable or even positive, especially for species with a link to natural habitats. It is also worth mentioning the improvement in the status of species associated with light forests, which were significantly helped by spontaneous lightening of the stand and the increase in the volume of dead wood due to the dry 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, from 18.9% to 15.8% (Chart 139).

The **overall status of the species of Community importance** has slightly deteriorated in the assessment period 2013–2018[136] compared to the previous period. While there was an improvement in the "Favourable status" category from 15.3% to 18.0% between 2000–2006 and 2007–2012, and this remained the same in 2013–2018, there was a deterioration in the unfavourable status category from 23.0% to 24.6% between 2007–2012 and 2013–2018. In the period 2013–2018, 50.8% of plant species were in poor condition. 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 moss and lichen species assessed in a good status has 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 2000–2006 and 2007–2012 (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 are assessed as being in a good status (Chart 139). Rescue programmes are an important tool to improve the status of the most endangered species. A conservation programme has so far been adopted for four species of vascular plants of Community importance. The most recent is the conservation programme for the Eastern pasqueflower *(Pulsatilla patens*), adopted in 2020.

[136] *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

Chart 139

Assessment of the state of animal and plant species of Community Importance in Czechia 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 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

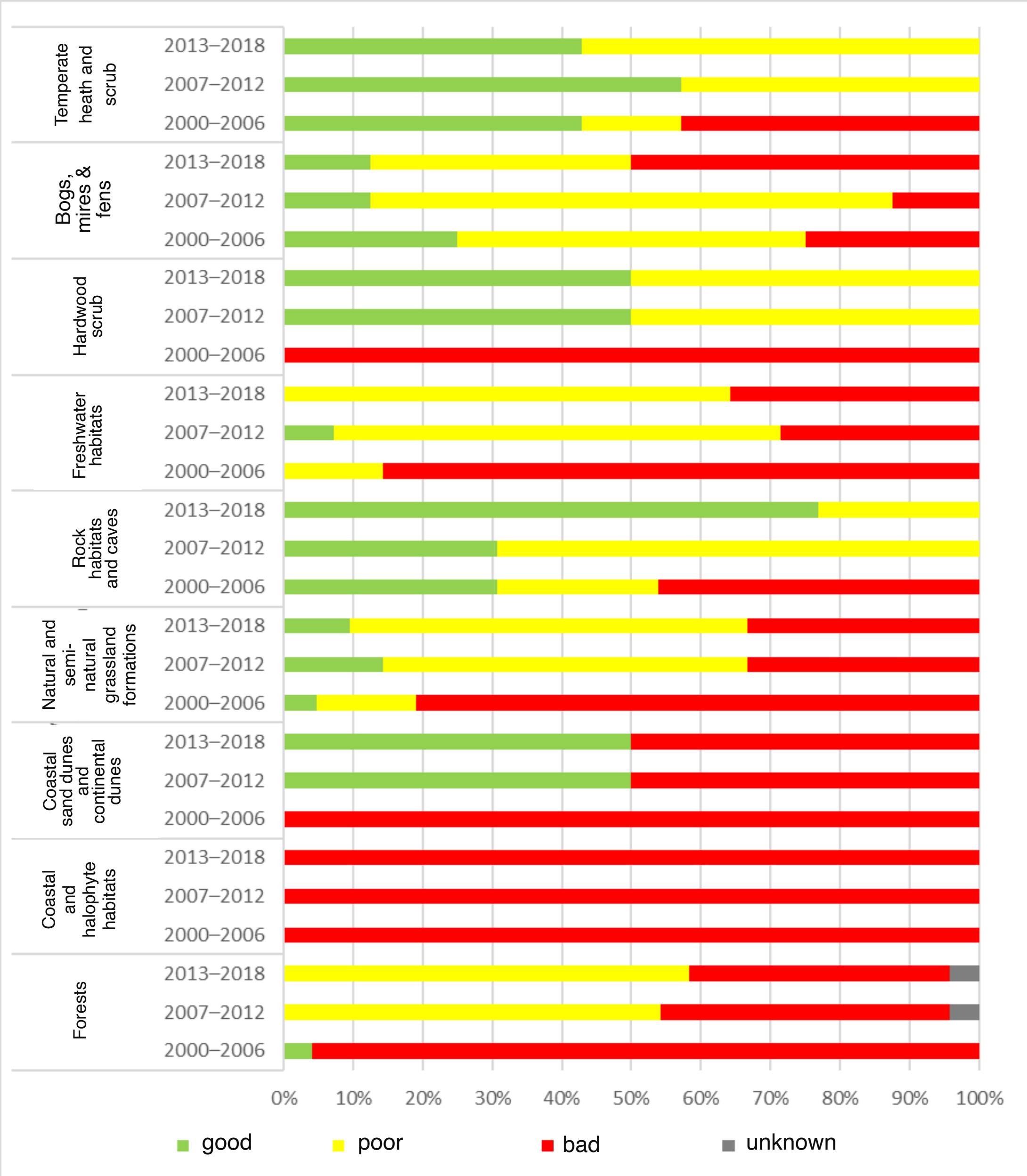
Data source: NCA CR

The **overall condition of each assessed habitat type** consists of four sub-parameters, namely existing area, potential area, structure and function, and future prospects. 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 on the territory of 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. Despite a slight improvement in the past, 79.6% of habitats are still rated in poor or unfavourable condition (49.5% and 30.1% respectively), compared to 82.8% in 2007–2012 and 88.2% in 2000–2006.

In all 3 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, 64.3% of these habitat types are rated in poor status. This is a deterioration compared to the previous 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 2007–2012 to 37.5% in 2013–2018), as 54.2% of habitats were assessed in the poor status category in 2007–2012 and 58.3% of habitats in the 2013–2018 period. No habitats from the forest 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 inadequate condition and only 23.1% as poor 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 140).

Chart 140

Assessment of the state of habitat types of Community importance in Czechia 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 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

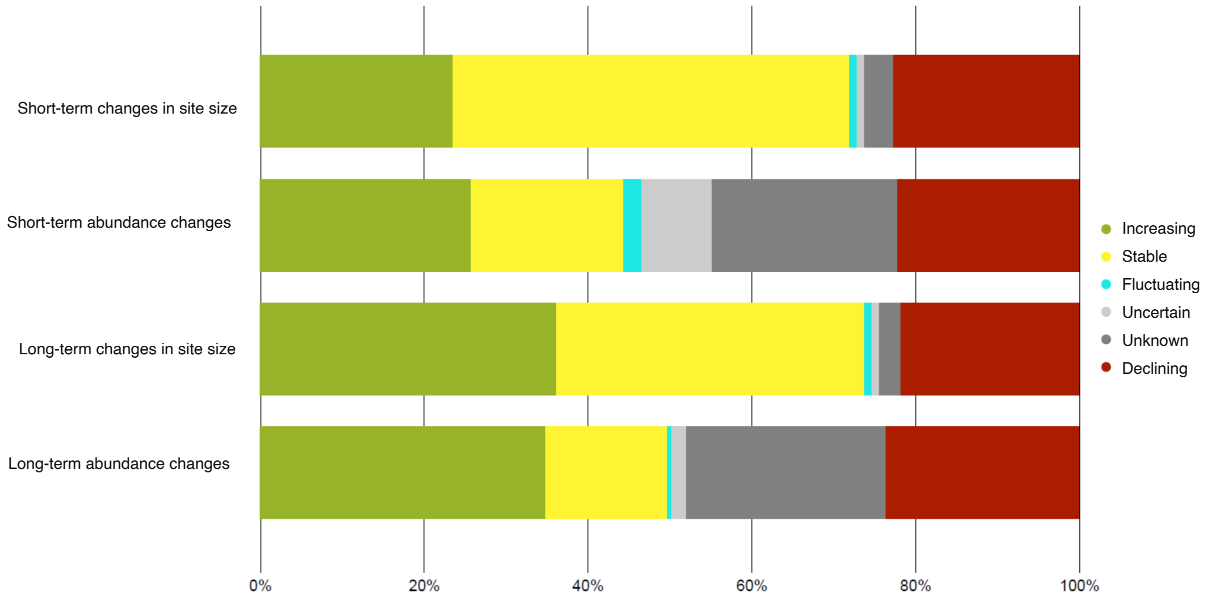
Data source: NCA CR

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)[137], 49.8% 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, 25.8% of wild bird populations were assessed as increasing, 18.6% as stable, followed by 2.3% as fluctuating, 22.2% as decreasing, 8.6% as uncertain and 22.6% as unknown. For long-term abundance changes, 34.8% of bird populations were assessed as increasing and 15% as stable. The other half of bird populations show long-term declining (23.5%), uncertain (1.8%) and unknown (24.4%) states. The population states of bird species depend to a large extent on the **state of their ranges**. An increase in abundance was recorded, for example, in the Šumava population of the ruffed grouse *(Tetrao urogallus*), which responded positively to the no-touch regime in Zone 1 of the National Park after the wind calamity caused by Hurricane Kyrill. In the long term, 73.8% of sites are in a stable or increasing state (i.e. increasing in area), and 72% in the short term (Chart 141). A species with significantly positive range and population trends is the peregrine falcon *(Falco peregrinus*), whose European population collapsed in the 1950s due to the use of various types of pesticides in agriculture, especially DDT. Falcons returned to Czech nature 30 years later and nowadays there are more than 100 pairs nesting in Czechia, thanks to the protection of natural nesting sites and the erection of bird houses on high-rise buildings. Also, the unpopular step of restricting access and activities in selected areas of NP Bohemian Switzerland, which is one of the most important nesting sites of the peregrine falcon, enabled the successful nesting and raising of chicks and significantly contributed to the protection of this species.

Chart 141

Conservation state of wild birds in Czechia under the EU Birds Directive [%],2013–2018



Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: NCA CR

[137] *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

Common bird species

Trends in bird populations[138] 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.[139] Populations of common bird species show a long-term slightly declining trend. Between 1982 and 2022, **populations of all common bird species** in Czechia declined by 8.9% overall, with new modelled trends showing stability until 2015 and a steady decline from 2016 onwards (Chart 142).

The **abundance of farmland bird populations** declined by 40.1% in 2022 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 high 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[140]. 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[141]. 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. The lack of improvement suggests that existing financial instruments are not effective enough to limit the negative impact of agriculture.

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 the year 2000. This was followed by a period of stability, but over the last ten years the population has shown a steady downward trend. In 2022, its value was 20.8% lower than in 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. Positive population trends are recorded for common bird species that have been able to adapt to the rapidly changing landscape. An example is the homing pigeon *(Columba palumbus*), a species once exclusively found in forest habitats, which now nests in large numbers in trees in every major city.

---

[138] *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 the Czech Republic. 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 (UBCP). 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.*

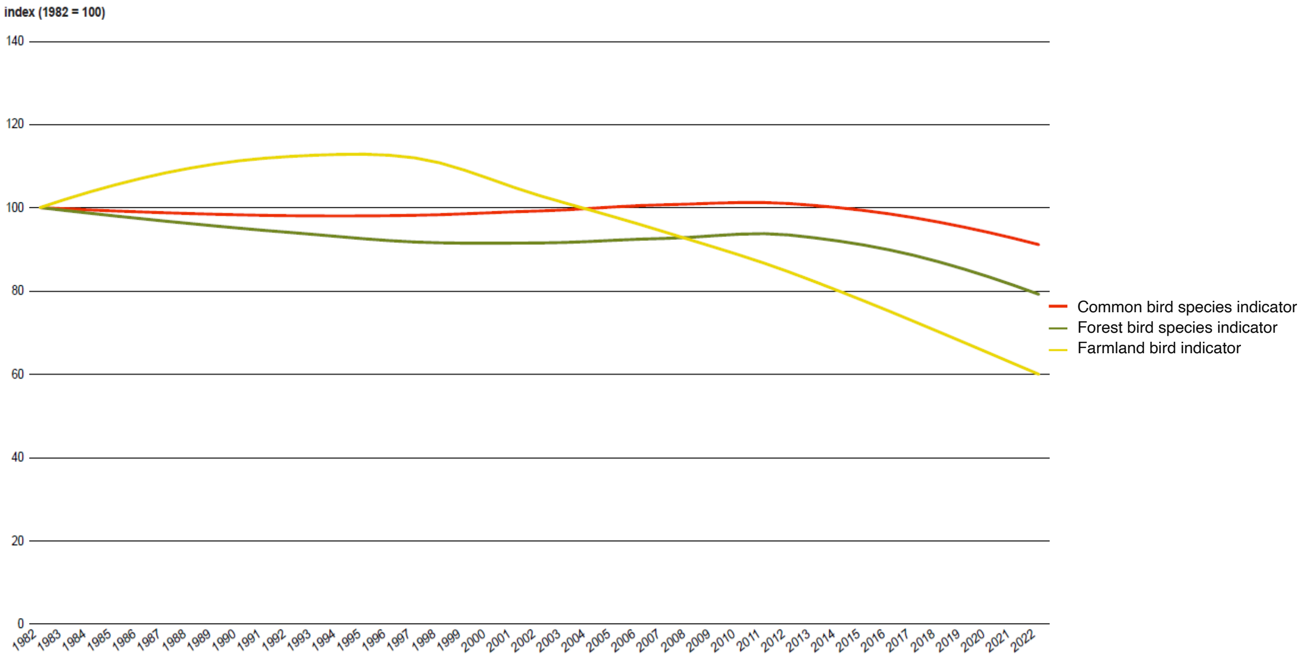
[139] *Reif J., Škorpilová J., Vermouzek Z. & Šťastný K. (2014): Changes in breeding populations of common bird species in the Czech Republic during the 1982–2013 period: analysis using multispecies indicators. Sylvia 50: 41–65.*

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

[141] *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.*

Chart 142

Indicators of all common bird species, forest bird species and farmland bird species in Czechia [index, 1982 = 100], 1982–2022



Data source: COS

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[142].

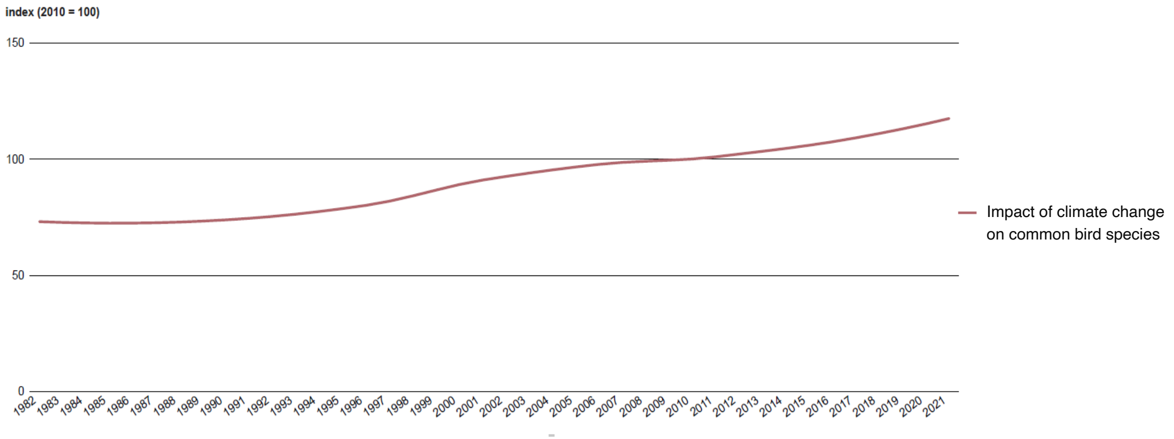
The **impact of climate change** on bird species in Czechia was insignificant in the 1980s, however, its importance began to grow after 1990 with a visible acceleration around the turn of the millennium. This was followed by a period of slower growth until about 2010, since when the impact of climate change on bird populations has been increasing again, especially in recent years[143]. 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 143). 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.

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

[143] *99 species in the Czech Republic were assessed. COS 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 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.*

Chart 143

Indicator of the impact of climate change on common bird species in Czechia [index, 2010 = 100], 1982–2021



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 for 2022 are not available at the time of publication.

Data source: COS

State of plant, animal and fungi species according to the red lists

In the 2017 red lists [144], 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. The Italian crested newt *(Triturus carnifex*) is the only amphibian species that has been reclassified in the new red list to a lower category than in the previous assessment. Thanks to appropriate management, its population has begun to thrive again. Since 2012, targeted management and control of suitable sites has been carried out in the territory of the Podyjí National Park – a change in the management of ponds, targeted reduction of fish stocking and the creation and restoration of pools and small wetlands, which strengthens the populations of the Italian crested newt. From the monitoring data available, it is currently possible to observe an increase in the abundance of populations, but also the successful spread of the species to new or restored sites.

A large share of endangered species can be found among reptiles, fish and lampreys, birds, diurnal butterflies and scarab beetles (Chart 144), 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. Predation by piscivorous predators also has an impact on fish populations. A large number of endangered plant and animal species (Fig. 38) are found in the border areas of Czechia, where many protected areas are located, and in the Pannonian region (southern Moravia).

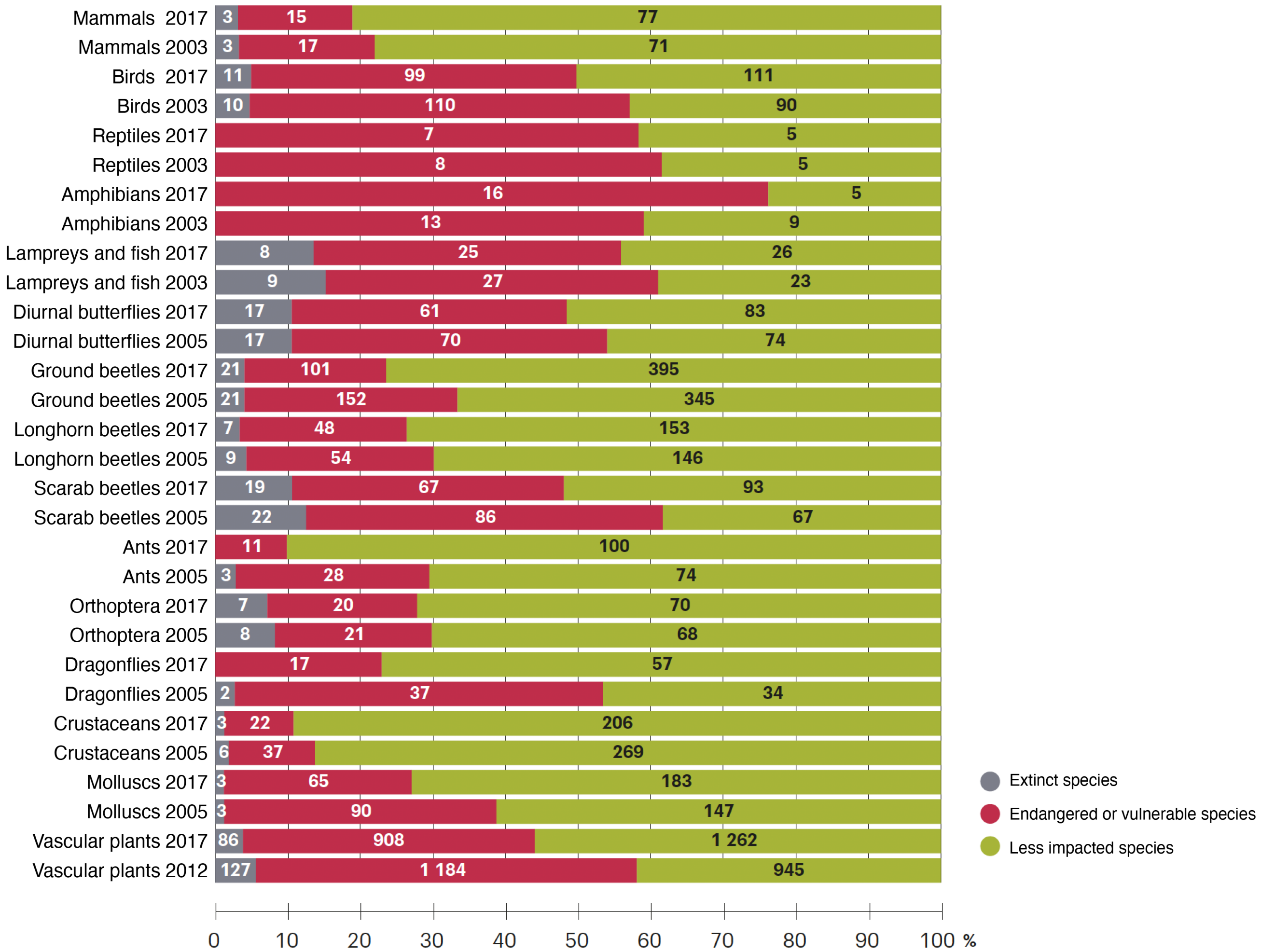
Conservation programmes are an important tool for the protection of the most endangered species. In 2023, the Active Tools for Species Conservation Concept was approved, which now includes regional action plans. Rescue programmes are currently being implemented for six species of animals and eight species of plants. Thanks to the rescue programme, for example, the sand pink *(Dianthus arenarius)* was saved, the remaining population of which (numbering about 200 individuals in the 1990s) has increased more than forty times.

