Ministerstvo životního prostředí

Ministry of the Environment

State Environmental Policy of the Czech Republic 2030 with outlook to 2050

The State Environmental Policy 2030, with outlook to 2050 (hereinafter “SEP 2030”) was approved by Government Resolution No. 21 of 11th January 2021.

State Environmental Policy of the Czech Republic 2030 with outlook to 2050
The strategy was prepared by the author's team under the leadership of the Ministry of the Environment, the author's team was represented by ministry staff and other external experts and consultants.
The author's team. Editors: Vladislav Smrž, Anna Pasková, Jaroslav Kepka, Markéta Linxová, Lucie Hanišová, Helena Vaňková.
Published by the Ministry of the Environment, based in Vršovická 1442/65, Prague 10.

ISBN: 978-80-7212-649-1

Contents

Abstract (Executive Summary)

The State Environmental Policy of the Czech Republic defines priority problematic areas in relation to the environment in the Czech Republic, formulates strategic and specific objectives based on these areas, and outlines their possible solutions by examples of types of measures whose implementation should lead to an effective protection of the environment and its improved condition. This State Environmental Policy ("**SEP 2030**") is valid until 2030, with outlook to 2050. Its main objective is to make maximum efforts and set the direction to fulfil the following vision (for 2050):

> "The Czech Republic provides its citizens with a safe, healthy and resilient environment, facilitating high-quality standard of life also for the future generations. The society and the economy have adapted to climate change and consume as little non-renewable natural resources and hazardous substances as possible while making extensive use of secondary raw materials and zero emission energy sources. Sustainable use of the landscape and biodiversity are perceived as one of the pillars of high quality of life and contribute to the mitigation of climate change effects. The Czech Republic complies with international treaties and contributes to the global protection of the environment and sustainable development."

The topics addressed by this policy are divided into three main areas (Environment and Health, Climate-Neutral and Circular Economy, Nature and Landscape), 10 strategic objectives and 32 specific objectives (an overview is presented below). A vision for 2050 was formulated for each of the three areas.

Objectives stipulated by SEP 2030 are achieved by implementing types of measures, whose examples are listed for individual strategic objectives. The selection of particular types of measures will be the subject of valid segment- and sector-specific strategic documents, whose implementation is ensured by cross-sectional instruments (listed in special Chapter 4), in particular by legislative instruments and financing.

Fulfilment of the SEP 2030 is monitored using indicators and coordinated through regular meetings of the **platform for monitoring the SEP 2030 fulfilment progress**, whose members include representatives of public administration bodies responsible or co-responsible for achieving the specific objectives, the academia and non-governmental organizations and associations. Monitoring of the indicators will be ensured by the annual publication of the Report on the Environment of the Czech Republic. Public administration bodies responsible for specific objectives are primarily Ministries and selected authorities. The implementation of SEP 2030 will require participation of local governments, the general public and others.

Overview of strategic and specific objectives within SEP 2030

1.1 Water availability is ensured and its quality is improving

- 1.1.1 Surface water quality is improving
- 1.1.2 Groundwater quality is improving
- 1.1.3 Drinking water supply of suitable quality to the population is improving
- 1.1.4 Wastewater treatment is improving
- 1.1.5 Water efficiency, incl. water recycling, is improving

1.2 Air quality is improving

- 1.2.1 Emissions of air pollutants are decreasing
- 1.2.2 Ambient air quality standards are being observed
- 1.2.3 Transboundary transmission of pollutants is decreasing

1.3 Exposure of the population and the environment to hazardous chemicals is decreasing

- 1.3.1 Emissions and leaks of hazardous chemicals into all environmental components are decreasing
- 1.3.2 Contaminated areas, incl. old ecological damage, are monitored and effectively sanitised

1.4 Noise and light pollution levels are decreasing

- 1.4.1 Noise pollution of the population and ecosystems is decreasing
- 1.4.2 Light pollution levels are decreasing

1.5 The society's preparedness and resilience against extraordinary events and emergencies is increasing

- 1.5.1 Preparedness, resilience and adaptation to weather extremes is increasing
- 1.5.2 Negative impacts of extraordinary events and emergencies of anthropogenic or natural origin are minimised
- 1.5.3 Occurrence of extraordinary events and emergencies of anthropogenic origin is minimised

1.6 Adapted settlements ensure quality and safe life of their residents

- 1.6.1 Settlements effectively adapt to climate change-related risks
- 1.6.2 Settlement development is conceptual, brownfields and built-up areas are developed preferentially
- 1.6.3 Settlements run effective water management systems, incl. rainfall management
- 1.6.4 Quality of green infrastructure, contributing to better microclimate in settlements, is increasing

2.1 Greenhouse gas emissions are decreasing

- 2.1.1 Greenhouse gas emissions are decreasing
- 2.1.2 Energy efficiency is improving
- 2.1.3 Use of renewable energy sources is increasing

2.2 Circular economy guarantees efficient management of raw materials, products and waste

- 2.2.1 Material intensity of economy is decreasing
- 2.2.2 Waste prevention efforts are maximised
- 2.2.3 Waste management hierarchy is fully observed

3.1 Ecological stability of landscape is rebuilt, farming is sustainable in long-term and reacts to climate change

- 3.1.1 Water retention levels in landscape are increasing via ecosystem solutions and sustainable farming
- 3.1.2 Soil degradation, incl. accelerated erosion, and loss of farmland is decreasing
- 3.1.3 Non-productive functions and ecosystem services of the landscape, especially of the farmed land, ponds and forests, are strengthened

3.2 Biodiversity is being maintained within the limits dictated by climate change

- 3.2.1 Condition of natural habitats is improving and species protection is ensured
- 3.2.2 Protection and management of the most valuable parts of the nature and landscape is ensured
- 3.2.3 Negative impact of invasive alien species is limited
- 3.2.4 Protection of wild animals in human care is ensured

Introduction

The environment surrounds us and we are its inherent part. Its condition affects the physical and mental condition of the population, it provides space for recreation, helps in regeneration and supports our health; it has a crucial influence on the quality of life in all its aspects. The right to a favourable environment is defined as one of the **basic human rights** in various key documents – in the Constitution of the Czech Republic or in the Charter of Fundamental Rights and Freedoms, as well as in internationally valid documents such as the EU Charter of Fundamental Rights or Convention on the Rights of the Child. Furthermore, it is a prerequisite for implementation of other basic rights, including the right to life. In 1992, the Rio Declaration was signed during the United Nations Conference on Environment and Development, which formulates the fundamental principles of sustainable development and environmental protection. A substantial damage to the environment may represent, in its consequences, a threat to the health of population, a threat to the economy and even to the basic functions of states.

A key point in the modern Czech history was the change of political regime in 1989, after which the state adopted more modern and environment-friendly legislation and formulated the first strategy for improvement of the environment in the Czech Republic. Subsequently, in 1995, the Czech government approved its first **State Environmental Policy (SEP)**. The current SEP 2020–2030 replaces the preceding SEP 2012–2020 and represents the 6th document striving for a better condition of the environment in the Czech Republic.

Despite the fact that there has been a significant and objective improvement of the environment since 1993 (facilitated also by the restructuring of economy and Czech Republic's entry into the EU), that much of the damage from the past has been remediated and that there has been an improvement in the general public's relationship to the environmental protection, the defined objectives in certain areas remain far from achieving. Fundamental environmental components continue to be exposed to negative impacts caused by human activity on a daily basis.

The upcoming decade in the protection of the environment will be closely linked to numerous **consequences of climate system destabilization**, which influence not only the environment but also the global economy and social ties. According to global climate development projections, assuming that the current trends and the society's behaviour continue without a change, the planet may warm by as much as 3 °C by the end of this century, despite the Paris Agreement demanding that the rise in average global temperature must be held significantly lower than 2 °C in comparison with temperature before the industrial revolution, and that every effort must be made to keep the rise in temperature below 1.5 °C. The challenge therefore is increasing resilience against climate change, transforming our economies to circular due to never-ending rise in consumption of raw materials and energy, moving away from fossil fuels and searching for new energy sources. The increasingly pronounced loss of biodiversity on a global scale combined with the increase of the world's population will have a significant impact on our ability to secure sufficient food supply and it will affect agricultural methods, trade with agricultural and food commodities and land use.

At the same time, the SEP 2030 is being adopted during the **COVID-19 pandemic** which may foster awareness of the environment's importance for human health, while its far-reaching impact on global economy may lead to a reduction of investment into environmental protection. We have a unique opportunity, in connection with the European Green Deal and the European recovery fund, to use financing earmarked for economic recovery in a manner that encourages sustainable resource management methods and transition to circular economy while emphasizing solutions related to climate change.

The **SEP 2030** seeks to ensure continued protection of the environment and the climate while actively promoting solutions to pressing problems on both national and international level. The goal is also to assist the achievement of objectives defined by the **2030 Agenda for Sustainable Development, respectively its Sustainable Development Goals (SDG), the Paris Agreement and other multilateral environmental treaties and conventions where the Czech Republic is a party.** In order to achieve these objectives, we will need to **intensify our efforts in protecting the environment**. The SEP 2030 must be taken into consideration when producing other national strategic documents and provide solid support for the Czech Republic's international activities in environmental policy. It is the Czech Republic's ambition to enable its citizens a high-quality standard of life that will not lead to environmental degradation in the Czech Republic or abroad.

Future steps should lead to improvements in the nature and landscape, achieving sustainability of the economy, transformation to a circular and climate-neutral economy and securing a high-quality environment. In addition, it will be necessary to increase environmental awareness, inspiring citizens to a considerate and responsible approach to the environment. It is also important to raise this awareness in the public sector (for example in public procurement) and in the private economic sector, which also should contribute to more sustainable and energy-efficient production processes.

Within the framework of the planned economic transformation based on European plans and strategies (European Green Deal (EGD) or the proposal for an 8th Environment Action Programme (8th EAP)), an opportunity arises to use financing instruments with a capacity to increase the competitiveness of the Czech Republic. This can be brought about through investment into research and development, introduction of new technologies and processes that use digital technologies both in enterprises and in innovation on municipal, regional or central levels. Deployment of new technologies, for example digital technologies, rapidly increased in certain areas also thanks to the COVID-19 pandemic. At present, several new financial instruments are in the process of preparation, including the European recovery fund, European Just Transition Fund or the Modernization Fund. In 2020, the existing operational programmes are in their final phase, while new ones are being prepared (for example, OP Transport, OP Environment, OP Technology and Applications for Competitiveness, Integrated Regional Operational Programme (IROP)). Furthermore, the EEA/Norwegian Grants and the Swiss Financial Mechanisms and framework programmes such as HORIZONT, URBACT and LIFE are available. Besides the European programmes, the Czech Republic will support projects from its national sources through the State Environmental Fund, State Fund for Transport Infrastructure (SFDI) or State Fund for Investment Support (SFPI). National research projects will be supported primarily by the Technology Agency of the Czech Republic (TACR) (and departmental programmes implemented by TACR – Environment for Life, Transport 2020+, TREND and others) and additionally by, for example, the Ministry of Industry and Trade (CFF), Ministry of Education, Youth and Sports (large research infrastructure – environmental sciences) or via research programmes run by the Ministry of Health and Ministry of Agriculture.

In order to meet these objectives, it will be necessary to **take into account differences** between individual areas and pay attention to the most vulnerable ones - whether in terms of geography or social characteristics (for example, higher temperatures caused by climate change affect more the senior population and people with chronical diseases, while in purely geographic terms, large cities are affected worse). In the social area, individuals have different abilities to implement appropriate measures.

SEP – a general description

What is the State Environmental Policy?

The State Environmental Policy of the Czech Republic represents a long-term **top-level national strategic document** that formulates objectives in the area of environmental protection in the Czech Republic and its overall strategic direction until 2030, with outlook to 2050, and serves as an umbrella document covering general environmental issues. SEP reflects other strategic documents[1] on the horizontal (national policies) as well as vertical level (European and international documents). When compiling the SEP, all relevant external influences such as socio-demographic development, economic development and global pressures were taken into consideration. This document also respects the principles of sustainable development as formulated in the *Strategic Framework of the Czech Republic 2030* and **legislative documents** on national and supra-national levels. The objective for the following period is to maintain sufficient and long-term legal protection of the environment.

Topics addressed in SEP are elaborated on a general level and measures are proposed as 'types of measures.' In the "Cross-Sectional Instruments" chapter, the SEP provides an overview of a wide range of available instruments (direct regulation, economic instruments, voluntary instruments, education and awareness, etc.). Specific instruments or their efficient combinations, allowing the achievement of the desired objectives in individual areas, must be further elaborated in detail at a lower level of strategic documents (concepts, strategies and plans).

A uniform, complex vision for the year 2050 was formulated for the entire SEP 2030 document. In addition, three additional partial visions for 2050 were formulated for the three main areas of interest (Environment and Health, Climate-neutral and Circular Economy, and Nature and Landscape). These areas are further divided into individual topics (for example, 'Water' or 'Circular Economy') with one main strategic and several specific objectives. The fulfilment of these objectives is important and entirely essential for improvement of the environment.

For the sake of further implementation, namely for the purposes of setting up instruments securing financing and personnel capacity, as well as serving as a signal towards the general public, these objectives are **prioritized** on the basis of 4 parameters - *International commitments*, *Current trends in the area, Worsening external pressures, Synergies between objectives*. The '*International commitments'* and '*Current trends in the area'* parameters were assigned a weight of 35 %, and the two additional criteria – '*Worsening external pressures'* impacting achievement of objectives and '*Synergies between objectives'* – each carry a weight of 15 %. Objectives were ranked according to the obtained points and divided into three categories – priorities – at the rate 1 : 2 : 1. From the 32 specific objectives in total, 8 were evaluated as important, 16 as highly important and 8 have the highest priority. A considerable number of objectives with the highest priority falls within the 'Climate-Neutral and Circular Economy' area.

SEP 2030 is based on the assessment of results achieved by the preceding SEP (2012–2020), as well as on the analysis of the condition of the environment according to the most recent available data (Annex 1), and on the Czech commitments arising from European legislation (Annex 5) and international documents (Annex 4). It also respects other Czech strategic documents, whose links to the new SEP are listed in an overview table (Annex 3).

[1] The instrument used in monitoring compatibility of strategic objectives at individual governance levels is the Czech Database of Strategies.

This document was elaborated between 2019 and 2020 through a participative process where all relevant state departments and both Parliamentary Chambers of the Czech Republic as well as non-state actors were represented. The document was distributed to selected bodies for review and for consultations during various stages of preparation and twice to the general public during public consultations (in March 2019 and July 2020).

Principles of the environmental policy

The State Environmental Policy of the Czech Republic is based on the following principles:

Principle of holistic approach and policy integration: the environmental policy, just as all other sector-specific policies, should approach the existing issues in a holistic manner. This approach requires cooperation on all levels of public administration participating in the preparation of strategic and conceptual documents. All relevant strategic documents should be based on collective analyses of external influences, principles and potential development scenarios, which also enables synergies in fulfilling individual strategic and specific objectives while simultaneously applying innovative available solutions for tackling the issues.

Principle of prevention: early implementation of preventive measure is more effective than remedying damage such as: climate change, pollution of the environment, depletion of resources, disruption of ecosystems or damage to health. Prevention has a great significance also in cases of natural disasters which, in the context of the Czech Republic, most often mean floods or long-term drought. Preventive approach also includes eco-design of products.

Precautionary principle: it is necessary to introduce preliminary measures also in cases where no certainty exists that undesirable events will actually take place or how quickly. If there is a threat of a damage to health or to the environment and the related event has not yet been sufficiently researched, measures should be adopted to prevent such potential damage or loss.

Polluter pays[2] **and 'tackling the problem at source' principle**: entities causing damage to the environment (polluters) should be held responsible for their actions and for related costs in cases of negative externalities[3]. Negative externalities are projected into the polluters' costs, which are subsequently projected into the price of their products or services. The consequent reduced demand for product and/or implementation of preventive measure by polluters helps in eliminating the generated pollution. At the same time, polluters should not be able to shift the burden of remedy to others, unless they clearly demonstrate that their proposed measures are, in terms of the overall impact on the environment, the best possible measures.

Principle of cost-effectiveness: effective allocation of resources contributes to achieving an economically optimal degree of depreciation and protection of the environment. Effectivity requires expediency, i.e., to what degree the desired objective will be fulfilled, and economy, i.e., at what cost.

[2] As arising from Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage and Article 191 (2) the consolidated version of the Treaty on the Functioning of the European Union.

[3] An 'externality' is understood as an external effect of an economic decision, respectively an activity, i.e. part of the effect of this activity borne by someone other than the originator. Externalities are costs or revenues of other entities for which no payment is made: the originator cannot appropriate these revenues (the so-called positive externalities), or these costs (the so-called negative externalities) cannot be recovered. Example of a negative externality is, for example, environmental pollution; an example of a positive externality is, for example, education or non-productive functions of forests.

The cost-effectiveness principle requires that the best possible ratio between resources employed for given activities and produced effects is achieved.

Principle of participation and raising public awareness of environmental issues: a sufficient amount of verified information about the environment, human health and decision-making processes provided to citizens in a clear and comprehensive form, including environmental education of the young generations, will lead to a better understanding of the context and, implicitly, to a quality and sustainable way of life. Higher awareness will allow members of the public to competently address environmental issues and participate in decision-making processes in various administrative proceedings, referenda, or SEA and EIA processes.

Principle of international responsibility: this principle is exercised primarily through cooperation in development and compliance with commitments arising from the country's membership in the EU, international conventions and various organizations such as the United Nations (UN) or Organisation for Economic Co-operation and Development (OECD). At the same time, all specific conditions and interests of the Czech Republic and the EU need to be observed.

SEP implementation process (monitoring)

SEP 2030 is implemented through valid segment- and sector-specific strategic documents, which are referenced primarily in the individual specific objectives and in Annex 3. Its implementation is ensured through specific legislative instruments and financing. Achievement of the defined objectives is conditional on close cooperation on the horizontal level, i.e. between individual Ministries, and in the vertical direction, i.e. along the national – regional – local axis of public administration bodies, as well as on the involvement of the general public. Ensuring this cooperation is a task for public administration bodies responsible for individual objectives. Synergic measures should be preferred in the fulfilment of objectives as they will have a positive impact on other areas while not jeopardizing other objectives. When implementing the SEP 2030, territorial specificities identified within the currently valid Regional Development Strategy of the Czech Republic will be taken into account.

SEP 2030 is regularly evaluated on the basis of current developments in the environment of the Czech Republic and internationally. Evaluation of progress of SEP 2030 fulfilment is based on the principle of regular monitoring of **SEP indicators** (please refer to Annex 2) and **activities** implemented by **public administration bodies responsible and co-responsible for individual specific objectives** through fulfilment of the proposed types of measures.

SEP indicators evaluate the condition and development of individual priority areas of the environment according to specific objectives within SEP 2030, instead of evaluating specific measures. Annex 2 specifies how these indicators are construed. The initial (reference) indicator values correspond to data available in 2018. The target indicator values reflect specific SEP objectives, as well as the currently valid strategic documents and international conventions. It was impossible to define target values for some of the indicators. In these cases, a desirable trend has instead been defined and its quantification will emerge from a discussion among actors directly involved in its implementation process, taking place within the framework of the Platform for monitoring the SEP fulfilment progress.

Data is collected by public administration bodies responsible for individual objectives, through the MoE Integrated Reporting System and other MoE agenda-specific information and reporting systems, such as the Information System for Waste Management. CENIA – the Czech Environmental Information Agency – is the body responsible for processing this data. Regular evaluations of indicators will be

published annually in the Report on the Environment of the Czech Republic, which will be available to the general public at MoE and CENIA websites. Additional data are published by MoE within the framework of information systems and MoE reports such as the Public Information System on Waste Management, the MoE website, the Statistical Yearbook, and others. SEP indicator-related data are also annually published within the framework of Information System for Statistics and Reporting (ISSAR) at the CENIA website.

A Platform for monitoring the SEP 2030 fulfilment progress was established for monitoring of the SEP 2030 implementation process; members of this platform include bodies responsible and co-responsible (administrators and co-administrators) for individual specific objectives, representatives of the academia and non-governmental organizations and associations. The Platform is convened by the MoE once a year following the conclusions of publication of the Report on the Environment of the Czech Republic. Discussion within this Platform will focus on development in SEP 2030 indicators and actions taken to fulfil specific objectives. This annual discussion will assist in early identification of risks associated with implementation, including potential negative impacts of already implemented measures on other objectives. The primary risk jeopardizing implementation of the SEP 2030 could be prioritizing other interests of the society. This could manifest itself in insufficient financing which is required for the proper fulfilment of SEP 2030 objectives.

In 2025, there will be a 'Mid-term Evaluation of SEP 2030'. If found necessary on the basis of its findings, development trends and in the context of new challenges facing priority areas, the State Environmental Policy 2030 will subsequently be updated. As the current SEP expires, a final evaluation of the SEP in 2030 will map the progress achieved as well as its effectiveness, and a follow-up document will be prepared.

State of the environment in 2020

The long-term process of environmental monitoring in the Czech Republic is constantly being more detailed thanks to the potential facilitated by new technologies. A Report on the Environment, published annually, provides a clear and detailed evaluation of the condition of individual environmental aspects in terms of their trends as well as year-to-year changes to the general public. The Report on the Environment is accompanied each year by the *Statistical Yearbook of the Environment*, which provides only the indicator values and, in certain cases, their geographical projections. Regional viewpoints are presented in *Reports on the Environment in the Regions*. The analytical part of this SEP 2030 used all these documents as sources as well as additional information from documents listed in Annex 6.

Despite the objective improvement of the environment since the establishment of the Czech Republic, satisfactory (hygienic) limits in certain areas have not been achieved yet such as ambient air quality limits for certain pollutants, noise limits, ecological and chemical condition of water bodies and others. At the same time, the environmental quality requirements continue to increase, both thanks to new research-driven knowledge and available monitoring capacities. The condition and development of all environmental components is affected by the climate change. In addition to natural factors, the condition of individual environmental components is significantly affected by the structure of national economy with a high importance of industry (generating 32 % of the GDP) and by the composition of the national energy mix which dominantly relies on fossil fuels (representing 40 % of primary consumption). Despite a downward trend in these areas, the energy and material intensity of the Czech economy remains high. An important part is played by the territorial distribution of economic activities, with the north-east and the north-west of the country hosting the largest concentrations of emission-intensive mining, heavy industry and energy sectors.

A crucial role in water protection is played by the low retention capacity of the landscape, caused by the major modifications of watercourses, inappropriate agricultural land management practices, increases in built-up areas but also by local concentrations of deforested areas following bark beetle calamity felling. This long-term development trend is gradually remedied using nature-based solutions within the landscape; however, this process needs to be accelerated. Development of water management infrastructure in the Czech municipalities contributed to better quality of wastewater treatment and drinking water distribution. However, this infrastructure is often absent in locations with lower population density, where development of water supply and sewerage network requires substantial funding. Another important factor is the share of population connected to sewerage system without a link to wastewater treatment plants (WWTP). Yet another problem suffering low public awareness is discharge of polluting substances into sewerage systems which cannot be broken down by standard treatment technologies.

Air quality has improved in general despite certain regions being unable to fully observe ambient air quality limits. At present, significant polluters include households heated by solid fuel combustion sources, transport and agriculture sectors, the energy and heating production sectors, all despite the fact that large sources of pollution have considerably reduced the volume of emissions released into the air.

In the area of municipal waste management, the share of material recovery from municipal waste continues to grow while the volume of landfilled waste is on the decrease; landfilling does however continue to represent the dominant method of municipal waste disposal. Collection of biodegradable waste has seen a marked improvement. Waste prevention measures and prevention of adverse impacts of waste management on the environment is supported. The waste management hierarchy is gradually being adopted. The number of sites with old ecological damage and contaminated sites is still significant.

The worldwide drop in biodiversity manifests itself also in the Czech Republic, where the existing issues include habitat degradation, inconsiderate soil management, anthropogenic habitat occupation and impacts of invasive alien species. These circumstances lower resistance against climate-induced stresses and exacerbate impacts of biotic actors (bark beetle, rodents). There is a long-term decrease in farmland at the expense of paved impermeable surface areas. Arable land suffers from soil compaction caused by farming technology, and inappropriate farming methods result in loss of soil due to erosion and reduction of organic matter content in the soil.

State of the environment – summary

1.1 Water

- Since 2013, monitoring of water bodies is mandated and implemented in accordance with the Framework Monitoring Programme which is regularly updated, with the last update taking place in 2018.
- In the long-term horizon, the quality of surface waters is improving in the Czech Republic, however certain bodies of water remain classified as III. category or worse.
- As of 2018, 94.7 % of population was connected to a public water supply network, with only 5.3 % of Czech Republic's population without connection. The share of residents connected to water supply network differs significantly from region to region.
- The share of population connected to sewerage system reached 85.5 % in 2018. 17.6 % of population is connected to sewerage that is not connected to WWTP. The share of residents connected to WWTP differs significantly from region to region.
- The importance of surface sources of pollution of water bodies is growing.

- The negative impact of pollution of water bodies by pharmaceuticals and their metabolites (and other slowly biodegradable substances) is increasing.
- An overall unsatisfactory chemical condition is observed in groundwater bodies, specifically due to ammonium ions and nitrates. In terms of organic substances, pesticides and their metabolites are especially problematic.
- Between 2012 and 2020, more than 263 km of watercourses were remediated, with additional 25 km being in the process of remediation.
- Use of rainwater, recycled water and treated wastewater in the Czech Republic represents a negligible volume, which can however be a part of the solution for local water shortages.

1.2 Air

- In comparison with 1990s, there has been a significant improvement in reducing pollutant emissions (NH_3, VOCs, CO, NO_x, SO_2, dust). However, this reduction has slowed down markedly in the last decade.
- Since 2004, the quality of air in the Czech Republic has improved. However, it is still not good. The most polluted localities suffering from poor air quality include the Ostrava/Karviná/ Frýdek-Místek metropolitan areas, as well as Central Moravia and the Moravian-Silesian Region. Problems associated with exceeding certain air pollution limits, for example, benzo(a)pyrene, ground-level ozone and PM_{10} and $PM_{2,5}$ suspended particles, persist.
- Significant sources of pollutants include public energy and heat production, local (household) heating, manufacturing, transport and agriculture.
- The growing share of pollutant emissions from transport is related to increasing transport intensity. Passenger transport intensity increased by 26.3 % between 2000 and 2018. The share of public transport on the total passenger transport intensity (excluding air transport) reached 33.9 % in 2018.

1.3 Hazardous substances

- Old environmental burdens and contaminated sites are being continuously remediated even though the financing available for these activities is decreasing over the long-term.
- In the area of preventing serious accidents, accident prevention plans represent an important instrument, including thorough verification of their preparation and subsequent observance of the defined measures.
- In relation to hazardous waste management, changes in legislation and applicable methodologies as well as introduction of new instruments (such as HWSRS – Hazardous Waste Shipment Registration System) have greatly contributed to improvements in this area.
- Regulation and control of risks associated with hazardous chemical substances and their compounds are well-established on the EU level. The two pivotal regulations include REACH and CLP, which are in the Czech Republic complemented by the Chemical Act[4].
- Removal of substances harming the ozone layer is implemented in line with the Commission Regulation (EU) No 744/2010[5].
- The priority use of brownfields is embedded in conceptual documents which also contain financial incentives for remediation efforts.

1.4 Noise and light pollution

- Ecosystems enjoy no protection against noise that would be addressed by generally applicable law. Processes resolving negative effects of noise pollution on ecosystems remain insufficient.

[4] Act No. 350/2011 Coll., on Chemical Substances and Compounds and on a change of certain other acts (Chemical Act)
[5] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halons

- Protection of the population against noise pollution is addressed in the Czech Republic primarily within the framework of general protection of public health[6]. The number of Czech citizens exposed to high noise pollution generated by road transport has decreased between 2012 and 2017 by 24.0 % (51.2 thousand persons) in case of all-day (24 hours) noise pollution, and by 12.5 % (34.9 thousand persons) in terms of night-time noise pollution.
- Light pollution has not yet been addressed by legislation in the Czech Republic. Public awareness of the seriousness of light pollution and its impacts on health and ecosystems remains insufficient.

1.5 Extraordinary events - emergencies

- Measures are being put in place to mitigate impacts of natural disasters, especially in areas such as flood protection, long-term drought, meteorological (weather) extremes and geological instabilities.
- Early warning systems are being continuously improved and made more efficient, including simplified processes for declaring smog-related emergencies.
- In order to reduce occurrences of extraordinary events and emergencies and mitigate their impacts, priorities in relation to human health and the environment are regularly identified and monitored, including monitoring of water in the landscape. The majority of crisis and emergency-related documentation are being regularly updated as mandated by applicable crisis legislation.
- Anthropogenic emergencies caused by hazardous chemical substances are duly addressed and mitigated by legislative means.

1.6 Settlements

- More frequent weather fluctuations and extreme meteorological events have a significant impact on settlements. For example, the total cost of reconstruction efforts after the 2005–2018 floods reached 44 billion CZK. In addition, the total damage caused by windstorms, hailstorms and snowstorms between 2006 and 2018 reached almost 45 billion CZK.
- Ill-conceived and intensive real estate development and the resulting expansion of settlements and their supporting facilities into the open country, instead of utilising and re-developing brownfields, remains a threat to the environment in general. Almost 2 % of the Czech population lives in areas that are threatened by significant risk of flooding.
- Settlements suffer from a large share of paved and impermeable areas which are mostly insufficiently drained by sewer collectors. The share of developed areas in the Czech Republic grew by 5 054 hectares between 1993 and 2018.
- The potential of rainwater and grey water management systems remains under-utilized in settlements in general as well as with respect to individual buildings.
- Areas with growing vegetation and bodies of water in towns and cities with more than 20 thousand residents take up between 63.1 % and 92.9 % of their total urban areas. Despite this, the potential of urban green areas, including gardens and parks and their maintenance, remains under-utilized; a significant portion of this urban vegetation is low-growing vegetation.

2.1 Transition to climate neutrality

- Despite the growing energy consumption, energy intensity of the economy declined in the Czech Republic thanks to the growing GDP. There is a shift in the Czech economy towards more ecologically favourable sectors with lower energy intensity. The final energy consumption in 2018 reached 1 064.9 PJ.

[6] Act No. 258/2000 Coll. of July 14, 2000. on Protection of Public Health and amendment to some related Acts

- In the long-term comparison, the greenhouse gas emissions declined significantly. After 2000, this decline in emissions ceased to be as significant as before. In 2019, for example, emissions traded in EU ETS were approximately 24 % lower than in 2005. Greenhouse gas emissions generated by transport, waste and agriculture continue growing.
- Decay of spruce-dominant forests caused by bark beetle calamity in the Czech Republic reduces emission removals in LULUCF. In 2018, the LULUCF sector was already a source of about 6 million tonnes of CO_2eq emissions and this adverse trend will continue for at least several more years.
- Between 2014 and 2019, Czech Republic achieved 36.6 PJ of new energy savings and 98.2 PJ in cumulative energy savings. There exists a deficit in cumulative energy savings for the period of 2014–2019 in the amount of 55.1 PJ, which was caused by slower implementation of savings-related measures between 2014 and 2015.
- Energy generated by renewable sources continues to grow in the long-term. Since 2013 however, its share on the final consumption has been stagnating. In 2018, renewable sources only accounted for 15.2 % of all energy consumed.
- Energy consumption in transport sector continues to grow, same as CO_2 emissions, which grew between 2000 and 2018 by 65.8 %. This growth was mostly driven by road transport, accounting for 92.6 % in 2018.
- The growth in the share of renewable energy sources (RES) on the total energy consumption in transport has been stagnant since 2011. Despite a dynamic development, electromobility in the Czech Republic remains a minor segment. Besides the electromobility segment, use of bio-CNG/bio-LNG in transport sector remains crucial for any increase in the RES-related objectives.

2.2 Transition to circular economy

- The EU approved the so-called circular economy package facilitating a more efficient use of resources and preventing generation of waste, which has already been implemented on national level.
- A new legislation addressing waste management has already been drawn up and includes increased fees for landfilling.
- Material intensity of the Czech economy declined between 2000 and 2018 by 42.7 %. It however remains 27.5 % above the EU 28 average.
- Waste production in the Czech Republic has been growing. In 2018, waste generated reached 3 555.7 kg per capita and year. Since 2009, this represents an increase of 480.2 kg of waste per capita. Since 2009, there has been a gradual increase in the share of recycled waste, primarily in terms of material recovery (from 72.5 % to 83.4 %) at the expense of waste simply disposed of (landfilling declined from 14.6 % to 9.4 %, incineration is stagnating at 0.2 %). Energy recovery of waste is minimal (3.2 % of the total waste generated in 2018).
- Packaging waste has been growing in volume and in 2018 it reached 1 296.9 thousand tonnes. At the same time however, this is accompanied by its increased recycling and in 2018, 69.6 % of packaging waste was recovered.
- Strategic objectives for selected products as formulated by Waste Management Plan of the Czech Republic are being observed, and their take-back is increasing.
- Almost a half of the total municipal waste however remains landfilled.

3.1 Ecologically functional landscape

- Occupation of agricultural land for development is still considerable, but the rate of its growth has been halted. The total acreage of land suitable for agricultural use (the so-called Agricultural Land Fund (ALF)) in the Czech Republic decreased by 1.8 % between 2000 and 2018. The most significant cause of such occupation is extension of built-up and other areas, which grew in size by 4.1 % between 2000 and 2018.

- More than 60 % of farmland is threatened by potential water erosion, half of the farmland acreage is vulnerable to compaction and 62 % is highly threatened by acidification. Risks affecting soil have been increasing due to a combination of long-term drought, increased occurrence of intensive rainfall and unsuitable farming practices. The maximum soil loss in the Czech Republic has been calculated at approximately 21 million tonnes of topsoil per year.
- Soil erosion, loss of organic matter and climate change effects cause a decline in the soil retention properties. The current state of agricultural landscape and farming intensity have an adverse effect on biodiversity and ecosystems (eutrophication of waterways and sediment input into the water environment, releases of pesticide residue and other substances, occurrence of flash floods etc.). Population levels of farmland bird species in agricultural landscape fell by 33.5 % since 1982, population levels of common bird species have been stagnating since 1982.
- The share of unfragmented landscape in the Czech Republic has been persistently decreasing since 1980. Between 2000 and 2016, the area of unfragmented landscape decreased from 54.1 thousand km^2 (68.6 % of the total area of the Czech Republic) to 47.8 thousand km^2 and in 2016 it only took up 60.6 % of the Czech Republic's entire territory. The number of natural biotopes in these unfragmented areas is also decreasing.
- Distortion of the natural character of waterways remains at a high degree and a high number of transverse structures prevent migration of aquatic animals. More than 6 600 transverse structures higher than 1 m have been erected across waterways of various sizes.
- Waterways are being gradually revitalized. However, given the total length of watercourses in the Czech Republic which underwent modifications, this remediation progress is slow. Despite the increased protection of water and wetland ecosystems, their biodiversity is declining as well as their resistance and extent of provided ecosystem services.
- The area of aged tree stands (older than 120 years) is growing, which is a positive factor in terms of preserving biodiversity. Damage to forests, especially coniferous, expressed by percentage of defoliation, remains high. The share of deciduous tree populations in forests is growing only very gradually; in 2018, this share was 27.3 % of the total forest area.
- The current adaptation capacity of forest ecosystems against climate change effects, especially against related extremities, remains insufficient. This is reflected in increased random felling which amounted to 23 million m^3 bark-free in 2018. A minimum of 3.2 million m^3 bark-free was achieved in 2012.
- The share of certified forests is decreasing. The area of forests certified in accordance with PEFC principles is 67.7 % of the total forest area. Area of forests certified in accordance with FSC grew in 2019 to 4 % of the total forest area.
- Besides drought, other abiotic and biotic factors (rodents, insects, fungi) and cloven-hoofed game remain a significant problem for forest regeneration.
- Extraction areas have been stagnating while areas which successfully underwent recultivation have been growing, including use of nature-based regeneration methods in landscapes disrupted by raw material mining and related recultivation activities.

3.2 Preserving biodiversity and natural and landscape values

- Specially protected areas and Natura 2000 network areas represent approximately a fifth of the Czech territory. Acreage of special protected areas and Sites of Community Importance (SCI) is growing. In 2018, specially protected areas and contractually protected areas took up 17.2 % of the Czech territory. Since 2004, two new protected landscape areas (PLA) have been established.
- The long-overdue and complex regulation of issues relating to national parks was addressed by the 2017 amendment to Act No. 114/1992 Coll., on the Protection of Nature and Landscape.

- Despite certain improvements, the overall condition of species and natural habitats of Community importance is not good and reflects, to a large degree, the status of endangered species in the Czech Republic and the overall biodiversity and landscape status in the Czech Republic.
- Population levels of common bird species have been stagnating over the long-term, in 2018 these population levels were only 0.4 % higher than in 1982. Population levels of farmland and woodland bird species have been declining. In comparison with 1982, populations of woodland bird species decreased by 9.9 %, and farmland bird populations by 33.5 % by 2018. The gradual reversal of the trend in woodland species seems promising.
- In order to reduce the negative impact of invasive alien species, new legislation is being prepared in the Czech Republic in line with the new EU legislation.
- Lack of information and data describing the state of individual objects of interest represents a general problem in the field of nature and landscape protection.

