THE 2030 NATIONAL ENVIRONMENTAL POLICY

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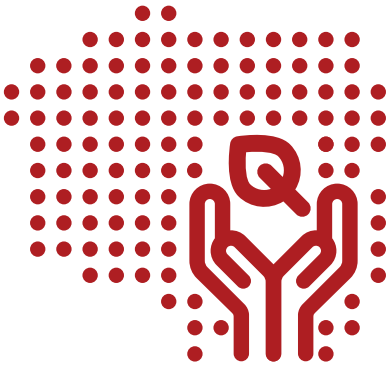

THE 2030 NATIONAL ENVIRONMENTAL POLICY

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List of Abbreviations:

7EAP	A General Union Environment Action Programme to 2020 "Living well, within the limits of our planet"
AKPOŚK	Updated National Municipal Wastewater Treatment Programme
aPGW	Updated River Basin Management Plan
aPWŚK	Updated National Water Environment Programme
ARiMR	Agency for Restructuring and Modernisation of Agriculture
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
BAT	Best Available Techniques
BEiŚ	Strategy "Energy Security and Environment – perspective to 2020"
CAFE	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
CE	Circular economy
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKPŚ	Coordination Centre for Environmental Projects
CLRTAP	Convention on Long-range Transboundary Air Pollution
CO_2	Carbon dioxide
CO	Carbon oxide
	Chancellery of the Prime Minister of Poland
EC	European Commission
EMF	Electromagnetic field
EPP	Environmental Protection Programme
ESD	Effort Sharing Decision, Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020
ESR	Effort Sharing Regulation, 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 525/201, replacing the ESD
ETV	Environmental Technology Verification System/EU ETV Pilot Programme
EU	European Union

EUCO	European Council
EU ETS	EU Emissions Trading System
EUROBATS	Agreement on the Conservation of Populations of European Bats
FBI	Farmland Bird Index, an indicator of the abundance of common bird species associated with farmland
GDOŚ	General Directorate for Environmental Protection
GDP	Gross Domestic Product
GES	Good Environmental Status (of marine waters), the main objective of Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
GHG	Greenhouse gas
GIOŚ	Chief Inspectorate for Environmental Protection
GMO	Genetically Modified Organism
GOZ	gospodarka o obiegu zamkniętym
GUS	Statistics Poland
HCs	hydrocarbons
IED	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
IMGW-PIB	Institute of Meteorology and Water Management – National Research Institute
IOŚ-PIB	Institute of Environmental Protection – National Research Institute
KKPR	Coordinating Committee for Development Policy
KOBiZE	National Centre for Emissions Management
KPGO 2022	National Waste Management Plan 2022
KPRM	Chancellery of the Prime Minister of Poland
KPOP	National Air Protection Programme
KWR	Classification of development expenditures of the general government sector
LULUCF	Land Use, Land Use Change and Forestry
MCP	Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants
M.P.	Monitor Polski (Official Gazette of the Republic of Poland)
MRiRW	Ministry of Agriculture and Rural Development

MSFD	Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)
MSY	Maximum Sustainable Yield
MŚ	Ministry of the Environment
NCBiR	National Centre for Research and Development
NEC	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
NFOŚiGW	National Fund for Environmental Protection and Water Management
non-ETS	Sectors not included in EU ETS
NO_x	Nitrogen oxides
OECD	Organisation for Economic Cooperation and Development
PAA	National Atomic Energy Agency
PEP2030	2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management
PEP2040	Energy Policy of Poland until 2040
PGL LP	Polish Forests - State Forest Holdinge
PGW WP	Polish Waters - State Water Holding
PIG-PIB	Polish Geological Institute – National Research Institute
PM	Particulate matter
PM_{10}	Particulate matter of less than 10 micrometers in diameter
$PM_{2,5}$	Particulate matter of less than 2.5 micrometers in diameter
PMŚ	State Environmental Monitoring System
POIŚ 2014–2020	Operational Programme Infrastructure and Environment 2014-2020
PONE	Low-Emission Reduction Programme
POŚ	Environmental Protection Programme
PPO	Public Procurement Office
PPSS	Drought Management Plan
RDOŚ	Regional Directorate for Environmental Protection
RES	Renewable energy sources

RP	Republic of Poland
RZGW	Regional Water Management Board
SDGs	Sustainable Development Goals
SOPO	Landslide Protection System
SOR	Responsible Development Strategy until 2020 (with an Outlook until 2030)
SO_x	Sulphur oxides
SP	Productivity Strategy
SPA2020	Strategic Adaptation Plan for Sectors Vulnerable to Climate Change until 2020
SRKL	Human Capital Development Strategy
SRKS	Social Capital Development Strategy
SRT	Sustainable Transport Development Strategy until 2030u
SSP	Strategy for Efficient and Modern State
SZRWRiR	Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries until 2030
UN	United Nations
UNO	United Nations Organisation
UOP	Nature Protection Act
UZP	Public Procurement Office
WHO	World Health Organisation
WIOŚ	Voivodship Inspectorate for Environmental Protection
WPGO	Voivodship Waste Management Plan
WB	Water body
WFD	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 (Water Framework Directive)

1 Introduction

1.1. The 2030 National Environmental Policy (PEP2030) in the national development management system

On 14 February 2017, the Council of Ministers adopted a medium-term national development strategy – *The Responsible Development Strategy until 2020 (with an Outlook until 2030) (SOR)*[1]. The objectives, directions of interventions, actions and strategic projects indicated in the SOR should be reflected in all the strategic documents. Thus, the SOR provides the basis for the preparation of new sectoral strategies, including the environmental strategy. The work on the environmental strategy was coordinated by the Ministry of the Environment with support from the members of an interministerial team. The document was entitled *the 2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management (PEP2030)*[2].

PEP2030 was prepared in accordance with the provisions of the Act on the Principles of the Pursuit of Development Policy[3] and constitutes a strategy within the meaning of that Act. It is one of the bases for the pursuit of environmental policy in Poland[4] and also one of the nine strategies[5] which are the foundations of the national development management.

Block diagram: *The position of PEP2030 in the national development management system.*

[1] The Resolution No. 8 of the Council of Ministers of 14 February 2017 on the Adoption of *the Responsible Development Strategy until 2020 (with an Outlook until 2030),* Monitor Polski (Official Gazette of the Republic of Poland), Item 260.

[2] This document and its appendixes use the abbreviated title *the 2030 National Environmental Policy* or the abbreviation PEP2030.

[3] The Act of 6 December of 2006 on the Principles of the Pursuit of Development Policy (OJ L of 2019, Item 1295), Article 4(1).

[4] The Act of 27 April 2001 on Environmental Protection Law (OJ L of 2018, Item 799, as amended), Article 14(1).

[5] In addition to t*he 2030 National Environmental Policy*, the integrated strategies include: *the Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries until 2030, Energy Policy of Poland until 2040, The Sustainable Transport Development Strategy until 2030, The Productivity Strategy, The National Strategy for Regional Development, The Strategy for Efficient and Modern State, The Social Capital Development Strategy* and *The Human Capital Development Strategy*.

In the system of the strategic documents, PEP2030 specifies further and operationalises the provisions of the SOR. Thus, the main objective of PEP2030, i.e. Developing the environmental potential for citizens and undertakings, was taken directly from the SOR. The specific objectives of PEP2030 were laid down in response to the most important trends identified in the diagnosis in the area of the environment in a manner enabling the harmonisation of the issues related to environmental protection with the economic and social needs.

The specific objectives of PEP2030 concern health, economy and climate. The achievement of the environmental objectives will be supported by horizontal objectives, as well as those related to environmental education and the functional effectiveness of instruments of environmental protection (see Chapter Objectives of PEP2030).

Specific objectives will be monitored with a set of indicators (see Chapter Performance indicators of the objectives of PEP2030) and implemented through directions of interventions (see Chapter Directions of interventions of PEP2030):

- Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters,
- Elimination of sources of air pollutant emissions or a substantial reduction of their impacts,
- Protection of the land surface, including soils,
- Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection,
- Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity,
- Supporting multifunctional, sustained and sustainable forest management,
- Waste management towards a circular economy,
- Managing geological resources by developing and implementing a Raw Materials Policy,
- Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT),
- Climate change mitigation,
- Adaptation to climate change and the management of the risk of natural disasters,
- Environmental education, including the shaping of sustainable consumption patterns,
- Improving the environmental control and management systems as well as streamlining the financing system.

PEP2030 startegic projects include (see Appendix 3):

- Clean air,
- Landscape audits,
- Developing and implementing a coherent and comprehensive Raw Materials Policy,
- GreenEvo – Technology Accelerator,
- Carbon Forests,
- Wooden buildings,
- Adaptation to climate change,
- A comprehensive programme for the adaptation of forests and forestry to climate change until 2020,
- Water for agriculture.

1.2. Architecture of PEP2030

The architecture of PEP2030 was proposed at the stage of preparing the initial assumptions for the document. A survey was carried out at the institutions involved in the execution and monitoring of the implementation of strategic documents to assess the structure of the strategies and programmes in effect, including the *Strategy "Energy Security and Environment – perspective to 2020"*[6]. On this basis as well as using the solutions worked out by the interministerial team for PEP2030, it was decided that the main objective of PEP2030 would be taken directly from the SOR and operationalised with specific objectives. In accordance with the assumptions, the specific objectives of PEP2030 were defined taking into account:

- the most important development challenges identified in the SOR,
- prognoses of trends,
- an in-depth diagnosis performed for each of the thematic areas of PEP2030.

The specific objectives will be monitored using a set of indicators and implemented through:

- strategic projects,
- a number of tasks constituting a concrete execution of the actions indicated in the SOR,
- other actions identified in the course of the work on the PEP2030 (e.g. those related to Poland's commitments in the perspective until 2030).

The actions and tasks were subordinated to directions of interventions which cover all the thematic areas of environmental policy. In addition to specific environmental objectives, PEP2030 also distinguishes horizontal objectives which will support the implementation of specific objectives.

Schematic diagram: *Architecture of PEP2030.*

[6] The Resolution No. 58 of the Council of Ministers of 15 April 2014 on the adoption of *the Strategy "Energy Security and Environment – perspective to 2020",* Monitor Polski (Official Gazette of the Republic of Poland), Item 469.

2 Priorities of the 2030 National Environmental Policy (PEP2030)

A modern national policy requires the building of an innovative economy complying with the principles of sustainable development. Sustainable development means stable economic growth coupled with the rational management of environmental resources and respect for human rights. In PEP2030, the highest priority is given to citizens' needs through its thematic focus on the Poles' quality of life, health and prosperity, while it ensures, at the same time, environmental protection and the preservation of biodiversity and other forms of living and inanimate matter.

Thus, the purpose of environmental policy is to ensure national environmental safety. This should be reflected in the relevant structure of state governance at the national, regional and local levels and in such a division of competences and tasks which would enable the objectives at each level to be set on the basis of the identification of needs and the measures for their achievement to be selected with consideration given to the environmental and economic efficiency criteria. Special importance for the achievement of the objectives of environmental policy is attributed to territorial self-government units. Their competence includes the rational planning of spatial development, which contributes to protecting the population against air pollution and noise, droughts and floods, and the damage they cause, as well as to protecting nature against excessive pressures.

The commitment to improve the quality of life causes a continuous need for development. However, this is possible only due to the sustainable use of natural resources, including the sustainable use of living marine resources. Citizens have the right to use natural resources and, at the same time, public authorities are obliged to ensure permanent access to these resources for the future generations. None of these forms of human activity should (as far as possible in given socio-economic conditions) cause a permanent deterioration of the state of natural resources. Should it occur, compensation, remediation or revitalisation and restoration measures should be taken with respect to the relevant elements of the environment the state of which has deteriorated. The development process will be monitored using relevant indicators which will enable the assessment of such aspects as: the improvement of the quality of water and air, the limitation of the impact on climate change and the favourable conservation status of native species and habitats and ecosystem services.

Particularly intensive actions will be taken to improve air quality by reducing low emissions which are the main cause of smog generation. At the government level, they will involve the preparation of relevant regulations and instruments to provide financial support to investment projects and to coordinate their implementation in regions.

PEP2030 should also support the implementation of Poland's objectives and commitments at the international level, including at the EU and UN levels, particularly, in the context of the EU's 2030 climate and energy policy targets, the *International Convention for the Prevention of Pollution from Ships (MARPOL), the Helsinki Convention (HELCOM)* and three Rio Conventions: the *Convention on Climate Change,* the *Convention on Biological Diversity* and the *Convention to Combat Desertification.*

In order to achieve the reduction targets set in the EU regulations, i.e. the reduction of the emissions of greenhouse gases (GHGs) by at least 40% compared with their level in 1990, appropriate actions will have to be taken in the sectors covered by the EU Emissions Trading System (EU ETS), where the reduction required at the EU level by 2030 is to reach 43% compared with the level in 2005 (there are no national targets),

and in the other, so-called non-ETS sectors, where the reduction at the EU level by 2030 is to reach 30% compared with 2005, while Poland's target is –7% compared with 2005, along with the possibility of using flexibility under the ESR Regulation, which amounts to 1.2 percentage points for Poland[1].

The basis for the global climate policy is the *Paris Agreement*, which Poland has also ratified. Its main objective is the launch of common efforts in order to prevent climate change, while, at the same time, taking into account the issue of sustainable development and the eradication of poverty. It is important to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and consequences of climate change. At the same time, the States should increase their ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. The *Paris Agreement* also provides for making financial flows consistent with a pathway towards low greenhouse gas emissions and climate-neutral development.

Poland attributes enormous significance to the long-term goal of the *Agreement* which is achieving a balance between anthropogenic greenhouse gas emissions and their removal by biosystems, by peaking greenhouse gas emissions as soon as possible and their quick reduction afterwards. In this context, Poland believes that it is necessary to better use biosystems as natural carbon sinks, as this would not only ensure an opportunity for the sustainable and real halting of the increase and the subsequent reduction of the CO_2 concentration in the atmosphere, but also foster synergies in the implementation of many Sustainable Development Goals (SDGs).

The implementation of the *Paris Agreement*, which provides that the reduction of GHG emissions should take into account the economic specificity of a given country, boosts sustainable development. Therefore, actions will be taken to effectively reduce the GHG concentrations in the atmosphere, including actions in those sectors of the economy that are responsible for GHG emissions (primarily, energy generation, transport and agriculture), involving, among others, the introduction of innovative technologies and the use of available energy sources, including the development of geothermal energy, as well as the implementation of the concept of Carbon Forests, which is a Polish proposal for reducing the concentration of greenhouse gases in the atmosphere. At the same time, a number of adaptation actions will be taken in order to reduce the vulnerability of the economy to the impacts of climate change.

In addition to achieving the climate neutrality targeted by the *Paris Agreement*, the implementation of multi-functional, sustained and sustainable forest management will contribute to the protection of biodiversity and job creation, particularly, in non-urbanised areas. Support will be provided to green investment projects, including the afforestation of private post-agricultural land and effective methods for biomass combustion at households. The promoted solutions will include those highlighting the role of wood as a fully natural, renewable construction material with comprehensive uses, including the storage of CO_2.

[1] Pursuant to 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 525/201 (Text with EEA relevance) (OJ L 156, 19.06.2018, p. 26; so-called ESR– Effort Sharing Regulation).

One of the priorities of PEP2030 will be the protection of Poland's natural heritage, among others, by taking actions to improve the state of biodiversity and a fuller coupling of its protection with the social and economic development of the country, including the improvement of the nature conservation system, the preservation and restoration of natural habitats and the populations of endangered species, as well as the maintenance and rebuilding of the functions of ecosystems which provide services to humans.

Efforts should be taken to strengthen the nature conservation system, including the improvement of the management of the Natura 2000 network. There is a need to continue the process of planning conservation tasks or elaborating conservation plans for forms of nature conservation which require them. Moreover, the system of environmental impact assessments should be improved.

The elimination of the causes of the loss of biodiversity resources resulting from social and economic activities requires consistent policy and more effective integration of biodiversity into the mainstream activities of the state, among others, into all the sectors – in particular, such as: agriculture, forestry, fisheries, water management and maritime economy – which, directly and indirectly affect the state of biodiversity resources, as well as into the sector responsible for combating crimes against the environment and wild nature. Such integration should manifest itself in a significant enhancement of the value and availability of resources for nature conservation in the sectoral funds.

In the context of the development of both urbanised and non-urbanised areas, huge opportunities are offered by a departure from the linear economy model in favour of the implementation of a circular economy (CE). The CE primarily means ensuring that materials and raw materials are used in the economy as long as possible. A circular economy assumes cooperation; therefore, business models and frameworks for the operations of undertakings should change, while consumers and the legal and institutional environment should be prepared for these changes. The CE also assumes the implementation of full waste recovery at the local level. In the case of urbanised and suburban areas, a circular economy offers opportunities for better use and recovery of available materials and energy resources, the limitation of the quantities of waste landfilled, with particular consideration given to minimisation and management of plastics as a material from the packaging waste stream, the management of construction and demolition waste to strengthen sustainable urban building, the production of biogas and agricultural biogas, and the use of raw materials recovered from other waste available in these areas, including e.g. the recovery of phosphorus from sewage sludge and cascade systems for waste use. The CE is also of substantial importance in wastewater management (in the context of the management of sewage sludge and the use of treated wastewater as technological process water or for maintaining urban greenery) and in the energy sector, as well as in the management of rainwater and melt water (water recycling, the reduction of the so-called water footprint).

In the context of the development of non-urbanised areas, a circular economy can contribute to partial self-sufficiency of these areas, particularly, in terms of energy, by using renewable energy sources.

Priority will be given to the issues of the implementation of the rational *Raw Materials Policy* and the related reform of geological services.

In this context, there is a need for a rational approach to Natura 2000 sites and

the use of their potential for socio-economic development. The Natura 2000 network can, and even should, stimulate sustainable development of local communities, as it enables development based on the local conditions and natural values; in addition, without blocking investment projects which have no significant adverse effect on the objects of conservation on individual sites. The Natura 2000 network should be maintained and developed, while its protection should be ensured by further work on the plans of conservation tasks for individual sites. A good example of the coupling of nature conservation objectives and economic development is the sustainable forest management implemented in forests covered by the Natura 2000 network the effectiveness of which is guaranteed by the combination of forest management plans with the conservation plans for Natura 2000 sites.

The implementation of a modern water resource and flood risk management system is an extremely important element from the point of view of sustainable development. Therefore, through basin-based management the Polish Waters - State Water Holding (PGW WP) will perform tasks in the scope of: the exercise of the ownership rights to public waters which are the property of the State Treasury, the preservation and improvement of the status of waters and the prevention of its deterioration, the improvement of flood safety, including the continuation of work to prepare draft planning documents needed to implement the Floods Directive[2] and the Act on Water Law[3], the prevention of drought effects and supporting Communes in water supply to meet the needs of the population and the economy. Special efforts are needed to carry out tasks to protect all the categories of waters – rivers, lakes, transitional, coastal and marine waters and groundwater – and to control pollution. For this purpose, Polish Waters will prepare planning documents required to implement the Water Framework Directive (WFD)[4] and the Marine Strategy Framework Directive (MSFD)[5], in particular, programmes of measures to maintain or achieve good status of waters, including marine waters.

Ecoinnovations play a particularly important role in stimulating the process of transition to a circular economy, the prevention of climate change and biodiversity loss, the protection of air quality or the sustainable use of water resources and ensuring their good quality. At the same time, they contribute to enhancing competitiveness and economic development as well as to strengthening the resilience of the economy to environmental pressures, improving the efficiency of using natural resources and reducing the adverse human impact on the environment. A change of the production and consumption patterns to more resource and energy efficient adaptation actions and the transformation of waste into products with a high added value will require new technologies, processes and services.

In light of the above, the priority tasks will include the promotion of, and support for, the implementation of innovative environmental technologies as well as the building of a consistent, systemic approach assisting the development and implementation of

[2] *Directive 2007/60*/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risk (OJ L 288, 06.11.2007, p. 27).

[3] The Act of 20 July 2017 on Water Law (OJ L of 2018, Item 2268, as amended).

[4] 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 (OJ L 327, 22.12.2000, p. 1, as amended; Polish translation: C*hapter 15 Volume 005 P. 275, as amended).*

[5] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (OJ L 164, 25.06.2008, p. 19, as amended).

innovations in Poland, among others, in order to ensure synergies in the operation of institutions responsible for innovations and synergies between the support instruments implemented by the them.

In order to ensure the implementation of the objectives of PEP2030, a greater emphasis needs to be placed on the improvement of the environmental control and management system and the refining of the financing system. Priority will be given to the combating of crimes against the environment, while, at the same time, developing the environmental competences of the public, understood as the provision of knowledge, the development of skills and the shaping of attitudes in order to disseminate the patterns of sustainable consumption and production, including such ones as voluntary environmental management systems (EMAS, ISO 14001) and eco-labelling.

The "polluter pays" principle plays a basic role in PEP2030. In practice, this principle means that he who has caused damage to the environment or the risk of damage should incur the costs of remedying the damage or elimination of the risk of damage. The principle applies to all the areas of environmental protection. Another rule the application of which has a positive effect on the use of public resources, including natural resources, is that the "polluter pays". This concept is increasingly often applied in relation to the protection of those environmental resources that are not renewable or renewable in a long period of time as a well as in a linkage to the global development trend of the so-called sharing economy[6].

Public procurement contracts represent a significant part of the Gross Domestic Product (GDP). In 2017, the value of public procurement contracts in Poland amounted to PLN 163.2 billion, i.e. 8.23% of the GDP. Moreover, it should be emphasised that these data cover only the contracts which are subject to the procedures defined in the Act on Public Procurement Law[7] and fail to account for expenditures made on the basis of exemptions from the regime of that Act. The above data illustrate not only the purchasing power of the public administration but also indicate the significant capacity of the administration to shape specific trends on the market of goods, services and construction works.

The widest possible use of the potential offered by public procurement to achieve environmental objectives requires not only the greater awareness of the employers and institutions controlling how public funds are spent in the scope of environment-friendly solutions available in the Act on Public Procurement Law[8], but also the launch of relevant actions to provide information on the existing environmental problems, their significance and the need to consider them at the stage of purchasing decision-making.

[6] At the same time, the sharing economy corresponds with the idea of sustainable development.
[7] The Act of 29 January 2004 on Public Procurement Law (OJ L of 2018, Item 1986, as amended).
[8] The Act of 29 January 2004 on Public Procurement Law (OJ L of 2018, Item 1986, as amended).

3

Summary of the diagnosis*

The environment, including its condition, diversity and abundance of resources, is the key element which ensures man's safe functioning in the social, economic and cultural dimensions. The environment shapes the living conditions of humans and living nature; it also supplies water, food, energy and many other natural resources. The quality and values of the individual components of the environment strongly affect the human health and living. An efficient use of the environment, coupled at the same time with the preservation of the natural equilibrium, determine the capacity of the state to carry out its tasks, including the satisfaction of the basic needs of existence of society.

Starting in 1990, as a result of structural changes in the economy, the implementation of the national environmental policy and its implementing programmes, including environment-friendly investment projects, and the strengthening of legal regulations, the air, water and soil pollution has decreased in Poland. The effective management of industrial emissions, in particular, those from the energy sector, has significantly reduced their share in the exceedances of air quality standards in Poland and enabled a substantial reduction of greenhouse gas emissions. However, effective climate protection requires a further reduction of emissions using continuously improved technical and natural methods.

Over the last dozen years or so the emissions of harmful compounds have been substantially reduced in Poland. It is necessary to continue actions aimed at the sustainable and more productive use of resources in a manner ensuring that the growing levels of the Poles' consumption and affluence do not cause burdens on the environment, including primarily exceedances of air quality standards, higher quantities of arising waste, an unacceptable pollution level of surface waters, including marine waters, a decrease of biodiversity, the exposure of the population and animals to noise or overfishing.

A special challenge is posed by the issues related to chaotic spatial development, caused by inadequate control of investment processes, particularly, in respect of housing construction. The diminishing share of the surface of greenery areas and the uncontrolled urbanisation and building up of aeration corridors and wedges as well as river valleys in urban centres, cutting off open spaces from the inner city, cause a deterioration of the climate conditions and the quality of life and enhance the flood risk. The task of the aeration corridors and wedges is to ventilate cities. They are expected to supply fresh air from green areas to the city centres, including heat islands. This requires open spaces extending from the peripheries into the city. They can be natural – such as rivers or green areas, which, at the same time, clean the city air – or artificial (such as railway tracks or wide roads). In light of this, it is necessary to adopt regulations limiting the building up of aeration corridors and wedges, ecological corridors and river valleys, in particular in urban centres. The preferred form of noise abatement in areas which function as aeration corridors and wedges should be the planting of densely leaved plants.

The most important challenges in this scope include the elimination of so-called low emissions which are generated by the use of solid fuels (including low-quality coal) and waste in the domestic and municipal sector, primarily to heat buildings, the use of expired and technologically mismatched furnaces and small local boiler-houses, as well

* The assessment of the state of the environment contained in the diagnosis, which provided the basis for further analyses, was carried out based on data from the state environmental monitoring system run by the Inspectorate for Environmental Protection.

as the low energy performance of buildings. In urbanised areas and along commuting routes, the transport emissions have a significant effect on air quality. At present, at the EU level, regulations on the emission standards for cars are being adopted, while at the national level actions are taken to promote electrical means of transport.

In addition to land-based transport, air transport, too, has an adverse effect on air quality. As a result of the process of combustion of hydrocarbon fuels, harmful and toxic products are emitted into the atmosphere, in the form of: carbon dioxide – CO_2, carbon oxide – CO, oxides of sulphur – SO_X, oxides of nitrogen – NO_X, hydrocarbons – HCs, particulate matter – PM and many other toxic substances which affect both the natural environment and human health and life. For this reason one of the objectives of EU transport policy is to increase the share of less emissive and more resource efficient modes of transport, among others, rail or water transport, in freight transport over distances of more than 300 km. Actions to limit the impact of transport on the environment are comprehensively described in the *Sustainable Transport Development Strategy until 2030*.

In the context of actions to improve air quality and mitigate climate change, a special role is played by the EU policy which aims at systematically reducing greenhouse gas emissions. In Poland's case, this is a particularly difficult task given the high emissivity of its economy, caused by the dominance of coal in electricity and heat generation. Despite these difficulties, Poland has successively reduced its greenhouse gas emissions, fulfilling its international commitments (under the *United Nations Framework Convention on Climate Change* and the *Paris Agreement*) and its obligations under EU law (the climate and energy package).

Poland and the other EU Member States have signed and ratified the *Paris Agreement* (2015). The EU will achieve the objectives of the *Paris Agreement* jointly with the *Nationally Determined Contribution*, to be implemented through the provisions of the 2030 climate and energy policy. The man goals of this policy include the reduction of greenhouse gas emissions by at least 40% (20% by 2020) compared with the level in 1990, ensuring at least a 32% share of renewable energy in the total energy consumption in the EU and the improvement of energy efficiency by at least 32.5%. The main tool for the implementation of EU policy in this field is the EU Emissions Trading System (EU ETS). The EU ETS system covers industrial installations, in particular, those in energy-intensive sectors, as well as the energy generation sector and airlines. Regulations have also been adopted on the monitoring of emissions from maritime transport. This was established by the 2003 Directive 2003[1] and as a result of its amendment in 2009[2] a single EU wide reduction target by 2020 was adopted at 21% relative to the emissions in 2005. This target is implemented through a linear decrease of the number of available emission allowances for installations. In accordance with the amendment to the Directive of March 2018[3], the emission reduction in the EU ETS system is to reach by 2030 a level of 43% relative to 2005. The achievement of this target will require an annual decrease of the available emission allowances.

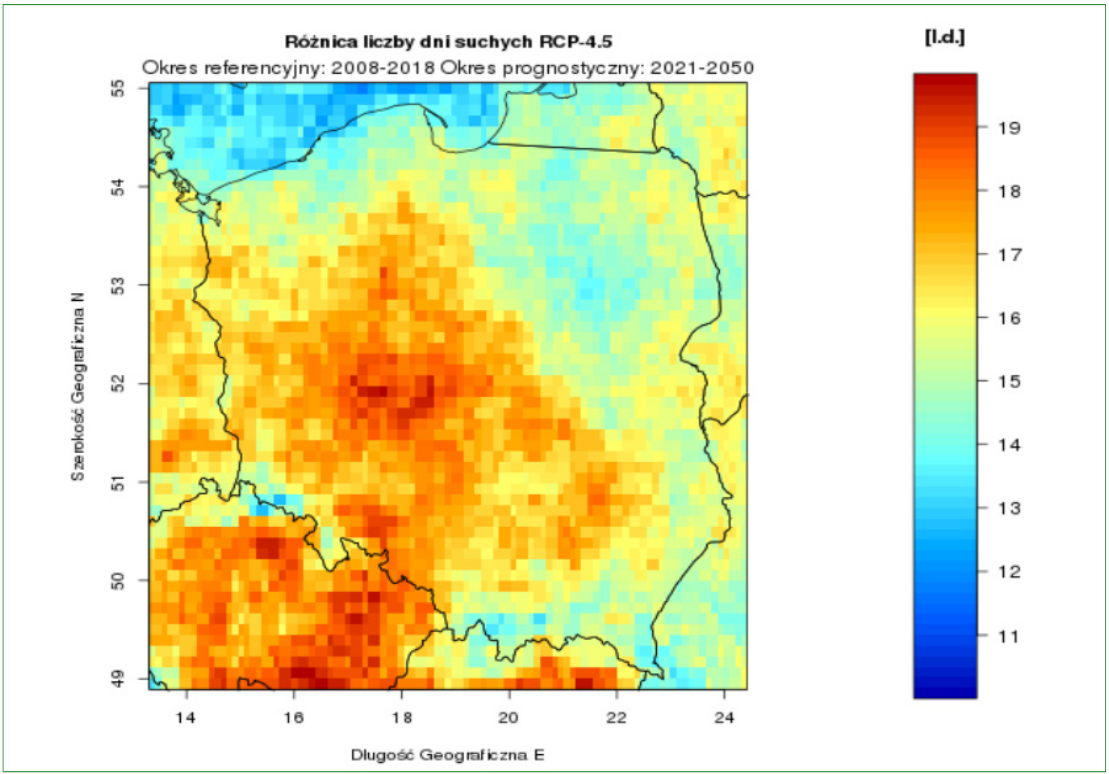
[1] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, pr. 32, as amended; *Polish translation: Chapter 15 Volume 007 P. 631, as amended).*

[2] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (*OJ L 140, 5.6.2009, p. 6***3).**

[3] Directive (EU) 2018/410 of the European Parliament and of the Council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814 (*OJ L 76, 19.3.2018, p. 3).*

The second pillar of EU climate policy is the reduction of emissions from sectors which are not covered by the EU ETS system (so-called non-ETS), such as: transport, buildings, agriculture, the municipal and domestic sector or waste management. The emissions from these sectors represent more than half of the total greenhouse emissions in the EU; it is similar for Poland (50.2%)[4]. The issues related to non-ETS emissions are subject to the ESR. In accordance with this Regulation, the reduction target for Poland is –7% relative to the emissions from the non-ETS sectors in 2005. Starting in 2021, the EU will also launch mitigation actions in the land use, land-use change and forestry (LULUCF) sector. They were defined in the Regulation on the LULUCF[5].