[144] *Data for 2018–2022 are not available at the time of publication.*

The Regional Action Plan for the Hermit (Chazara briseis) in the Bohemian Central Highlands, which was approved at a time of critically low numbers of this species at the last site (Raná), has been successful. So far, we have managed to significantly increase the numbers of hermits at Raná and, through a combination of measures, to restore their abundance at other sites.

Chart 144

Assessment of the state of selected groups of native endangered plant and animal species in Czechia according to the red lists [number of species, %], 2003, 2005, 2012, 2017

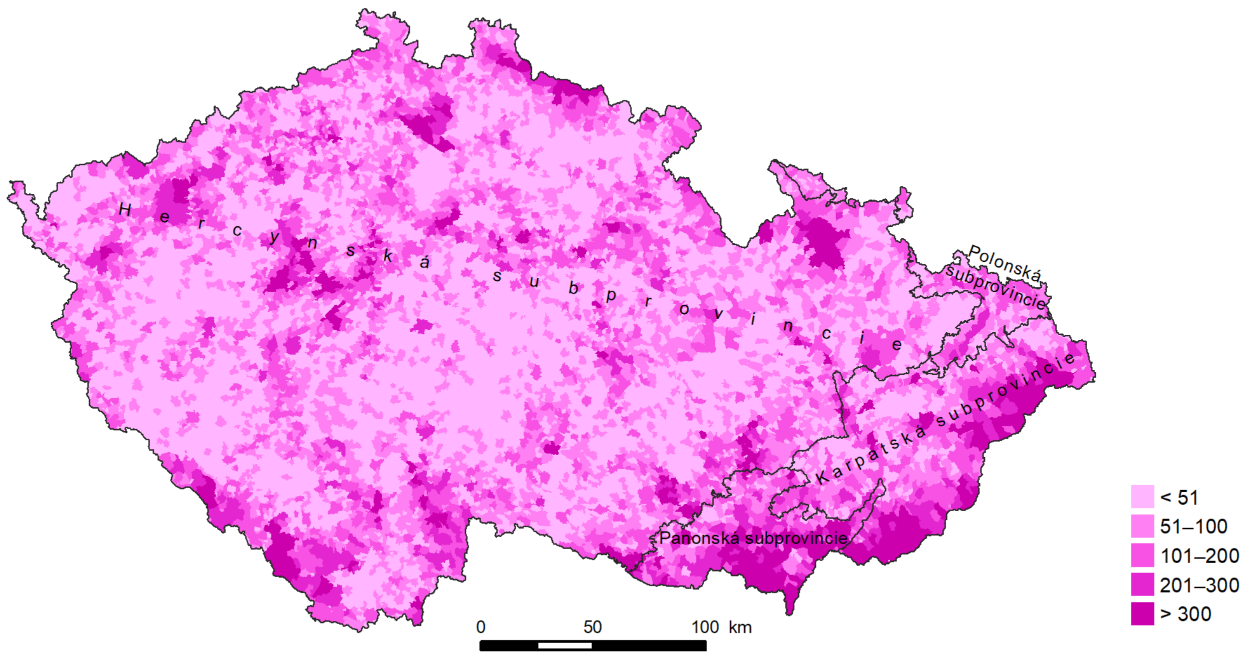


Data for 2018–2022 are not available at the time of publication.

Data source: NCA CR

Fig. 38

Occurrence of endangered plant and animal species according to the red lists in individual cadastral territories of Czechia [number of species], 2022



Data source: NCA CR

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 SPAs, has increased by 224.7 ha since 2021. This increase was mainly due to the creation of new small-area SPAs.

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	↗	↗	→	~
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

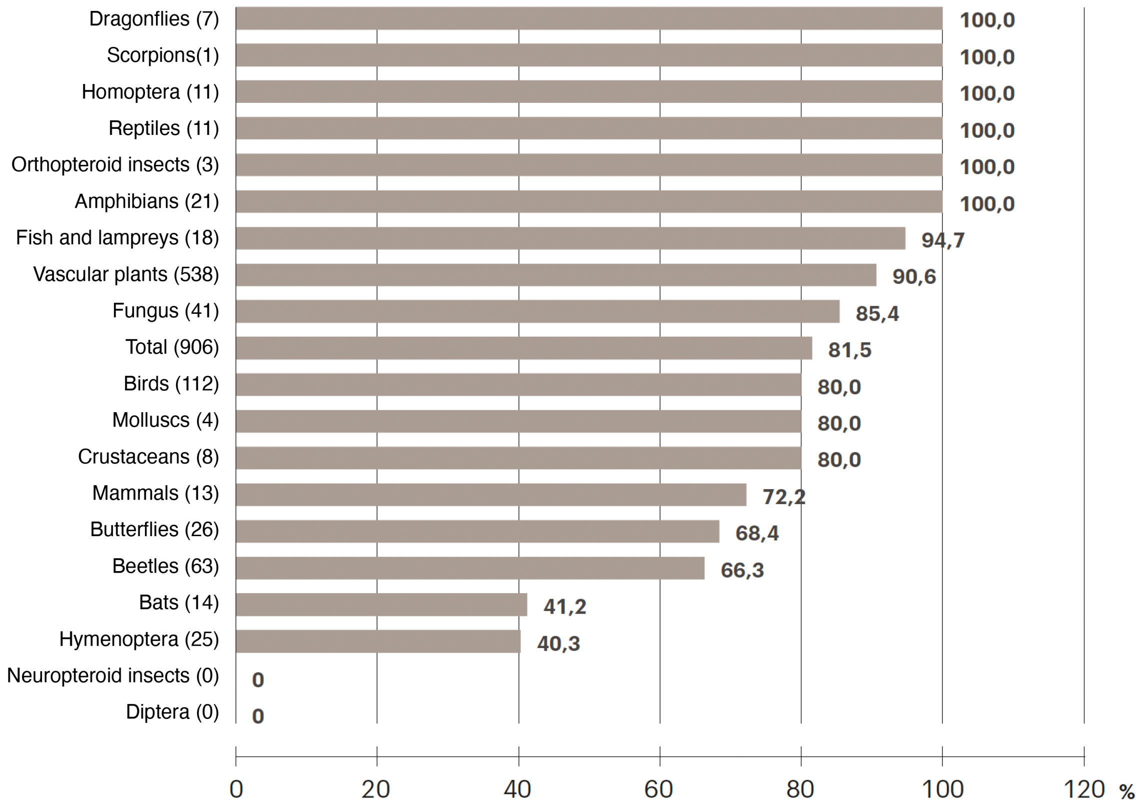
Protected species are listed in the Annex to the Act on Nature and Landscape Protection No. 114/1992 Coll., Decree No. 395/1992 Coll. as amended[145], Decree of the Ministry of the Environment of Czechia implementing certain provisions of the Act of the Czech National Council mentioned above. Yet there 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[146]. 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 2022, 81.5% of specially protected species were on red lists (i.e. genuinely endangered) (Chart 145).

[145] *More at: https://portal.nature.cz/redlist/v_cis_vyhl.php?akce=none&choice=1&plny_vypis=1*

[146] *A digital database of red lists is available at: https://portal.nature.cz/redlist/v_cis_redlist.php?akce=none&choice=1&plny_vypis=1*

Chart 145

Share of protected species on red lists in Czechia [%], 2022



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: NCA CR

Specially protected areas and Natura 2000 sites

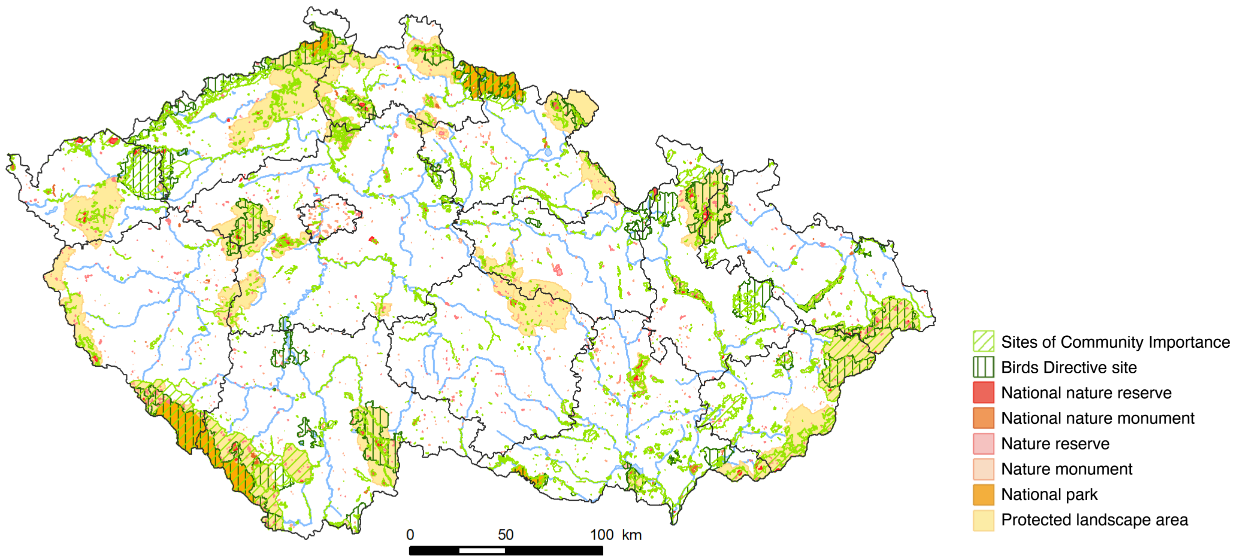
The total area of specially protected areas (SPAs) in Czechia, including both small-area and large-area SPAs, as of 31 December 2022 amounted to 1,324.9 thous. ha, i.e. 16.8% of the national territory. This has increased by 224.7 ha since 2021. This increase was mainly due to the creation of new small-area SPAs (Fig. 39). The area of large-scale specially protected areas, which include national parks (NP) and protected landscape areas (PLA), amounted to 1,257.2 thous. ha in 2022 (15.9% of the Czech territory), compared to 1,257.2 thous. ha in 2021. Small-area Specially Protected Areas in 2022 covered 116.3 thous. ha, i.e. 1.5% of the territory of Czechia (in 2021 it was 115.9 thous. ha, i.e. 1.5% of the territory). In 2022, 10 new small-area SPAs were created and their total area increased by 434.3 ha. Almost a third of small-area SPAs are located in a protected area or a national park. From 1 July 2022, the Blanský les was newly declared as a Protected Landscape Area, which resulted in a more precise definition of the boundary of the Protected Landscape Area, more effective protection of the Blanský les site of Community importance, and a new setting of the necessary closer protection conditions of the Protected Landscape Area so that the typical character of the harmonious landscape is preserved and natural and semi-natural communities with important species of plants and animals are maintained. At the same time, the new designation of nature protection zones will enable the effective protection of the most valuable places in the Blanský les.

Maintaining no-touch zones in national parks and other protected areas is also of great importance for biodiversity. For example, in the Šumava National Park, the no-touch zones allow the survival of two rare forest beetle species – the *Peltis grossa* and the pine wood-living beetle *(Tragosoma depsarium).*

In 2022, there were 1,153 Natura 2000 sites. Of these, 41 bird areas covered a total of 703.4 thous. ha and 1,112 sites of Community importance covered a total of 795.6 thous. ha. The total area of all Natura 2000 sites at the end of 2022 was 1,115.4 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 (SPA), 35.9% of the Natura 2000 area was outside other SPAs. Natura 2000 covers more than 18% of the territory of the EU Member States. The total area of SPAs and Natura 2000 sites, taking into account their overlaps, was 1,725.6 thous. ha in 2020, i.e. 21.9% of the area of Czechia (Fig. 39).

Fig. 39

Specially protected areas and Natura 2000 sites in Czechia, 2022



Data source: NCA CR

Share of the area of habitats and species in Natura 2000 sites

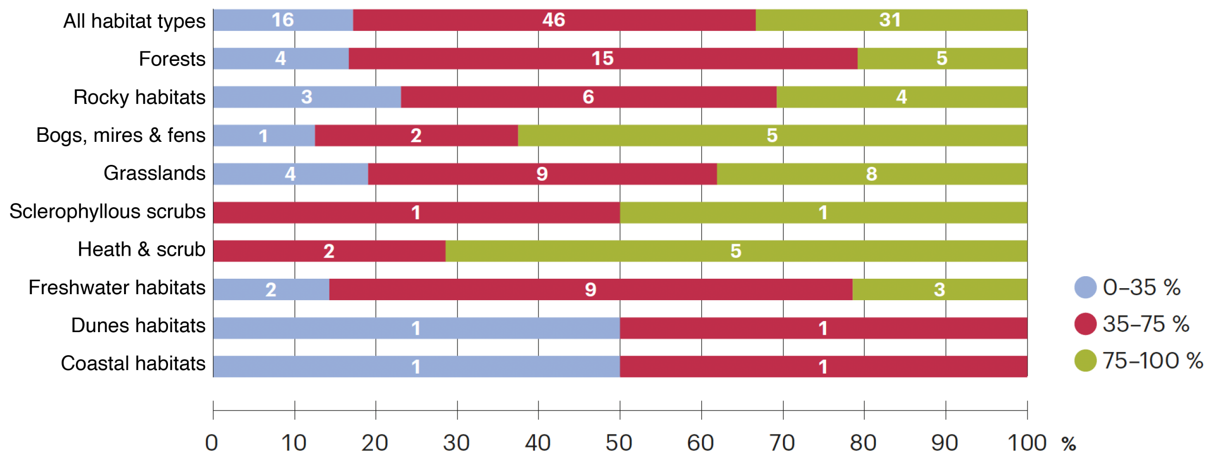
The representation of individual habitats in Natura 2000 sites according to cover classes distinguishes nine habitat types and three cover classes, which express what share of the Natura 2000 site area is occupied by a particular habitat type (Chart 146).[147] Information is reported for the 2013–2018 period[148]. It is noticeable that the majority of covered sites are bogs, mires and fens.

[147] *More at: https://www.eea.europa.eu/themes/biodiversity/state-of-nature-in-the-eu/article-17-national-summary-dashboards/natura-2000-coverage*

[148] *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

Chart 146

Representation of habitat types in Natura 2000 sites by in Czechia by cover classes [%], 2013–2018



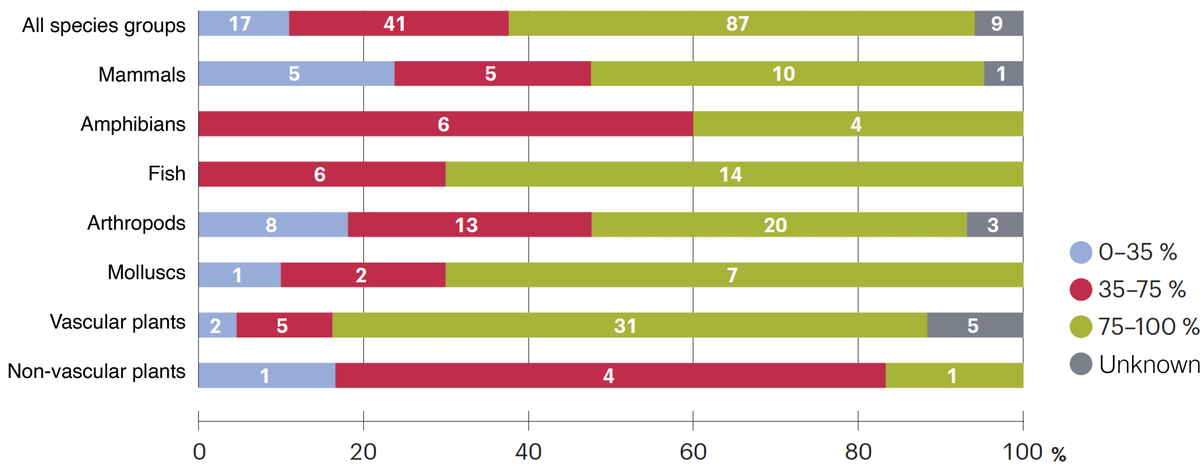
Assessment of the share of habitats in cover classes 0–35%, 35–75% and 75–100%, which express the percentage of the monitored habitat type in the assessed site. The 2013–2018 assessment period includes 93 sites. Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: NCA CR

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[149] reporting period (Chart 147). Most of the species covered in Natura 2000 sites are molluscs, fish and vascular plants.

Chart 147

Representation of species types in Natura 2000 sites in Czechia by cover classes [%], 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 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: NCA CR

[149] *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

3.2.3. Invasive species

Key question

How many invasive species live in Czechia?

Key messages

✖	Of the total of 1,576 non-native plant species that occur or have been recorded in Czech territory, 75 are considered invasive. Of the 595 non-native species, 113 are invasive.

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
Non-native species in Czechia	N/A	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 1,576 **non-native plant species** that occur or have been recorded in Czech territory in 2022, 75 are considered **invasive** [150]. Widely spread invasive plant species are considered to be, amongst others, *the small balsam (Impatiens parviflora)*, horseweed (*Conyza canadensis)*, prickly lettuce (*Lactuca serriola)*, Canadian goldenrod (*Solidago canadensis)* and black locust (*Robinia pseudoacacia)*. One of the places where efforts are being made to stop the spread of the black locust is the Podyjí National Park. From the original area of about 180 ha of acacia trees, about 50 ha have been treated so far (the size of about 17 football fields). Eradication of individuals and stands is carried out by manual injection. Acacia is treated according to a strategy aimed at preferentially treating small isolated outbreaks and stands growing on sites with preserved vegetation.

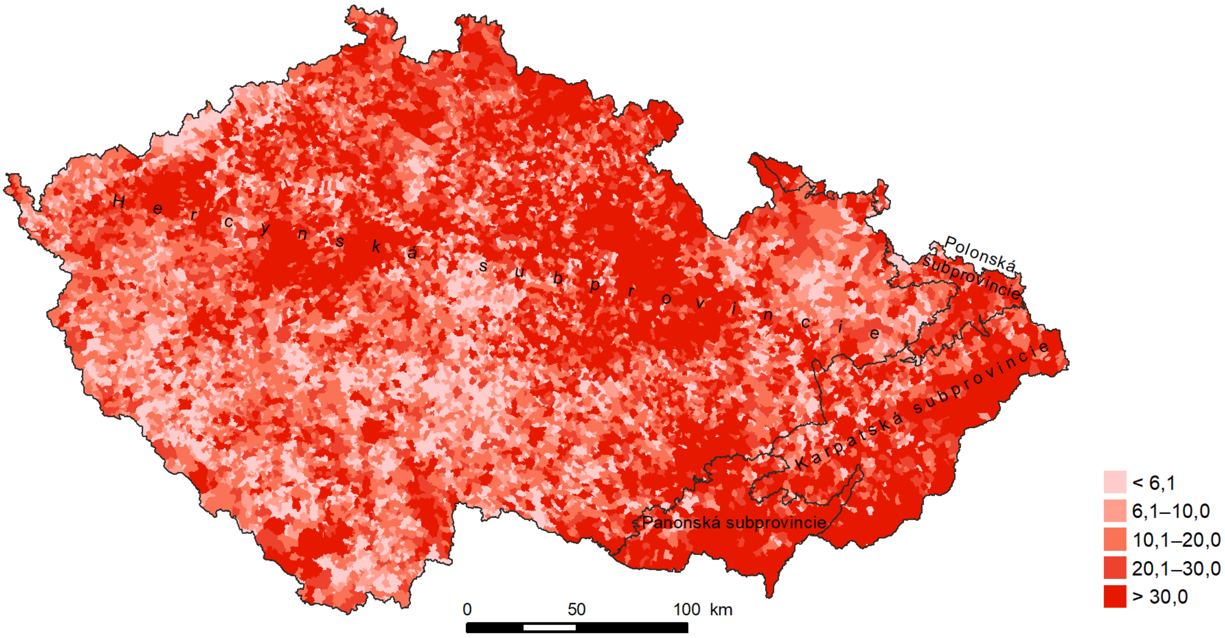
Of the 595 **non-native animal species**, 113 are considered **invasive** as of 2022. Widespread invasive species include, among others, the American mink *(Neovison vison*), the common raccoon *(Procyon lotor*), the Sika deer *(Cervus nippon*), the stone moroko *(Pseudorasbora parva*), the Prussian 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 (Fig. 40). The occurrence and spread of invasive species in Czechia is assessed approximately once every ten years. Data on the occurrence of non-indigenous species are collected primarily in the NCA CR Finding Database. The data are also used to plan interventions against invasive species in selected sensitive areas, including important projects aimed at the eradication of the giant hogweed in the Karlovy Vary Region and the common raccoon in Doupovské hory.