External impacts

Socioeconomic development

Economic situation in the Czech Republic is directly and indirectly affected by external pressures, which may be economic, political, environmental, or linked to situation in other countries, especially within the framework of EU (Brexit), but also by unexpected events (such as the COVID-19 pandemic, natural disasters and others), social pressures (polarization of the society, extremist groups, migration) and, last but not least, also by technology-related risks. The COVID-19 pandemic must be used as an opportunity to kick-start restructuring of the Czech economy. Economic situation in the Czech Republic is also significantly affected by domestic demand, supply and rate of (un)employment and inflation. The job market is affected by availability of workforce which had been, as late as 2019, insufficient due to generally low unemployment. The job market will be significantly influenced by COVID-19 pandemic-related impacts in 2020. Preliminary data show that unemployment rates grew slightly in all regions since Q2 2020 while again underscoring regional disparities. State of emergency forced certain issues into the foreground of the national debate, for example digitalization and job flexibility; however, the potential there remains under-developed in the Czech Republic in comparison with certain other EU Member States.

The long-term prediction of population development trends on national level anticipates only “moderate” fluctuations. In 2017, the population of the Czech Republic reached 10.61 million (actual data), but it is anticipated that in 2100 this number will fall to 10.53 million. During the next several decades this trend will be greatly influenced by migration, which may partially substitute natural growth of population the Czech Republic. In the future, a gradual adjustment is also expected in the representation of individual age groups. However, the differences lie at the regional level. While the population in the Moravian-Silesian Region has been decreasing, demographic developments in Prague and the Central Bohemian Region remain positive. Opportunities and challenges that are directly relating to the condition of the environment are thus concentrated only in certain areas. Projections however cannot anticipate sudden external impacts, for example deep economic crises, significant shifts in the system of social measures, epidemics or important new developments and discoveries which may have the capacity to exert significant influence on the future development.

Historically, economic development has a direct connection to the growing impacts on the environment as the ever-growing economic activity is driven by demand for raw materials and energy and results in increasing degree of pollution. The long-term objective stemming from this development is the so-called concept of ‘decoupling’ i.e. a method of securing economic growth without exerting

increased burden on the environment. The Czech Republic has been partly successful in these attempts in the last several years, in the so-called relative terms meaning that the burden imposed on the environment grows slower than economic growth. In general, this means that growth of advanced economy goes hand in hand with growing investment into the environment, whether corporate or public investment, which rectifies previous damage while applications of ecologically favourable technologies further drive sustainable development. This growth in investment is reinforced by a growing environmental awareness of the general public, which is however demonstrating itself in the Czech Republic, similar to advanced economies of today, with certain delay.

Despite the general economic convergence achieved in the last several years and improving social situation, the differences between regions continue to deepen. GDP per capita ranges between 63 % of the EU average in the northwest Czech Republic up to 182 % in Prague. In Region Northwest (Ústecký and Karlovarský Region) GDP per capita actually fell since 2010 in absolute numbers. The significant aftershock triggered by the COVID-19 pandemic in 2020 terminated the long period of economic boom and the ensuing deep economic crisis[7] will represent an important factor affecting development of societies in future years. These impacts are regionally asymmetric and sector-specific. Certain sectors, such as gastronomy and tourism sector, have been hit hard, same as the automotive industry and transport sector in general, which generate about a fifth of the Czech economic output.

Global pressures on the environment in the Czech Republic

When elaborating the SEP, the authors took into consideration certain global pressures on the environment and the economy of the Czech Republic. The most significant trends were identified as climate change, food availability, growing consumption of resources and energy, loss of biodiversity, increased speed of technological change (including digitalization), but also disparities and mobility (of people, products and information).

Climate change impacts can be already observed in the Czech Republic today and their intensity will continue to grow. These impacts will make their mark also by extension (via global markets, flow of migration and through other vectors). The pressure on decarbonisation of the economy will certainly grow, determining acceptable technologies for manufacturing sector. **Energy sector** in the Czech Republic will be affected indirectly by pricing and political mechanisms. Electromobility and hydrogen as well as the growing share of renewable energy sources will require transformation of electricity distribution systems. Climate change and pressure exerted on food production, along with soil degradation, will create an adverse mix for energy production from primary biomass.

Another challenge for the energy sector and industry will be the growing demand for **raw materials** arising due to economic transformation. In order to mitigate this pressure, it will be necessary to make raw material flow as circular as it can possibly be (i.e. to achieve a transition to circular economy). The growing digitalization and economic transformation will trigger demand for new materials, whose acquisition and disposal may cause environmental damage. It will be necessary to learn to deal with hazardous and new types of waste which will come into existence in connection with further development of our society. At the same time, digitalization will make it possible to make certain waste management processes more efficient and better control will improve the prospect of successful implementation of circular economy.

Changes in rainfall distribution over time will more and more influence availability of **water** in the Czech Republic and this availability will decrease hand in hand with increased pressure on its quality.

[7] According to the September outlook of the Ministry of Finance, COVID-19 pandemic will cause a drop in GDP of about 6.6 % in 2020

The main challenge will be to ensure availability of water for the population, ecosystems, agriculture and the industry, primarily by being able to retain water within our landscape. New technologies and water management methods may contribute to this process, especially in the area of wastewater management, and it is already necessary to prepare the environment for their applications.

Climate change will also have significant impact on **biodiversity** in the Czech Republic. In the long-term horizon, there will be a shift in vegetation zones, as well as changes in the composition of species in ecosystems coupled with easier proliferation of alien species, which may lead to spread of tropical diseases in the Czech Republic, etc. We also need to address, in the short-term horizon, the growing pressure on production capacity and sustainability of agriculture in general. The growing mobility of people and goods, along with changes affecting habitats, make it easier for alien invasive species to proliferate. In a medium-term horizon, we can expect increased national and international efforts to enlarge protected areas.

On the other hand, global contexts in the areas of **settlement development** and **air quality** will translate into the Czech Republic only in a very limited degree and local pressures/conditions will prevail in shaping the situation. Air quality is affected in certain degree by transboundary pollution. Climate change will affect air quality by shortening the heating season on the one hand and by worsening air quality parameters in the summer months on the other hand. Settlement development will be influenced by continuing migration to suburban areas. The faces of our cities will be affected in the future also by developments in transport, for example by the use of drones, autonomous driving or shared ownership of means of transport, but also by new methods of going about one's employment or profession and providing services (digitalization, remote access, sharing or leasing material goods). New concerns may also arise in connection with technological development and geopolitical change with unclear consequences for the European environment, for example, failure to manage environmentally or economically driven migration, development and dissemination of new practices, technology, business models and ways of life throughout our society.

International dimension

The Czech Republic is aware of its responsibility for global environment. Events in the Czech Republic may directly or indirectly influence environment/biodiversity levels at the other end of the world. And similarly, events outside our borders may affect the environment in the Czech Republic. A good example would be non-ecological methods of goods production accompanied by increased pressure on the environment in countries with lower regulation and controls and their subsequent transport to the eventual points of sale. The place of production suffers from damaged environment which translates itself across other elements into the broader landscape. It is therefore necessary to remain aware of this international dimension and cooperate on the global improvement of the environment.

In order to face these numerous challenges in the area of the environment, Europe formulated a new growth strategy, the so-called European Green Deal (EGD) which seeks to ensure sustainability of the EU economy and to transform the European Union into a modern, competitive economy, which is using its resources efficiently. Implementation of certain of the European Green Deal objectives may also present an opportunity for an effective economic restoration after the COVID-19 pandemic will have run its course. The Czech Republic continues to support the long-term EU objective to achieve climate neutrality by 2050, as it had been formulated in the European Council's conclusions of 12 December 2019.

The principles of the Czech Republic's foreign policy define certain global objectives, including security, prosperity, sustainable development and human dignity, including human rights. A fundamental factor

influencing world events is a change in the world power balance and the shift to the multipolar world order. This manifests itself on economic, strategic-political and demographic levels, which has a consequent impact on the protection and state of the environment.

The Czech Republic, as a member of international organizations (UN, OECD and EU) and a party to a number of environmental agreements and conventions (please refer to Annex 4), will build on existing efforts and continue to contribute to the protection and improvement of the global and European environment, not only within the framework of the Czech Republic's presidency of the Council of the EU in 2022 (CZ PRES 2022).

At the **international level**, the Czech Republic will continue to support climate protection efforts so that global trends in greenhouse gas emissions fall in line with the objectives of international climate agreements; CR will also continue to support protection of the ozone layer for the purpose of its gradual renewal. It will also seek to strengthen the regulatory framework for improving air quality, especially in the context of Europe and Central Europe. It will also support halting the loss of and improving the state of biodiversity through a more effective global biodiversity protection framework after 2020 and strengthening action against global illegal trade in endangered species, as well as continuing to promote environmentally sound management of chemicals and waste.

The Czech Republic will cultivate efforts seeking protection and improvement of the environment in developing countries. Within the framework of the **Development Cooperation Concept**, it will support climate change mitigation and adaptation measures, combat ozone depletion and loss of biodiversity, desertification, drought and soil degradation, as well as promote disaster planning and sustainable management of chemical substances and waste.

Section detailing proposals

SEP 2050 Vision

The Czech Republic provides its citizens with a safe, healthy and resilient environment, facilitating high-quality standard of life also for the future generations. The society and the economy have adapted to climate change and consume as little non-renewable natural resources and hazardous substances as possible while making extensive use of secondary raw materials and zero emission energy sources. Sustainable use of the landscape and biodiversity are perceived as one of the pillars of high quality of life and contribute to the mitigation of climate change effects. The Czech Republic complies with international treaties and contributes to the global protection of the environment and sustainable development.

Overview of SEP objectives

1. The environment and health Vision: The Czech Republic enjoys a high-quality and safe environment in 2050		
Strategic objectives 2030:	Specific objectives:	Priority
1.1 Water availability is ensured and its quality is improving	1.1.1 Surface water quality is improving	2
	1.1.2 Groundwater quality is improving	2
	1.1.3 Drinking water supply of suitable quality to the population is improving	2
	1.1.4 Wastewater treatment is improving	2
	1.1.5 Water efficiency, incl. water recycling, is improving	1
1.2 Air quality is improving	1.2.1 Emissions of air pollutants are decreasing	1
	1.2.2 Ambient air quality standards are being observed	2
	1.2.3 Transboundary transmission of pollutants is decreasing	3
1.3 Exposure of the population and the environment to hazardous chemicals is decreasing	1.3.1 Emissions and leaks of hazardous chemicals into all environmental components are decreasing	2
	1.3.2 Contaminated areas, incl. old ecological damage, are monitored and effectively sanitised	3
1.4 Noise and light pollution levels are decreasing	1.4.1 Noise pollution of the population and ecosystems is decreasing	3
	1.4.2 Light pollution levels are decreasing	3
1.5 The society's preparedness and resilience against extraordinary events and emergencies is increasing	1.5.1 Preparedness, resilience and adaptation to weather extremes is increasing	2
	1.5.2 Negative impacts of extraordinary events and emergencies of anthropogenic or natural origin are minimised	2
	1.5.3 Occurrence of extraordinary events and emergencies of anthropogenic origin is minimised	3
1.6 Adapted settlements ensure quality and safe life of their residents	1.6.1 Settlements effectively adapt to climate change-related risks	2
	1.6.2 Settlement development is conceptual, brownfields and built-up areas are developed preferentially	3
	1.6.3 Settlement run effective water management systems, incl. rainfall management	3
	1.6.4 Quality of green infrastructure, contributing to better microclimate in settlements, is increasing	2

Priority ranking: 3 – important objective; 2- highly important objective; 1 – objective with utmost priority

2. Transition to climate neutrality and circular economy Vision: In 2050, the Czech Republic contributes to the EU climate neutrality and circular economy to the maximum while supporting sustainable development and competitiveness of the Czech Republic		
Strategic objectives 2030:	Specific objectives:	Priority
2.1 Greenhouse gas emissions are decreasing	2.1.1 Greenhouse gas emissions are decreasing	1
	2.1.2 Energy efficiency is improving	1
	2.1.3 Use of renewable energy sources is increasing	2
2.2 Circular economy guarantees efficient management of raw materials, products and waste	2.2.1 Material intensity of economy is decreasing	2
	2.2.2 Waste prevention efforts are maximised	1
	2.2.3 Waste management hierarchy is fully observed	1

Priority ranking: 3 – important objective; 2- highly important objective; 1 – objective with utmost priority

3. Nature and landscape Vision: In 2050, the Czech Republic enjoys a diverse, ecologically stable landscape and nature, which is duly protected and providently used		
Strategic objectives 2030:	Specific objectives:	Priority
3.1 Ecological stability of landscape is rebuilt, farming is sustainable in long-term and reacts to climate change	3.1.1 Water retention levels in landscape are increasing via ecosystem solutions and sustainable farming	1
	3.1.2 Soil degradation, incl. accelerated erosion, and loss of farmland is decreasing	2
	3.1.3 Non-productive functions and ecosystem services of the landscape, especially of the farmed land, ponds and forests, are strengthened	2
3.2 Biodiversity is being maintained within the limits dictated by climate change	3.2.1 Condition of natural habitats is improving and species protection is ensured	2
	3.2.2 Protection and management of the most valuable parts of the nature and landscape is ensured	2
	3.2.3 Negative impact of invasive alien species is limited	2
	3.2.4 Protection of wild animals in human care is ensured	3

Priority ranking: 3 – important objective; 2- highly important objective; 1 – objective with utmost priority

1. The environment and health

1.1. Water

Strategic objective 1.1: Water availability is ensured and its quality is improving

Water is one of the fundamental conditions for life on Earth. Freshwater represents only 3 % of the world's total water supply and majority of that supply is outside human reach. Ecosystems and humans are dependent on water. Water is used in all areas of the economy, in industrial production, in energy sector and in agriculture, it is crucial for household supply, recreation etc. Lack of water triggered by climate change constitutes a fundamental problem. The Czech Republic gets its water almost exclusively in the form of rainwater as there are no major rivers flowing into the country from abroad; on the contrary, the overwhelming majority of water flows out of the Czech Republic's territory. There is no great scarcity of rainfall but due to global climate change its distribution over the course of seasons is changing. Higher average temperatures in the winter months are the cause of a lack of the usual water supply in the form of snow and ice, while high early spring and autumn temperatures bring higher evaporation rates and last longer. There is therefore not a sufficient supply of water in the soil profile or in groundwater reserves. For a functioning system, it will be necessary to consider possible future developments and harmonize use of water. Water must be managed prudently, but in the case of drinking water consumption, the Czech Republic is already approaching hygienic minimums as defined by the World Health Organization (WHO).

Although the quality of water in the Czech Republic has significantly improved over the last 30 years, shorter comparisons show that this rate of improvement has been stagnating and there are still areas and activities that require our increased attention. Surface water pollution, caused by wastewater from point sources of pollution, continues to have a significant effect on eutrophication of reservoirs and ponds. To a lesser extent, eutrophication of surface waters is caused by influences that can be linked to the ponds' economic use. In addition, due to absence of sufficient anti-erosion elements in the landscape or inappropriate application of industrial fertilizers and other products protecting plant-life, combined with inappropriate modifications of stream morphology and insufficient treatment of water discharged into watercourses, especially municipal wastewater, there are numerous occurrences of surface water degradation, which manifest themselves mainly in reservoirs and ponds, but also in lower sections of major watercourses and in the form of contamination plaguing surface waters and groundwater. It is therefore required that we continue in implementing measures improving condition of surface waters and groundwater by, for example, reducing water erosion, reducing pollution from surface and point sources, removing sediments, revitalizing and remediating watercourses, clearing watercourses and re-instating natural migration of aquatic animals (removal of transverse structures, implementation of fish passes, etc.).

On the national level, water protection is generally addressed in the Water Act[8] and in specific water protection measures that have been formulated within the framework of National river basin management plans.

Improvement of water quality is also addressed in European legislation, which is spearheaded by the EU Water Framework Directive [9], which represents one of the most complex Directives drafted by the European Commission. Its key purpose is to prevent further deterioration of surface and groundwater quality, improve quality of water and quality of ecosystems linked to water. Besides this Framework

[8] Act No. 254/2001 Coll., on Water and on changes to certain other acts (Water Act)
[9] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (the EU Water Framework Directive)

Directive, this topic is addressed in detail by additional and specific EU Directives[10]. Water, in its full spectrum of use, is also one of the key topics of a UN Programme for the period 2015-2030, the so-called Agenda 2030, where it forms a part of most objectives, the so-called Sustainable Development Goals (SDGs), and has a special objective – No. 6 – dedicated to its improvement.

Specific objective 1.1.1: Surface water quality is improving

Bodies of surface water – standing water and watercourses – represent about 2 % of the Czech Republic's territory. They are characterized by great environmental dynamics and changes over time. In the case of watercourses, this is manifested by deepening and widening of riverbeds, erosion of riverbanks, by deposition of sediments, meandering, levelling of riverbeds etc. In stagnant waters, accumulation of nutrients causes subsequent massive development of cyanobacteria or algae, clogging and overgrowth by vegetation.

Quality of surface waters depends on natural conditions. However, it is also very strongly influenced by human activity and pollution from point and surface sources. **Point sources** of pollution are mainly caused by wastewater discharges [objective 1.1.4] from municipalities, cities, industrial enterprises and large agricultural livestock production facilities. Intensive modernization and construction of wastewater treatment plants (WWTPs), restructuring of the industrial sector, and last but not least, socio-economic and political developments have all had a positive effect on improving surface water quality. All the more important pollution source are therefore surface and diffuse sources, i.e. agricultural activities, small villages and scattered buildings, but also the unified sewerage systems [1.6.3]. Untreated or insufficiently treated wastewater is the most important source of phosphorus.

Other significant pollutants include plant protection products that enter water via runoffs from farmed land, but also from non-agricultural areas (for example, railways, gardens, etc.). Continued presence of some pesticides, or their metabolites, has been proven in surface waters and in analysed sediments although these may have not been used for many years (atrazine, alachlorine, simazine). In addition to this, there is also an increased incidence of newly used types of these substances. Water pollution is also affected by air quality. **Atmospheric deposition** [objective 1.2] enable significant anthropogenic pollutants to reach the Earth's surface – entering soil, vegetation, water surface as well as modified or paved surfaces and subsequently, via runoffs, to enterthe surface waters. In addition to emissions of sulphur dioxide and nitrogen oxides, this also includes dust particles and heavy metals (cadmium, lead, nickel, mercury) and other undesirable substances such as arsenic and polyaromatic hydrocarbons (PAH).

Hydro-morphological modifications, i.e. anthropogenic changes of watercourses causing deviations in natural processes in watercourse beds, include all previous modifications aimed mainly at stabilizing watercourse routes, increasing their capacity to enable navigation and implementation of flood control measures. Other significant morphological changes include interruptions in the continuity of the watercourses' environment by transverse structures (from valley dams, large weirs to small weirs and steps). These structures were built, and to a limited extent are still being built, for the purpose of flood protection, slowing down outflow of water from a territory, ensuring production of drinking water, energy supply or enabling navigation, etc. From the perspective of biodiversity, however, they represent disturbances of the natural environment, prevent natural migration of aquatic fauna and

[10] Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council; Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration; Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrate Directive); Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment; Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC

general ecological permeability, limit natural hydro-morphological processes and significantly affect ecological conditions of such bodies of water. These modifications cause straightening and shortening of watercourses' routes, reduce diversity of their environment, eliminate alternations of fords and pool sections, remove or degrade stream or river banks thus preventing contact between the watercourse and natural floodplain areas and significantly reduce their self-cleaning ability.

Other sources, such as the discharges of cooling water, treatment of paved surfaces, heat feeder lines, shipping and related construction measures, tourism or mining activities and, where applicable, processing of raw materials, can also have an additional negative effect on water. The biocenosis (specifically benthos), structure of riverbeds, concentrations of silt and oxygen consumption can also be directly affected by sediment removals in order to ensure navigability and maintenance of the flow.

Significant water offtake for cooling of energy sources and water transfers between sub-basins can also prevent water bodies from achieving their natural environmental objectives. Surface water offtake is used mainly in industry, energy sector, agriculture and also for production of drinking water, but also for provision of other services (for example, artificial snow). Water bodies may also be negatively affected by other facilities (for example, production lines, hydroelectric power plants, water treatment plants, etc.) that are problematic in terms of reducing the flow of water between the offtake and discharge points.

Surface water bodies are assessed in accordance with Decree No. 98/2011 Coll., as amended. This assessment includes chemical status and the ecological potential of surface water bodies.

Surface water quality has been evaluated in the Czech Republic in the long-term according to Czech Technical Standard (CTS *or, as commonly known in Czech "ČSN"*) No. 757221 – Water Quality – Classification of surface water quality (monitoring of chemical, physicochemical and selected biological indicators). Despite there being a significant improvement in surface water quality over the last 25 years, a significant proportion of watercourses or their sections still remain categorized as degraded in quality, i.e. in the III. - V. quality categories.

In connection with ongoing climate change, the risk of eutrophication in water reservoirs (increased content of mineral nutrients, especially phosphorus compounds) is increasing and this also applies to the increased intensity of cyanobacteria, the so-called aquatic flowers, growth. Lower precipitation and reduction of water volumes flowing through watercourses in recent years has also had the effect of reducing the ability of watercourses to dilute residual pollution discharged from WWTPs, which is one of the reasons why water quality is not improving as fast today as it did in the 1990s. Development of new methods and technologies enables monitoring of new types of surface water pollution (micro pollutants - for example, residues of plant protection products, pharmaceuticals, personal care and hygiene products, micro plastics, etc.).

Bathing water constitutes a specific category of surface water and its quality is assessed in accordance with the Public Health Protection Act[11] and Decree No. 238/2011 Coll.[12] Water quality is monitored in natural bathing pools and in bodies of surface water used for bathing that are not run by specific operator. These bathing waters are monitored for indicators essential for human health (cyanobacteria, Escherichia coli, Enterococci, chlorophyll-A and multicellular organisms, etc.). Quality of bathing water depends not only on input of pollutants or nutrients, especially phosphorus, but also on hydrological and atmospheric conditions, especially in connection with temperature and length of sunlight, which affects growth of phytoplankton – cyanobacteria or algae whose bloom is the most frequent reason for banning bathing in these bodies of water.

[11] Act No. 258/2000 Coll., on Protection of public health

[12] Decree No. 238/2011 Coll., on determining hygienic requirements for swimming pools, saunas and hygienic limits of sand in outdoor playground sandpits

Strategies implementing SEP objectives

- National Action Plan for Safe Pesticide Use in the Czech Republic 2018–2022 (MoA)
- Action Plan for Development of Ecological Agriculture in the Czech Republic 2020–2025 (MoA) and its subsequent updates – *in preparation*
- National river basin management plans in the Czech Republic (MoE, MoA)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030
- Action Programme pursuant to Government Regulation No.262/2012 Coll.,[13] defining required measures addressing nitrates (MoA)

Types of measures

- Limiting pollution input from point sources by implementing measures in objective 1.1.4.
- Limiting pollution input from surface or diffuse pollution sources (pesticides, phosphorus and nitrogen) with priority given to catchment areas containing water supply sources and bathing water.
- Sustainable management of agricultural land and ponds, including ecological and precision agriculture.
- Identification of pollution sources, including surface sources, allowing determination of what causes water quality deterioration.
- Improving morphology of surface water bodies, for example, by revitalizing watercourses, improving their permeability (fish passes, obstacle removals) etc.
- Broader application of ecosystem-friendly approaches in watercourse management practices.
- Broader application of close-to-nature flood control measures and measures retaining water in the landscape.
- Reviewing existing water management permits, including definitions of minimal flow parameters (balances).
- Amending legislation in order to align it with the objectives in water management and planning.

Responsible authorities

- Responsible Authorities (Administrators): MoA, MoE
- Co-Administrators: MoH, MIT

Indicators

- 1.1.1a Water quality in watercourses
- 1.1.1b Quality of bathing water

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- RDP – Rural Development Programme 2014–2020

[13] Government Decree No. 262/2012 Coll., on identification of vulnerable areas and on the action program

- CAP – CAP Strategic Plan2021–2027

Specific objective 1.1.2: Groundwater quality is improving

Same as with surface water, quantity and quality of groundwater is significantly affected by human activities in the landscape, including former activities. Risks in this area are represented, for example, by contaminated sites (old ecological damage or landfills) [objective 1.3], that contain higher concentrations of hazardous substances.

Nitrates have a fundamental effect on the groundwater quality, which can also negatively affect supply of drinking water. Roughly 42 % of the Czech Republic's territory is defined as vulnerable within the meaning of the so-called Nitrate Directive[14]. The main cause of this pollution is agricultural production, especially incorrect applications of nitrogen-based fertilizers. Groundwater has also long been shown to be polluted by pesticides and their metabolites; this pollution also comes from agriculture. Due to the slow dynamics of changes in groundwater chemistry and the long pesticide decomposition times, some of the already banned pesticides and their metabolites (alachlorine, atrazine) still continue to be detected in groundwater.

Due to the combination of long-term droughts and water offtake for human consumption, the Czech Republic already has a certain experience with declining groundwater levels and the resulting local problems with drinking water supply from shallow wells. In some cases, groundwater quality can be negatively affected by land use in infiltration areas, current and past extraction of raw materials, especially gravel in floodplains, but also by old environmental damage, excavation of deep geothermal wells for heat pumps, geological surveys, etc. Measures improving groundwater quality may include artificial infiltration, where surface water is artificially transferred to groundwater to ensure steady quantity and improved quality through natural filtration processes in the soil and then its use for purposes of water supply.

More efficient farming practices in agriculture will contribute to the improvement of groundwater quality, which is a very slowly renewable raw material by, for example, using precise amounts of plant protection products, improving infiltration by changing agro-technical processes (for example, using lighter equipment, employing better ploughing techniques, creating seepage belts, etc.), as well as in industry and in households (regulated water offtake). Reforms in water management financing can also serve as preventive instruments by, for example, adjusting fees due for amounts of groundwater offtake to balance the cost of surface and groundwater treatment.

Strategies implementing SEP objectives

- National river basin management plans in the Czech Republic (MoE, MoA)
- National Action Plan for Safe Pesticide Use in the Czech Republic 2018–2022 (MoA)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030
- Action Plan for Development of Ecological Agriculture in the Czech Republic 2020–2025 (MoA) and its subsequent updates – *in preparation*

[14] Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrate Directive)

- Action Programme pursuant to Government Regulation No. 262/2012 Coll., defining required measures addressing nitrates (MoA)

Types of measures

- More environment-friendly farming methods in agriculture (for example, ecological agriculture, precision agriculture) and forestry (ensuring better infiltration of water from forest road network into groundwater).
- Groundwater offtake regulation.
- Adjustment of fees due for groundwater offtake.
- Limiting gravel and sand extraction in floodplains in cases of potential high risk of significant water pollution and compromised infiltration capacity.
- Increased infiltration of surface water into groundwater.
- Regulation of geothermal bores for heating pumps in protection zones of water sources.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoA

Indicators

- 1.1.2a Groundwater quality

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- RDP – Rural Development Programme 2014–2020
- CAP – CAP Strategic Plan 2021–2027

Specific objective 1.1.3: Drinking water supply of suitable quality to the population is improving

Guaranteed quality of drinking water for the population is a basic condition for a prosperous society. In recent years, increased attention has been paid to the development of water management networks and the supply of high-quality drinking water to the population has significantly improved. At present, 94.7 % of the Czech Republic's households have the opportunity to connect to the public drinking-water supply infrastructure, which supplies drinking water with controlled quality. Nevertheless, some households still prefer to use water from private underground sources (their own wells) especially in areas with lower population density.

Due to droughts and extreme rainfall, drinking water supply may be threatened by reduced water quality and availability. Decreases in groundwater levels due to increasingly frequent periods of drought are already causing local problems in many municipalities in the Czech Republic. In the event that drinking water supply from public waterworks is endangered over a larger area, whether due to drought or contamination of the water source, it is possible to declare an emergency and ensure emergency drinking water supply or prevent such situation by adopting regulatory measures. Recent incidents have mostly escalated due to non-compliance with imposed restrictions (restrictions on the

use of water for unnecessary purposes) on the part of consumers and had to be resolved locally for example, by extraordinary re-supply of water towers.

In order to improve the situation and maintain good quality of drinking water, it will be necessary to consistently protect existing sources of water and prepare new sources and implement improved networking of water supply systems. Upgrades of technically obsolete water supply networks will both reduce leakages from accidents and contribute to increased efficiency of drinking water use [objective 1.1.5] as well as reducing the cost of raw water treatment, which will together improve the supply of drinking water. These upgrades should also consider introduction of new technologies for the treatment of raw water.

With regard to surface and groundwater bodies that are used for raw water offtake for the purposes of treatment to produce drinking water, the aim must be to achieve good chemical status and ecological condition of surface water [objective 1.1.1] and good chemical status and quantity of groundwater [objective 1.1.2], which will reduce the cost of raw water treatment. Effective measures could include establishment of protection zones around water sources according to the Water Act and defining acceptable methods of their management, as well as instituting bans on activities damaging or endangering the yield, quality or health safety parameters of water sources.

Strategies implementing SEP objectives

- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- National river basin management plans in the Czech Republic (MoE, MoA)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)

Types of measures

- Upgrades of water supply systems.
- Improved networking of water supply systems.
- Construction of new water supply systems (connecting households to public water supply).
- Defining regulation controlling water offtake.
- Searching for and developing new surface water and groundwater sources for supply to the general population.

Responsible authorities

- Responsible Authorities (Administrators): MoA, MoE
- Co-Administrators: MoH, MfRD

Indicators

- 1.1.3a Number of residents supplied by water from public water-supply system
- 1.1.3b Water source yield capacity

Sources of funding

- NPE - National Programme “Environment”
- OPE - Operational Programme “Environment”
- Construction and technical upgrades of water-supply infrastructure and sewerage systems

Specific objective 1.1.4: Wastewater treatment is improving

Wastewater from households, industry and other sources contains impurities and substances that have a negative effect on aquatic ecosystems and may cause loss of dissolved oxygen and subsequent eutrophication. These are mainly nutrients (phosphorus and nitrogen), other inorganic and organic substances, toxins and pathogenic microorganisms, but also macroscopic objects. Since 1990, there has been an improvement in the area of wastewater treatment and thus a significant reduction in the levels of pollution discharged. The fact that the majority of the population is already connected to the sewerage system which terminates in a wastewater treatment plant (WWTP) also plays a significant role in this process. Thanks to investment going into the construction and intensification of WWTPs, macronutrients (nitrogen and phosphorus) are being removed more efficiently, especially in agglomerations with more than 10 000 population equivalent (PE), which is one of the requirements set by Council Directive 91/271/EEC.[15] However, it is also important to ensure removal of macronutrients in smaller agglomerations. During this period, we have also managed to reduce the amount of hazardous and especially hazardous substances discharged into water.

Problems associated with discharges of untreated wastewater still exist, especially in smaller agglomerations below 2 000 PE that are not connected to the sewerage systems terminating in a WWTP. In these municipalities, it is necessary to individually assess possibilities of wastewater disposal in terms of sustainability, i.e. the overall economic, environmental and social impact and, taking into consideration specific local conditions, allow residents to make an informed decision to choose a suitable way of wastewater treatment, whether in the form of central or decentralized sewerage removal or removal of wastewater from sumps to a central treatment plant. In the future, it will be necessary to focus on smaller agglomerations below 2 000 PE, and to properly address free discharges of untreated wastewater. In agglomerations of any size, it will be necessary to address reduction of pollution discharged from the uniform sewerage system during heavy rainfall.

Developments and improvements in chemical analysis methods make it possible to detect new types of pollution (for example, micro pollutants - endocrine disruptors, pharmaceuticals, drugs, personal care and hygiene products, etc.), which are not covered by the currently established methods of treatment. Discharges of industrial wastewater into the sewerage system (pollutants such as hydrocarbons, cadmium, chromium, arsenic, mercury, etc.) also remain problematic. To improve the quality of water in watercourses, it will be necessary to pay attention to quality of wastewater discharged from industrial facilities, develop tertiary stages of wastewater treatment and support development of quaternary stages and apply these new technologies to normal WWTP operations within the framework of their further modernization and expansion. Leakages of wastewater from sewers can also be significant sources of groundwater pollution. In order to rectify these problems, it will be necessary to set up monitoring and data collection processes separately for public and industrial sewerage systems.

Strategies implementing SEP objectives

- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- National river basin management plans in the Czech Republic (MoE, MoA)
- National Action Plan on Adaptation to Climate Change (MoE)
- Water Supply and Sewerage System Development Plan for the Czech Republic (MoA)

[15] Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment

- Waste Management Plan of the Czech Republic (MoE)

Types of measures

- Expansion and modernization of sewerage systems and effective connection of households to WWTP, or household wastewater treatment units.
- Ensuring functionality of household wastewater treatment units (inspections).
- Modernization of existing WWTPs, including taking into consideration specific requirements for wastewater treatment methods and quality (for example, in special protected areas, Natura 2000).
- Fundamental reduction in the volume of untreated wastewater discharged from uniform sewerage systems during rainfall (sewer overflow tanks etc.).
- Introduction of remote operational monitoring of WWTP technologies, remote management of WWTP technologies with long-term data archiving.
- Research into and application of new techniques removing newly detected pollutants.
- Sustainable sewage sludge management methods, focusing on phosphorus recycling and energy efficiency.
- Introducing new techniques for pre-treating industrial wastewater before it is released into sewerage systems.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrator: MoA

Indicators

- 1.1.4a Wastewater treatment

Sources of funding

- NPE - National Programme “Environment”
- OPE - Operational Programme “Environment”
- Programme for Development and Upgrades of Water Supply and Sewerage Network Infrastructure

Specific objective 1.1.5: Water efficiency, incl. water recycling, is improving

Responsible water management equals effective use of water. Surface water and groundwater offtake reflect development of the economy, hydrometeorological conditions of a given year and households’ behaviour patterns. The largest water offtake in the Czech Republic is represented, in the long-term, by drinking water supply to the population (public water supply systems), followed by water consumed by the energy sector, industry and agriculture. In the long run, Czech Republic managed to significantly reduce consumption, respectively water offtake, in industry and in water supply industry sector. Water consumption in the energy sector has also been declining since 2010. However, reserves must be also sought in terms of technology change that will enable closure of the water cycle. In the energy sector, for example, this means a transition from flow cooling to circulation cooling, in the industry it is most

often water used for heating, cooling, extinguishing fires, washing or hydraulic transport. Separate sewerage systems for wastewater and rainwater form an important prerequisite for expansion of water recycling processes. This solution will better facilitate subsequent treatment and possible further (re-)use of water.

In the water industry, savings were achieved mainly through gradual upgrades of water supply infrastructure and by reducing losses through leaks and accidents. As the production of drinking water is economically and technologically demanding, it is necessary to further reduce its consumption. This can be achieved by replacing it wherever it is hygienically and environmentally safe. Grey water is characterized by fluctuations in pollution levels – water from bathrooms tends to be slightly polluted, but use of water from other sources, such as kitchens, remains more problematic. In urbanized areas, the primary effort must be directed at ensuring maximum infiltration of rainwater falling there – i.e. conversion of hard surfaces to permeable surfaces. Nevertheless, even here, water from paved surfaces, such as roofs and roads, should be retained for further use. In the future, it will be possible to use treated wastewater and grey water, which must be safe from the environmental as well as health perspective. Recycled water can be used for watering public vegetation and gardens, as process water in buildings (for flushing toilets) and for other purposes [objective 1.6]. To ensure safe and cost-effective reuse of grey wastewater, the legislative environment needs to be adapted as well as construction requirements, standards and technical regulations, including minimum hygiene requirements for reused water.

Although recycled water is still negligible in terms of volume of water consumed at national level, these savings can address local water shortages. In 2017, at EU level, recycled wastewater was most often used in agriculture and many EU Member States would no longer be able to maintain agricultural production at required levels without using recycled wastewater for irrigation. The EU approved Regulation 2020/741[16], which will allow irrigation with modified treated municipal wastewater in agriculture from wastewater treatment plants larger than 2 000 PE. In the Czech Republic, it is yet necessary to amend legislation that will enable recycling and use of municipal wastewater from smaller municipalities for irrigation and for use supporting blue-green infrastructure.

Strategies implementing SEP objectives

- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- National Action Plan on Adaptation to Climate Change (MoE)
- Circular Czechia (MoE) – *in preparation*

Types of measures

- Introduction of new technologies enabling use or recycled water in production, especially in sectors with a high water consumption such as food production, paper mills, chemical and textile industry and energy sector.
- Repeated use of process water in plant utility operations (maintenance, logistics, transport, social facilities).