Predicted difference in the number of dry days in a year between the periods of 2008–2018 and 2021–2050.



Map legend: Różnica liczby dni suchych RCP 4-5 - Difference in the number of dry days under RCP 4-5; Okres referencyjny - Reference period; Okres progostyczny - Prognostic period; l.d. = No of days; Szerokość geograficzna - Latitude; Długość geograficzna – Longitude.

Source: Based on the study by Joanna Strużewska, Department of Atmospheric and Climate Modelling, Institute of Environmental Protection - National Research Institute.

The climate scenarios for Poland indicate that the most common weather events in the next decade will be heat waves, with a tendency to become longer. Short but very intensive rainfalls can be just as harmful, as they can cause local floods and inundations, i.e. events which occur with a large frequency but at a small scale. The problem of floods and inundations affects all the sectors of the economy, primarily

[4] According to the initial GHG emissions inventory for 2016.

[5] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance) (OJ *L 156, 19.6.2018, p. 1).*

the infrastructure existing in particularly vulnerable areas. Small-scale events of this type occur every year and cause losses at an average level of 0.08–0.1% GDP[6]. The effects of climate change can also be seen in the more intensified occurrence of drought in Poland's territory. A change in the precipitation structure can be observed in the growing season, involving more frequent summer and spring droughts. The predicted climate change and the related higher frequency and intensity of droughts in agriculture will increase the demand for water for irrigation. Prognostic calculations of the levels of water shortage in soils for selected plants indicate a continuous process of soil over drying and a growing risk of drought.

Cities are particularly vulnerable areas with a concentration of the most urgent contemporary challenges, starting with water shortages and bad air quality, through economic disturbances, and ending with a lack of social stability. At present, the population of Polish cities is estimated at about 23.3 million persons, which represents more than 60% of the population of the country; thus, the scale of the problem is huge. The performed climate analyses and the scenarios prepared on their basis unequivocally indicate a growing problem of the adverse impacts of climate change on urbanised areas. Among other things, due to their high population density and their closed and sealed character, cities are vulnerable, in particular, to the intensification of the urban heat island, showers and torrential rains causing inundations and a water deficit. As part of the project of the Ministry of the Environment *The preparation of plans of adaptation to climate change in cities with more than 100,000 inhabitants*, in 44 cities participating in the project four sectors most vulnerable to the climate phenomena threatening cities were selected. In all of them, water management was indicated. This results from the fact that the sewage system cannot cope even now with the currently occurring heavy rains. Therefore, it is not enough to adapt it to the current conditions, but also consideration has to be given to the growing intensity of precipitation related to climate change in the next decades.

In 41 cities, it was recognised that the health and safety of their inhabitants were most vulnerable to the adverse effects of extreme climate events, among others, due to the risk of intensification of diseases of the circulatory or respiratory systems. In 36 cities, it was recognised that increased intensity of threats – rainfalls, extreme temperatures, storms or floods – can disturb the operation of transport. In 14 cities, the energy sector was indicated as the one sensitive to climate change. The disturbances of the operation of this sector arising as a result of climate threats can affect the functioning of a city as a whole. Snowfall and freezing rain can cause breakdowns of low voltage networks and blackouts lasting even several days. Power losses caused by high temperatures in the summer can be of even greater importance. On hot days, the efficiency of coal-fired units falls due to the too high temperature of the water used to cool the turbine condensers and its insufficient quantity due to the falling water levels in rivers. This happened in August 2015 when it was necessary to introduce restrictions on the supply and use of electricity because of hot temperatures and increased consumption for air-conditioning purposes.

In addition to the climate policy related to the reduction of GHG emissions, water management is another area of climate policy. Water resources in Poland are very variable in time and differentiated spatially. In three fourths of the territory of the

[6] SAP2020, pp. 13-14.

country, there are periodical water shortages (most frequently and to the greatest extent they affect the areas of Wielkopolskie, Mazowieckie and Kujawsko-Pomorskie). The total water balance of Poland depends on the precipitation levels in river basins, their distribution in time and the capabilities of natural and artificial retention, including the ability to use rainwater. In this context, there is the problem of too low retention in local catchments, which is caused, among others, by a growing area of sealed surfaces arising as a result of the process of urbanisation, the development of transport infrastructure, changes in agricultural production and also an excessive acceleration of water runoff from land amelioration facilities in river catchments and valleys, which mostly perform drainage functions. Nevertheless, quantitatively stable surface water abstraction satisfies most domestic and economic needs.

Insufficient investments in water management have resulted in an unsatisfactory condition of water management infrastructure, e.g. artificial reservoirs, and the low effectiveness of the national flood protection system. The results of the monitoring of the state of surface waters in 2010–2015 indicate that the overwhelming majority of bodies of surface water do not reach good status. Bad water status limits the use of waters from rivers, watercourses and reservoirs for agricultural purposes (irrigation), industrial purposes (production) and recreation purposes (bathing sites, water sports). In contrast, the chemical status of groundwater is found to be good. However, there is excessive exploitation of the resources of groundwater reservoirs situated near the largest cities in Poland.

The greatest pressures on surface waters are generated by the municipal economy, agriculture and industry (in particular, the extractive, energy generation and agri-food industries). Gradually, equal access of the population to sewage and water supply systems is provided. The share of the population using wastewater treatment plants also grows. Nevertheless 15% of households in rural areas still continue to use private water intakes with variable quality, while in rural areas with low population density and developing tourist infrastructure there is a lack of local sewage systems and wastewater treatment plants.

The policy of the EU Member States aims at achieving at least good environmental status (GES) of marine waters and good status or potential of all water bodies, pursuant, respectively, to the MSFD and the WFD. Poland implements the provisions of the WFD and other Directives related to the WFD by carrying out measures to improve the status or potential of water bodies as defined in planning documents (the river basin management plans and the *National Municipal Wastewater Treatment Programme*). Moreover, in accordance with the provisions of the Floods Directive[7], measures are planned and implemented to reduce flood risk as defined in relevant documents (the flood risk management plans).

The Baltic Sea is also an important element of Poland's environment. The activities carried out by the Baltic Sea states have a significant effect on the whole marine ecosystem of the Baltic Sea, and, as a result, the bad environmental status of the Baltic Sea is a problem which all the Baltic Sea states, including Poland, strive to resolve. In addition to the WFD, the MSFD also plays a key role in improving the environmental status of marine waters. The 2016 assessment of the environmental status of the marine areas of the Baltic Sea indicated inadequate environmental status of the southern Baltic

[7] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (OJ *L 288, 6.11.2007, p. 27).*

Sea; however, an analysis of trends shows the process of improving environmental status of the Baltic Sea. Still, the response of the sea is extremely slow. The Danish straits are the only point where marine waters can mix; therefore, the exchange of waters in the Baltic Sea is very slow. In addition, the progressing climate change or natural disasters are not favourable for the improvement of the marine environment.

The status of waters in the Polish marine areas has a large effect on Poland's tourism potential. Tourism is an important sector of the Polish economy, while the tourism industry is one of the key development drivers in the coastal regions. Strong assets of the Polish coastal areas include ports and harbours situated in localities with key importance for resting (e.g. Gdańsk, Gdynia, Hel, Jastarnia, Łeba, Ustka and Świnoujście). Due to a long (770 km including the Szczecin and Vistula Lagoons) and beautiful coastline and the historic and cultural heritage in place, the coastal tourism thrives. The marine space is used, among others, for such activities as: yachting, windsurfing, kitesurfing, diving to wrecks and recreational fishing. In Poland, the ferry industry develops very well due to diversified recreational cruises.

The Baltic Sea is also an area where fishermen carry out their economic activity. The Common Fisheries Policy requires the restoration and preservation of the populations of the species fished over levels enabling the so-called maximum sustainable yield to be achieved by ending overfishing by 2015, where possible, and by 2020, at the latest.

Poland's biodiversity is highly valued. The good condition of nature is mainly demonstrated by its differentiation at the levels of ecosystems and the species of fauna and flora. Poland is characterised by very high biodiversity, manifested, among others, by a large number of species of fauna and flora and natural habitats occurring in the Polish territory. These results, among others, from the relatively good preservation of unique landscapes owing to the dispersal of farmland, the persistence of extensive agriculture and the dominance of state ownership in the forest management structure. The total number of registered species is about 60 000, including about 16 000 species of plants and about 35 000 species of animals. Due to the specific situation of Poland, it is rich in species with their range limits in its territory. In Poland's territory, there are 485 plant communities, 12% of which are frequently encountered ones, whereas 22% are those that occur rarely and have only been registered at few sites.

Agricultural areas are characterised by a rich checkerboard of habitats arising from traditional forms of cultivation. About 30% of farmland has high natural values, functioning as a refuge for endangered species of flora and fauna. Due to the fragmented agriculture, local varieties of crops and local livestock breeds have been preserved until the contemporary times.

The richness of natural resources is also demonstrated by the presence of large predators, i.e. wolf, lynx and bear. In Poland, there is the largest European bison population in the world. The natural riches in our country are regionally diversified. There are regions (e.g. the north-eastern part of the country) with well-preserved nature, with an abundance of species which are strongly endangered or extinct in the other parts of Europe.

However, in spite of the positive examples and successes of nature conservation, a general deterioration of natural values can be seen in the country. In Poland, there are regions, e.g. urbanised ones or those with intensive agriculture, where nature degrades, and the species composition becomes poorer. Unfavourable changes in the abundance and composition of species of flora and fauna most frequently result from incorrect

spatial management: the quick, uncontrolled city development, the settlements spreading within areas with natural values or in their direct vicinity, the crossing of ecological corridors by transport infrastructure, the unification and impoverishment of landscapes. Changes in agriculture are also significant – both the intensification of crops towards large-area farming and the abandonment of traditional agricultural uses lead to the decline of ecosystems and species related to traditional agriculture and the loss of traditional agricultural landscapes which are the habitats of many organisms. The state of preservation of natural habitats and the habitats of species on Natura 2000 sites is not satisfactory. Their conservation is one of the most important current objectives of environmental protection.

Biodiversity conservation means systemic actions to ensure the permanent preservation of all the elements of biodiversity.

Since Poland acceded to the European Union the regulations on the European network of protected sites, the so-called Natura 2000, have been in effect in the country. It is a system of conservation sites which focuses on specific species of flora and fauna, on their habitats and on natural habitats as such. An important element of the network is the spatial connectivity between sites. At present, the Polish Natura 2000 network consists of 849 Special Areas of Conservation designated to protect habitats and 145 Special Protection Areas designated to protect birds[8], which occupy about 20% of Poland's terrestrial territory. It should also be emphasised that the Natura 2000 sites have been designated in the coastal water zones and river valleys.

Forestland has the large share in the surface area of the Natura 2000 sites: 52% (including: coniferous forests 24%, mixed forests 15% and broadleaved forests 13%), as well as agricultural land: 22% (including: meadows and pastures 13% and farmland 9%). Habitats and refuges of most species protected within the Natura 2000 network are related to forestland and agricultural land, in particular, permanent grassland.

Natura 2000 sites occupy 38% of the surface area of State Forests, with a view to preserving specific types of natural habitats and species recognised to be valuable and endangered on the scale of Europe as a whole. Forests affect the extent of natural retention in catchments, retaining rainwater. They are an important element stabilising the global and local climate since Polish forests can absorb about 34 million tonnes[9] of carbon dioxide annually. In construction, wood has the lowest carbon footprint compared with other materials – wood production does not need high-energy fossil fuels, as is the case with brick, cement or plastics. In the course of their growth, trees absorb carbon dioxide from the atmosphere, while its storage in wooden structures directly contributes to climate protection. Each cubic metre of wood used in construction has absorbed 0.8 tonne of carbon dioxide emissions.

More than 19% of Polish forests are private. In the period from 1990 to 2017, the share of private forests grew by 2.3 percentage points. At present, about 95.7% of the surface area of private forests is covered by approved management documentation which enables their owners to implement forest management. Efforts should be taken to ensure that as much as possible, possibly all, of the surface area of private forests is covered by approved management documentation (current simplified forest management plans or inventories of the state of forests).

[8] Statistics Poland (GUS), Ochrona środowiska 2018 (Environmental Protection 2028 – in Polish), Warszawa, 2018, p. 115.
[9] Poland CRF 2018 – United Nations Climate Change, Table 4.A, Sectoral background data for land use, land-use change and forestry.

The land surface provides the space and resources necessary for the functioning of ecosystems, the human existence and the development of the economy. It is indispensable for the implementation of various production processes (e.g. crop cultivation, extraction of raw materials), as well as for the distribution of different socio-economic activities carried out by man (e.g. the construction of road, industrial, service and housing infrastructure). Soil is the basic production resource in agriculture; hence, the good condition of Polish soils ensures the potential for high-quality food production. However, there is relatively little land which is highly suitable for agricultural production: the land of Classes I–III represents about 25% of the total agricultural land. The soil cover in Poland forms a checkerboard system, with the dominance of medium-quality soils (Classes IVa and IVb) – 35.2% as well as poor and very poor soils (V and VI) – 37.3%, while the most fertile soils represent barely 3.7%. The natural soil-forming process is extremely slow and the creation of about 1 cm of the humus layer of soil takes about 100 to 400 years. For this reason, soil is considered to be a resource which is a non-renewable one in practice and which should be subject to special protection for the future generations.

More than 90% of the territory of the country is used for agriculture and forestry. Land use changes over last ten years have been slight. The surface area of urbanised and built up areas increases, while the phenomenon of suburbanisation can be seen to unfold around large urban centres. More than 96% of arable land is suitable for the production of safe food since it is characterised by natural or slightly higher contents of heavy metals. No substantial changes can be seen in the quality of soils which could significantly affect their suitability for food production. The surface area of degraded and devastated land represents about 0.2% of the territory of the country. Land is gradually subjected to reclamation and redevelopment; however, this process is too slow, and it is not correctly correlated with the investment process.

Poland's geological resources consist of the resources of documented deposits in the prognostic and prospective areas of many valuable raw materials, certain critical raw materials, chemical and rock raw materials, peats and thermal waters which can provide the basis for the development of local energy generation, as well as brines and curative waters which are mostly used in health resorts.

Minerals (excluding peat) are non-renewable resources; therefore, it is so important to protect them against an irreversible loss caused by the mismanagement of deposits. There is also a significant problem of the use of areas situated directly over mineral deposits. In particular, this is the case with deposits situated in areas of accelerated urbanization, in areas subject to the conservation of other natural and landscape resources or ones of importance in light of the other strategic interests of the state.

Affecting the intensity of production and the levels and patterns of individual consumption, the economic development is the main factor determining the quantity of waste generated. An analysis of the rate of changes in the quantity of waste generated with respect to changes in the GDP since 2000 shows a positive trend – a constant waste generation level with more than a 50% GDP growth. With some generalisation, this can be considered a result of the actions taken to rationalise the waste management in Poland. Although the growing trend in the quantity of waste generated is not proportional to the GDP growth, all possible actions should be launched, and every effort should be taken to reduce the quantity of waste generated. The introduction of changes in waste management supports the successive reduction of the weight

of waste deposited at landfills and their secondary use as raw materials (according to the GUS, in 2017, 42% of collected municipal waste was deposited at landfills). In 2017, the quantity of selectively collected municipal waste grew more than three times compared with 2010; however, this indicator represented only about 27% of the weight of total collected waste. When calculated per capita for Poland, this is 85 kg of 312 kg of waste generated. Similarly, there is too low utilisation of municipal and industrial waste (including the waste from the treatment of sewage sludge) as a potential energy source, in spite of the application of the correct waste hierarchy by industrial plants. There is also a too low level of recovery and secondary use of industrial waste which is a valuable source of raw materials and opportunities for the development of the economy in Poland.

Incorrect waste management contributes to climate change and air pollution, and directly affects many ecosystems and species. Landfills, considered the last resort in the waste hierarchy, release methane, a very powerful greenhouse gas which contributes to climate change. Methane is formed due to the presence of microorganisms and biodegradable waste in landfills, such as food, paper and garden waste. Depending on their construction, landfills can also contaminate soil and waters. After waste is collected, it is transported and treated. During transport carbon dioxide — the most prevalent greenhouse gas — and other air pollutants, including particulate matter, are released into the atmosphere. Part of the waste can be incinerated or recycled. Energy generated in the incineration process can be used to produce heat or electricity, which can thus replace the energy produced using coal or other fuels. Energy recovery from waste can help reduce greenhouse gas emissions. Recycling can help even more effectively to reduce the emissions of greenhouse gases and other substances. When recycled materials replace new materials, fewer new materials need to be extracted or produced[10]. The more advanced the implementation of the waste hierarchy is, the less adverse effect on the climate and environment is caused by the waste management sector. In this context, it is important to introduce the model of a circular economy which will contribute to diminishing greenhouse gas emissions and climate protection.

The level of implementation of the concept of a circular economy (CE), including all the life cycle stages and affecting both the social and economic spheres, is still too low in Poland. The EU policy in this scope places an increasingly large emphasis on the efficient management of waste already from the stage of the acquisition of a raw material, through design, production and consumption, up to the collection and management of waste. In this context, it is important to open to other areas of socio-economic life and to go beyond traditionally conceived environmental management tools which should support the development of new business models, the development of the services sector and the substitution for the now used raw materials or production and consumption modes. Moreover, attention should be paid to necessary lifestyle changes and the need to enhance the knowledge of the CE both of the public, entrepreneurs and the public finance sector. The CE related issues were comprehensively addressed in the *Productivity Strategy* and the *Roadmap of the Transition to a Circular Economy*.

In 2015, the Roadmap was prepared after public consultations, identifying Poland's priorities in the context of building the CE. They include:

- innovativeness, the strengthening of the cooperation between industry and the

[10] European Environment Agency, Waste: a problem or a resource?, 2014, https://www.eea.europa.eu/ (accessed on 17.06.2019).

science sector and, as a result, the implementation of innovative solutions in the economy,
- the creation of the market for secondary raw materials on which their flow would be facilitated,
- the provision of high-quality secondary raw materials as a result of sustainable production and consumption,
- the development of the services sector.

The European Commission has adopted a new package on a circular economy. It is expected to assist European undertakings and consumers in the transition to a circular economy where resources are used in a more sustainable manner. The proposed actions will contribute to "closing the loop" of the lifecycle of products due to their enhanced recycling and reuse and they will bring benefits to both the environment and the economy. The implementation of these plans will make it possible to achieve the maximum value and the maximum use of all the raw materials, products and waste, and this will foster energy savings and greenhouse gas emission reductions. These proposals cover the whole lifecycle of products: from production and consumption to waste management and the market for secondary raw materials. This process will financially be supported from the European Structural and Investment Funds, including EUR 5.5 billion allocated to investments in waste management. Moreover, support in an amount of EUR 650 million will be provided as part of Horizon 2020 (the EU financial programme for research and innovation) and investments in a circular economy launched at the national level.

The level of eco-innovation at Polish undertakings is still insufficient. In the 2017 EU Eco-Innovation Index, Poland took the 26th position[11]. The dynamic economic growth of Poland does not go hand in hand with resource efficient management, since, in accordance with the EU trends, resource efficiency and innovation are considered to be some of the major drivers of undertakings' competitiveness. In 2015, the national raw materials consumption in Poland amounted to 16.9 tonnes per capita compared with the EU average of 14.6 tonnes per capita. The growing outlays on research and development of innovative environmental technologies do not translate into the uptake of these technologies by the market. According to the data of the Ecoinnovation Observatory, in 2016 barely 10% Polish undertakings implemented innovations which brought environmental benefits for them, while the EU average was 53%. In turn, 12% of undertakings placed on the market innovations which brought environmental benefits for end-uses (compared with the EU average of 50%). So poor data result from the absence of a system of incentives encouraging the implementation of eco-innovations, an excessively high levels of technological and investment risks and the undertakings' low awareness of the benefits from the application of new environmental technologies. A major problem is also the absence of a unified, systemic approach to the development, implementation and promotion of eco-innovations in Poland as an important element of the overall innovation system. There are no synergies in the activities of institutions responsible for innovations and no synergies in the support instruments which they use. As a result of this, investors and financing institutions apply the same criteria to eco-innovations as to other investment projects, often without taking into account the added value of the reduced environmental loads. This value plays a marginal

[11] European Commission, EU Eco-Innovation Index 2017. EIO Brief, April 2018.

role in investment decisions. The opportunities offered by green public procurement are insufficiently used, significantly limiting the stimulation of the market for eco-innovative technologies. Due to Poland's low eco-innovation level, it is impossible to monitor environmental technologies developed and offered, along with their economic and environmental effects. This hampers undertakings' access to reliable offers of new environmental technologies and diminishes the interest of the capital market in investments in promising eco-innovations with a high implementation potential. At the same time, the EU policies in this field aim at increasing the business opportunities for undertakings, in particular, those of the SME sector, which are ensured by the transition to a green economy by enhancing their energy efficiency, supporting green entrepreneurship, using the potential of more environment-friendly value chains and facilitating green SMEs' access to the market[12] as well as innovative environmental technologies supporting the transition to the model of a circular economy[13].

The expenditures on environmental protection in 2017 were PLN 29 billion. They represented 1.5% of the Gross Domestic Product (GDP). It can be seen that these expenditures steadily fell relative to the GDP – from 4.4% in 2000. The structure of the expenditures on environmental protection is dominated by those incurred by households[14].

Poland faces the challenge of providing an appropriate system for financing environmental projects, with consideration given to the implementation of innovative solutions, in a manner ensuring that the actions carried out by the private and public sectors, both at the local and central levels, are coordinated and mutually complementary and that they will bring tangible benefits for the environment (an environmental added value). Thus, it is important not only to identify sources of financing for environmental protection but also to build a model which would enable even more effective coordination of actions taken by different stakeholders, the promotion of eco-innovative solutions, a quick exchange of information and the launch of joint, integrated projects. For this purpose, market-based instruments and mechanisms will also be used. Moreover, it is also necessary to consider different forms of cooperation to carry out environment-friendly projects, with special consideration given to the public-private partnership. One of the ideas which would enable the achievement of these objectives is, among others, the development of the concept of energy clusters or energy cooperatives stimulating stakeholder cooperation and communication at the local level.

The negative factors indicated in the diagnosis, such as poor air quality, scarce water resources, the effects of progressing climate change, the shortage of tools to create the spatial order which would prevent, among others, construction on floodplains, substantially enhance the current development costs and cause losses due to the absence of investments and the allocation of development sources for the restoration of the desirable quality of the air, soils and water and for the treatment of diseases dependent on environmental factors. The launch of appropriate actions in a long term will make it possible to avoid much higher macroeconomic costs of failure to take action.

The appropriate environmental policy measures should be based on universal

[12] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions *Green Action Plan for SMEs. Enabling SMEs to turn environmental challenges into business opportunities*, COM/2014/0440 final.

[13] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Closing the loop - an EU action plan for the circular economy, COM(2015) 614 final.

[14] Statistics Poland (GUS), Ochrona środowiska 2018 (Environmental Protection 2028 – in Polish), Warszawa, 2018, p. 179.

principles and environmental concepts. Many adverse effects in the environment can be prevented or their undesirable impacts can be minimised if the "precautionary principle" is applied well in advance. This principle should guide all the entities influencing the state of the environment and the stakeholders of the environmental procedures. The "precautionary principle" applies in situations where there is no certainty about the impacts of a certain action on nature, while the "prevention principle" ensures that the expected pollution is not allowed to arise. There are the following elements of the "prevention principle":

- the prevention of pollution and other adverse impacts,
- recycling,
- an integrated approach to the limitation and elimination of pollutants and threats based on the recommendations of EU Directives,
- the application of the best available techniques (BAT),
- environment-friendly management systems for production processes (e.g. cleaner production programmes) and services based on standards (e.g. the ISO 14000 series and EMAS).

4

Prognosis of socio-economic trends in environmental terms

The natural environment is one of the areas which affect the achievement of the objectives of the SOR, which is the key document for Poland's medium-term socio-economic policy. The new model of the development of the country – the responsible development – provides, among others, for the satisfaction of the needs of the present generation without diminishing the chances of the future generations, which is consistent with the principle of sustainable development. The responsible development requires knowledge, an innovative approach to problem solving and the efficient management of non-renewable resources. The implementation of these principles will also contribute to creating new development levers and improving the competitiveness of the Polish economy; it will also make it possible to avoid the diagnosed development traps.

The SOR provides, among others, for a selective approach – the concentration of actions on strategic objectives and the implementation of tasks responding to current challenges. The environmental conditions are of large importance for the socio-economic development; therefore, they are considered essential for the actions carried out by the state.

The SOR has identified a number of challenges to the development of the country. To a large extent, they directly concern the issues related to the environment and its resources. Partly, they provide the grounds for taking intensified actions in particular areas, since the state of the environment is a factor which affects the materialisation of the development scenarios described in the SOR.

The following trends are considered to be most important in the area of the environment:

– the growing consequences of climate change,
– the growing competition for natural resources,
– the growing pressures on ecosystems,
– the increasingly significant adverse impact of the environment on human health,
– the depletion of the existing sources of financing for environmental protection.

4.1. The growing consequences of climate change[1]

In the nearest years, the effects of climate change in Poland may become much more felt. The most important predicted impacts for the area of Central and Eastern Europe include: the more frequent extreme temperatures, the greater precipitation intensity which may cause foods in each season of the year, the higher frequency and intensity of hurricanes, the more frequent occurrence of droughts and the related losses in the agricultural and forestry production, limited access to water intended for human consumption and an enhanced risk of forest fires. The more frequent occurrence of temperatures varying about 0°Celsius in the winter is also predicted, which may lead

[1] Prepared on the basis of the World Bank report Poland: Toward a Strategic, Effective, and Accountable State Systematic Country Diagnostic (31 July 2017) and analyses of the Ministry of the Environment carried out for the purposes of the preparation of the *Strategic Adaptation Plan for Sectors and Areas Vulnerable to Climate Change until 2020*.

to greater damage to roads and squares.

The results of prognoses show that until 2030 climate change will exert a twofold, positive and negative, impact on both the environment, the economy and society.

An increase in the average air temperature will have positive effects, including, among others, the extension of the growing season and the possibilities of cultivating new plant species, the shortening of the heating season and the extension of the tourism season. On the other hand, negative impacts on the environment caused by the extension of the growing season have also been identified. Recent years saw an unfavourable tendency, consisting in that the acceleration of the beginning of the growing season is greater than the acceleration of the end of the ground frost season. As a result of this, ground frost comes in less favourable phases of plant development – at the time of blossoming and even that of fruit setting, i.e. when plants are most sensitive to low temperatures. This effect is clearly negative for plants, also including protected ones.

However, the predicted negative consequences of climate change dominate. Climate change will significantly determine the status of biodiversity, since it affects the ranges of species, including those of invasive alien species, their reproductive cycles, growing periods and interactions with the environment. Under the impact of this change biodiversity undergoes gradual transformation. Climate change causes unfavourable alterations of the hydrological conditions. Although the annual precipitation totals do not change substantially, still they become less uniform in character, resulting in longer periods without precipitation which are interrupted by heavy downpours (torrential rains). E.g. Łódzkie Voivodship[2] will be threatened by strong desertification and, in parallel, by floods in the valleys of the largest rivers in the region, i.e. the Warta, the Pilica and the Bzura. The water deficit area will cover a substantial part of the voivodship. It will be aggravated by the presence of a zone of low precipitation and a zone of a high-water deficit in the growing season in the northern part of the region as well a zone of strong desertification in the north-eastern part of the region. It is estimated that in 90% of the territory of Łódzkie Voivodship there is already the threat of precipitation below 400 mm annually.

The groundwater level will fall, adversely affecting biodiversity and natural resources, in particular, water reservoirs and wetlands. It will be possible to see changes in the winter season when the residence period and thickness of snow cover will diminish and the evaporation process will intensify, reducing the national water resources. Changes in the ranges of plants and animals will also be important as they can affect the condition of tree-stands and crops.

The problem of drought can be seen, in particular, in Kujawy, the Dobrzyń Lake District and the Chełmno Lake District. In parallel, there is a flood hazard in the Vistula River Valley, related, among others to unfavourable changes in the hydrological conditions on the Vistula downstream of the Włocławek dam (the lowering of the bottom level, strong erosion) and upstream of the dam (shallowing and sediment accumulation, making the operation of icebreakers difficult). It is also important to note the risk of collapse of the Włocławek dam, which can cause contamination of the environment with sediments accumulated in the reservoir bowl.

Climate change will increase the frequency of extreme weather events and disasters which will have significant impacts on vulnerable areas and the national economy.

[2] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

Heavy rains bringing the risk of floods, inundations or landslides will be of fundamental importance – mainly in mountain and upland areas, but also on the slopes of river valleys and on cliffs along the seashore.