---

[150] *Pyšek, P.; Sádlo, J.; Chrtek, J. Jr. et al. (2022). Catalogue of alien plants of the Czech Republic (3rd edition): species richness, status, distributions, habitats, regional invasion levels, introduction pathways and impacts. Preslia. 94, p. 447–577*

Fig. 40

Occurrence of invasive plant and animal species in individual cadastral territories of Czechia [number of species], 2022



Data source: NCA CR

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	N/A	N/A	N/A
Breeding of endangered species in zoos	N/A	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 Earth, 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[151].

Reptiles have the highest number of registered specimens, especially tortoises of the genus Testudo. They are followed by 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).

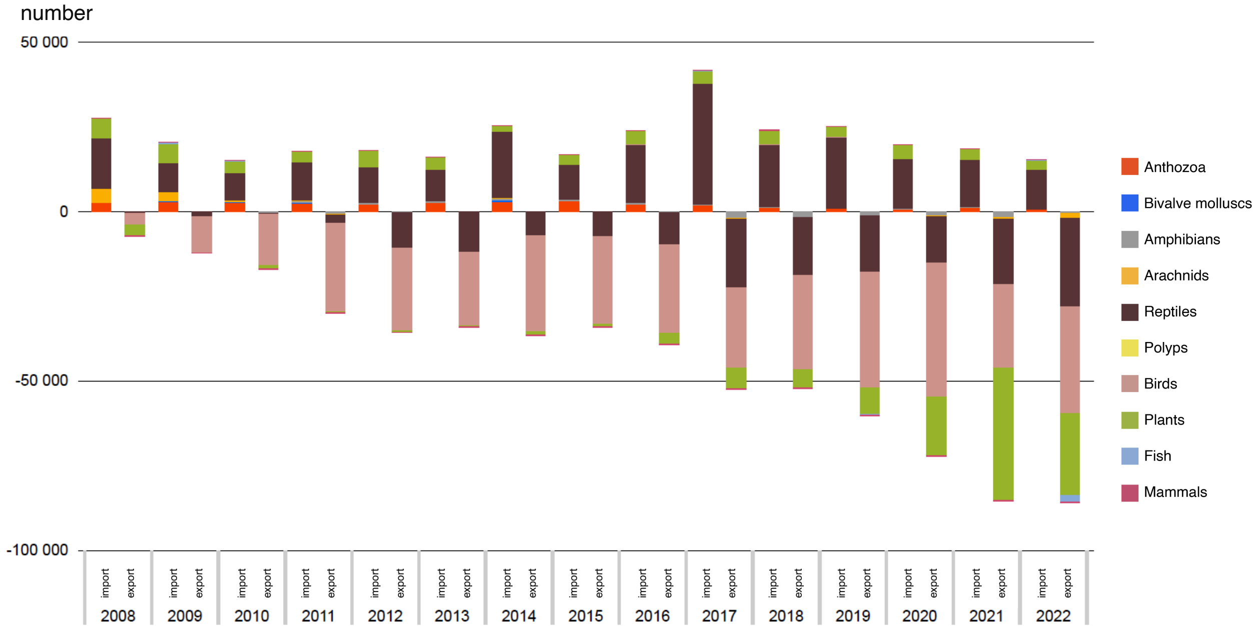
Exports of endangered and CITES-protected species show a negative upward trend in the assessed medium-term (2013–2022) and short-term (2018–2022) periods. Imports cannot be assessed in the medium term (2013–2022), while in the short term (2018–2022), the import rate shows a decrease. Reptiles are the 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 imported to Czechia. **Imported live plant specimens** include artificially grown orchids as well as representatives of the resinous and apoynaceae families. Of **inanimate plant specimens**, we import mainly the extract of the Burdock tree for traditional Chinese medicine. 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 148).

[151] *More at: https://www.mzp.cz/cites and https://sysnet.shinyapps.io/CITES_public/*

Among **living specimens seized due to illegal trade**, plants (mainly cacti) dominate and are in the order of hundreds of specimens, while no illegally traded species were recorded among animals in 2022 (Chart 149). In 2022, the majority of **inanimate specimens seized due to illegal import** are fish and 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 (623 seizures), and animals, mainly containing specimens of reptiles (e.g. extracts of python or cobra fat, with a total of 85 seizures in 2022) or mammals (e.g. bear bile, musk from the kabar deer, etc., with a total of 286 seizures in 2022).

Chart 148

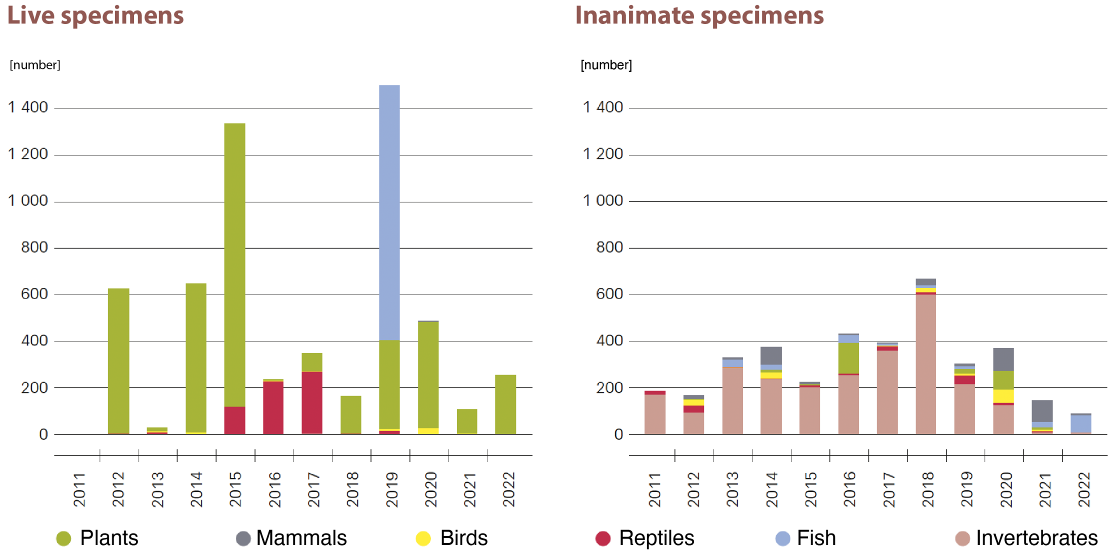
International trade in CITES-protected endangered species in Czechia [number of customs-cleared specimens], 2008–2022



Data source: MoE

Chart 149

Illegal trade in endangered species protected under CITES in Czechia [number of seized specimens], 2011–2022



In 2019, the seizure of approximately 70 000 specimens of elvers at Václav Havel Airport was exceptional. For the sake of clarity of the visualization, the number of captured specimens is capped at 1,500 specimens.

Data source: MoE

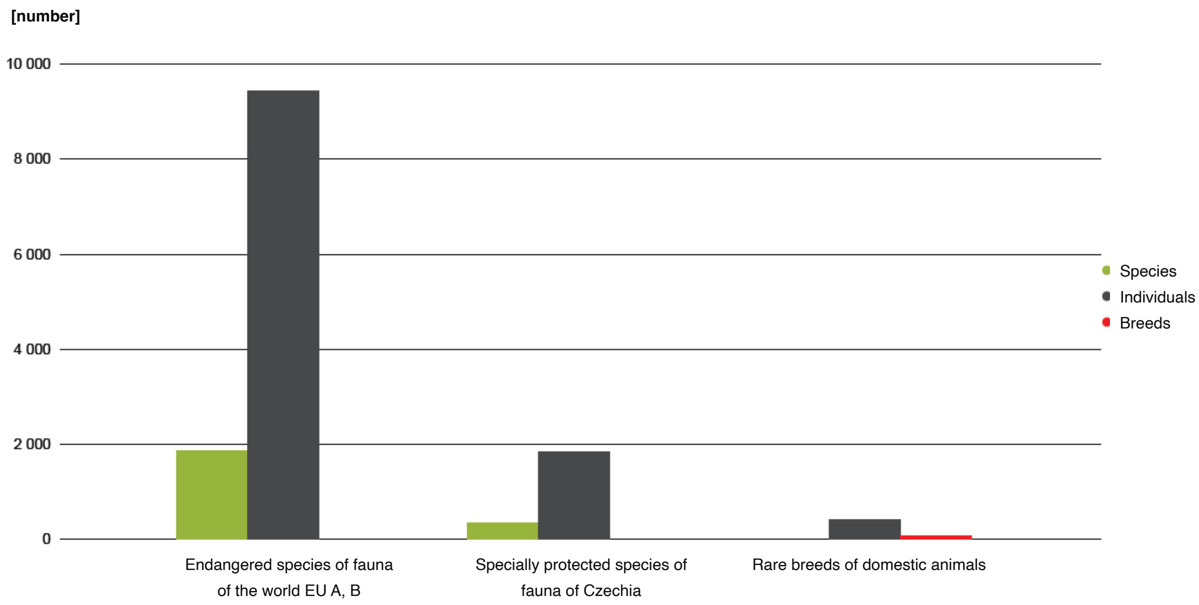
Breeding of endangered species in zoos

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. That 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 2022, 298 **specially protected species of Czech fauna,** 1,817 endangered species of world fauna and 65 rare breeds of domestic animals were bred **in zoos**. Endangered species of the world‘s fauna represented the largest number of individuals (Chart 150).

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 150

Breeding of endangered species in zoos in Czechia [number], 2022



Data source: MoE

Biodiversity in an international context

Key messages

✓	The share of terrestrial sites of Community importance and Natura 2000 bird areas in 2021 was 26.4% of the EU territory, which is still below the global target for the area (30% of terrestrial protected areas by 2030), but the increase in the area of terrestrial SPAs and Natura 2000 sites shows a positive trend. For Czechia, this share was 21.9% by 2021.
✗	The abundance of common bird species in Europe decreased by 11.8% between 1990 and 2021, the abundance of farmland bird species decreased by 36.0% and the abundance of forest bird species decreased by 5.0%. Grassland butterfly abundance in Europe has been declining for a long time, falling by 27.32% between 1991 and 2018[187].

Landscape fragmentation in an international context

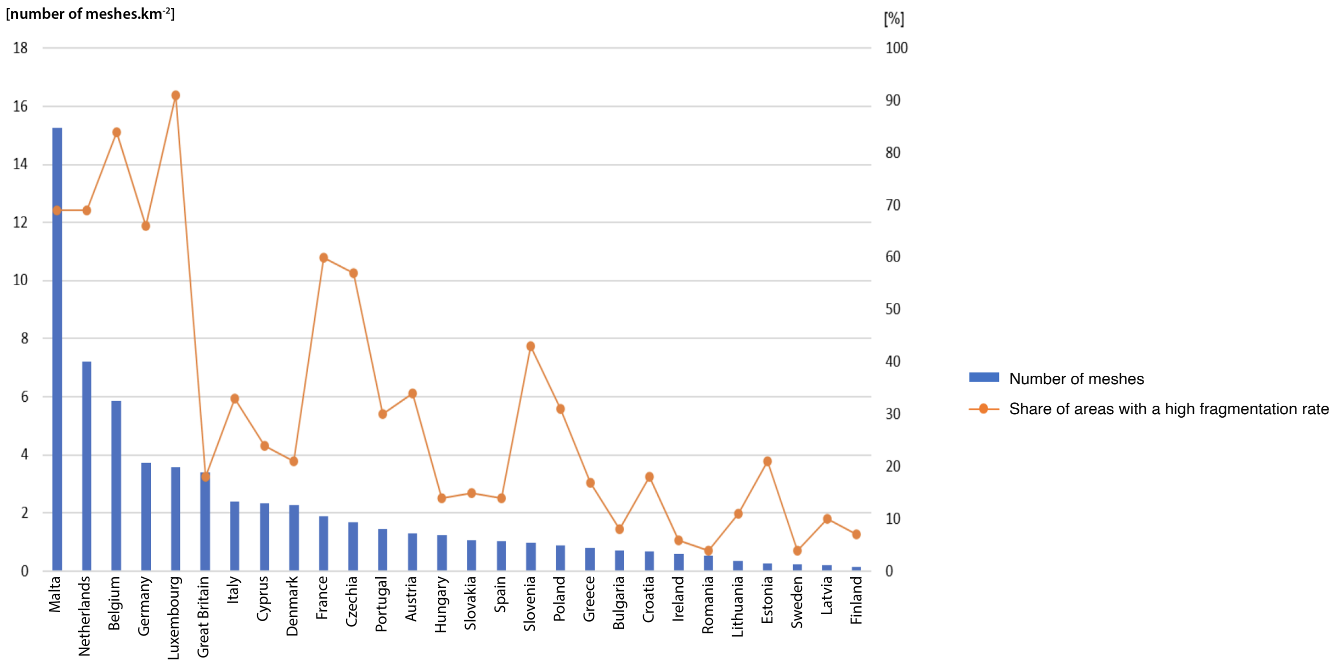
The most fragmented areas in 2018[152] were Malta, the Netherlands, Belgium and Germany (according to the average density of meshes expressing the degree of interruption of movement through the landscape due to fragmentation)[153]. Malta had around 15.3 fragmented meshes per km^2, the highest of any country. In the Netherlands it was 7.2, in Belgium 5.8, in Germany 3.7 and in Luxembourg 3.6 meshes per km^2. Although the level of landscape fragmentation is on average highest in Malta, Luxembourg and Belgium have the largest area of highly fragmented habitats, i.e. areas with an average habitat size of less than 0.02 km^2. Czechia is one of the European countries with the most fragmented landscape, with a density of 1.7 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 with 0.2 meshes per km^2 followed by Sweden, Finland and Latvia (0.2 meshes per km^2), Chart 151.

[152] *Data for 2019–2022 are not available at the time of publication.*

[153] *More at: 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 151

Landscape fragmentation in EU countries [number of meshes.km², %], 2018



Fragmentation due to the expansion of urban and transport infrastructure. Effective Mesh Density (EMD;S_{eff}) 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 density, hence the higher the fragmentation[154]. The geographical coverage of the dataset is EEA39. Data for 2019–2022 are not available at the time of publication.

Data source: EEA

State of species and habitats of Community importance in an international context

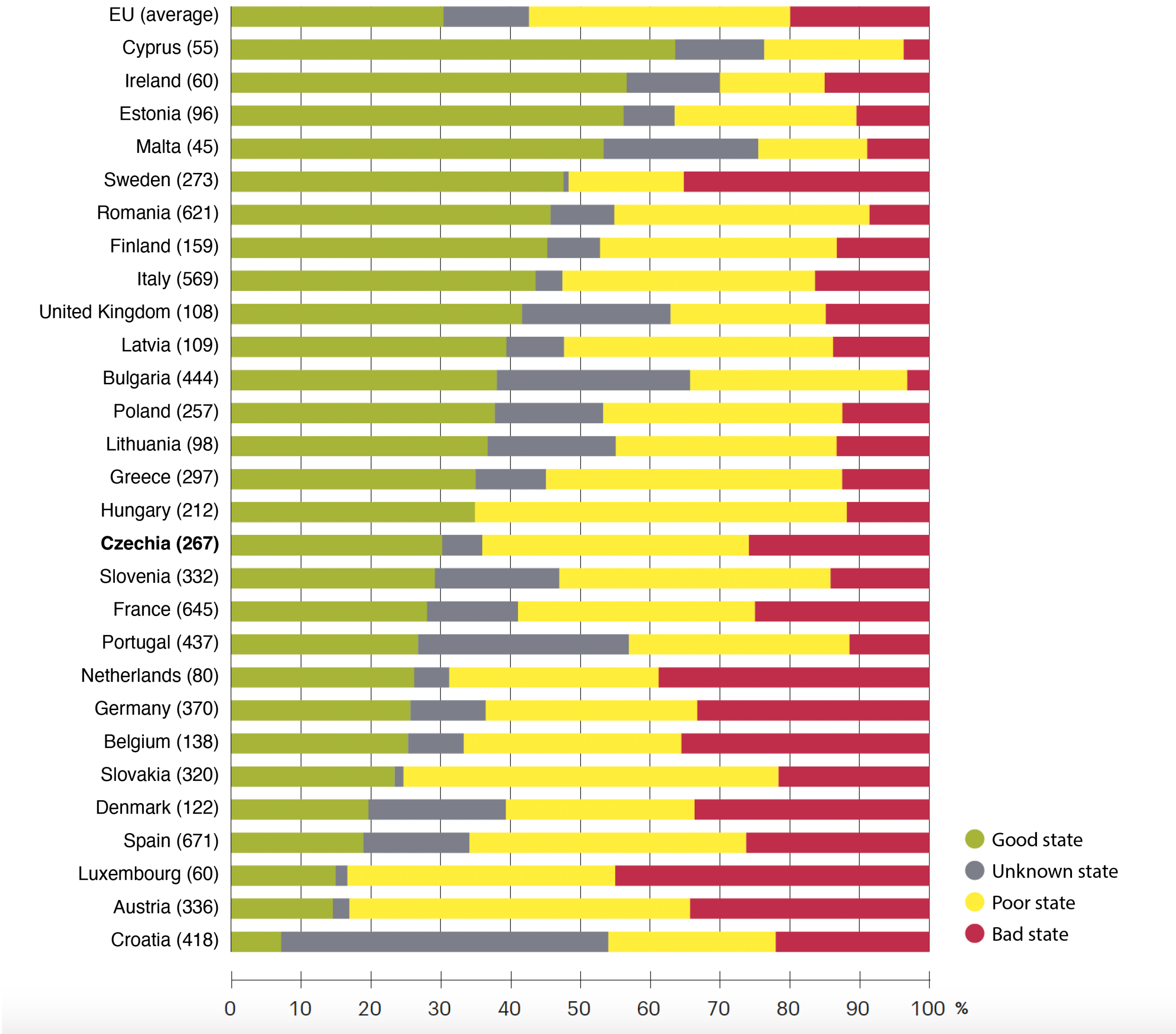
In an international comparison of the **state of animal and plant species of Community importance,** Czechia is around the European average (Chart 152). Cyprus (63.6%), Czechia (30.3%) and Croatia (7.2%) have the most species in good status. On the other hand, Luxembourg has the highest number of species in a bad status (45%), Bulgaria the lowest (3.2%). Czechia has 26.2% of species of Community importance in a bad status. Only 30.4% of species of Community importance (EU28) are in a good status (Chart 151)[155].