[16] Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse

- Recycling of wastewater (grey, pre-treated from WWTP, etc.) from households, public buildings (kitchens, bathrooms) and service-sector establishments (wellness and spas, swimming pools, accommodation and restaurants etc.).
- Introduction of technologies and processes saving and reusing water in agriculture.
- Construction of separate sewerage systems and tanks retaining rainfall water (retention tanks, underground storage, accumulation reservoirs).
- Removing the existing fee exemption for removing rainfall water via uniform sewerage systems pursuant to Act No. 274/2001 Coll.,
- Supporting development of systems and distribution networks for use of pre-treated grey water.
- Removing legislative barriers for use of pre-treated wastewater.
- Supporting research, innovation and introduction of best available techniques.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MIT, MoA, MoH
- Co-Administrator: MfRD

Indicators

- 1.1.5a Offtake of groundwater and surface water
- 1.1.5b Consumption of water from public water supply systems (households) and losses from the water supply network
- 1.1.5c Supported projects for the use of rainfall and recycled grey water

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- InterReg – European Programme for interregional cooperation
- LIFE Programme
- State (national) budget

1.2. Air

Strategic objective 1.2: Air quality is improving

Air quality has a fundamental impact on the health of the population. Despite significant improvements since the 1990s, air quality still remains unsatisfactory in some regions. The limit values for certain pollutants are being exceeded (especially PM_{10}, $PM_{2,5}$, benzo(a)pyrene, tropospheric ozone), especially in large cities and also in regions such as the Moravian-Silesian Region or Ústecký Region. Benzo(a)pyrene limits are exceeded in almost all residential areas (i.e. also in smaller municipalities), where solid fuel heaters are operated.

Outdoor air quality and reduction of air pollution is addressed by Directives 2008/50/ES[17], 2004/107/ES[18] and 2016/2284[19]. At national level, air quality is addressed by the Air Protection Act [20] and Decree No. 330/2012 Coll.[21] Specific measures with nationwide impact are formulated in the National Emission Reduction Programme and, on regional level, in the Air Quality Improvement Programmes. The Czech Republic is a signatory to the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP).

Specific objective 1.2.1 Emissions of air pollutants are decreasing

Within the framework of national emission reduction commitments, the Czech Republic monitors emissions of SO_2, NO_X, $PM_{2.5}$, as well as volatile organic compounds other than methane (VOC) and ammonia (NH_3). In the long-term comparison, air pollution levels have decreased but this trend has slowed down in recent years and it is therefore necessary to further support and accelerate technological change in problematic sectors. Within the framework of the underlying analysis for the update of the National Emission Reduction Programme, six key measures were selected to reduce pollutant discharges related to renewable energy sources (RES), and to facilitate changes in agriculture, transport, replacement of household heaters, etc.

While emissions of pollutants from energy sector and industry have fallen sharply as a result of tightening environmental legislation, introduction of BAT and emerging technologies, other sectors are gaining in importance, such as local domestic heating, transport and agriculture.

Larger settlements use (district) heat supply systems for heating and hot water supply, which are optimal in a given location in terms of emissions. **Local heating** of households with solid fuel, especially combined with obsolete heating sources (boilers, stoves, fireplaces) and poor-quality fuel, negatively impacts air quality especially in older urban areas and in smaller municipalities. For this reason, the control mechanisms have been strengthened in this area and the state has been actively supporting replacement of household heaters with more environmentally friendly alternatives such as biomass (wood, pellets), natural gas, heat pumps, etc. For heating and hot water supply, the potential of combined heat and waste heat production from local industry and other potential sources (data centres) remains untapped. The tendency of households to disconnect from public heat supply systems is a worrying trend.

A problematic trend that has not been reversed yet is the growth in the air and road **transport** sector, which is the cause of increased noise levels [objective 1.4] and emissions of pollutants into the air. Priorities in road transport sector therefore include gradual development of low-emission and emission-free vehicles, especially in cities and metropolitan areas, both in the category of passenger cars and gradually in the category of trucks and especially public transport vehicles[22]. Furthermore, it is necessary to ensure a good technical condition of the current vehicle fleet (for example, quality and functioning particulate filters (DPF) or functioning catalytic reduction (SCR) systems). This is connected to mobile technical inspections, including emission measurements during the actual operation of

[17] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[18] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
[19] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
[20] Act No. 201/2012 Coll., On Air Protection, as amended
[21] Decree No. 330/2012 Coll., On the method of assessment and evaluation of pollution levels, the scope of informing the public about the level of pollution and in smog situations
[22] In addition to legislation, agreements are concluded with the automotive industry in the Czech Republic, such as the Memorandum on the Future of the Automotive Industry in the Czech Republic

vehicles in order to gradually eliminate a relatively small number of vehicles which markedly contribute to pollution generated by transport. Improvements of specific local situations will be brought about by air quality improvement plans developed at regional or local level or regional/local sustainable mobility plans addressing not only transport and mobility, but also their impact on other areas (the environment, health, territorial planning, energy sector, etc.) in a given city and its surrounding area. These plans form a basic prerequisite for choosing the most suitable solution for a given area, for example, declaring low-emission zones, increasing continuity of traffic flows associated with traffic calming, development of combined transport, support of non-motorized mobility, diversion of transit and individual transport from city centres by, for example, construction of bypasses or construction of parking houses on the outskirts of cities with good connections to public transport (P + R and other systems), but also use of suburban rail links. In order to transfer road freight transport to rail, it is important to build (transhipment) terminals and also to increase railway transport capacities by construction and modernization of railway lines with emphasis on electrification with possible use of alternative fuels on non-electrified sections.

Agriculture is an important source of ammonia, which is generated mainly in animal production and by fertilizer use, and to a lesser extent also a source of dust particles caused by wind erosion [objective 3.1]. In livestock farming, more emission-friendly methods and technologies can be used to reduce NH_3 emissions, for example, technologies cleaning air in stables, by increasing proportion of grazing, etc. Strict and widespread adherence to good agricultural practices in the use of urea-based nitrogen fertilizers and land management will contribute to reducing NH_3 emissions and dust.

Today, the public energy sector is regulated by European legislation. In the public energy sector, a high proportion of solid fossil fuels remains a problem in terms of emissions of pollutants into the air, combined with lower conversion efficiencies, especially for some coal-fired power plants. Transition to non-combustion energy sources [objective 2.1] represents a significant potential for reducing pollutant emissions.

In the area of other, non-combustion, **industrial sources of pollution**, measures have been taken in the past to reduce fugitive dust emissions, in particular by tightening operating conditions pursuant to Decree No. 415/2012 Coll.[23] Dust emissions reductions were also facilitated by adoption of BAT Conclusions, a substantial part of which is now being reflected by the regional authorities in the operating permits they issue. These changes are also associated with measures contained in the Air Quality Improvement Programmes, especially for the Ostrava/Karviná/Frýdek-Místek metropolitan area. Further potential exists in the search for and reduction of sources of fugitive emissions, for example, extraction of raw materials and storage of loose material.

Strategies implementing SEP objectives

- National Emission Reduction Programme of the Czech Republic (MoE)
- Air quality improvement Programmes (MoE)
- National Action Plan for Clean Mobility (MIT)
- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)

[23] Decree No. 415/2012 Coll. on the permissible level of pollution and its detection and on the implementation of certain other provisions of the Air Protection Act

- Action Plan for Development of Ecological Agriculture 2020–2025 (MoA) and its subsequent updates – *in preparation*

Types of measures

- Increasing the share of electricity and heat generated by non-combustion renewable energy sources.
- Using waste heat for heating and water heating.
- Expansion in the use of efficient heating energy supply systems (HESS).
- Supporting reduction of heat losses in HESS.
- Reflecting ecological aspects in tax and fee rates.
- Replacement of heating sources in local household heating sector.
- Edification focusing on correct household heating methods.
- Tightening obligations related to storage and application of fertilizers.
- Supporting introduction of new technologies in stabling livestock.
- Creating and implementing sustainable mobility plans.
- Supporting alternative fuel propulsion systems.
- Supporting non-motorized, railway and mass public transport.
- Rigorous inspections of technical condition of vehicles and renewal of vehicle fleets.
- Supporting and introducing "smart" approaches to monitoring, technology and transport management.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoT, MIT, MoA
- Co-Administrator: MFin

Indicators

- 1.2.1a Emission levels of selected air pollutants

Sources of funding

- IROP – Integrated Regional Operational Programme
- NPE – National Programme "Environment"
- OPE – Operational Programme "Environment"
- OPT – Operational Programme "Transport"
- Modernisation Fund
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- InterReg – European Programme for interregional cooperation
- LIFE Programme
- State (national) budget
- JTF – Just Transition Fund
- RRF – Recovery and Resilience Facility
- NGL – New Green Light for Savings

Specific objective 1.2.2: Ambient air quality standards are being observed

Despite positive developments in generation of pollutant emissions, the limit values for the protection of human health are still being exceeded in the Czech Republic. Situations still occur where high (above-limit) concentrations of pollutants are being recorded for several days over large areas. These so-called smog situations are associated with human activities. The sources of air pollution are mainly local solid fuel heaters, as well as the transport and industry sectors. Local heating plants, especially obsolete boilers, furnaces and heaters using solid fuel are especially problematic. Operation of this equipment and fuel that is being used has a great influence. Industrial sources affect air quality in two ways. Emitted NO_x and SO_2 compounds originating mainly in energy sector are transformed into secondary particles in the atmosphere by chemical and physical forces, thus increasing the air pollution concentrations of PM_{10} and $PM_{2.5}$. The impact is widespread. Industrial sources also act locally and directly, through primarily emitted dust. These impacts are felt, in particular, in the vicinity of industrial enterprises, typically for example, in the Ostrava region or in the Ústecký Region. In these cases, fugitive emissions (emissions escaping from leaks and open spaces (i.e. outside a defined exhaust) have a great influence. In larger cities, air quality is mainly affected by transport, which in combination with unfavourable dispersal conditions significantly worsens the smog situation in densely populated areas.

Transboundary pollutant transmission also has an impact on air pollution. Prevailing meteorological conditions may have a significant effect on air pollution in a given locality. Prolonged unfavourable dispersion conditions together with low temperatures may cause increased concentrations of pollutants in an area, and thus increase the risk of exceeding air pollution limits. On the contrary, on hot, sunny days, concentrations of ground-level ozone increase. Suspended particles may be transported over long distances, so a reduction of transboundary pollution is essential for compliance with defined air pollution limits.

The volume of undesirable substances in the air is monitored within the framework of a state-run network monitoring air pollution. Limit values for air pollutants are determined by the so-called air pollution limits pursuant to legal regulation and international obligations for the following substances: sulphur dioxide (SO_2), nitrogen dioxide (NO_2), nitrogen oxides (NO_X), suspended particles PM_{10} and $PM_{2.5}$, tropospheric ozone (O_3), carbon monoxide (CO), benzene, lead (Pb), arsenic (As), cadmium (Cd), nickel (Ni) and benzo(a)pyrene (B(a)P). In the Czech Republic, the limit values for PM_{10}, $PM_{2.5}$, benzo(a)pyrene and tropospheric ozone are most often exceeded. Above-limit concentrations of benzo(a)pyrene are found mainly in residential areas; in Ostrava, very high concentrations are also detected near coke ovens. Above-limit concentrations of PM_{10} and $PM_{2.5}$ particles are found mainly in the Moravian-Silesian Region, the Ústecký Region, in Central Moravia and also rarely in Prague, Brno and in the Central Bohemia. Above-limit concentrations of NO_2 frequently occur in Prague and Brno. Tropospheric ozone is exceeded according to meteorological conditions in most of the Czech Republic.

There is potential for influencing air quality, which is mostly facilitated by research into new technologies reducing emissions, introduction of BAT within industry, dynamic management of transport services in specific areas according to current air quality, but also by public awareness in relation to correct methods of household heating (local heating). A combination of measures is needed to improve air quality, as emissions from local heating plants are becoming increasingly important in certain densely populated regions, especially after modernization of industrial plants has been mostly completed. To obtain relevant data sets for setting a suitable mix of measures, it is also necessary to expand monitoring – supplementing the state air pollution monitoring network in new localities and introducing a comprehensive monitoring of other pollutants.

Strategies implementing SEP objectives

- National Emission Reduction Programme of the Czech Republic (MoE)
- Air quality improvement Programmes (MoE)
- National Action Plan for Clean Mobility (MIT)
- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (*in preparation*), (MoT)

Types of measures

- Limiting emissions of pollutants by implementing measures in objective 1.2.1.
- Cooperation with neighbouring states to limit transboundary pollution (objective 1.2.3).
- Limiting fugitive emissions.
- Regulating mobility in settlements according to air quality in the area.
- Additional development of monitoring capacities and assessment of air pollution levels.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoT, MIT
- Co-Administrator: MoA

Indicators

- 1.2.2a Observance of ambient air quality limits for selected pollutants

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- IROP – Integrated Regional Operational Programme
- Modernisation Fund
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- InterReg – European Programme for interregional cooperation
- State (national) budget
- JTF – Just Transition Fund
- RRF – Recovery and Resilience Facility
- LIFE Programme

Specific objective 1.2.3: Transboundary transmission of pollutants is decreasing

In order to observe air pollution limits, it is necessary to reduce air pollution from abroad. According to the analysis elaborated for NERP (National Emission Reduction Programme of the Czech Republic), foreign air pollution in the form of PM_{10}, $PM_{2.5}$ and benzo(a)pyrene may contribute on average by as much as 50 % in those areas where limit values are exceeded. However, there are large regional differences and the impact of foreign pollution sources decreases with increasing number and density of domestic sources. The MoE has been drawing the attention of the European Commission to this problem for a long time, and the Commission promised a helping hand to the Czech Republic in solving this problem. Cooperation with neighbouring states is crucial, especially the Republic of Poland, which is one of the most polluted neighbouring countries, and therefore it is appropriate here to assume a strong influence on the quality of air in the Czech Republic.

The Czech Republic is a party to the CLRTAP Convention[24], which is one of the important instruments for preventing air pollution transmission over long distances and is implemented through individual protocols, for example, Protocol on Heavy Metals, Protocol on Persistent Organic Pollutants and the Gothenburg Protocol.

Strategies implementing SEP objectives

- National Emission Reduction Programme of the Czech Republic (MoE)
- Air quality improvement Programmes (MoE)

Types of measures

- Strengthening international cooperation in improving air quality in a given area.
- Internationally harmonize legislative demands on air quality control.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrator: MFA

Indicators

- 1.2.3a Activities and projects leading to reduced transboundary transmission of pollutants

Sources of funding

- InterReg – European Programme for interregional cooperation

1.3. Hazardous substances

Strategic objective 1.3: Exposure of the population and the environment to hazardous chemicals is decreasing

Many chemicals, either alone, or in compounds or present in everyday objects, carry risks to the environment and health and may have one or more negative properties - they may for example be carcinogenic, mutagenic, toxic to reproduction, persistent, with the ability to bio-accumulate, or affecting hormonal systems. Due to the sheer volume of man-made chemicals, it is problematic to find the full information on the effects that these substances may cause. Around 23 000 substances are used in the European industry alone and new ones are constantly being developed. The European Environment Agency (EEA) has estimated that in 2016, approximately 62 % of the volume of chemicals consumed in Europe were hazardous to human health. These substances must be managed in a manner that their negative impact on health and the environment is either eliminated in full or as much as currently possible. However, the public often underestimates hazards associated with chemicals and does not respect hazardous properties of chemicals and thus handles them in inappropriate and dangerous ways.

In addition to that, one of the main topics in recent times is the combined effect of chemicals. Even if no negative effect on health is demonstrated for individual chemicals (ingested for example in food or

[24] Convention on Long-range Transboundary Air Pollution

present in cosmetic products, in the air or in medical products), this may not be the case for their combinations or when entering into contact with other substance or materials. The identification and description of such combined effects is very complicated and remains in the research phase.

The basic legislation governing handling of chemicals in the EU is REACH[25], which sets out certain conditions on manufacturers, importers, downstream users and distributors of chemicals, whether existing on their own or in compounds or in articles, including the obligation to register these substances.

The main objective of the REACH Regulation is to improve protection of human health and the environment from the risks that chemicals may pose. Hazardous substances are gradually being included in the Candidate List – a list of substances of very high concern (SVHC substances) for possible inclusion in Annex XIV of the REACH Regulation ("Authorisation List"). Currently (2020), there are approximately 210 substances on this list, whose production and use should be restricted. In the long term, the most dangerous substances should be replaced by less dangerous ones. The Czech Chemical Act[26] adapted the Czech legal environment to the relevant EU regulations dealing with chemicals.

The Czech Republic is also a party to various international chemical and waste conventions whose aim is to reduce risks in relation to certain substances where it has been determined that they can be effectively addressed only at the global level. The examples of these substances include persistent organic pollutants (Stockholm Convention on Persistent Organic Pollutants), mercury (Minamata Convention on Mercury) or hazardous waste (Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal) or substances that deplete the Earth's ozone layer (Montreal Protocol on Substances that Deplete the Ozone Layer, Vienna Convention for the Protection of the Ozone Layer). The Czech Republic is also a party to the UNECE Convention on the Transboundary Effects of Industrial Accidents (Helsinki Convention) and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, which aims to prevent mishandling of hazardous substances in target countries due to insufficient information. The Czech Republic is also actively involved in a number of other international activities, such as the Global Policy Framework – Strategic Approach to International Chemicals Management (SAICM), which aims to ensure that chemicals are treated in an environmentally sound manner worldwide by 2020. Unfortunately, this objective could not be fulfilled in time. Preparation work is underway on a new framework that should build on SAICM and replace it after 2020. In addition to chemicals, the new framework should also cover waste, which needs to be addressed at global level and which has not been addressed within the framework of other available instruments. The Czech Republic fully supports creation of this new framework. Efforts to achieve good chemical and waste management at global level need to be continued, even on a voluntary basis such as SAICM.

Specific objective 1.3.1: Emissions and leaks of hazardous chemicals into all environmental components are decreasing

Hazardous substances are emitted into the air, water and soil during production (industry), during their use or at the end of life cycle of products containing these substances (waste disposal, old ecological damage), or in accidents. It is therefore necessary to consider, within the framework of handling synthetic chemicals, their entire life cycle, from production to use and finally, to their disposal. The

[25] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

[26] Act No. 350/2011 Coll., on chemical substances and chemical compounds and on changes to certain other acts (Chemical Act)

primary effort is to replace hazardous substances with other and safer alternatives, including non-chemical solutions.

The Czech Republic fully complies with EU legislation in the areas of reducing risks associated with hazardous chemical substances, their compounds or preparations. **Prevention of major accidents** caused by selected hazardous chemicals and compounds and limitation of consequences of such accidents on human health and the environment represents a very important area. Given the number of facilities handling hazardous substances that have the potential to cause a major accident with transboundary effect, it is important that the Czech Republic is involved in the implementation of the UNECE Convention on the Effects of Transboundary Industrial Accidents.

One of the major actors introducing synthetic chemicals into the environment is **agriculture** where chemicals enter the environment, for example, during applications of plant protection products or industrial fertilizers, when some chemicals are not fully absorbed and remain in the form of residue or contaminate their surroundings due to incorrect procedures, including use of excessive amounts or at the wrong time or during incorrect vegetation phase. This can be prevented in particular by using biopreparations, following good practices in the use of pesticides, edification in the conventional agricultural sector, or by introducing and expanding methods of organic farming and farming in accordance with good agricultural and environmental conditions (GAEC). New technologies and processes also enable implementing the so-called precision agriculture, which makes it possible to optimize application of resources only to the extent necessary.

Hazardous waste that may adversely affect the environment and human health is also included among hazardous substances. Responsible management of such waste, which includes prevention and reduction of hazardous properties of this waste, substitution of hazardous substances and materials in products, building and modernizing technical facilities dedicated to hazardous waste management, implementation of best available techniques and more form the bedrock to build upon. Secure transport and handling of hazardous waste have the potential to reduce risks arising in transport of hazardous waste that may be caused both by actual handling of waste and the risk of leakage during transport or in the event of an accident. Production of hazardous waste is chiefly influenced by the state of the economy and industry, but also by remediation of old environmental damage.

The riskiest groups of chemicals which require special attention are **heavy metals** and the above-mentioned **persistent organic pollutants** (so-called POPs). Some POPs are produced intentionally by humans, others may be released unintentionally due to human activity, during combustion processes, and as by-products of chemical production processes. The best-known POPs include DDT, PCBs (polychlorinated biphenyls), polychlorinated dioxins and furans, newer groups of brominated substances used as flame retardants and some groups of fluorocarbons, often referred to as "forever chemicals" due to their extreme persistence in the environment. Unfortunately, the Czech Republic is one of the countries that has a relatively rich history in the use and unintended release of many of these substances into the environment and contamination of the environment precisely due to their persistence remains a problem. As a consequence, the Czech Republic still demonstrates a relatively high content of PCBs in breast milk samples. According to the European Parliament and of the Council Regulation (EU) 2019/1021[27], a definitive ban has already been set in place and the Czech Republic is obliged to close down the remaining facilities using PCBs by 2025 at the latest. The most important heavy metals include mercury, lead, cadmium or arsenic, the sources of which mainly include fossil fuel combustion, production and processing of iron, waste incinerators, transport and others.

[27] Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants

Emissions of heavy metals as well as POPs are condensed in the atmosphere into an atmospheric aerosol.

In addition to POPs and heavy metals, there are many other hazardous substances and their groups. Among others, great attention is currently paid to substances that disrupt the hormonal system, the so-called **endocrine disruptors** or **pharmaceutical residues**.

Thanks to its specific geological subsoil, the Czech Republic is one of the countries with a higher level of exposure from natural sources, especially radon, in the world. A long-term stay in buildings with increased radon volume activity is a proven risk that may affect homes, schools, workplaces etc., which are not sufficiently protected against penetration of radon from the subsoil. According to the latest estimates of the National Radiation Protection Institute, a public research institute, more than 4.5 % of the housing in the Czech Republic may be affected by radon activity. Czech legislation defines specific areas with increased radon-associated risks, naming individual municipalities, and explicitly stipulating obligations for workplace operators in underground or first above-ground floors of any buildings located within the territory of these municipalities. Regulation of natural irradiation in the area of prevention and existing irradiation is implemented by a set of binding legal norms[28], technical standards and methodologies issued by State Office for Nuclear Safety (SONS) in the form of recommendations. Research into the natural occurrences of radon in the rock environment will continue to be supported by the state.

In general, the results of a number of reviews and evaluations of chemical legislation that took place shortly before 2020 indicate that this field is relatively well regulated in the EU / the Czech Republic from the legal point of view and thus ensures safe handling of chemicals. Some other recommendations that have emerged from these evaluations need to be followed in the future and include improving compliance monitoring, raising awareness of the legal obligations, making more effective use of information that is available, supplementing missing information and improving available information on chemicals for the purposes of their evaluation, strengthening the link between scientific output and adopting measures for regulation. Certain gaps were also identified in terms of informing final consumers, for example, existence of certain incomplete, incomprehensible information regarding presence of hazardous substances, targeted focus on risks affecting vulnerable groups (children, pregnant women).

A long-term global effort is to reduce emissions of **substances that deplete the Earth's ozone layer**. These are mainly halons, freons and other halogenated hydrocarbons previously used in refrigeration. The handling of ozone-depleting substances is covered by Act No. 73/2012 Coll.,[29] Commission Regulation 744/2010[30] and in international agreements – the Montreal Protocol on Substances that Deplete the Ozone Layer and the Vienna Convention for the Protection of the Ozone Layer. These substances however still remain in use, for example in fire extinguishing systems, and so it remains necessary to pay attention to their ecological disposal in the future and to support research into alternative substances.

Strategies implementing SEP objectives

- Updated National Implementation Plan of the Stockholm Convention on persistent organic pollutants in the Czech Republic for 2018–2023 (MoE)
- Environmental Security Strategy of the Czech Republic 2021–2030 with outlook to 2050 (MoE)

[28] ČSN 73 0601 Protection of buildings against radon from the subsoil and ČSN 73 0602 Protection of buildings against radon and gamma radiation from building materials

[29] Act No. 73/2012 Coll. on substances that deplete the ozone layer and fluorinated greenhouse gases

[30] Commission Regulation (EU) No 744/2010 of 18 August 2010 amending Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer, with regard to the critical uses of halons

- National Implementation Plan for Minamata Convention on Mercury in the Czech Republic (MoE) – *in preparation*
- Action Plan for Development of Ecological Agriculture 2020–2025 (MoA) and its subsequent updates – *in preparation*
- National Action Plan for Safe Pesticide Use of the Czech Republic (MoA)
- National Action Plan for Radon Radiation Control (State Office for Nuclear Safety)
- Waste Management Plan of the Czech Republic (MoE)

Types of measures

- Replacement of hazardous substances by safer alternatives including non-chemical solutions.
- Monitoring presence of chemical substances in the environment, food chain and human matrices
- Researching combined effects of chemical substances.
- Controlling presence of hazardous chemical substances in products on the market.
- International cooperation in assessing risks in relation to substances and products introduced to the EU market, i.e. to the Czech Republic and subsequently during implementation of measures such as imposing limited use, sales bans etc.
- Developing prevention system for serious accidents for facilities handling hazardous substances (technical and organizational measures, safety management protocols, public awareness).
- Edification regarding requirements imposed by law, their observations in practice, more effective use of available information.
- Permanently sustainable farming, including introduction of precision agriculture and expanding ecological agriculture.
- Making information on chemical substances for their assessment more detailed and precise and strengthening the link between scientific products and measures adopted for their regulation.
- Providing full and clear information on the presence of hazardous substances in order to support their safe handling with regard to human health and the environment, focussed on risks that may arise to vulnerable groups (children, pregnant women).
- Replacement and disposal of substances depleting the ozone layer.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoA, MIT
- Co-Administrators: MoH, MoI, State Office for Nuclear Safety, MoD

Indicators

- 1.3.1a Leakages of selected hazardous chemical substances into water, soil and emissions into the air
- 1.3.1b Emissions of heavy metals and POPs into the air

Sources of funding

- RDP – Rural Development Programme 2014–2020
- CAP – CAP Strategic Plan2021–2027

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- InterReg – European Programme for interregional cooperation
- LIFE Programme

Specific objective 1.3.2: Contaminated areas, incl. old ecological damage, are monitored and effectively sanitised

Contaminated sites are areas contaminated with hazardous substances as a result of their previous use by, for example, industrial, agricultural, military or other activities. These areas pose a potential risk to the environment and health of the population (contamination of soil, water etc.). They cannot be used efficiently and safely without completing a corresponding remediation and regeneration process. In order to effect removal and also monitoring of hazardous substances, it is absolutely essential to record information on contaminated and potentially contaminated sites (number of sites, total area and risks involved) in the Czech Republic, including data on the status of their remediation. For this reason, there exists a Registry of Contaminated Sites (RCS) in the Czech Republic. Although contaminated sites are being gradually rehabilitated, their number still remains high and the remediation process is slow. Additional ecological damage may also arise, for example, in the form of illegal dumps. However, much of this damage predates 1989. For this so-called old ecological damage, it is no longer possible (for various reasons) to demand that the polluter carries out remediation. Contaminated sites, posing a serious risk to the environment and human health, may include waste repositories from mining. Identification of closed and abandoned storage sites is governed by Act 157/2009 Coll.[31] The MoE continuously (annually) inspects conditions at several high-risk abandoned storage sites.

A specific category of polluted areas are the so-called **brownfields**, i.e. under-utilized real estate (land, buildings or areas), which are in essence remnants of previous industrial, agricultural, residential, military or other activities, often contaminated with hazardous substances due to previous use, which prevents their effective use today. In addition to constituting a primary risk to the environment and health of the population, these areas also introduce other negative effects to their broader environment, such as a reduction in the attractiveness of adjacent localities, concentration of social problems, etc. Re-development and use of brownfields will provide room for developing settlements, space for business and for use within the framework of cultural and creative industries, including tourism. Their preferential use will contribute to the reduction of the so-called green field development and thus limit occupation of the Agricultural Land Fund [objective 1.6]. At the same time, however, it is necessary to evaluate the state and degree of damage in individual areas and adjust the priorities for their use, including the possibility of preserving natural values that may develop in some brownfields (for example, in former military zones). For these reasons, the National Brownfield Regeneration Strategy 2019–2024 was adopted. Since 2018, brownfields have been a newly observed phenomenon within the framework of territorial analytical data.

Strategies implementing SEP objectives

- National Strategy for Brownfield Re-development 2019–2024 (MIT)

[31] Act No. 157/2009 Coll., on Mining Waste Management and on changes to certain other acts

Types of measures

- Remediation of contaminated sites, including brownfields.
- Priority remediation of contaminated sites representing a risk for water.
- Supporting priority use of brownfields for development while taking into consideration their state and potential natural value of such areas.
- Keeping records of newly contaminated sites.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MfRD, MIT
- Co-Administrator: MFin, MoA, MO

Indicators

- 1.3.2a Contaminated sites (record-keeping and remediation)

Sources of funding

- OPTAC – Operational Programme Technology and Applications for Competitiveness
- OPE – Operational Programme "Environment"
- IROP – Integrated Regional Operational Programme
- CAP – CAP Strategic Plan 2021–2027
- RDP – Rural Development Programme 2014–2020
- NPE – National Programme "Environment"
- Special privatization account (MFin)
- InterReg – European Programme for interregional cooperation
- Just Transition Fund
- Programme for re-development and commercial use of brownfields
- Smart Parks for The Future Programme

1.4. Noise and light pollution

Strategic objective 1.4: Noise and light pollution levels are decreasing

The environment is defined as the sum of phenomena and processes that have, either directly or indirectly, an effect on health and well-being of individuals, populations and functioning of ecosystems. This concept includes physical, chemical and biological factors as well as social interactions. Physical factors include various forms of waves such as light and sound, which are received by organisms through their sensory organs. High intensities together with long-term action or inappropriate timing (sleep time, rest time) can have negative impacts on the organism's behaviour, but also on its physical or mental state. Negative influences impacting larger numbers of individuals can affect the local state of the populations, whether human or fauna and flora populations.

However, as these are phenomena that we encounter on a daily basis (artificial lighting, cultural events, road traffic and air transport, etc.) and their negative impacts manifest themselves over a long period of time, they have not yet been considered with corresponding importance by the general public. Sensitivity of individuals also plays an important role. Human activities and their expansion into

open landscape (transport, land development, mass tourism) deepen the impact of these factors on an ever-increasing area of the Czech Republic and its ecosystems.

While noise pollution and its impacts on the population and landscape are addressed at EU level by Directive 2002/49/EC, light pollution has not yet been underpinned at international or European level. In formulating the Strategic Framework of the Czech Republic 2030, the Czech Republic took into account the need to reduce noise and thus contribute to improving health of its population. One of the steps that should lead to this is compliance with relevant noise limits (Czech Republic 2030 objective 5.5).

Specific objective 1.4.1: Noise pollution of the population and ecosystems is decreasing

Noise, i.e. an above-limit, unpleasant sound, arises as a by-product of human activity. Its effects can have negative impact on the mental and physical health of humans and animals. For this reason, outdoor noise and associated issued are addressed legislatively at both the European level, by Directive 2002/49/EC[32] (END Directive) and at the national level by the Decree on Noise Mapping[33], which sets out the procedure for strategic noise mapping and action plans, defines the calculation of noise indicators and their limit values for individual categories of outdoor noise sources. The protection of health against noise is also regulated by Act No. 258/2000 Coll.,[34], and Government Regulation No.272/2011 Coll.,[35] which defines hygienic noise limits and Decree 315/2018 Coll.[36] which defines limit values for noise mapping.

The current noise load is being solved mainly by construction of noise barriers which, however, often disturb the character of surrounding landscape, reduce permeability of landscape and the quality of public spaces. It is therefore necessary to look for suitable alternatives that reduce the noise load and at the same time meet functional and aesthetic criteria and support their introduction into general practice. Increased share of electromobility in transport has the potential to reduce traffic noise. Innovation and research have already produced certain new technologies (such as quiet asphalt) and construction solutions (low noise barriers, roads recessed under the terrain or placed into tunnels) and these are being developed further. In contrast, certain individuals still voluntarily expose themselves to above-limit noise, for example during leisure activities. In these cases, it is necessary to protect the surrounding landscape and other residents by a suitable mix of legislative regulation and technical measures.

With increasing economic prosperity, the extent of noise pollution, which has a stressful effect on organisms, increases. In order to provide certain protection against noise, the European Directive 2002/49/EC defines the so-called quiet areas in agglomerations and quiet areas in the open country. The Czech Act No. 258/2000 Coll., on the Protection of Public Health, defines quiet areas in agglomerations as areas which are not exposed to a noise greater than the limit value of the noise indicator or that is not greater than the maximum permissible value of the hygienic noise limit defined in Section 34 of the said Act; quiet area in open country means an area that is not disturbed by noise from transport, industry or recreational activities. Quiet areas in agglomeration are defined by regional authorities and quiet areas in open country are determined by the MoE. The aim of declaring quiet areas in the open country is to preserve and protect demarcated areas in their most natural state,

[32] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise - Declaration by the Commission in the Conciliation Committee on the Directive relating to the assessment and management of environmental noise

[33] Decree No. 523/2006 Coll., laying down limit values for noise indicators, their calculation, basic requirements for the content of strategic noise maps and action plans and conditions for public participation in their preparation (Decree on noise mapping)

[34] Act No. 258/2000 Coll. of July 14, 2000, on Protection of Public Health and amendment to some related Acts

[35] Government Decree No. 272/2011 Coll., on protection of health against the adverse effects of noise and vibration

[36] Decree No. 315/2018 Coll., on Strategic Noise Mapping

including protection against anthropogenic noise pollution. Quiet areas in open country cannot yet be declared in the Czech Republic until the existing legislation is supplemented by substantive legal regulation.

Although the effects of elevated sound levels on human health and nature are known, public interest in this issue is inadequate. Awareness of this issue needs to be raised through suitable education and by providing access to information about noise and its effects to the general public. However, the noise load values are not being continuously monitored (strategic noise maps are available for the Czech Republic only for 2012 and 2017 and only for selected transport corridors and urban agglomerations). There is also a lack of data for evaluating the impact of noise on biodiversity in the Czech Republic. It is therefore necessary to carry out regular noise monitoring to facilitate further implementation of anti-noise measures and use the results of this regular monitoring for territorial planning.

Strategies implementing SEP objectives

- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*

Types of measures

- Legislative underpinning of issues associated with quite areas in open country.
- Implementation of suitable anti-noise measures along selected roads and railways reducing negative impact on the character of landscape.
- Taking into consideration the need to reduce noise loads in planning transport connectivity within a given territory.
- Research into and support provided to applications of technologies that reduce noise load on population and open country.
- Research into and introduction of noise impact monitoring on biodiversity, application of the results into practice and utilization of impact assessment instruments etc.
- Edification and facilitating access to information about noise.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoH, MoT
- Co-Administrators: MfRD, MIT, MoC

Indicators

- 1.4.1a Population and territory exposure to noise pollution

Sources of funding

- OPT – Operational Programme “Transport“
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- “EFEKT” Programme
- LIFE Programme

Specific objective 1.4.2: Light pollution levels are decreasing

Since the invention of a light bulb in 1879, the use of artificial light has expanded to such an extent that it is already taken for granted by the society. The so-called light temperature (also correlated colour temperature – CCT), (warm / cold) or its colour, together with other technical parameters of lighting, play a crucial role in influencing the daily cycles (biorhythms) of animals and people and other aspects of their health. However, public awareness of negative effects of light at night is not significantly widespread. Therefore, it is necessary to provide information to the lay and professional public on the seriousness of issues associated with light pollution and on environment-friendly methods of lighting. Improperly designed lighting also damages aesthetic quality of the landscape and architecture and generally reduces the harmonious nature of the living environment. Particularly undesirable is night light pollution in special protected areas, national parks and PLAs, for example, in ski resorts that have night-time skiing [objective 3.2].

We talk about light pollution when light is directed to unwanted spaces (for example, toward the sky, to open country or through windows into interiors), lighting of spaces outside the necessary time periods (for example, lighting of shopping centre parking lots outside opening hours) or in connection with use of light sources that have unsuitable spectral characteristics (especially in the blue part of the spectrum). Illuminated advertisements represent a very specific case of light pollution, which can cause problems for more sensitive individuals not only due to the high intensity of emitted light, but also due to effects that may be used, such as flickering, colour changes, etc. Like noise, light pollution is not being systematically monitored. New data need to be acquired to assess the state of light pollution and its effects on animals. Based on this data, it will then become possible to identify options to rectify the situation and take further steps to reduce excess or inappropriate lighting and related economic losses.

The Czech Republic, unlike other European countries (France, Slovenia, Croatia, etc.), has not yet addressed the issues associated with light pollution by legislation. The European Commission issued optional but officially recommended criteria for green public procurement for lighting transport infrastructure, the purpose of which is also to prevent light pollution. Light management should be promoted at legislative level. At present, it is marginally addressed in connection with energy savings as unsuitable or excessive lighting causes unnecessary waste of electricity.