The predictions of changes in precipitation levels in the future, made for the purposes of a project on urban plans for adaptation to climate change[3] for 44 cities in Poland, indicate that although the predicted increase of the total number of days with precipitation is slight, the number of days with extreme precipitation exceeding 10 mm/day grows, mainly in cities in the eastern and southern parts of the country. This phenomenon will intensify in the successive decades.

Strong winds will be increasingly frequent, and they may be even accompanied by incidental tornadoes and atmospheric electrical discharges which can have a significant effect e.g. on agriculture, forestry and construction as well as energy and transport infrastructure.

E.g. Lubuskie and Pomorskie voivodships[4] noted a large threat of the occurrence of strong winds and torrential rains. The problem was identified as an urgent one, in particular, in urbanised areas. The consequences of the occurrence of extreme weather events and natural disasters (such as the storm which went through a substantial part of Pomorskie Voivodship in August 2017) are of long-term character and in the areas affected by a disaster they cause a decline of socio-economic activities which are traditional in these areas, such as tourism and timber industry. It will take many years to restore the state from before the storm in these areas.

Torrential rains also pose a large threat all over Poland[5]. In the 21st century, inundations caused by torrential rains have become increasingly harmful, in particular, in urbanised areas. In the questionnaire-based survey, this problem was pointed out by the representatives of Mazowieckie Voivodship, indicating that this threat occurred especially in agglomerations and large cities in this region.

The direct adverse effects of climate change also include the intensification of eutrophication of inland, transitional, costal and marine waters, a greater threat to human life and health posed by thermal stress and air pollution, an increased demand for electricity in the summer season and the lower cooling capacity at thermal power plants, which results, for example, in a fall in their generation capacity and overloading of the electricity grid.

A very high risk of eutrophication of inland waters was noted by the representatives of Pomorskie, Warmińsko-Mazurskie and Zachodniopomorskie voivodships[6]. In particular, it is necessary to emphasize the problem of eutrophication of the Baltic Sea, resulting e.g. in the closing of marine bathing sites due to the toxicity of certain species of blue-green algae occurring in phytoplankton blooms in the summer. In 2018, 11 out of 146 seashore bathing sites in Zachodniopomorskie Voivodship and 55 bathing sites in Pomorskie Voivodship were closed due to the blooms of blue-green algae. The bathing site at Chałupy was closed for the longest period of time – for 15 days – due to

[3] The website of the project: http://44mpa.pl/

[4] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

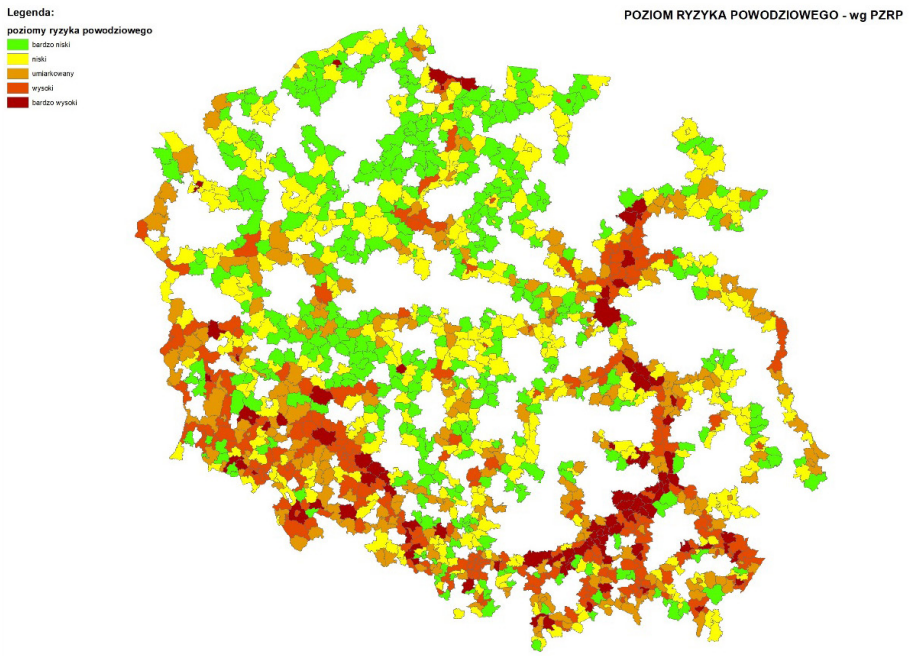
[5] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

[6] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

the blooms of blue-green algae[7]. The sanitary authorities paid special attention to the blooms of blue-green algae because of the toxins which they released and which could be dangerous to the bathers' heath, as they could cause irritation of the skin, itching and watering of the eyes, ailments of the alimentary tract and even neurological disorders[8]. The emergence, duration and intensity of the blooms depend on both the phosphorus concentration, the water temperature and the weather conditions.

Therefore, one of the main challenges to sustainable development in Poland is the adaptation to climate change by improving the resilience of the particular sectors of the economy. Climate change will have a significant effect primarily on the national water management. Poland has relatively scarce water resources and the efficiency of their use is low. In certain regions, periodic water supply problems can already be found. At the same time, in all the parts of the country, the flood risk grows, among others, as a result of the insufficient retention capacity of natural and artificial reservoirs, an increased share of impermeable surfaces, especially in cities, water runoff from small catchments due to the incorrectly carried out regulation and maintenance of rivers, the reduction of natural floodplains and the general lack of damming-up facilities in the systems of land amelioration ditches.

In accordance with a flood hazard analysis performed as part of flood risk management plans (FRMPs), the areas characterised by a very high flood risk are mainly situated in southern Poland and along the Vistula Lagoon and the Gulf of Gdańsk. In turn, areas with a high flood risk are those along the middle and lower sections of the Vistula and Oder Rivers as well as along the tributaries of the middle Vistula – the Bug, Narew and Kamienna Rivers.



Map legend (Legenda): poziomy ryzyka powodziowego – flood risk levels; bardzo niski – very low; niski – low; umiarkowany – moderate; wysoki – high; bardzo wysoki – very high; POZIOM RYZYKA POWODZIOWEGO – wg PZRP – Flood risk level acc. to the PZRP – Flood Risk Management Plan.

Source: Flood Risk Management Plan.

[7] The Chief Sanitary Inspectorate, the Bathing Service: https://sk.gis.gov.pl/ [accessed on 21.09.2018].
[8] The Chief Sanitary Inspectorate, the Bathing Service: https://sk.gis.gov.pl, p. 15 [accessed on 21.09.2018].

The exposure of investment areas and large cities to floods was pointed out by the representatives of Opolskie Voivodship[9] due to its situation in river valleys, in particular, in the valleys of the Oder and Nysa Kłodzka Rivers. In the voivodship, there are also agricultural areas with a high potential where the threat of drought and the fall of the groundwater level can substantially halt the socio-economic development in the future.

The changing climate will also have a crucial effect on the production conditions in the sectors of agriculture and forestry. A water shortage is one of the examples of an adverse impact of climate change on the sectors of agriculture and forestry. Periodic problems also include inundations caused by intensive precipitation and ground frost. Moreover, the extension of the growing season as a result of a higher average temperatures increases the risk of the presence of crop pests and a change of their range. Threats also include animal diseases and the lower productivity of livestock. This can have a significant effect on the efficiency of agricultural production and, at a larger scale, also on the national food security level. The extension of the growing season also increases the risk of pests affecting the forestry production and, in a longer term, also causes a change of the ranges of the individual tree species.

Given that the manufacturing economy is based on agriculture and forestry, the occurrence of catastrophic climate phenomena will cause particularly adverse consequences for the development of Warmińsko-Mazurskie, Lubelskie, Wielkopolskie and Mazowieckie voivodships.

The transport and construction sectors will also require the launch of adaptation actions.

In light of its spatial character, transport is one of the sectors of the economy which are the most vulnerable to climate change. The effects of climate change, such as heavy showers, winds, inundations and landslides, snow and hail falls, storms, low and high temperatures or limited visibility clearly affect all the transport modes: road, rail, air and shipping modes. Modes of transport, the related infrastructure and the users' social comfort are vulnerable to climate change. Analyses show that most of negative climate factors affect the individual transport modes, still it is road and rail transport infrastructure that is the most sensitive to the climate conditions. These transport modes are particularly susceptible to the impact of snow, rain, strong wind and frost[10].

The above situation will encourage the preparation and development of new standards for designing of transport infrastructure and modernisation of the existing one. Changes in technical standards will also be inevitable in the construction sector, particularly those on the design of buildings (mainly in respect of the energy efficiency of foundations and bearing elements) and drainage systems.

The overwhelming majority of landslides occur in the southern part of Poland, in the area of the Outer (flysch) Carpathians, built almost exclusively from Cretaceous and Paleogenic sand and shale formations (Małopolskie and Podkarpackie voivodships)[11]. The threat is posed, in particular, by the geological structure, morphology, the hydrogeological and hydrological conditions, excessive precipitation and human activities. Landslides cause degradation of the areas affected by them and damage to

[9] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

[10] Prepared on the basis of SAP2020, KLIMADA, materials of the Ministry of the Environment placed on the website klimada.mos.gov.pl.

[11] The Landslide Protection System (LPS) Programme managed by the Polish Geological Institute – National Research Institute (PGI-NRI).

the built structures ad infrastructure erected in their area (the road network, the sewage system, telecommunications and power lines, gas pipelines). In agricultural areas, crops are damaged and sometimes there is a need to restore the agricultural function of a given area. In forest areas, landslides cause damage to stands. A large hazard of landslides, particularly in rural and mountain areas, was identified in Podkarpackie and Śląskie voivodships, too.

The predicted increase of the intensity and frequency of sea storms and the greater wave heights in the Baltic Sea will intensify coastal erosion and enhance groundwater salinity in lower lying areas. The changes of the character of the coastline caused by human-induced transformations also affect the erosion and accumulation processes. The assessment of these processes as part of the monitoring of the seacoast is of large importance for the choice of the protection methods. Projects to protect the seacoast should be carried out taking into account the need to preserve the natural process of the coastal dynamics. The progressing coastal erosion increases the flood hazard from the sea. The most threatened areas include the Hel Peninsula and the Middle Pomerania. Over more than 70% of their length, the Polish shores of the southern Baltic Sea undergo erosion processes[12]. Climate change also makes winters milder and this may be expected to reduce the ice cover providing the natural protection against storm waves and to diminish the resilience of the shore to washing out. The monitoring of the coastal zones will also be important.

The expected climate warming will cause the migration of species, including invasive alien ones, mostly from Southern Europe, North Africa and Asia, along with the simultaneous withdrawal of those species that are not used to higher temperatures and drought in the summer and do not tolerate severe frost well. The impact of climate change on the species composition and condition of tree-stands will also be important. Throughout the country trees can be seen to become weaker. Trees will be more susceptible to damage caused by the wind. It is well-advised to launch further actions to ensure sustainable forest management, an adequate amount of water in forests and a possible reconstruction of the species composition of forests. The very great threat of the weakening of tree-stands was pointed out by the representatives of Pomorskie Voivodship[13] (in particular, in Kashubia and Tuchola Woods) or Śląskie Voivodship.

The mountain ecosystems are probably most vulnerable to the impact of climate factors. It is estimated that 60% of species in these areas in Poland are at risk of extinction due to climate change.

In addition to adaptation actions, Poland should take efforts to mitigate climate change and reduce the carbon dioxide concentration in the air. The shift towards the reduction of greenhouse gas emissions will require strong and coordinated actions in the different sectors of the economy, while the pursued climate policy will continue to encourage the use of clean technologies. Poland has a large potential to reduce the GHG concentrations in the air, among other things, by improving the efficiency of fuel use, using the potential of forests, using the forest and agricultural biomass to produce renewable energies at dedicated installations, taking into account the hydro-power potential and Polish geothermal resources, preserving and restoring wetlands,

[12] Pruszak Z., Brzeg Morski. Procesy fizyczne obszaru płytko- i nadwodnego (The Physical Processes in the Shallow and Coastal Areas – in Polish), Publishing House of the Institute of Hydro-Engineering of the Polish Academy of Sciences, Gdańsk, 2014.
[13] On the basis of the findings of a survey on the assessment of threats which has been carried out by the Ministry of the Environment at the Marshalls' Offices.

developing wooden buildings as CO_2 reservoirs and sequestering carbon in soil.

In accordance with the national projections of greenhouse gas emissions prepared in 2017 for the purposes of the *Seventh National Communication and the Third Biennial Report for the Conference of the Parties of the United Nations Framework Convention on Climate Change*, it is estimated that in 2030 Poland's total emissions will be lower by 23% than those in 1990 and lower by 37% than those in 1988. The results of the national greenhouse gas emission inventory for the non-ETS sectors for the period from 2013 to 2015 as well as emission projections indicate that Poland will achieve the target laid down in Decision No 406/2009/EC of the European Parliament and of the Council[14] (+14%) with a surplus for the whole period from 2013 to 2020. However, already in 2021 to 2030 Poland can have a problem with achieving its non-ETS reduction target at the level of –7%, as its contribution to the fulfilment of the EU wide non-ETS reduction target of 30% relative to the emissions in 2005. Therefore, legislative actions should be intensified and coordinated and the reductions in these sectors of the economy should be supported.

Climate change should be perceived as a risk which needs to be taken into account when creating regulatory mechanisms and investment plans, just as consideration is given to risks of a macroeconomic or a geopolitical character.

It is also important to bear in mind that anthropogenic climate change resulting in climate anomalies in their extreme version and long-term changes will reduce at the global scale access to food, drinking water and energy, thus increasing the competition for natural resources and the migration of populations from endangered areas (e.g. island states) to safer regions. The disturbance of the ecosystem productivity caused by economic development is strengthened by climate change.

4.2. The growing competition for natural resources

The most important challenges in the field of environmental protection include the sustainable, economical and rational management of the natural resources of the environment. It is important to take efforts to ensure access to these resources for the next generations, particularly in light of the progressing urbanisation which, creating incentives for economic development, will increase the pressures on the resources of food, water and energy.

In the past decade, Poland made a substantial progress in the efficient use of energy and water, nevertheless it is still characterised by lower indicators of their use compared with the Western European standards. The Polish economy is still one of the least efficient in the European Union in terms of resource and energy savings, although e.g. the efficiency of its use of water has greatly improved relative to the early 21st century. With its water resources of about 1 600 m^3/per capita/year, Poland is

[14] Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (OJ L 140, 05.06.2009, p. 136).

one of the countries of the Organisation for Economic Cooperation and Development (OECD) which have the scarcest freshwater resources[15].

The risk of a water deficit was regarded as a very high one in Łódzkie Voivodship, particularly in zones with very large development needs and low retention capacity, where unfavourable changes in the hydrogeological conditions in the form of the depression cone of an open-cast mine cause the drying up of wells, degradation of the vegetal cover, biodiversity loss, the waning of rivers and watercourses and losses in the agricultural sector.

Limited access to water of appropriate quality, raw materials and energy in the future can, on the one hand, pose a threat in the context of security and quality of life and for the development of sectors based on these resources. On the other hand, it is an incentive encouraging the development of innovative environmental technologies, the overcoming of the trap of a mediocre product and the implementation of the model of a circular economy. The actions for a circular economy are also strictly related to the main EU priorities, such as: employment, economic growth and industrial innovation.

Although in the nearest years Poland can expect an improvement in its actions for eco-innovation, a holistic transition to more efficient use of resources in the economy will require long-term investments. The introduction of eco-innovations should be perceived as an economic and social opportunity, making it possible to overcome the middle-income trap, rather than as a cost – in particular, in the private sector for which public authorities should ensure further relevant incentives and support[16].

The transition to the model of a circular economy[17] will be supported at all the stages of the value chain – from design through production, consumption, repair and remanufacturing to waste management and acquisition of secondary raw materials which are returned to the economy. The basic aim of a circular economy is to ensure that a product is manufactured and used as effectively as possible and that the waste arising from it is managed in an appropriate manner in economic and environmental terms. It is important for waste – if it arises – to be regarded as potential secondary raw materials.

The above approach will mean, among others, the achievement of long-term targets for the limitation of the landfill of waste and the intensification of actions to ensure levels of the preparation for reuse and recycling of priority waste streams, such as municipal waste and packaging waste. On the basis of these targets, the EU, including Poland, will gradually work towards the introduction of the best practices and encourage further investments in waste management, contributing to achieving the objectives of a circular economy.

Primary raw materials, including renewable materials, will still continue to play an important role in production processes. In this context, the environmental and social effects of production will be increasingly important, in both the EU and third countries. For this reason, the sustainable acquisition of raw materials will be supported at the global scale, e.g. by means of a political dialogue, cooperation, trade policy and development policy. It seems inevitable that the importance of distributed energy generation will grow, with users grouped around small local energy sources, which

[15] On the basis of the World Bank report Poland: Toward a Strategic, Effective, and Accountable State Systematic Country Diagnostic (31 July 2017).
[16] On the basis of the EU Environmental Implementation Review: Highlights.
[17] On the basis of the Communication from the Commission Closing the loop - an EU action plan for the circular economy, COM(2015) 614 final.

would be complemented by a growing share of energy produced by users themselves, i.e.so-called prosumer energy generation.

The need to create a sustainable, low-carbon, resource-efficient and competitive economy will provide a strong stimulus for the development of eco-innovation. To this end, it will be necessary to overcome many barriers, consisting in insufficient research activities, a poor linkage between industry and science, difficult access to capital, the absence of a reliable market offer, an uncertain return on investment and the lack of economic or tax incentives in daily life[18].

Consumers are also of key importance in the process of transition to the model of a circular economy. The shaping of new consumption patterns will require the presence of technologies and advanced education tools, the dissemination of the concept of a voluntary systemic approach to the management of environmental impacts by organizations holding EMAS or ISO 14001 certificates and the use of economic instruments, such as taxes, so that product prices better reflect environmental costs. Support will also be given to innovative forms of consumption, such as the use of the same products or infrastructure (the sharing economy), the consumption of services rather than products and the use of information technologies or digital platforms.

The array of economic instruments also includes product and deposit charges which can encourage customers to choose goods and services of less environmental annoyance. These charges should be a source of revenues of specialised funds whose resources will enable support for the transformation of production and consumption.

The issue of food waste will also gain in importance. The production, distribution and storage of food involve the use of natural resources and environmental impacts. The discarding of food generates a pressure on the environment and causes financial losses for consumers and the economy. Food waste has also an important social aspect: there is a need to facilitate the transfer of food which is good for consumption but cannot be placed on the market for logistics or marketing reasons to those in need. In September 2015, the United Nations General Assembly adopted as part of the SDGS the objectives of halving per capita global food waste at the retail and consumer level and reducing food losses in production and supply chains, including post-harvest losses. The EU and its Member States undertook to achieve these objectives[19].

[18] On the basis of the report on the Environment Performance Review of Poland, OECD 2015.

[19] On the basis of the Communication from the Commission Closing the loop - an EU action plan for the circular economy, COM(2015) 614 final.

4.3. The growing pressures on ecosystems

Biodiversity is the wealth of the ecosystems, species and genes surrounding us which represents a value in itself and also has a significant effect on human living comfort (e.g. food, flood protection, air quality, noise protection, recreation space). However, biodiversity diminishes at a very fast pace. The extinction of species has reached a critical condition since it is already about 1 000 times faster than in ordinary periods of the Earth's history and it is predicted to speed up even more[20]. Almost one fourth of wild species in Poland is at risk of extinction and most ecosystems have degraded to such an extent that they have lost their precious values. This degradation means huge social and economic losses. The phenomena which are the main drivers of biodiversity loss (e.g. the transformation of habitats, the excessive exploitation of natural resources, the introduction and expansion of invasive alien species and climate change) increase, weakening the favourable effects of actions to halt this process[21]. The threat of degradation of valuable natural resources was pointed out in Opolskie, Lubelskie and Świętokrzyskie voivodships, while the pressures exerted by the extractive industry, infrastructure and urbanisation were noted in Dolnośląskie Voivodship.

The EU vision until 2050 provides for the conservation and restoration of biodiversity and the valuation of ecosystem services in light of their effect on human welfare and economic growth. This increases the significance of agriculture and forestry for maintaining and strengthening biodiversity and the conservation status of the protected natural habitats of terrestrial ecosystems as well as that of fisheries for ensuring the sustainable use of aquatic ecosystems. Actions will also be taken to combat invasive alien species. The wealth of biodiversity is Poland's potential, which – if correctly used – can improve competitiveness at the regional and local levels. In practice, this will mean the launch of actions to enhance the effectiveness of the protection of the natural environment, taking into account the interests of the local communities and the need to increase financial outlays. The socio-economic development requires the national and responsible management of the physical space, while taking into account the needs of food production, industry, urbanization, infrastructure and areas with natural values, as well as the condition of ecosystems and their services. In light of this, actions will be taken to better inventory the resources of habitats and species. This will improve the quality and efficiency of both the system for the management of natural resources and the system of environmental impact assessments, as well as other tools for development planning at the national, regional and local levels.

The issue of the maintenance and reconstruction of the functions of ecosystems will apply to the whole territory of the country and be based on the assessment of the condition of ecosystems and their services. This requires the development of a system for the valuation of ecosystem services and the integration of these values into the development strategy, the planning system and the national accounting and reporting systems. As a result of this, biodiversity will regain the rank of the driver of the social and economic development and, in consequence, its perception by the public will change. The integration of the values of ecosystem services into the national decision-

[20] See the Millennium Ecosystem Assessment, 2005, Ecosystems and Human Well-being: Biodiversity Synthesis, World Resources Institute, Washington, DC.
[21] The EU Biodiversity Strategy to 2020.

making processes will make it possible to correctly assess the extent of the possible biodiversity loss, to apply compromise solutions and to improve the coordination of actions among the individual sectors and administration levels.

An important problem is also the pollution of the Baltic Sea ecosystem with waste. Much waste which finds its way into the marine waters has an adverse impact, mostly due to its accumulation as a result of the very slow process of its degradation. The waste in the sea originates from different sources; however, the greatest pressures are exerted by terrestrial sources. Most of waste found in the marine environment is related to the modern "take away" lifestyle (plastic packaging, coffee cup lids and mixing sticks, plastic cups and straws). Plastics play an important role in our economy and daily life, but the manner in which they are produced, used and discarded is harmful to the environment. Plastic materials raise particular concerns because of threats to the environment and slow degradation. About 70% of marine waste in the Baltic Sea is plastics. Although they do not decompose they fall apart into increasingly small particles. Large impacts are also exerted by hygienic articles, cosmetics and cleaning supplies containing plastic microparticles (washing powders, peeling lotions etc.), which can be carried over large distances by sewage systems and river runoff. The smallest microwaste, in particular, plastic microwaste, is invisible to the human eye, but reaches the food chain of animals and through it, humans.

There is also the problem of waste left by tourists on beaches and blown away from local landfills. Although terrestrial sources dominate the generation of waste in the sea, marine sources, such as the fisheries, recreation and marine shipping sectors, also contribute to this problem.

4.4. The increasingly significant adverse impact of the environment on human health[22]

The good-quality natural environment significantly contributes to improving man's physical, mental and social well-being. However, the interaction between the environment and human health is very complex and difficult to assess. Different demographical and socio-economic trends, coupled with sustained inequalities in this respect, increase the sensitivity of the population to many factors, including those related to the environment and climate. The effects of environmental pollution are substantially felt in Europe. The World Health Organisation (WHO) estimates that the stress factors related to the environment are responsible for 15–20% of all the deaths in 53 European countries.

The best-known factors affecting health are related to air pollution, poor water quality and insufficient sanitary conditions. Relatively new problems in the area of

[22] Prepared on the basis of the 2015 EEA report The European environment – State and outlook 2015 – synthesis report and the World Bank report Poland: Toward a Strategic, Effective, and Accountable State. Systematic Country Diagnostic (31 July 2017).

environmental protection include noise, electromagnetic fields, chemical hazards and major-accidents hazards. Climate change, the depletion of the stratospheric ozone layer and soil degradation can also affect human health. The presence of these impacts is related to long-term environmental and socio-economic trends, changes in lifestyles and consumption and the quick introduction of new chemical substances and technologies.

The countries of the European Union, including Poland, have established strategic objectives the achievement of which is expected to ensure a good quality of life for the present and future generations. Promoting good health and reducing social inequalities are the central themes of the EU policy in the field of health and also an integral part of smart and inclusive growth in Europe. *A General Union Environment Action Programme to 2020 "Living well, within the limits of our planet"* (7EAP) lays down the directions of the actions of the institutions of the EU and Member States. Its nine priorities include three priority areas where more action is needed to protect nature and strengthen ecological resilience, boost resource-efficient, low-carbon growth, and reduce threats to human health and wellbeing.

The new strategy of the World Health Organisation for Europe recognises well-being as a possible focus of the reorientation of social policy in the 21st century, including its environmental dimension. At the European level, the WHO implements its Health and Environment Process. The central issues are the threats posed by the state of the environment and climate and their impacts on the human health condition, particularly that of children[23].

The impact of the environment on human health and well-being can be seen particularly in cities. Almost 73% of the European population lives in cities and it is expected that it will reach 82% in 2050[24]. The development of cities in Europe increases pressures on the environment and health, among others, with air pollutant emissions from transport, an unfavourable structure of urbanised space, fragmentation and unification of landscapes. According to the OECD, by 2050 the air pollution level in cities is expected to become the main environmental cause of mortality in the world. In addition, the data available on long-term average exposure indicate that 65% of Europeans living in large urban areas are exposed to a high noise level and 20% to night-time noise which often causes adverse health effects[25].

In cities, there are many pressures which affect large populations, including the particularly vulnerable groups, such as children and the elderly. Thermal conditions are one of the significant aspects. It is predicted for the largest cities in Poland that the number of hot days (with the maximum temperature exceeding 30°C) will grow, most significantly in the north of the country. This direction of temperature change in the summer months can cause a deterioration of the living comfort of the particularly vulnerable groups. The conditions in the cold season will also change. The number of days with ground frost will decrease by 20 days on average, while it will slightly increase in the north of the country. The number of freezing days will also fall across the country. The largest reduction will come in the northeast of the country.

[23] In accordance with the report of the European Environment Agency the European environment – state and outlook 2010 (SOER 2010).

[24] General Assembly resolution 66/288: The future we want, A / RES/66/28, 11 September 2012, United Nations and World Urbanization Prospects — The 2011 Revision — Highlights, New York.

[25] Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 "Living well, within the limits of our planet" (OJ L 354, 28.12.2013, p. 171).

The above situation indicates the need to launch special adaptation actions. On the other hand, the development of dense urban building and a more efficient approach to the resources of the urban environment provide opportunities for mitigating pressures on the environment and improving man's quality of living. Moreover, well-planned urban areas which ensure good access to natural green areas, including riverside areas, and enable the creation of green[26] and blue[27] infrastructure can bring benefits for human health and well-being and also mitigate the effects of climate change felt by city dwellers.

The urbanisation related pressures affect, in particular, the areas around and inside large cities, open areas and areas with natural and landscape values.

The further implementation of the policy on the sustainable planning and design of urban space, including the prevention of urban sprawl, will be of key importance for supporting the sustainable development of cities. Smart planning and governance mechanisms can affect mobility related behaviour, pushing it towards more sustainable modes of transport and reduced demand for transport. They can also improve the energy performance of buildings, reducing pressures on the environment and, at same time, improving man's quality of living.

Air pollution causes significant financial and economic consequences. It is damaging in terms of both the social costs of mortality and morbidity, and direct losses of household budgets. The adverse effects of air pollution are not limited to human health only. Many other factors need to be considered: those related to the surroundings (e.g. the condition of buildings, built structures and infrastructure), the condition of fauna and flora (having further consequences for the productivity of agricultural and forest resources) and larger ecosystems.

Despite a systematic improvement of air quality in Poland, excessive concentrations of particulate matter and benzo(a)pyrene in the winter season still remain a significant problem. In accordance with the results of the assessment of air quality in 2017, performed by the Inspectorate for Environmental Protection, exceedances were found in all the 46 zones in the country, including 34 zones with exceedances of the limit value of particulate matter PM10, 19 zones with exceedances of the limit value of particulate matter PM2.5 and 43 zones with exceedances of the target value of benzo(a)pyrene, as well as 4 zones with exceedances of the limit value of nitrogen dioxide, 1 zone with exceedances of the limit value of sulphur dioxide, 3 zones with exceedances of the target value of arsenic and 6 zones with exceedances of the target value of ozone set to protect human health. The average concentrations of pollutants which are harmful to health in Poland are some of the highest in the EU and the OECD.

The air quality in Poland mainly depends on the level and spatial distribution of emissions from stationary and mobile sources, as well as on transboundary fluxes

[26] Green infrastructure is a tool for providing ecological, economic and social benefits through nature-based solutions. It is a network of nature, semi-natural areas and green space that delivers ecosystem services, which underpin human well-being and quality of life. For example, green infrastructure can be used to reduce the amount of storm water runoff entering sewer systems and ultimately lakes, rivers and streams, through the natural retention and absorption capabilities of vegetation and soils. Benefits of green infrastructure in such a case could include increased carbon sequestration, improved air quality, urban heat island mitigation, additional wildlife habitat and recreational space. Green areas also contribute to the cultural and historical landscape, giving identity to places, as well as to the scenery of urban and peri-urban areas where people live and work. Source: European Environment Agency, issue no. 2015/3 of the Newsletter, 15 September 2015. Benefits of greenery, mostly for health, were collected in the draft Resolution of the European Union on the European Year of Greener Cities 2020.

[27] Blue infrastructure relates to water management. It includes rainwater retention, rainwater drainage and renaturalisation of watercourses and water reservoirs. Source: The Future Cities Adaptation Compass – guidance for developing climate-proof city regions, http://www.future-cities.eu/project/adaptation-compass/.

and physic-chemical transformations taking place in the atmosphere. These processes affect the development of the so-called background pollution, which results from the state of a dynamic equilibrium at larger distances, and also determine the ranges of increased concentrations in the area of the direct impact of sources. The unfavourable weather conditions (a windless state - calm, low temperature, fog, no precipitation, inversion) are important particularly in the case of low emissions, e.g. from household furnaces, local boiler-houses and road transport.