[154] *The degree of fragmentation can be analysed in two ways: The first is the Effective Mesh Size – the probability that 2 points in the landscape will meet; the mesh size reflects the size of the unfragmented polygons. The higher the EMS results, the lower the fragmentation rate. The second method is the so-called Effective Mesh Density per km² or larger area – it shows the density of unfragmented polygons per km². The higher the mesh density per km², the worse the fragmentation rate.*

[155] *Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.*

Chart 152

Conservation state of animal and plant species of Community importance in EU28 [%], 2013–2018



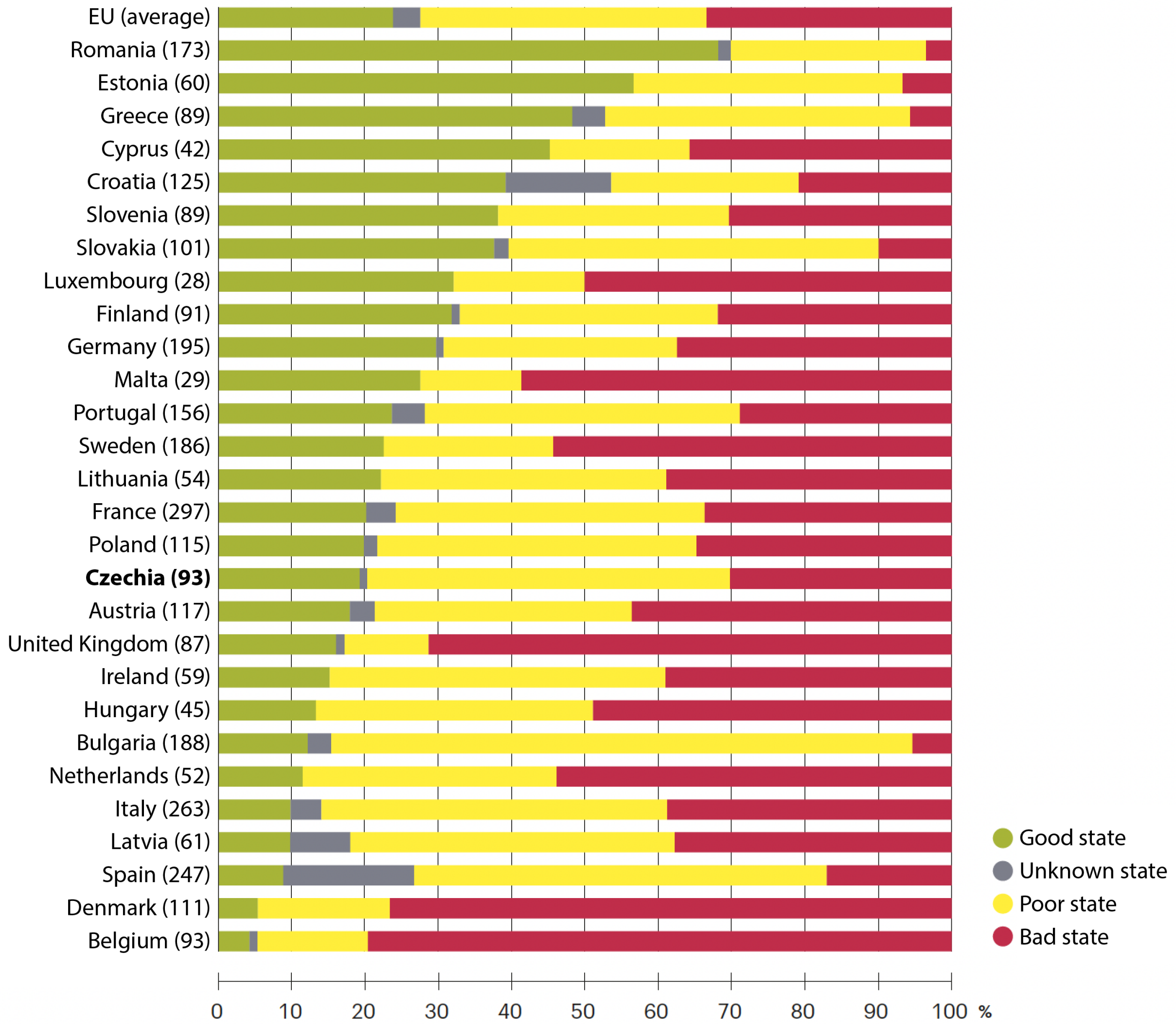
The numbers in brackets show the total number of species assessed. Data for 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

Data source: EEA

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%. 19.4% of the assessed habitat types were in a good state 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 153).

Chart 153

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 2019–2022 are not available at the time of publication due to the indicator being reported in six-year cycles.

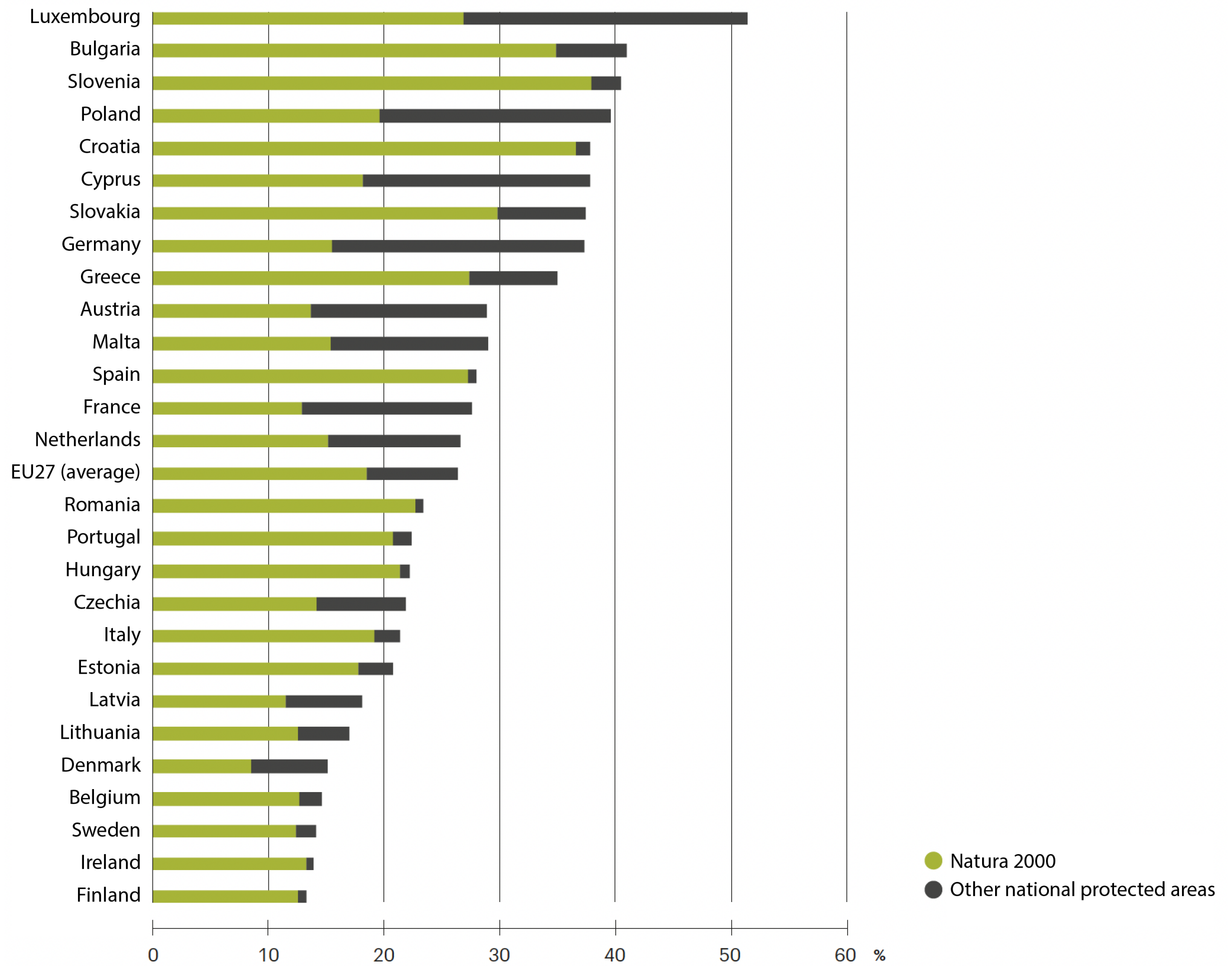
Data source: EEA

Protected areas in an international context

Luxembourg has the highest **share of Natura 2000 sites and national protected areas** as of 2021[156] (51.5%, of which 26.9% are Natura 2000 sites), while Finland has the lowest (13.2%, of which 12.6% are Natura 2000 sites). The EU average is 26.4% and in Czechia, specially protected areas and areas protected under the European Natura 2000 network cover 21.9% of the area (Chart 154).

Chart 154

Percentage of the territory designated as a protected area and Natura 2000 sites in EU27 [%], 2021



The area of other protected areas in the country is added to the share of sites in the national area. Different types of protected areas often overlap; these overlaps are not shown in the graph. Data for 2022 are not available at the time of publication.

Data source: EEA

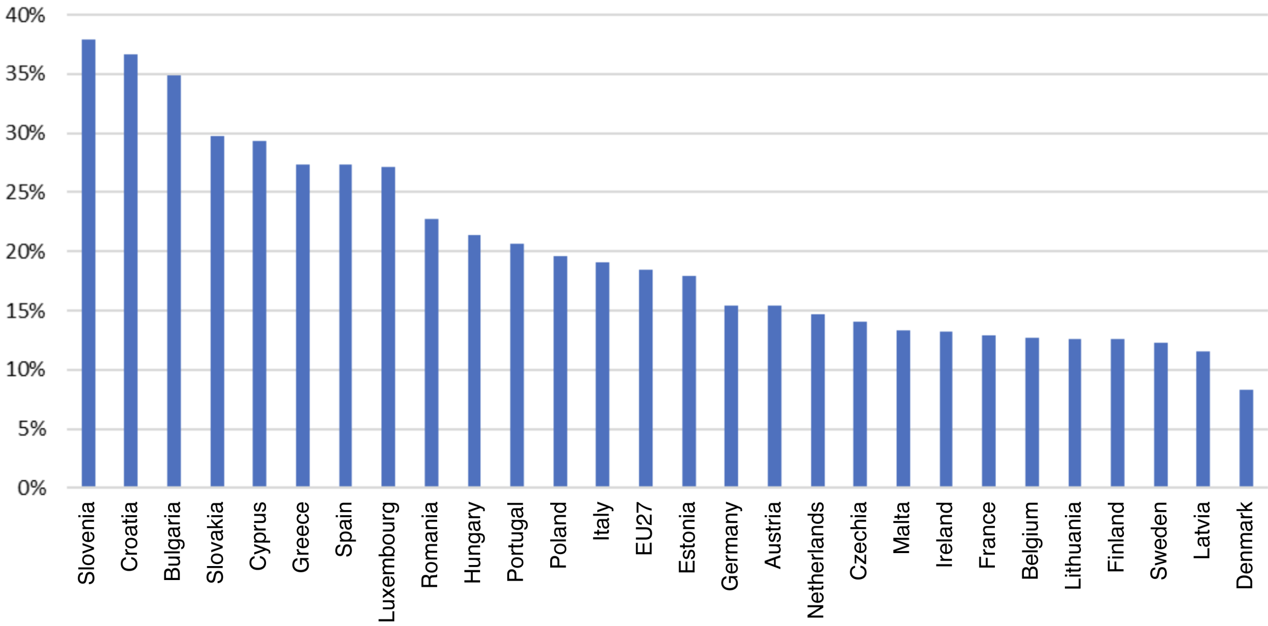
Slovenia (38%), Croatia (37%) and Bulgaria (35%) have the highest **share of terrestrial sites of Community importance and Natura 2000 bird sites in the country**. The EU27 average in 2020[157] was 18%. Czechia, with 14%, is one of the countries with a lower share of Natura 2000 sites in the national area. Denmark has the lowest share (8%), Chart 155.

[156] *Data for 2022 are not available at the time of publication.*

[157] *Data for 2021 and 2022 are not available at the time of publication.*

Chart 155

Percentage of terrestrial sites of Community importance and Natura 2000 bird sites in EU27 [%], 2020



Data for 2021 and 2022 are not available at the time of publication.

Data source: EEA

Common bird species in an international context

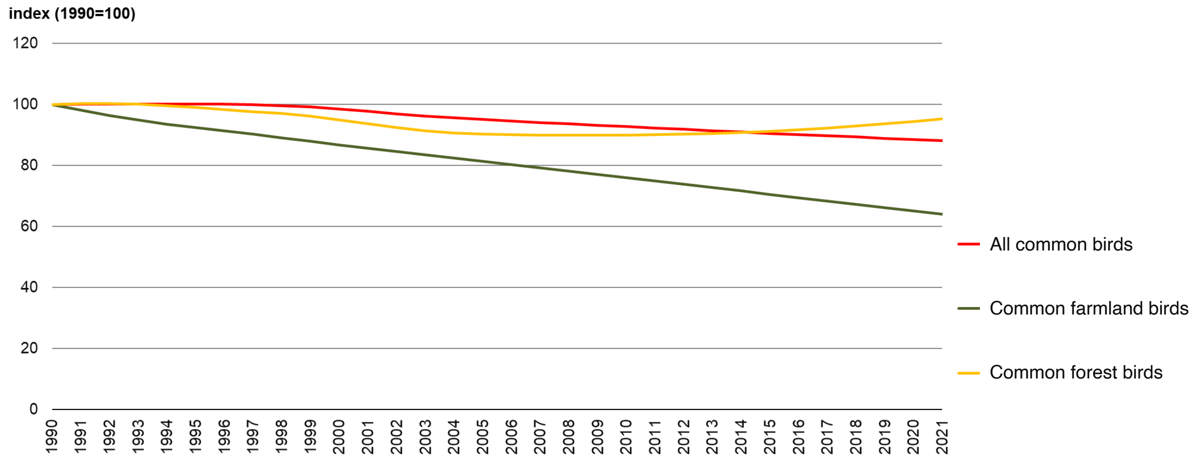
The **abundance of common bird species** in Europe has been declining steadily since about 1997, by 11.82% between 1990 and 2021[158]. **Farmland bird species** have been declining steadily since the beginning of the period under review, with a 35.95% decline in populations from 1982 to 2021. **Forest bird species** have declined by 4.96% since 1990[159] (Chart 156).

[158] *Data for 2022 are not available at the time of publication.*

[159] *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 (168 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 joint monitoring programme. The data coverage increased from 9 to 22 EU Member States between 1990 and 2010, and covered 25 countries from the 2011 reference year.*

Chart 156

Indicator of common bird species, forest bird species and farmland bird species in Europe [index 1990 = 100], 1990–2021



Data for 2022 are not available at the time of publication.

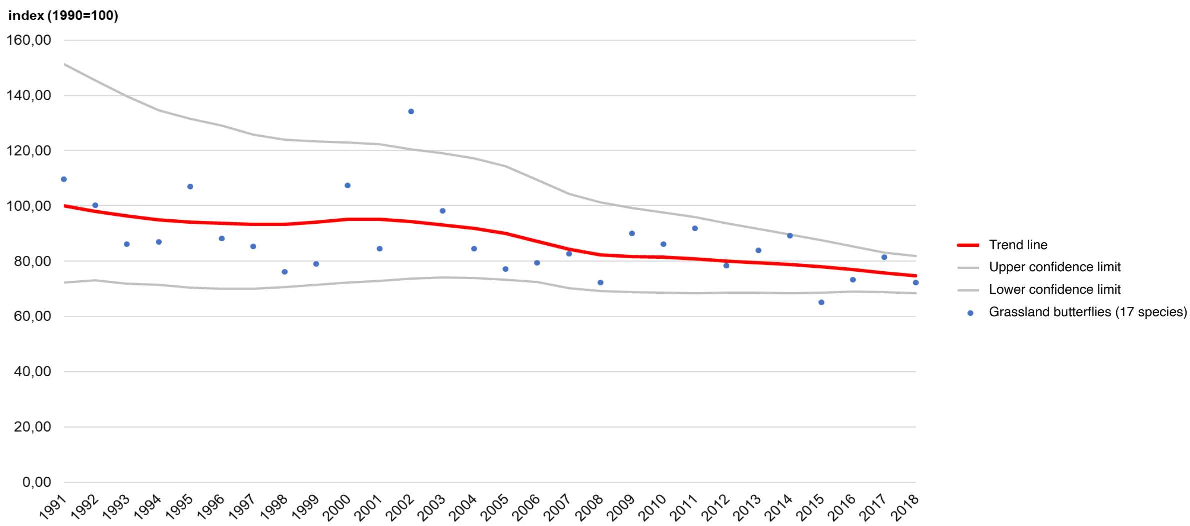
Data source: EEA, EBCC (European Bird Census Council)

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[160], they declined by 27.3%[161] (Chart 157).

Chart 157

Grassland butterfly indicator in Europe [index, 1990 = 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 2019–2022 are not available at the time of publication.[162]

Data source: EEA

---

160 *Data for 2019–2022 are not available at the time of publication.*

161 *More at: https://butterfly-monitoring.net/able-results*

162 *More at: https://www.eea.europa.eu/data-and-maps/daviz/european-grassland-butterfly-indicator-4/#tab-chart_6*

4. 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 testify 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 of 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 of this topic. Public sources of 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[163].

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 Czechia 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 2030 with a view to 2050

- a sufficiently diversified mix of programme financial support given the uncertainty about the shape of future EU multi-annual financial frameworks, the level of national funding received and the areas of support
- a significant shift away from primarily subsidy-based programmes and the mobilisation of private capital

[163] *The information on public expenditure is based on the MoF's budget composition, which also tracks funds provided primarily for the creation and protection of the environment over the long term. As the source of expenditure of territorial budgets can also be financial transfers (e.g. from the state budget, state funds, etc.), some of these expenditures are duplicated with expenditures from central sources, i.e. European funds. For this reason, expenditure from central, territorial and European or international sources is assessed separately and cannot be summarised.*

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 urbanised 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 2021–2027

- allocation of financial support to the OP ENV 2021–2027 of EUR 2.4 bil. (CZK 58.2 bil.) of EU funds, or EUR 2.9 bil. (CZK 69.6 bil.) of the TEE into the following support areas:
    1. Energy savings: 20.0% of programme allocation
    2. Renewable energy: 11.5% of programme allocation
    3. Adaptation to climate change: 16.7% of programme allocation
    4. Water supply and sewerage: 23.1% of programme allocation
    5. Circular economy: 11.6% of programme allocation
    6. Nature and pollution: 17.4% of programme allocation

National Reform Programme of the Czech Republic 2022

- investments in reducing energy consumption in the public sector, switching to cleaner energy sources, developing clean mobility, renovating buildings and protecting the air, protecting nature and adapting to climate change, circular economy and recycling, revitalising areas with old buildings, promoting biodiversity and combating drought

Investment and non-investment costs for environmental protection

Key question

What is the structure and volume of investments to maintain and improve the quality of the environment?