Light parameters represent one of the impacts of new projects that are assessed within the framework of Environmental Impact Assessment (EIA). Emissions of annoying artificial light from buildings to their surroundings should ideally be already minimized when designing the buildings within the framework of construction law. Newly, the light pollution parameters (which are currently defined by the Czech technical standards, which formulate requirements for new buildings in terms of permissible light pollution values) are to be regulated by legislation within the framework of recodification of public building laws and related Decrees laying down technical requirements for buildings. Local governments are already able to regulate excessive light disturbing peace at night and may apply for financial support from MoE and MIT grant programmes for projects seeking reconstruction and installation of new public lighting systems. New subsidy programmes for upgrades of the lighting infrastructure are in preparation.

Strategies implementing SEP objectives

- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*

Types of measures

- Amending and ensuring binding nature of technical requirements for buildings, specifically in connection with imposing permissible light pollution values (correct installation of lighting fixtures, suitable technical accessories etc.).
- Updating standards laying down lighting parameters.
- Taking into consideration the need to reduce light pollution already in the building design process and in permitting procedures.
- Implementation of criteria for responsible public procurement for lighting of transport infrastructure.
- Edification and facilitating access to information on light pollution and associated issues.
- Research and monitoring of light pollution impact on biodiversity and human health, application of results in practice and utilization of impact assessment instruments etc.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoH
- Co-Administrators: MoT, MfRD, MIT, MoC

Indicators

- 1.4.2a Brightness of the night sky

Sources of funding

- NPE – National Programme "Environment"
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- Modernisation Fund

1.5. Extraordinary events

Strategic objective 1.5: The society's preparedness and resilience against extraordinary events and emergencies is increasing

The threat analysis for the Czech Republic identified threats with unacceptable risk, which may result in situations where some form of crisis management regimes can be expected to be declared. These include threats of natural character (for example, floods, flash floods, heavy rainfall, long-term drought, extremely high temperatures, extreme wind) or anthropogenic character (for example, leakages of dangerous chemical substance from stationary facilities, special types of floods). SEP 2030 also considers as relevant those threats that may carry a conditionally acceptable risks, whether these are of a natural or anthropogenic origin, and which require measures to be taken to eliminate them or reduce their impacts. These risks include, for example, ice events, storms, slope instabilities or natural fires.

The crisis management system in the Czech Republic is legislatively addressed in the Crisis Act[37], and Act on Integrated Rescue System (IRS)[38] and other laws, for example, the Water Act[39]. For IRS- related activities in the event of long-term drought, it is necessary to pay increased attention to conservation

[37] Act No. 240/2000 Coll., on Crisis Management and on amendments of certain acts (Crisis Act)
[38] Act No. 239/2000 Coll., on the Integrated Rescue System and on changes to certain other acts
[39] Act No. 254/2001 Coll., on Waters and on changes to certain other acts (Water Act)

of fire-fighting water sources during droughts, which are associated with a higher probability of fires in open country and their easier spreading. Conservation of water resources (boreholes, water reservoirs) is also key to providing drinking water for the population [objective 1.1]; similarly, process water remains important for other sectors such as the energy sector, industry and agriculture, where it is necessary to maintain operations of facilities (for example, maintaining energy and heat supply).

Issues related to disaster risk reduction and relief are addressed in the UN's Sendai Framework for Disaster Risk Reduction (2015–2030), adopted in 2015. The Czech Republic actively participates in fulfilment of its objectives and monitors and evaluates the situation on our territory. The Czech Republic has used experience with a significant episode of long-term drought in recent years to systematically address this issue by developing key strategic documents (The Czech Republic's Climate Change Adaptation Strategy, Concept for Protection against Drought in the Czech Republic and others), and by including long-term drought in the type plans and legislative amendments, adopting the so-called 'Dry Chapter' added to the Water Act.

Prioritization of economic gains and private or local interests to the detriment of the society and nature represents a very serious problem, which disrupts natural processes, burdens ecosystems and exacerbates the impacts of emergencies and disasters on the human society, the landscape and all components of nature.

Specific objective 1.5.1: Preparedness, resilience and adaptation to weather extremes is increasing

Availability of adequate response and timely mitigation of impacts associated with emergencies and crises (disasters) is based not only on the premise of an existing and functional crisis management system, but on preparedness of the entire society to face such events and respect these risks already during planning phases of development and regeneration of settlements, buildings and infrastructure. Increased attention needs to be paid with respect to educating the population in these areas, with an emphasis on acquiring the right habits should emergencies arise. These procedures must be reviewed and updated regularly, in the light of new experience, development of new technologies and scientific knowledge.

The crisis management system in the Czech Republic is firmly anchored in legislation and fully functional. However, this system must also be complemented by building resilient environments and implementing measures that will prevent or reduce impacts of emergencies and disasters on humans and the environment. At present, IRS's readiness to carry out rescue work, mitigate damage and eliminate consequences of serious threats is assessed as being very good, but it is still necessary to maintain and cultivate this state of readiness further. Systems in place protecting the population and the IRS itself must be supported by adequate equipment (technology) and its increased efficiency must be ensured in accordance with the increasing demand for solving current threats (for example, due to climate change). It is necessary to make use of every potential offered by modern technology and to apply this technology as broadly as possible, as well as to support measures aimed at preparedness, measures reducing vulnerability, increasing resilience, mitigating impacts and adapting the population and landscape to climate change. Examples of good application and practice include warning systems, their wider implementation, modernization, expansion of gauging parameters and spectra for warning the population. Certain shortcomings were identified mainly in connection with preparing the population for effective self-protection and with respect to desirable and responsible behaviour for protecting one's own lives or securing property.

SEP 2030 addresses issues associated with risk prevention and with increasing resilience of natural and anthropogenic systems throughout its text. In order to be ready to adapt to possible occurrences of drought, it is necessary to maintain sufficient capacity of water resources [objective 1.1], especially for the critical infrastructure (for example, energy sector, drinking water supplies). In the event of drought, the probability of natural fires increases, so it is necessary to ensure availability and quality of fire-fighting water (for example, by restoring water reservoirs).

Using territorial planning as a suitable instrument, it is necessary to create conditions for preventing or minimizing impacts of emergencies and disasters, for example, by reserving sufficient areas to maintain water sources of adequate capacity[40], to plan measures preventing severe impacts of extremely high temperatures and extreme winds in urban environments [objective 1.6], and to respect foreseeable natural hazards (for example, floods and heavy rainfall, slope instability, storms) when assessing changes in the territory and in territorial planning development [objective 1.6] and when securing functionality of critical infrastructure. Although water reservoirs may contribute to flood protection, water retention in the landscape provides greater potential. Therefore, measures will continue to be developed to improve retention capacity of landscape [objective 3.1] and to respect areas which are naturally flooded by watercourses (floodplains), which will in turn mitigate adverse effects of flooding in built-up areas. At the same time, certain landscape elements (such as alleys, polders, copses, hedges, contour furrows, etc.) will be developed or restored within the framework of general land modifications to help keep water in open country and prevent severe impacts of floods, droughts and excessive water erosion.

Strategies implementing SEP objectives

- Flood risk management plans for the Czech Republic (MoE)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Concept for Protection of the Population (MoI)
- Environmental Security Strategy of the Czech Republic (MoE)

Types of measures

- Increasing resilience of individual economic sectors and entire population.
- Taking into consideration measures strengthening resilience and adaptation of territories in territorial planning processes and during building design.
- Adaptation of crisis management process to increasing seriousness of threats and the state of the environment.
- Increasing preparedness and expertise of all IRS segments and supporting their mutual cooperation.
- Continuous upgrades of IRS equipment and equipment used in protection of the population.
- Development of warning systems with regard to their quality and quantity.
- Assessment of possible systemic prevention measures combating extraordinary events.
- Supporting and developing population education systems and processes.
- Development of research, development and innovation capacities for the needs of bodies tasked with crisis management, IRS responders and for the protection of the population and the environment.

[40] A comprehensive project for protection of areas designated for surface water accumulation (in Czech “Generel LAPV”) (MoA)

- Protection of heritage sites.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoI, MfRD, MoA
- Co-Administrators: MoT, MIT, MoC

Indicators

- 1.5.1a Public funding dedicated to adaptation to climate change effects and processes
- 1.5.1b Warnings issued within the framework of the Integrated Warning Service System (IWSS)

Sources of funding

- OPE – Operational Programme "Environment"
- IROP – Integrated Regional Operational Programme
- Rural Development Programme 2014–2020
- CAP – CAP Strategic Plan2021–2027
- Security Research Programme (MoI)
- InterReg – European Programme for interregional cooperation
- LIFE Programme

Specific objective 1.5.2: Negative impacts of extraordinary events and emergencies of anthropogenic or natural origin are minimised

Impacts of emergencies on the population can be reduced either by introducing preventive measures (for example, suitable building design, technical or nature-friendly measures in open country or agglomeration) or by reactive measures implemented by the population directly, for example, by using protective properties of buildings, observing instructions issued by crisis management teams and IRS responders. Timely intervention is important to minimize negative impacts. In the first phase, warning systems, their quality and deployment, play an essential role and subsequently, the quality of response depends on actions of regional, city or municipal officers as well as IRS units and citizens themselves. Residents often underestimate seriousness of the situation, for example, by refusing to evacuate, or by violating instructions or recommendations (in times of drought, banning fires or non-essential watering), exposing themselves and IRS responders to unnecessary risk. For this reason, it is necessary to further support awareness-raising events, education within the framework of the school system, educational programmes for the general public, etc. aimed at understanding the level of risk involved in various scenarios, what constitutes adequate response, but also at increasing media literacy of the public in order to limit the spread and impact of fake news.

Technical equipment and its availability also play an important role in minimizing impacts of emergencies and disasters. For IRS, regular upgrades of equipment are key for quality of their response but settlements must also be prepared, for example, to provide alternative drinking water supplies, erect flood barriers and by generally increasing resilience of their municipality.

Prevention is crucial in reducing impacts of anthropogenic emergencies and as such it must be given required attention [objective 1.5.3]. It is also essential to educate the population about risks involved and about desirable standards of behaviour in the event of an emergency.

Increased attention must be paid to the protection of cultural heritage sites against impacts of threats, especially of natural origin (for example floods, heavy rainfall, extreme winds, extremely high temperatures). Impacts of these emergency events are even more serious here due to the potentially high economic losses and the factual irreplaceability of destroyed objects or articles.

Strategies implementing SEP objectives

- Concept for Protection of the Population (MoI)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Flood risk management plans for the Czech Republic (MoE)
- Environmental Security Strategy of the Czech Republic (MoE)

Types of measures

- Popularization and edification, education of the general public.
- Increasing preparedness of IRS responders in line with current threats and developments in technology.
- Improving warning systems.
- Preparedness of state material reserves for extraordinary events and emergencies.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoI
- Co-Administrators: MfRD, MoT, MIT, MoC, MoA

Indicators

- 1.5.2a Preventive education in the area of population protection and crisis management
- 1.5.2b Events and interventions triggered by natural disasters
- 1.5.2c Amount of damage caused by natural disasters

Sources of funding

- Security Research Programme (MoI)
- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- IROP – Integrated Regional Operational Programme

Specific objective 1.5.3: Occurrence of extraordinary events and emergencies of anthropogenic origin is minimised

Anthropogenic emergencies are linked to expanding chemical, pharmaceutical and petrochemical industries. These emergencies may take the form of a serious leakage, hazardous fire or explosion. Newly developed chemicals are launched to markets every year and their production or transport may be associated with a serious risk. Accidents result in undesirable release of hazardous chemicals into the environment. Chemical leaks can occur during any part of the production cycle, whether due to

material wear or human error. Contact between discharged substances and ecosystems (fauna and flora) or humans can lead to direct threat or actual harm or subsequent indirect effects on health via contaminated components of the environment in the vicinity. Leakages or emissions of contaminants into the air, water or soil can also compromise groundwater or drinking water sources and their quality.

Extraordinary events include intentionally initiated events, for example arson (fires in nature), terrorist attacks (special floods) or negligence. Prevention of man-made emergencies must be based on compliance with principles governing safe handling of chemicals and utilization of precautionary principles in accordance with applicable legislation and emergency measures for designated facilities.

Extraordinary events and disasters do not only arise as a result of adverse phenomena or events, but also their combinations. Combinations of hazards can take various forms – one scenario is represented by concentration of events, where one (or more) initial event(s) leads to the occurrence of another emergency that is different from the initial one, in other scenarios, a combination leads to the escalation of an existing event. For example, natural fires in times of drought are common but may be gravely complicated by extremely high temperatures or winds or careless handling of open fires. Floods exacerbate leaks of hazardous chemicals.

Past events have taught us that synergic phenomena and domino effects are likely to occur in critical scenarios. The situation may be of a different kind, if the course of a combined event is significantly affected by an event which is not directly triggered by the original event, but which may increase or decrease its effect.

The possibility and probability of an anthropogenic emergency can be predicted and the needs of the IRS can be consistently taken into account in territorial planning processes and in building project documentation. Adherence to legislation in force and safety procedures may also greatly minimize this risk, for example by locating operations dealing with hazardous substances [objective 1.3] at sufficient distance from residential areas; when approving emergency plans for such facilities, the administrative authority must thoroughly verify all aspects of preventive procedures and subsequent rectification process in cases of accidents. All newly identified risks and findings must also be taken into consideration when amending legislation and relevant safety regulations.

Strategies implementing SEP objectives

- Environmental Security Strategy of the Czech Republic (MoE)
- Concept for Protection of the Population (MoI)
- National river basin management plans (MoA, MoE)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Flood risk management plans (MoE)
- Strategy for mitigating risks associated with emergencies caused by hazardous chemicals (MoE) – *in preparation*

Types of measures

- Rigorous observance of technological discipline.
- Edification and education focusing on safe handling of hazardous chemical substances and observance of precautionary principles.
- Development of early warning systems.
- Amending safety regulations in the light of new knowledge.

- Assessment of past experiences with extraordinary events and disasters in the Czech Republic and in the world.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoI
- Co-Administrator: MIT

Indicators

- 1.5.3a Number of serious accidents reported

Sources of funding

- State (national) budget

1.6. Settlements

Strategic objective 1.6: Adapted settlements ensure quality and safe life of their residents

Floods, heavy rainfall, rising temperatures, long-term drought, extreme winds and extremely high temperatures (heat waves). Although the Earth's climate has been always changing, scientific evidence shows that human activities are the cause for the climate now changing faster. Manifestations of climate change bring negative consequences for the population. It is therefore necessary to pay attention to ensuring security as well as to improving the quality of life in cities, where the majority of the population is concentrated. Overheating of urbanized areas in comparison with the environment in its vicinity (open country) reduces the comfort of the population, and in case of more sensitive individuals overheating leads to health complications; overheating is exacerbated by densified urban development, paved surfaces and lack of vegetation which together bring about the effect of the so-called urban heat island. Accelerated surface runoffs from a high proportion of roofs and exterior paved areas in urban areas causes flooding of sewers or flooding of lower-lying areas during torrential rains. It is therefore necessary to expand natural water retention areas, for example by converting hard surface parking areas into permeable surfaces. Care and management of residential vegetation and green belts surrounding settlements (cities) which suffer more from droughts and subsequently lose their functions (filtration, humidification, thermoregulation, aesthetics, etc.), must also be conceptually adapted to the changing conditions.

In recent decades, the Czech Republic has also experienced the trend of increased population growth in the vicinity of large cities – suburbanization, which is environmentally burdensome for the surrounding open country. In addition to annexations of arable land for construction and development [objective 3.1], this trend also contributes, for example, to increased air pollution [objective 1.2], because the availability of basic services is often not sufficient in the new suburbs. Commuting to the city centre where job opportunities and services (offices, shops, schools, etc.) exist, increases demand for individual passenger transport on access roads around these cities, especially if there is a lack of good-quality public transport connections. Negative consequences of suburbanization include the disconnectedness (fragmentation) of built-up areas or increasing requirements for transport and technical infrastructure and serviceability of these new settlements. In addition to that, insufficient

share of high vegetation, i.e. a different structure from the traditional rural development enjoying a higher share of woody plants and gardens represents additional significant negative effect of suburbanization.

At the same time, rural environment plays a key role in the care for a cultural landscape [objective 3.1], which includes both natural and cultural heritage. In rural areas, climate change manifests itself primarily by increasing the risk of flash floods [objective 1.5], which includes the risk of flushing the soil into municipalities (mud floods) [objective 3.1]; other threats include insufficiently abundant sources of good-quality water [objective 1.1]. These risks and threats depend on the configuration of the terrain, but also on farming methods, for example, maintenance of large integrated fields in the vicinity of municipalities.

Adapting settlements to climate change is a global issue and the UN dedicated its objective SDG 11 which promotes "Creating inclusive, secure, resilient and sustainable cities and municipalities" to this topic. At the national level, this topic is addressed in the Strategic Framework of the Czech Republic 2030, in its Objective 18 (Ensure high-quality urban development of settlements) and Objective 19 (Cities and municipalities reduced their greenhouse gas emission levels and adapted themselves to negative impacts of climate change) as well as in other documents, for example, in the Strategy of Regional Development of the Czech Republic 2021+.

In order to ensure quality of life of their populations, i.e. security and protection of health and property, some cities have already started preparing adaptation strategies aimed at adapting the urban environment to climate change and reducing potential damage. Adaptation measures can be divided into "green," which are based on ecosystem-based approaches, "soft" measures, which include early warning and information systems, and "grey" representing construction design solutions, construction or modification of infrastructure and adaptation of individual buildings [objective 2.1].

EU policies for urban areas support cities in implementing principles for sustainable urban planning and design. These should include innovative approaches to urban public transport and mobility, sustainable buildings, energy efficiency and protection of urban biodiversity. In the Czech Republic, cities can participate, for example, in the Local Agenda 21 programme, which is a way of practically applying principles of sustainable development at the local and regional levels. It enables regions to develop in balance with all key dimensions – that is, to succeed in reconciling economic development with social requirements and with respect for the limits imposed by their actual environment. Local governments play a key role in this process. Furthermore, the concept of smart cities has been in development in the Czech Republic for a long time and this concept facilitates provision of better public services through digital technologies while reducing impact on the environment, for example, as well as facilitating a more efficient use of resources and limiting emissions. In practice, this concept means, for example, better planning of public transport capacities and restrictions on individual car use, improved water management and waste management practices, more efficient public lighting and heating of buildings. In the future, the smart cities concept could be developed into circular cities, which achieve maximum recycling and utilization of waste and wastewater and thus a high degree of self-sufficiency, especially in terms of energy and process water supply. Shared economy has the potential to expand into areas with which it has not been much associated so far, such as the energy sector and the sharing of energy produced from renewable sources owned by individuals.

Specific objective 1.6.1: Settlements effectively adapt to climate change-related risks

Settlement adaptation to climate change places additional demands on territorial planning processes. In addition to fulfilling the general statutory objectives associated with territorial planning, it must also respect any identified local risks in terms of expected climate change manifestations and define regulation for adequate protection of population and crisis management for the given area. In the future, there will be a growing need to preserve or restore functional interconnection between natural and urban structure in a broader context of open country, where well-developed measures implemented in the open country around settlements will significantly contribute to improving the situation within settlements.

Rapid development of some cities pushes construction activities ever closer to endangered areas, for example, to floodplains. New risks arise in connection with inappropriate rainwater management methods or increasing air pollution [objective 1.2] etc. The cities themselves influence the local microclimate, especially in terms of air temperature, as well as certain parameters of meteorological phenomena, such as the direction and strength of the wind close to the ground and sometimes even the local precipitation regime.

Sensitivity of settlements to **floods** depends mainly on their location within the landscape and on configuration of the surrounding terrain. Increased urbanization causes land annexations, significant changes in the quality of surfaces and thus a reduction in the natural water retention capacity. Impermeable surfaces increase the risk of flash floods on smaller watercourses and, in the event of insufficient rainwater drainage, even in low-lying areas in the vicinity of such watercourses. Settlements in the low-lying sections in the middle or in lower parts of watercourses are particularly susceptible to river floods. Increases in the share of impermeable ground surface exacerbated by high number of residents and development of commercial enterprises on river floodplains increases the potential damage to urban areas. Due to certain inertia in the definition of buildable areas carried over from previous decades, new developments are still being located in floodplains in some cases. This increases the flood risk and flood protection of these developments is required only additionally, which increases the scope and cost of flood control measures.

During periods of prolonged drought, settlements may be at risk of **water shortages**. In larger cities, increased susceptibility is mainly linked to higher population concentrations and concentration of economic activities which have a higher water consumption; in smaller settlements this sensitivity is linked to availability and yield of water resources, either individual or in terms of public water supply, which is often limiting. The primary task is to ensure supply of high-quality and safe drinking water [objective 1.1], and this supply may be put at risk either by lack of discipline on the part of residents or corporations and their wasting of water for non-essential purposes, or by using drinking water instead of process water [objective 1.1 and 2.2]. Management of water sources must undergo a change whether at the level of cities or their individual residents. In addition, increased clogging of sewerage networks and higher concentrations of pollution in sewers and in watercourses below cities represents a specific problem.

Rising temperatures and heat waves represent another significant potential impact on human health in the conditions prevalent in the Czech Republic. The most overheated parts of settlements are those with numerous taller buildings, lacking sufficient vegetation and water features, with a predominance of artificial, impermeable hard surfaces, where rainwater drains into sewers and areas generating large amounts of anthropogenic heat. These are mainly the city centres or shopping and industrial zones. The typical character of microclimate in cities is also an important factor, creating the so-called urban heat island, which increases the temperature of urban environment and exposes the population living in these areas to extremely high temperatures more often. More frequent complications can be expected in some population groups, especially for people suffering from cardiovascular diseases, the

elderly or people with reduced social status. The situation is also complicated by insufficient adaptation of buildings to climate change, which mainly leads to the impossibility of achieving thermal comfort inside buildings.

Heavy rainfall, **windstorms and thunderstorms**, carry the risk of damage to property in cities. Health and lives of residents may be endangered especially during mass events or as a result of the failure to heed the warnings of rescue services. In the Czech Republic, we do not expect a marked increase in the incidence of storms in the future; strong wind gusts causing objects to fall may be more problematic. Settlements' resilience against extreme winds can be increased by technical measures to increase resilience of buildings, decentralization of energy systems and underground power distribution and by certain soft non-structural measures including regulatory and financial mechanisms that may results in increased building resilience and in updates of contingency and emergency plans and in the overall strengthening of IRS capacities.

In order to eliminate certain negative effects on the environment in cities, it will be necessary in the future to require an integrated approach to the protection of the environment in accordance with the principles of sustainable development. The key lies in involvement of local governments, civic associations and the private sector, etc., which have the capacity to effect independent adaptation activities. Since 2015, with the support of the EEA and Norwegian Grants, and other sources of funding, several projects have been implemented focusing on adaptation to climate change at local levels. Within the framework of these projects, a number of methodologies and publications have been developed, which serve as an informative source and basis for development of adaptation measures in regions, cities and municipalities in the Czech Republic. Currently, local adaptation strategies for individual cities exist, which respond to two main manifestations of climate change – namely heat waves and extreme precipitation events associated with insufficient seepage of rainwater. Municipalities can benefit from involvement in one of the international initiatives, such as the Covenant of Mayors for Climate and Energy, or only in relation to their adaptation-oriented initiatives. Other initiatives include 'Mayors Adapt,' or NAZCA (Non-State Actor Zone for Climate Action), which support and register commitments assumed by cities, businesses and individuals in relation to mitigation and adaptation measures such as, for example, conceptual planting of vegetation [objective 1.6.4].

Strategies implementing SEP objectives

- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- Flood management plans (MoE)
- Concept for Protection of the Population (MoI)
- Environmental Security Strategy of the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)

Types of measures

- Preparing local or regional adaptation strategies.
- Supporting municipalities in their involvement in international initiatives focusing on climate change adaptation.
- Planning and implementation of anti-flood control measures, including local flooding – construction of anti-flood barriers, modifications of sewerage systems, bed modifications of smaller watercourses in cities in nature-friendly manner, respecting flow dynamics through the settlements.

- Measures improving comfort of residents during extremely high temperatures (shading and supplementary water elements in public spaces, buildings adaptations – heat insulation, air-conditioning, energy efficient and intelligent buildings, air-conditioning of public transport).
- Using materials with suitable/favourable properties (for example, surfaces that are permeable for water, surfaces with good heat-related properties).
- Respecting identified risks (especially in relation to real estate development), among others potential drinking water deficits (water source yield capacity).
- Improving forecasting services and warning systems and educating the general public in the sense of their adequate behaviour leading to minimisation of risks of harm during extreme weather events.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrators: MfRD, MoI, MIT

Indicators

- 1.6.1a Number of municipalities which have adaptation plans in place

Sources of funding

- NPE – National Programme "Environment"
- OPE – Operational Programme "Environment"
- Norwegian Grants
- IROP – Integrated Regional Operational Programme
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- NGL – New Green Light for Savings
- InterReg – European Programme for interregional cooperation
- LIFE Programme

Specific objective 1.6.2: Settlement development is conceptual, brownfields and built-up areas are developed preferentially

Development of settlements, including their regeneration, must be conceptual and comprehensive and in accordance with legal regulation, with territorial planning documentation and with administrative decisions in force. Urban development planning processes must respect a wide range of interests, needs and constraints as well as prevent negative impacts (for example, noise, odour, etc.) on the quality of life caused by improperly located resources. Therefore, it is necessary to create room for finding consensus in terms of strategic planning and management, especially with the participation of not only (locally) important commercial enterprises, but also with citizens and the professional public. Construction and improvement of public infrastructure is essential for urban development. New developments/buildings must take into account possible risks in areas where they are located (floodplains, landslides, etc.), both for humans and the environment, and reduce susceptibility of the area in relation to creation of new problematic phenomena (for example, formation of heat islands). In the area of public support given to territorial planning there is a need, among other things, to

provide more support for elaboration of regulatory plans. Individual permitting procedures must continue to take into account risks within the framework of, for example, newly identified floodplains located outside areas with a significant risk of flooding. Urban development should respect the current and future needs of the population and adapt its infrastructure accordingly. New developments should be located primarily in areas with good accessibility to public transport and have sufficient capacity of water management infrastructure [objective 1.6.1], as well as ensuring other services in the given locality.

When planning new developments, public administration authorities should make every effort to prevent uncoordinated territorial expansion of municipalities and the so-called green field construction. New developments should be preferably located within already urbanized areas in a manner ensuring that such compact development respects the tolerable capacity of cities as well as other needs of the population and limits imposed on the territory with regard to climate change. At the same time, it is necessary to take into account the already existing municipality structure. Updated territorial and strategic plans should minimize annexation of agricultural land for development. Incentives must be aimed at re-use of abandoned and unused industrial, agricultural, residential or military buildings (brownfields) or reconstructions and renovations of already existing but unsuitable buildings. **Brownfields** often pose a significant risk to the environment and human health due to the presence of hazardous substances in the soil. In case of these plots of land, it is therefore necessary to first remove the contamination that prevents its further use due to potential health risks, but also in relation to possible water pollution [objective 1.3]. Brownfields with the greatest development potential and the least obstacles to new development have been mostly already regenerated. Brownfield revitalization is often hindered by unresolved ownership rights or land contamination. There is a need to increase the pressure on owners of dilapidated buildings and unused areas within settlements to promote their reasonable use and development. Use of brownfields is both desirable as well as being one of the main tools that may assist in reducing suburbanization. In order to monitor this area effectively, it will be necessary to amend related legislation, introduce and maintain a uniform, regularly updated database of brownfields and evaluate their condition with regard to prioritizing their further use or development (from decontamination and re-development to conservation of natural values that have developed in some brownfields).

Within the framework of territorial and strategic planning, it is also necessary to consider impacts of the city's development on its **transport system**. Intensity of individual car transport has been increasing for a long time, partly due to expansion of suburbs of regional centres, where large numbers of people commute to work and for services. This results in reduced comfort for passengers (congestion on access roads and in the centres of the agglomeration, lack of parking spaces). In the long run, we can expect a transition to the use of new modes of transport such as car sharing, autonomous driving etc. This will help in optimising traffic intensity in the city centres and the need for parking space. In the short term, it is necessary to offer commuters the opportunity to replace individual car transport with alternative methods, in particular public transport, pedestrian and bicycle transport, as well as the possibility to combine individual modes of transport. The solution lies in part in the use of short-term car parks (P + R, P + G) which offer good connection to public transport at entrance points into the city, at shopping centres, at transport terminals, etc. At the same time, it is necessary to reduce the area of car parks with impermeable surfaces, either by giving priority to development of parking houses, or at least by using permeable surfaces. In the area of pedestrian transport and cycling, there is a need to give more focus to building bicycle paths and pedestrian paths that are separated from car lanes, and to revitalizing street space to support pedestrian and bicycle transport, and continuing to set up bicycle parking spaces.

Strategies implementing SEP objectives

- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Territorial Development Policy of the Czech Republic, as amended by Update No. 1, 2 and 3 (MfRD)
- Architecture and Building Culture Policy of the Czech Republic (MfRD)
- National Strategy for Brownfield Re-development 2019–2024 (MIT)
- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*
- Regional Development Strategy of the Czech Republic 2021+ action plans (MfRD) – *in preparation*

Types of measures

- Territorial development respects the needs and interests of all population groups, considering safety risks and the environment.
- Support is provided to elaboration of regulatory plans.
- Use and development of brownfields or re-development of already used space.
- Development of uniform and complete brownfield database, which will be regularly updated.
- Support provided to public, bicycle and pedestrian transport, including their combinations, at the expense of individual car transport.

Responsible authorities

- Responsible Authorities (Administrators): MfRD, MoE,
- Co-Administrators: MoI, MoT, MIT, MoA, MoC

Indicators

- 1.6.2a Brownfields
- 1.6.2b Local Agenda 21

Sources of funding

- OPE – Operational Programme “Environment”
- IROP – Integrated Regional Operational Programme
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- Just Transition Fund
- Programme for re-development and commercial use of brownfields
- Programme Smart Parks for The Future
- Support and development regions

Specific objective 1.6.3: Settlements run effective water management systems, including rainfall management

Improper water management, especially rainwater, in urbanized areas is a common problem for many settlements. The basic principle for any sustainable manner of rainwater management is to return

water to its natural cycle and achieve natural water balance in urbanized areas. Decentralized systems allow for a slow outflow of rainwater by means of nature-friendly measures promoting evaporation, infiltration and retention. Due to climate change-related impacts (on the one hand heat waves, on the other hand extreme precipitation), the complexity of rainwater management concepts (and not only rainwater) in cities is growing to ensure that cities are less vulnerable in all their aspects. Urbanism, architecture, urban landscape development, civil, transport and urban engineering, urban drainage, etc. must respond to these challenges and exploit synergies with microclimate protection. Mutual communication and cooperation of experts in all these areas is also important. Nevertheless, some types of measures cannot be applied, especially in compact historic centres.

Water management concepts in place in Czech cities are generally based on drainage optimized for given design parameters. However, due to climate change and ongoing urbanization, these parameters may no longer apply and it will be necessary to consider their adjustment. The increasing incidence of heavy rainfall overloads rainwater drainage systems and causes more frequent flooding of underground and low-lying areas. In cases where there exists a danger of hydraulic overload of the unified sewerage system, wastewater is discharged from relief chambers without treatment directly into surface water [objective 1.1.1]. It is therefore necessary to modify the unified sewerage system into a segmented one, which will allow rainwater to accumulate. In the periods of long-term drought, it is necessary to address water supply in cities, especially in relation to ensuring sufficient availability and supply of (drinking) water, which must be adapted to the demographic development of cities and municipalities. Reducing water consumption is also essential, including recycling (so-called grey water) and use of retained rainwater. However, hygienic requirements impose certain limitations for their use and this water can therefore be primarily used as utility water for watering the municipal vegetation, for street cleaning and in households [objective 1.1.5] etc.

Strategies implementing SEP objectives

- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- Drought Protection Concept for the Territory of the Czech Republic (MoA)
- National river basin management plans in the Czech Republic (MoA, MoE)
- Architecture and Building Culture Policy of the Czech Republic (MfRD)
- National Action Plan on Adaptation to Climate Change (MoE)

Types of measures

- Multidisciplinary approach to planning systems dedicated to water retention and use.
- Elaboration of Natural Flow Condition Studies in individual settlements.
- Implementation of measures reducing runoff of rainwater into the unified sewerage system.
- Development of segmented sewerage systems for wastewater terminating in WWTPs and for rainwater into new accumulation capacities for process water.
- Implementation of decentralized rainwater management systems.
- Use of rainwater and recycled grey water for watering vegetation, street cleaning etc.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MfRD
- Co-Administrators: MoA, MIT

Indicators

- 1.6.3a Supported projects seeking utilization of rainwater and recycled grey water

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- IROP – Integrated Regional Operational Programme
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- InterReg – European Programme for interregional cooperation
- Construction and technical upgrades of water supply and sewerage system infrastructure
- LIFE Programme

Specific objective 1.6.4: Quality of green infrastructure, contributing to better microclimate in settlements, is increasing

Pressure on the economic use of areas in settlements and the resulting increasing share of built-up and paved areas comes at the expense of municipal vegetation. Permanent vegetation in settlements, where trees represent its backbone, as well as bodies of water make a significant contribution in terms of increasing the comfort of the population and adaptation of the urban environment to climate change, especially in relation to combating extremely high temperatures. Vegetation in settlements, especially in combination with water features and areas, provides important quiet zones with natural shading, allows rainwater to infiltrate the soil, slows down surface runoff and increases air humidity, which contributes to the cooling of the environment. Long-term planning and conceptually and professionally well-established and maintained green infrastructure in settlements significantly mitigates impacts of heat on the population and increases the attractiveness of settlements also for tourism.

Public vegetation is often under attack from developers and their plans or does not receive sufficient professional and systematic care. In many cases, there are frequent changes and modifications in relation to arrangement of vegetation without any long-term concept for development of residential vegetation, which therefore does not have the opportunity to achieve its full functionality. Also, the root systems of higher forms of vegetation suffer from lack of space due to dense urban infrastructure (utilities) underground on top of being regularly damaged by interference during construction. Elements of residential vegetation are often lacking, due to minimal maintenance and related operational safety, among other things, mosaicity and diversity, which would better support biodiversity by offering food and shelter for a wide range of animals. For example, presence of pollinators and other insect species may be greatly supported by suitable treatment regimen for species-diverse grass mixtures.

Vegetation in private gardens as well as vegetation in purpose-built areas such as, for example, in the courtyards of residential buildings, in yards and within public facilities’ areas, on flat roofs, etc., can also be considered a functional part of green infrastructure in settlements.

Strategies implementing SEP objectives

- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)

- National Action Plan on Adaptation to Climate Change (MoE)
- Architecture and Building Culture Policy of the Czech Republic (MfRD)

Types of measures

- Support planning and implementation of green infrastructure – establishment and re-development of city parks, street alleys, grassy tramway strips, green roofs and façades, vertical gardens, establishment of water elements, private gardens etc.
- Strengthening protection of vegetation in urbanized areas within the city, including establishment of protection zones and by amending legislation and technical standards.
- Sharing examples of good practice especially at the local government level.
- Public procurement for vegetation maintenance to follow principles of responsible public procurement.
- Activating the public in relation to 'greening' of private area (courtyards, gardens, roofs etc.).

Responsible authorities and deadlines

- Responsible Authorities (Administrators): MoE, MfRD
- Co-Administrator: MoC

Indicators

- 1.6.4a Green areas in cities

Sources of funding

- NPE – National Programme "Environment"
- OPE – Operational Programme "Environment"
- IROP – Integrated Regional Operational Programme
- InterReg – European Programme for interregional cooperation
- LIFE Programme
- State (national) budget
- JTF – Just Transition Fund
- RRF – Recovery and Resilience Facility

2. Transition to climate neutrality and circular economy

2.1. Transition to climate neutrality

Strategic objective 2.1: Greenhouse gas emissions are decreasing

Greenhouse gases trap a portion of the heat radiated from the Earth's surface in the atmosphere and prevent this energy from being released back into space. Presence of greenhouse gases in the atmosphere is natural but increased concentrations of greenhouse gases due to human activity, especially CO_2, CH_4, NO_2, and F-gases (fluorocarbons), contribute to a higher warming of the planet. Greenhouse gas emissions are closely linked to economic development and the increasing demands of the population in terms of energy and primary resources' consumption. The Czech Republic has a

relatively diversified energy mix, which is currently largely based on fossil fuels, which are the main source of carbon dioxide, as well as other pollutants released into the air [objective 1.2]. The second most prevalent greenhouse gas from anthropogenic sources is methane, which is mainly generated in waste management, by fugitive emissions and in the agricultural sector. Agriculture, along with transport and chemical industries, is also a major source of nitrous oxide. A special group of greenhouse gases are the so-called F-gases, which have replaced the formerly used CFCs. They are used for example, in refrigeration units or for firefighting purposes. Their use is regulated by Regulation (EU) No 517/2014 of the European Parliament and of the Council.[41]

The Czech Republic's goal is to move towards a climate-neutral economy. Transition to low-emission and renewable energy sources and reduction of total energy consumption by increasing energy efficiency forms the necessary prerequisite for the fulfilment of this goal. Transition to a climate-neutral economy will bring about changes (technological, administrative, legislative) that will have significant social and economic impact and the society will need to prepare for this change. Development of new innovative industries will also be reflected in the labour market and thus in the field of education. In order to ensure the needs of society, it will be essential to ensure a reliable, affordable and sustainable supply of energy to households and the economy in the long-term. The nuclear energy sector will play an important role in the transition to a climate-neutral economy in the Czech Republic, especially in connection with closures of coal-fired power plants.[42] Without the use of nuclear energy, the Czech Republic would find it difficult to meet its climate commitments. The social restructuring process will require support and use of a combination of various instruments, from a more efficient setting up of the EU Emissions Trading Scheme (EU ETS) to changing the energy mix (replacing fossil fuels with renewable energy, nuclear energy or waste energy recovery) to using waste heat, further supporting building insulation, as well as broader introduction of zero-emission and low-emission vehicles. Certain modifications to the tax system are also still being discussed, i.e. introduction of environmental elements for excise and energy tax on fuel rates.