City inhabitants are exposed, in particular, to the effects of poor air quality. Due to the relief of the terrain, the dominating heating mode and the population density, the limit values of particulate matter are most often exceeded in cities and agglomerations situated in central and southern Poland (in the Upper Silesia, Kraków, Rybnik-Jastrzębie, Łódź and Warszawa agglomerations).The problem of air pollution also affects the residents of rural areas since households use individual heating systems with insufficient parameters of pollutant emissions.

Analyses indicate that the domestic and municipal sector, transport and to a slight extent industry are primarily responsible for this situation. The contributions from the different sectors vary across the country and depend on the degree of industrialisation of a given zone.

The domestic and municipal sector uses obsolete installations and equipment failing to meet emission standards in combustion processes, poor-quality solid fuels are often used, e.g. coal mud, post-flotation concentrates, coal fines, bad-quality coal or lignite, and waste is burned. These incorrect practices result from the inadequate awareness of the public of the impact of its activities on the air quality and the related health effects. Poor-quality fuels are often used for financial reasons related to so-called energy poverty affecting residents with the lowest incomes. Due to the incorrect spatial development in cities, natural corridors and aeration wedges are blocked in the city centres.

A short-term exposure to high concentrations of particulate matter PM_{10} (from several hours to several days) can cause the emergence of disease symptoms, especially in the particularly vulnerable social groups (the elderly, small children, pregnant women or ill persons). A long-term exposure to excessive concentrations of particulate matter increases the risk of diseases of the respiratory or circulatory systems in the whole exposed population[28].

The number of motorised vehicles, both passenger cars and commercial vehicles, systematically grows in Poland. In the period from 2005 to 2015, their number was enhanced by about 10.6 million cars, including more than a million of commercial vehicles. In 2015, according to GUS data[29], in Poland there were 27 409 motorised vehicles (as of 31.12), 75.6% of which were passenger cars. According to the Central Register of Vehicles, the average age of passenger cars is 17.5 years, while that of commercial vehicles is almost 16 years[30]. However, the fast increase of the number of motorised vehicles was accompanied by the process of implementing increasingly stringent car exhaust emission standards and the development of road infrastructure (e.g. the construction of ring roads around cities, expressways). As a result of these actions,

[28] Chief Inspectorate for Environmental Protection, Juda-Rezler K., Toczko B. (Eds.), Pyły drobne w atmosferze. Kompendium wiedzy o zanieczyszczeniu powietrza pyłem zawieszonym w Polsce (Find Dust in the Atmosphere. A Compendium of Knowledge of Air Pollution with Particulate Matter in Poland – in Polish), Environmental Monitoring Library, Warszawa 2016.
[29] Data from the Polish Association of the Automotive Industry.
[30] The fleet of cars registered in Poland, Polish Association of the Automotive Industry.

despite a substantial increase of the number of cars, the carbon oxide emissions from road transport in 2016 fell by more than 37% compared with 2005, while the emissions of oxides of nitrogen diminished by about 1%. At the same time, the total particulate matter emissions from road transport in that period, including mainly emissions from engines and those from the abrasion of tires and brakes, grew by about 12%[31].

On the basis of an analysis of the obligations to reduce the emissions of air pollutants and taking into account the commitment to achieve EU standards, innovation should be expected to grow in the Polish economy, particularly, in the area of electromobility, in both the individual and collective dimensions. Rail and water modes of transport will also gain in importance. The number of users of municipal heating systems will increase an effect of the expansion of heating networks. The energy efficiency of existing and new buildings will considerably improve. The development of renewable energy sources, including RES microinstallations, is also predicted. The sustainable development of local heating networks and RES microinstallations will be possible, among others, due to the support for the development of local initiatives launched via energy clusters or energy cooperatives.

Water quality is of key importance for the quality of human life and the correct functioning of both aquatic and terrestrial ecosystems. A challenge to the achievement and maintenance of good water status is the reduction of the impact of pressures from different sectors of the economy and man. One of the key problems is the excessive load of nutrients – nitrogen and phosphorus – in waters. They originate primarily from runoffs from areas used for agricultural purposes (arable land, pastures, areas of intensive livestock rearing) and dispersed rural and recreation buildings, the deposition of total nitrogen and phosphorus from the atmosphere, and pollutants from wastewater and households unconnected to collective sewage systems.

An excessive input of nutrients (nitrogen and phosphorus) into the aquatic environment causes eutrophication, which results in blooms of algae and cyanobacteria at a sustained high-water temperature. Blooms restrict access of sunlight to deeper water layers, impeding the development of plants living in deeper parts of water and using sunlight in the photosynthesis process. Eutrophication contributes to the emergence of oxygen deserts (dead zones) and low-oxygen areas where life wanes, in both water reservoirs and rivers. Reduced oxygenation and differentiation of species, each of which specialises in the recovery of other substances from water, diminish the self-cleaning capacity of waters. This effect, which reduces the useful water resources, speeds up the unification of hydromorphological elements as a result of the regulation of rivers. In a longer term, all these changes threaten the quality of the aquatic environment. This affects ecosystem services, such as the provision of sources of water intended for consumption (the contamination of groundwater with nitrogen and phosphorus compounds), fisheries and recreation. Waters in Europe are much cleaner now than 25 years ago as a result of investments in sewage systems aimed at reducing pollutants coming from municipal wastewater. Many challenges still remain. It is estimated[32] that more than 40% of rivers and coastal water bodies are exposed to diffuse pollution from agriculture and 20-25% of these waters are affected by pollution

[31] Poland's Informative Inventory Report 2018, http://www.kobize.pl [accessed 17.06.2019].

[32] Prepared on the basis of the 2015 EEA report The European environment – State and outlook 2015 – synthesis report and the World Bank report Poland: Toward a Strategic, Effective, and Accountable State. Systematic Country Diagnostic. Report No. 117802-PL (31 July 2017).

from point sources, e.g. industrial plants, sewage systems and wastewater treatment plants. In turn, in accordance of data from the Chief Inspectorate for Environmental Protection[33], the status of the Polish marine waters in 2016 was recognised to be poor under the MSFD in terms of eutrophication. Moreover, pursuant to the Act on Water Law[34], the Nitrogen Programme[35] was prepared and published for the whole territory of the country. Its implementation will contribute to reducing the pollution of waters with nitrogen from agricultural sources.

The combat against inadequate wastewater treatment and the release of nitrogen compounds into the environment by agriculture is particularly important for reducing the release of nutrients[36]. The reduction of the total release of nutrients into waters requires comprehensive solutions, covering entire hydrological systems, since nutrients present in surface waters and groundwater affect transitional and coastal waters. All the measures to reduce the input of nutrients must take into account the delayed response time of the environment, since actions on inland waters reduce the pressures on the marine, transitional and coastal environments only after a certain period of time.

In Poland, flowing surface waters are a source of drinking water for many localities. Therefore, human health and the levels of costs which need to be incurred for its treatment depend on the quality of these waters. Surface waters are also used to irrigate farmland and orchards. The pollutants which they carry can be captured by soils and taken up by plants cultivated on them. The pollutants from flowing waters can penetrate into the human body in the meat of fish caught in the environment or those from fish farms.

The creation of healthy aquatic ecosystems requires a systemic vision, since the condition of these ecosystems strictly depends on how terrestrial and aquatic resources are managed and on the pressures from such sectors as industry, agriculture, energy, transport and the municipal sector. There are many ways in which water management can be improved. They include the implementation of water policy objectives in other areas, such as agricultural policy, spatial policy, cohesion policy, structural funds and sectoral policies.

Investment actions will be continued in wastewater management, focusing on the removal of nitrogen and phosphorus compounds and bacterial contaminants. Due to the extended sanitary sewage network and the growing public awareness, the quantity of untreated wastewater released into waters or to land will be reduced. Changes in agriculture (fertilisation, land amelioration) towards the use of so-called good agricultural practices will be of importance for the quality of waters in Poland. Moreover, the correct implementation of measures under the Nitrogen Directive[37] (primarily through the programme of measures throughout the country), under the *HELCOM* Convention (through the Baltic Sea Action Plan), as well as the promotion, introduction and implementation of agricultural practices friendly to the marine

[33] Inspectorate for Environmental Protection, Ocena stanu środowiska polskich obszarów morskich Bałtyku na podstawie danych monitoringowych z roku 2016 na tle dziesięciolecia 2006–2015 (An Assessment of the State of the Environment of the Polish Marine Waters of the Baltic Sea on the Basis of 2016 Monitoring Data against the Decade of 2006 to 2015 – in Polish), Warszawa, 2017.

[34] The Act of 20 July 2017 on Water Law (OJ L of 2018, Item 2268, as amended).

[35] A programme of measures to reduce nitrogen runoff from agricultural sources.

[36] Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 "Living well, within the limits of our planet".

[37] Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (OJ L 375, 31.12.1991,p. 1, as amended; *Polish translation: Chapter 15 Volume 002 P. 69, as amended*).

environment at farms will be of large importance for reducing the pollution of waters with nitrates from agricultural sources and preventing their further pollution. The quality of flowing waters in Poland also depends on transboundary pollution, particularly from the East; therefore, support will continue to be provided to projects intended to improve the quality of waters flowing into Poland's territory.

4.5. The depletion of the existing sources of financing for environmental protection

One of the external challenges identified in the SOR which Poland faces in a short term is the change predicted in the operational model of the European budget, including the reduction of the budget for the implementation of cohesion policy and the decrease of the amounts allocated so far to the particular countries and regions. At the same time, in light of the national system of proceeds from environmental fees and fines, it can be predicted that these proceeds will also fall as the particular sectors achieve a high level of environmental protection. There will be a challenge of maintaining the continued capacity of generating payments to finance environmental protection and water management in amounts exceeding the proceeds from environmental fees and fines by maintaining and improving the worked-out mechanisms of returnable financing of environmental protection and also by seeking new financial instruments. In addition, it will still be necessary to finance expensive investment projects aimed at meeting the EU standards and maintaining the existing facilities.

Thus, there is the risk of a gradual depletion of the existing sources of financing for environmental protection, along with the need to provide, at the same time, further financial support to it, including in the form of non-returnable assistance in the case of actions related to projects intended to ensure access to key ecosystem services. Moreover, it should be expected that gradually more and more expenditures on environmental protection will be incurred by both consumers (households) and producers (enterprises), in accordance with the "polluter pays" principle. The amounts incurred should be based on estimated external costs.

At the same time, it should be pointed out that if the logic of programming the European funds after 2020 is based on the linkages of particular policies to environmental objectives this may provide an opportunity for better understanding of Polish development priorities and integrating them into the EU development objectives.

Other factors which will contribute to reducing access to sources of financing for environmental protection include the following:

- the limit of the 75% of the average EU GDP is exceeded by successive voivodships (this has happened in the case of Mazowieckie Voivodship and now concerns Wielkopolskie and Dolnośląskie voivodships, thus, resulting in the limitation of the allocation of EU resources);
- the EU prefers loans and other returnable instruments to grants in the next EU financial perspective,

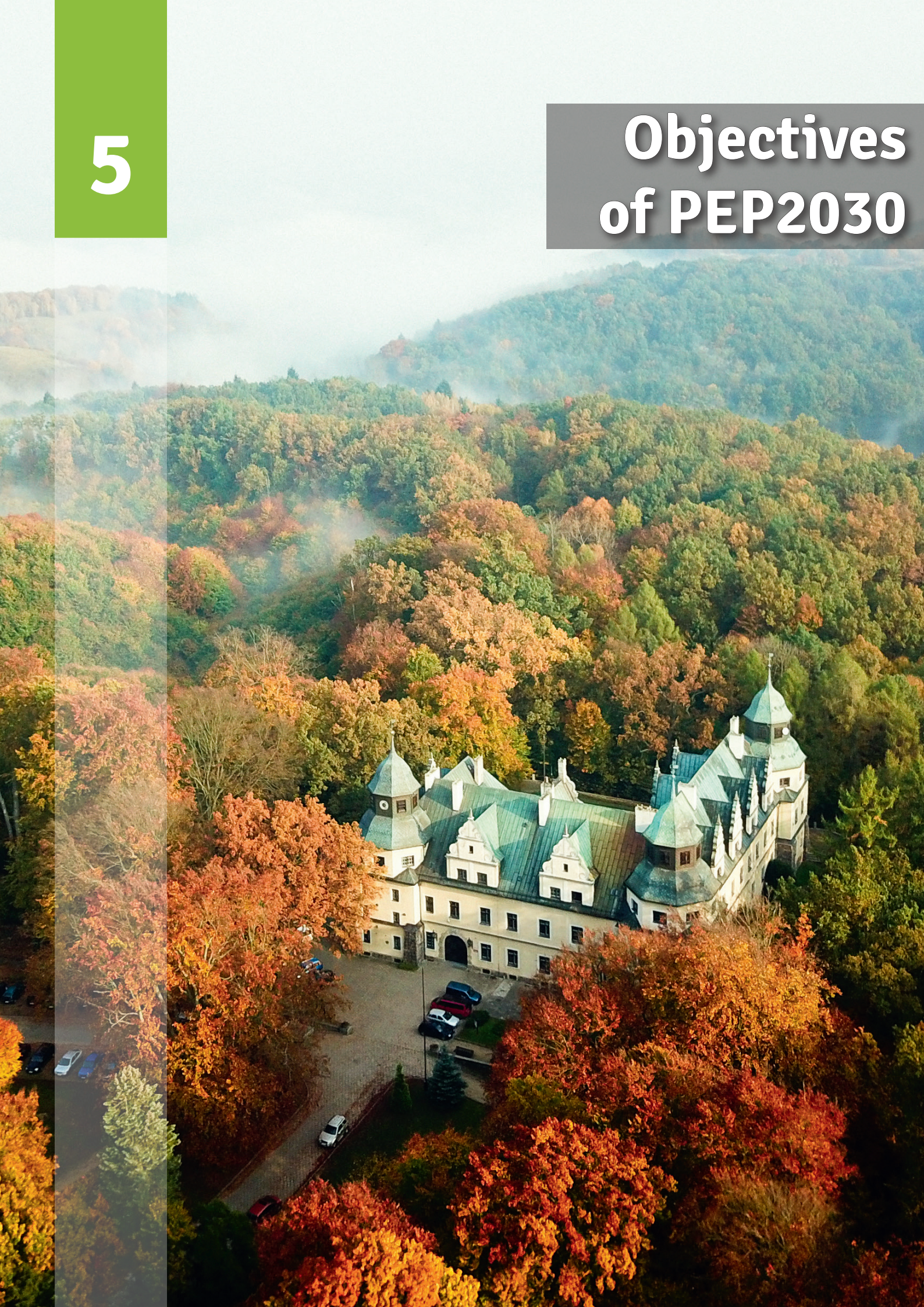
– the debt of self-governmental units can make it difficult or even impossible to use EU resources requiring matching funds.

Opportunities for mobilising resources for environmental protection should also be sought in overcoming the "trap of institutional weakness" by focusing on the improved performance of instruments for environmental protection, including, in particular, the environmental and governance system. This will involve efforts to combat the grey area in waste management and the illegal extraction of minerals, as well as the strengthening of the Inspectorate for Environmental Protection in the scope of both inspections and monitoring of the environment, including the provision of the Inspectorate with relevant resources for carrying out inspection tasks relating to the implementation of the Nitrogen Directive[38]. The full implementation of reform of water management will be of key importance for the execution of environmental investments. In light of the limited availability of resources for the implementation of the objectives of PEP2030, it will be important to ensure the consistency of the public expenditures in other areas with the objectives of PEP2030 (sustainability proofing) and to implement the principle that public resources should not be used to support actions and projects inconsistent with the objectives of PEP2030.

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

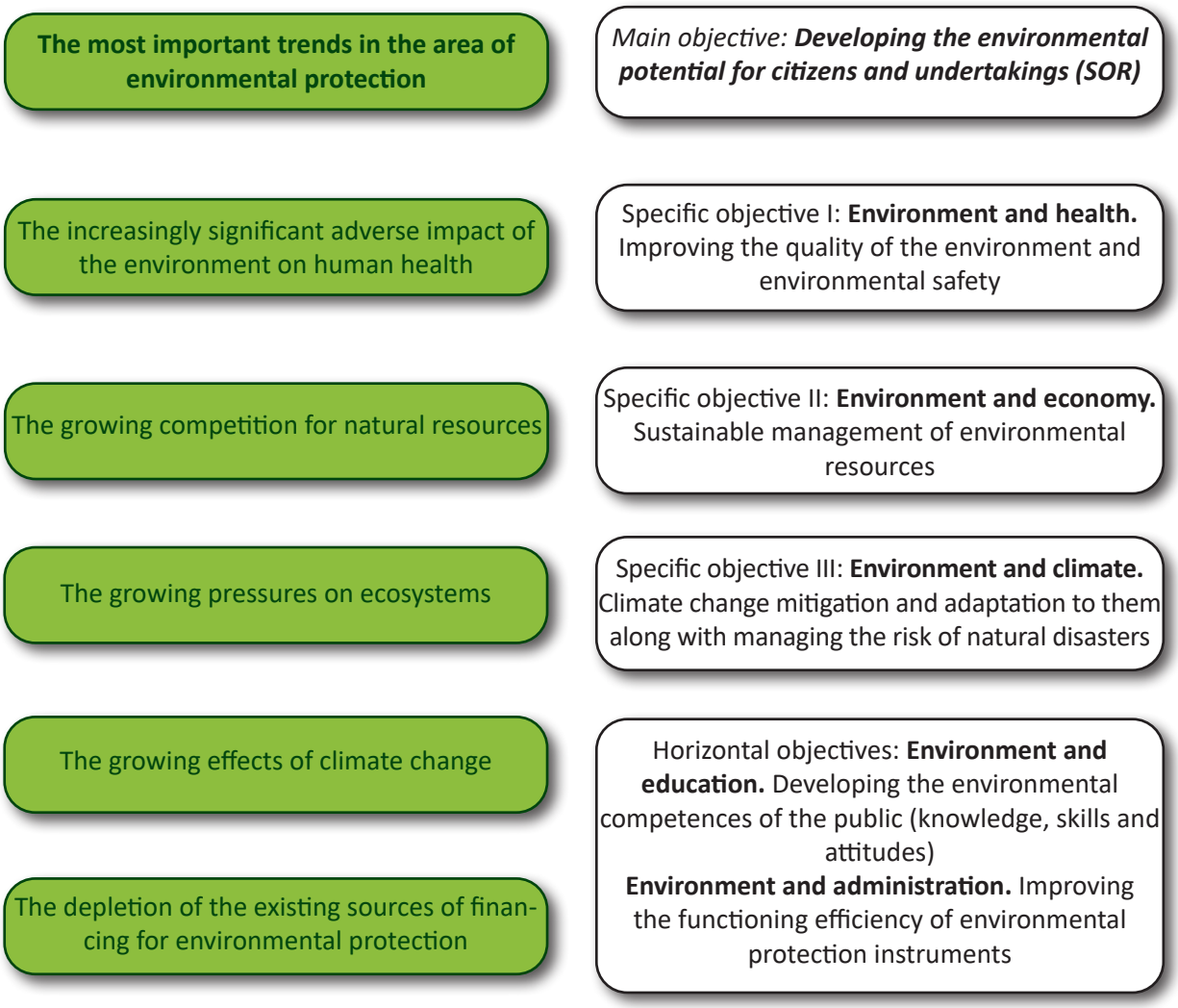
5

Objectives of PEP2030



In the system of the strategic documents, the PEP2030 specifies further and operationalises the provisions of the SOR. Thus, the main objective of the PEP2030, i.e. *Developing the environmental potential for citizens and undertakings,* was taken directly from the SOR. The specific objectives of the PEP2030 were laid down in response to the most important trends identified in the diagnosis in the area of the environment in a manner enabling the harmonisation of the issues related to environmental protection with the economic and social needs.

The achievement of the environmental objectives will be supported by horizontal objectives.



6

Performance indicators for the objectives of PEP2030

The effectiveness of the implementation of PEP2030 will be monitored with a set of indicators based on data from reliable sources, in particular, the State Environmental Monitoring System, Statistics Poland (GUS) and the General Inspectorate for Environmental Protection. The indicators enable the quantification of the selected objectives by determining the existing and target values of the particular parameters of the environment.

Main objective. Developing the environmental potential for citizens and undertakings (SOR)				
Indicator	Unit of measure	Baseline value[1]	Intermediate value (2020)	Target value (2030)
Environmental Performance Index[2] (Yale University, Columbia University, World Economic Forum)	Point	64.11 (2018)	>65	>70
Objective: Environment and health. Improving the quality of the environment and environmental safety				
The ratio between the number of bodies of surface water in good status and the total number of bodies of water[3] a) rivers and dam reservoirs, b) lakes (PMŚ)	%	a) 20% good status, 80% bad status, b) 37% good status, 63% bad status, (2015)	Improved status[4]	Improved status relative to the intermediate value[5]

[1] The value of the indicator for the last year available.

[2] Environmental Performance Index, https://epi.envirocenter.yale.edu/. The Environmental Performance Index consists of a number of metrics of environmental health (e.g. air quality, water quality, the impact of the environment on human health) and ecosystem health and vitality (e.g. wastewater treatment, nitrate pollution, change in forest cover, fisheries, species protection, greenhouse gas emission level). The maximum value of the index is 100 and means high environmental performance.

[3] The full name of the indicator: the ratio between the number of bodies of surface water in good status monitored as part of surveillance monitoring over last 6 years and the total number of bodies of surface water monitored as part of surveillance monitoring over last 6 years in a given category of waters: a) for the assessed water bodies of rivers and dam reservoirs; b) for the assessed water bodies of lakes.

[4] The increase, relative to the values in the base year, of the percentage values defining the ratio between the number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) in good status, monitored as part of surveillance monitoring over last 6 years, and the total number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) monitored as part of surveillance monitoring over last 6 years, with a simultaneous decrease of the percentage values defining the ratio between the number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) in bad status monitored as part of surveillance monitoring over last 6 years and the total number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) monitored as part of surveillance monitoring over last 6 years. In light of proposed changes, with respect to the base year, in the manner of assessment of the status of surface waters and the review of the WFD carried out by the European Commission, it is impossible to give a precise percentage value of the indicator.

[5] The increase, relative to the intermediate values (2020), of the percentage values defining the ratio between the number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) in good status monitored as part of surveillance monitoring over last 6 years and the total number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) monitored as part of surveillance monitoring over last 6 years, with a simultaneous decrease of the percentage values defining the ratio between the number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) in bad status monitored as part of surveillance monitoring over last 6 years and the total number of bodies of surface water in a given category (rivers and dam reservoirs or lakes) monitored as part of surveillance monitoring over last 6 years. In light of proposed changes, with respect to the base year, in the manner of assessment of the status of surface waters and the review of the WFD carried out by the European Commission, it is impossible to give a precise percentage value of the indicator.

The ratio between the number of bodies of groundwater in good chemical status and the total number of bodies of surveyed as part of surveillance monitoring (PMŚ)	%	91.9 (2016)	Improved status[6]	Improved status relative to the intermediate value[7]
The population using sewage systems as percentage of the total population[8] (GUS)	%	70.5[9] (2017)	73.0	85.0
Wastewater treatment plant users as percentage of the population (GUS)	%	73.6[10] (2017)	75.0	86.0
Air quality index[11] (PMŚ)	%	76.09 (2016)	21.7	0
Value of the National Target for Exposure to PM 2.5 (PMŚ)	$\mu g/m^3$	18	18	18
Number of agglomerations and cities with more than 100,000 inhabitants where the average exposure value does not exceed the concentration ceiling for exposure to PM 2.5 at a level of 20 $\mu g/m^3$ (PMŚ)	Number	11	20	30
Degraded areas as percentage of the total surface of the country (GUS)	%	0.02 (2017)	≤0.02	≤0.02
Objective: Environment and economy. Sustainable management of environmental resources				
National forest cover (GUS)	%	29.6 (2017)	30	31
Progress towards sustainable forest management[12](GUS)	%	95.7 (2017)	96	99
Percentage of Natura 2000 sites having management planning instruments[13](GDOŚ)	%	50.76 (2016)	75	100

[6] The increase, relative to the values in the base year, of the percentage values defining the ratio between the number of bodies of groundwater in good chemical status and the total number of bodies of water surveyed as part of surveillance monitoring.

[7] The increase, relative to the intermediate values (2020), of the percentage values defining the ratio between the number of bodies of groundwater in good chemical status and the total number of bodies of water surveyed as part of surveillance monitoring.

[8] The indicator does not apply to individual wastewater treatment installations.

[9] In cities: 90.2%, in rural areas: 40.8%. Source: Local Data Bank, Statistics Poland. Housing and municipal economy → Network systems → Installation users as percentage of the total population.

[10] The Voivodships where the value of the indicator is less than 70% include Lubelskie, Łódzkie, Małopolskie, Podlaskie and Świętokrzyskie. The value of the indicator for cities is 94.5% and for rural areas it is 42%. Local Data Bank, Statistics Poland. State and protection of the environment → Municipal wastewater treatment → Wastewater treatment plant users as percentage of the total population.

[11] Air quality index = (the number of zones with exceedances of the limit value for PM10/46 zones where measurements are made) · 100%.

[12] The indicator defines the surface area of forests which have approved management documentation as percentage of the total surface area of forestland. In order to calculate the indicator, it is assumed that 100% of forests managed by State Forests and national parks have approved forest managed plans.

[13] The indicator is expressed by the ratio between the number of Natura 2000 sites for which conservation measures plans and

Farmland Bird Index (FBI) 2000 = 100% (PMŚ)	%	79.98 (2017)	90	90
Levels of recycling and preparing for re-use and recycling of paper, metals, plastics and glass from municipal waste[14](MŚ)	% by weight	28 (2016)	50	-
Levels of preparing for re-use and recycling of municipal waste[15](MŚ)	% by weight	-	-	60
Number of Polish environmental technologies verified within the Environmental Technology Verification System (MŚ)	Number	2 (2018)	5	10
Objective: Environment and climate. Climate change mitigation and adaptation to them along with managing the risk of natural disasters				
Capacity of small retention facilities (Ministry of Maritime Economy and Inland Navigation)	dam^3	826 034.2 (2016)	832 000	844 836
Percentage of residents of Polish cities covered by urban adaptation plans (MŚ)	%	0 (2015)	30	60
Surface area of parks, green areas and housing estate-based greenery in cities (GUS)	ha	49 954.8 (2017)	Diminished reduction rate	Increased relative to the baseline value of the indicator
Surface area of parks, green areas and housing estate-based greenery in cities as percentage of their total surface area (GUS)	%	2.3[16] (2017)	Not less than 2.0 in each Voivodship	More than 2.3 in each Voivodship
Change rate of greenhouse gas emissions (1990=100)(KOBiZE)		84.9 (2016)	82.9[17]	77.1[18]
Length of the shoreline protected in a year against erosion and flood from the sea (Ministry of Maritime Economy and Inland Navigation)	km	7,6 (2016)	Not less than 7.0	Not less than 8.0

conservation plans have been established and the total number of Natura 2000 sites designated in Poland's territory.

[14] Given the fact that the European Union has adopted amendments to 6 Directives relating to waste management as part of the so-called Waste Package and then the need to transpose these regulations, this indicator will be replaced by another one, i.e. the levels of preparing for re-use and recycling of municipal waste.

[15] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (OJ L 150, 14.06.2018, p. 109) adopted new targets to be achieved by 2025, i.e. levels of preparing for re-use and recycling of municipal waste. In light of this, there will not be the baseline value and the value for 2020.

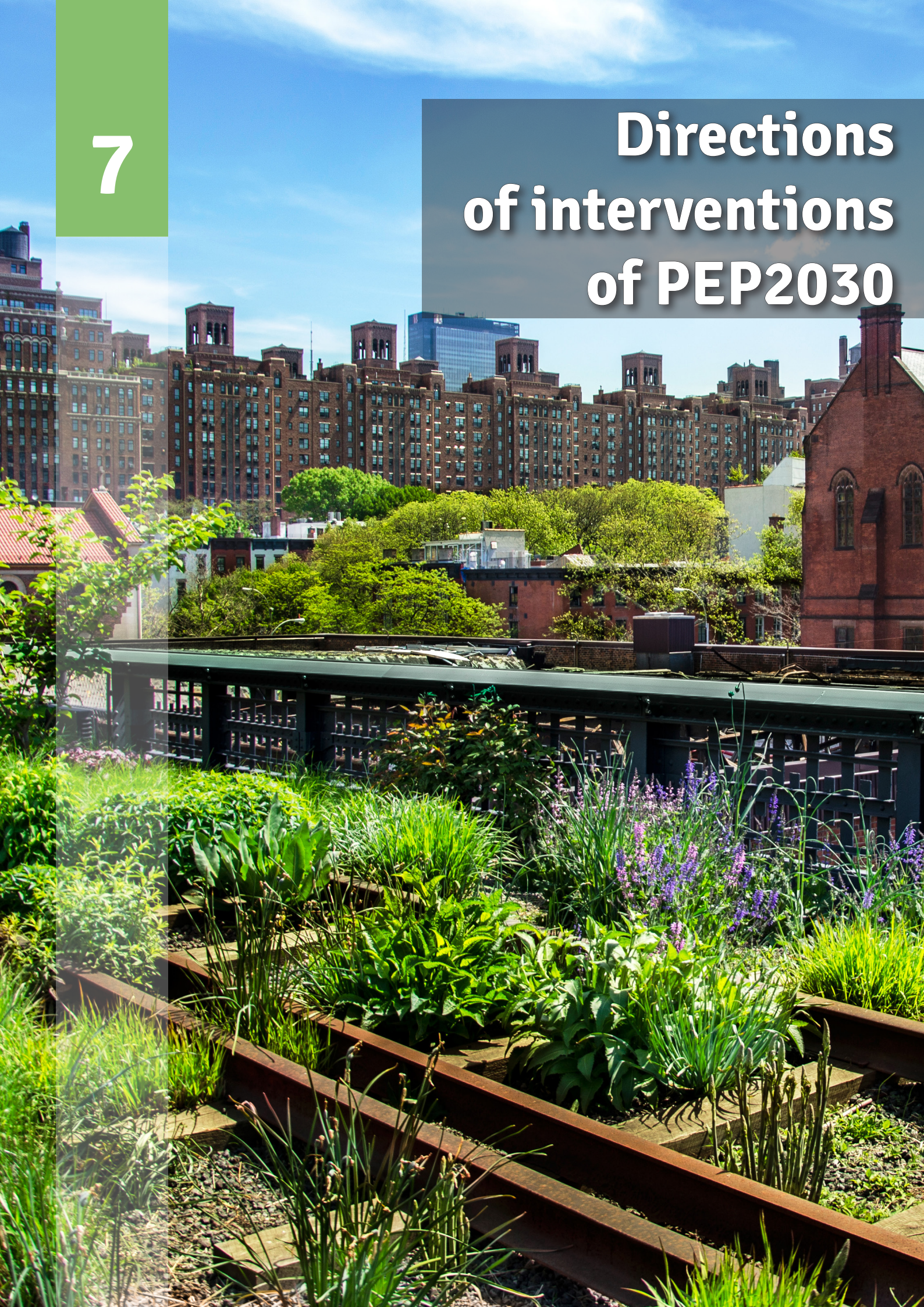
[16] The national average (the Voivodships where the surface area of parks, green areas and housing estate-based greenery in cities is 2% or less of their total surface area: Opolskie, Podkarpackie, Podlaskie, Świętokrzyskie and Zachodniopomorskie).