Key messages

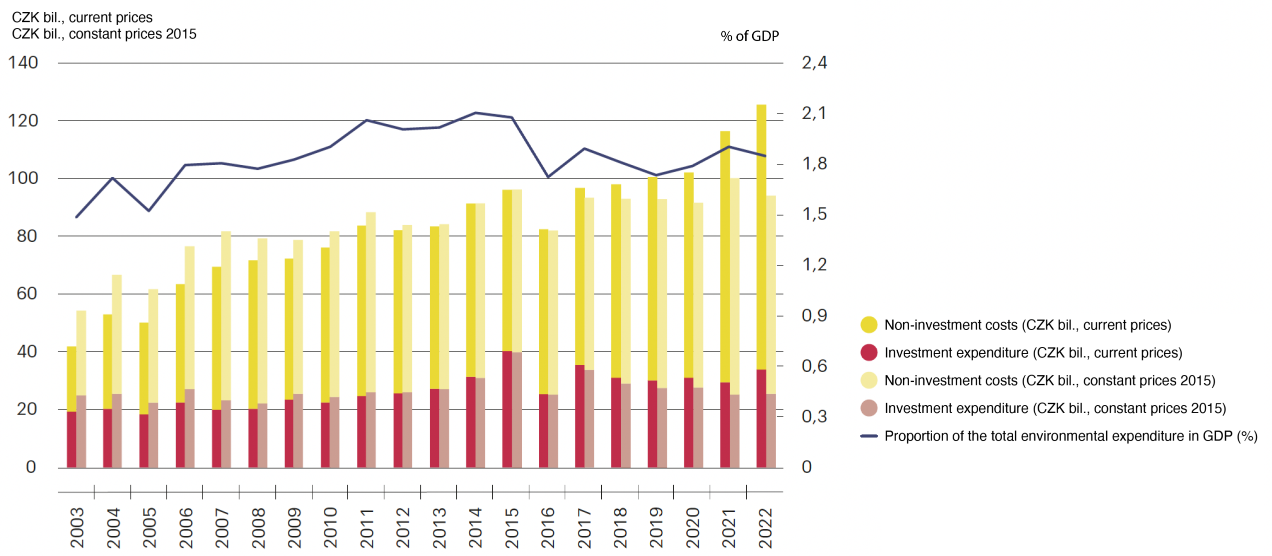
In 2022, total expenditure, i.e. investments and non-investment costs in environmental protection, totalled CZK 125.6 bil. and increased by CZK 9.3 bil. compared to 2021, i.e. by 8.0%. However, given the stronger growth of the Czech economy in 2022, the share of investments and non-investment costs in GDP decreased slightly by 0.05 p.p. to 1.85% 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.

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 CZSO since 1986 in the case of investment expenditure in environmental protection or since 2003 in the case of non-investment costs.

In 2022, the total cost of environmental protection increased by CZK 9.3 bil. year-on-year, i.e. by 8.0% to a total of CZK 125.6 bil. in cu.p. (Chart 158). Both investments and non-investment costs grew – in the case of investments, their growth amounted to CZK 4.6 bil., i.e. 15.5% to the total of CZK 34.1 bil., non-investment costs increased by CZK 4.7 bil., i.e. by 5.5% to CZK 91.5 bil. However, the **total share of investments and non-investment costs in GDP** still fell slightly by 0.05 p.p. to 1.85% of GDP, given the strong economic growth in 2022.

Chart 158

Total expenditure on environmental protection in Czechia [CZK bil., current prices, constant prices 2015, % of GDP], 2003–2022



Data source: CZSO

In the long and medium term, after excluding the impact of price changes (i.e. in constant prices (co.p.) 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 to slightly decreasing. While the total volume of investments and non-investment expenditure (in co.p. 2015) increased by 73.2% between 2003 and 2022, their share in GDP increased by only 0.36 p.p., 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 0.17 p.p.

Investments were dominated by expenditure on integrated devices (i.e. for pollution prevention) in 2022, amounting to CZK 20.1 bil. above the expenditure on terminal equipment (i.e. on cleaning up pollution), which amounted to CZK 13.9 bil. 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 2022 was on waste water management (CZK 12.3 bil., e.g. for the reconstruction and construction of sewers and WWTPs), and air and climate protection (CZK 8.0 bil., e.g. in reducing industrial emissions) and in waste management (CZK 5.2 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 2022 were accounted for by the sectors of public administration and defence, compulsory social security sector (39.0% of total investment) and the energy sector, i.e. the production and distribution of electricity, gas, heat and air-conditioned air (21.9% of total investments), followed by water supply, including activities related to waste water, waste and sanitation (20.6% of total investments) and manufacturing (11.8% of total investment).

In terms of the **breakdown by institutional sector into corporate and government sectors**, private and public non-financial corporations invested CZK 20.2 bil. in 2022 and the government (central and regional) sector CZK 13.9 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 2022, when these costs increased by CZK 4.7 bil. year-on-year, i.e. by 5.5% to CZK 91.5 bil. and thus, continued to form, in addition to investments, a substantial part of the expenditure on environmental protection monitored by the CZSO. As in previous years, in terms of programme focus, the largest current expenditure in 2022 was in waste management (CZK 60.7 bil.) and in waste water management (CZK 17.0 bil.). Other cost-intensive areas are long-term air and climate protection (CZK 6.1 bil. in 2022), as well as soil protection and remediation, including the protection of groundwater and surface water (CZK 4.1 bil. in 2022).

Public expenditure on environmental protection

Key question

What is the structure and volume of funds spent from national and international public sources onenvironmental 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 2022. In the case of environmental protection expenditure from central sources, growth was 52.9% to CZK 91.9 bil. and 4.8% for expenditure from territorial budgets to CZK 49.8 bil. in 2022. Priority areas of support in 2022 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 or so-called boiler subsidies) continued in 2022. Under the 2014–2020 OP ENV, 9 685 projects were approved for funding from the beginning of the programming period until the end of 2022 worth EUR 3.7 bil. (CZK 93 bil.) of the TEE. In 2022, the EC approved the follow-up OP ENV 2021–2027 with a total allocation of EUR 2.4 bil. (CZK 58.2 bil.) of EU funds, respectively EUR 2.9 bil. (CZK 69.6 bil.)) of the TEE. Further international funding for projects is now also provided through the Modernisation Fund and the National Recovery Plan.

The 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[164].

As in other areas, in environmental protection the share of expenditure in gross domestic product is monitored. In 2022, the volume of expenditure from central sources grew significantly compared to the previous year, while the volume of expenditure from territorial budgets grew less. This growth was reflected in a 0.37 p.p. year-on-year increase in the share of expenditure in GDP from central sources to 1.35% of GDP (Chart 159), while expenditure from territorial budgets fell by 0.05 p.p. to 0.73% of GDP due to higher GDP growth (Chart 160).

In the long and medium term, after excluding the impact of price changes (i.e. in co.p. 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 to slightly increasing.

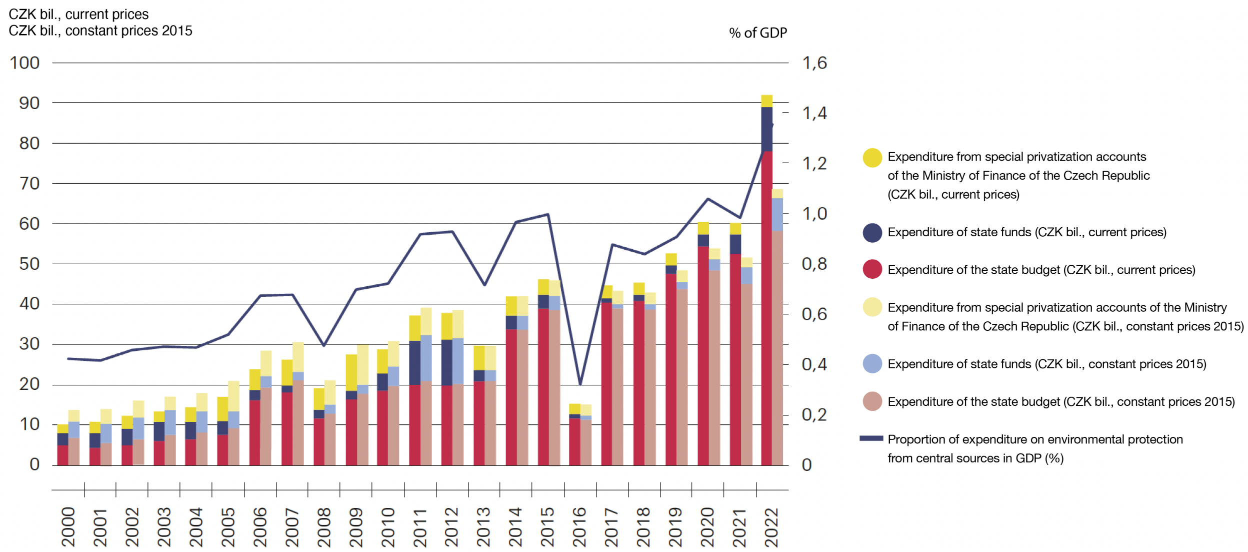
Expenditure on environmental protection from central sources in 2022 increased significantly by 52.9% year-on-year to CZK 91.9 bil. (Chart 159). In particular, the volume of funds provided from the **state budget** increased (by 48.7% to CZK 78.1 bil.), partly in connection with the use of funds from foreign sources, especially within the framework of operational programmes. The funds 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

[164] *The information on public expenditure is based on the MoF's budget composition, which also tracks funds provided primarily for the creation and protection of the environment over the long term. As the source of expenditure of territorial budgets can also be financial transfers (e.g. from the state budget, state funds, etc.), some of these expenditures are duplicated with expenditures from central sources, i.e. European funds. For this reason, expenditure from central, territorial and European or international sources is assessed separately and cannot be summarised.*

Environmental Fund of the Czech Republic plays a crucial role, increased by 126.4% to CZK 10.9 bil. The specific reason for the significant increase in expenditure from central sources is the increase in spending on air and climate protection under the insulation and energy saving programmes.

Chart 159

Public expenditure on environmental protection from central sources in Czechia [CZK bil., current prices, constant prices 2015, % of GDP], 2000–2022



Data source: Eurostat

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 OP ENV or the **New Green Savings** Programme **(NGS)**[165]. This programme, running since 2014, falls within the scope of thermal insulation and energy saving programmes, or changes in heating technologies and measures to reduce greenhouse gas emissions. In 2022, progressively documented implementations were being reimbursed for applications received in the first phase of the NGS programme (2014–2021), namely 7 335 applications worth CZK 2.4 bil. Since the NGS programme was terminated on 11 October 2021, the administration of the follow-up second phase, the so-called **"NGS 2021+"**, took place at the same time**.** Its financing will be provided by the State Environmental Fund of the Czech Republic from the resources of the National Recovery Plan (NRP) and will be subsequently financed through the HOUSEnerg programme from the Modernisation Fund once this allocation is exhausted. Two calls were announced in the NGS 2021+, namely Call No. 1/2021 Family Houses and Call No. 2/2021 Apartment Buildings. Within the framework of Call No. 1/2021 Family Houses, as of 31 December 2022, a total of 85 072 applications amounting to CZK 16.3 bil. had been registered, of which 34 408 applications worth CZK 5.5 bil. have been paid out. A total of 1 415 applications were registered under Call No. 2/2021 Apartment Buildings with a total value of CZK 1.7 bil., of which 188 applications worth CZK 146.3 mil. have been paid out.

The SEF CR 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 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 Czechia (i.e. water, biodiversity, landscape and air protection, and waste management). In 2022, the main sources of income of the SEF CR from the

[165] *The administrator and paying unit of the NGS programme is the Ministry of the Environment. The SEF CR is in charge of some administrative tasks, especially the selection and evaluation of applications.*

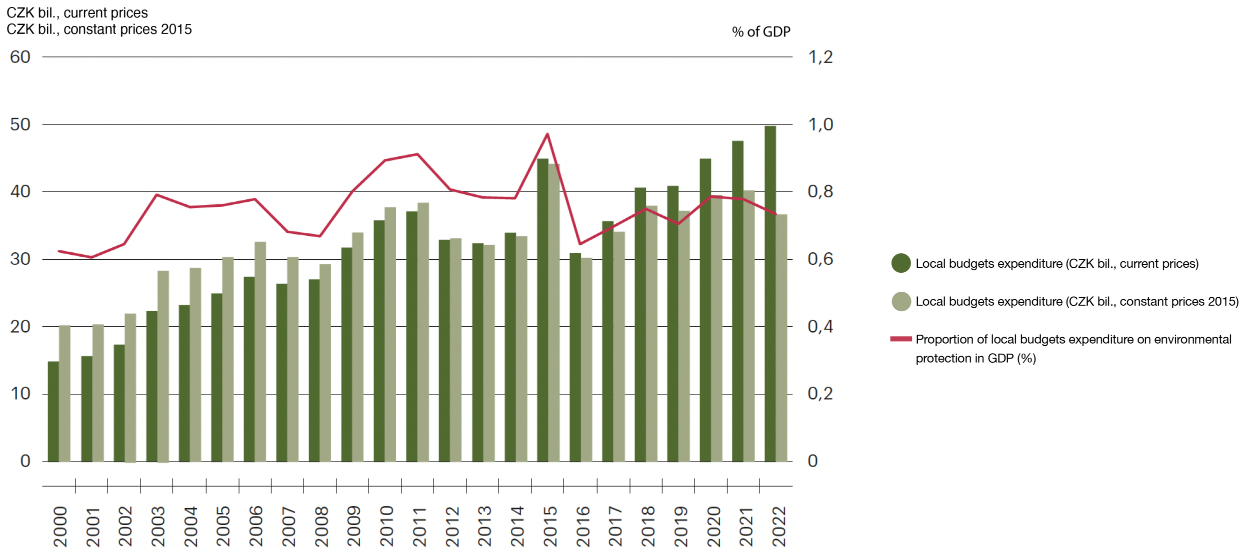
collection of fees or levies were waste disposal (CZK 982.7 mil.), groundwater abstraction (total CZK 359.7 mil.), The withdrawal of agricultural and forest land (CZK 255.9 mil.), air pollution (CZK 219.1 mil.), and the discharge of waste water into surface waters (CZK 190.0 mil.).

In addition to the state budget and state funds, the funds of the defunct National Property Fund of the CzechRepublic 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 2022[166]. 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 4.8% in 2022 to a total of CZK 49.8 bil. (Chart 160).

Chart 160

Public expenditure on environmental protection from territorial budgets in Czechia [CZK bil., current prices, constant prices 2015, % of GDP], 2000–2022



Data source: Eurostat

From the perspective of **programme focus**, the largest financial support from national sources was also directed to **air and climate protection** in 2022 (CZK 50.4 bil. from central sources, respectively CZK 1.9 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 gases emissions continued. This area includes, for example, the above-mentioned NGS or NGS 2021+ programme or the so-called boiler subsidies paid to support boiler replacement (more on this programme in the paragraph below, which concerns the OP ENV).

Other priority areas of support included **water protection** (CZK 6.3 bil. from central sources, respectively CZK 16.8 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 7.3 bil. from central sources, respectively CZK 14.8 bil. from territorial budgets), where the majority of the funds were

---

166 *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 privatisation of mining companies in connection with the restructuring of the metallurgy sector, and for the revitalisation of the affected areas.*

spent on support for protected parts of nature. Important national programmes falling under 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 2021[167]. 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 2.4 bil. from central sources, respectively 15.8 bil. from territorial budgets), especially the collection and transport, respectively the recovery and disposal of municipal waste and waste prevention.

In addition to national environmental subsidy programmes, public spending on environmental protection has been boosted since 2004 by **direct EU support and the possibility of co-financing projects from other foreign sources**. At present, these are mainly the Financial Mechanisms of the European Economic Area and Norway, LIFE, Interreg and the Swiss-Czech Cooperation Programme. Among European funds, the strongest in terms of subsidies is the OP ENV, which is the main source of EU funding for environmental protection, and the RDP, which aims, among other things, to restore, preserve and improve natural ecosystems dependent on agriculture.

The total allocation of the **OP ENV 2014–2020** (including reallocations) is EUR 3.3 bil. (CZK 83.7 bil.) of the total eligible expenditure (TEE). From the beginning of the programming period until 31 December 2022, the managing authority of the OP ENV (MoE) announced 163 calls, of which 4 new calls were announced in 2022 with an allocation of EUR 36.1 mil. (CZK 0.9 bil.)) of the TEE. A total of 15 464 project applications were registered in the already closed calls since the beginning of the programming period until the end of 2022. On the basis of the subsequent recommendation of the selection committee, 9,858 applications amounting to EUR 4.0 bil. (CZK 96.4 bil.) of the TEE were approved for subsidies and 9,685 legal acts were issued amounting to EUR 3.7 bil. (CZK 93 bil.) of the TEE. Of these, EUR 3.0 bil. of the TEE have been used by the beneficiaries (CZK 75.9 bil.) since the beginning of the programming period.

On 18 July 2022, the EC approved the **OP ENV 2021–2027** with a total allocation of EUR 2.4 bil. (CZK 58.2 bil.) of EU funds, respectively EUR 2.9 bil. (CZK 69.6 bil.) since the beginning of the programming period. From the beginning of the programming period until 31 December 2022, the Managing Authority of the OP ENV announced 31 calls for proposals with an allocation corresponding to 54% of the programme allocation and 832 applications for support in the amount of approx. EUR 1.7 bil. (CZK 40.7 bil.) since the beginning of the programming period. As of 31 December 2022, the selection committee recommended 177 applications for funding with a total financial volume of EUR 263.3 mil. (CZK 6.4 bil.) of the TEE. Since the beginning of the programming period, 32 legal acts have been issued, amounting to EUR 182.3 mil. (CZK 4.4 bil.) of the TEE and the funds cleared in the payment requests amounted to approx. EUR 17.7 mil. since the beginning of the programming period.

The OP ENV also finances the **so-called boiler subsidies**, in which 3 calls for individual regions were announced for the entire programming period 2014–2020 with a total allocation of approximately EUR 428.6 mil. (CZK 10.43 bil.) of the TEE, respectively EU funds. This financial allocation from the OP ENV was further increased by the amount of CZK 1.5 bil. from the NGS programme. In all 3 calls, 107,000 replacements of solid fuel boilers had been approved by the end of 2022, with a total volume of EUR 489 mil. (CZK 11.9 bil.). The boiler subsidies continue in the OP ENV 2021–2027, where they are aimed at supporting low-income households. In 2022, the 1st call for proposals was launched and approximately 17,000 applications for support were received. At the end of 2022, 4,500 applications for support worth CZK 690 mil. had been approved and 750 applications for CZK 112 mil. had been paid out.

---

[167] *Data for 2022 are not available at the time of publication.*

The **Rural Development Programme (RDP)** of the Ministry of Agriculture of the Czech Republic 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 9.2 bil. was disbursed from the RDP 2014–2020 in 2022.

The implementation of the **Modernisation Fund**, an investment instrument of the European Investment Bank and the European Commission, started in 2021. This fund is aimed at supporting green projects that will significantly reduce Czechia's dependence on coal combustion and accelerate the transition to clean energy sources. The investment aims to contribute to the reduction of greenhouse gas emissions through energy savings and the development of renewable energy sources. The allocation of the fund depends on the price of emission allowances and is estimated at CZK 500 bil. by 2030. In November 2022, the Modernisation Fund was expanded to include the HOUSEnerg (Residential Energy Efficiency) programme. Calls worth a total of CZK 57.8 bil. have already been announced in the Modernisation Fund, including seven calls for CZK 18.3 bil. in 2021 and eight calls with a total allocation of CZK 40.5 bil. in 2022. 448 applications were submitted in 2022 under all calls with a total requested support of CZK 37.3 bil. Of the applications submitted, a total of 186 projects were approved with a total subsidy of CZK 4.7 bil.

As mentioned above, the successor programme NGS 2021+ was launched in 2021 and will be financed by the NRP (after the allocation is exhausted, subsequently from the HOUSEnerg programme under the Modernisation Fund). The NRP presents Czechia's plan for reforms and investments to mitigate the impact of the COVID-19 pandemic and restart the economy using funds from the so-called Recovery and Resilience Facility from the EU recovery plan Next Generation EU. In 2021, the preparation of the administration of the NRP under the so-called components, for which the Ministry of the Environment acts as the owner, with a total allocation of almost CZK 25 bil., was underway. In addition to the already mentioned two calls in the NGS 2021+ programme announced in 2021, four more calls are being implemented under the NRP, namely for energy savings in public buildings with an allocation of CZK 3.3 bil., for water management in municipalities with a total allocation of CZK 1.8 bil., to support the purchase of vehicles (el. H2) and non-public charging infrastructure for municipalities, regions and state administration in the total allocation of CZK 0.6 bil., and finally to support environmental education programmes on climate change with an allocation of CZK 46.5 mil. By the end of 2022, a total of 918 applications with a total funding request of CZK 8.3 bil. had been submitted under the NP ENV calls and 470 positive decisions of the Minister on granting subsidies in the total amount of CZK 4.9 bil. had been issued.