Reducing greenhouse gas emissions is a priority for both the European Union and the Czech Republic, which also has obligations under international agreements, in particular the United Nations' Framework Convention on Climate Change, its Kyoto Protocol and the Paris Agreement. Obligations under these agreements are transposed into the European Union legislation. In December 2019, the European Council endorsed a long-term objective of achieving EU climate neutrality by 2050. Following this objective, the European Commission published a package of measures called the European Green Deal. The EU's 2030 climate and energy policy framework set out the objective of achieving reductions in greenhouse gas emissions at EU level of at least 40 % by 2030 compared to 1990. This objective also sets out reductions compared to 2005 levels in sectors falling under the Emissions Trading Scheme (EU ETS) by 43 % and in sectors outside the EU ETS by 30 % at EU level. The Paris Agreement is implemented by Regulation (EU) 2018/842 of the European Parliament and of the Council[43], which lays down binding national targets for each Member State for sectors not covered by the Emissions Trading Scheme. The Czech Republic must achieve a 14 % reduction (compared to 2005) in greenhouse gas emissions by 2030.

In 2020, the European Commission proposed a legislative 'climate framework,' which included, among other things, increasing reduction of EU greenhouse gas emissions to at least 55 % by 2030 compared

[41] Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006

[42] Discussions on moving away from fossil fuel use are also taking place within the so-called Coal commission platform, which in December 2020 recommended to end coal use for energy and heat production purposes by 2038.

[43] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

to 1990. This objective was approved by the European Council in December 2020, including the so-called support framework for achieving this target. The legislative climate framework was subsequently approved by the Environment Council and a new EU objective was submitted to the UN Framework Convention on Climate Change as a new reduction commitment for 2030. Following the approval of the new objective, appropriate proposals to amend the EU legislation to incorporate the new –55 % objective will be published in mid-2021.

Directive 2012/27/EU of the European Parliament and of the Council[44] introduces a framework of measures to support energy efficiency improvements across the EU, so as to ensure the EU objective in the area of energy efficiency by 2020 respectively 2030. It sets out to achieve, at EU level by 2030, a target of 32.5 % as well as the obligation to achieve additional annual energy savings of 0.8 % in terms of final annual energy consumption. Based on this directive, the Czech Republic has set a national objective for final energy consumption, which should not exceed 990 PJ, respectively 1 735 PJ of primary energy consumption. The Czech Republic's goal is to save 84 PJ in final energy consumption by 2030, i.e. 8.4 PJ per year for the period 2021–2030 and 462 PJ of accumulated energy savings in total.

Reductions of greenhouse gas emissions is enshrined in Czech legislation, inter alia, in the Energy Act,[45] which defines conditions for conducting business and for performance of state administration functions in the energy sectors, and in Act No. 406/2000 Coll.[46] Certain specific measures and supported areas are then defined in the National Energy and Climate Plan of the Czech Republic (2019). This topic is also addressed by the general Strategic Framework of the Czech Republic 2030, in its Objective 10.3 (Electrification network guarantees distribution of electricity in the required technical standard regardless of the structure of sources) and Objective 10.4 (Thermal energy supply systems create conditions for effective use of heat from renewable and secondary energy sources as may be available at regional and local levels).

High demand for energy consumed in buildings and in construction sector, together with declining mineral resources, dictate the need to improve energy management there, and Directive 2018/844/EU (EPBD III) addresses these issues at the EU level.[47] Since 2020, Act No. 406/2006 Coll., and its implementing Decree No. 264/2020 Coll.,[48] require that in case of construction of new buildings the energy performance of such buildings must comply with almost zero energy consumption. In addition to low-energy buildings, it would also be appropriate to support small "home" cogeneration units in order to increase efficiency of fuel used (especially natural gas).

Governments play a key role in this area by supporting investment in research, development, product standards, subsidies for emerging and environmentally friendly technologies. Measures such as improving efficiency of energy transformations of fuels, introduction of new materials and other technical solutions will not be sufficient to meet the EU's objectives in the field of emissions and sustainability. To achieve climate neutrality, both the public and the private sector need to be involved in reducing greenhouse gas emissions. In addition to changes in energy, industry and agricultural sectors, it is therefore essential that the entire society undergoes a transformational change, which

[44] Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
[45] Act No. 458/2000 Coll., on Business Conditions and Public Administration in Energy Sectors and on Amendment to Other Laws (Energy Act)
[46] Act No. 406/2000 Coll., on Energy Management, as amended
[47] Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency
[48] Decree No. 264/2020 Coll., on the energy performance of buildings

can, for example, achieve a drastic reduction in its carbon footprint through responsible consumer behaviour.

Specific objective 2.1.1: Greenhouse gas emissions are decreasing

The main producers of greenhouse gas emissions in the Czech Republic are chiefly the energy, transport and industry sectors. Production of greenhouse gases from waste is also gradually increasing, especially CH_4. Other sectors that are important from the perspective of climate change are **agriculture and forestry** which, thanks to their ability to capture carbon in biomass, are able to positively influence the overall greenhouse gas balance (LULUCF) and at the same time provide alternative energy sources. However, due to the current beetle bark calamity, carbon sequestration in the forests is temporarily limited and in the overall balance, forests now contribute to the production of greenhouse gases. The return to normal will be only very gradual and depends on appropriately chosen methods of reforestation of calamity areas according to local conditions (habitat conditions and vegetation conditions) and the corresponding financial motivation of forest owners.

Additional potential for long-term carbon fixation also lies in the broader use of wood, for example, for production of building components complemented by appropriate marketing of modern wooden buildings. An accelerated legislative solution of fire safety issues of these buildings forms the necessary precondition for this development.

The **industry and energy sectors** are regulated through the European Emissions Trading Scheme. In the Czech Republic, the EU ETS is regulated by Act No. 383/2012 Coll.[49] The aim of this system is to motivate market participants to invest in low-carbon technologies without compromising their competitiveness. In the sectors that are at risk, allowances are partly allocated free of charge on a benchmark basis. Implementation of cross-cutting measures based on EU legislation is crucial for reducing greenhouse gas emissions in the industrial sector. In addition to the EU ETS, integrated prevention and pollution reduction both play an essential role in making significant contributions to reducing emissions in particular when acting in line with the Integrated Prevention and Control Act.[50] For many sectors of the manufacturing industry, absence of low-carbon technologies on the market or temporary unavailability of clean energy forms an obstacle to reducing greenhouse gas emissions. It is therefore in the interest of the Czech Republic to ensure gradual modernization and transformation of the industry, in which clean energy electrification will play a major role.

Electricity generation in the Czech Republic is traditionally centralized in large power plants. Development of small, decentralized energy sources, for example, roof solar panels, municipal wind farms or biogas stations requires, above all, a qualitative adaptation of the electricity distribution network, including smart elements. The Czech Republic enjoys a well-developed heating production system, which needs to be gradually transformed for the use of low-carbon energy sources, including energy from secondary sources and waste heat, which in accordance with the National Action Plan for Nuclear Energy Development includes maximizing the use of heat from nuclear power plants. Use of locally available heat production sources as well as energy recovery of non-recyclable combustible component of waste contributes to decentralization of energy sector, reduces dependence on fossil fuel imports and strengthens local economy.

Transport is one of the main consumers of conventional fuels. In the long run, the passenger and freight transport intensities are increasing along with associated greenhouse gas emissions. It is

[49] Act No. 383/2012 Coll., on the Terms of Greenhouse Gas Emission Allowance Trading, as amended
[50] Act No. 76/2002 Coll., on Integrated Pollution Prevention and Control, on Reducing Pollution and on the Integrated Pollution Register and on changes to certain other acts (Integrated Pollution Prevention and Control Act)

therefore necessary to support development of (urban) public transport and non-motorized transport (pedestrian and bicycle) and to prefer their use instead of individual (car) transport. Prudent urban planning and city administration and management [objective 1.2 and 1.6] will also contribute to this process. Development of vehicles using alternative fuels (electric, hydrogen, bio-CNG, bio-LNG, bio-LPG) and development of charging and filling infrastructure will have a positive impact on greenhouse gas emissions produced. In order to offset ecological impacts caused by transport sector, it will be necessary to use economic instruments and include externalities from all types of transport in the tax system. Renewal of public transport fleet by moving to low-emission and emission-free vehicles using alternative fuels will also play an important role, same as using biogas stations with biogas purification for biomethane, construction and modernization of routes with emphasis on electrification and with possible use of alternative fuels in non-electrified sections, and gradual shift of freight from road to railway. These measures can also contribute to fulfilment of Objective 1.2.1.

Strategies implementing SEP objectives

- National Energy and Climate Plan of the Czech Republic (MIT)
- Climate Protection Policy of the Czech Republic (MoE)
- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*
- National Action Plan for Smart Grids (MIT)
- National Action Plan for Clean Mobility (MIT)
- National Action Plan for Nuclear Energy Development of the Czech Republic (MIT)
- Raw Material Policy of the Czech Republic in the Field of Mineral Resources and their Sources (MIT)

Types of measures

- Application of EU ETS.
- Development and application of new low-carbon technologies.
- Supporting vehicles running on alternative fuel, infrastructure for alternative fuel.
- Supporting personal non-motorized transport and low-emission public transport, including suburban railway transport, tramways and trolleybuses.
- Using waste for energy recovery.
- Integrating smaller heat production sources in smart grid systems and decentralised management systems.
- Introducing BAT in the energy and industry sectors.
- Ecological tax and fiscal reforms.
- Reviewing state aid (subsidies and tax exemptions) from the perspective of greenhouse gas emissions production.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MIT
- Co-Administrators: MoT, MoA, MFin, MfRD, ERO

Indicators

- 2.1.1a Greenhouse gas emissions

Sources of funding

- NPE – National Programme “Environment”
- OPE – Operational Programme “Environment”
- OPT – Operational Programme “Transport”
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- Modernisation Fund
- IROP – Integrated Regional Operational Programme
- RDP – Rural Development Programme 2014-2020
- CAP – CAP Strategic Plan2021-2027
- JTF – Just Transition Fund
- State (national) budget
- RRF – Recovery and Resilience Facility

Specific objective 2.1.2: Energy efficiency is improving

Increasing energy efficiency in end-use sectors – i.e. in households, in industry, in services and agricultural sector – will also contribute to reducing energy consumption, and thus reducing CO_2 and other greenhouse gas emissions. Integrated solutions for cities and urban agglomerations (smart cities and regions) represent a complex area, which are often linked to broader European-wide initiatives. In the residential sphere, there exist various smart homes and housing concepts which represent an intersection of various areas such as construction, local energy production, smart appliances, but also other elements for a safe and happy life. Introduction of more energy efficient technologies supports innovative development and helps increase competitiveness. However, energy savings must be focused not only on technical solutions, but also on business and financing models.

Energy intensity of **buildings** also plays an important role and it is necessary to combine reductions of energy intensity of buildings with more ecological heating sources, such as biomass boilers, heat pumps or gas condensing boilers, and support introduction of cogeneration units combining heat and electricity or connecting to an efficient heat supply system. According to the current Czech legislation, all buildings for which an application for a building permit was submitted after 1 January 2020 must meet almost zero energy consumption standard, i.e. requirements have been defined for average heat transfer coefficient indicator, total energy and primary non-renewable energy supplied.

European legislation lays down certain requirements relating to **eco-design and energy labelling** of products related to energy consumption, which are transposed in the Czech Republic by Decree No. 319/2019 Coll.[51] State administration is able to support faster replacements of certain appliances for highly efficient products through information campaigns focusing on benefits of energy-efficient appliances and through the exemplary role of state institutions by selecting the most energy-efficient appliances within the framework of responsible public procurement. In addition to reducing energy consumption in appliances, savings can be achieved by using **energy-efficient public lighting** with the possibility of installing intelligent and technologically innovative elements, where replacement of lighting fixtures could be associated with reducing light pollution [objective 1.4.2].

Economically and ecologically responsible management of energy coupled with increase in energy efficiency can also be achieved by introducing the so-called **energy management**, i.e. efficient

[51] Decree No. 319/2019 Coll., on eco-design and energy labelling of products related to energy consumption

distribution of energy consumption, planning and regulation of energy needs. Acquisition of real-time and up-to-date data will be required in order to adequately set up, control and predict long-term energy consumption.

Industry, in its sectoral breakdown, represents the most energy-intensive part of the entire economy. To increase energy efficiency in industry, it will be necessary to develop and modernize technologies or replace unsatisfactory ones with the best available techniques – these efforts must be made in energy production, by reducing losses in electricity and heat distribution systems, and using waste energy in production processes.

In **passenger transport**, potential to achieve energy savings consists in greater use of public transport, which can be achieved within the framework of integrated transport systems and through better linkages between individual transport and public transport networks [objective 1.2] and also by development of electric vehicles. In freight transport, savings may be achieved by increasing volume of freight transported over electrified railways at the expense of road-based transport.

Strategies implementing SEP objectives

- Climate Protection Policy of the Czech Republic (MoE)
- Secondary Raw Materials Policy of the Czech Republic (2019–2022) and its subsequent updates (MIT)
- National Energy and Climate Plan of the Czech Republic (MIT)
- Transport Policy of the Czech Republic 2021–2027 with outlook to 2050 (MoT) – *in preparation*
- National Action Plan for Smart Grids (MIT)
- National Action Plan for Clean Mobility (MIT)

Types of measures

- Supporting increased energy performance of buildings, industry, services and transport.
- Supporting energy savings in buildings (insulation, energy consumption metering and management).
- Modernization of technologies in industrial energy sector, increasing fuel-to-energy transformation efficiency.
- Supporting retention of economically and energy efficient heating energy supply systems.
- Supporting and developing community-level energy sector.
- Supporting increases in the share of highly efficient combined electricity and heating generation and energy efficient heating energy supply systems, including related reduction in losses in heat distribution.
- Effective use of waste heat and waste gas.
- Supporting energy efficient appliances through labelling, information campaigns and by examples of good practice on the part of the state.
- Developing public transport and integrated transport systems, strengthening linkages between individual and public transport (for example, P + R parking).
- Electrification of railways, supporting railway freight transport.
- Supporting introduction of energy management systems and use of energy services with guaranteed results, including supporting monitoring, regulation and management of energy consumption.

- Supporting energy-efficient public lighting.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MIT
- Co-Administrators: MfRD, MoT, ERO

Indicators

- 2.1.2a Energy intensity of the economy
- 2.1.2b Energy efficiency

Sources of funding

- NGL – New Green Light for Savings
- Modernisation Fund
- NPE – National Programme "Environment"
- IROP – Integrated Regional Operational Programme
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- OPE – Operational Programme "Environment"
- Just Transition Fund

Specific objective 2.1.3: Use of renewable energy sources is increasing

In order to reduce pressure on fossil fuel consumption and thus mitigate certain climate change-related effects, it will be necessary that a portion of energy used to generate electricity, heating, cooling and energy in transport comes from renewable energy sources such as wind, water, solar radiation, geothermal energy, biomass and biodegradable fraction of solid municipal waste (MBDW). The natural and geographical conditions of the given location must always be taken into account when choosing a suitable source. Massive increase in the capacity of electricity generated using RES on the European scale will require construction of accumulation and storage systems.

In the Czech Republic, the wind conditions are favourable for construction of **wind power plants**, mainly in mountain areas and in the highlands, where sufficient wind speeds are ensured. However, there is often a conflict with other requirements linked to the use of landscape, such as protection of special protected areas and biodiversity, preservation of the character of the landscape etc. **Hydropower** has historically been used to power, for example, mills, sawmills, iron-mills and power stations. At present, the Elbe, Moldau and Morava Rivers are the most favourable watercourses in our territory in terms of average flows for generation of hydro-energy. Other rivers and smaller watercourses have potential for smaller-scale production capacity. However, before such plants may be installed, it is always necessary to take into account other aspects, such as protection of nature, where, for example, excessive diversion of water for energy purposes, especially in times of drought, or constructions of transverse structuresin the river may endanger ecosystems by disrupting migration routes [objective 3.1]. From the perspective of current social needs, the potential of **solar energy** is inexhaustible. The Czech Republic's territory receives a hundred times more energy than what is currently consumed in terms of primary energy sources. In the future, priority should be given to installing solar panels in built-up areas, for example, on roofs, in brownfields or on land of low natural value and quality, before installations on rich agricultural land [objective 3.1]. Additional potential for

the future also lies in so-called agro-photovoltaics (APV), i.e. co-developing the same area of land for both solar photovoltaic power on tall or vertical structures as well as for agriculture. Profits can be realized in the partial shade, which some crops prefer, or by directing of precipitation to cultivated areas [objective 3.1].

Agriculture and forestry play a significant role in the production of biomass (wood chips, cellulose extracts, firewood) that can be further used as a renewable source of energy. However, the primary role of agricultural land must remain in ensuring sufficient food for human consumption and for production of feed and litter for livestock. The acreage of land available for production of 'energy' biomass will thus rather stagnate in the future, although it is regionally appropriate to use agriculturally uncultivated land, and especially land endangered by erosion, for widespread cultivation of fast-growing and other woody plants in multifunctional young or agro-forestry stands. Therefore, it is important to focus primarily on achieving a more efficient use of biomass in terms of increasing the energy obtained per hectare, and also a more efficient use of energy from biomass, for example by supporting development of biomethane production in biogas plants. Significant potential also lies in production of wood biomass, not only due to the current increase in total logging due to bark beetle calamity and saturation of the Central European raw wood market, but also due to gradual increase in volumes of weaker wood from pruning interventions and reconstructions of preparatory trees in stands created after the calamity. Overall, we can expect an increase in the amount of wood grown for energy and material use in the future. It is also important to ensure suitable integration of biodiversity and ecosystems considerations with mitigation measures as well as concurrence of adaptation and mitigation measures, which may very well be served by energy and possibly agro-forest tree stands. In terms of biomass sources, preference should be given to domestic plant species or plants that do not have adverse effects on natural (native) ecosystems. In the long term, it will be necessary to find ways to replace biomass production with a biodegradable component in municipal waste for energy recovery.

Czech Republic is making effort to achieve a 22 % share of renewable energy sources on final gross consumption by 2030 (compared to the 2020 target of 13 %). The average year-on-year growth in the share of RES in the heating and cooling sector currently corresponds to 1 %.

Greater use of **alternative fuels in transport** is also required by European legislation, within the framework of the RED II Directive[52] which lays down a binding objective for the share of RES in transport sector to 14 % by 2030 and achieving a share of at least 3.5 % of advanced biofuels (i.e. higher generation biofuels) in transport by 2030. In the future, it will be necessary to focus more on the production of biofuels from waste biomass and other sources (algae and microorganisms). On the positive side, palm oil products are practically not in use in the Czech Republic in biofuel production, as cultivation of palms for oil has a drastic effect on deforestation and economy in third countries (increase in greenhouse gases, degradation of the natural environment). Transport sector can also plausibly use hydrogen or biomethane (bio-CNG, bio-LNG) produced from sources not dedicated to food production. The potential of hydrogen for energy storage is also significant.

Strategies implementing SEP objectives

- Climate Protection Policy of the Czech Republic (MoE)
- National Energy and Climate Plan of the Czech Republic (MIT)
- National Action Plan for Smart Grids (MIT)

[52] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources

- National Action Plan for Clean Mobility (MIT)
- National Action Plan for Nuclear Energy Development of the Czech Republic (MIT)
- Raw Material Policy of the Czech Republic in the Field of Mineral Resources and their Sources (MIT)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030

Types of measures

- Modernizing distribution networks to allow for integration of a larger share of smaller alternative electricity sources.
- Supporting development of RES for generation of electricity, heat, cooling and combined electricity generation and heat including measures within the framework of community-level energy sector.
- Supporting systems for medium- and long-term accumulation of electricity.
- Transition of especially medium-size and smaller district heating systems to multi-fuel systems using locally available biomass, natural gas or other fuels, where the natural gas in particular will play the role of stabilising and complementary fuel.
- Ensuring fulfilment of objectives in the transport sector (alternative fuels, RES in transport and energy efficiency in transport – supporting use of alternative fuels (electricity, hydrogen, bio-CNG, bio-LNG), advanced bio-fuels, construction and upgrades of railways – electrification, use of alternative fuels on non-electrified railway routes).

Responsible authorities

- Responsible Authorities (Administrators): MoE, MIT, MoT
- Co-Administrators: MoA, ERO

Indicators

- 2.1.3a Renewable energy sources
- 2.1.3b Share of RES on energy consumption in transport sector

Sources of funding

- NGL – New Green Light for Savings
- Modernisation Fund
- OPE – Operational Programme “Environment”
- OPT – Operational Programme “Transport“
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- Interreg – European Regional Cooperation Programmes
- RDP – Rural Development Programme 2014–2020
- CAP – CAP Strategic Plan2021–2027
- LIFE Programme
- Just Transition Fund
- IROP – Integrated Regional Operational Programme
- RRF – Recovery and Resilience Facility

2.2. Transition to circular economy

Strategic objective: 2.2 Circular economy guarantees efficient management of raw materials, products and waste

Global increase in waste production is, except for regional specifics, almost always tied to a growing population and the growing wealth of the society. The linear economy from raw materials to waste represents an uneconomical consumption of materials and is associated with an increased burden on the environment and human health. Many countries strive to achieve the so-called decoupling, where economic performance is separated from pressures on the environment. In the interests of sustainable management of natural resources and reduction in waste production, it is necessary to focus on prevention, minimization, recycling and reuse of waste i.e., to move to a circular economy.

The requirement for the longest possible but safe, from the perspective of human health, retention of raw materials in circulation must be taken into account already when designing a product. The so-called material **eco-design** should prevent the product from becoming obsolete quickly while increasing its life cycle, enabling repairability, but also easy decomposition into recyclable or reusable components. The efficiency of recycling and re-use is affected by a number of factors, including legislative standards restricting the re-use of products and their parts or use of recycled materials. Significant economic aspects are also at play affecting development of processing infrastructure and its technological level, consumer demand for high-quality recycled goods and goods containing recycled product. In the future, we can expect an increase in the potential of waste as a raw material. Development of low-carbon technologies and increasing energy storage requirements in particular will trigger an increase in demand for alkaline and precious metals. In order to transform linear economy into a circular one, it will be necessary to implement new technologies, support market for secondary raw materials and create an appropriate economic and legislative framework.

The state administration supports waste management hierarchy, where waste prevention is preferred over material recovery and recycling, recycling over energy recovery of waste and energy recovery of waste before disposal by landfilling. In connection with the development and expansion of new materials and technologies, it will also be necessary to take into account generation of new types of wastes such as nanomaterials, composite materials and microplastics, which will require adaptation of the recycling system.

The concept of **bioeconomy** is closely related to waste management. Bioeconomy is based on the principles of sustainability, circulation and involves production of renewable biological resources and conversion of these resources and waste streams into value-added products such as food, livestock feed, bio-products and bioenergy or fertilizers. Bioeconomy covers all sectors and systems that use biological resources, including sectors with an impact on land use and water resources. Therefore, they have a considerable potential for climate change mitigation and adaptation. Bioeconomy has the potential to become, among other things, a driving force for competitiveness, growth and renewal of the Czech industry, modernization of the Czech primary production systems, protection of the environment and strengthening of biodiversity. Use of renewable resources saves primary non-renewable resources, lowers greenhouse gas emissions and also drives development of alternative fuels and agricultural production.

The Czech Republic thus follows up on international and European documents, the so-called Circular Package adopted by the European Commission in 2015, a new Circular Economy Action Plan for a Cleaner and More Competitive Europe, the 2030 Agenda for Sustainable Development, adopted by all

United Nations, Council Directive 1999/31/EC [53], a Sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment, and others. At the national level, a new document 'Circular Czechia 2040' is being prepared while the already approved documents remain in force; these include: The Waste Management Plan of the Czech Republic, the updated version of the Secondary Raw Materials Policy of the Czech Republic, and the Waste Prevention Program. in the Strategic Framework of the Czech Republic 2030, circular economy is addressed in Objective 9.3 (Increasing energy and material efficiency of the economy).

Specific objective 2.2.1: Material intensity of economy is decreasing

Primary, non-renewable resources are present in limited quantities on Earth. Their extraction, processing and transformation into products are often energy-intensive and associated with a considerable burden on the environment. Reducing material intensity means ensuring production while reducing pollution and the associated impact on the environment. Many materials have a high energy footprint. At the same time, the same product can often be made from less energy-intensive materials, for example secondary raw materials, recycled materials, nanomaterials, bio-materials and many others which will result from ongoing research and development. In addition, use of innovative technologies, such as nanotechnology, biotechnology, digitization, 3D printing or artificial intelligence, etc., will reduce waste generated in production as well as material and energy intensity of production in order to achieve sustainable industrial production and tertiary services.

The Czech Republic's GDP is largely generated by manufacturing and creation of added value in industry and energy sector which are mainly based on fossil fuels. The Czech Republic is one of the most industrialized countries in the European Union in terms of the industry's share on GDP, and this is the cause of an increased material intensity of the entire Czech economy. Rising prices of natural resources and instabilities in their imports will result in a tendency to resume extraction of raw materials available in the Czech Republic. **Use of secondary raw materials** will help in reducing material inputs and the environmental burden associated with extraction. Given the current level of technological processes, use of secondary raw materials is not yet a full-fledged alternative but it has the potential to bring economic effects in the form of increased competitiveness of Czech companies, new business opportunities and jobs. The recycling industry, based on recovery of secondary resources from materials and products at the end of their life cycle, is becoming increasingly important for traditional industries and technologies that depend on imports of raw materials, especially critical raw materials, for example, cobalt, rare soils and others, whose occurrence and production are concentrated in a few remote destinations outside Europe.

Greater support given to secondary raw materials market, use of sustainable public procurement to promote use of products made from secondary raw materials, assessing possibilities of reducing value added tax on recycling-related activities, reviewing taxation and fees imposed on primary raw materials or on use of low-quality materials, products with a short life cycle or products containing hazardous substances can all contribute to a successful transition to circular economy and to promoting use of secondary raw materials in production processes.

Strategies implementing SEP objectives

- Circular Czechia 2040 (MoE) – *in preparation*
- Waste Management Plan of the Czech Republic (MoE)

[53] Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

- Raw Material Policy of the Czech Republic in the Field of Mineral Resources and their Sources (MIT)
- Secondary Raw Materials Policy of the Czech Republic (2019–2022) and its subsequent updates (MIT)
- Economic Strategy of the Czech Republic 2020–2030 (MIT) – *in preparation*

Types of measures

- Supporting use of secondary, recycled materials in production processes.
- Supporting use of products and materials containing secondary raw materials especially in public procurement.
- Optimising production processes with a view of preventing waste production and its elimination.
- Innovation and development of new materials, processes and technologies in order to reduce material intensity.
- Reviewing taxation and fees imposed on primary raw materials.

Responsible authorities

- Responsible Authorities (Administrators): MIT, MoE
- Co-Administrator: MFin

Indicators

- 2.2.1a Material intensity of the economy
- 2.2.1b Level of circular use of materials

Sources of funding

- OPE – Operational Programme “Environment”
- OPTAC – Operational Programme Technology and Applications for Competitiveness

Specific objective 2.2.2: Waste prevention efforts are maximised

With economic growth and improving living standards, the number of available products and products on the market increases. As sales grow, the responsibility of manufacturers and retailers for these products must extend until the end of product's life. The **extended producer responsibility** principle dictates reduction of negative impacts on the environment (preventing use of hazardous substances, low-quality materials, giving preference to designs that are more suitable for recycling) and includes ecological collection and disposal of the product at the end of its life cycle. This principle, which is fully in line with the "polluter pays" principle, is currently applied for example to electrical equipment. In addition to that, environment-friendlier products can be labelled with an **eco-label**. In the Czech Republic, the share of products certified in this manner is very low compared to the EU and for expansion of this portfolio it will be necessary to support producers and consumers to take an interest in ecological labelling.

The problem lies in artificially created consumer interest in buying a product that is heavily supported by targeted marketing, for example rapid changes in fashion trends, promotional prices and oversized packaging at original price. Products purchased by consumers in excess of their needs are not always properly used thus creating unnecessary waste and unnecessarily spent energy and materials for production and disposal of such products. Consumers, including contracting authorities within the framework of responsible public procurement, need to be encouraged to make **environmentally conscious decisions** favouring more environmentally friendly products with a longer life cycle rather than opting for disposable products, to promote local products, but also to choose a reasonable amount of consumer goods or decide whether it would be more economical to use alternative consumer models, such as providing products as a service (lending, sharing) and thus preventing production of a product for all consumers. At the same time, it would be appropriate to support certain more advanced forms of services, not only basic product-oriented services (such as extended warranty, guaranteed repair, etc.), but also user-oriented services (rentals of products in order to access the service – "access model") or direct result-oriented services, often associated with a digital solution (providing only the service as such, not the physical product to the user – the "performance model").

Unused or unworn products can also be returned to circulation. Similarly, out-dated products (for example furniture, clothing) can be put back on the market either without modification or after a re-design and reused. Waste can also be prevented by repairing damaged products. Product design must however allow for such easy maintenance, operation and disposal. For example, a composite design of a product may be a common cause for its disposal rather than its recycling. At the same time, long-term availability of spare parts must be ensured. Therefore, in 2016, the European Union extended the eco-design requirements for products involving consumption of energy to include availability of the most frequently needed spare parts, access to repair and maintenance information and for the dismantling of materials for further use and recycling.

Aspects relating to consumer goods are equally important. **Consumer packaging and packaging used in transport** accounts for a significant proportion of generated waste. It is therefore necessary to support minimization of packaging waste, both at consumer and retailer level as well as during transport or production, while continuing to maintain hygienic and technical standards. Examples include purchasing goods in reusable packaging or putting pressure on manufacturers to minimize disposable packaging. In the case of industrial goods, it is desirable to further promote a meaningful reduction in the required industrial packaging and to promote good practice in implementation of reusable industrial packaging systems for the logistics of goods and components.

Examples of waste generated by unused products include large volumes of **food waste** from households, canteens, gastronomic establishments and unsold goods in stores. It is very desirable to reduce food waste by 50 % per capita at the retail and consumer levels by 2030, and to reduce food losses in the field of food production and in supply chains. This commitment correlates with the UN's sustainable development goals (Objective 12.3). Safe unused and more durable foods are resources, whose potential should be exploited for example via food banks, donations to charities, etc. The remaining unused food can then be processed together with **bio-waste** [objective 2.2.3] in composting plants or biogas stations and thus maximize use of nutrients and energy contained in them.

Economically profitable **waste recycling** is hindered by low demand for secondary raw materials due to insufficient capacity of producers using recycled products (recyclates). A good example would be insufficient local capacity for recycling sorted plastics, which became fully apparent after reduction of their consumption by producers in Asia. Demand for recycled material is also reduced by its variable quality depending on the input raw material, given that contamination of the recycled material with additives affecting material properties or with harmful and dangerous substances cannot be prevented

[objective 1.3]. This uncertainty further compromises the trust of producers and consumers in materials and products containing recyclates.

It is therefore necessary to support enterprises that process or recycle secondary raw materials and waste, to support research in the field of waste prevention, but also promote use of secondary raw materials in production and to increase awareness of the general and professional public, especially through examples of good practice. Detailed knowledge of material flows, based on high-quality and continuous monitoring, will also be necessary for an efficient circular economy.

Strategies implementing SEP objectives

- Waste Management Plan of the Czech Republic (MoE)
- Waste Prevention Programme of the Czech Republic (MoE)
- Circular Czechia 2040, (MoE) – in preparation
- National Energy and Climate Plan of the Czech Republic (MIT)
- Secondary Raw Materials Policy of the Czech Republic (2019–2022) and its subsequent updates (MIT)

Types of measures

- Supporting low-waste and innovative technologies in production. Focusing on processes allowing substitution of primary raw material by secondary raw materials.
- Supporting infrastructure that processes and uses secondary raw materials.
- Further development of the extended producer responsibility. Products on the Czech market correspond to eco-design principles.
- Supporting sharing of products, centres facilitating repeated use and repairs, including long-term availability of spare parts.
- Limiting food waste, including increased use of gastro-waste.
- Giving preference to re-usable packaging and packaging-free retail.
- Supporting research, experimental development and innovations in the area of waste prevention.
- Development of material flow monitoring systems, including information systems.
- Information support for preventing waste, for example within the framework of professional education and environmental tutoring and education.
- Supporting consumers' and industry's interest in recycled products, including broadening of the range of certified products and services (eco-labelling). Giving preference to responsible public procurement in all areas of public administration.

Responsible authorities

- Responsible Authorities (Administrator): MoE, MIT,
- Co-Administrator: MoA, MEYS

Indicators

- 2.2.2a Waste production
- 2.2.2b Eco-labelling

Sources of funding

- OPE – Operational Programme “Environment”
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- OPJAK – Operational Programme “Jan Amos Komenský”
- InterReg – European Regional Cooperation Programmes
- LIFE Programme
- Just Transition Fund
- RRF – Recovery and Resilience Facility
- NPE – National Programme “Environment”

Specific objective 2.2.3: Waste management hierarchy is fully observed

The Waste Framework Directive laid down a **binding waste hierarchy**: **waste prevention, reuse, material recovery, energy recovery and waste disposal**.

The material prerequisite for compliance with waste hierarchy is to use the product throughout its life and to recycle the generated waste. The Czech Republic has been failing in its efforts to stop the growth of **waste production** or selected end-of-life products. At the same time, however, their take-back is also growing. Collected waste, packaging and end-of-life products may be used, in accordance with legislation governing waste, as secondary raw materials [objective 2.2.2]. With the development of new types of products, the circular economy must also respond to newly emerging types or increasing amounts of certain groups of waste (for example, batteries, electrical and energy equipment), some of which may constitute hazardous waste [objective 1.3.1]. Increased collection and recycling of electrical equipment containing critical raw materials (for example, electric car batteries) may help in reducing dependence on imported materials, especially from problematic or economically unstable regions, and help in maintaining the value of recovered materials in the EU economy. **Construction waste** represents the largest share in the production of waste; this waste generated during demolitions of buildings, in some cases buildings that are culturally and historically valuable. New buildings are preferred to reconstructions. A large part of construction waste is never returned to the production cycle, but instead it is used for landscaping, landfill reclamations, etc. In order to increase re-usability of construction waste, it is first necessary to significantly increase its sorting followed by additional processing, where new technologies represent a great potential, for example **concrete recycling.**

Municipal waste remains a long-term problem, and its production is also increasing. A significant part of municipal waste in the Czech Republic is still disposed of by landfilling. Nevertheless, more than half of the municipal waste is already used, mainly in material recovery (recycling) and in smaller part for energy recovery (incineration resulting in electricity and heat production). Increasing the rates for landfilling, which are so low in the Czech Republic that landfills have a competitive advantage over other, more environmentally friendly and hierarchically superior waste management technologies, will contribute to a shift away from landfilling.

Citizens and enterprises are also motivated to sort their waste by a dense network of collection points, collection yards and a network of containers for sorting paper, plastic and glass, metals and biodegradable municipal waste, and so far, only rarely, containers for edible oils and textiles. Collection

yards also accept and collect waste from electrical appliances, furniture, construction debris, tires, chemicals (hazardous waste).

The residual mixed municipal waste, which remains after separation of the so-called recyclable components by the population, is still a valuable raw material. This waste, which is no longer suitable for material recovery, does not have to be landfilled, but can be used for production of heat and electricity for households in specialized facilities for energy recovery of municipal waste. Waste utilized in energy recovery still represents only a small portion of the total volume of waste produced in the Czech Republic. By 2035, the Czech Republic will be obliged to meet European objectives regulating waste, including increasing material and energy recovery of municipal waste. It will no longer be possible to landfill more than 10 % of municipal waste, and no materials that could be recycled, used in energy recovery or biodegraded will be allowed to be landfilled. EU-wide legislation[54] in place also regulates cross-border shipments of waste. Nevertheless, certain portion of waste continues to be transported illegally. Therefore, inspection activities will need to be intensified in the future.

Specifically, it is necessary to focus on the management of the **biodegradable component of municipal waste** (MBDW). Czech Republic introduced a system of collection points for this biodegradable waste and it is used for production of biological fertilizer in the form of compost. Another method is to use a higher share of biodegradable waste as a renewable energy source [objective 2.1] in biogas stations. For the future, it would be desirable to look for other uses and processing methods. Inconsistent sorting represents a major risk for the MBDW use, which is the main reason why biodegradable waste ends up in landfills or in incinerators.