[17] On the basis of the emission projections contained in the Seventh National Communication and the Third Biennial Report (NC7-BR3 2017).

[18] On the basis of the emission projections contained in the Seventh National Communication and the Third Biennial Report (NC7-BR3 2017).

7

Directions of interventions of PEP2030



The directions of interventions include all the thematic areas of environmental policy. They represent clusters of actions and strategic projects contributing to the achievement of the specific objectives of PEP2030.

Specific objectives	Directions of intervention
Environment and health. Improving the quality of the environment and environmental safety	Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters
	Elimination of sources of air pollutant emissions or a substantial reduction of their impacts
	Protection of the land surface, including soils
	Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection
Environment and economy. Sustainable management of environmental resources	Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity
	Supporting multifunctional, sustained and sustainable forest management
	Waste management towards a circular economy
	Managing geological resources by developing and implementing a Raw Materials Policy
	Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT)
Environment and climate. Climate change mitigation and adaptation to them along with managing the risk of natural disasters	Climate change mitigation
	Adaptation to climate change and the management of the risk of natural disasters
Horizontal objectives	**Directions of interventions**
Environment and education. Developing the environmental competences of the public (knowledge, skills and attitudes)	Environmental education, including the shaping of sustainable consumption patterns
Environment and administration. Improving the functioning efficiency of environmental protection instruments	Improving the environmental control and management systems as well as streamlining the financing system

7.1.

Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters

Given the need to achieve good water status, the predicted climate change and the growing human impact on the environment, the quality and availability of the resources of surface waters and groundwater will be some of the most important factors affecting the socio-economic development of the country. At the same time, water management must comply with the principle of recovery of the costs of water services, taking into account the "polluter pays" principle.

The intervention in this area will primarily consist in the implementation of a uniform basin-based water management structure, which will be responsible for all the water related actions, above all for flood and drought protection, as well as for the supply of water of adequate quality and wastewater collection. The following will be continued: support for the implementation of projects to improve the quality of surface waters and groundwater, in compliance with the requirements of the EU Directives, and the construction and modernisation of wastewater treatment plants on the basis of the updated *National Municipal Wastewater Treatment Programme* in agglomerations.

A large emphasis will be placed on the preparation and updating of strategic/planning documents on water management and the monitoring to be carried out for the purposes of both acquiring the knowledge necessary for sustainable water management and preparing updated river basin management plans for the water cycle 2022–2027.

The updated river basin management plans will include measures for the particular bodies of surface water and groundwater and protected areas which should be implemented to improve or maintain good status of waters. The units responsible for their implementation and the deadlines for their implementation will also be specified. The documents will also lay down the investment projects of importance/strategic status for the country which, despite their impact on the status of waters, should be implemented in light of the public priority and sustainable development.

The actions to shape landscapes contributing to water retention and protection of marine waters will also gain in importance. On the basis of amended legal acts and strategic documents, measures will be taken to achieve good status of the marine environment by 2020, with regard to eleven quality indicators determining good status of the marine environment, in accordance with the requirements of the MSFD.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 2, 6, 11, 12, 13, 14 and 15.

Examples from Voivodships:

The preparation of the programme to build individual municipal wastewater treatment systems

Świętokrzyskie

Project objective: The correct management of water resources by saving them and preserving them in as good status as possible.

Expected effects: The project will contribute to the elimination of untight septic tanks and their replacement by individual municipal wastewater treatment systems and improve the quality of surface waters and groundwater and the health of inhabitants.

Project description: The settlement system in Świętokrzyskie Voivodship is characterised by very varied density, from a compact building structure to a very dispersed one. The programme to build individual municipal wastewater treatment systems will be one of the instruments to address wastewater management problems in Świętokrzyskie Voivodship. The programme will include the concept of the construction of individual wastewater treatment systems, the project selection criteria, along with a list of proposed investment projects broken down for the specific years, the manner of managing projects and the financial instruments for the implementation of these investment projects.

Project implementation 2018-2030 ***Estimated cost:*** **PLN 351.5 million**

7.2.

Elimination of sources of air pollutant emissions or a substantial reduction of their impacts

Air protection is very important for protecting the environment protection and ensuring human health. Air pollution contributes to shortening the average duration of human life and enhancing treatment costs. The most important challenges in this respect include the elimination of so-called low emissions, as well as the correct spatial planning and the protection of aeration corridors and wedges.

PEP2030 provides for the implementation of a package of measures to restore good air quality, also including the sources of low emissions, and the fulfilment of the recommendations for the Council of Ministers laid down in the *Clean Air Programme*. Correctly designed measures to improve air quality also require better cooperation at all the levels of state and self-government administrations. Therefore, the Communes will be provided with substantive support for the preparation of programmes to reduce low emissions (PONE) and for the multi-criteria management of emissions. In

order to ensure wider access to current information on air quality and to monitor the effectiveness of measures, the network for measuring air quality will be expanded. It will also be important to support the connection of new users to heating networks, if technically feasible. Particular emphasis will be placed on the modernisation of existing heating networks and the development of new ones. Moreover, an important complementary action will consist in supporting the use of electricity for heating purposes.

Work will also be carried out to further reduce emissions from road transport. The complementary actions in this area are laid down in *Sustainable Transport Development Strategy until 2030*.

In the area of air protection, work will also be carried out to regulate the issue of odour annoyance.

The actions proposed in PEP2030 complement the fulfilment of Poland's international commitments under the *Convention of Long-Range Transboundary Air Pollution* (*LRTAP*), Directives of the European Union (CAFE, IED, MCP, NEC) and the BAT conclusions for large combustion plants.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 3, 6, 11, 12, 13, 14 and 15.

Examples from Voivodships:

The implementation of the Air Protection Programme for Małopolskie Voivodship

MAŁOPOLSKA

Project objective: The improvement of air quality in the area of Małopolskie Voivodship. The achievement of the limit values of pollutants in the air.

Expected effects: Raised awareness of the inhabitants of the Małopolskie Voivodship of the ways of reducing emissions, eradicating energy poverty, eliminating low efficiency heating equipment and eliminating the adverse effects of waste burning.

Project description: The Air Protection Programme for Małopolskie Voivodship aims at achieving the limit values of pollutants in the air: PM10, PM2.5, benzo(a)pyrene, nitrogen dioxide and ozone. The current Air Protection Programme was adopted by Resolution No XXXII/451/17 of the Assembly of Małopolskie Voivodship of 23 January 2017 amending Resolution No XXXIX/612/09 of the Assembly of Małopolskie Voivodship of 21 December 2009 on the Air Protection Programme for Małopolskie Voivodship, as amended by Resolution No VI/70/11 of 28 February 2011 and Resolution No XLII/662/13 of 30 September 2013 (OJ L of Małopolskie Voivodship of 2017, Item 811). As part of the implementation of the Air Protection Programme for Małopolskie Voivodship, the project LIFE-IP MALOPOLSKA was established, called "The Implementation of the Air Protection Programme for Małopolskie Voivodship – Małopolska in Healthy Atmosphere", involving 62 partners, including 55 Communes, and coordinated by Małopolskie Voivodship. The main actions of the project are based on educational activities, i.e., among others, the creation of a network of eco-advisers

in Communes, consulting on the methods for reducing pollutant emissions or the establishment of the Competence Centre at the regional level. The implementation of the project includes assistance in mobilising co-financing for the replacement of old solid fuel-fired boilers, thermal modernisation of buildings, the construction of systems of heating networks or the assembly of installations of renewable energy installations.

Project implementation: 2015–2023 ***Estimated cost:*** **5 PLN billion** (including PLN 70 million for the implementation of the LIFE-IP project)

Examples from Voivodships:

A package of investments projects for air protection in the area of Mazowieckie Voivodship

Project objective: The improvement of the living conditions of the local communities by implementing actions to achieve the limit and target values in the air.

Expected effects: The reduction of low emissions generated by the heating of buildings.

Project description: In order to achieve air quality standards, the Assembly of Mazowieckie Voivodship has adopted resolutions on air protection programmes and a resolution on the restrictions and prohibitions for the operation of installations where fuel combustion takes place, the so-called Anti-Smog Resolution. Analyses carried out under those resolutions have demonstrated that the main cause of exceedances are low surface emissions related to the heating of residential buildings and public utility buildings.
In order to improve air quality, many municipalities treat investment projects to reduce surface emissions as priority tasks. Due to this, the inhabitants of areas exposed to exceedances will be able to breathe the air which meets the required standards. Projects are or will be proposed by municipalities themselves or by enterprises carrying out tasks in the area of air protection in the areas of the municipalities of Mazowieckie Voivodship.

Project implementation: 2017–2027 ***Estimated cost:*** **PLN 11 billion**

7.3.

Protection of the land surface, including soils

Among the many identified threats to soils, the issue of soil contamination and the problems of loss of organic matter and erosion are of high priority from the point of view of environmental protection in Poland.

Soil is the basic production resource in agriculture; therefore, a good condition of Polish soils provides the potential for high-quality food production. The protection of the productivity of agricultural and forest soils will primarily consist in preventing the exclusion of soils from agricultural and forestry uses, the prevention of soil erosion and loss of organic matter in soils. The protection of soils against erosion should consist e.g. in the maintenance of midfield clusters of trees and shrubs or the use of a correct direction of tillage, perpendicularly to the water runoff direction.

The contamination of soil and earth with substances having an adverse impact on human health and the state of the environment results from the implementation of different types of economic activity. It also affects the functions performed on the land surface, including the manner of land development.

PEP2030 proposes actions to identify contaminated soils and to support their remediation. It will consist in carrying out actions in contaminated areas to eliminate or reduce the quantities of harmful substances, their control and the limitation of their spread.

From the point of view of soil protection, the principle of precedence of space reuse in investment processes is also important, as it serves, among others, to limit sealing of the surface which prevents the penetration of precipitation water and air. Soil sealing is caused by changes of the hitherto functions of soils. Key significance for soil protection should be attributed to the principles of spatial planning which enables reuse of post-industrial areas.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 3, 6, 12 and 15.

7.4.

Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection

The development of road infrastructure and the growing number of its users increase noise annoyance. Noise is a stress factor and poses a severe threat to human health. It also affects animal welfare.

As a result of the implementation of actions proposed in PEP2030, the current problems related to the determination of the optimum acoustic environmental quality standards from the point of view the interest of the environment and sustainable development will be diagnosed. If such a need is demonstrated by the results of the diagnosis, the limit values of environmental noise will be changed.

The emissions of artificially generated electromagnetic fields (EMFs) in the environment remain at a very low level, representing barely several percent of the limit value. However, given the continuously growing number of EMF sources, mainly base stations of cellular telephony systems, and emerging concerns of the public about their potential health impact, the EMF levels in the environment will continue to be monitored.

Moreover, the proposed actions and tasks will ensure access to the current results of research on the potential effects of electromagnetic fields and instruments applied to ensure protection. This, in turn, will make it possible to define the actions necessary to ensure an adequate level of protection against the potential effects of electromagnetic fields. The qualifications of the staff responsible for the protection of the environment against noise and electromagnetic fields will be improved.

An important element of environmental safety is also ensuring nuclear safety and radiological protection, in particular, in the context of plans to build nuclear power plants, meaning the absence of the threat of the adverse effects of ionising radiation to the environment and society. The tasks implemented in this area will aim at strengthening the effectiveness of state authorities in the exercise of supervision over safe use of ionising radiation and the preparation and construction of a new storage site for low- and intermediate-level radioactive waste.

In light of the fact that the use of products of advanced biotechnology in many areas of everyday life can pose a danger to human life and to the natural environment, the task of the state administration is primarily to regulate the conditions for carrying out activities involving genetically modified organisms.

The actions under the Marine Water Monitoring Programme will be continued and supported, since the underground noise level in the Baltic Sea can potentially have adverse impacts on the mammals and fish living in it.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 3, 12, 14 and 15.

7.5.

Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity

Poland is characterised by valuable natural resources, including large biodiversity. Nevertheless, action needs to be taken against factors and phenomena which have an adverse impact on the condition of biodiversity. These include, in particular: transformation and degradation of habitats, land-use change, excessive exploitation of natural resources, environmental pollution or the spread of invasive alien species. Biodiversity is a heritage and its preservation constitute the condition for ensuring access of the future generations to natural riches. Disturbance of the stability of ecosystems can lead to multi-dimensional adverse impacts on the economy and society.

The effective protection of biodiversity and landscape resources requires an objective assessment and verification of protected areas. The actions proposed for implementation as part of PEP2030 will primarily aim at halting biodiversity loss, the protection of habitats and valuable landscapes, and the combating of related crimes. Support will be provided to projects to preserve biodiversity and to develop green and blue infrastructure, as well as to projects for in-situ or ex-situ conservation of endangered species and natural habitats. The conservation of marine nature will be ensured as part of the Natura 2000 network, covering marine areas, species-specific conservation and conservation under international agreements.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 6, 11, 14 and 15.

Examples from Voivodships:

The conservation of biological, landscape and geological diversity in Świętokrzyskie Voivodship

Świętokrzyskie

Project objective: The preservation or restoration of a favourable status of habitats and species, the combating of threats to biological and geological diversity, as well as the management of natural and landscape resources in both protected areas and those used for economic purposes.

Expected effects: The deepening and provision of knowledge of the natural resources and landscape values of Świętokrzyskie Voivodship.

Project description: Świętokrzyskie Voivodship has the largest share in terms of surface of legally protected areas in Poland. These areas represent a valuable regional potential for tourism and recreation; however, they need efforts to preserve their natural values. The most important nature conservation problem is now degradation of natural and semi-natural habitats, which may be partly caused by the predicted climate warming, i.e. migrations of species, including invasive alien ones, drying up and shrinking wetlands, the growing number of extreme events – floods and droughts, as well as change in the water regime affecting the growing period.

Project implementation: until 2030 ***Estimated cost:*** **PLN 6 million**

Examples from Voivodships:

Renaturalisation of the inland delta of the Nida River

Świętokrzyskie

Project objective: The improvement of the water conditions in the inland delta of the Nida River which will contribute to restoring the unique natural values within the meaning of the Habitats[1] and Birds[2] Directives.

Expected effects: The restoration of a favourable status of meadow habitats, including the creation of the optimum habitat conditions for selected birds, as well as the restoration or restitution of the populations of selected species subject to strict species-specific conservation.

Project description: The area of the inland delta of the Nida River has been chosen as the project implementation site in light of a significant threat posed to the habitats situated here by drying up and regulation of the middle section of the Nida valley, as a result of incorrectly carried out land amelioration works. The abandonment of the use of inland delta of the Nida River for agricultural and grazing purposes triggered succession processes and caused an unfavourable change to the composition of habitats, leading, at the same time, to the withdrawal of plant species typical of the habitats. The drying up of the area and the waning of local reservoirs cause the loss of bird breeding habitats. In turn, excessive water stagnation and swamp formation lead to distortions of riparian forests and their transformation into alder forests. The maintenance of habitat variability requires the launch of active conservation measures, consisting in the restoration of the natural water regime as well as the restoration and maintenance of previous uses, such as grazing and mowing.

[1] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.07.1992, p. 7, as amended; OJ L Polish translation, Chapter 15 Volume 002 P. 102, as amended).
[2] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ L 20, 26.01.2010, p. 7, as amended).

7.6.

Supporting multifunctional, sustained and sustainable forest management

The implementation of multi-functional, sustained and sustainable forest management enables the preservation of an equilibrium between the functions provided by forests: nature conservation related, social and economic ones. At the same time, it creates the conditions for the preservation of natural riches, along with their use to meet social and economic needs. Forests are also a place where the hunting economy is implemented.

Forests represent a large potential for climate change mitigation, which can be enhanced by carrying out further measures in the forest sector. Such measures also contribute to enhancing biodiversity. As part of the actions proposed for implementation in the *National Environmental Policy*, it is envisaged that a system will be set up to increase carbon sequestration. The system of additional actions related to sustainable forest management provides, among others, for the preparation of multiannual programmes to change the species composition of tree-stands and programmes to shape their multi-storey structure.

The implementation of forest management tasks will contribute to making use of the production capacity of forests to systematically increase wood supply, while, at the same time, complying with the principles of the protection of natural wealth and making forests open to the public.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 6, 13 and 15.

7.7.

Waste management towards a circular economy

The actions to fully implement the waste hierarchy in Poland correspond with the concept of a circular economy. In accordance with its assumptions, first of all, it is necessary to ensure the implementation of actions which are at the highest levels of the waste hierarchy, i.e. prevent its generation and create the indispensable infrastructure for separate waste collection at source so as to ensure their preparing for reuse or effective recycling. These actions will support climate protection by reducing greenhouse gas emissions from the waste management sector, above all from waste landfills.

The fundamental instrument implementing PEP2030 in this area is the *National Waste Management Plan 2022* (KPGO 2022). It has been prepared to achieve waste management targets, implement the waste hierarchy and the principles of self-sufficiency and proximity, as well as to create and maintain an integrated and adequate network of waste management installations. KPGO 2022 sets out the directions of actions to

prevent waste generation and to shape the waste management system. These directions are reflected in Voivodship water management plans prepared at the regional level (including investment plans).

First of all, support will be provided to investment projects related to waste recycling and treatment and the use of secondary raw materials, projects to implement circular waste management at the local level and research and development work on innovative environmental technologies related to the use of secondary raw materials and waste management, implemented, among others, by entities making up the system of science and higher education and their consortia with industry.

In order to adopt the waste package, its provisions will be transposed into the Polish legal order, including an update of KPGO 2022.

Among others, the purpose of the support will be to eliminate gaps in the system of waste collection, transport, treatment and disposal, in particular, plastic waste, so as to prevent its penetration from land into waters, including marine waters. The prevention of pollution of waters, including marine waters, with plastic waste, will also be supported by the modernisation of municipal wastewater treatment plants with a view to fully implementing in them the approach of a circular economy.

Support will also be provided to educational actions aimed at reducing the quantities of plastics penetrating into marine waters and actions to modernise port-based waste receiving equipment in order to ensure that waste generated on board ships or collected at sea (e.g. old fishing nets) is taken to land and properly managed (segregation, recycling, disposal).

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 6, 11, 12 and 14.

7.8.

Managing geological resources by developing and implementing a Raw Materials Policy

In light of the existing knowledge and experience related to raw materials and the current situation on the markets, it can be said that the present raw materials management system makes it difficult to manage them effectively. The actions necessary to systematise and improve the tools now in place, and above all to integrate measures, go beyond the competence of one area of state administration and, as a result, require strict cooperation among all the Ministries.

The construction of an efficient and effective system for governance and management of all the types of mineral raw materials, including secondary materials, in the whole value chain and of the resources in Poland's possession requires the development of consistent national policy, i.e. a *Raw Materials Policy*, analysing all the aspects of the interdisciplinary sector of the economy, which the raw materials economy is, and indicating the most important problems and needs in this respect. The *Raw Materials*

Policy will also make it possible to work out effective tools for sustainable management of resources of raw materials at the national level, taking into account the interests of industry. This will increase the stability of supply of raw materials used by industry on the national market and also make it possible to increase the volume of exports.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 7 and 12.

7.9.

Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT)

The economic trends in highly developed countries indicate that the building of a competitive advantage based on the results of research and development work and scientific and technological progress can guarantee sustained sustainable development. The high innovativeness of environmental technologies improves the competitiveness of economies and minimises the adverse impact of human activities on the environment. At the same time, Poland's low position in the European eco-innovation ranking indicates the presence of barriers to the implementation of innovations in this country.

In its area related to the implementation of eco-innovations, PEP2030 proposes actions to promote Polish environmental technologies domestically and abroad, also in the context of the process of internalisation of innovative enterprises. The Environmental Technology Verification (ETV) system, intended to provide independent and reliable information on innovative environmental technologies by verifying whether verification statements presented by the authors and producers of technologies are complete, reliable and based on the credible results of testing, will be implemented and promoted among entrepreneurs and the public administration authorities. As a result of this, a new product is distinct on the market and gains a competitive advantage, and, thus, the chances of its implementation increase. Support will also be provided to research and development work in the area of innovative environmental technologies, carried out e.g. by the entities making up the system of science and higher education and their consortia with industry. Efforts will be taken to ensure wider use of the ETV system by the public finance sector in green public procurement.

At the same time, environmental policy provides for substantive support for entrepreneurs in the implementation of investment projects to align their installations with the BAT Conclusions.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 7, 9 and 12.

7.10.

Climate change mitigation

The effects of climate change which have occurred over recent decades, in particular, the growing average annual temperature and the frequency and intensity of extreme weather events, have become stronger. As a result, they pose a threat to social and economic development and natural resources. It is, therefore, necessary, to take further actions to reduce greenhouse gas emissions (mitigation) and also, in parallel, actions to adapt to the predicted effects of climate change (adaptation).

In the scope of actions to reduce GHG emissions, as priorities PEP2030 sets out the implementation of:

– the EU climate policy goals until 2030,
– the provisions of the *Paris Agreement*.

The EU undertook to reduce GHG emissions by 40% relative to their level in 1990, with a breakdown into the sectors covered by the EU emissions trading system (EU ETS) and the other, so-called non-ETS sectors (with the target of –7% relative to 2005 laid down for Poland in the ESR). In light of this, it is necessary to define an approach to the reduction of greenhouse gas emissions – in particular, those from the non-ETS sectors – which will assess the possible reduction potential of the individual sectors and identify specific actions and their effect on the reduction of GHG emissions until 2030.

As part of the implementation of the *Paris Agreement*, which provides that the reduction of GHG emissions should take into account the economic specificity of a given country, actions will be taken to effectively reduce the GHG concentrations in the atmosphere, taking into account the actions in the sectors of the economy which are responsible for GHG emissions. In light of this, actions will be launched, among others, to introduce innovative technologies, to use available energy sources, including geothermal energy, or to implement the concept of Carbon Forests. Support will be provided, among others, to investments to enhance energy generation from renewable sources. Consideration should also be given to the development of energy storage technologies, using different forms of energy carriers, including storage of electricity, storage of energy in gaseous form, liquid and solid fuels, and the development of hybrid RES installations. Efforts should be taken to ensure the systematic alignment of the level of support with the energy generation and storage costs and with the real needs in the scope of energy acquisition. Support should also take into account the reduction of external costs. Moreover, Poland has a large potential for reducing the CO_2 concentration in the atmosphere, among others, by intensifying actions to store carbon in wooden products and developing energy-efficient wooden building industry.

The actions taken to achieve the EU climate policy goals and the *Paris Agreement* will be consistent and often the same, since they will be guided by the same reduction target.

Work will also be carried out to draft a policy on the reduction of greenhouse gas emissions from the non-ETS sectors until 2030; this will involve the need to achieve the reduction target under the ESR. The key actions in this scope will include an

analysis to estimate the potential for the reduction of greenhouse gas emissions in the particular non-ETS sectors until 2030 and the identification of actions which can be taken in these sectors and the effects of these actions, i.e. their quantified contributions to the reduction of greenhouse gas emissions.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 2, 11, 13, 14 and 15.

7.11.

Adaptation to climate change and the management of the risk of natural disasters

Another component of climate policy is adaptation to climate change, i.e. the launch of initiatives and the use of measures to reduce the susceptibility of natural and human systems to the arising or expected effects of climate change. Adaptation actions will consist in the preparation and implementation of strategic/planning documents on water management, support for the preparation and implementation of plans of adaptation to climate change for urbanised areas, the construction of necessary flood protection infrastructure and small retention facilities (where it is justified in economic, environmental and social terms), renaturalisation of rivers and their valleys, renaturalisation of wetlands and the investment projects to protect the seashore, coupled with renaturalisation of selected parts of the seashore (wherever it is justified in economic, environmental and social terms) and the development of green and blue infrastructure in urbanised areas. The actions will also deal with rainwater management in urbanised areas by different forms and retention and developing greenery infrastructure and limiting the occupation of land and soil sealing. Special attention should also be paid to land development and the conditions for building up of areas which are vulnerable to floods, inundations and the erosion of the seacoast. The technical zone along the seashore is included in the areas of particularly flood hazard. Bearing these factors in mind, the actions need to focus on the protection of particularly sensitive areas, including the dune belt and landslide areas, against excessive and unjustified investment pressures.

Adaptation actions will also be implemented in rural areas. Their purpose will be, in particular, to enhance the resilience of the agricultural landscape to climate change and the protection of agricultural production. Midfield clusters of trees and shrubs (especially, those of a unique character in natural or cultural terms) will be protected and developed, and new roadside plantings will be carried out, dominated by native shrubs with abundant foliage, particularly, in regions which are most vulnerable to drought and desertification, with a low share of forest cover. These actions will require cooperation between road managers and farmers.

There is no doubt that climate change has also a territorial dimension. A special climate change-related threat to the coastal zone, and in particular to port cities and costal localities, is posed by flood from the sea. The enhanced protection against flood from the Baltic Sea and marine erosion will require the implementation of proposed

protection actions and seashore monitoring. Among others, these actions will consist in artificial shore replenishment, the construction of stormwater protection embankments, seawalls, groynes and breakwaters or underwater ridges. An important element of the seashore protection will be the implementation of artificial shore replenishment to restore the natural protection system, consisting of shoals, beaches and dunes. These actions are carried out as part of the *Seashore Protection Programme* [3].

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 2, 11, 13, 14 and 15.

7.12. Environmental education, including the shaping of sustainable consumption patterns

Effective environmental protection requires the involvement of all the citizens. The raising of the environmental awareness of the public and the shaping of the environmental attitudes of the public by promoting the principles of sustained and sustainable development are some of the most important factors which have a positive effect on the current and future state of natural resources (among others, air, water, soil and biodiversity) and on the quality of the ambient environment (among others, in relations to the areas of waste management, energy efficiency, adaptation to progressing climate change and ecosystem processes).

The shaping and raising of the environmental awareness of the inhabitants of Poland are of key importance for the implementation of environmental protection standards. The achievement of environmental quality objectives strictly depends on the level of environmental competences of the public (i.e. its knowledge of the environment, practical skills and environment-friendly motivation to change its attitudes and everyday behaviour).

Environmental education is an important element of the education (from the earliest years of life) aimed at developing society which accepts the interdisciplinary principles of sustained and sustainable development of the country, is able to assess the state of environmental safety and to take action to improve it, as well as one aware of the need to consciously take care of the common cultural and natural heritage.

Environmental education is also a basic condition for a change of public practices towards the model of sustainable consumption. Therefore, there is an important need for reflections on and the moderation of the public discussion on the possibilities of changing lifestyles towards more sustainable ones.

The implementation of comprehensive environmental education includes informal, formal and non-formal education in thematic areas covered by the strategy and support for the implementation of projects related to environmental education. Each of the abovementioned components of environmental education should be implemented using advanced methods and teaching tools, as well as in a dialogue and cooperation

[3] The Act of 28 March 2003 Establishing the Multiannual Programme "The Seashore Protection Programme" (OJ L of 2016, Item 678).

with the stakeholders of these actions, including, among others, with scientific institutions, nongovernmental organisations and representatives of local communities.

At the same time, given the horizontal character of the issue and the need to involve many entities and stakeholders in educational activities, PEP2030 provides for the preparation of a strategic action plan for environmental education. This plan will present the implementing framework for the activities of environmental education which will incorporate the contents of all the thematic fields of environmental protection addressed in PEP2030.

Environmental education must be supported by access to reliable sources of the knowledge of the state of the environment.

Actions to provide reliable and up-to-date information on the environment and its state will be implemented, in particular, by carrying out research, observations and assessments of the state of components of the environment as well as the continued building and development of spatial databases.

The use of public procurement to achieve environmental objectives requires not only the adoption of relevant tools in the Act on Public Procurement Law [4], but also the launch of appropriate promotion measures to raise the awareness of purchasers and the representatives of inspection institutions in respect of the existing environmental problems and their significance, as well as the need for and the manner of taking these issues into account as part of tender procedures.

The National Action Plan for Sustainable Public Procurement for 2017–2020 is already the fourth document to provide the basis for the implementation of promotion and education actions in favour of the representatives of purchasing institutions and inspection institutions, serving to popularise the possibilities of taking into account, among others, the environmental aspects in public procurement pursuant to the applicable provisions of the Act on Public Procurement Law[5]. The National Action Plan is an independent document which defines the basic activities of the Public Procurement Office in the areas of sustainable public procurement. Among others, this document specifies the actions proposed for implementation in the period from 2017 to 2020, indicators, quantitative targets to be achieved by 2020, monitoring methods and sources of financing for the proposed actions.

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 2, 4, 6, 11, 12, 13 and 14.