The NRP has also approved approximately CZK 200 mil. for 2022 under component 5.2 "Support for research and development in enterprises and the introduction of innovations into business practice" and its investment "Support for research and development in the field of environment" for the **Programme of Applied Research, Experimental Development and Innovation in the Field of Environment – Environment for Life**. The Ministry of the Environment is the expert guarantor of this programme, which is administered by the Technology Agency of the Czech Republic. According to it, about CZK 3.8 bil. should be disbursed in 2019–2026 (mostly from the state budget) to support applied research for both public administration (mainly methodologies, maps and studies) and the private sector (commercializable results, typically environmental technologies).

Within the framework of support for energy savings and emission reduction, it is also worth mentioning the operational programmes of the MIT, especially **OP TAC** 2021–2027, the most important area of which is Priority 4 "Transition to a low-carbon economy" with a total allocation of CZK 29.1 bil. This priority is divided into three specific axes: 1. Specific Axis 4.1 Support for energy efficiency and CO_2 reduction with an allocation of CZK 13 bil. and an indicative energy savings target of 3.3 PJ, 2. Specific Axis 4.2 focused on support for energy from RES with an allocation of CZK 6.7 bil. and a target of 202 MW of newly installed capacity, 3. Specific Axis 4.3 Support for the development of intelligent energy systems, networks and storage with an allocation of CZK 7.6 bil. OP TAC builds on **OP EIC**, a key programme of the programming period 2014–2020, under which, for example, 3,882 projects with a subsidy of CZK 17 bil. were approved under the specific objective "Energy Savings Programme", with a saving of about 6 PJ.

Furthermore, preparation of the **Operational Programme Just Transformation** was underway in 2021. This is targeted support for the most affected regions (coal regions) to mitigate the socio-economic (coal mining decline, economic transformation, etc.) and environmental impacts of the transition. In Czechia, support from the programme with a total allocation of over CZK 40 bil. will be provided to the regions Karlovy Vary, Ústí nad Labem and Moravia-Silesia, as the regions most affected by the shift away from coal. In November 2021, a call for pre-project preparation of strategic projects under this instrument was announced with a total allocation of CZK 170 mil. At the end of 2022, the first three calls for applications for strategic projects of the Karlovy Vary, Ústí nad Labem and Moravian-Silesian Regions were announced with a total allocation of CZK 18.9 bil.

Financing in an international context

Key messages

✓	Investments in environmental protection in Czechia have long been above the EU27 average. The reason for the increased investments in Czechia, supported by drawing from European funds, is primarily the need to meet the conditions and requirements set by the relevant European legislation and the need to remedy the significant environmental burdens associated with the intensive industrial production and mining in the last century.
~	In 2021, total revenues from environmental taxes in the EU27 amounted to EUR 325.8 bil. (CZK 8.4 bil.), i.e. 2.2% of GDP of the whole EU27. In terms of the subject of taxation in the EU27, taxes on energy products, particularly significant in Czechia, 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 in 2021 increased significantly year-on-year to USD 697.2 bil. (approx. CZK 15.1 tril.), in Czechia the support increased slightly to CZK 8.8 bil. (approx. 0.14% of GDP).

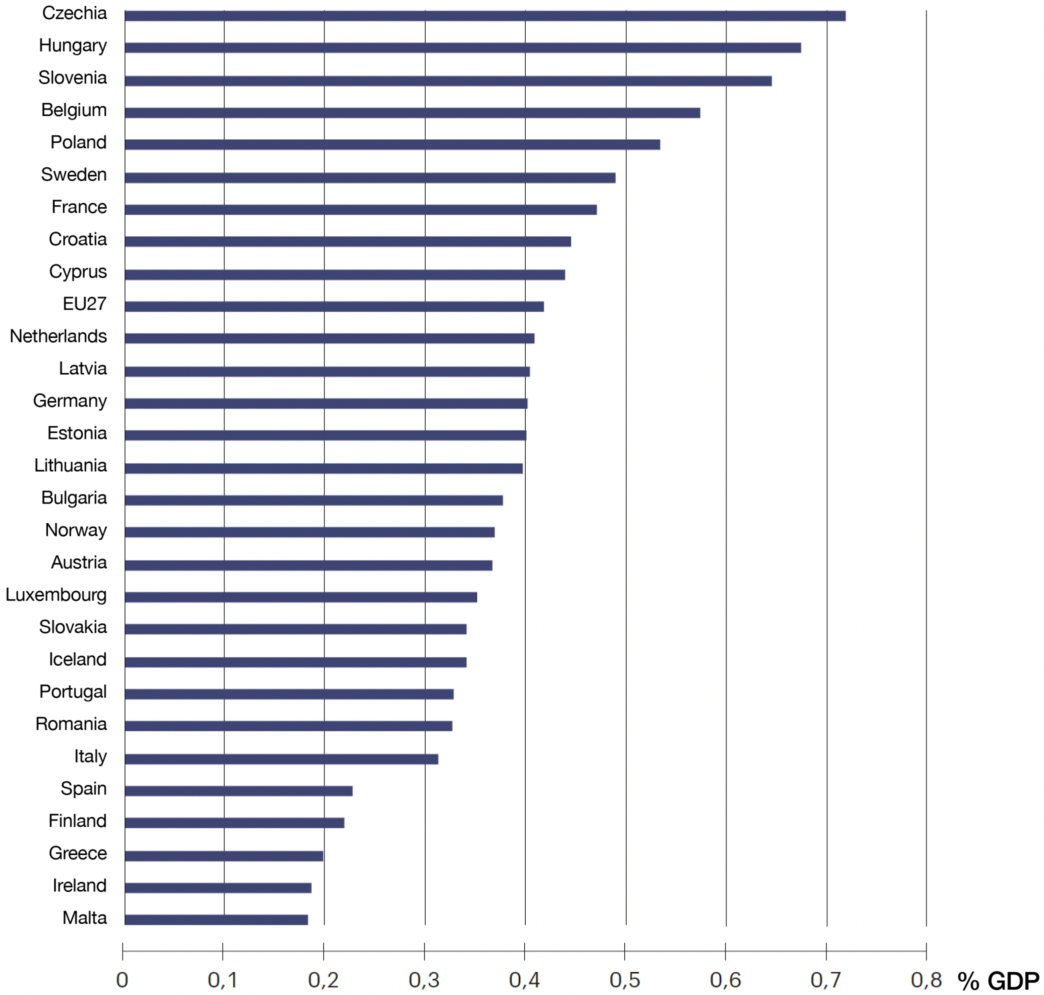
Investments in environmental protection in an international context

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) sectorsin environmental protection, compared to the EU27 average, are significantly above average, and actually the highest, of all EU27 countries (Chart 161).

This is mainly due to the fact that Czechia, 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 or other foreign subsidy sources.

Chart 161

Total investment in environmental protection (public and industrial sectors) in EU countries [% of GDP, cu.p.], 2019



Data for 2020–2022 are not available at the time of publication.

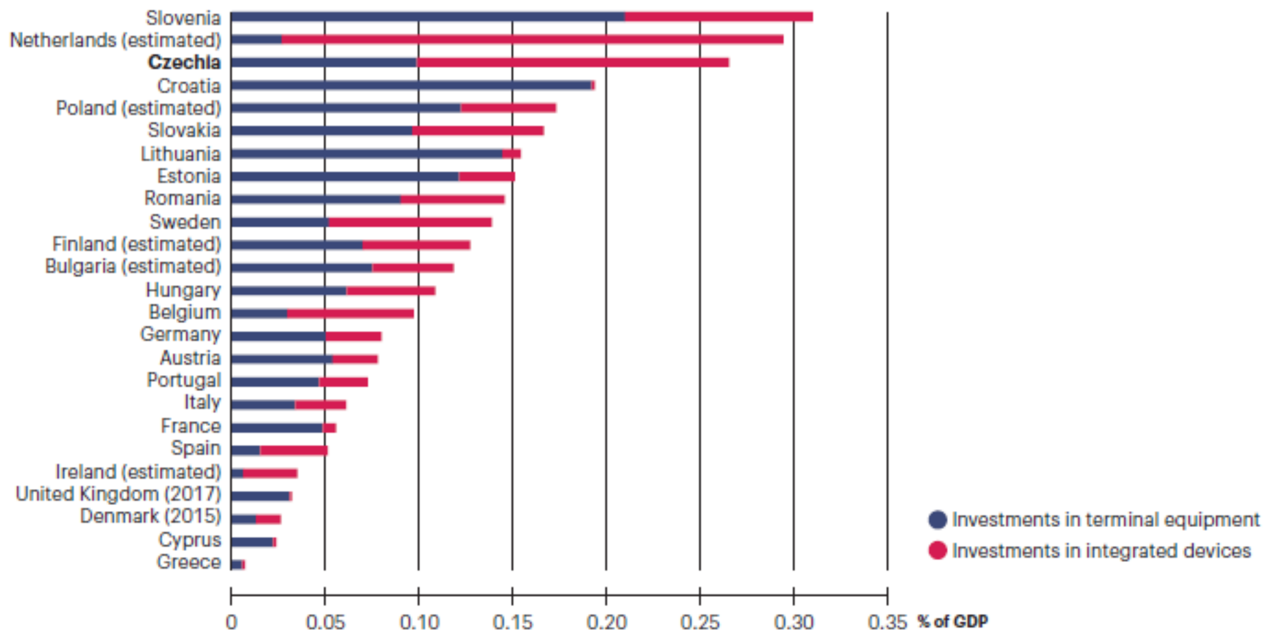
Data source: Eurostat

Investments in the industrial sector are crucial (Chart 162). These are usually above average in the case of new Member States, e.g. in Slovenia and Czechia (over 0.25% of GDP in current prices in 2018[168]), on the other hand, many original EU15 Member States did not even reach 0.03% of GDP in current prices. (Cyprus and Greece). Unlike in Czechia, where in 2018 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.

[168] *Data for 2019–2022 are not available at the time of publication.*

<u>Chart 162</u>

Investment in environmental protection in the industrial sector in EU countries [% of GDP, co.p.], 2018



Data for 2019–2022 are not available at the time of publication.

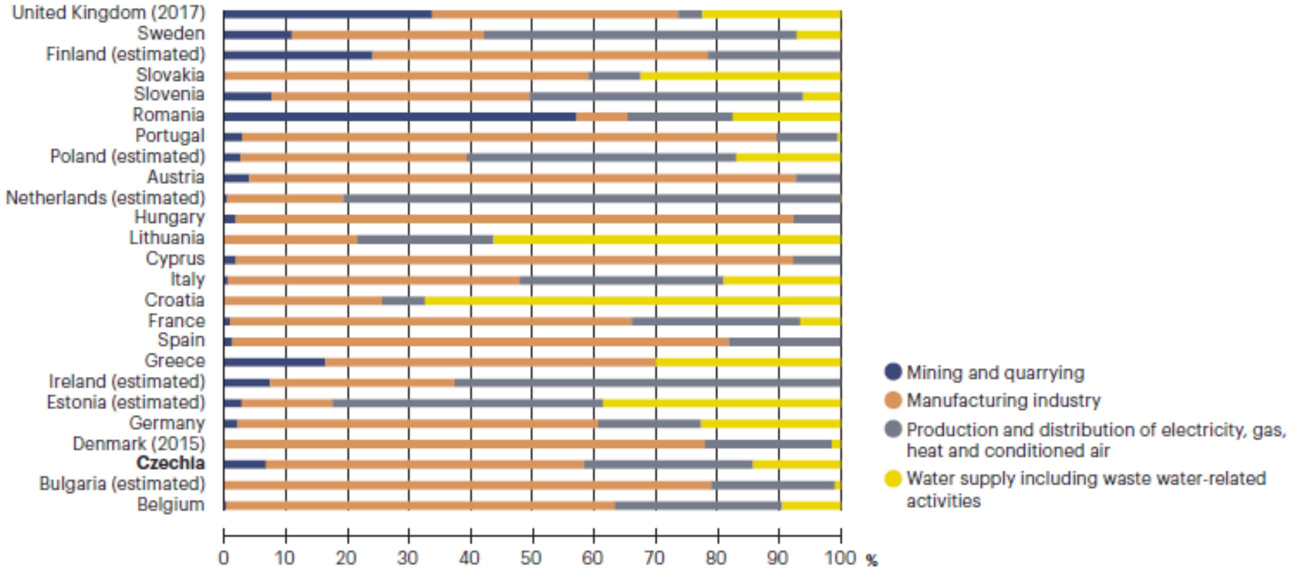
Data source: Eurostat

In terms of the representation of the main sectors of the industrial sector in the total investments in environmental protection, in the majority of EU27 Member States, including Czechia, 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 163). From the perspective of the programme focus, in 2018[169] in the majority of EU27 Member States, including Czechia, the largest investments were in **air and climate protection**, otherwise in waste water management (Chart 164).

[169] *Data for 2019–2022 are not available at the time of publication.*

Chart 163

Investments in environmental protection in the industrial sector by major industry in EU countries [%], 2018

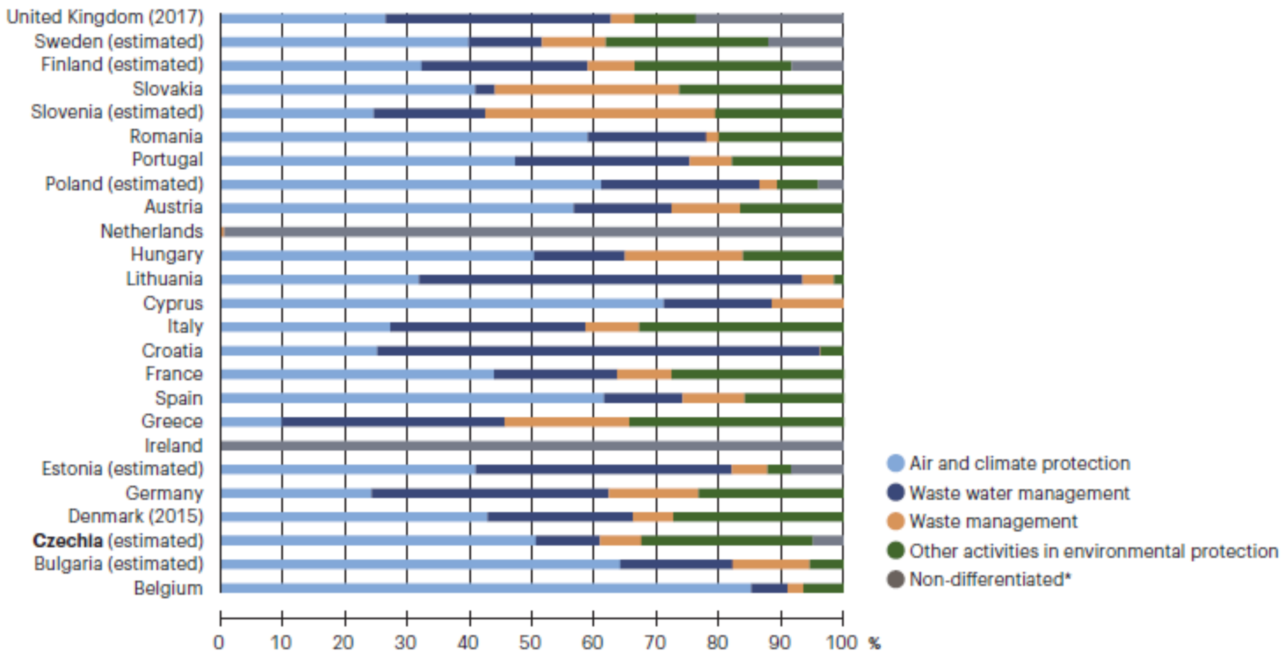


Data for 2019–2022 are not available at the time of publication.

Data source: Eurostat

Chart 164

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 2019–2022 are not available at the time of publication.

Data source: Eurostat

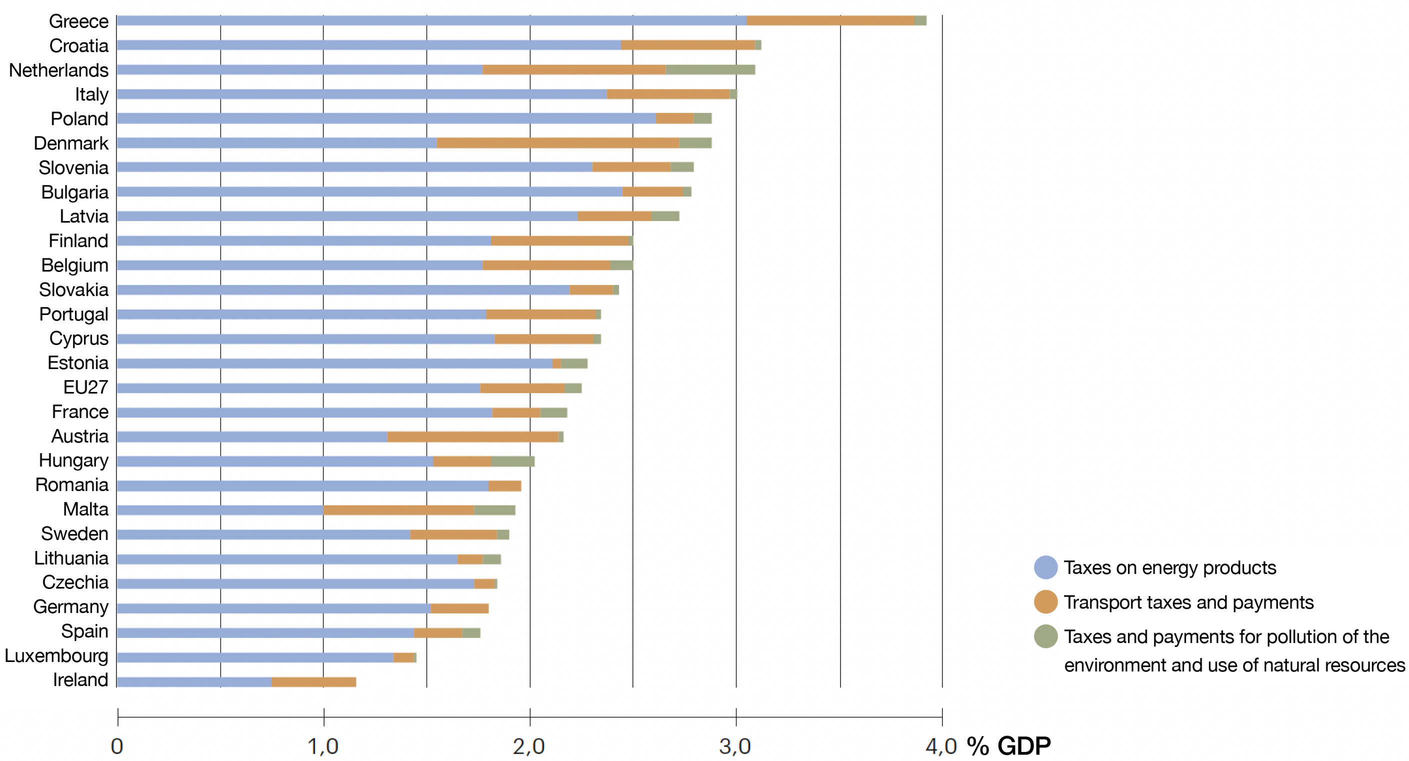
Revenues from environmental taxes and levies in an international context

Total revenues from **environmental taxes** in the EU27 in 2021[170] amounted to EUR 325.8 bil. (CZK 8.4 bil.), i.e. 2.2% of GDP, respectively 5.4% of government revenues from taxes and social contributions for the EU27 as a whole. In 2021, revenues from environmental taxes were about EUR 108.2 bil. higher than in 2002, but in terms of GDP the revenue share fell from 2.6% to 2.2% of GDP.

In an EU27 international comparison, Czechia has below-average revenues from environmental taxes (1.8% of GDP), Chart 165.

Chart 165

Environmental taxes by main group in EU countries [% of GDP, cu.p.], 2021



Data for 2022 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 Czechia) 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, which encourages non-residents to purchase taxed products cross-border (as is the case, for example, with petrol or diesel).