Strategies implementing SEP objectives

- Waste Management Plan of the Czech Republic (MoE)
- Waste Prevention Programme of the Czech Republic (MoE)
- Secondary Raw Materials Policy of the Czech Republic (2019–2022) and its subsequent updates (MIT)
- Circular Czechia 2040, (MoE) – *in preparation*
- National Energy and Climate Plan of the Czech Republic (MIT)
- Strategy for Prevention and Fighting Waste-Related Crime 2021–2023 (MoI)

Types of measures

- Information support – promoting waste management hierarchy.
- Building environmentally-effective infrastructure and network waste conversion and processing facilities.
- Limiting the volume of landfilled yet re-usable waste.
- Reducing production of municipal waste, respectively preventing its production.
- Increasing material recovery of municipal waste.
- Supporting a better-quality sorting of building waste and edification leading to giving preference to repairs and reconstructions of buildings instead of large-scale demolitions.
- Supporting and motivating farmers to use compost from biodegradable waste.
- Supporting energy recovery of non-recyclable waste in line with waste management hierarchy and complex protection of the environment.

[54] Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste is the key piece of legislation in this area

- Supporting research, experimental development and innovations in the area of processing and recycling technologies.
- Adopting new waste management legislation, which will improve waste management, especially municipal waste management.
- Raising the landfilling fees pursuant to the waste management hierarchy principles and objectives.

Responsible authorities

- Responsible Authorities (Administrator): MoE, MIT, MoA
- Co-Administrator: MEYS, MoI

Indicators

- 2.2.3a Waste management structure
- 2.2.3b Management of municipal waste

Sources of funding

- OPE – Operational Programme "Environment"
- OPTAC – Operational Programme Technology and Applications for Competitiveness
- OPJAK – Operational Programme "Jan Amos Komenský"

3. Nature and landscape

3.1. Ecologically functional landscape

3.1 Ecological stability of landscape is rebuilt, farming is sustainable in long-term and reacts to climate change

Landscape is a space shared by people and functioning ecosystems and as such it is significantly affected by human activities. Landscape is being used to meet the need for a happy existence and development of contemporary society, i.e. as a place where a wide range of interests, whether economic or leisure activities, come together. However, in order to maintain the landscape's capacity to meet the needs of future generations, it is necessary to strive for a sustainable use of this landscape, with full awareness of its cultural, historical, aesthetic (landscape character, natural parks) and natural values and associated limits, as well as awareness of the possibilities and limits of economic benefits and public interests which are inextricably linked to the landscape.

Healthy, resilient and productive ecosystems as a prerequisite for a sustainable economy are then able to provide a wide range of **quality ecosystem functions and services**, for the present and future generations. These are mainly supply services (including production of commodities, supply of water, etc.) and regulation (including regulation of floods, pests, climate, water and air quality, etc.). If the ecosystems present in the landscape are in a good condition, it will be easier for them to withstand adverse pressures and recover in the event of damage. However, natural regeneration of ecosystems is usually a long-term process. This, of course, does not correspond to the human tendency to prioritize short-term gains and immediate benefits over sustainability of such benefits and gains of future

generations. Negative impacts of a long-term and intensive use of landscape accumulate and may be exacerbated by climate change.

Climate change significantly affects ecosystems which are essential for carbon storage (forests, permanent grasslands or wetlands and peat bogs), i.e. the vast majority of natural and close-to-nature ecosystems in our landscape. This leads to an increase in natural threats, for example, floods, droughts or the rapid spread of alien invasive plant and animal species. These events will cause changes within territories, which may further strengthen climate change effects on regional scale.

Significant interference with or over-exploitation of ecosystems to maximize a single benefit or service (for example, land acquisition for construction, monoculture crops or timber production) also reduces **species and habitat diversity** and limits their ability to provide additional ecosystem functions and services. Negative impacts can manifest themselves not only at the local level, but also in related or more distant ecosystems. Eventually, the preferred target service may be weakened as well as the key regulatory ecosystem services on which it is directly dependent. A good example of such interference would be the current scale of significant damage to forests exacerbated by the predominant economic orientation towards spruce. Adverse climatic conditions have weakened forest stands and that has contributed to the spread of biotic pests. Massive calamity logging due to bark beetle infestation as well as the amount of timber felled by windstorms resulted in the price of wood dropping and thus exacerbating economic damage in the entire forestry sector.

Intensive landscape (open country) development and intensive urbanization cause degradation of ecosystems, unification of the landscape, disintegration of its functional structures, fragmentation and emergence of migration barriers. Continuity of the open country is most gravely affected by construction of linear transport infrastructure and associated transport intensity and by construction of large buildings. This in turn causes significant separation of various species' populations by impenetrable or hardly permeable migration barriers, thereby reducing food availability and opportunities for reproduction. This results in a loss of genetic diversity of plant and animal species and reduced viability of populations and ecosystems, but also in certain permanent changes in character of the landscape.

Ecological stability is defined by the Act on the Environment[55] as the capacity of ecosystems to offset changes caused by external agents and preserve its natural properties and functions. Ecological stability of landscape (which is a set of functionally interconnected ecosystems and civilizational elements) is most critically weakened by sudden, frequent and especially spatially far-reaching changes to the landscape that disrupt its natural functions and connections and that are associated with the general unsustainable use of natural resources, development of settlements, transport and other infrastructure, fragmentation of rivers by establishing transverse structures, or intensive farming techniques in certain sectors. One of the most serious manifestations of weakening ecological stability of landscape is reduction of its natural **retention and accumulation capacity**. Autoregulatory mechanisms in ecosystems exposed to long-term and intensive pressure fail and the ecosystems degrade. Degraded ecosystems lose their ability to provide ecosystem functions and services or withstand not only other anthropogenic pressures but also natural stresses. This causes, in many cases, disruption to longstanding and natural interlinks and relationships within populations of individual species of organisms, between individual species and between organisms and their natural external environment. The landscape loses the ability to resist climate change impacts and adapt to change.

[55] Act No. 17/1992 Coll., on the Environment, as amended

The ecosystems' ability to provide a wide range of ecosystem functions and services, which is directly or indirectly linked to maintaining and improving quality of life of human population, depends on their structural and functional integrity. Decisions on the functional use of the landscape must therefore be made in a manner that will reconcile the various needs of human society, while restoring and strengthening ecological stability and biodiversity of the landscape by means of protection, expansion and functional linkages between ecologically stable areas as well as by mitigating negative impacts of human activities on the landscape and ecosystems.

Stable ecosystems better withstand effects of climate change. In the future, it will be therefore necessary to support sustainable farming methods, natural retention and accumulation of water in the landscape, improve soil quality and strengthen the non-productive functions of agricultural landscape and forests. Natural and aesthetic values of the landscape also require corresponding protection and that protection is already available under the existing legislation in the form of nature parks.

The nature and biodiversity, respectively an ecologically stable landscape, is essential for ensuring sustainable existence of a functioning society. The main piece of legislation in this area is the **Nature and Landscape Protection Act**, which represents a comprehensive system of instruments and competencies to ensure this important public interest. Within the framework of preparation of any legal regulation and its amendments, it is necessary to thoroughly examine and, if possible, eliminate impacts of proposed changes on the nature and landscape, and to preserve the importance of protection of nature and landscape in the public interest and the internal integrity of the law.

Territorial planning carried out in accordance with the Building Code[56] plays an important role in protecting the landscape. With regard to the statutory objectives of territorial planning, it is in the public interest to protect and develop the natural, cultural and civilizational values of a territory, including urban, architectural and archaeological heritage, to protect the landscape as an essential component of the living environment and the basis of its population's identity, and with these interests in mind determine conditions for economical use of built-up areas and to ensure protection of undeveloped land as well as land that may not be developed, and to ensure that buildable areas are defined taking into consideration their potential for development and the degree of use while considering the natural and landscape value of the territory and its natural functions.

From the perspective of ecologically stable landscape, the **Act on Land Consolidations and Land Registries**[57] is of the key importance. Land consolidation aligns certain ownership rights to land and related encumbrances, modifying land plots spatially and functionally, whether by the process of consolidation or division, ensuring their accessibility and straightening of their boundaries. At the same time, consolidations create conditions for rational management, protection and reclamation of the soil, improvements of the landscape while increasing its ecological stability. Within the framework of the so-called common facilities (field paths, water management, reclamation and ecological measures) land is set aside for their implementation.

The importance of protection, care and planning in the landscape and the interest of European countries in sustainable development landscape forms the basis of the European Landscape Convention, which seeks to balance social needs, economic activity and protection and creation of the environment through sustainable policymaking and implementation – in landscape, territorial development, urban planning etc. Protection of ecosystems and correction of undesirable trends resulting from unsustainable landscape management are among the top Czech priorities formulated

[56] Act No. 183/2006 Coll., on Territorial Planning and the Building Code (Building Code)

[57] Act No. 139/2002 Coll., on land consolidations and land registries and on amendment of Act No. 229/1991 Coll., on proprietary relations to land and other agricultural property, as amended

in the Strategic Framework of the Czech Republic 2030. At the national level, these issues are comprehensively addressed by the Biodiversity Protection Strategy and by the Territorial Development Policy of the Czech Republic, which is binding for elaboration and issue of territorial planning documentation (zoning plans) and for decisions on changes within a territory, for example, zoning decisions.

Specific objective 3.1.1: Water retention levels in landscape are increasing via ecosystem solutions and sustainable farming

Given the hydro-geographical nature of the Czech Republic, retention of water in the landscape and its subsequent gradual release for use is particularly important. Due to absence of inflowing rivers, the only source of water in the Czech Republic is precipitation. The increasing territorial and temporal variability of atmospheric precipitation leads to more frequent floods or hydrological droughts and therefore retention and accumulation of water in the landscape will play an increasingly important role in the future. The ability of the landscape to retain (accumulate) rainfall water and thus slow down surface water runoff is adversely affected by growth of built-up areas, respectively hard impermeable surfaces, and in certain cases also by inappropriate management of agricultural land and forests, where surface water runoff accelerates and causes soil erosion. The natural ability of the landscape to retain water has been reduced in particular by systematic drainage of agricultural land and by consolidation of agricultural land into large tracts, associated with removal of natural elements formerly scattered throughout agricultural landscape (boundaries between fields, copses, hedges, seepage belts, etc.). In order to improve the water cycle, certain agricultural management methods are supported (for example through GAEC) reducing excessive evaporation of water from soil surface such as use of catch crops, crop combinations (agroforestry – for example, combined grazing and forestry systems), strip tills and others which are, however, not yet being sufficiently utilized. For water retention in forests, open areas are a problem because snow melts faster here and rainwater evaporates quicker. Accelerated re-forestation of large areas after the bark beetle calamity felling, including possible use of temporary preparatory tree species in suitable natural and vegetation conditions, is therefore fundamentally important for restoration of the hydric function of forests. The natural ability of the landscape to retain water is weakened by changes in the landscape structure, such as by degradations of river floodplains, reduction of wetlands, small reservoirs and areas with permanent vegetation or by losses of natural watercourses' morphology caused in the past by modifications including straightening of watercourses, bank reinforcement or routing small watercourses via conduits. These changes negatively affect all ecosystems and human needs and further amplify the impact of climate change.

Protection and restoration of the natural water regime in the landscape requires a comprehensive approach whether in relation to planning land use and coordination of various interests within the landscape, or in relation to implementation of anti-erosion, revitalization and nature-friendly flood control measures and modification of landscape management methods. It is desirable that water infiltrates the soil preferably at the point of impact, and this may be facilitated by suitable terrain surface, by presence of vegetation, by sufficient organic matter (humus) content in the soil, but also by good condition of the deeper soil layers. When selecting suitable measures, it is necessary to respect the geomorphological and hydrological conditions of the landscape and to make targeted use of the preserved landscape structures, which in the past performed retention functions. Retention capacity of the soil can be supported by biological measures (grassing of infiltration areas, restoration of landscape elements, etc.) as well as by technical or combined measures such as systems of ponds or small reservoirs, catchment grasslands, or by adjustment of agricultural farming methods. Priority

should be given to nature-friendly solutions which simultaneously have a positive effect on biodiversity and further lead to reduction in soil erosion and eutrophication, and which lead to improvements in the quality of water and increase of groundwater quantity. Compliance with standards and requirements pursuant to the cross-compliance principles, as well as well-prepared land consolidations which comprehensively deal with agricultural landscape in individual cadastres and organize property rights and related encumbrances also contribute to the improvement of water retention conditions in the landscape. So far, land consolidations have been carried out on only about one-fifth of suitable areas.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- Action Plan for Development of Ecological Agriculture 2020–2025 (MoA) and its subsequent updates – *in preparation*
- National river basin management plans (MoA, MoE)
- State Forestry Policy Concept to 2035 (MoA)
- Concept for Protection Against Consequences of Droughts in the Czech Republic

Types of measures

- Reclamation and protection of landscape elements (Territorial System of Ecological Stability (TSES), copses, tree alleys, woody plants growing outside forests, contour furrows etc.).
- Use of suitable agro-technical methods (grassing, crop rotation patterns, catch crops, leaving plant residue, under-sowing, incorporation of organic content into soil, strip tilling).
- Adjustment of farming methods in sensitive areas and spring areas.
- Implementation of nature-friendly anti-flood measures, protection and expansion of natural seepage and infiltration areas, including infiltration of water from forest road drainage systems.
- Revitalization of watercourses and floodplains, ponds, wetland reclamation, building nature-friendly small water reservoirs.
- Utilising spontaneous ecosystem recovery processes (re-naturation) and maintaining such reclaimed functional landscape elements.
- Reviewing drainage systems and implementing reclamation measures on farm and forest land that strengthen water retention and infiltration capacities.
- Restricting technical modifications of watercourses and implementing nature-friendly elements where conditions allow.
- Implementing land consolidations with a view to improving water regime and climate change, including adjustment of ownership rights to land in the vicinity of watercourses.
- Supporting documents (Adaptation strategies on local and regional levels) focusing on systemic proposals of measures for water retention in open country (for example, territorial landscape studies).

Responsible authorities

- Responsible Authorities (Administrator): MoE, MoA, MfRD

Indicators

- 3.1.1a Infiltration capacity of soils
- 3.1.1b Land use

Sources of funding

- CAP – CAP Strategic Plan 2021–2027
- RDP – Rural Development Programme 2014–2020
- OPE – Operational Programme "Environment"
- InterReg – European Regional Cooperation Programmes
- LMP – Landscape Management Programme
- LIFE Programme
- National Programmes of the Ministry of Agriculture

Specific objective 3.1.2: Soil degradation, incl. accelerated erosion, and loss of farmland is decreasing

Most of terrestrial ecosystems include soil which is used to produce food, materials and energy and ensure water (retention and infiltration) and nutrient cycles, carbon storage, etc. Soil formation is a long-term process and it takes centuries to form mere centimetres. Notwithstanding all that, it is exactly the soil (or by extension, farmland) that is significantly threatened in the Czech Republic by permanent annexations for development, by transformation into impermeable, hard surfaces, by intensive farming and by events associated with such use, such as accelerated erosion, desertification, compaction, overuse of pesticides and replacement of livestock fertilizers with industrial fertilizers, acidification, loss of organic matter and low infiltration. These events significantly reduce the ability of ecosystems (terrestrial and aquatic) to provide the potential full range of ecosystem services while reducing the resilience of ecosystems to climate change, pests and diseases.

Permanent removal of land from the Agricultural Land Fund, especially in the vicinity of large cities, and its transformation into impermeable, hard surfaces represents a long-standing problem in the Czech Republic, which has only slowed down in recent years. To ensure adequate food and energy self-sufficiency, it is essential to maintain a strategic acreage of high-quality agricultural land. It is necessary to continue efforts to reduce the loss of agricultural land by amending existing legislation, or by imposing economic instruments, and by preferential use of brownfields without significant natural value [objective 1.3.2 and 1.6.2].

In addition to losses of agricultural land, land depletion, especially in terms of organic matter content, and loss of topsoil due to **accelerated erosion** also constitute a major problem. In the Czech Republic, the risk of water erosion outweighs the risk of wind erosion. One of the main causes are inappropriate farming methods, especially cultivation of unsuitable crops, absence of landscape elements (including seepage belts, windbreaks, etc.) or farming practices that are unsuitable for areas with high erosion risk. **Excessive soil compaction** is another result of intensive farming, involving use of heavy-weight agricultural machinery (tractors, harvesters). This results in disintegration of the soil structure –

changes in porosity, bulk density, infiltration capacity and permeability. Reduced retention capacity accelerates surface runoffs and assists in furthering erosion processes which may contribute to flooding. Land becomes locally waterlogged after intensive rainfall, yields of cultivated crops are reduced which compromises competitiveness of businesses farming on compacted land. **Loss of organic matter content** in the soil impairs the physical and chemical properties of the soil, reduces the ability of the soil to retain and absorb water, which leads to gradual degradation of the soil, especially by salinization and erosion. Deteriorating soil properties are then compensated by higher input of industrial fertilizers in order to achieve the required production of agricultural crops. Loss of organic matter in the soil is caused by intensive farming, in which drainage and increased aeration of the soil cause a decrease in the humification of organic residues and promote their mineralization. This can be prevented by organic fertilization (from animal production, composting or by biomass use), by growing suitable crops and catch crops and by carrying out sensitive interventions in the soil water regime. Quality of farmland can be also improved by use of extracted sediment or sludge from WWTPs, as long as they meet limits of the content of hazardous substances.

In addition to industrial fertilizers, the quality of agricultural soil is directly affected by other inputs such as plant protection products (herbicides, rodenticides, etc.), sludge from wastewater treatment plants, sediments extracted from watercourses, ponds and reservoirs, which may contain unwanted/hazardous contaminants. Contamination of soil [objective 1.3] with harmful substances from other human activities, such as accidents involving leaks of hazardous substances, emissions from industry and, for example, unsecured landfills and illegal waste storage, represents additional negative factor. These inputs must be monitored and regulated in such a way that their impact does not damage the soil and its properties.

Cross-compliance requirements and standards applied within the framework of the Common Agricultural Policy contribute to improvements in landscape management, which, among other things, regulate water retention on agricultural land and restoration of eco-stabilization elements (GAEC 7) or reduction in the size of crop areas (GAEC 7d) and thus reducing soil losses caused by water erosion. Crop rotation also assists crops in better withstanding effects of droughts and prevents floods.

Forest soil is also threatened by degradation. Quality of air used to be an important factor in past that compromised health of forests. However, **degradation of forest soil** still continues and manifests itself in problems related to health of forests which occur even in regions without significant air pollution history. Nutritional problems are often combined here with other pressures, most often with periods of drought and biotic pests [objective 3.1.3]. In order to avoid forest soil degradation, its regeneration capacity needs to improve. Specific processes that counteract soil environment acidification need to be applied, for example by amelioration materials containing missing nutrients and trace elements, by retaining part of the harvest residues in place, and especially by continuing the overall modification of the wood composition with the objective to create a stable mixed forest.

In case of soil damage, its functions must be restored by means of protective measures, such as revitalization (measures of chemical, physical and biological nature leading to soil recovery), re-naturalization (returning the soil to its original state), reconstruction (for example after landslides) and remediation of land, soils and rocks after their contamination by, for example, oil. The aim, therefore, is to reduce negative effects of contaminated sites on soil, which affect the environment and human health.

In the future, it will be necessary to develop environment-friendly forms of agriculture and support **responsible attitudes of farmers** to the land. New knowledge and implementation of available technologies in landscape management in practice (for example, precision agriculture, information and

data services, digitalization) will help streamline fertilization or predictions and prevention of diseases and pests.

Strategies implementing SEP objectives

- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- Action Plan for Development of Ecological Agriculture 2020-2025 (MoA) and its subsequent updates – in preparation
- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- State Forestry Policy Concept to 2035 (MoA)

Types of measures

- Strengthening responsible attitudes of farmers to the land and biodiversity – providing support and edification in the area of rights and obligations, sharing examples of good practice.
- Establishing and maintaining landscape elements and supporting soil-protecting technologies.
- Using environment-friendly farming techniques, including precision agriculture and good practices.
- Developing and supporting ecological agriculture and agro-forestry.
- Optimising the range of existing plant protection products and their management, developing and preferring less detrimental alternatives.
- Reducing sizes of continuous agricultural crop areas.
- Crop diversification and ensuring vegetation cover of the soil over the longest possible period (for example, by using protective crops, sowing into freezing-out catch crops or under-sowing).
- Using lighter agricultural equipment to prevent soil compaction and environment-friendly forestry equipment (reducing negative impact of mechanization on forest soil).
- Adoption and controls of compliance with sufficiently effective anti-erosion decree on agricultural land.
- Increasing the share of organic matter in the soil for example by prioritising livestock fertiliser and compost over industrial fertiliser and other methods.
- Imposing measures combating degradation of forest soil and reclamation of already degraded forest soils.
- Using less intensive farming methods, supporting natural diversity of wood species.
- Increasing controls of adherence to cross-compliance requirements in farming.
- Methodological guidance of control bodies and their education.
- Prioritising development of already used land, especially brownfields over green field construction.
- Reviewing economic instruments to achieve higher protection of agricultural soil against development.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoA, MfRD

Indicators

- 3.1.2a Quality of agricultural and forest soil
- 3.1.2b Erosion and compaction of agricultural soil
- 3.1.2c Consumption of plant protection products and mineral fertilisers
- 3.1.2d Land occupation

Sources of funding

- CAP – CAP Strategic Plan 2021–2027
- RDP – Rural Development Programme 2014–2020
- OPE – Operational Programme "Environment"
- InterReg – European Regional Cooperation Programmes

Specific objective 3.1.3: Non-productive functions and ecosystem services of the landscape, especially of the farmed land, ponds and forests, are strengthened

Landscape is important for provision of productive as well as non-productive, so-called ecological functions and for preservation of cultural and civilizational values of a given area, including urban, architectural and archaeological heritage. In the Czech Republic, most of the landscape has long been intensively used for production purposes which resulted, especially in the second half of the 20th century, in a considerable unification of the landscape and in the loss of small landscape elements such as wetlands, reservoirs, hedges, boundaries, copses etc. This in turn caused further damage and continues to have the potential to disrupt the preferred production functions (wood production, food production, clean water). An example of such disturbance may be soil degradation, which is the cause of increased surface run-off. Particles transported by such run-off subsequently cause water eutrophication and clogging of water reservoirs and ponds by sediments. It is only in recent decades that emphasis has been placed on eliminating inappropriate modifications, increasing mosaicism and generally improving the functional condition of ecosystems and landscape structures, which are tied to important ecological-stabilizing functions of the landscape. Another example may be soil and water contamination [objective 1.3] due to application of plant protection products in order to ensure or increase production levels. Contamination also negatively affects desirable animal species such as pollinators or soil organisms, which are essential for the production function of the landscape.

In terms of landscape use, the most important sector is agriculture which, in addition to the production of agricultural commodities, also performs a number of other functions, for example, environmental or socio-economic functions. Non-productive environmental functions include, in addition to soil protection including anti-erosion, water retention in the landscape as well as general protection of nature and creation of landscape. These include maintaining a natural balance, protecting and promoting biodiversity in agricultural ecosystems, preserving ecological stability of natural ecosystems and protecting close-to-nature communities of plant and animal species in the open country and in protected areas. These functions are ensured by general landscape protection, especially by creating territorial systems of ecological stability within the landscape, protection of important landscape elements, by sustainable agriculture with balanced plant and animal production and by responsible water and forest management practices.

Biodiversity on agricultural land is partly supported by the so-called agri-environmental-climate measures and by ecological agriculture. The system of agricultural support, including cross compliance,

should guarantee a sustainable use of agricultural land. However, there is still a lack of sufficient support for targeted environmental advice and training for farmers.

Ecological agriculture utilizes environment-friendly practices and promotes landscape biodiversity by banning use of conventional agrochemicals and GMO inputs. It is used especially in areas with disadvantaged growing conditions. Therefore, a large part of ecologically managed agricultural areas is occupied by permanent grasslands which host and widely use native species and plant varieties. The acreage of ecologically farmed land is however growing only very slowly and its potential has not yet been fully exploited. The adverse environmental effects of ecological agriculture are generally lower than in the case of conventional agricultural practices, and for those reasons ecological agriculture is preferred especially in areas where water sources are protected.

The goal of territorial planning is to move towards a harmonious arrangement of a territory, to enable its appropriate use and to ensure protection and development of its values. Territorial planning also regulates land use with regard to protecting the needs of its living segments. The **territorial system of ecological stability** (TSES) plays a crucial role here. Its purpose is to connect habitats with relatively high ecological stability, where development of natural, especially plant, communities is enabled. Development of this continuous network of areas should ensure basic spatial conditions for the preservation or restoration of diversity of native biological species and their communities and have a positive effect on the surrounding less ecologically stable parts of the landscape. According to the Nature and Landscape Protection Act, implementation of TSES constitutes a public interest requiring involvement of landowners, municipalities and the state. Important landscape elements also play an essential ecological role within the landscape, many of which (for example, valley floodplains) are also important for the water regime and water retention capacity of the landscape.

Permanent grasslands forming a part of the agricultural landscape serve as a natural filter of rainwater, reducing infiltration of nutrients and harmful substances into deeper layers of the soil profile, or leaching of these substances into groundwater; grasslands also reduce surface run-off of harmful substances into surface water sources and thus prevent eutrophication. In the drinking water sources' protection zones, grassland helps in maintaining good chemical and physical properties of the soil. Agriculture and forestry also have an impact on the scenic qualities of the landscape (character of landscape).

A substantial part of the Czech landscape is covered with **forests**. Forests are the source of wood as a renewable raw material, biodiversity, they play an important role in the global carbon cycle, in balancing the aquatic environment, regulating erosion and thermal regime of the landscape, in preventing natural hazards, but also in providing social and recreational opportunities for the society. In the Czech Republic, forests are still dominated by mostly contemporaneous forest stands established in the past, with unsuitable spatial composition, with little or no mixing, which is the result of former orientation towards spruce or pine growth in particular. At present, a significant part of these forests is affected by the ongoing bark beetle calamity and by influence of other biotic (fungal pathogens) and abiotic (long-term drought, extreme wind) harmful factors. Due to the limited possibilities of utilising natural forest regeneration processes in large calamitous open clearings, especially in nutritive and enriched stands with missing fruiting trees and irregular availability of seeds and tree seedlings that are more resistant to extreme events associated with climate change, the forest owners do not always use the whole range of suitable tree stands for artificial regeneration. Therefore, certain parts of the calamitous clearings are again re-forested by spruce as a preparatory tree species, which will sooner or later need to be replaced with more resistant **composition of target tree species** due to changing habitat conditions. Leaving a part of the fallen **wood to decay** also makes a significant contribution to the stability of forest stands and to forest biodiversity. In cases of deliberate felling,

the economic method of wedge or group felling with formation of smaller clearings still prevails. At the same time, the share of undergrowth economy is increasing. The selective method of management in economic forests has been applied so far only marginally by their owners. Felling and dragging of trees carried out by unsuitable technologies for the given climatic conditions, or by insufficiently qualified staff, can be a cause of erosion or compaction of forest soils and also the reason for implementation of artificial drainage. Secondary waterlogging of large-scale calamitous clearings constitutes a specific negative situation which affects successful forest regeneration. This situation however cannot be solved, albeit temporarily, by drainage of such sites, but only by planting of suitable species of preparatory and target trees. It is absolutely necessary to adapt forest management to the changing conditions due to climate change, including adaptation of the recommended target tree composition in forests, proportion of dead wood residue, etc.

Large populations of cloven-hoofed game constitute a significant obstacle to the natural regeneration of forests. Game causes considerable local damage to younger growths, but also to agricultural and other land (especially in the case of the wild boar). At the same time, the risk of spreading diseases, including those communicable to livestock (for example, African swine fever), is growing. Effective reduction of cloven-hoofed game populations will be necessary in order to ensure a balance between these populations and the conditions of forests. In connection with this process, it will be necessary to implement other forestry and game management measures that contribute to the renewal of forest stands.

Water reservoirs in landscape are built for various purposes – as retention reservoirs for flood protection, for fish farming, recreation, storage (water supply, fire-fighting, for irrigation), reservoirs protecting flora and fauna and for other purposes. In addition to their main purpose, construction or renovation of a reservoir can also achieve a number of other beneficial effects. One is an increase of the water supply in the landscape, although in comparison with water retained in the permeable soils, in floodplains and in wetlands, it is usually a passive supply. In some cases, reservoirs have a beneficial effect on local shallow groundwater supply due to seepage of water into its surrounding space. If there is a retention space, reservoirs may contribute to softening down the effects of flooding. Flow-through reservoirs may improve quality of the flowing water, depending on the type of water management in place and the water retention time. Multi-purpose water reservoirs may also serve to improve flood prevention measures, for more effective drought management and certain mitigations of climate change effects.

Small reservoirs in particular represent important habitats for aquatic and wetland species of plants and animals. From the perspective of nature, the most valuable parts of the reservoir are the littoral zone and the shores in immediate vicinity. The littoral zone is associated with reproduction of amphibians, spawning of fish, nesting of water birds, occurrence and reproduction of small aquatic animals that serve as food for fish and birds. The eco-stabilization function of small water reservoirs as important landscape elements depends on suitable water management arrangement of the reservoir, on its favourable layout and location within the landscape and on the proper forms of its subsequent use and management. Ponds are the most common type of small reservoirs and their primary function lies in production of economically important species of fish or waterfowl. Non-productive functions of ponds (water retention, ecological functions) and compliance with proper management principles ensuring objectives in the area of protection of nature, for example, restriction of fertilization, feeding, etc. are regulated by legislation (Act No. 254/2001 Coll., Act No. 114/1992 Coll., Act No. 99/2004 Coll., and others) and methodologically (Methodical instruction regulating use of harmful substances in fish feed), because excessive feeding, fertilization, liming, excessive fish stock or use of herbicides can have a negative impact on the vegetation component in the reservoir.

A specific factor that affects the landscape and its functions in many different ways is **extraction of minerals**. The extraction itself always constitutes a significant intervention in the landscape and affected ecosystems, but subsequently, with a properly chosen method of **reclamation**, it may create the potential to adequately restore ecosystem functions, and even increase landscape diversity and complement often specific and under-represented environmental types. Use of nature-friendly methods of reclamation, such as natural and controlled succession, preservation of varied morphological or substrate sections etc., contributes to this process. The acreage of extraction areas is currently stagnant while the acreage of sites where reclamation has been completed is growing (including reclamation by nature-friendly methods).

The improved structure of the landscape complemented by land consolidation [objective 3.1.1] may partially compensate some of the anticipated impacts of climate change, which will affect biodiversity and especially endanger rare native species with specific demands on habitats. These include species that are tied, in relation to their habitats, to areas that are farmed using traditional agricultural methods, which have decreased as a result of intensified farming, landscape development and an increase in areas used in the same manner.

In the future, it will be necessary to regularly evaluate the state of the landscape through high-quality and comprehensive monitoring, including acquisition of new data that will contribute to responsible landscape management and increase general awareness of the importance of ecological functions of the landscape and cultural and civilizational values of landscape. This will contribute to an active and responsible participation of the public in the protection, management and planning of the landscape and strengthen general awareness that landscape represents a common cultural and natural heritage and forms the basis of the local population's identity.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- Strategy on Adaptation to Climate Change in the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change (MoE)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- Action Plan for Development of Ecological Agriculture 2020 – 2025 (MoA) and its subsequent updates – in preparation
- Integrated Strategy Supporting Culture (MoC)
- State Forestry Policy Concept to 2035 (MoA)

Types of measures

- Using sustainable methods of management in agriculture and forestry.
- Land consolidation with a view to maintain water regime and reflect climate change.
- Establishment and maintenance of landscape elements and their protection.
- Supporting biodiversity on agricultural land.
- Supporting traditional and environment-friendly farming methods in the landscape.
- Managing permanent grasslands and their use as pastures for economic livestock.
- Reducing size of crop areas.
- Leaving larger share of fallen wood in forests to decay in order to support biodiversity and reduce soil degradation.

- Reviewing recommended target tree species compositions values in forests.
- Promoting forest certification in accordance with international standards.
- Broader use of natural forest regeneration processes, use of a variety of ameliorative and strengthening tree species, preparatory species in re-forestation processes, not limited to extensive calamity clearings.
- Limiting damage to forest stands by effective management of cloven-hoofed game populations.
- Increasing landscape permeability for fauna and humans (by regulating fencing and enclosures in accordance with occurrence and needs of species and ecosystems functions).
- Strengthening non-productive functions of ponds, including littoral development, by supporting development of long-term and sustainable fish farming, by introducing sustainable fish farming standards and by controlling observance of these standards.
- Continuing in the trend of using nature-friendly recultivation methods and increasing acreage of land reclaimed in this manner.
- Utilising benefits of digitalization and research, application and use new technologies for reducing pressures on ecosystems and for controlling observance of standards.
- Respecting, in a sufficient degree, non-production functions of the landscape during territorial planning and in subsequent proceedings.
- Protecting the character of the landscape for example in the form of natural parks.
- Supporting elaboration of territorial landscape studies.
- Ensuring availability of relevant and current information on the state of nature and landscape, including remote sensing data analyses.
- Introduce ecosystems valuation and bring it into practice.
- Supporting targeted environmental consulting and education for farmers.
- Protection of cultural and civilizational values of the landscape.

Responsible authorities

- Responsible Authorities (Administrators): MoE, MoA
- Co-Administrators: MfRD, MoD, MoC

Indicators

- 3.1.3a Organic agriculture
- 3.1.3b Average size of soil blocks
- 3.1.3c Sustainable forest management
- 3.1.3d Development of forest species composition
- 3.1.3e Acreage of Agricultural Land Fund (ALF) used for non-production purposes

Sources of funding

- OPE – Operational Programme “Environment”
- LMP – Landscape Management Programme
- CAP – CAP Strategic Plan2021–2027
- RDP – Rural Development Programme 2014–2020
- InterReg – European Regional Cooperation Programmes
- Programmes of the Ministry of Culture for Renovation of Cultural Heritage Sites (MoC)

3.2. Biodiversity conservation and conservation of natural and landscape values

Strategic objective 3.2: Biodiversity is being maintained within the limits dictated by climate change

Biodiversity is understood as variability of life or ecosystems, species and genes. Its decline is reflected worldwide in the ever-accelerating extinction of species, declining populations of common species, disappearing natural habitats and decreasing genetic variability of organisms. The chief reason for the loss of biodiversity is human activity, which results in overuse and unilateral use of land and natural resources, climate change, pollution of individual components of the environment and the spread of invasive species.

Europe is one of the most anthropogenically affected areas in the world. Nevertheless, compared to other European countries, the Czech Republic still belongs, mainly due to its geographical location, diversity of geological background and historical development of landscape, among areas with a relatively high richness of plant and animal species and natural habitats. The diversity and number of plant and animal species are constantly evolving and changing over time. Approximately one third of the species living in the Czech Republic are threatened with extinction. On the other hand, new species are emerging, either by natural migration due to changes in habitat conditions or by human introduction. However, they are often alien species, in some cases invasive. Changes in the species composition in the Czech nature are largely a reaction to the ongoing climate change on a regional or global scale, but it is necessary to limit pressures of human activity which have a negative impact on the survival of more sensitive, respectively domestic species and ecosystem functions.

In order to support biodiversity, it is essential to improve protection and status of natural habitats and species as a basic precondition for the functioning of ecosystems and to provide appropriate care to the open country and protected areas, to regulate impact of invasive species and protect wildlife kept in human care. It is also essential to raise public awareness with regard to the importance of maintaining functional ecosystems and their benefits for humans, for example, dependence of food production on the presence of pollinators or the importance of natural communities for water retention in the landscape and for mitigating the effects of drought. Additional potential lies in the legislation for selected areas, for example updating the list of specially protected animal species.

Protecting species and habitats, entire ecosystems and the links between them, and ensuring their sustainable use also constitutes a commitment of the Czech Republic arising from international treaties and the EU law, such as the Convention on Biodiversity, the Berne Convention, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Council Directive 92/43/EEC[58], Council Directive 2009/147/ES[59] and others. Additional and new ambitious objectives in relation to biodiversity protection are contained in the EU Biodiversity Strategy. At the national level, the Conservation of Nature and Landscape Act plays an important role in the protection of organisms, natural habitats and ecosystems.[60]

Factors that can potentially endanger the environment, native species as well as human and animal health include genetically modified organisms (GMOs) and genetic products. Within the framework of

[58] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
[59] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds
[60] Act No. 114/1992 Coll., on the Conservation of Nature and Landscape, as amended

precautionary principle, their handling in the Czech Republic is regulated by law and subject to the authorization.

The protection of the world's natural resources also contributes to ensuring genetic diversity (conservation of original genetic resources) and resources for food and agriculture production. The aim of the 'National Program for Conservation and Utilization of Genetic Resources of Plants, Animals and Microorganisms that are Important for Nutrition and Agriculture' is to ensure their permanent conservation, availability and sustainable use.