[4] The Act of 29 January 2004 on Public Procurement Law (OJ L of 2018, Item 1986, as amended).
[5] The Act of 29 January 2004 on Public Procurement Law (OJ L of 2018, Item 1986, as amended).

7.13.

Improving the environmental control and management systems as well as streamlining the financing system

The concept of co-governance is important for the correct management of environmental protection. Its implementation enhances the feeling of responsibility on the part of not only the administration but also economic entities, public organisations and single persons for the continuous improvement of the natural elements of the quality of life in Poland. A social dialogue should provide the basis already when new legal regulations are drafted, thus facilitating their later implementation and stimulating positive changes in the behaviour of the public.

Moreover, the application of the regulations on environmental protection depends on the effective control of the activities of the entities obliged to comply with them and, in case of failure to comply with the law, their effective enforcement. At the same time, the obligations to implement, control and enforce the provisions of environmental law have been imposed on both the central and territorial government administration authorities and the authorities at practically all the levels of the administrative division of the country (self-government authorities at the levels of Communes, Counties and Voivodships, including both those of a legislative and executive character). In light of the above, it is necessary to strengthen the existing state control authorities in the area of the environment and to enhance their effectiveness in enforcing the law, including the combating of the grey area. Addressing these challenges, PEP2030 envisages tasks related to the implementation of reform of the Inspectorate for Environmental Protection.

The effective enforcement of the regulations on environmental protection gains in importance, particularly, in light of predictions concerning the national system of revenues from environmental fees and fines. Theses revenues will fall due to the achievements of the individual sectors in the implementation of clean technologies. The risk of the gradual depletion of the existing sources of financing for environmental protection, along with the simultaneous need for the further financing of investment projects in this area, makes it necessary to continuously improve the financing system.

In the context of the constantly occurring environmental challenges and the need to implement increasingly demanding legal standards in the area of the environment into the Polish legal system, there is a need to strengthen the Polish system for financing environmental protection.

Bearing in mind the scarcity of available resources and the scope of the investment activities which must be undertaken, it is necessary to devise tools which would make it possible to:

- carry out a current assessment of the efficiency and effectiveness of the aid provided (using the same indicators for the achievement of the environmental effect), irrespective of which entity participates in the implementation of a project,
- the current identification of all the significant environmental projects implemented with public resources, irrespective of which sources are used and which entity

implements a project,
- the current coordination of investment priorities in the area of environmental protection,
- the inclusion of the innovation criterion in the system for the assessment for applications for the award of financing for environmental projects with an investment character,
- the facilitation of the implementation of integrated projects.

In order to improve the system for the management of environmental protection, it is also important to strengthen the expert and analytical support for the Minister responsible for the environment, the Minister responsible for water management, the Minister responsible for fisheries and the Minister responsible for the maritime economy. PEP2030 provides for tasks to improve the functioning of instruments of environmental protection, also understood as the provision of data of adequate quality which are needed to create evidence-based policy [6].

The actions carried out as part of the direction of intervention contribute to the implementation of SDGs 6, 11, 12, 13, 14 and 15.

[6] E.g. the provision of the authorities controlling and monitoring the agricultural activity and the areas where it is carried out with additional tools useful for the more efficient, faster and more precise identification of the actual situation, i.e. access to satellite data and the processing of these data.

8

PEP2030 actions and tasks

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
Detailed objective: Environment and health. Improving the quality of environment and ecological safety (I)				
8.1. Direction of intervention: Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters **(I.1)**				
until 2020	1. Creation and development of a homogeneous structure for water management in a catchment area-based system, responsible for all actions related to water, including primarily those related to protection against floods and droughts (SOR)	1. Issuance of executive regulations to implement efficient catchment area management in water management	legislation	minister responsible for water management
		2. Organisation of units forming PGW WP	other	PGW WP
until 2025		3. Evaluation of water management reform and introduction of necessary corrections	analysis	minister responsible for water management
until 2020	2. Creation of legal and financial mechanisms favouring rational use of water resources and implementation of water-saving technologies (SOR)	1. Supporting the performance of actions related to rational management of water resources	financing	system of environmental protection funds
until 2020	3. Construction and modernisation of wastewater treatment plants based on an updated National Municipal Wastewater Treatment Programme (AKPOŚK) (SOR)	1. Monitoring progress in the implementation of AKPOŚK	analysis	minister responsible for water management PGW WP
		2. Supporting projects related to water and sewage management, implemented in urban agglomerations of at least 10,000 PE, as part of action 2.3. POIŚ	financing	NFOŚiGW
		3. Supporting projects related to water and sewage management, implemented in more developed regions in urban agglomerations of 2 000 PE to 10 000 PE, as part of action 2.3. POIŚ	financing	NFOŚiGW

[1] If several entities in charge are listed, the first mentioned entity is the task coordinator, meaning the leading entity. The remaining ones are entities cooperating during implementation of the task.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		4. Supporting the execution of undertakings intended to improve the quality of surface and groundwater according to the requirements of directives governing the treatment of municipal wastewate	financing	system of environmental protection funds
		5. Supporting actions related to improving the condition of surface and groundwater in Poland via water and sewage investments outside the country (in the catchment area of the Bug River)	financing	NFOŚiGW
until 2021		6. Implementation of AKPOŚK	investments	local governments[2]
until 2030	4. Continuing the construction and modernisation of wastewater treatment plants based on an updated National Municipal Wastewater Treatment Programme	1. Supporting the execution of undertakings intended to improve the quality of surface and groundwater according to the requirements of directives governing the treatment of municipal wastewater	financing	system of environmental protection funds
		2. Supporting actions related to improving the condition of surface and groundwater in Poland via water and sewage investments outside the country (in the catchment area of the Bug River)	financing	NFOŚiGW
		3. Supporting modernisation of municipal wastewater treatment plants in terms of full implementation of the circular economy approach	financing	NFOŚiGW
until 2020 / continuously	5. Implementation of the 2nd update of water management plans in catchment areas and an update of the national water-environment programme along with execution of work for the needs of another update of the plans in 2021 (SOR)	1. Performing the studies and assessment of water condition as part of National Environmental Monitoring, including a collective assessment of the status of uniform surface water parts for the needs of preparing a water management plan for the 2022–2027 water cycle	analysis	GIOŚ
		2. Review and verification of methodologies for demarcating heavily modified and artificial water parts with preliminary and final demarcation	analysis	PGW WP
		3. Identification of pressures in water regions and catchment areas	analysis	PGW WP
		4. Analysis of significant human impact with an assessment of its influence on water status and an evaluation of the risk of not fulfilling environmental objectives	analysis	PGW WP
		5. Review of important problems of water management in catchment areas along with the performance of public consultation	analysis	PGW WP

[2] Local governments pursuant to article 7 item 1 point 3 of the Municipal Government Act of 8 March 1990 (OJ L of 2019, item 506, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		6. Review of registers of protected areas[3]	analysis	PGW WP GIOŚ GDOŚ RDOŚ
		7. Establishing environmental objectives and preparing a register of lists of protected areas[4]	analysis	PGW WP GIOŚ GDOŚ RDOŚ
		8. Assessing progress in the implementation of work programmes	analysis	minister responsible for water management PGW WP
		9. Development of a national surface water rehabilitation programme	programming	PGW WP
		10. Analysing the reimbursement of expenses for water services along with a development forecast for water regions and catchment areas along with an analysis of the reimbursement of environmental and resource-based costs in water regions and catchment areas	analysis	PGW WP
		11. 2nd update of water management plans in catchment areas	programming	minister responsible for water management PGW WP
until 2020		12. Supporting projects related to the preparation and updating of strategic/planning documents in terms of water management as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2020		13. Enhancement of water monitoring in terms of procedures assuring and controlling the quality of measurements and assessments of surface water status, as well as research, measurement and computer infrastructure	investments/ analysis	GIOŚ
until 2020		14. Supporting projects as part of action 2.1. of POIŚ involving enhancement of water monitoring in terms of procedures assuring and controlling the quality of measurements and assessments of surface water status, as well as research, measurement and computer infrastructure	financing	NFOŚiGW

[3] Indicated in article 317 item 4 point 1–5 of the Water Law Act of 20 July 2017 (OJ L of 2018 item 2268, as amended).
[4] Indicated in article 317 item 4 point 1–5 of the Water Law Act of 20 July 2017 (OJ L of 2018 item 2268, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020		15. Development of a surface water monitoring programme for the 2022–2027 water cycle	programming	GIOŚ
until 2021		16. Execution of actions listed in aPWŚK	investments/ other	in compliance with aPWŚK
until 2021		17. Monitoring of actions listed in aPGW/aPWŚK	analysis	minister responsible for water management
until 2030 / continuously	6. Implementation of the 2nd update of water management plans in catchment areas and an update of the national water-environment programme along with execution of work for the needs of another (3rd) update of these documents in 2027 (SOR)	1. Performing the studies and assessment of water condition as part of National Environmental Monitoring, including a collective assessment of the status of uniform surface water parts for the needs of preparing a water management plan for the 3rd water cycle (after 2027)	analysis	GIOŚ
		2. Review and verification of methodologies for demarcating heavily modified and artificial water parts with preliminary and final demarcation	other	PGW WP
		3. Identification of pressures in water regions and catchment areas	analysis	PGW WP
		4. Analysis of significant human impact with an assessment of its influence on water status and an evaluation of the risk of not fulfilling environmental objectives	analysis	PGW WP
		5. Review of important problems of water management in catchment areas along with the performance of public consultation	analysis	PGW WP
		6. Review of lists of areas intended for protection of habitats or species, for which maintaining or improving the condition of waters is an important factor in their protection	analysis	PGW WP
		7. Establishment of environmental objectives preparation of a register of lists of areas intended for protection of habitats or species, for which maintaining or improving the condition of waters is an important factor in their protection	analysis	PGW WP
		8. Assessing progress in the implementation of work programmes	analysis	minister responsible for water management PGW WP

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		9. Analysing the reimbursement of expenses for water services along with a development forecast for water regions and catchment areas along with an analysis of the reimbursement of environmental and resource-based costs in water regions and catchment areas	analysis	PGW WP
		10. 3rd update of water management plans in catchment areas	programming	minister responsible for water management PGW WP
		11. Development of a surface water monitoring programme for a water cycle after the year 2027	programming	GIOŚ
		12. Execution of actions indicated by aPGW	investments/ other	in compliance with aPGW
		13. Monitoring of actions listed in aPGW	analysis	minister responsible for water management
until 2020	7. Environmental management of local water resources, also involving the shaping of landscapes favouring the retention of water (SOR)	1. Supporting the execution of tasks pursuing the achievement of good water condition under action 2.1. POIŚ	financing	NFOŚiGW
until 2020	8. Informational-educational actions for promoting environmentally friendly ways of storing and using fertilisers, including the execution of actions aimed at rational management of fertilisers (SOR)	1. Development of a set of recommendations for good agricultural practice for voluntary use	programming	minister responsible for agriculture
continuous		2. Promotion of a set of recommendations for good agricultural practice for voluntary use	other	minister responsible for agriculture minister responsible for water management
until 2030		3. Execution of a programme of actions aimed at decreasing the contamination of waters with nitrates originating from agricultural sources and preventing further contamination	investments	minister responsible for water management minister responsible for agriculture

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020	9. Protection of marine waters	1. Updating the initial assessment of the environment status of marine water environment with a set of characteristics for good environmental status of marine water	programming	minister responsible for water management minister responsible for marine economy minister responsible for fishery minister responsible for construction, planning and spatial development and housing GIOŚ
		2. Updating the monitoring programme for marine water	programming	minister responsible for water management GIOŚ
		3. Updating the set of environmental targets and associated indicators for marine waters	programming	minister responsible for water management PGW WP
until 2030		4. Preparing an Update of the national programme of measures for marine waters	programming	minister responsible for water management PGW WP
continuous		5. Studying and assessing the status of marine environment as part of National Environmental Monitoring	analysis	GIOŚ
until 2020	10. Preparing a map of water resources available for use by the population, industry, agriculture and other branches of economy along with rules of their updates based on balances of surface and groundwater resources (SOR)	1. Supporting projects related to the preparation and updating of strategic/planning documents in terms of water management as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2030		2. Preparing a map of water resources available for use by the population, industry, agriculture and other branches of economy	analysis	minister responsible for water management PIG-PIB
		3. Developing rules of updating the map of available water resources based on balances of surface and groundwater resources	analysis	minister responsible for water management PIG-PIB

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	11. Providiang protection of society and economy against an unjustified increase in water prices	1. Improvement in the functioning of the tariff approval mechanism – introduction of a regulatory body	other	PGW WP
8.2. Direction of intervention: Eliminating the sources of emission of pollutants into the air or a significant reduction of their impact **(I.2)**				
until 2020	12. Giving priority to the actions of NFOŚiGW and WFOŚiGW supporting projects serving air quality improvement (SOR)	The action is executed as part of the *Clean air strategic project*	financing	NFOŚiGW
until 2020	13. Creation of a legal framework introducing quality requirements for solid fuels based on the type and size of fuel burning installations, highlighting the installations used in the residential -municipal sector, as well as technical requirements for small solid fuel boilers (SOR)	The action is executed as part of the *Clean air strategic project*	legislation	minister responsible for economy minister responsible for energy minister responsible for environment
until 2020	14. Dynamising projects for the elimination of low emission from heating systems (SOR)	The action is executed as part of the *Clean air strategic project*	programming/ financing	minister responsible for environment NFOŚiGW
until 2020	15. Providing under the construction law control of the application of the Energy Law act[5] in terms of the obligation to connect heating installations in new buildings to district heating networks	The action is executed as part of the *Clean air strategic project*	legislation/ programming	minister responsible for construction, planning and spatial development and housing

[5] The Energy Law Act of 10 April 1997 (OJ L of 2019 item 755, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020	16. Substantive support of municipal governments, including the development of guidelines for the preparation of Low Emission Reduction Programmes (PONE), involving multiple criteria of programmed actions and an inventory of emission sources (SOR)	The action is executed as part of the *Clean air strategic project*	analysis	minister responsible for environment
until 2020	17. Development and financial support of National Environmental Monitoring in terms of air quality measurements (SOR)	1. Supporting projects related to implementing the methods of observation and purchase of equipment in order to improve the environmental monitoring system as part of action 2.1. POIŚ	financing	minister responsible for environment NFOŚiGW
		2. Financial support of National Environmental Monitoring	financing	NFOŚiGW
		3. Development of National Environmental Monitoring in terms of air quality measurements	investments/ other	GIOŚ
continuous		4. Studying and assessing the quality of air as part of National Environmental Monitoring	analysis	GIOŚ
until 2030	18. Adjustment of legal framework for further limitation of the emission of pollutants into the air, including the low emission phenomenon (SOR)	1. Changing regulations related to: a) conveying information on air contaminations, b) assessing the levels of substances in the air, c) air protection programmes and short-term action plans	legislation	minister responsible for environment
until 2030	19. Supporting local governments in terms of multi-dimensional management of areal (heating systems) and linear emissions (transport) and the location of investments with discrete emitters (SOR)	1. Development of materials (guidebooks and guidelines) involving air quality improvement	analysis/other	minister responsible for environment
		2. Organisation of media and information campaigns related to environmental behaviours favouring air quality improvement and the impact of low emission on health and environment	other	minister responsible for environment minister responsible for transport

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	20. Further limitation of emissions from road transport (SOR)	1. Supporting the development of low-emission and zero-emission transport	financing	system of environmental protection funds
until 2020	21. Development of odour policy	1. Preparation of regulations for preventing odour nuisance	analysis/ legislation	minister responsible for environment
until 2020	22. Reducing the emission of pollutants into the air	1. Implementation of commitments resulting from derogatory mechanisms[6]	other	minister responsible for environment
until 2020		2. Implementation of the directive on the limitation of emissions of certain pollutants into the air from medium combustion plants (MCP)[7]	legislation	minister responsible for environment
from 2020 until 2029		3. Implementation of the directive on the reduction of national emissions of certain atmospheric pollutants (NEC)[8]	legislation	minister responsible for environment minister responsible for economy minister responsible for transport minister responsible for energy minister responsible for agriculture
until 2020		4. Supporting entrepreneurs in the execution of pro-environmental investments	financing	system of environmental protection funds
until 2020		5. Creation of a Poland-wide advisory assistance system for the public and residential sector and enterprises in terms of energy efficiency and RES	other	NFOŚiGW
until 2021		6. Execution of tasks resulting from joint development ventures/development projects of PGL LP called "Thermal modernization of PGL LP buildings (including the use of RES in buildings)" and "Renewable energy sources as a primary supply of electric energy for the buildings and means of transport in PGL LP"	financing/ investments/ other	PGL LP

[6] Derogatory mechanisms established pursuant to Directive 2010/75/UE of the European Parliament and of the Council dated 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334 dated 17 December 2010, p. 17), including the National Transitional Plan, heating derogation and limited derogation from the 17,500-hour working time (the so-called natural derogation).

[7] Directive (UE) 2015/2193 of the European Parliament and of the Council dated 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants (OJ L 313 dated 28 November 2015, p. 1).

[8] Directive (UE) 2016/2284 of the European Parliament and of the Council dated 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending directive 2003/35/WE and repealing directive 2001/81/WE (OJ L 344 dated 17 December 2016, p. 1).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	Execution of the strategic project: *Clean air*		legislation/ financing/ analysis/ other	minister responsible for environment minister responsible for economy minister responsible for transport minister responsible for energy system of environmental protection funds
8.3. Direction of intervention: Protection of land surface, including soils **(I.3)**				
until 2020	23. Executing the programme of identification of contaminated soils (SOR)	1. Supporting projects involving the inventory of degraded lands and polluted lands as part of action 2.5. POIŚ	financing	minister responsible for environment NFOŚiGW
		2. Supporting the execution of projects related to land surface protection	financing	system of environmental protection funds
until 2030		3. Identifying and keeping a register of historical land surface contaminations	analysis	minister responsible for environment (in terms of supervision) heads of counties[9] GDOŚ RDOŚ
until 2020	24. Supporting remediation of identified contaminated soils (SOR)	1. Supporting remediation of identified contaminated soils (SOR)	financing	minister responsible for environment NFOŚiGW
		2. Supporting the execution of projects related to land surface protection	financing	system of environmental protection funds
until 2030		3. Supporting research, development, implementation and testing of innovative soil remediation technologies, including large-scale demonstration projects	financing	system of environmental protection funds minister responsible for science NCBiR

[9] Heads of counties pursuant to article 101d of the Environmental Protection Law act dated 27 April 2001 (OJ L of 2018, item 799, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030		4. Establishing task schedules related to historical earth surface contaminations (studies, preparation of remediation plans, performance of remediation)	analysis	minister responsible for environment (in terms of supervision) GDOŚ RDOŚ
continuous	25. Protecting the productivity of agricultural areas (SOR)	1. Studying and assessing the quality of arable soils as part of National Environmental Monitoring	analysis	GIOŚ
until 2020		2. Supporting projects related to restoration of the productivity of agricultural areas	financing	system of environmental protection funds
until 2030		3. Preventing the erosion of soils and loss of organic matter content in soils via the implementation of Joint Agricultural Policy (planned for execution as part of SZRWRiR)	other	minister responsible for agriculture
until 2030	26. Protection against landslides	1. Execution of the SOPO project – Landslide Protection System	analysis/other	PIG-PIB minister responsible for environment (in terms of supervision)
8.4. Direction of intervention: Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection (I.4)				
continuous	27. Determination of rational acoustic standards of environmental quality (SOR)	1. Measuring and assessing the acoustic climate under National Environmental Monitoring in terms of protection against noise	analysis	GIOŚ
continuous		2. Analysing the timeliness of legislation and timeliness of execution of tasks in noise action plans	analysis	WIOŚ
until 2020		3. Analysis of applicable acoustic standards of environmental quality with consideration of standards valid in EU member states, extended to include the analysis of WHO requirements in this area	analysis	minister responsible for environment
until 2020		4. Changing regulations related to allowed noise levels in the environment[10]	legislation	minister responsible for environment

[10] The task will be executed, provided an analysis performed as part of the previous task will indicate the need to change acoustic standards of environmental quality.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020	28. Development and financial support of National Environmental Monitoring in terms of noise in the environment	1. Supporting projects related to the implementation of methods for measurements and calculations and purchasing equipment in order to improve the environmental monitoring system as part of action 2.1. POIŚ	financing	minister responsible for environment NFOŚiGW
until 2030		2. Financial support of National Environmental Monitoring	financing	system of environmental protection funds
until 2020	29. Appointing a team of experts performing constant surveillance of the results of basic scientific research on the influence of electromagnetic fields on the environment and preparing periodic reports involving this issue (SOR)	1. Participating in operations of the team and performing constant surveillance of the results of basic scientific research on the influence of electromagnetic fields on the environment and an analysis of applied instruments providing protection against electromagnetic fields	other	minister responsible for computerisation minister responsible for environment minister responsible for health
until 2020	30. Improving the transparency of administrative procedures related to the location and operation of installations emitting electromagnetic fields and infrasounds (SOR	1. Analysis of procedures used so far in RP and other EU member states along with their optional correction and electronification of processes related to registering installations and delivering reports on the measurements of electromagnetic fields	analysis/ legislation	minister responsible for computerisation minister responsible for environment
continuous	31. Providing adequate levels of protection against electromagnetic fields based on a continuous review of the results of scientific research (SOR)	1. Analysing the results of basic scientific research on the influence of electromagnetic fields on the environment and an analysis of applied instruments providing protection against electromagnetic fields	analysis	minister responsible for environment minister responsible for health minister responsible for computerisation
continuous	32. Providing data on the levels of electromagnetic fields in the environment	1. Measuring and assessing the levels of electromagnetic fields in the environment under National Environmental Monitoring in terms of protection against EMF	analysis	GIOŚ
		2. Introducing new methodology for measuring electromagnetic field in the environment, in particular for modern mobile communications networks	analysis, legislation	minister responsible for computerisation minister responsible for environment minister responsible for energy

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	33. Training of personnel in terms of protecting the environment against noise and electromagnetic fields (SOR)	1. Improvement of qualifications via cyclical/periodic trainings/meetings	other	minister responsible for environment GIOŚ GDOŚ
until 2030	34. Providing access to data on electromagnetic fields	1. Introducing a homogeneous computer system enabling public access to technical specifications of installations and reports on measurements of electromagnetic field levels (SOR)	legislation	minister responsible for computerisation minister responsible for environment GIOŚ
		2. Increasing social awareness related to the influence of an electromagnetic field originating from base stations of mobile telecommunications on the environment by activating a government information portal about electromagnetic fields and conducting awareness campaigns	other	minister responsible for computerisation minister responsible for environment minister responsible for health
until 2035	35. Ensuring nuclear safety and radiological protection	1. Constructing a repository for short-lived low and intermediate level radioactive waste	investments	minister responsible for energy
continuous		2. Supervising safety of the environment and society by performing safety assessment, issuing licenses and administrative decisions as well as inspecting the construction, commissioning and decommissioning of nuclear facilities and other activities related to radiation exposure	other	PAA
continuous		3. Performing measurements in early warning stations for radioactive contamination of IMGW-PIB, monitoring the concentration of caesium Cs137 isotope in soil and monitoring radioactive contaminations of surface waters and bottom sediments, as well as the atmosphere as part of National Environmental Monitoring	analysis	GIOŚ IMGW-PIB
until 2030		4. Fulfilling international and national obligations related to reviewing and improving the quality of actions of the nuclear regulatory authority	other	PAA
		5. Modernising and extending systems of environmental monitoring and supporting the mission of the nuclear regulatory authority	investments/ other	PAA

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		6. Extending the human resources potential of the team of nuclear safety inspectors and analysts for the needs of current and future tasks of the nuclear regulatory authority	other	PAA
Objective: Environment and economy. Sustainable management of environmental resources (II)				
8.5. Direction of intervention: Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity **(II.1)**				
until 2020	36. Objective evaluation and verification of protected surfaces and their resources in order to improve the efficiency of protecting space of particular value in terms of nature and landscape (SOR)	1. Establishment of planning documents for Natura 2000 areas	legislation	minister responsible for environment RDOŚ
		2. Supporting projects related to the development of planning instruments for Natura 2000 areas and national parks as part of action 2.4. POIŚ	financing	minister responsible for environment NFOŚiGW
		3. Supporting the process of implementing management instruments in nature protection as part of action 2.4. POIŚ	financing	minister responsible for environment NFOŚiGW
until 2020	37. Mapping and estimating the value of ecosystem services (SOR)	1. Development of methodologies for evaluating the natural capital of the country	analysis	minister responsible for environment
		2. Development of national rules of incorporating valuation of ecosystem services into accounting and reporting systems	analysis	minister responsible for environment minister responsible for finance GUS
until 2020	38. Adjusting standards of the land planning and use system and introducing changes in the management of protected areas in order to reduce natural conflictual of protection of highly esteemed values (SOR)	1. Establishing and implementing surveillance over the execution of protective actions, including in the Natura 2000 areas	other	national parks RDOŚ
		2. Supporting projects involving protection and restoration of biological and landscape-based diversity	financing	NFOŚiGW

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2025	39. Indicating and protecting the most valuable – priority – landscapes of Poland (SOR)	1. The action is executed as part of the strategic project: *Landscape audits*	legislation/ analysis/ financing	voivodship authorities[11] minister responsible for environment NFOŚiGW
until 2019	40. Implementation of the European Landscape Convention (SOR)	1. Issuing regulations related to the preparation of landscape audits	legislation	minister responsible for environment
continuous		2. Operating a domestic European Landscape Convention Secretariat	other	GDOŚ
until 2020	41. Protection of biological diversity	1. Improving the protected species management system	other	minister responsible for environment GDOŚ
continuous		2. Protecting the species and habitats of the Baltic Sea and efficient management of Natura 2000 marine areas	legislation/ programming	minister responsible for environment minister responsible for marine economy directors of maritime offices
continuous		3. Protection of migrating species via implementing and following the provisions of the Bonn Convention with particular emphasis on the provisions of ASCOBANS and EUROBATS agreements as well as the aquatic warbler protection agreement	programming/ other	minister responsible for environment
continuous		4. Protection of world whale population by active participation in meetings of the International Whaling Commission preceded by active participation in the process of establishing a common of the European Union	programming/ other	minister responsible for environment
until 2020		5. Preparation of reports on the execution of the bird directive[12] and the habitat directive[13]	analysis	minister responsible for environment GIOŚ GDOŚ
		6. Preparation of a report on preventive and remedial actions related to the introduction and spreading of invasive alien species	analysis	minister responsible for environment

[11] Voivodship authorities pursuant to article 38b item 1 of the Act of 27 March 2003 on spatial planning and development (OJ L of 2018, item 1945, as amended).
[12] Directive 2009/147/WE of the European Parliament and of the Council dated 30 November 2009 r. on the conservation of wild birds.
[13] Council Directive 92/43/EWG of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		7. Developing the resources of the natural inventory bank	other	minister responsible for environment GDOŚ
continuous		8. Execution of provisions of the *Convention on Biological Diversity*	other	minister responsible for environment
continuous		9. Execution of provisions of the *Carpathian Convention* and its protocols	other	minister responsible for environment minister responsible for economy minister responsible for transport minister responsible for energy minister responsible for agriculture minister responsible for rural development – in compliance with classification of government administration units
continuous		10. Activation of society for protection of biological diversity	other	minister responsible for environment GDOŚ national parks PGL LP
continuous		11. Execution, under National Environmental Monitoring, of natural monitoring involving plant and animal species as well as natural habitats, with particular emphasis on Natura 2000 Special Areas of Conservation, and birds, with particular emphasis on Natura 2000 Special Protection Areas	analysis	GIOŚ
until 2020		12. Execution of a pilot wolf and lynx monitoring programme in Poland (financed as part of action 2.4. of POIŚ 2014–2020)	other	GIOŚ

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020		13. Execution of pilot monitoring project for marine species and habitats	other	GIOŚ
until 2020		14. Supporting projects involving in-situ or ex-situ protection of endangered species and natural habitats as part of action 2.4. POIŚ	financing	minister responsible for environment NFOŚiGW CKPŚ
until 2020		15. Supporting projects involving the development of green and blue infrastructure as part of action 2.4. of POIŚ	financing	minister responsible for environment CKPŚ
until 2020		16. Supporting projects involving the performance of informational-educational actions related to environmental protection and efficient use of its resources as part of action 2.4. POIŚ	financing	minister responsible for environment NFOŚiGW
until 2030		17. Supporting the implementation of projects related to maintaining and restoring biological diversity	financing	system of environmental protection funds
until 2020		18. Execution of tasks resulting from development projects of PGL LP „Active protection of the black grouse on lands managed by State Forest in Poland", „Protection of the osprey Pandion Haliaeetus in selected SPA Natura 2000 areas in Poland" and „Comprehensive project for the protection of the European bison by State Forests" and other joint projects of the organisational units of the LP, whose purpose is to retain biological diversity.	financing/ investments/ other	PGL LP
continuous		19. Supporting the operation of national parks	legislation/ analysis/ financing	minister responsible for environment
continuous		20. Increasing the total area of strict and passive protection in national parks and rationalising the demarcation of individual areas	legislation/ analysis/ financing	minister responsible for environment
continuous		21. Supplementation of the network of national parks and nature reserves in a manner which will ensure their representativeness for the diversity of natural resources in the country	legislation/ analysis/ financing	minister responsible for environment GDOŚ RDOŚ

until 2023	Execution of the strategic project: *Landscape audits*		legislation/ analysis/ financing	voivodship authorities[14] minister responsible for environment NFOŚiGW
8.6. Direction of intervention: Supporting multifunctional, sustained and sustainable forest management (II.2)				
continuous	42. Maintaining and, depending on the availability of lands for forestation, increasing the overall forest cover of the country and the compactness of forest complexes and areas undergoing forestation (SOR)	1. Acquisition of lands for forestation	other	PGL LP minister responsible for environment local governments[15]
continuous		2. Forestation of lands	other	PGL LP minister responsible for environment local governments[16] minister responsible for agriculture ARiMR
until 2020	43. Maintaining and, if possible, rationally increasing forest biomass (including energy wood) for the needs of satisfying local needs of energy self-sufficiency (SOR)	1. Including in *Regulations for timber sales* wood material intended for energy production in compliance with the definition of the "energy wood" assortment	analysis/ programming	PGL LP
continuous		2. Promoting the idea of using wood residues as a material meant for energy production in compliance with the rule of cascading use of wood	other	minister responsible for energy
until 2020		3. Introducing legislative changes facilitating the trade of wood biomass	legislation	minister responsible for environment PGL LP
continuous	44. Inclusion of forestry into further actions for protection of biological diversity	1. Assessing the value of non-productive functions of forest and its reflection in policies and programmes involving forests	analysis	PGL LP
		2. Protecting the population of rare indigenous tree and shrub species in forest ecosystems	programming/ investments	PGL LP all forest management units and their owners[17]
		3. Protecting forest bird populations in order to maintain, in an undeteriorated condition, the populations of forest species across the country (according to the *Forest Bird Index* for birds)	programming/ investments	PGL LP all forest management units and their owners[18]