---

170 *Data for the year 2022 are not available at the time of publication.*

In terms of the subject of taxation, **taxes on energy products**[171] clearly predominated, which, in addition to taxes on electricity, gas or solid fuels, include taxes on fuels. They accounted for 78.4% of total EU27 environmental tax revenues in 2021. Energy taxes were particularly significant in Czechia, Luxembourg, Estonia and Romania, 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 2021 (18.1% in the EU27). **Taxes and payments for environmental pollution and use of natural resources** accounted for a relatively small share (3.2%) of total environmental tax revenues in the EU27 in 2021. This category of environmental taxes groups together various taxes or payments levied, for example, on pollution and water abstraction or on landfilling of waste. Only the Netherlands, Hungary and Malta have a more significant share higher than 10%.

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 51 national economies, shows that total support for fossil fuels almost doubled year-on-year to USD 697.2 bil. in 2021[172] (approx. CZK 15.1 tril.) from USD 362.4 bil. in 2020 (respectively to USD 190 bil. from USD 147 bil. in G20 economies)[173]. The reason for the sharp increase in support was the rise in energy prices in the context of the global economic recovery after the COVID downturn. There will be further increases in support in 2022 due to the sharp rise in energy prices and energy instability caused by Russian aggression in Ukraine. 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. was provided to support fossil fuels by national governments between 2014 and 2021 (approx. CZK 1.3 tril.) per year.

Compared to OECD, respectively G20, averages, support for fossil fuels in Czechia in 2021 increased only slightly, from CZK 8.4 bil. to CZK 8.8 bil. (in GDP terms it even fell to 0.14% of GDP, Chart 166), and overall, in the 2010–2021 period this support amounted to CZK 83.0 bil. We can positively evaluate that in the comparison[174] of Member States regarding the ratio of fossil subsidies to subsidies for renewable sources, Czechia spends approximately 4 times more funds per GDP on support for renewable sources compared to fossil sources.

[171] *Eurostat methodology on environmental taxes – see more at: https://ec.europa.eu/eurostat/cache/metadata/en/env_ac_tax_esms.htm.*

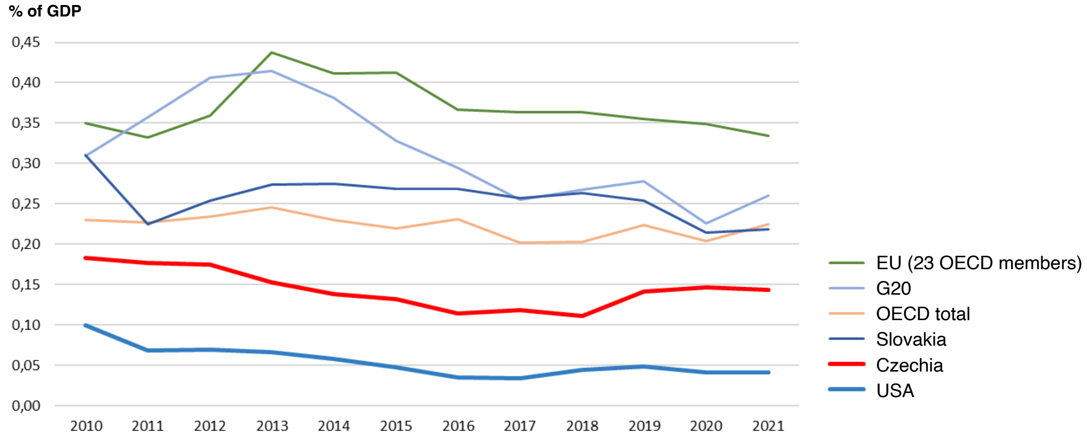
[172] *Data for the year 2022 are not available at the time of publication.*

[173] *More at: https://www.oecd.org/fossil-fuels/.*

[174] *More at: https://www.eca.europa.eu/Lists/ECADocuments/RW22_01/RW_Energy_taxation_EN.pdf.*

Chart 166

Total support for fossil fuels in selected OECD countries [% of GDP, current prices], 2010–2021



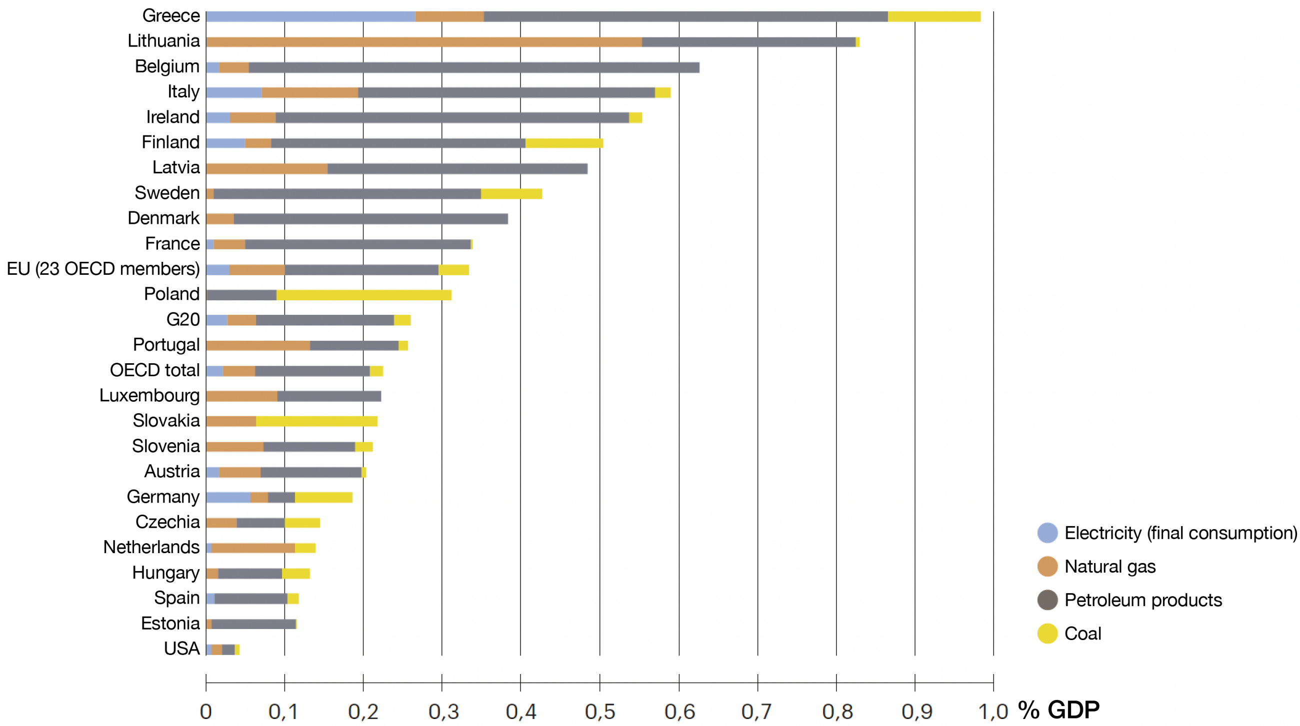
Data for 2022 are not available at the time of publication.

Data source: OECD

The largest share of support in Czechia, almost 42%, was directed to the consumption and production of petroleum products, similarly to most other countries, respectively in the case of international averages (Chart 167). In Czechia, 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.

Chart 167

Support for fossil fuels by type of fuel supported in selected OECD countries [% of GDP, current prices], 2021



Data for 2022 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. As part of the Fit For 55 package, the EU has published a revision of the Directive amending the framework legislation on the taxation of energy products and electricity. Its main objective is to level out the tax environment in favour of renewable energy.

Given the high prices of energy commodities, the impact of the new regulation on households will also be important. If the new tax structure, as proposed by the European Commission, were to place an even greater burden on households, negotiating support would be complicated.

Detailed visualisations and data

https://www.envirometr.cz/data

Opinions and attitudes of the Czech public

Regular representative survey of public opinion on Czech society's relationship with the environment

Satisfaction with the environment in Czechia

In regular representative surveys, respondents are asked whether they are satisfied or dissatisfied with their environment.

In 2022, respondents rated the **environment in their place of residence** better than the **overall situation** in Czechia (Chart 168). More than four-fifths (84%) of respondents were satisfied with the state of the environment in their place of residence in 2022, while three-quarters (76%) were satisfied with the overall environment in Czechia. Satisfaction has increased compared to the previous assessment in 2021, when 76% of respondents were satisfied with the environment in their place of residence and 69% in Czechia overall.

The environment in the place of residence has long been rated as better than the overall environment in Czechia (since the beginning of the survey in 2002). The long-term trend shows that satisfaction with the environment in the place of residence is stable and is expressed by at least 70% of respondents (except for 2004 and 2010). On the other hand, satisfaction with the overall state of the environment in Czechia has been gradually increasing with slight variations since the beginning of the surveying in 2002.

<u>Chart 168</u>

Satisfaction with the environment in Czechia and in the place of residence [%], 2022

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

Evaluation of institutions in environmental protection

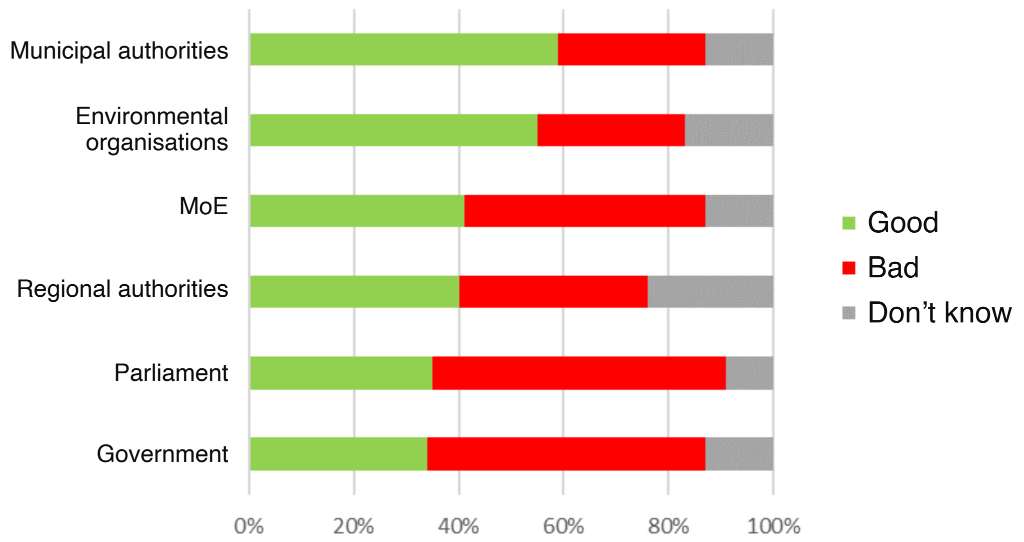
In the area of environmental protection, respondents are asked to evaluate the performance of selected authorities and institutions.

In 2022, the **activity of municipal authorities** (59% of responses) and **environmental organisations** (55% of responses) were the most highly rated in terms of environmental protection, with more than half of the responses. On the other hand, a negative assessment of environmental protection was expressed in the case of the work of the Parliament (59% of responses) and also the Government (53% of responses), Chart 169.

Compared to 2020[175], when the same survey was carried out, an improvement in the assessment was recorded, especially in the case of the activities of regional (7 p.p. increase in positive assessment) and municipal authorities (3 p.p. increase in positive assessment).

Chart 169

Evaluation of institutions in environmental protection [%], 2022



Question asked: As far as environmental protection is concerned, how do you evaluate the activities of the Government, the Ministry of the Environment, the Parliament, regional authorities, municipal authorities, environmental organisations?

Data source: Public Opinion Research Centre, Institute of Sociology, Academy of Sciences of the Czech Republic

Evaluation of activities affecting the environment

Respondents also have the opportunity to rate situations related to various activities or facts that affect the state of the environment.

The results of the 2022 survey show that around three quarters of respondents are critical of the environmental burden of **road transport** (78% of respondents said the situation is bad) and of **penalising those who damage the environment** (70% of respondents said the situation is bad), about two thirds of respondents rate **measures against drought** as insufficient (68% of respondents) and **measures to protect natural areas during construction** as insufficient (64% of respondents said the situation is bad), Chart 170.

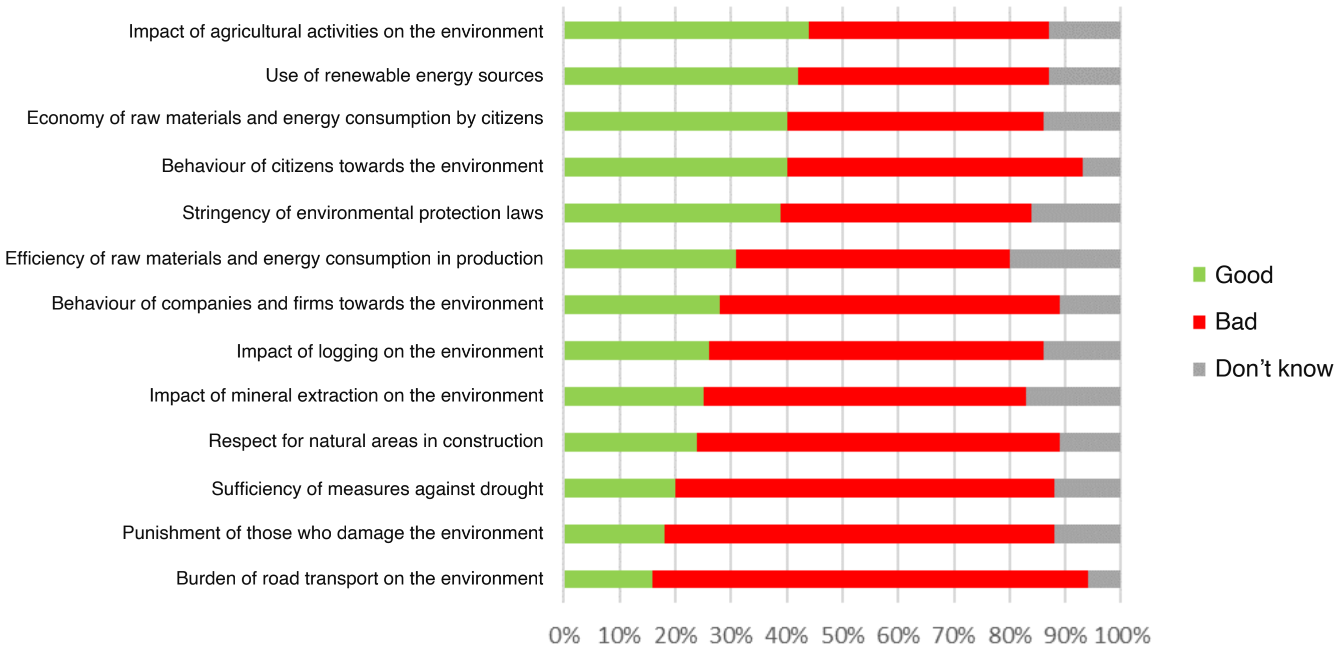
Compared to the 2020 results[176], there was a decrease in the proportion of negative ratings for all situations. The biggest difference was in the assessment of the environmental impact of agricultural activity (65% of respondents rated this situation as bad in 2020, while only 43% rated it as bad in 2022) and the strictness of environmental protection laws (59% of respondents rated this situation as bad in 2020, in 2022 only 45%) and the impact of mineral extraction on the environment (71% of respondents rated the situation as bad in 2020, 58% in 2022).

[175] *Not evaluated for 2021 – no survey was carried out.*

[176] *Not evaluated for 2021 – no survey was carried out.*

Chart 170

Evaluation of activities affecting the environment [%], 2022



Question asked: In your opinion, what is the situation in Czechia in terms of: (a) punishment of those who damage the environment, (b) the behaviour of companies and firms towards the environment, (c) the behaviour of citizens towards the environment, (d) the impact of mineral extraction on the environment, (e) the impact of logging on the environment, (f) the efficiency of raw materials and energy consumption in Czech production, (g) the economy of raw materials and energy consumption by citizens, (h) the respect for natural areas in construction, (i) the stringency of environmental protection laws, (j) the burden of road transport on the environment, (k) the impact of agricultural activities on the environment, (l) the use of renewable energy sources, (m) the sufficiency of measures against drought?

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

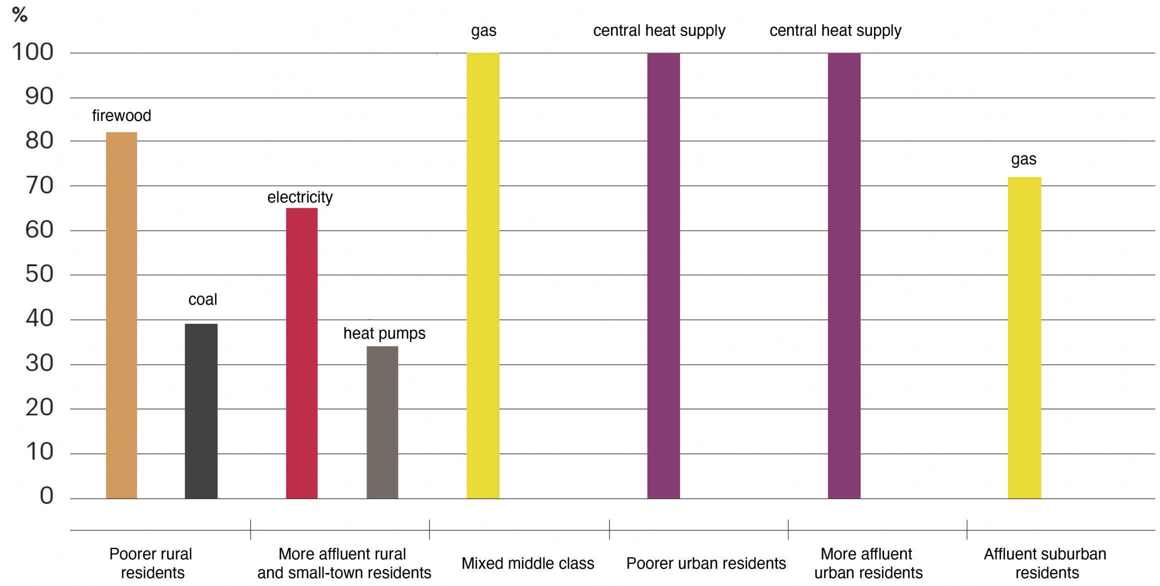
Energy profiles of Czech households

The data analysis Energy Profiles of Czech Households[177] identified 6 segments of Czech households according to their household heating and use of passenger car transport. It shows how various Czech social groups are threatened by the growth of fossil fuel energy. The study details the segments of poorer rural residents (18%), more affluent rural and small-town residents (10%), the mixed middle class (22%), poorer urban residents (33%), more affluent urban residents (9%), and affluent suburban residents (7%). For these six segments, an energy profile has been developed, on the basis of which appropriate decarbonisation measures and related social measures for the most vulnerable groups can be set up.

In terms of household heating, it appears that poorer rural residents primarily heated **with firewood** (82%) and **coal** (39%) (Chart 171). **Electricity** and **heat pumps** for heating were more likely to be used by rural and small-town residents (65% and 34% of respondents, respectively).

Chart 171

Source of household heating [%], 2022



Question asked: What source do you use to heat your apartment unit or house?

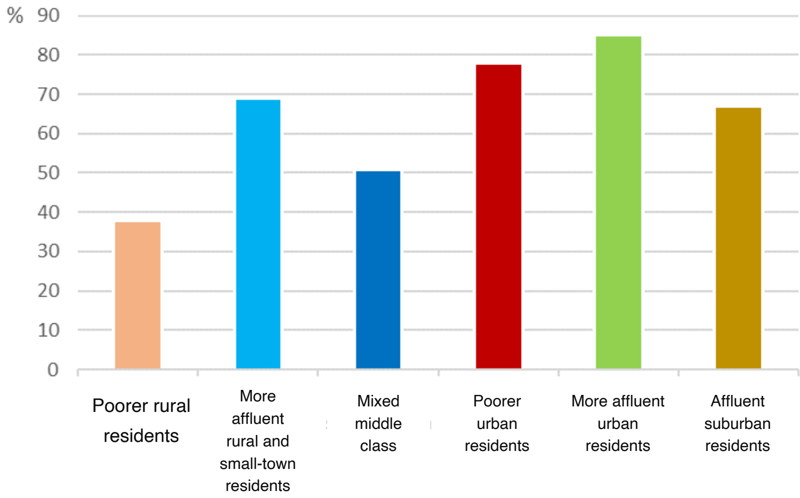
Data source: Energy profiles of Czech households

Thermal insulation of houses is a prerequisite for reducing the energy consumption of households. About two thirds (62%) of the Czech population live in an insulated house. The only group that does not live in an insulated house in the majority are poorer rural residents (only 38% of respondents lived in an insulated house in 2022), Chart 172. The proportion of inhabitants living in insulated houses, or the frequency of insulated houses, is higher in larger municipalities, which is related to the extensive insulation of apartment buildings on the basis of subsidy titles. Nevertheless, poorer urban residents are also currently at risk, as they often live in sublets, where – unlike sublet housing providers – they bear the costs of rising energy prices and their economic options are very limited (52% of them cannot afford a one-off unexpected expense of CZK 10,000).