Specific objective 3.2.1: Condition of natural habitats is improving and species protection is ensured

The basic prerequisite for ensuring favourable conditions for species and their natural habitats is the good condition of the landscape and preservation or restoration of its functions, that is contingent upon careful use of the landscape and appropriate management in particular. The resistance of natural habitats and individual species' populations to external pressures is weakened by human activities that contribute to changing habitat conditions and fragmentation of ecosystems. The rapidly declining permeability of landscape and watercourses reduces potential for further conservation of species, genetic and habitat diversity and in many cases in the past it has led to the extinction of native species in the Czech Republic.

Many **natural habitats** are endangered due to intensive use of the landscape or, conversely, by being abandoned. In some areas, habitats gradually degrade because their existence was contingent upon traditional, presently declining farming methods (pastures, steppe grasslands, light forests maintained by grazing, stump clearing resulting from young forest management, traditional methods of fishing and hunting). Landscape use intensification continues to endanger forest and non-forest natural habitats (for example, preserved remnants of natural forests and biologically valuable cultural forests and peat bogs, species-rich meadows, wetlands). Surprisingly, however, disappearing habitats include those requiring some degree of disturbance by natural factors (for example, river pools) or that are conditioned by human activity blocking natural succession (habitats requiring disturbance of the soil surface, many of which can be found in former military or not-yet-reclaimed areas where raw materials were extracted). Condition of natural habitats is also affected by the **status of species** associated with these habitats. Species' status can be also affected by food availability and contamination of food chains, infection, invasive or expansive species, excessive predation, etc. With the loss of natural habitats in the landscape, many species, for example, birds and bats, find suitable habitat conditions in settlements. Due to their specific living conditions, settlements are also a suitable habitat for alien species.

Human activities in the landscape also result in animals being injured and killed for example after a collision with glass, power lines, vehicles and agricultural machinery, misuse of herbicides and other chemical substances in the landscape etc.

The condition of many species and habitats requires targeted attention and special measures must be taken to improve their condition. Therefore, **rescue programmes** are being implemented for selected species of plants and animals, with the aim to support the status of endangered species, minimize threatening factors (transport, high voltage poles) and increase their populations to levels ensuring their permanent existence.

The increasing transport intensities and growing area of paved surfaces, non-compliance with minimum residual flows in watercourses, inappropriate watercourse modifications and unification of

agriculture [objective 3.1], which is also over-burdened by excessive chemical use, all of which has a significant impact on the **fragmentation of ecosystems and populations**, represents a major and long-term problem for the Czech landscape. An important role is also played by the decrease of transition areas (ecotones), i.e. areas that are characterized by a higher occurrence of species and play the role of refuges in the agricultural landscape. In order to improve the condition of species and natural habitats, it is necessary to maintain connectivity of the landscape and support the effective functioning of the territorial system of ecological stability [objective 3.1.3] and other instruments important for landscape permeability.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- National river basin management plans (MoE, MoA)
- Departmental Strategy of the Ministry of Agriculture of the Czech Republic with outlook to 2030 (MoA)
- State Forestry Policy Concept to 2035 (MoA)
- National Multi-Year Strategic Plan for Aquaculture (MoA)

Types of measures

- Sustainable management of the landscape (sustainable forest, agricultural and fish farming management, including limiting acreage of land dedicated to monocultures, increasing mosaicity, implementation of and protection of landscape elements etc.).
- Providing care to endangered natural habitats and species (endangered by succession, declining forms of traditional farming etc.).
- Protection of natural biotopes, biotopes originating by natural succession and transition areas, the so-called ecotones.
- Utilising the potential of extraction areas, or other areas influenced by human activity, for establishment and conservation of valuable habitats – suitable recultivation of mining areas, disruption of soil surface by heavy machinery etc.
- Implementation of programmes for the protection of endangered communities (biotopes).
- Ensuring permeability of landscape, watercourses and ecosystems' connectivity including TSES functionalities – conserving and recovery of connectivity for movement of animals, removals of transverse structures on watercourses, building fish passes, ensuring a system of functional migration corridors and linkages within a territory in a systemic manner, from territorial planning stages to designing transport and other infrastructure to implementation of specific measures and taking into consideration the need for permeability of the landscape in its use (when erecting enclosures and fencing etc.).
- Implementation of measures preventing injury and death of wild fauna, including methodological definition and creation of binding standards.
- Implementation of rescue programmes for selected endangered species.
- Regulation of species' populations in order to achieve a balanced structure of communities.
- Ensuring areal and continuous monitoring and assessment of species and habitat conditions.

Responsible authorities

- Responsible Authorities (Administrator): MoE, MoT, MoA,

- Co-Administrators: MIT, MfRD

Indicators

- 3.2.1a Landscape fragmentation
- 3.2.1b Common bird species

Sources of funding

- OPE – Operational Programme "Environment"
- Operational Programme Fisheries 2021-2027
- RDP – Rural Development Programme 2014–2020
- CAP – CAP Strategic Plan2021–2027
- LMP – Landscape Management Programme
- InterReg – European Regional Cooperation Programmes
- LIFE Programme

Specific objective 3.2.2: Protection and management of the most valuable parts of the nature and landscape is ensured

Sustainable use of the landscape as a whole is important for protection of nature. Nevertheless, the most valuable areas, representing the most valuable parts of the natural and landscape heritage, must be protected under a special regime using institutionalized protected areas. These are mostly areas with a high number of rare or endangered native species of plants and animals, with preserved natural or close-to-nature habitats and ecosystems and functioning natural processes, or areas having an aesthetic value. In the Czech Republic, these specifically protected areas include **specially protected areas** (national parks (NP), protected landscape areas, national nature reserves, national natural monuments, natural reserves or natural monuments) and **Natura 2000 sites** (Important Bird Areas and Sites of Community Importance defined on the basis of requirements laid down in European Habitat Directive[61] and Birds Directive[62]). Protection of these areas is enshrined in the Nature and Landscape Protection Act,[63] and subsequently in the founding regulations for each specific specially protected area and selected bird areas. Individual conceptual documents are drafted for such protected areas, determining the optimal level of care (management principles for NPs, care plans for other specially protected areas, summaries of recommended measures for Natura 2000 sites). In order to ensure functionality of the entire system of protected areas, it is essential not only to protect individual protected areas and define the necessary degree of care for them, but also to ensure their linkage to other parts of the landscape with a higher degree of ecological stability (a significant factor is a linkage to TSES, migration corridors, important landscape elements, etc.).

Geological formations and caves also represent important objects of natural wealth. Cave ecosystems are highly sensitive to any external influence and protected within the framework of general nature conservation policies. The same level of protection is enjoyed by natural phenomena on the surface (for example, karst ditches, sinkholes, ravines and springs of karst waters) that are related to caves. Many caves are also protected within the framework of special protected areas. The most valuable

[61] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
[62] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds
[63] Act No. 114/1992 Coll., on the Protection of Nature and Landscape, as amended

geological formations with a high aesthetic value are declared to constitute national geoparks, the diversity of which still often remains an under-appreciated phenomenon of Czech landscape. In many cases, these geoparks enjoy a supra-national importance (the 'Bohemian Paradise' Geopark has the status of a UNESCO global geopark, the 'Egeria' and 'Geoloci' geoparks are parts of the Czech-Bavarian European Geopark, etc.). Territorial protection must also include long-term systematic and comprehensive monitoring of the state of the Czech nature and landscape, which will enable timely intervention in identifying deterioration of its state or, conversely, a potential discovery of valuable species.

The act of declaring a protected area may have certain consequences such as regulation of some activities that would have a negative impact on the protected phenomena. The previously predominant influence of industry, in particular, is now often replaced by influence brought about by **mass tourism** and the related development, including development of public infrastructure (hiking trails, accommodation, catering and other services), development of transport capacity (bicycle and ski buses, cable cars) and sports facilities (ski slopes, bobsleigh tracks). However, as tourism may often act as a means of education of the general public, it is desirable to develop its sustainable forms with the participation of local businesses, municipalities and certified destination management organizations and to consistently monitor and evaluate impacts of tourism on the environment and quality of life of local people. However, large numbers of tourists, concentrated in a limited number of sites over small periods of time, not only lead to a reduction in the attractiveness of these sites and their own holiday experience, but often create disproportionate pressures on the environment. Similarly, increasing noise levels and light pollution [objective 1.4.2] due to, for example, extensions of opening hours and interconnections between leisure facilities (ski resorts) represent a problem for endangered species. In order to expand the tourists' interests and reduce the load on the most exposed sites, it will be necessary to set up appropriate tourist management instruments and regulate development of infrastructure, including leisure facilities in other locations and use of the potential of nearby cultural monuments in settlement heritage zones and especially in the surrounding landscape.

The most valuable parts of the nature and landscape represent an important legacy which must be preserved in the best possible condition for future generations. In this context, environment-friendly methods of farming and forestry management and other economic uses of the landscape will remain absolutely essential to achieve this end. Another important factor will be to ensure compliance with and enforcement of existing laws, as well as raising widespread awareness of the importance of biodiversity protection.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- Tourism Development Strategy (MfRD) – *in preparation*

Types of measures

- Ensuring representative development of the most valuable parts of the nature and landscape within the system of specially protected areas and Natura 2000 sites.
- Ensuring existence of linkages between protected areas and other parts of the landscape with a higher degree of ecological stability.
- Protection of landscape phenomena and elements of inanimate nature such as geomorphological and geological formations.

- Ensuring appropriate legislative protection of specially protected areas and Natura 2000 sites, for example, by amending and updating founding regulations, detailed conditions of protection level and objects of protection, establishment of specially protected areas to ensure protection of Natura 2000 network sites.
- Introducing the possibility of contractual protection of Sites of Community Importance.
- Ensuring level of care for protected areas in line with protection objectives for these areas, including embedding this level of care in planning documentation (care and maintenance plans, management principles, summary of recommended measures).
- Managing visitor levels and general tourism especially in national parks and protected landscape areas and in neighbouring areas.
- Setting up of a continuous and area monitoring of the nature and landscape, allowing assessment of its state and trends in the development of objects of protection in specially protected areas.
- Setting up of a continuous and area monitoring for evaluations of impacts of tourism on the nature and landscape and quality of life of local population in specially protected areas.
- Setting up monitoring in order to evaluate the state of objects of protection in Natura 2000 sites.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrators: MfRD, MoC

Indicators

- 3.2.2a Native endangered species according to the Red List
- 3.2.2b Share of specially protected areas and Natura 2000 sites
- 3.2.2c State of species and habitats of Community Importance

Sources of funding

- OPE – Operational Programme “Environment”
- LMP – Landscape Management Programme
- Programme of care for village heritage reserves and zones and landscape monument zones (MoC)
- Regeneration programme for urban heritage reserves and urban monument zones (MoC)
- InterReg – European Regional Cooperation Programmes

Specific objective 3.2.3: Negative impact of invasive alien species is limited

Invasive alien (non-native) plant and animal species are a major threat to biodiversity, related ecosystem services, the economy and, in some cases, human health. Biological invasions are considered to be one of the most significant factors threatening native biodiversity worldwide. In the Czech Republic, the number of known alien species exceeds 2 000, 10 to 15 % of which are considered invasive. The precautionary principle is highly relevant in cases of introduction of alien species. Considering the financial demands and efficiency of eradication activities, it is desirable to prevent their imports and optimize eradication (in time, place) of species already present in the Czech Republic.

It is also absolutely essential that the general public is aware of these issues, including representatives of the public administration, and this is best ensured by continuous education.

Among the best known and most serious examples of alien invasive species, which have already had negative impact on biodiversity in the Czech Republic, include, for example, North American crayfish species (transmitting the crayfish plague pathogen with fatal consequences for all European crayfish populations), some fish species (silver crucian carp, stone moroko) and, in case of mammals, mainly the American mink, northern raccoon or the raccoon dog. In case of plants, examples include giant hogweed, the reynoutria genus plants, the Himalayan balsam, the large-leaved lupine, the Tree of heaven and many others, which tend to create extensive primarily monocultural stands and reduce representation of native species, but which also have many other adverse effects.

In the Czech Republic, prevention and regulation of introduction or planting and dissemination of alien invasive species has so far been addressed only in a limited extent in the Nature and Landscape Protection Act[64] and other related regulation that generally regulates deliberate use and planting of alien species. Active measures seeking to reduce alien invasive species have so far been defined in a rather more conceptual manner and only within the framework of special protected areas (as part of measures specified in individual care plans) and individual projects of various extent that mostly focused on the most important species of invasive plants (giant hogweed, the reynoutria genus plants, the large-leaved lupine or other, as per specific location). From the point of view of local biodiversity protection, international cooperation is essential, both in case of invasive species removals (eradication) and with respect to regulation of their spread and for sharing information on their presence. To this end, the EU adopted a directly applicable Regulation (EU) No 1143/2014 of the European Parliament and of the Council[65] and the organisms on this Union-wide list of alien species are thus prohibited from being imported, traded, bred and cultivated. In order to adapt Czech law to this European Regulation, a comprehensive amendment to the Nature and Landscape Protection Act and other related regulation is currently being discussed, to lay down relevant processes, as well as define competences and impose sanctions. At the same time, it will be necessary to ensure practical fulfilment of the Regulation's requirements, whether in relation to monitoring invasive alien species or implementing measures preventing and regulating their presence, for which appropriate conditions (organizational, financial) have not yet been created. An expert discussion should also continue on the topics of approach to other invasive alien species (not included in the EU list), taking into account the needs of biodiversity protection at national, respectively regional and local levels.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- National Action Plan on Adaptation to Climate Change in the Czech Republic (MoE)

Types of measures

- Ensuring eradication or, as the case may be, isolation and regulation of invasive alien species.
- Strengthening human resource and financial capacities for monitoring of invasive species and for international cooperation, especially with neighbouring countries.

[64] Act No. 114/1992 Coll., on the Protection of Nature and Landscape, as amended

[65] Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species

- Financial and methodological support of competent bodies and responsible parties (persons) in the area of invasive species.
- Educating professional public and public administration officers.
- Raising awareness of the general public about risks associated with invasive species, introductions of alien species, including their potential degree of risk etc.
- Within the framework of research, carrying our assessments of invasive alien species' impact on the landscape, formulating methods and approaches that have the potential to mitigate associated risks, and identifying potentially invasive species on the Czech territory.
- Identifying risks and priorities above and beyond the framework of the Union-wide list of invasive alien species on the national level.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrators: MoA, MIT, MO

Indicators

- 3.2.3a Invasive alien species

Sources of funding

- OPE – Operational Programme "Environment"
- LMP – Landscape Management Programme
- PNRLF – Programme for Natural Restoration of Landscape Functions
- InterReg – European Regional Cooperation Programmes
- LIFE Programme

Specific objective 3.2.4: Protection of wild animals in human care is ensured

Trade in protected species is regulated by Council Regulation (EC) No. 338/97 and its implementing regulation and, in the Czech Republic, by the Act on Trade in Endangered Species[66] (CITES) and Decree No. 210/2010 Coll.,[67] implementing this Act. Illegal trade in endangered species, so-called wildlife crime, is one of the world's most widespread areas of crime. Besides illegal profits associated with this criminal activity and other manifestations of crime, wildlife crime can cause direct and indirect threats to populations of endangered species. Additional risk also lies in introducing infectious diseases, parasites or invasive alien species, which can cause significant economic damage. The Czech Republic belongs among countries in the European Union with the highest levels of trade in live animals and plants, which is also reflected in the level of illegal activities, where the Czech Republic plays an important role as a destination and transit country. Cases occurring in the Czech Republic demonstrate that it is not merely individual traffickers but also organized groups that operate here. Especially problematic situation in the Czech Republic arises in connection with large Asian communities that focus, among other things, on trade in profitable types of animal goods (ivory, rhino horns and tiger products).

[66] on the protection of species of wild fauna and flora by regulating trade therein and on further measures for protection of these species and on amendment of several acts (Act on trade in endangered species CITES), as amended
[67] Decree No. 210/2010 Coll., on Implementing Certain Provisions of the Act on trade in endangered species

Activities carried out by **zoological gardens** (ZOOs) are immensely important for the protection and conservation of species on international scale. While they serve primarily as recreational facilities, they also at the same time educate the general public in many ways and assist in expanding scientific knowledge, and contribute to conservation of many endangered species and their environments – from ex-situ breeding of endangered species to reintroduction of many animal species, to in-situ conservation of species, populations and natural habitats. in the Czech Republic, operation of ZOOs is regulated by the Zoological Gardens Act[68] and all ZOOs are subject to licensing. Most Czech ZOOs are members of major international organizations.

In addition to ZOOs, endangered animal species (subject to CITES) in the Czech Republic are often bred by private breeders, who do not always provide their animals with adequate breeding conditions. At the same time, keeping various animal species (for example, such as pets, or exhibits in circuses, kennels and private mini-ZOOs) does not always meet safety standards and can cause personal injury. The problem lies in the lack of licensing requirements for entities providing ecological education and edification, or insufficient control of the manner of carrying out this education by entities outside the state and public administration. Specimens of protected species bred in human care are often used in these instances, and the public mistakenly gets the impression that any captive breeding is good for protection of the species. A similar problem that continues to exist in relation to educating the general public, and in relation to endangered species' protection, is the persistent dressage and performance of selected groups of animals in circuses, where animal species are presented in unnatural conditions and without respect for their biological and ethological needs.

Every year, a large number of injured, sick, exhausted, immature or otherwise handicapped specimens (of common species) of wild animals also come into human care in the Czech Republic. Especially in case of rare and less numerous species, such individual rescues represent a great benefit for the entire population – if carried out by qualified staff in **rescue stations**. Rescue stations provide handicapped animals with comprehensive care from the first aid, through necessary veterinary treatment to rehabilitation and release back into the wild, which is the primary goal of their care. In the future, the goal is not to increase the number of animals in the rescue stations' care. Therefore, education and edification are also an important function of rescue stations, enabling active cooperation with the informed public in implementation of preventive measures to reduce animal injuries, but also to limit interventions to rescue animals (and place them in rescue stations) only to individual specimens which actually require human care.

Strategies implementing SEP objectives

- Biodiversity Protection Strategy of the Czech Republic (MoE)
- State Nature Conservation and Landscape Protection Programme of the Czech Republic (MoE)
- National Strategy for Combating Illegal Killing and Poisonings of Wild Fauna in the Czech Republic 2020–2030 (MoE)
- Action Plan for Combating Illegal Trade in Endangered Species of Animals and Plants 2023 (MoE)

Types of measures

- Strengthening enforcement of the law in the area of the environment and international cooperation in combating illegal trade in endangered species.

[68] Act No. 162/2003 Coll., on the conditions for the operation of zoological gardens and amendment to some laws (The Zoological Gardens Act), as amended

- Creating sufficient capacity to house confiscated animals.
- Supporting professional activities of ZOOs and rescue stations.
- Edification of the general public about issues associated with illegal trade in endangered species.
- Defining standards for private keepers and breeders involved in ecological education.
- Tightening conditions for keeping and breeding and limiting the number of specimens of one species of protected animals kept in private facilities, including carrying out effective inspections.
- Edification of the general public about handling found wild fauna.
- Limiting the number of animal specimens that are used in circus performances.

Responsible authorities

- Responsible Authority (Administrator): MoE
- Co-Administrators: MoI, MoA, MoJ

Indicators

- 3.2.4a Share of confiscated protected animals that were poached or illegally transported on the total number of imported animals
- 3.2.4b Breeding of specially protected and endangered animal species

Sources of funding

- OPE – Operational Programme “Environment”
- LMP – Landscape Management Programme
- Contributions provided to Zoological Gardens

4. Cross-sectional instruments

Mix of instruments for implementation of the State Environmental Policy between 2020 and 2030

The listed typology of instruments implementing the State Environmental Policy represents a broad instrument mix and corresponds to the current experience and state of knowledge. Each category of instruments also lists specific examples of utilising a given instrument. These examples serve for illustrating the actual application of instruments during implementation of SEP 2030. The purpose of this instrument mix is to provide a comprehensive perspective of issues associated with various possible interventions by the state administration bodies in order to select the most efficient solution. The actual shape of an optimal solution may change significantly in the next 10 years due to external conditions as well as due to availability of new solutions.

Instruments of direct regulation and exercise of state administration

Administrative and Legal instruments

Administrative and legal (legislative) instruments have represented the fundamental pillar of global environmental policy over the last 50 years. These instruments impose obligations in the form of various bans, directives and restrictions which imply that the addressees have an obligation to refrain from doing something, to tolerate something or to do something in the interest of protecting the environment. This set of instruments also includes various permitting procedures and decisions and opinions arising from law. These instruments form the basis of the Czech and European environmental protection policies and in the next 10 years this is not expected to change significantly.

- Technical amendment of parts of relevant Acts and Decrees
- New and revised legislation reacting to new needs, discovered trends pursuant to environmental monitoring, developments in EU legislation and other international commitments – *for example, amendment and expansion of legislation addressing transition to the circular economy*
- Reviews of regulation, amendments and adjustment of long-term different conditions in legislation
- Control and enforcement of issued decisions
- Definition and adjustment of administrative standards and limits – *maximum air pollution limits for given substances, water quality status*
- Categorization of protection levels or sources of harm for the environment and natural and cultural values of the landscape – *Stabilization and expansion of established protected landscape areas, Natura 2000 sites, cultural heritage zones and update of their founding regulations*
- Definitions of specific obligations, sanctions and exemptions – *prohibited landfilling of recoverable waste*

Institutional and organizational

These are instruments resulting from legislation which should in particular meet the criteria of effectiveness, proportionality and controllability, and which should be coordinated so as not to impose a disproportionate administrative burden (both for the institution and for the audited entity). Furthermore, these instruments streamle the actual functioning of public administration bodies and exercise of their activities.

- Market supervision and control – *controls by the Czech Environmental Inspectorate (CEI) on fulfilment of obligations in handling of chemical substances according to REACH, control of waste management processes*
- Safety measures – *enforcement of the Act on prevention of serious accidents*
- Preventing and limiting impact of risks – *Flood committees, Regional drought committees , etc.*
- Introducing quality management systems for projects and services provided by public administration
- Modifications of the status, competences and activities of a public administration body – *consolidation of permitting procedures*
- Legal enforcement and exercise of decisions issued by a competent environmental protection authority - *CEI, other nature protection bodies*
- Estimates of regulation impacts and review of its efficacy – *ensuring personnel capacities and procedural implementation of previously not existing efficacy reviews of draft bills, adjustment of RIA (regulatory impact assessment) within the meaning of SIA (strategic impact assessment)*
- Increasing the efficiency of ministerial cooperation and strengthening the "ownership" of implementation measures
- Amendment of internal processes, creation of project-oriented intra-departmental networks and specialized working groups outside standard hierarchy

Methodological

Instruments of a methodological nature represent a logical framework that acts as a guide in solving a given problem. Methodical guidance in a certain area enables an effective exercise of state administration at the level of ministries, regions, municipalities, national parks, etc. The aim of the methodological work is to unify procedures where desirable, and to utilize examples of good practice.

- Publication of methodological manuals
- Certification of methodologies produced by a research project
- Methodological support of public administration bodies in certain territories – *Local Agenda 21, nature protection bodies*
- Methodological guidance of state administration bodies in specific areas – *SDG, Smart Cities, responsible public procurement*

Information instruments

Information systems and transition to digital public administration represents an independent corpus of the instrument mix as it occupies a very specific position. Digital solutions are often linked to the material performance of an agenda or specific public administration services. The digital solution itself can then represent a service as such, especially in the case of data processing automation in public administration, its publication and ensuring open access to data. The gradual increase in the importance of data science and instruments such as big data represents another logical step for development and streamlining of public administration in the environmental area. For example, in the area of monitoring the behavioural aspects of population or complex, previously hidden relationships for a higher level assessment of potential impacts of interventions. Information instruments enable strategy assessments which form an integral part of effective strategic management in all its phases. Assessments facilitate definition of objectives for strategic documents and monitoring their fulfilment.

- Information systems for the environment – *IS for Statistics and Reporting (ISSaR), Waste Management Information System (ISOH) and other existing and new/additional IS*

- Utilising remote sensing techniques – *use of satellite data produced by the European Copernicus service for monitoring and assessment of the state of the environment*
- Utilising open data principles to allow the public, enterprises and NGOs to process the data to create added value or discover a whole new potential use of the data
- Analysis of hidden relationships using big data and data science

Innovative public administration instruments

In addition to the traditional instruments according to the typology, it is also appropriate to engage innovative procedures for streamlining public administration services:

- Service tracing, service scenarios, "blueprint" services (from the customer perspective) – this involves mapping of processes, phases and actors engaged in providing a service, which are directly related to the customer's requirements, with the aim of improving customer satisfaction (customer-friendly service) and making services more efficient.
- Systemic thinking approach, objective-lead innovation and eco-innovation, prototypization etc.
- Verification of experimental solutions and "sandboxing" should form an integral part, especially the regulatory sandbox which is applicable for example in the energy sector when testing and discovering new methods of future market regulation. In this case, the sandbox is an artificially defined environment for testing the functionality of alternative forms of regulation (this environment can be modelled, but also real). For example, a fixed time-limited region where different approaches are tested than those applied at the national level.
- Experimental verification of effectiveness - *experiments with control groups* (*identification and testing of behavioural aspects of a policy*)

Economic instruments

Market instruments

Economic instruments help to redress market failures through market mechanisms in the event of prior failure to take negative externalities into account. Negative environmental impacts caused by individuals or specific legal entities are borne by the entire society or its part, have an impact on the quality of life of the population, have repercussions for the economy itself and are often financially remediated through public expenditures. Well-defined taxes (and other market instruments, for example allowance trading) lead to an efficient allocation of resources, enable an organic development of technologies and adaptation of the actors involved (in the market). At the same time, in many cases they are more efficient both administratively and in terms of achieving environmental objectives compared to regulatory instruments, especially in case of a large number of regulated entities. However, the administrative burden, especially in connection with tax collection, is increasing with an increasing number of exceptions. Last but not least, they allow a better development of new solutions to problems.

- Reflecting ecological aspects in tax and fee rates and other similar economic instruments with the aim of effectively achieving their regulatory function – energy taxes, fees for extracted minerals, looking into potential alternative and stimulating taxation schemes, public water offtake-related charges etc.
- Tradable allowances – *market system for emission allowances EU ETS*

- Responsibility and compensation schemes – *controls of implementation of compensatory measures in cases of territorial violations within the Natura 2000 network*

Financial instruments

Financial instruments represent a proven positive financial motivation for socially desirable behaviour and decision-making of corporations and individuals. Due to some uncertainty regarding the form of the future EU multiannual financial frameworks, amounts of national funding achieved and the extent of supported areas, it is necessary to create a sufficiently diversified mix of financial support programmes, and at the same time significantly deviate from the primarily subsidy-oriented form of the programmes. It is obvious that without the mobilization of private capital, public budgets alone, even with EU funds, will not be sufficient to finance necessary investment projects. An illustrative list of different types of financial instruments, their use and specific significant financial funds and programmes for 2020-2030 is given below.

- Subsidies and financial support – national programme financing – *National Programme "Environment", Landscape Management Programme, Programme supporting NGOs, Programme for Natural Restoration of Landscape Functions and programmes run by other ministries (MoC programmes in cultural heritage sphere, MoA programmes etc.)*
- Subsidies and financial support – European programme financing – *ESI funds, Norwegian Grants, Common Agricultural Policy, Just Transition Fund, Modernisation Fund*
- Direct public investment from the state budget – *public procurement, especially through responsible and green public procurement (including criteria supporting circular economy or bioeconomy – for example support towards the use of wood and natural materials)*
- Guarantees and assurances, loans – ESI funds, use of financial instruments in export policies or broader use of insurance against natural risks – *InvestEU 2021-2027*
- Preferential loans and capital input – *brownfield re-development*
- Technical assistance – *energy savings*
- Incentive schemes within the framework of financial instruments ("capital rebates") – a portion of otherwise refundable support may be, in case of a preliminary fulfilment of defined objectives, retained by the developer as a form of remuneration for achieved efficacy (energy savings, innovative support etc.)
- Combined financial instrument – investment platforms – for public administration, public buildings etc.
- Mobilization of private financing – development of green bonds, transparency in labelling of financial products and investment on the market from the perspective of their environmental impacts (using EU taxonomy for sustainable finance), use of the so-called "blended finance" – combination of public and private investment (equity investment)
- Payments for ecosystem services – for example voluntary public/PPP/private financial schemes for forest owners, who will receive reimbursement for provided non-market ecosystem services for the society/municipality as a compensation for higher cost and reduced financial yield due to provision of ecosystem services by their forests (motivation for sustainable management and protection of forests in a situation of declining logging revenues)
- Modernisation Fund – using revenue generated by allowance trading to modernize and innovate industrial and energy-sector base of the Czech Republic
- Financial instruments within the framework of Operational Programmes – OPE, OPTAC, OPT etc.
- Just Transition Fund – support of coal-mining regions for transition to climate-neutral economy and development of social programmes mitigating the impacts of such transition

- Recovery and Resilience Facility – implementation of environmental and climate-related components of the National Recovery and Resilience Plan
- Revolving fund – (providing loans to achieve energy savings and using the revenue and principal repayments for additional financing)
- Financial products of the European Investment Bank, CMZRB and PPP projects
- InvestEU – mobilization of private investment and support to transformation projects of European importance
- National development fund – use of "blended finance" (combination of public and private financing) for investment projects with a significant social impact
- *The issue of financial subsidies also involves the need to eliminate environmentally harmful subsidies and support - for example, by eliminating subsidies for use of fossil fuels in the form of tax exemptions or social support of coal for household heating and their replacement with less environmentally harmful forms of support*

Research, development and innovation

The RDI support instrument leads to reductions of negative effects of human activities on the environment in the long run, ensuring remedy and elimination of damage, as well as monitoring of changes in the quality of the environment. New technologies and business models also represent considerable potential for protecting and improving the environment and for sustainable economic growth. Specific areas for RDI support in relation to the environment are listed in the MoE's RDI Concept and are further prioritized within the framework of the Environment for Life Programme and its individual competitions/challenges.

- Social innovation – new business models for sustainable consumption, sharing economy, shift in the assessment of impacts toward complex relationships between water, energy sector and food security
- Technology innovations and eco-innovations for increasing competitiveness and creation of 'green' jobs – new technologies, materials, techniques and innovations for improving the quality of the environment (small modular reactors and micro-reactors, geo-engineering, carbon capture and storage (CCS) technologies, nano-materials etc.) and their support through responsible public procurement, for example, innovation partnership procedures.
- Monitoring and assessment of new technological and social trends and publication of their potential impacts on the environment – for example, risks associated with geo-engineering, carbon capture, blockchain, application of small modular reactors and micro-reactors.
- Applied research in the area of the environment and landscape management in order to increase public administration efficacy, improve the state of knowledge in relation to given issues etc.

Voluntary instruments

Voluntary instruments positively motivate desirable behaviour. Specific applications usually take the form of using standardized instruments such as EMAS or eco-labelling, etc. In addition to these standards, openly demonstrating the actual pursuit of sustainable behaviour, especially responsible public procurement for public administration is essential, which has a significant incentivising effect in terms of influencing the markets of required products and services providers. For example, by requiring specific certifications or eco-labels for products or services in public procurement. In addition to these commonly used instruments, we can name voluntary commitments of corporations, individuals and non-profit organizations, which themselves commit to a higher standard of

environmentally responsible behaviour. The Czech Republic will also consider closer voluntary cooperation with industries and associations in order to achieve an environment-friendly state of affairs without resorting to direct or stricter regulation. A very special category is the so-called nudging, which uses behavioural sciences and tries to change traditional behaviour patterns of the population through sophisticated non-financial motivation (and without limiting the choice of available options).

- EU Ecolabel and environmentally friendly products/services – voluntary certification according to EU conditions
- Green Key – certification of ecological services in tourism
- Environmental management systems – EMAS, ISO 14001 etc.
- Responsible public procurement – wider use in public administration according to relevant methodology
- Ecological governance – responsible and sustainable behaviour in public administration
- Voluntary agreements and open coordination methods – voluntary commitments assumed by corporations with related state guarantee providing long-term legislative certainty, for example, commitments assumed by manufacturers above legislative requirements – "beyond BAT" commitments
- Voluntary commitments – voluntary corporate commitments reducing plastics and packaging, platform of voluntary commitment for sustainability in the Czech Republic 2030
- Other activities – indirect, non-financial motivation supporting environmentally responsible behaviour (for example, adjustment of marketing processes – changes in presenting products and services leading to presentations of environmentally friendly products in visible places in stores; changes to the basic "default" option to 100 % RES option when selecting new electricity supply services etc.), open platforms for sharing examples of good practice.

Environmental education and edification and volunteering in the protection of nature and landscape

This is a long-term, systemic and preventive instrument for reducing future environmental damage associated with insufficient information and lack of competencies in decision-making processes. In addition to standard education and upbringing of children and adolescents, it also includes awareness-raising campaigns for the general public and support for civic activism and participation in the protection of the environment.

The content, forms and methods of EEE need to be based on the State EEE and EC Program 2016-2025 and updated in the context of the European Green Deal. EEE and education for sustainable development can play an important role in influencing responsible pro-environmental behaviour, especially in relation to tackling climate change and achieving climate neutrality by 2050.

- Development of sustainable and environmentally responsible individual behaviour, for example, by providing continuous support to ecological education centres and ecological consulting services including voluntary certification of services provided by these establishments and quality of their ecological education programmes with an emphasis on field training
- Provision of formal and informal education to children and youth – strengthening environmental education and education for sustainable development as a cross-cutting principle in the Framework Educational Programmes, support of teachers' education, support of undergraduate training of teachers in the fields of ecology, environment sciences and

environmental didactics, systematic support of environmental education programmes and long-term supra-regional educational projects
- Development of public administration competencies - programme supporting responsible behaviour in public administration offices, environmental and sustainable education in such offices, programme supporting responsible public procurement
- Environmental consulting, awareness-raising and information campaigns for the general public - for example, #*Enough plastic*, competitions - for example, *Conversion of waste into resources*, edification and preparation of the population for emergencies and disasters, verification and transparency of environmental data
- Development of environmental topics in the lifelong education system
- Development of public involvement in the protection of environment in the form of the so-called "citizen science," where scientific research is carried out entirely, or in part, by amateur scientists
- Development of volunteering in the protection of nature and landscape
- Active communication with the general public combating untrue stereotypes or biased, unfounded and false information ("fake news," alternative facts, deep fakes)
- Supporting civic involvement in environmental issues
- Edification about innovations and their potential impacts – energy intensity of new technologies etc.

Other instruments:

Strategic management instruments

Instruments of strategic nature need to be applied for a successful implementation of any public policy. Without active involvement of all stakeholders, professional and general public, environmental objectives cannot be satisfactorily achieved. These instruments are mainly of a procedural nature and contribute to improving the effectiveness of strategic work conducted by the public administration.

- Participation – involvement of all relevant actors (ministries, research organizations, interest groups, non-governmental and non-profit organizations, landowners) and the general public in the preparation and implementation of strategic documents – public consultations
- Supporting transparency and open communication
- Greater interconnection between strategic management and territorial planning processes
- Deliberation – moderated and rule-based structured discussion of specific issues with relevant actors and the general public. This approach ensures stronger engagement of professional and general public in resolving problems and public decision-making processes using experienced facilitators and consulting techniques (world café format, deliberative polls, etc.)
- Active management of implementation and coordination in the area of other sector-specific policies
- Elaboration of implementing plans, action plans and subordinate strategies in a given area

Monitoring

Measuring and monitoring developments in the state of the environment as well as individual steps in achieving objectives represents a necessary condition for effective implementation of the SEP. Monitoring instruments have two aspects - measuring the success of a chosen solution and informing the public about impacts and state of the environment in which they live. These aspects must be taken into account when using these instruments as well as when defining what purpose the given instruments or indicators should serve. The overall monitoring must also be complemented by aspects

relating to impacts on the quality of life of the Czech population, as unpredictable side effects of all public policies can be crucial for their success and public acceptance.

- Further development of indicator system mapping the state of the environment – *use of new information systems for statistics and reporting and the Waste Management Information System (ISOH), the INSPIRE National Geoportal, improvement of the measuring network, use of quality-of-life indicators to examine side effects in the implementation of new measures*
- Ensuring consistent and long-term measurement for sufficient time series, robustness of data and reliability of monitoring
- Use of remote sensing techniques – *measuring temperature and humidity of surfaces, mapping ecosystem services, changes in the landscape, etc.*
- Use of innovative monitoring methods – *blockchain*
- Development, research and promoting of mapping and assessments of ecosystem services, ecosystem accounting, interconnection with national accounts

Instruments of international cooperation

The Czech Republic is not an isolated country whose environment is influenced only by its own activities, but forms a part of a broader European ecosystem (natural, cultural, economic and political). International cooperation and coordination are crucial for successfully resolving a number of environmental problems or undesirable transboundary impacts. The Czech Republic will actively use its membership in international organizations and cooperate with its bilateral partners, especially neighbouring countries. The Czech Republic will continue to declare its global responsibility as a country with a fully developed economy and will actively contribute to the implementation of universal sustainable development objectives and fulfil its global commitments.