[14] Voivodship authorities pursuant to article 38b item 1 of the Act of 27 March 2003 on spatial planning and development (OJ L of 2018, item 1945, as amended).
[15] Cooperation of local governments is voluntary in nature
[16] Cooperation of local governments is voluntary in nature
[17] Cooperation of all forest management units and their owners is voluntary in nature.
[18] Cooperation of all forest management units and their owners is voluntary in nature.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020		4. Improving methods for inventorying game animals	analysis	minister responsible for environment
continuous	45. Protecting the productivity of forest areas (SOR)	1. Increasing the share of various types of coarse woody debris in forest ecosystems	programming/ investments	PGL LP all forest management units and their owners[19]
		2. Reconstruction of tree stands leading to a full adjustment of tree stand species compositions to habitat conditions	programming	PGL LP all forest management units and their owners[20]
until 2020		3. Supporting projects related to restoration of the productivity of forest areas	financing	system of environmental protection funds
continuous	46. Providing information on the health status of forests	1. Execution of forest monitoring under National Environmental Monitoring	analysis	GIOŚ
8.7. Direction of intervention: Waste management towards a circular economy **(II.3)**				
until 2030	47. Waste management according to the hierarchy of waste handling methods (SOR)	1. Supporting investments related to waste management as part of action 2.2. POIŚ	financing	minister responsible for environment NFOŚiGW
		2. Supporting the execution of investments related to the prevention of waste generation and proper waste management	financing	system of environmental protection funds
		3. Planning necessary waste management installations by the development of a WPGO along with investment plans	analysis/ programming/ investments	voivodship authorities[21]
until 2030		4. Updating the national waste management plan 2022	analysis/ programming	minister responsible for environment
until 2025		5. Evaluation of municipal waste management system and introduction of necessary corrections	analysis	minister responsible for environment
until 2020		6. Transposition of EU regulations under the so-called waste package	legislation	minister responsible for environment

[19] Cooperation of all forest management units and their owners is voluntary in nature.
[20] Cooperation of all forest management units and their owners is voluntary in nature.
[21] Voivodship authorities pursuant to article 36 item 2 of the Waste Law Act of 14 December 2012 (OJ L of 2019, item 701, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	48. Development of waste recycling (SOR)	1. Supporting the execution of investments related to waste recycling	financing	system of environmental protection funds
until 2030	49. Aiming at maximising the use of waste as raw materials (SOR)	1. Supporting research-development and implementation work related to innovative environmental technologies and new business models involving the recovery and utilisation of secondary raw materials and waste management	financing	system of environmental protection funds
until 2030		2. Supporting the execution of investments related to the processing and use of recycled raw materials	financing	system of environmental protection funds
until 2030		3. Supporting projects related to the implementation of circular waste management at a municipal level	financing/ other	minister responsible for environment NFOŚiGW
until 2030		4. Development of guidelines stimulating the implementation of actions for circular economy in the sector of public finances (green public procurements)	other	UZP minister responsible for economy minister responsible for environment minister responsible for regional development local governments[22]
8.8. Direction of intervention: Managing geological resources by developing and implementing a Raw Materials Policy **(II.4)**				
until 2020	50. Delimitation of mineral deposits strategic for the economy and providing their long-term protection, rational use and access to them	The action is executed under the strategic project: *Development and implementation of a coherent and comprehensive Raw Materials Policy*	programming/ legislation	minister responsible for environment
until 2020	51. Supporting innovativeness in the extraction, processing and use of secondary market raw materials, from resources created by post-consumer and post-production waste and secondary deposits generated from it	The action is executed under the strategic project: *Development and implementation of a coherent and comprehensive Raw Materials Policy*	programming/ legislation/other	minister responsible for environment

[22] Cooperation of local governments is voluntary in nature

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	Execution of the strategic project *Development and implementation of a coherent and comprehensive Raw Materials Policy*		programming/ legislation/ analysis/other	minister responsible for environment
8.9. Direction of intervention: Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT) (II.5)				
until 2020	52. Promoting and supporting eco-innovation and eco-innovative enterprises	1. Identifying technological needs and key areas related to the development and implementation of eco-innovations in Poland	analysis	minister responsible for environment minister responsible for economy
until 2030		2. Substantive support of the sector of public finances in terms of applying public procurements involving environmental technologies and the use of pre-commercial public procurements (innovative partnership) and public procurements for purchasing eco-innovations[23]	other	UZP minister responsible for economy minister responsible for environment
until 2030		3. Substantive support of entrepreneurs in the execution of investments resulting in limitation of the impact of their activity on the environment due to eco-innovations	other	minister responsible for economy minister responsible for environment
until 2030		4. Financial support of entrepreneurs in the execution of investments using innovations for improving the efficiency of utilising resources	financial	minister responsible for regional development system of environmental protection funds minister responsible for public finances
until 2020		5. Supporting the creation of the concept of a municipal wastewater treatment plant as a unit fully implementing the approach of circular economy and the performance of research and development work in this area	financing	NFOŚiGW
until 2030		6. Supporting research-development and implementation work related to innovative environmental technologies	financing	system of environmental protection funds

[23] *Public Procurement of Innovation*.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030		7. Supporting research-development and implementation work related to: a. recykling, b. rational management of natural resources with particular emphasis on renewable energy, c. limiting the emission of pollutants and development of products and processes with diminished negative environmental impact	financing	NCBiR
until 2020		8. Development of guidelines stimulating the implementation of actions for circular economy in the sector of public finances (green public procurements)	analysis/ other	UZP minister responsible for economy minister responsible for environment
until 2030		9. Implementation of the Environmental Technology Verification Programme (ETV) in Poland	legislation/ financing/other	minister responsible for environment minister responsible for economy NFOŚiGW
until 2030	53. Supporting enterprises in the process of adjusting installations to the conclusions of BAT	1. Substantive support of entrepreneurs in the execution of investments related to the adjustment of installations to the conclusions of BAT	other	minister responsible for environment
until 2030	Execution of the strategic project: *GreenEvo – Technology Accelerator*		financing/other	minister responsible for environment NFOŚiGW
Objective: Environment and climate. Climate change mitigation and adaptation to them along with managing the risk of natural disasters (III)				
8.10. Direction of intervention: climate change mitigation **(III.1)**				
until 2030	54. Reducing the emission of greenhouse gases into the air	1. Supporting investments related to an increase in production of energy from renewable sources	financing	system of environmental protection funds Auction system of supporting renewable energy sources (pursuant to the Act on Renewable Energy Sources[24])

[24] The Act on Renewable Energy Sources dated 20 February 2015 (OJ L of 2018, item 2389, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		2. Supporting investments related to expansion of a network enabling the connection of producers of energy from renewable sources	financing	system of environmental protection funds
		3. Supporting investments related to heating systems cooperating with renewable energy sources and heat storages	financing	system of environmental protection funds
		4. Supporting investments related to modernisation of CHP plants, heat plants and power plants, associated with reducing emission into the air	financing	system of environmental protection funds
		5. Supporting investments related to the development of low-emission and zero-emission transport	financing	system of environmental protection funds
		6. Supporting investments related to actions involving reduction of energy losses related to its transfer	financing	system of environmental protection funds
		7. Supporting investments related to developing energy clusters, energy operators and energy self-sufficient municipalities	financing	system of environmental protection funds
until 2020	55. Developing the policy of reducing the emission of greenhouse gases from sectors not included in the emissions trading scheme (non--ETS)	1. Analysing the reductive potential of emission of greenhouse gases in the individual non-ETS sectors in the 2030 perspective along with identification of actions possible to be undertaken in these sectors and their effects, i.e. quantified impact on reducing the emission of greenhouse gases	analysis	minister responsible for environment GIOŚ
until 2020		2. Developing a strategy for achieving the reduction objective resulting from the ESR with consideration and indication of priority actions in each of the non-ETS sectors	programming	minister responsible for environment
until 2022		3. Developing a management strategy for the national limit[25]	programming	minister responsible for environment upon agreement with the Council of Ministers
until 2030		4. Supporting actions and investments identified in the analysis and indicated in the abovementioned strategy for reducing and limiting emissions from non-ETS sectors	financing	system of environmental protection funds
until 2030	56. Modification of sustainable forest management in order to increase the carbon sequestration capacity of forests (SOR)	The action is executed as part of the strategic project: *Carbon Forests*	other	PGL LP

[25] The limit which is mentioned in article 21d item 2 of the Act dated 17 July 2009 on the system for managing emissions of greenhouse gases and other Substances (OJ L of 2018, item 1271, as amended).

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030	57. Development of methodological bases for managing the capturing of CO2 in forestry as part of the execution of climate policy (SOR)	The action is executed as part of the strategic project: *Carbon Forests*	analysis	PGL LP
until 2030	Execution of the strategic project: *Carbon Forests*		analysis/ programming/ investments	PGL LP
until 2030	Execution of the strategic project: *Wooden buildings*		analysis/ programming/ financing/ investments	minister responsible for environment minister responsible for construction, planning and spatial development and housing PGL LP NFOŚiGW
8.11. Direction of intervention: Adaptation to climate change and the management of the risk of natural disasters **(III.2)**				
until 2021	58. Implementing flood risk management plans (PZRP) for catchment areas, reviewing and updating them (SOR)	1. Execution of actions listed in PZRP	investments/ other	in compliance with PZRP
		2. Preparing a progress report on the implementation of actions listed in PZRP	analysis/other	minister responsible for water management PGW WP
		3. Reviewing and updating a preliminary flood risk assessment	analysis	PGW WP minister responsible for water management minister responsible for marine economy
		4. Reviewing and updating flood risk maps and flood hazard maps	analysis	PGW WP minister responsible for water management directors of maritime offices

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		5. Reviewing and updating flood risk management plans	programming	minister responsible for water management minister responsible for marine economy PGW WP
		6. Supporting projects related to the preparation and updating of strategic/planning documents in terms of water management as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2030	59. Implementing an update of flood risk management plans (PZRP) and executing work for the needs of another (2nd) update in 2027.	1. Execution of actions listed in PZRP update	investments/ other	in compliance with PZRP
		2. Preparing a progress report on the implementation of actions listed in PZRP	analysis/ other	minister responsible for water management PGW WP
		3. 2nd review and update of the preliminary flood risk assessment	analysis	PGW WP minister responsible for water management minister responsible for marine economy
		4. 2nd review and update of flood hazard maps and flood risk maps	analysis	PGW WP minister responsible for water management directors of maritime offices
		5. 2nd review and update of flood risk management plans	programming	PGW WP minister responsible for water management minister responsible for marine economy

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020	60. Development and implementation of a plan for counteracting the effects of droughts (SOR) and development of its updates	1. Development of a plan for counteracting the effects of droughts	programming	minister responsible for water management PGW WP
until 2030		2. Implementation of a plan for counteracting the effects of droughts	investments/ other	in compliance with PPSS
until 2030		3. Development of an update to the plan for counteracting the effects of droughts	programming	minister responsible for water management PGW WP
until 2020	61. Preparation and implementation of the Retention Development Programme	1. Preparation of the Water Retention Development Programme	programming	minister responsible for water management PGW WP
until 2030		2. Implementation of the Water Retention Development Programme	investments/ other	minister responsible for water management PGW WP
continuous	62. Development of flood control infrastructure based on investments with a high degree of effectiveness and economic rationality and proper spatial planning, including the construction of multi-purpose, functionally coherent tanks for low[26] and – in specific cases – high[27] retention (SOR)	1. Execution of flood control investments	investments	PGW WP
until 2020		2. Supporting projects related to the construction, rearrangement or repair of water equipment helping to reduce the effects of floods and droughts as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2020		3. Supporting supraregional small retention systems as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2020		4. Supporting investments related to the construction, rearrangement and restoration of hydroengineering facilities (finishing the execution of tasks) initiated before 2018.	financing	NFOŚiGW
until 2030	63. Protection against marine erosion and flood from the sea	1. Performing protective actions on the seashore and the zone of offshore waters (e.g. artificial shore nourishment, storm surge barriers, seawalls, groynes, breakwaters, offshore ridges)	investments	minister responsible for marine economy directors of maritime offices

[26] With a capacity up to 5 million m^3.
[27] With a capacity above 5 million m^3.

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2030		2. Sea shore monitoring including the coastal zone	analysis	minister responsible for marine economy directors of maritime offices
until 2020		3. Supporting projects related to the protection of seashores as part of action 2.1. POIŚ	investments	NFOŚiGW
until 2020	64. Sustainable and resistant to climate change management of rainwaters in urbanised areas via various forms of retention and the development of green infrastructure (SOR)	1. Analysis of legal acts in terms of the introduction of necessary changes enabling efficient adaptation to climate change and sustainable management of rainwaters in urbanised areas along with the performance of these changes	analysis/ legislation	minister responsible for water management
until 2020		2. Supporting the execution of tasks related to rainwater management systems in urban areas as part of action 2.1. POIŚ	financing	NFOŚiGW
until 2030		3. Supporting investments related to the utilisation of rainwaters in urban areas	financing	system of environmental protection funds
until 2020	65. Developing green and blue infrastructure of urbanised areas in order to maintain spatial communication inside these areas and with open areas, as well as support the processes of adaptation to climate change (SOR)	1. The action is executed as part of the strategic project *Adaptation to climate change*	analysis/ financing	minister responsible for environment
until 2020	66. Limiting occupation of land and soil sealing	1. Supporting projects involving development of green areas in cities and their functional areas as part of action 2.5. POIŚ	financing	minister responsible for environment NFOŚiGW
		2. Supporting the execution of projects related to land surface protection	financing	system of environmental protection funds

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020	67. Counteracting environmental hazards	1. Supporting investments related to adaptation to climate change executed by territorial government units	financing	system of environmental protection funds
		2. Supporting investments related to the construction of systems warning against and responding to environmental hazards and natural disasters	financing	system of environmental protection funds
		3. Supporting investments related to improving the level of protection against the results of natural risks[28] and serious malfunctions, improving the elimination of their effects and enhancing selected elements of environmental management	financing	system of environmental protection funds
until 2030	Execution of the strategic project *Adaptation to climate change*		analysis/ programming/ financing/ investments	minister responsible for environment IOŚ-PIB NFOŚiGW minister responsible for water management minister responsible for marine economy GUS
until 2020	Execution of the strategic project *Comprehensive programme of adaptation of forests and forestry to climatic change until 2020*		investments	PGL LP
until 2030	Execution of the strategic project *Water for agriculture*		legislation/ financing/ programming	minister responsible for rural development minister responsible for regional development minister responsible for water management PGW WP

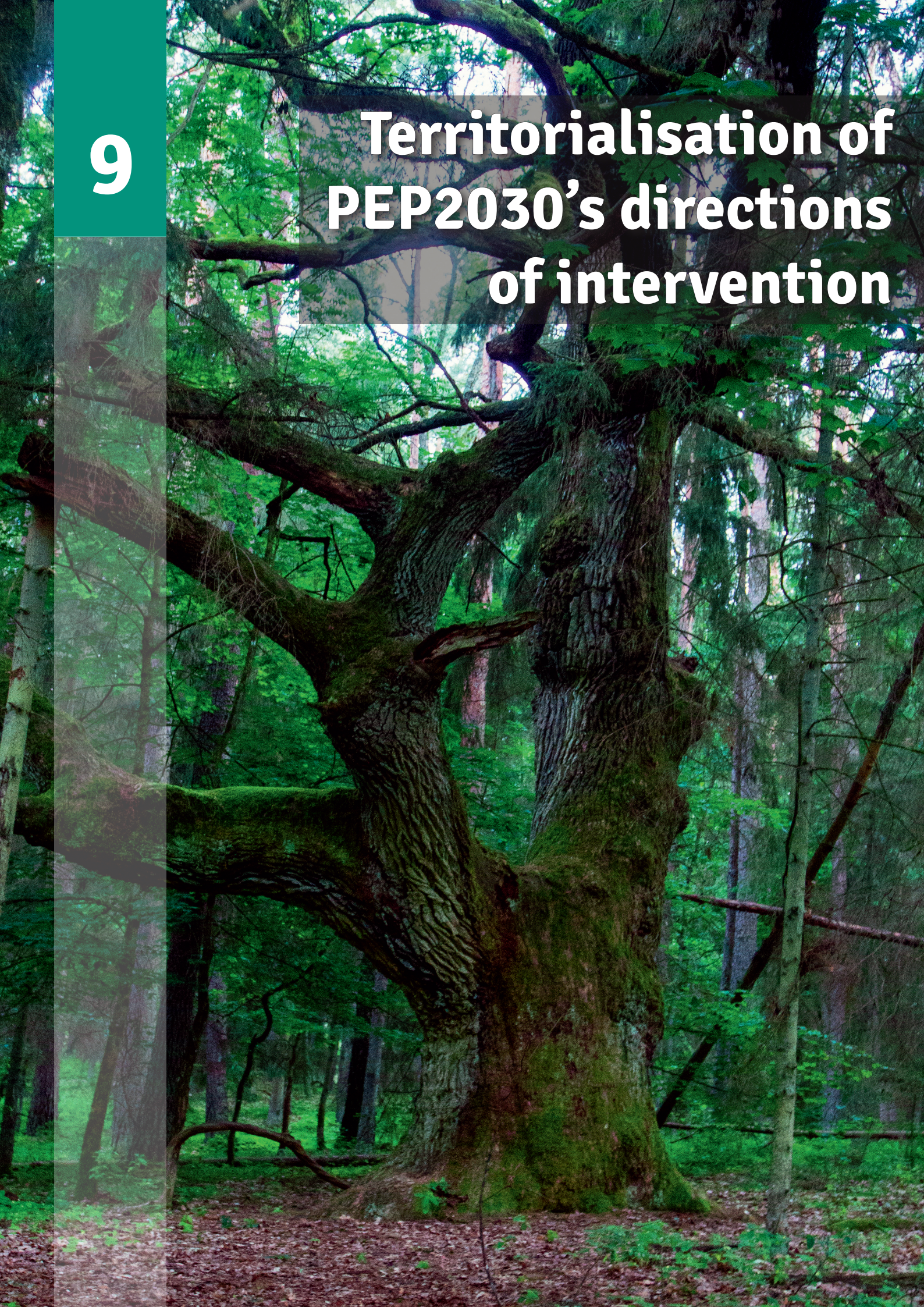
[28] According to the directions of actions listed in the Strategic Adaptation Plan for sectors and areas sensitive to climate change until the year 2020 with prospects until the year 2030.

Objective: Environment and education. Developing the ecological competence (knowledge, abilities and positions) of the society **(IV)**				
8.12. Direction of intervention: Ecological education, including the shaping of sustainable consumption patterns **(IV.1)**				
continuous	68. Providing comprehensive ecological education	1. Performing studies of the ecological awareness of Poles	analysis	minister responsible for environment
continuous		2. Conducting informal and non-formal education in areas covered by the strategy, including in cooperation with non-government organisations	other	minister responsible for environment
continuous		3. Conducting and supporting formal education in areas covered by the strategy, including in cooperation with non-government organisations	other	minister responsible for education and pedagogy minister responsible for environment
until 2025		4. Preparing a strategic plan of actions for ecological education	programming	minister responsible for environment
until 2020		5. Supporting the execution of projects related to ecological communication and education	financing	system of environmental protection funds
until 2020	69. Promoting green public procurements	1. Execution of actions and initiatives included in the "National Plan of Actions related to sustainable public procurements for the years 2017–2020"	other	UZP
continuous	70. Providing reliable and up-to-date information on the environment and its state	1. Performing studies, observations and evaluations of the status of environmental components and impacts under National Environmental Monitoring in order to provide knowledge and inform about the condition of the environment and sharing data on the condition of the environment	analysis	GIOŚ
		2. Releasing information on the environment and its protection	other	minister responsible for environment GIOŚ
		3. Increasing the availability of public data from the area of the environment and their update, as well as providing referentiality and interoperability of existing systems and databases	other	minister responsible for environment minister responsible for water management minister responsible for computerisation

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		4. Continuation of construction and development of spatial databases along with maintenance, popularisation and development of spatial information infrastructure, including the geoportal.gov.pl service	other	minister responsible for environment GDOŚ GIOŚ minister responsible for water management minister responsible for construction, planning and spatial development and housing / Surveyor General of Poland minister responsible for computerisation
until 2030		5. Digitisation of historical resources	other	minister responsible for environment
Objective: Environment and administration. Improving the functioning efficiency of environmental protection instruments (V)				
8.13. Direction of intervention: Improving the environmental protection control and management system and perfecting the financing system **(V.1)**				
until 2020	71. Strengthening existing state control authorities in the area of the environment, increasing their efficiency in terms of law enforcement, including fighting the grey market (SOR)	1. Increasing the efficiency of control authorities, in particular related to fighting the grey market (reforming the Inspection for Environmental Protection)	other	GIOŚ WIOŚ
continuous		2. Performance of actions related to controlling and preventing illegal transboundary movement of waste	other	GIOŚ WIOŚ
continuous		3. Performance of actions related to controlling and preventing illegal disassembly of end-of life vehicles	other	GIOŚ WIOŚ
continuous		4. Performance of actions related to controlling and preventing the processing of electric and electronic waste	other	GIOŚ WIOŚ
continuous		5. Performance of actions related to controlling and preventing the placing of illegally acquired timber on the market	other	GIOŚ WIOŚ

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
until 2020		6. Supervising and overseeing compliance with regulations in terms of using microorganisms and genetically modified organisms	legislation	minister responsible for environment
continuous		7. Intensification of actions for fighting illegal sales and trade of specimens of species subject to EU regulations on CITES, national protection of species, dangerous, alien invasive and others subject to limitations in possession, sales or trade	other	minister responsible for environment minister responsible for public finances minister responsible for internal affairs / National Police Headquarters GDOŚ
until 2022		8. Maintaining or perfecting structure ensuring effective fighting of crime related to sales and trade of specimens of species subject to CITES regulations, national protection of species, dangerous, alien invasive and others subject to limitations in possession, sales or trade	other	minister responsible for environment minister responsible for public finances minister responsible for internal affairs National Police Headquarters GDOŚ
until 2022	72. Securing the financing of tasks related to environmental protection from domestic and foreign funds after the year 2020	1. Creating a coherent monitoring system for the environmental effects of investments supported by environmental protection funds	analysis/ programming	system of environmental protection funds
until 2020		2. Evaluation of the national system of financing environmental protection and water management and introducing necessary corrections	analysis	minister responsible for environment minister responsible for water management
		3. Evaluation of projects financed from POIŚ 2014–2020 funds based on the Evaluation Plan	analysis	minister responsible for environment minister responsible for water management
		4. Monitoring and participating in the development of instruments intended to finance tasks related to environmental protection after 2020 from foreign funds	analysis/ programming	minister responsible for environment

Time horizon	Action name/Strategic project	Task name	Area	Entity in charge[1]
		5. Monitoring instruments intended to finance tasks related to environmental protection after 2020 from national resources within a scope related to the activities of environmental protection funds	analysis	minister responsible for environment NFOŚiGW
continuous		6. Conducting the financial management of environmental protection funds in a manner securing maintenance of their financial and organisational potential	analysis/ programming	system of environmental protection funds
until 2025	73. Increasing the efficiency and responsibility of the system of environmental impact assessments	1. Standardisation of the nature inventory process and the format of reporting about the environmental impact of a project	analysis/ legislation	minister responsible for environment GDOŚ
continuous	74. Supporting systemic management of environmental protection	1. Preparing directions of actions intended to construct a system of legislative and financial solutions supporting implementation of the Eco-Management and Audit Scheme (EMAS) in organisations	other	minister responsible for environment GDOŚ
until 2025		2. Implementation of project management standards in the environmental department	other	minister responsible for environment
until 2020	75. Strengthening the resources of experts and analysts in the area of environment and water management	1. Constructing a knowledge base for tests, evaluations, analyses, studies, reports on the environment executed by institutions of the environmental sector/resort and other entities working for environmental protection in Poland	analysis	minister responsible for environment minister responsible for water management
continuous		2. Performance of studies and analyses related to environmental protection resulting from current needs of the environmental department	analysis	minister responsible for environment
		3. Development and implementation of a programme for cooperation of the minister responsible for environment with non-government organisations	analysis/ programming	minister responsible for environment
		4. Improving the competences of the environmental department personnel	other	minister responsible for environment



9 Territorialisation of PEP2030's directions of intervention

Territorialisation[1] in PEP2030 is presented in the form of a synthetic description of voivodships, which focuses on problem areas – occurring frequently or repeating more frequently than indicated by average GUS indices for the country for each voivodship. The described phenomena had or have a territorial nature/territorial impact – primary on the scale of a voivodship, but not limited to it.

The problem was described as significant for a voivodship when the given voivodship was listed in the statistical yearbook of GUS as one of voivodships[2] which are characterised by the least preferable values for statistical date related to the described problem[3].

Sectors in which the given voivodship did not exhibit significant problems reaching beyond those typical of the country were not listed in the given description.

The selected problems were mainly those[4] which indirectly indicate related tendencies and problems – in such cases related data feature an analogical tendency (e.g. a high share of devastated/degraded areas is usually associated with a large amount of accumulated waste and a high number of plants harmful to the environment).

Based on an indication of negative trends, state intervention should be directed towards these phenomena in order to counteract them effectively. The most important directions of intervention for the individual voivodships include:

[1] The informational basis for short characteristics of voivodships in terms of the most important environmental problems typical of a given voivodship included: reports on the execution of environmental protection programmes, WIOŚ and IOŚ reports, GUS statistical yearbook "Environmental protection 2018" and the documents of voivodship statistical offices, information from the PEP2030 forecast, statements and data for forecasts involving various plans and programmes for the individual voivodships, information/data/reports from marshal offices and voivodship offices and the STRATEG portal (in particular long-term data).

[2] One of three to five voivodships (or as many voivodships as there are with indices of similar values).

[3] It was assumed that there are significant (by an order of magnitude) differences in indices between negative "leaders" of the statistics and the rest of the voivodship.

[4] The sequence in which the problems and data are listed (the individual points relate to selected voivodships):

a. Condition of ground surface – including waste management, geology, e.g. above-average sizes of degraded and devastated areas,

b. Condition of air quality/climate change/adaptation to climate change, e.g. emissions excessive in terms of magnitude and/or time: of dusts and contaminants (solid and gaseous), effect of climate change which are frequent or cover a large area or a high probability of their occurrence, frequent extreme weather conditions,

c. Condition of water resources, e.g. Excessive share of waters with unsatisfactory or low air quality, excessive draining of untreated wastewater into the water or ground, excessive abstraction of surface or groundwater,

d. Forests, e.g. wood cover percentage of a voivodship being significantly below the national average,

e. Protection of nature, e.g. the share of important protected areas being considerably below the average,

f. Situation related to noise/electromagnetic fields, e.g. considerable and frequent exceeding of limits, in particular in larger areas – in urban agglomerations, along arterial roads, etc.

9.1. Dolnośląskie Voivodship

Dolnośląskie is an area in which numerous industrial investments were commenced during the last dozen years or so. One of the side effects of economic development involves, e.g. generation of large amounts of waste and earth surface contamination. Intense economic development was one of the reasons behind the creation of a large area of devastated and degraded lands requiring rehabilitation inside the voivodship, considering its total surface area[5]. In the years 2014–2016 there was an upward trend in the size of these areas. In the year 2017 this trend was stopped and a certain drop in the size of devastated and degraded areas took place[6]. However, the area of rehabilitated and developed land in an analogical period did not compensate quantitatively – even by a half – the size of abovementioned areas requiring land rehabilitation[7]. Additionally, as part of this spatial phenomenon, it is possible to distinguish the largest area of unrehabilitated waste disposal sites in the country[8].

Dolnośląskie is also an area of traditional extraction of fossil raw materials, which causes degradation of the natural land relief. Nowadays, such a phenomenon, or even just the risk of its occurrence, often generates social conflicts.

Due to the geological and geophysical structure, vast areas of the voivodships are subject to landslides and mass wasting.

In terms of forest management, in 2017 Dolnośląskie was ranked second in terms of the volume of wood removed as part of intervention cuts[9], which resulted, e.g. from the fact that a considerable area of the voivodship's forests featured a diminished health level: for example, the area of forests prone to infectious diseases reached a 9% share in the forest area of the Regional Directorate of State Forests in Wrocław[10]. This data is consistent with the fast that a large area of protective forests in Dolnośląskie was damaged by industry[11].

In terms of air condition, in 2017 in urban areas of the Dolnośląskie the recorded permitted number of exceeded daily average standard was exceeded for PM_{10} dust (in 18 measurement stations), and an excess target level of benzo(a)pyrene present in the PM_{10} dust was recorded in all measurement stations[12]. The exceeded target average annual arsenic level is a specific feature of the voivodship due to the existence of the Legnica-Głogów Copper District within its boundaries[13].

Uniform parts of surface river waters in Dolnośląskie are characterised by a weak or bad condition[14]. In the catchment area of Odra there are commonly known flood hazards.