[177] *Krajhanzl, J. et al. (2022). Representative research: Energy Profiles of Czech Households. Institute 2050. Available from: https://institut2050.cz/reprezentativni-vyzkum-energeticke-profily-ceskych-domacnosti*

Chart 172

Thermal insulation of houses [%], 2022



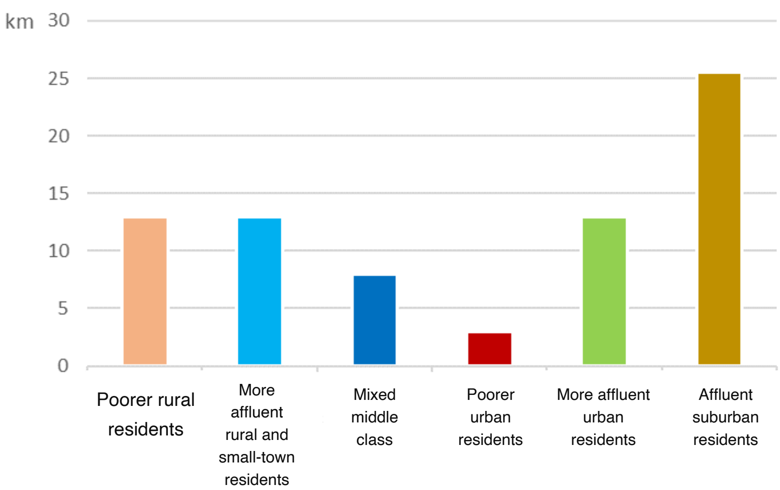
Question asked: Is the house you live in insulated?

Data source: Energy profiles of Czech households

In 2022, 69% of the Czech population used a car for regular daily journeys. The use of a car is strongly related to the size of the municipality – while in smaller municipalities the vast majority of poorer rural and more affluent rural and small-town residents are currently without a car, in larger municipalities car use is linked to the socio-economic level of the household. The lowest car mobility was identified in the poorer urban segment, where only 22% of the population drives more than 20 km per day. The mixed middle class also drives less, with 25% of the population driving more than 20 km per day. In contrast, the wealthier suburbanites segment drives the most miles by car of any group, with more than 54% driving more than 20 km per day (Chart 173).

Chart 173

Passenger car use on regular journeys exceeding 20 km per day [km], 2022



Question asked: On average, how many kilometres do members of your household drive per day in a car on regular journeys, e.g. to work, school?

Data source: Energy profiles of Czech households

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 SEP 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 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).

Time horizon of the trend

Trend	Time period
Short-term	last 5 years
Medium-term	last 10 years
Long-term	last 15 years and over

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 directive 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.

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
more than +/-10% per year	very significantly upward/downward trend

2) Trend and Indicator state

The **trend of individual indicators** is assessed on the basis of determining the trend of individual quantities from which the indicator is constructed. The aggregate trend is assessed by aggregating the indicator scores composed of time series of individual quantities. For individual indicators, the variables entering into the aggregate trend assessment, the chosen aggregation method, or other parameters for trend assessment are listed in the specific indicator sheets available on the portal https://www.envirometr.cz. A fluctuating trend is established for a summary trend when a majority of the number of individual variables has a determination coefficient less than 0.5. A trend cannot be assessed if there is no time series over a given time period. Structure indicators (e.g. Structure of waste management, municipal waste management, land use, etc.) are inherently trendless.

Graphical representation of the aggregate trend		
Positive upward trend	Stagnation	Negative upward trend
Positive downward trend	Fluctuating	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

3) Assessment of the state

The state is assessed using the expert estimation method, based on the distance from the set target in the given year or generally accepted assumptions. 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. The parameters for assessing the state are given in the specific indicator sheets available on the portal https://

Graphical representation of the state		
Good state	Neutral state	Bad state
N/A The state cannot be determined		

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 isassessed 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 state assessment		
✓ Heading towards target achievement	~ Uncertain target achievement	✗ Far from target
N/A The target achievement 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	Fulfilment of target
96.7% of the population connected to the public water supply	2030	✓
89% of the population living in houses connected to the sewerage system	2030	✓

1.2 Air quality

Overview of related targets 1.2.1 Pollutant emissions

Set target	Set for year	Fulfilment of target
49% reduction in NO_X emissions compared to 2005	2025	✓
64% reduction in NO_X emissions compared to 2005	2030	✓
34% reduction in VOC emissions compared to 2005	2025	✗
50% reduction in VOC emissions compared to 2005	2030	✗
55% reduction in SO_2 emissions compared to 2005	2025	✓
66% reduction in SO_2 emissions compared to 2005	2030	✓
14% reduction in NH_3 emissions compared to 2005	2025	N/A
22% reduction in NH_3 emissions compared to 2005	2030	N/A
38% reduction in $PM_{.5}$ emissions compared to 2005	2025	✓
60% reduction in $PM_{.5}$ emissions compared to 2005	2030	✓

However, according to the 2023 Projection of the CHMI, measures are set such that the national emission reduction commitments will be met in both 2025 and 2030 without additional measures (https://www.ceip.at/status-of-reporting-and-review-results/2023-submission). The emission balance of the whole time series was recalculated from the August 2023 CHMI data.

1.6 Adapted settlements

Overview of related targets 1.6.2 Conceptual development of settlements and use of brownfields

Set target	Set for year	Fulfilment of target
Increase in the total number to 500 registered entities in LA21	2030	✗

2.1 Transition to climate neutrality

Overview of related targets 2.1.1 Greenhouse gas emissions

Set target	Set for year	Fulfilment of target
Reduction in aggregate net greenhouse gas emissions (including LULUCF) by at least 55% compared to 1990 – EGD target and European Climate	2030	✗
Achieving climate neutrality, i.e. zero net emissions (aggregate emissions including LULUCF) – EGD target and European Climate Law	2050	✗
26% decrease in non-ETS emissions (covered by the ESR) compared to 2005	2030	✗
Achieving a balance of emissions in the land use, land use change and forestry (LULUCF) sector of at least -1 228 kt CO_2 eq. (Annex II of Regulation (EU) 2018/841)	2030	✗
Electricity generation from lignite and black coal in the range of 11–21%	2040	✓
Electricity generation from natural gas in the range of 5–15%	2040	✓
Electricity generation from nuclear fuel in the range of 46–58%	2040	✗

Overview of related targets 2.1.2 Energy efficiency

Set target	Set for year	Fulfilment of target
Share of nuclear fuel in the PES structure 25–33%	2040	✗
Share of solid fuels in the PES structure 11–17%	2040	✓
Share of gaseous fuels in the PES structure 18–25%	2040	✓
Share of liquid fuels in the PES structure 14–17%	2040	✗
Share of renewable and secondary sources in the PES structure 17–22%	2040	✓
Energy import dependency will not exceed 65%	2030	✓
Energy import dependency will not exceed 70%	2040	~
PES consumption will not exceed 1 735 PJ	2030	✓
Final energy consumption will not exceed 990 PJ	2030	~

Overview of related targets 2.1.3 Use of renewable energy sources

Set target	Set for year	Fulfilment of target
Share of RES in gross final energy consumption 22%	2030	✓
Share of RES in electricity generation in the range of 18–25%	2040	✓
Share of RES in final energy consumption in transport 14%	2030	✗

2.2 Transition to a circular economy

Overview of related targets 2.2.2 Waste prevention

Set target	Set for year	Fulfilment of target
Total number of 100 valid Environmentally Friendly Product or Environmentally Friendly Service ecolabel licenses	2030	✗
Total number of 25 valid EU Ecolabel licences	2030	✓

Overview of related targets 2.2.3 Compliance with the waste treatment hierarchy[178]

Set target	Set for year	Fulfilment of target
Increase in the municipal waste recycling rate to at least 55%	2025	✗
Increase in the municipal waste recycling rate to at least 60%	2030	✗
Increase in the municipal waste recycling rate to at least 65%	2035	✗
Reduction in the municipal waste landfilling rate to no more than 10%	2035	✗
Increase in the municipal waste energy recovery rate to no more than 25%	2035	✗

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	Fulfilment of target
Slowing down the loss of the agricultural land fund to 0.25% of the ALF for the 2020–2030 period	2030	✗
Achieving the recommended share of deciduous trees in forests of 35.6%	–	✗
50% reduction in the use and risk of chemical pesticides	2030	✗
Achieving a 22% share of organic areas in the total agricultural land in Czechia	2027	✗
Achieving a 30% share of arable land in the total land area in organic farming	2027	~
Achieving a 10% increase in the area under permanent crops in organic farming compared to 2021	2027	~

[178] *Data for the year 2022 are not available at the time of publication.*

3.2. Biodiversity

Overview of related targets 3.2 Biodiversity

Set target	Set for year	Fulfilment of target
30% of the protected bird species and habitats that are not in a favourable condition by 2022 will be in this category by 2030 or will show a strong positive trend. No species or habitat will show declines.	2030	N/A

Detailed visualisations and data

https://www.envirometr.cz/data

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.

Alkaline nutrients. Cations of calcium, magnesium, sodium and potassium in the sorption complex in the soil sorption.

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. AOT40cumulative ozone exposure is calculated as the sum of the differences between the hourly ozone concentration and the threshold level of 40 ppb (= 80μg 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 chloridesas 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 the biotic and abiotic agents which together form the environment of a certain organism or group of organisms. There are 157 natural biotope types in Czechia, 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.

Black beasts. Wild boar.

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 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 fertilisers. 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, 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 ofclimatological 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. Fluorinated greenhouse gases (F-gases) have a radiative forcing many times higher than CO_2, on the order of hundreds to tens of thousands of times the radiative forcing of CO_2.

COD_{Cr}. Chemical oxygen demand determined using the dichromate method. COD_{Cr} is the amount of oxygenconsumed 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.

Combines cycle power plants. Gas is first incinerated in a gas combustion turbine, where the first part of theelectricity 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 alwaysbegins on the first day of the month, and so each month is divided into three decades. In general terms, 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 andthe 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, semifinished 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.

EMS. Effective mesh size**.** The EMS is proportional to the probability of two randomly selected points in the area being connected. This probability is then converted to the size of the area or mesh – the effective size of the network. The EMS unit is the unit of area (km^2). The higher the EMS value (mesh size), the lower the fragmentation rate.

Environmental investments (= capital expenditure). Capital expenditure on environmental protection includes all expenditure incurred by reporting agents in acquiring tangible fixed assets (whether by purchase or by own activity), together with the total value of tangible fixed assets acquired by way of acquisition without consideration, or by transfer under applicable legislation, or by reclassification from personal use to business.

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.

ESCS. Evidence System of Contaminated Sites is a public database that contains information about sites where old environmental burdens or 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.

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.

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 motordirectly 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; Council Regulation (EU) No. 2017/997 of 8 June 2017 amending Annex III to Directive 2008/98/EC of the European Parliament and of the Council as regards the hazardous characteristic HP 14 "ecotoxic"); waste that is classified in a waste type that is assigned a hazardous waste category in the Waste Catalogue; or waste that is mixed with or contaminated by any of the waste listed in the previous sentence.

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, 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.

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 low forest cover countries where there are rapid landscape changes in the direction towards cultural landscape. A positive balance also indicates poor forest health due to biotic (bark beetle) and abiotic factors, causing a high volume of incidental logging that exceeds the natural growth of timber.

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 organisation 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 hazardouscomponents from municipal waste is sometimes also called “residual” waste.

Monoculture. A stand consisting of one species of plant. This is typical of intensive agriculture and forestry.

Municipal waste. Mixed and sorted household waste, in particular paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, in particular mattresses and furniture, as well as mixed waste and sorted waste from other sources if similar in nature and composition to household waste; municipal waste does not include waste from manufacturing, agriculture, forestry, fishing, septic tanks, sewage systems and waste water treatment plants, including sludge, end-of-life vehicles or construction and demolition waste.

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 or non-profit institutions providing services to non-financial enterprises (associations of entrepreneurs, etc.).

Non-financial public enterprises. The public non-financial enterprises subsector includes all non-financial corporations, quasi-corporations and non-profit institutions recognised as independent legal entities that are market producers under the control of government units.

Non-hazardous waste. Waste that does not qualify as hazardous waste.

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 andprecipitation 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. The boundaries of the individual normality categories are calculated according to the percentile distribution of a given climatic element (air temperature, precipitation) in the normal period. Values between the 25th and 75th percentile of the normal range are referred to as normal, values between the 25th and 10th percentile are referred to as subnormal, values between the 75th and 90th percentile are referred to as above normal, values below the 10th and above the 90th percentile are referred to as strongly below/above normal, and values below the 2nd and above the 98th percentile are referred to 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) thatdiffer 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. PES 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 by 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.

Pollutant. A contaminant present in the environment.

POPs. Persistent organic pollutants 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 smalldoses.

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 existentiallyendangered 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.

STD. The standard deviation (or σ) is a measure of the dispersion of the data relative to the mean. A low standard deviation means that the data are clustered around the mean and a high standard deviation means that the data are more spread out.

Sub-crown precipitation. Rainwater trapped under the crowns of trees. This is enriched with substances trapped on the surface of the leaves.

Summer day. The 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 particularterritory, representing the mean value of that element in that territory.

Total eligible expenditure. In the context of the OP ENV, this is the sum of funds from the CF, ERDF, 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. The 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.

Wildlife. Hunting even-toed ungulates. Ruminants (e.g. European deer, spotted deer, roe deer) and wild boar.

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

AAI	Association of Automobile Importers
AECM	agri-environmental-climatic measures
ALF	agricultural land fund
AOT40	Accumulated Ozone exposure over a Threshold of 40 ppb
APL	air pollution limit
AWC	available water capacity
B(a)P	benzo(a)pyrene
BAT	Best Available Techniques
BDMW	Biodegradable municipal waste
BEV	Battery Electric Vehicles
BMBG	basic moisture balance of grassland
BOD_5	biochemical oxygen demand over five days
BPEJ	farmland classification
BSM	basal soil monitoring
CAS	Czech Astronomical Society
CAUMD	Commission for the Assessment of Urban Mobility Documents
CCT	correlated colour temperature
CEI	Czech Environmental Inspectorate
CENIA	Czech Environmental Information Agency
CGS	Czech Geological Survey
CHMI	Czech Hydrometeorological Institute
CISTA	Central Institute for Supervising and Testing in Agriculture
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNG	Compressed Natural Gas
co.p.	constant prices
COD_{Cr}	chemical oxygen demand by potassium dichromate
COD_{Mn}	chemical oxygen demand by potassium permanganate
COS	Czech Ornithological Society
COSC	Czech Office of Surveying and Cadastre
CPP	Climate protection policy
CR	Czech Republic
cu.p.	current prices
CZ-NACE	Statistical Classification of Economic Activities in the European Community
CZSO	Czech Statistical Office
DDT	dichlorodiphenyltrichloroethane
DMC	Domestic Material Consumption
DNA	deoxyribonucleic acid

DRM	Directorate of Roads and Motorways
EEA	European Environment Agency
EFP	Environmentally friendly product
EFS	Environmentally friendly service
EGD	European Green Deal
EMS	Effective Mesh Size
EQS-AA	Environmental quality standard – annual average
EQS-MPC	Environmental quality standard – maximum permissible concentration
ERO	Energy Regulatory Office
ESCS	Evidence System of Contaminated Sites
ESD	Effort Sharing Decision in force until 2020, when it was replaced by the ESR
ESE	Ecologically significant element
ESR	Effort Sharing Regulation
ETBE	ethyl tert-butyl ether
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
FAL	flood activity level
FAME	Fatty Acid Methyl-Esters
FCEV	Fuel Cell Electric Vehicles
FGMRI	Forestry and Game Management Research Institute, public research institution
FHI	fire hazard index
FMI	Forest Management Institute
FMP	Forest management plans
FRFS	flood Reporting and Forecasting Service
FRS	Fire and Rescue Service
FSB	field soil block
FSC	Forest Stewardship Council certification system
FWI	Forecast warning information
GDP	gross domestic product
HA	High Annoyance
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane
HPJ	Main soil unit of the classification system
HSD	High Sleep Disturbance
HSS	heat supply system
IAT	individual automobile transport

IOHP	information on the occurrence of a hazardous phenomenon
IPR	Integrated Pollution Register
IROP	Integrated Regional Operational Programme
IRS	Integrated Rescue System
IWSS	Integrated Warning Service System
KRNAP	Krkonoše National Park
LA21	Local Agenda 21
LAG	Local Action Group
LPG	Liquefied Petroleum Gas
LPIS	Land Parcel Identification System
LULUCF	Land Use, Land-Use Change and Forestry
LV	limit value
MEYS	Ministry of Education, Youth and Sports
MIT	Ministry of Industry and Trade
MoA	Ministry of Agriculture
MoE	Ministry of the Environment
MoF	Ministry of Finance
MoI	Ministry of the Interior
MoLSA	Ministry of Labour and Social Affairs
MoT	Ministry of Transport
MRD	Ministry of Regional Development
NAP CM	National Action Plan for Clean Mobility
NCA CR	Nature Conservation Agency of the Czech Republic
NECP	National Energy and Climate Plan of the Czech Republic
NGS	New Green Savings
NICS	National inventory of contaminated sites
NIPH	National Institute of Public Health
NP	national park
NP ENV	National Programme Environment
NRL	National Reference Laboratory for Municipal Noise
NRP	National Recovery Plan
OECD	Organisation for Economic Co-operation and Development
OP EIC	Operational Programme Enterprise and Innovation for Competitiveness
OP ENV	Operational Programme Environment
OP T	Operational Programme Transport
OP TAC	Operational Programme Technologies and Applications for Competitiveness
p.p.	percentage point
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls

PCDD/PCDF	polychlorinated dioxins and furans
PCR	Police of the Czech Republic
PEFC	Programme for the Endorsement of Forest Certification Schemes certification system
PES	Primary energy sources
PG	permanent grassland
PHEVs	Plug-in Hybrid Electric Vehicles
PLA	Protected Landscape Area
PM	Particulate Matter
POPs	Persistent Organic Pollutants
PPS	Purchasing Power Standard
PT	public transport
RDP	Rural Development Programme
RES	renewable energy sources
RISWC	Research Institute for Soil and Water Conservation, public research institution
s.e.	state enterprise
SCI	site of Community importance
SDG	Sustainable Development Goal
SEC	State Energy Concept
SECAP	Sustainable Energy and Climate Action Plan
SEF	State Environmental Fund of the Czech Republic
SEP	State Environmental Policy
SHARES	Short Assessment of Renewable Energy Sources
SNM	strategic noise mapping
SPA	Specially Protected Area
SPEI	Standardized Precipitation Evapotranspiration Index
STD	standard deviation
SUMF	Sustainable Urban Mobility Framework
SUMP	Sustainable Urban Mobility Plan
T.G.M. WRI	T. G. Masaryk Water Research Institute, public research institution
TA CR	Technology Agency of the Czech Republic
TAGR	total average growth rate
TC	transport company
TEE	total eligible expenditure
TOC	Total Organic Carbon
TRC, v.v.i.	Transport Research Centre, public research institution
TSES	territorial system of ecological stability
USLE	Universal Soil Loss Equation
VAT	value added tax
VOC	Volatile Organic Compound

WEI	Water Exploitation Index
WHO	World Health Organization
WM	waste management
WMO	World Meteorological Organization
WWTP	waste water treatment plant

2022