- Multilateral environmental agreements
- Bilateral environmental agreements
- Cooperation within the framework of international organizations and other platforms – *UN – UNESCO, UNEP, HLPF, UNECE, UNDRR; EU; Council of Europe; OECD; V4 and others*
- Foreign development cooperation and humanitarian assistance – *official development cooperation, project cooperation, Development Programmes CzechAid and CMZRB, technical assistance to developing countries including transfers of knowledge and technology*
- International funds within the framework of development cooperation (GEF, GCF)

Overview of areas of responsibility for individual specific objectives

Specific objectives/ Responsible authorities A = Administrator, C = Co-Administrator	MoE	MfRD	MoA	MPSV	MoT	MIT	MEYS	MoI	MFA	MFin	MoC	MO	MoH	MoJ	SONS	ERO
1.1.1 Surface water quality is improving	A		A			C							C			
1.1.2 Groundwater quality is improving	A		A													
1.1.3 Drinking water supply of suitable quality to the population is improving	A	C	A										C			
1.1.4 Wastewater treatment is improving	A		C													
1.1.5 Water efficiency, incl. water recycling, is improving	A	C	A			A							A			
1.2.1 Emissions of air pollutants are decreasing	A		A		A	A				C						
1.2.2 Ambient air quality standards are being observed	A		C		A	A										
1.2.3 Transboundary transmission of pollutants is decreasing	A								C							
1.3.1 Emissions and leaks of hazardous chemicals into all environmental components are decreasing	A		A			A		C				C	C		C	
1.3.2 Contaminated areas, incl. old ecological damage, are monitored and effectively sanitised	A	A	C			A				C		C				
1.4.1 Noise pollution of the population and ecosystems is decreasing	A	C			A	C					C		A			
1.4.2 Light pollution levels are decreasing	A	C			C	C					C		C			
1.5.1 Preparedness, resilience and adaptation to weather extremes is increasing	A	A	A		C	C		A			C					
1.5.2 Negative impacts of extraordinary events and emergencies of	A	C	C		C	C		A			C					

Specific objectives/ Responsible authorities A = Administrator, C = Co-Administrator	MoE	MfRD	MoA	MPSV	MoT	MIT	MEYS	MoI	MFA	MFin	MoC	MO	MoH	MoJ	SONS	ERO
anthropogenic or natural origin are minimised																
1.5.3 Occurrence of extraordinary events and emergencies of anthropogenic origin is minimised	A					C		A								
1.6.1 Settlements effectively adapt to climate change-related risks	A	C				C		C								
1.6.2 Settlement development is conceptual, brownfields and built-up areas are developed preferentially	A	A	C		C	C		C			C					
1.6.3 Settlements run effective water management systems, incl. rainfall management	A	A	C			C										
1.6.4 Quality of green infrastructure, contributing to better microclimate in settlements, is increasing	A	A									C					
2.1.1 Greenhouse gas emissions are decreasing	A	C	C		C	A				C						C
2.1.2 Energy efficiency is improving	A	C			C	A										C
2.1.3 Use of renewable energy sources is increasing	A		C		A	A										C
2.2.1 Material intensity of economy is decreasing	A					A										
2.2.2 Waste prevention efforts are maximised	A		C			A	C									
2.2.3 Waste management hierarchy is fully observed	A		A			A	C	C								
3.1.1 Water retention levels in landscape are increasing via ecosystem solutions	A	A	A													

Specific objectives/ Responsible authorities A = Administrator, C = Co-Administrator	MoE	MfRD	MoA	MPSV	MoT	MIT	MEYS	MoI	MFA	MFin	MoC	MO	MoH	MoJ	SONS	ERO
and sustainable farming																
3.1.2 Soil degradation, incl. accelerated erosion, and loss of farmland is decreasing	A	A	A													
3.1.3 Non-productive functions and ecosystem services of the landscape, especially of the farmed land, ponds and forests, are strengthened	A	C	A								C	C				
3.2.1 Condition of natural habitats is improving and species protection is ensured	A	C	A		A	C										
3.2.2 Protection and management of the most valuable parts of the nature and landscape is ensured	A	C									C					
3.2.3 Negative impact of invasive alien species is limited	A		C			C						C				
3.2.4 Protection of wild animals in human care is ensured	A		C					C						C		

A = Administrator, C = Co-Administrator

Annex 2: Overview of SEP indicators

The environment and health

Indicator code	Indicator name and definition	Initial indicator value as of 2018*	Target indicator value as of 2030
1.1.1a	**Water quality in watercourses**	Average concentration: BSK_5: 3.1 mg/l, COD_{Cr}: 19.5 mg/l, $N\text{-}NO_3^-$: 2.8 mg/l, $N\text{-}NH_4^+$: 0.2 mg/l and P_{total}: 0.2 mg/l	x
	Evaluation of developments in water quality in watercourses in the Czech Republic according to average concentrations of BOD_5, COD_{Cr}, $N\text{-}NO_3^-$, $N\text{-}NH_4^+$ and P_{total}. Share of profiles which exceeded the value of average annual permissible pollution or EQS (pursuant to Government Regulation No. 401/2015 Coll.,) for individual indicators - AOX, PAU, FC, Cd, Pb, Hg. More detailed evaluation for selected indicators ($N\text{-}NO_3^-$, P_{total}) – share of profiles in intervals defined by limit values for individual specific indicators. Maps will depict amounts of discovered pesticides. A share of samples, which exceeded EQS value for PFOS in fish hatchlings, PBDEs in fish muscle matter, Hg in fish muscle matter, PAHs in macrozoobenthos will be evaluated on the basis of bioaccumulation monitoring. Assessment of the chemical and ecological condition of surface water bodies in accordance with the Water Framework Directive will also be performed.		
1.1.1b	**Quality of bathing water**	Share of locations in individual categories I. Quality category: 48.5 % II. Quality category: 14.9 % III. Category: 13.5 % IV. Category: 12.3 % V. Category: 10.8 %	x
	Evaluation of surface water quality used for outdoor bathing intended for personal bathing according to the summary evaluation of the Czech Republic according to Annex No. 6 of Decree No. 238/2011 Coll. The evaluation recognizes five categories, and localities are, at least once every month during the bathing season, assigned into one of the five evaluation categories based on the quality of water (water suitable for bathing; water suitable for bathing with degraded properties; deteriorated water quality; water unsuitable for bathing; water dangerous for bathing - bathing prohibited). In the annual evaluation of a specific locality, the overall result corresponds to the worst evaluation the locality received during the entire bathing season.		
1.1.2a	**Groundwater quality**	Share of samples which exceeded reference value of 50 $mg.l^{-1}$ for nitrates 10.6 %, reference value of 0.5 $mg.l^{-1}$ for ammonium ions 11.4 %, reference value of 0.5 $\mu g.l^{-1}$ for individual pesticides 35 % and reference value of 0.5 $\mu g.l^{-1}$ for the sum of pesticides 22 %.	x
	A comprehensive assessment of groundwater quality will be carried out on the basis of developments in the share of groundwater bodies that have exceeded the limit for groundwater in individual years in at least one indicator. Furthermore, development in the share of samples relative to reference values (50 %, 75 %) for nitrogenous substances and for the sum of pesticides. The occurrence of pesticides in groundwater (exceeding the reference values) for the current year will be reported on the map of the Czech Republic. It will also include an assessment of the chemical and quantitative condition of groundwater.		
1.1.3a	**Number of residents supplied by water from public water-supply system**	Share of the population connected to public water supply system: 94.7 %. The	Share of the population connected to public water supply system: 96.7 %

		highest share of residents connected was recorded in Capital City of Prague and the Karlovy Vary Region (100 %). The lowest share of residents supplied by public drinking water sources was in Pilsen Region (86,3 %) and in the Central Bohemian Region (86.4 %).	
	The indicator is construed as a share of the population connected to public water supply system nationwide and in a regional breakdown and its development over time.		
1.1.3b	**Water source yield capacity**	shallow wells: worst situation in August - 42% of shallow wells below normal levels; yield in springs: worst situation in November and December - yield below normal in 75% of springs; deep well water levels: worst situation in November - 70% of deep wells below normal level; in none of the selected monitored profiles did the average annual flow reach 100% of the long-term average (1981–2010)	x
	Evaluation of water levels in shallow wells, spring yield and water level of deep wells. Furthermore, the average annual flow on selected profiles will be evaluated in comparison with the long-term normal (1981–2010).		
1.1.4a	**Wastewater treatment**	Share of the population connected to sewerage network: 85.5 % The volume of treated wastewater: 446.3 million $m.^3$ Share of the population connected to sewerage network terminating in WWTP: 82.4 % Share of WWTP with tertiary stage of treatment in 2018: 55,9 %	Share of the population connected to sewerage network: 89 %
	The indicator evaluates the development of the share of population connected to the sewerage network and to sewerage network with WWTP. Furthermore, it evaluates the share of WWTPs with a tertiary stage of treatment and compliance with the requirements of Council Directive 91/271/EEC.		
1.1.5a	**Offtake of groundwater and surface water**	Total water offtake: 1 591.1 million m^3. Of this amount, energy sector consumed 39.5 %, public water supply system 39.3 %, industry 16.4 %, agriculture and other sectors total 4.8 %.	x
	The indicator is construed as the sum of water offtake volumes according to individual sectors in a given year, broken down into agriculture, forestry and fisheries; energy sector; industry		

	(including raw materials mining); water supply for public consumption; others (including construction).		
1.1.5b	**Consumption of water from public water supply systems (households) and losses from the water supply network**	Household water consumption: 89.2 litres/person^{-1}/day^{-1} Share of drinking water losses on the total volume of produced water: 15.8 %	x
	The indicator is construed as a share of the total amount of water produced for households against the total number of people supplied with water through water supply system per day. The indicator is construed as the share of water losses in the water supply network on the total volume of water produced and intended for implementation.		
1.1.5c	**Supported projects for the use of rainfall and recycled grey water**	800 million CZK (IROP) 170 million CZK (NPE)	x
	The indicator evaluates financial support for implementing the reuse of recycled grey water or rainwater by subsidies.		
1.2.1a	**Emission levels of selected air pollutants**	Reduction of emissions between 2005 and 2018: SO_2: by 53.4 % NO_x: by 42.4 % NH_3: by 13.5 % VOC: by 21.3 % TSP: by 17.7 % CO: by 16.1 % PM2,5: by 7.7 % PM10: by 11.5 % **Increase in emissions between 2005 and 2018:** B(a)P: by 11 % Distance from non-exceedable national emissions levels as of 2020: The required decrease NO_x, VOC, SO_2 and NH_3 emissions has already been achieved . In case of $PM_{2.5}$ emissions, the levels recorded for 2018 are higher by 11 % than the defined objective for 2020.	Commitment to reduce emissions by 2030 (in % against 2005): SO_2: by 66 % NO_x: by 64 % NH_3: by 22 % VOC: by 50 % $PM_{2.5}$: by 60 % Other substances do not have a defined limit.
	The indicator evaluates status and development of emission levels for selected basic pollutants into the air (SO_2, NO_x, NH_3, VOC, TSP, CO, $PM_{2.5}$ and PM_{10}, B(a)P) since 2005. The indicator also evaluates production of these basic emissions by individual sources and their share in total emissions. Consumption of solid fuels is also included within the framework of emissions produced by household heating. The indicator evaluates distances from non-exceedable values of national emissions according to the NPSE-WaM (2015) scenario recalculated to a relative reduction compared to 2005.		
1.2.2a	**Observance of ambient air quality limits for selected pollutants**	Share of the territory and the population with exceeded 24-hour air pollution limit for PM_{10}: 3.2 % of the territory, 13.8 % of the population; Share of the territory and the population with exceeded annual air pollution limit for	x

		PM_{10}: 0.1 % of the territory, 0.3 % of the population; Share of the territory and the population with exceeded air pollution limit for $PM_{2.5}$: 1.2 % of the territory, 6,1 % of the population Share of the territory and the population with exceeded air pollution limit for B(a)P: 12.6 % of the territory, 35.5 % of the population; Share of the territory and the population with exceeded air pollution limit for O_3: 80 % of the territory, 52.1 % of the population.	
	The indicator evaluates the share of territory with exceeded ambient air quality limits for PM_{10}, $PM_{2,5}$, B(a)P and O_3. Simultaneously, it evaluates exceeded ambient air quality limit in individual zones and agglomerations. In addition, it evaluates the share of Czech population living within zones and agglomerations suffering from above-the-limit concentrations of PM_{10}, $PM_{2.5}$, B(a)P and O_3.		
1.2.3a	**Activities and projects leading to reduced transboundary transmission of pollutants**	x	x
	The indicator evaluates available national and international activities, studies, agreements, bilateral negotiations and agreements leading to a reduction in the transboundary transmission of pollutants.		
1.3.1a	**Leakages of selected hazardous chemical substances into water, soil and emissions into the air**	x	x
	Discharges of selected substances into air, water and soil will be evaluated according to data in the integrated pollution register.		
1.3.1b	**Emissions of heavy metals and POPs into the air**	2000-2018 lead (Pb) emissions decreased by 91.6 % Cadmium (Cd) emissions decreased by 15.9 % Mercury (Hg) emissions decreased by 18.3 % Arsenic (As) emissions decreased by 66.5 % Chrome (Cr) emissions decreased by 18.6 % Copper (Cu) emissions rose by 23.9 % Nickel (Ni) emissions decreased by 64.4 % Selenium (Se) emissions decreased by 19.7 % Zinc (Zn) emissions decreased by 31.9 %PCB emissions decreased by 17.3 % Dioxin and furan (DIOX) emissions decreased by 56.2 %	x

		PAU emissions, including benzo(a)pyrene, rose by 0.8 %	
	The indicator evaluates development in emissions of heavy metals and persistent organic pollutants since 2000 in kt/year, index (year 2000 = 100).		
1.3.2a	**Contaminated sites (record-keeping and remediation)**	records: 4 967 RCS, 9 347 in territorial analytical documentation remediations: 26 sites; remediations 2010–2018: total 369 sites	x
	The indicator is construed as the number of registered contaminated sites and the number of remediated contaminated sites.		
1.4.1a	**Population and territory exposure to noise pollution**	$L_{(all\text{-}day)}$> 55 dB: 1 767 354 residents in 2017 $L_{(night)}$> 50 dB: 1 052 124 residents in 2017 (road transport in agglomerations)	x
	The indicator is construed as the number of residents exposed to noise pollution: • According to all-day noise exposure indicator "$L_{(all\text{-}day)}$" above 55 dB • According to disturbed sleep indicator "$L_{(night)}$" (for time period between 22 and 06 hours) above 50 dB • Above the defined limit values for indicators "$L_{(all\text{-}day)}$" and "$L_{(night)}$" As a measure of potential health impacts of noise pollution, the share of the population highly annoyed by noise (%HA) and people with highly disturbed sleep (%HSD) will be also evaluated within the framework of this indicator, according to the noise indicators "$L_{(all\text{-}day)}$" and "$L_{(night)}$".		
1.4.2a	**Brightness of the night sky**	x	x
	The indicator evaluates the artificial brightness of the night sky. This evaluation uses data from remote sensing (processed according to the methodology used in "*The new world atlas of artificial night sky brightness"* – the so-called Falchi atlas), where the artificial brightness of the night sky is displayed as a quantity (natural brightness is subtracted). The value set for the natural brightness of the night sky is 174 µcd/m^2 as the typical brightness of a night sky during minimal solar activity.		
1.5.1a	**Public funding dedicated to adaptation to climate change effects and processes**	approximately 13.0 billion CZK (MoE Dept.) and approximately 17.7 billion CZK (MoA Dept.), (2007–2017) + 4.4 billion CZK (MfRD Dept.)	x
	The indicator is constructed as the sum of public funds within the relevant programmes spent on adapting to individual climate change effects.		
1.5.1b	**Warnings issued within the framework of the Integrated Warning Service System (IWSS)**	125 issued warnings	x
	Frequency of issued warnings for various individual levels of danger with for a breakdown to floods, drought, precipitation, extreme temperatures and wind. CHMI's IWSS service covers 100% of the territory in uninterrupted mode.		
1.5.2a	**Preventive education in the area of population protection and crisis management**	approximately 7 900 activities approximately 326 thousand participants	x
	The indicator monitors activities in the area of preventive educational activities related to population protection and crisis management. The indicator is based on data provided by the Fire and Rescue Service (FRS CR) on the number of activities carried out and their participants. Specifically, the direct preparation of the population through various educational projects, programmes, discussions, lectures or excursions for children, pupils and students from kindergartens to universities, for the general public including seniors and disabled citizens,		

	training of primary and secondary school teachers, movement/knowledge competitions and indirect support of public awareness through national and regional media are included.		
1.5.2b	**Events and interventions triggered by natural disasters**	Fire and rescue unit responses: total 15 728 events: total 11 938	x
	Based on data provided by MoI-DG FRC, the indicator monitors the number of events, respectively responses to natural disasters and extreme weather events. Events include for example fires, traffic accidents, leaks of hazardous chemical substances or technical accidents. The monitored types of natural disasters, respectively weather events include floods, overflows, rain, snow, icing, windstorms, landslides and others (for example, earthquakes). Furthermore, it also monitors duration of individual events, number of responding units, cooperation of fire protection units with the basic components of IRS and finally the consequences of those events (death, injury or direct damage and values protected in case of fires).		
1.5.2c	**Amount of damage caused by natural disasters**	insurance events covered by natural disaster insurance: 34 475 events with reported damage of 1.3 billion CZK Damage caused by droughts in agriculture: approximately 12 billion CZK, in forestry: more than 12 billion CZK Cumulative damage (2007–2018) caused by extreme weather – windstorms: more than 5 billion CZK Cumulative flood-related damage (2005–2018) (i.e. total cost of territory recovery): approximately 44 billion CZK	x
	The indicator is construed as the sum of reported damage caused by floods, windstorms, hailing and by the weight of snow within the framework of natural disaster insurance, and also as the sum of relevant insurance events. The indicator will be extended further in the case of: - occurrences of extreme flood events, by the amount of cost for the restoration of property in the area affected by individual flood events - occurrences of extreme drought, or extreme wind by the amount of damage caused by these events.		
1.5.3a	**Number of serious accidents reported**	For the period 2018–2020: 17	x
	Indicator evaluates the number of major accidents reported to the European e-MARS system or within the framework of the Convention on the Transboundary Effects of Industrial Accidents.		
1.6.1a	**Number of municipalities which have adaptation plans in place**	12, with total population of 2 049 584	x
	The indicator evaluates the number of municipalities that prepare and have approved adaptation strategies and adaptation plans, or that have taken adaptation to climate change into account in their other strategic, conceptual and planning documents, municipalities involved in international projects and initiatives, and the number of people living in this area.		
1.6.2a	**Brownfields**	Total number of brownfields registered in the database (2014–2018): 944 Total area of brownfields registered in the database (2014–2018): 2 727.2 ha	x

	The indicator evaluates the number and area of brownfields in the Czech Republic and their share on the total area of the municipality. Attention is also paid to the share of revitalized brownfields with respect to their total number and total area.		
1.6.2b	**Local Agenda 21**	Total number of registered entities: 172 Interested parties: 89 Category D: 31 Category C: 46 Category B: 4 Category A: 2	Total number of registered entities: 500
	The indicator monitors application of sustainable development principles in the management of municipalities and regions. The development in the number of LA21 implementers will be monitored, both quantitative (number of implementers) and qualitative (progress within the framework of individual LA21 categories).		
1.6.3a	**Supported projects seeking utilization of rainwater and recycled grey water**	800 million (IROP) 170 million CZK (NPE)	x
	The indicator evaluates financial support for introducing reuse of recycled grey water or rainwater provided by subsidies.		
1.6.4a	**Green areas in cities**	Area of residential vegetation: 62 cities in the Czech Republic (including regional capitals) above 20 thousand inhabitants: from 63.1 % (Mladá Boleslav) to 92.9 % of the total urbanized area. Low vegetation: representing on average 57.0 % of the urban area, i.e. more than 77.7 % share of the total green areas in settlements. High vegetation: 43 % of the urban area.	x
	The indicator evaluates the area of residential greenery, in categories of high and low vegetation, in settlements and its share on the total urban area of the municipality.		

Climate-neutral and circular economy

Indicator code	Indicator name and definition	Initial indicator value as of 2018*	Target indicator value as of 2030
2.1.1a	**Greenhouse gas emissions**	128,1 Mt CO_2 eq.	A decrease by 44 Mt CO_2 eq by 2030 in comparison with 2005; Reduction of emissions in sectors falling under EU-ETS by 43 % by 2030 in comparison with 2005; Reduction of emissions outside EU-ETS by 14 % by 2030 in comparison with 2005

	The indicator is construed as the total aggregated greenhouse gas emissions reported by the National Inventory System (NIS) for reporting to the UNFCCC with the possibility of classification according to individual CRF categories (Common Reporting Format). The second source of GHG emission data are emissions from installations covered by the European Emissions Trading Scheme (EU-ETS).		
2.1.2a	**Energy intensity of the economy**	Energy intensity in 2017: EU28 – 4.6 TJ/million EUR CR – 6.4 TJ/million EUR Consumption per person in 2017: EU28 – 91.9 GJ/person CR – 100.9 GJ/person	Achievement of energy intensity and average energy consumption per person below EU28 average
	The indicator represents the amount of energy needed to ensure a certain volume of production, transport or services. It therefore meets the demands of the national economy on energy consumption. Indicator is construed as a share of primary energy resources consumed against GDP of the Czech Republic.		
2.1.2b	**Energy efficiency**	Final energy consumption: 1 065 PJ. Primary energy consumption: 1 687 PJ.	The objective is to save 84 PJ in final energy consumption by 2030, i.e. 8.4 PJ annually throughout 2021–2030 and to achieve cumulated savings of energy of 462 PJ in total. In 2030, the final energy consumption should not exceed 990 PJ and consumption of primary energy 1 735 PJ.
	The indicator monitors the development of primary energy consumption and final energy consumption according to the Europe 2020–2030 methodology. It compares consumption values with the SEP targets and evaluates performance status.		
2.1.3a	**Renewable energy sources**	Share of RES on gross final consumption of energy: 15.2 %. Share of RES in heating and cooling: 20.7 %.	Share of RES on gross final consumption by 2030 to reach 22%. The average year-on-year growth in the share of RES in the heating and cooling sector corresponds to 1%.
	The indicator evaluates development in the share of energy produced from RES on the total to the gross final consumption of energy and share of RES for heating and cooling according to the EUROSTAT methodology.		
2.1.3b	**Share of RES on energy consumption in transport sector**	6.5 %	14 % by 2030
	The indicator is construed as the share of renewable energy sources on final consumption of energy in transport sector in a given year. The share of renewable sources in transport is determined according to the Eurostat SHARES methodology (Short Assessment of Renewable Energy Sources).		
2.2.1a	**Material intensity of the economy**	35.8 kg (1 000 CZK GDP)$^{-1}$	x
	Material intensity of the economy is calculated as the share of the Domestic material consumption indicator and GDP at constant prices (2010 is the currently used year). Material		

	intensity represents the volume of materials that the economy needs to create a unit of GDP, and measures effectiveness of the transformation of raw materials within the economy into economic performance.		
2.2.1b	**Level of circular use of materials**	In 2016: 7.6 % excluding secondary raw materials; 17.5 % including secondary raw materials.	x
	The indicator is defined as the share of consumption of recycled and secondary materials on the total consumption of materials.		
2.2.2a	**Waste production**	Total waste production: 37 784.8 thousand tonnes Production of other waste: 36 016.9 thousand tonnes Production of hazardous waste: 1 768.0 thousand tonnes Production of municipal waste: 5 782.1 thousand tonnes Production of packaging waste: 1 296.9 thousand t	x
	The indicator evaluates developments in total waste production, including production of other and hazardous waste (total waste production is the sum of production of other and hazardous waste). It also shows the time dynamics in the area of municipal waste production and monitors trends in packaging waste production.		
2.2.2b	**Eco-labelling**	Total number of valid EFP or EFS eco-label licenses: 47 Total number of valid EU Ecolabel licenses: 11	Total number of valid EFP or EFS eco-label licenses: 100 Total number of valid EU Ecolabel licenses: 25
	The indicator will monitor the total number of valid eco-label licenses for eco-friendly products (EFP) and eco-friendly service (EFS) and the total number of valid licenses for the EU Ecolabel.		
2.2.3a	**Waste management structure**	Material recovery: 83.4 % (31 528.0 thousand tonnes) Energy recovery: 3.2 % (1 200.8 thousand tonnes) Incineration: 0.2 % (93.6 thousand tonnes) Landfilling: 9.4 % (3 565.4 thousand tonnes) Total waste production: 100 % (37 784.8 thousand tonnes)	x
	The indicator evaluates waste management structure for the following categories: material recovery, energy recovery, incineration, landfilling of waste.		
2.2.3b	**Management of municipal waste**	Material recovery: 38.6 % (2 230,4 thousand tonnes) Energy recovery: 11.7 % (676.6 thousand tonnes) Incineration: 0.07 % (3.9 thousand tonnes) Landfilling: 46.0 % (2 658.3 thousand tonnes)	recycling 60 % (by 2030); recycling 55 % (by 2025); recycling 65 % (by 2035) landfilling 10 % (by 2035)

		Municipal waste production: 100 % (5 782>1 thousand tonnes)	energy recovery 25 % (by 2035)
	The indicator evaluates the structure of municipal waste management according to individual categories: material recovery, energy recovery, incineration, municipal waste landfilled.		

Nature and landscape

Indicator code	Indicator name and definition	Initial indicator value as of 2018*	Target indicator value as of 2030
3.1.1a	**Infiltration capacity of soils**	x	x
	The indicator evaluates infiltration capacity of agricultural soil based on soil properties and characteristics (soil infiltration and permeability, soil granularity, soil organic matter content, soil structure) in combination with a layer of land with reduced infiltration.		
3.1.1 b	**Land use**	Increase of built-up areas: by 1.8 thousand ha (1,4 %) between 2000 and 2018. Increase of other areas: by 32 thousand (4.7 %). The share of impermeable surfaces is growing (from 2.3 % in 2006 to 2.4% in 2015).	x
	The indicator evaluates the change in land use, especially the share of built-up areas (plus the share of impermeable surfaces according to EEA data once every 3 years).		
3.1.2a	**Quality of agricultural and forest soil**	Preventive limit exceeded for PCB (5 % of samples), PAH (18 % of samples) and DDT (15 % of samples); High vulnerability to compaction assessed for 16.2 % of farmland area; soil production capacity – medium to high production with stabilized yields on 19.7 % of agricultural land; low organic matter content identified on 10.3 % of agricultural land; average pH for 2013–2018 was 6.1.	x
	Quality of agricultural soil will be evaluated as the share of agricultural soil samples where the preventive limits for hazardous substances were exceeded; the content of organic substances and soil pH will be also evaluated. Production capacity will be evaluated on the basis of land point yield. The quality of forest soil will be evaluated according to Base Saturation (BS) in experimental plots of ICP Forests.		
3.1.2b	**Erosion and compaction of agricultural soil**	Water erosion potentially threatens 56.7 % of agricultural land, 17.8 % face extreme threat. Wind erosion threatens 18.4 % of agricultural land. 276 erosion events were recorded. High potential of compaction threatens 16.2 % of agricultural land.	x
	The indicator is construed as the share of areas potentially endangered by water and wind erosion on the total area of agricultural land and the degree of threat. Erosion monitoring and analysis data are also used. Furthermore, potential susceptibility to lower soil layers to compaction will be assessed.		
3.1.2c	**Consumption of plant protection products and mineral fertilisers**	Consumption of active substances contained in plant protection	x

		products: 4 388.5 thousand kg of active substances. Consumption of mineral fertilisers: 122,9 kg pure nutrients/ha^{-1}	
	The indicator is construed as the quantity of individual active substances from the group of pesticides (rodenticides, growth regulators, fungicides and biocides, herbicides and desiccants, zoocides and biocides, others), consumed for plant protection in the Czech Republic. The evaluation will also include the volume of mineral fertilizers applied to agricultural land in a given year.		
3.1.2d	**Land occupation**	Decrease in ALF by 1.8 % (from 4 279.9 thousand ha in 2000 to 4 205.3 thousand ha in 2018) (COSMC); Between 2000 and 2018 approximately 5 221 ha of agricultural land and approximately 495 ha of forest land was occupied in the Czech Republic for construction of transport infrastructure (CTR)	Slow down losses of ALF to 0.25 % ALF in 2020 - 2030
	The indicator aims to monitor developments in land use and occupation of the agricultural land fund (ALF) and land designated for the fulfilment of forest functions (LDFFF). Indicator is created on the basis of land records from the real estate cadastre administered by COSMC and the LPIS land register and data gathered by CTR monitoring occupations of ALF and LDFFF by transport infrastructure.		
3.1.3a	**Organic agriculture**	Acreage of organically farmed land: 539.0 thousand ha, the share of arable land is 15.1 %, the share of grasslands is 80.8 %. The share of organically farmed land on total ALF reached 12.8 %.	15 % of organically farmed land on total LPIS and share of arable land in organically farmed land at 30 %
	The indicator is construed as an area of organically farmed agricultural land and its share on the total area of agricultural land and its development in time and according to individual types of use.		
3.1.3b	**Average size of soil blocks**	5.84 ha; 5 578 SB were larger than 60 ha	x
	The indicator is calculated on the basis of the number of soil blocks classified into categories according to size in the LPIS soil register.		
3.1.3c	**Sustainable forest management**	PEFC 67.7 %, FSC 2.0 %; Selective management 3.6 %; 24.8 m^3 dead wood per hectare of forest land; undergrowth 17.1 %, rich structured growth 1.1 %; acreage of clearances 35 761 ha	x
	Data on the share of forests certified according to international standards (PEFC and FSC) and the share of forests with application of undergrowth and selective management according to FMP will be used for the evaluation of the indicator. The indicator will include evaluation of the structure and balance of clearings (based on CSO data supplemented by remote sensing data). NIF data will be used to evaluate amounts of dead wood in the forests and richness of the stand structure.		
3.1.3d	**Development of forest species composition**	27.3 % deciduous trees	35.6 % is the recommended share of

			deciduous trees (2030)
	The indicator evaluates the distance between the current species composition and the recommended target species composition.		
3.1.3e	**Acreage of Agricultural Land Fund (ALF) used for non-production purposes**	x	x[##]
	The indicator evaluates the share of landscape element areas and areas supporting biodiversity (non-forest greenery, hedges and boundaries, fallow land, water protection zones, etc.) on the total ALF acreage. [##] The indicator, including target values, will be modified according to EC-accepted 'Farm to Fork' methodology		
3.2.1a	**Landscape fragmentation**	Non-fragmented landscape 63.4 % 60 implemented fish passes since 2010 Share of natural habitats 13.2 %	x
	The indicator will include evaluation of landscape fragmentation by transport infrastructure according to UAT polygons, number of migration barriers on watercourses, including evaluation of migration permeability status on specific migration-important watercourses and number of implemented fish passes and the share of natural habitat areas in cadastral areas.		
3.2.1b	**Common bird species**	Common species 99.3; woodland species 87.0; farmland species 62.2 [index 1982 = 100]	x
	The indicator evaluates developments in abundance of common bird species, farmland birds and woodland bird species.		
3.2.2a	**Native endangered species according to the Red List**	On the Red List in 2017: 908 species of vascular plants, 162 vertebrate species and over 3 300 invertebrate species.	x
	The indicator evaluates endangered species according to Red Lists.		
3.2.2b	**Share of specially protected areas and Natura 2000 sites**	Special protected areas 16.7 % (small-scale special protected areas 1.4 %, NP 1.5 %, PLA 14.4 %) Natura 2000 sites: 14.1 %	x
	Share of special protected areas (large-scale and small-scale) and Natura 2000 systems on the territory of the state.		
3.2.2c	**State of species and habitats of Community Importance**	Insufficient or unfavourable condition 60.3 % of animal species, 75.4 % of plant species and 79.6 % of habitats	x
	Share of species and habitats of Community importance in favourable, insufficient and unfavourable condition assessed in accordance with the Habitats Directive.		
3.2.3a	**Invasive alien species**	61 species of plants and 113 species of animals. Cumulatively approximately 300 million CZK (OPE, LMP, PNLRF, LIFE)	x
	Occurrence of non-native and invasive alien species in the Czech Republic. Resources spent on reducing the spread of invasive alien species.		
3.2.4a	**Share of confiscated protected animals that were poached or illegally transported on the total number of imported animals**	5.3 %; 1 430 animals	x
	Share of confiscated protected animals that were illegally transported to the Czech Republic according to CITES on the total number of imported animals.		
3.2.4b	**Breeding of specially protected and endangered animal species**	Specially protected species in the Czech Republic 1 858	x

		Endangered species of world fauna 8 614 Rare breeds of domestic animals 311	
	Number of specially protected animal species of the Czech Republic, endangered animal species of the world fauna and rare breeds of domestic animals kept in Czech ZOOs.		

* Unless stated otherwise

X not defined /cannot be defined

List of Abbreviations

ALF	Agricultural land fund
B(a)P	Benzo(a)pyrene
BAT	Best Available Techniques
Bio-CNG	Compressed Natural Gas, with a share of biomethane
Bio-LNG	Liquefied Natural Gas, with a share of biomethane
Bio-LPG	Liquefied mix of Propane and Butane from renewable energy sources (RES)
CAP	Common Agricultural Policy
CBRN	Chemical, biological, radiological and nuclear agents
CEI	Czech Environmental Inspectorate
CFF	The Country for the Future
CHMI	Czech Hydrometeorological Institute
CHP	combined heat and power
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ČMZRB	Czech-Moravian Guarantee and Development Bank
COSMC	Czech Office for Surveying, Mapping and Cadastre
CR	Czech Republic
CTR	Centre for Transport Research, a public research institution
CTS	Czech Technical Standard
EAP	Environment Action Programme
EC	environmental consulting
EEA	European Environment Agency
EEA	European economic area
EEE	Environmental education and edification
EGD	European Green Deal
EIA	Environmental impact assessment
EMAS	Eco-Management and Audit Scheme
EP	equivalent population
EQS	Environmental quality standards
ERO	Energy Regulatory Office

EU	European Union
EU ETS	European Union Emissions Trading System
EU28	28 EU Member States
FB	Farmer block
FSC	Forest Stewardship Council
GAEC	Good agricultural and environmental conditions
GDP	Gross domestic product
GMO	Genetically modified organism
HLPF	High-level Political Forum on Sustainable Development
HSS	Heat supply system
IPCC	Intergovernmental Panel on Climate Change
IROP	Integrated Regional Operational Programme
IRS	Integrated Rescue System
IWSS	Integrated Warning Service System
JTF	Just Transition Fund
LMP	Landscape Management Programme
LULUCF	Land use, land use change and forestry)
MBDW	Municipal biologically degradable waste
MEYS	Ministry of Education, Youth and Sports
MFA	Ministry of Foreign Affairs
MFin	Ministry of Finance
MfRD	Ministry for Rural Development
MIT	Ministry of Industry and Trade
MoA	Ministry of Agriculture
MoC	Ministry of Culture
MoD	Ministry of Defence
MoE	Ministry of the Environment
MoH	Ministry of Health
MoI	Ministry of Interior
MoI-DG FRC	Ministry of Interior – Directorate General of Fire and Rescue Corps
MoJ	Ministry of Justice

MoT	Ministry of Transport
NATO	North Atlantic Treaty Organization
NIL	National Forest Inventory
NP	National park
OECD	Organisation for Economic Co-operation and Development
OPE	Operational Programme “Environment”
OPJAK	Operational Programme Jan Amos Komenský
OPT	Operational Programme transport
OPTAC	Operational Programme Technology and Applications for Competitiveness
p. p.	percentage point
P+G	Park & Go
P+R	Park & Ride
PEFC	Programme for the Endorsement of Forest Certification Schemes
PG	permanent grassland
PLA	Protected landscape area
PM	Particulate Matter
PNRLF	Programme for Natural Restoration of Landscape Functions
POPs	Persistent organic pollutants
PPCP	Pharmaceuticals and personal care products
PPP	Plant protection products
PPP	Public Private Partnership projects
RCS	Registry of Contaminated Sites
RDI	Research, Development and Innovation
RDP	Rural Development Programme
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RES	Renewable energy sources
RRF	Recovery and Resilience Facility
SAICM	The Strategic Approach to International Chemicals Management
SCI	Site of Community Importance in Natura 2000 network
SDG	Sustainable Development Goals
SEA	Strategic environmental assessment

SEF	State Environmental Fund
SEP	State Environmental Policy
SFIS	State Fund for Investment Support
SFTI	State Fund for Transport Infrastructure
SIA	Social impact assessment
SONS	State Office for Nuclear Safety
TA	Thematic area
TACR	Technology Agency of the Czech Republic
TSES	Territorial System of Ecological Stability
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
UPT	Urban Public Transport
V4	Visegrad Group
VOC	Volatile Organic Compounds
WWTP	Wastewater treatment plant