[5] 5661 ha – second largest in the country – in 2017, "Environmental protection 2018", GUS, Excel file, section 2, table 11(29).
[6] Based on data from the STRATEG base.
[7] Based on data from the STRATEG base.
[8] 2506,4 ha – first among all voivodships – in 2017 r.; GUS, Environmental protection, Warszawa, 2018, p. 145.
[9] 1.2 million m^3 of wood removed in 2017; Team of authors of the Forest Research Institute, Report on the condition of forests in 2017, PGL LP 2018, p. 67.
[10] Team of authors of the Forest Research Institute, Report on the condition of forests in 2017, PGL LP 2018, p. 69.
[11] 43,570 ha – ranked third among all voivodships in the country – in 2017; GUS, Statistical Yearbook of Forestry 2018, p. 143.
[12] WIOŚ, Air quality assessment in the Dolnośląskie in 2017, Wrocław, 2018, p. 56.
[13] Ibid., p. 52.
[14] Evaluation of the condition of uniform parts of surface waters in the Dolnośląskie in the year 2017, table 2. Discussion of classification results and an assessment of the condition of uniform groundwater parts in the Dolnośląskie, cf. p. 3.

9.2. Kujawsko-Pomorskie Voivodship

Kujawsko-Pomorskie is characterised by relatively satisfactory statistics related to environmental protection; nonetheless, it is affected by problems related to air and water quality. As in numerous other voivodships, in urban areas – in agglomeration zones – there are contaminations with suspended dust PM_{10}, suspended dust $PM_{2.5}$ and benzo(a)pyrene in suspended dust PM_{10}. In 2017 – due to the protection of human health – all 4 zones in the voivodship were obliged to execute air protection programmes[15]. In the years 2014–2017, the emission of gaseous contaminants including carbon dioxide from particularly harmful plants exhibited an upwards trend[16].

Monitoring studies indicated a poor (including bad) condition of most uniform parts of waters (JCW). In the year 2017, bad chemical condition of JCW was observed in all measurement sites monitored in this regard[17]. The eutrophication phenomenon also contributes to the bad condition of waters. In the year 2017, of all 37 JCWP monitored for municipal eutrophication, only one JCWP was not affected by this phenomenon[18]. Research indicates that 72.6% JCWP investigates in the years 2007–2017 is at risk of failing to fulfil the requirements of RDW[19].

In view of the voivodship being at risk of water deficiency, it is becoming a particularly significant fact that in the years 2013–2015, in Kujawsko-Pomorskie there was an observed continuation of a trend towards a descending groundwater table (in the year 2015, the groundwater level dropped below the low warning point).

Forests belonging to the State Treasury in Kujawsko-Pomorskie are in a quite good health condition, but its woodiness ratio is one of the lowest in the country[20].

In 2017 the voivodship in question had a 31.7% share of areas with particular natural assets protected by the law in the area of the voivodship, which was close to the national average of 32.5% (excluding the Natura 2000 areas). Unfortunately, in the case of Natura 2000 areas themselves the statistics did not look that good anymore, since their share was quite low[21].

Landslides and mass wasting, wind erosion and floods are hazards with spatial impact and characteristics which occur in the voivodship mainly due to its geological structure and specific land relief.

9.3. Lubelskie Voivodship

Lubelskie Voivodship is not an intensely industrialised or urbanised area, but similar to many other voivodships it has problems with an increasing area of devastated and degraded lands which require rehabilitation[22]. In the years 2013–2015 there was an annual increase in the size of such areas – with a small drop in the year 2016 and

[15] WIOŚ, Information on the condition of the environment in Kujawsko-Pomorskie in 2017, Bydgoszcz, 2018, p. 5.
[16] Based on data from the STRATEG base.
[17] WIOŚ, Information on the condition of the environment in Kujawsko-Pomorskie..., ditto, p. 42.
[18] Ibid.
[19] Ibid., p. 24.
[20] 23,5% – ranked thirteenth of all voivodships in the country in 2017; GUS, Statistical Yearbook of Forestry 2018, Warszawa, 2018, p. 37.
[21] 4,9 % – second lowest percentage in the country in 2017 – with a national average of 11.2%; GUS, Environmental Protection 2018, Excel file, table, section 5, 22(181).
[22] Team of authors of the ATMOTERM S.A. company, Report on the execution of the Environmental Protection Programme in Lubelskie for the years 2015–2016, Lublin, 2017, p. 129.

again an increase in the year 2017. At the same time, in the years 2015–2017 the area of rehabilitated and developed lands was decreasing[23].

Also, similar to many other regions of Poland, in the Lubelskie Voivodship, in spite of it not being a heavily industrialised and intensely urbanised region, exceeded permitted 24-hour PM_{10} levels and exceeded allowed numbers of days with concentrations above the acceptable values of suspended dust PM_{10} occur and persist in urban zones (in most measurement stations)[24] along with the associated exceeded benzo(a)pyrene levels. In addition, in 2017 the average annual concentrations of the PM_{10} dust, as well as the number of cases of exceeded daily concentrations were higher than in the previous year[25]. In the case of benzo(a)pyrene, average annual values in the PM_{10} dust exceeded the target level in 2017 in all measurement stations[26]. These phenomena were accompanied by increasing – since 2013 – emissions of gaseous contaminants from particularly harmful plants[27]. In the climate protection area, there was also another adverse phenomenon – an increase in the emission (in the years 2013–2016) of carbon dioxide from particularly harmful plants. In 2017 there was a drop-in emission, but its level still exceeded the one-year emission level from each year in the 2013–2015 period[28].

In terms of the status of water resources, the studies of WIOŚ proved that in 2017 the condition of all assessed (49 out of 53) uniform parts of surface waters (JCWP) was bad[29]. Due to the primarily agricultural nature of the voivodship, water resources are of particularly great significance. However, this is not accompanied by a proper number of small water retention facilities, which is the lowest of all voivodships (85 in 2016). Agriculture – within the boundaries of catchment areas which it affects – causes eutrophication of surface waters with nitrogen compounds. Problems of the voivodship related to water management are also reflected by the fact that in 2017 only 52.7% of population used sewage systems, which resulted in the voivodship having been listed as the last one of all voivodships[30].

In spite of having abundant natural resources, Lubelskie has a woodiness ratio which is one of the lowest in the country (23.3 % in 2017, with a national average of 29.6 %)[31] and one of the country's lowest percentages of protective forests (22.1 %)[32].

9.4. Lubuskie Voivodship

In a statistical approach of the environmental condition, Lubuskie Voivodship looks relatively good, although there are still areas which require proper intervention. In terms of waste management, one of the adverse phenomenons involves the large amount of stored waste, in particular of the municipal origin. In terms of the amount of municipal waste accumulated and intended for storage per 1 inhabitant, Lubuskie is ranked

[23] Based on data from the STRATEG base.
[24] WIOŚ, Report on the condition of the environment in Lubelskie in 2017, Lublin, 2018, p. 26.
[25] Ibid.
[26] Ibid., p. 28.
[27] Based on data from the STRATEG base.
[28] Based on data from the STRATEG base.
[29] WIOŚ, Report on the condition of the environment in Lubelskie ..., ditto, p. 52.
[30] Source: Local Data Bank, Statistics Poland, Residential and municipal management ▯ Network devices ▯ Users of the installation as % of total population.
[31] Fourteenth among all voivodships in the country in 2017; GUS, Statistical Yearbook of Forestry 2018, p. 37.
[32] Fifteenth among all voivodships in the country in 2017 r., ditto, p. 143.

second of all voivodships in 2017[33]. Another adverse phenomenon of unoptimized waste management involved a drop in the amount of separately collected waste[34]. In the years 2014–2017 there was an increase in the amount of collected municipal waste which was stored in landfills per 1 inhabitant[35], despite the fact that the amount of waste in landfills should be successively reduced, and the landfills themselves should be shut down, following proper procedures. Another process related to land surface which featured a downwards trend involved the size of rehabilitated and developed areas in the years 2014–2016[36]

In terms of air quality, Lubuskie has problems typical of numerous more heavily urbanised regions. The main problem related to air contamination in the voivodship involves high concentrations of suspended dust PM_{10} and benzo(a)pyrene present therein. In 2017, the levels of permitted concentrations of PM_{10} dust were not maintained in the area of two zones of the Lubuskie[37].

In the area of water management, one of the most serious problems involves the eutrophication of water. It has been observed in 77% of sensitive areas classified in 2016[38]. The condition of all uniform parts of surface river waters monitored in 2017 and almost all lacustrine JCWP of the Lubuskie was assessed to be below good[39]. One negative trend related to water management and having a spatial impact in the years 2014–2017 involved an increase in the amount of industrial and municipal wastewater, requiring treatment and drained into waters or into the ground during the year.[40]

Lubuskie is the woodiest voivodship in Poland (49.3% in 2017).

9.5. Łódzkie Voivodship

In Łódzkie, problems associated with the condition of earth surface are of particular significance due to the occurrence of lignite deposits within its boundaries. In the voivodship there is an open pit mine in Bełchatów, and there are plans for a lignite mine in Złoczew. Rehabilitation of post-extraction areas of the Bełchatów mine will present a challenge for the upcoming years, especially considering that this is the largest excavation of this type in Europe. In the years 2012–2015, the area of soils requiring land rehabilitation exhibited a growing trend.

Location of numerous industrial plants (especially related to home appliances) in the voivodship favours the generation of large amounts of waste. This accelerates economic growth, but it has its side effects, e.g. a considerable amount of generated[41] and accumulated waste[42].

In the voivodship there are many active plants which are particularly harmful in

[33] 185 kg per 1 inhabitant – ranked second of all voivodships – in 2017 – with a national average of 130 kg/inhabitant; GUS, Environmental protection 2018, Excel file, section 6, table 10 (241).
[34] Team of authors of the "E & W Consulting Beata Grzonka" company, Report for the years 2014–2015 from execution of the environmental protection programme for Lubuskie for the years 2012–2015 with prospects until the year 2019, part II, p. 70.
[35] Based on data from the STRATEG base.
[36] Based on data from the STRATEG base.
[37] WIOŚ, *Annual air quality assessment in Lubuskie based on immission tests performed in 2017*, Zielona Góra, 2018, p. 47.
[38] WIOŚ, *Condition of environment in Lubuskie in the years 2016–2017*, Zielona Góra, 2018, p. 95.
[39] WIOŚ, *Evaluation of uniform parts of river and lacustrine surface waters in Lubuskie in the year 2017*, Zielona Góra, 2018, p. 19-20.
[40] Based on data from the STRATEG base.
[41] 7,006.2 thousand tonnes – ranked third in all of Poland in 2017; GUS, *Environmental protection 2018*, Excel file, section 6, table 3 (234).
[42] 108,753.8 thousand tonnes – ranked fifth in all of Poland in 2017, ditto, Excel file, section 6, table 3 (234).

terms of the emission of pollutants into the air[43]. Excess concentration of the PM_{10} suspended dust was recorded in Łódzkie in the years 2002–2017, which resulted in a need to implement air protection programmes[44]. The number and range of areas with exceeded permitted levels of the PM_{10} dust in 2017 was increased in relation to the preceding year[45]. The PM_{10} dust contains benzo(a)pyrene. This is why excessive levels of PM_{10} are associated with excess amounts of benzo(a)pyrene. Excessive target level of benzo(a)pyrene contained in the PM_{10} suspended dust was recorded in 2017 in the whole Łódź urban agglomeration area[46]. Excessive levels of $PM_{2.5}$ dust also occurred in the voivodship, having taken place in almost every county city[47].

In the context of climatic policy, it is worth pointing out that in the year 2016 Łódzkie emitted one of larger amounts of carbon dioxide in Poland[48].

In 2017 there was no recorded good condition of water in any of the studied uniform parts of surface waters of Łódzkie – neither in the Vistula nor the Oder catchment area[49]. This status is caused by municipal wastewater, outflows from urbanised and agricultural areas.

Problems in Łódzkie also occur in the forestry area. A large area of protective forests was damaged by industry[50], and the high dissemination of forest complexes along with the domination of pine monocultures in the structure of stands are not favourable. This is particularly significant considering the fact that the discussed voivodship has the lowest woodiness ratio in the country[51].

The surface area of protected natural resources in the voivodship is smaller compared to numerous other voivodships. This is evidenced, e.g. by the low share of areas with particular natural assets protected by the law in the whole voivodship[52] and the low share of Natura 2000 areas of both types[53].

9.6. Małopolskie Voivodship

Małopolskie Voivodship is one of the smaller voivodships, instead being among the most diverse ones with respect to geography. Geographical diversity corresponds – in this case – to the diversity of economic development, which includes many various areas from biotechnology, through energy, to smelting and mining industry. Economic growth and high population (Małopolskie is among the most densely populated in Poland) are associated with a considerable amount of accumulated waste[54]. In addition,

[43] 118 – ranked fifth in the country in 2017, ditto, Excel file; table 22(135).
[44] WIOŚ, *Report on the condition of the environment in Łódzkie*, Łódź, 2018, p. 97.
[45] Ibid.
[46] Ibid., p. 106.
[47] Ibid., p. 104.
[48] 45,707.893 thousand tonnes – ranked third in all of Poland in 2016; GUS, *Environmental protection 2018*, Excel file, section 4, table 8 (121).
[49] WIOŚ, *Report on the condition of the environment in Łódzkie*, Łódź, 2018, p. 51.
[50] 41,519 ha – ranked fourth among all voivodships in the country – in 2017; GUS, *Statistical Yearbook of Forestry 2018*, p. 143.
[51] 21.5% – ranked sixteenth among all voivodships in the country – in 2017; ditto, p. 37.
[52] 19.7% – second lowest in the country in 2017 – with a national average of 32.5%; GUS, *Environmental Protection 2018*, Excel file, section 5, table 3(162).
[53] Special protection areas for birds constitute 2.2% of the overall area of the voivodship (ranked fourteenth of all voivodships; in the whole country these areas constitute 15.7%). Special areas of conservation of habitats constitute 2.9% of the overall area of the voivodship (ranked fifteenth of all voivodships; in the whole country they constitute 11.2%). Data for 2017, ditto, Excel file, section 5, table 22(181).
[54] 124,939.2 thousand tonnes – ranked fourth in the country – in 2017; GUS, *Environmental protection 2018*, Excel file, section 6, table 3 (234).

compared to the previous year there was an increase in the amount of produced and accumulated waste[55]. Also, packaging waste recycling level in Małopolskie in the year 2017 was among the lowest in the country[56]. It is assessed that 79% of inventoried asbestos waste in the voivodship remains to be neutralised[57].

In the area of air quality, the WIOŚ report showed that in 2017, in relation to criteria established for health protection, in the urban agglomeration of Kraków there were recorded excessive concentrations of nitrogen dioxide, PM_{10} suspended dust, benzo(a)pyrene in PM_{10} dust and $PM_{2.5}$ suspended dust, while in the remaining part of the voivodship – PM_{10} suspended dust, benzo(a)pyrene in PM_{10} dust and $PM_{2.5}$ suspended dust[58].

In Małopolskie there are numerous plants which are particularly harmful in terms of emission of pollutants into the air, all operating and exerting impact, also spatially[59].

Large areas of mountains and uplands in Małopolskie influence more frequent occurrence of extreme weather and geomorphological phenomena. A large part of the voivodship is prone to water erosion. The risk of landslides also constitutes a problem. By the end of 2017, 34 239 landslides were identified in the whole Małopolskie[60]. Their risk always grew after long atmospheric precipitation. Małopolskie is considered to be one of areas with the largest amount of precipitation in Poland and a high degree of flood hazard.

The status of water resources in Małopolskie looks unfavourable. Among all 76 uniform parts of surface waters (JCWP) studied in 2017, 91% of JCWP presented a moderate, weak or bad condition/potential, i.e. Not fulfilling the conditions of a good water condition[61].

One of the more serious negative phenomena important for water management, and at the same time presenting spatial impact, involved the generation of a large amount of industrial and municipal wastewater which remained untreated[62].

9.7. Mazowieckie Voivodship

Mazowieckie Voivodship is the largest in terms of area and population and it has the highest economic potential. This is associated with increased pressure exerted on the environment. Mazowieckie is one of these voivodships in the country which are at the top of statistics on the amount of generated municipal and industrial waste. The voivodship has a lot of problems related to waste management. In 2017, selectively collected rainwater constituted only 26.5% of the overall mass of rainwater collected in the years 2012–2017[63]. Problems related to waste management are also evidenced by the

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[55] GUS, *Environmental protection 2017*, p. 325; GUS, *Environmental protection 2018*, Excel file, section 6, table 3 (234).
[56] 56,8 % – ranked thirteenth in the country – in 2017, ditto, Excel file, section 6, table 28(259).
[57] WIOŚ, *Report on the condition of the environment in Małopolskie in 2017*, Kraków, p. 207.
[58] Ibid., p. 19.
[59] 139 – ranked third in the country – in 2017; GUS, *Environmental protection 2018*, Excel file, section 4, table 22(135).
[60] Team of authors of Lemtech Konsulting sp. z o.o., *Report on the execution of voivodship environmental protection programme in the Małopolskie for the years 2016–2017 – i.e. the Environmental Protection Strategic Programme*, Kraków, 2018, p. 60.
[61] WIOŚ, *Report on the condition of the environment in Małopolskie in 2017,* Kraków, 2018, p. 87.
[62] 14,1 hm^3 – ranked third among all voivodships – in 2017; GUS, *Environmental protection 2018*, Excel file, section 3, Tab. 29(74).
[63] WIOŚ, *Report on the condition of the environment in Mazowieckie in 2017*, Warszawa, 2018, p. 106.

level of packaging waste recycling, which is among the lowest in the country[64]. Illegal dumps are an additional phenomenon related to precipitation which is negative, e.g. for the space and landscape. According to the data of GUS, in 2017 in Mazowieckie there were 143 illegal dumps with a total area of 80 906 m^2 [65]. Although in 2017 in Mazowieckie there was a considerable increase in the amount of asbestos stored in a dump[66], the process of its transport to proper landfills is slow[67].

Along with the economic growth of Mazowieckie, since 2014 there has been a growth in the total emission of gaseous pollutants from particularly harmful plants[68]. This is affected by the high number of these plants in the voivodship[69].

On the other hand, low emission, including transport, often results – mainly in the urban agglomeration of Warszawa – in the concentrations of $PM_{2.5}$ and PM_{10} suspended dusts which are exceeded above the permitted levels. In 2017, in Mazowieckie there were several cases of exceeded information and alert levels for the PM_{10} dust[70]. In one station (Warszawa, Al. Niepodległości St.), in the years 2014–2017 there were recorded exceeded average annual levels of the PM_{10} dust[71] and nitrogen dioxide[72]. Exceeded average annual level of the $PM_{2.5}$ dust was recorded in the years 2016–2017[73]. Excessive emissions of PM_{10} dusts are associated with the frequent occurrence of high concentrations of benzo(a)pyrene[74].

For big cities which are transit centres, it is common to record upward trends of harmful traffic noise in terms of frequently exceeded limits (primarily traffic and aircraft noise).

In the context of climatic policy, it is worth pointing out that in the year 2016 Mazowieckie emitted one of larger amounts of three greenhouse gases – methane, nitrous oxide and carbon dioxide in Poland[75].

In terms of water management, in 2017 a bad condition was recorded for 83 out of 87 evaluated uniform parts of surface waters in Mazowieckie[76]. In the voivodship there is a considerable flood hazard – in the Central Vistula area. In particular, the Vistula valley, from Wyszogród to the border of the voivodship, has been categorised as a problematic area with a countrywide significance.

Similar to the neighbouring Łódzkie, Mazowieckie faces problems related to forest management. One of them involves the lowest percentage of protected forest areas in the country[77] and one of the lowest woodiness ratios in the country[78].

[64] 56,9 % – ranked twelfth in the country – in 2017; GUS, *Environmental protection 2018*, Excel file, section 6, table 28(259).
[65] Local Data Bank (as of 28 January 2019).
[66] WIOŚ, *Report on the condition of the environment in Mazowieckie in 2017,* Warszawa, 2018, p. 110.
[67] *Programme for the removal of products containing asbestos from Mazowieckie,* Warszawa, 2018, p. 33.
[68] Based on data from the STRATEG base.
[69] 137 – fourth largest number of harmful plants in the country in 2017; GUS, *Environmental protection 2018*, Excel file, section 4, table 22(135).
[70] WIOŚ, *Report on the condition of the environment in Mazowieckie in 2017*, Warszawa, 2018, p. 20.
[71] Ibid., p. 21.
[72] Ibid., p. 17.
[73] Ibid., p. 23.
[74] Ibid., p. 28.
[75] 46 677.13 thousand tonnes CO_2 – ranked second among all voivodships; 167.48 thousand tonnes of methane – ranked second among all voivodships; 7.8 thousand tonnes of nitrous oxide – ranked second among all voivodships; GUS, *Environmental protection 2018*, Excel file, section 4, table 8 (121).
[76] WIOŚ, *Report on the condition of the environment in Mazowieckie in 2017*, ditto, p. 49.
[77] 20.9 % – ranked sixteenth of all voivodships – in 2017; GUS, *Statistical Yearbook of Forestry 2018*, p. 143.
[78] 23.3% – ranked fifteenth of all voivodships – in 2017; ditto, p. 37.

9.8. Opolskie Voivodship

Similar to other regions of Poland, Opolskie Voivodship struggles with exceeded concentrations of suspended dusts – mainly in urban areas in heating seasons: $PM_{2.5}$ (annual standard value exceeded in the Kędzierzyn-Koźle station in 2017)[79], PM_{10} (24-hour permitted value in all stations measuring the concentrations of PM_{10} dust)[80] and benzo(a)pyrene (average annual concentration)[81]. Average annual concentrations of benzo(a)pyrene studied in 2017 in all measurement stations greatly exceeded the established standards[82].

Industry has been leaving its increasing gas footprint in the voivodship. Emission of gaseous pollutants from particularly harmful plants in the years 2015–2017 exhibited an upward trend[83]. In an analogical period, the emission of carbon dioxide from particularly harmful plants also exhibited an upward trend[84].

In terms of the status of water resources in the Opolskie, in 2017 a bad condition was recorded in 32 of the tested JCWPs[85]. The voivodship is listed among areas at risk of floods, in particular in the drainage basin of Oder and in the valleys of its tributaries. This is influenced, e.g. by insufficient retention capacities of the Oder catchment area.

In 2017, Opolskie had a quite high – close to the national average – woodiness ratio (26.7%), but at the same time it featured a large area of protective forests damaged by industry[86], even in spite of its high share of protective forests (66.8%).

In terms of natural resources, the Opolskie is characterised by the lowest share of Natura 2000 areas of both types in its overall surface area compared to all of Poland: special protection areas for birds and special areas of conservation for habitats[87].

9.9. Podkarpackie Voivodship

Podkarpackie Voivodship has numerous natural assets, which among other things results from the fact that its area comprises 3 physiographic units and 3 climate zones. At the same time, it is an area characterised by intense industrial growth, which is exemplified by its economic zones and the so-called "Aviation Valley". Within its boundaries there are also heavy industry plants which negatively affect the surrounding environment, including groundwaters and aquifers. Examples include production waste dump sites (6 tailings ponds and a landfill) of the Stalowa Wola Steel Mill. It is an example of side effects of the functioning of a large heavy industry plant which considerably adversely affects the surrounding space. In the Subcarpathian region there are also other spatial phenomena typical of mountain and upland areas – i.e. landslides. Also, hydrometeorological conditions in this region favour the erosion of soils.

Although the voivodship is less urbanised compared to the rest of Poland, in

[79] WIOŚ, *Condition of the environment in Opolskie in the year 2017*, Opole, 2018, p. 20; WIOŚ, *Measurement results produced in 2018 in air quality monitoring stations in Opolskie*, Opole, p. 4.
[80] WIOŚ, *Condition of the environment in Opolskie in the year 2017*, Opole, 2018, p. 19.
[81] Ibid., p. 22.
[82] Ibid., p. 22.
[83] Based on data from the STRATEG base.
[84] Based on data from the STRATEG base.
[85] WIOŚ, *Condition of the environment in Opolskie in the year 2017*, ditto, p. 40.
[86] 82722 ha – ranked second among all voivodships in the country – in 2017; GUS, *Statistical Yearbook of Forestry 2018,* p. 143.
[87] 1.5 % special protection areas for birds – ranked sixteenth of all voivodships, with 15.7% at a national scale; 2.9% special areas of conservation for habitats – ranked sixteenth among all voivodships, with 11.2% at a national scale; GUS, Environmental Protection 2018, Excel file, section 5, 22(181).

the existing town areas there are air pollutions typical of the more urbanised areas. Examples of such pollutions include the exceeded permitted daily concentration of the PM_{10} dust[88] and exceeded target values of benzo(a)pyrene in all measurement sites[89]. Excessive concentrations of the PM_{10} dust in 2017 caused the demarcation of 32 areas of exceeded daily standard of the PM_{10} dust in Podkarpackie. These areas were inhabited by approximately 500 thousand people[90].

In terms of water management, evaluation of the condition of surface waters performed in the year 2017 by WIOŚ in Rzeszów indicated a bad condition of water in 87% of all evaluated uniform parts of surface waters[91]. In the year 2017 bad condition was recorded in all evaluated river JCWPs[92]. In Podkarpackie there are problems related to both the shortages of water and its excess. Due to the fact that before 2015 in Podkarpackie there was a deficiency of precipitation, every several years this place saw the occurrence of droughts[93]. In 2015, a risk of agricultural drought was recorded in the whole Podkarpackie[94]. Also, during that time, the situation related to drought could not be improved due to the relatively low number of small water retention facilities[95]. At the same time, there is a high level of flood hazard, primarily caused by frequent water surges in rivers[96]. This risk is enhanced and strengthened by the mountainous and upland nature of catchment areas in the voivodship. Also, at the same time there was too small a number of identified objects intended to prevent floods[97].

9.10. Podlaskie Voivodship

Podlaskie Voivodship is among the voivodships which generate the least waste, but this does not mean the absence of problems related to the protection of ground surface. They are exemplified by the fact that the area of rehabilitated and developed lands decreased considerably in the years 2014–2017[98].

Podlaskie is one of the least urbanised in Poland; however, in spite of this, in the urban agglomeration of Białystok and the Podlaskie there were occurrences of negative phenomena in terms of air quality: exceeded permitted concentrations of the $PM_{2.5}$ suspended dusts (in the Podlaskie) and an exceeded target level of benzo(a)pyrene (in the Podlaskie and the urban agglomeration of Białystok) in 2017[99]. One negative trend involved growing methane emissions in the years 2014–2017, with a huge increase in the year 2017 itself[100].

In Podlaskie there are occurrences of the eutrophication phenomenon, which is typical of agricultural regions. There is an observed increase in the amount of water

[88] WIOŚ, *Annual air quality assessment in Podkarpackie, report for 2017*, Rzeszów, 2018, p. 29.
[89] Ibid., p. 52.
[90] Ibid., p. 94.
[91] Team of authors of the Podkarpackie Spatial Planning Office in Rzeszow, *Report on the execution of the environmental protection programme in Podkarpackie for the years 2015–2016*, Rzeszów, 2018, ditto, p. 19.
[92] WIOŚ, *Report on the condition of the environment in Podkarpackie in 2017*, ditto, p. 35.
[93] Team of authors of the Podkarpackie Spatial Planning Office in Rzeszow, *Report on the execution of the environmental protection programme in Podkarpackie for the years 2015–2016*, ditto, p. 2.
[94] Ibid., p. 72.
[95] *Land use plan of Podkarpackie – prospect for 2030*, Rzeszów, 2018, p. 60.
[96] Team of authors of the Podkarpackie Spatial Planning Office in Rzeszow, *Report on the execution of the environmental protection programme in Podkarpackie for the years 2015–2016*, ditto, p. 62.
[97] Ibid., p. 65.
[98] Based on data from the STRATEG base.
[99] WIOŚ, *Evaluation of the levels of substances in the air and classification of zones in Podlaskie in 2017*, Białystok, 2018, p. 31.
[100] Based on data from the STRATEG base.

prone to municipal eutrophication[101]. In the years 2014–2017 there was an increase in the amount of industrial and municipal effluents requiring treatment, drained into the water or into the ground during the year[102].

The woodiness ratio for Podlaskie in 2017 amounted to 30.8%, meaning above the national average (29.6%), but the quite large amount of wood was removed as part of intervention cuts in the area of Regional Directorate of National Forests in Białystok[103].

9.11. Pomorskie Voivodship

For many years, Pomorskie Voivodship – similar to the neighbouring Zachodniopomorskie Voivodship – has been at risk of the following phenomena of a spatial nature: drought (in particular agricultural), floods (especially Żuławy, for which the risk comes from the Vistula Lagoon), landslides (e.g. the cliff in Jastrzęba Góra) and seashore erosion (including beaches) – in particular considering the predicted rise in the level of the Baltic Sea.

Pomorskie is among the most urbanised regions, and therefore it is affected by problems related to the process of expansion of urban areas. In such areas where the so-called low emission occurs, there are typically excessive levels of permitted concentrations (primarily daily) of the PM_{10} suspended dust and benzo(a)pyrene contained in it. As shown by the studies of numerous voivodship inspectorates for environmental protection, the problem of elevated benzo(a)pyrene level concerns virtually ass urbanised areas. It also occurred in Pomorskie, where in 2017 levels of benzo(a)pyrene in the PM_{10} dust exceeding permitted values occurred in two out of three monitoring stations[104].

Pomorskie has very large and varied water resources – within its boundaries there are 245 distinguished uniform parts of river waters[105], 155 uniform parts of surface lacustrine waters, 4 uniform parts of transitional waters and 7 uniform parts of coastal waters[106]. In the year 2017, all evaluated uniform parts of flowing waters were assigned a bad condition. Problems of water management also include the relatively low number of small water retention facilities, which did not increase in the period of 2013–2016[107]. In the years 2014–2017 there was an increase in the amount of industrial and municipal effluents requiring treatment per 1 inhabitant, drained into the water or into the ground during the year[108]. The phenomenon of eutrophication of water by agricultural nitrates occurs mainly in agricultural areas of the voivodship.

There is a continuous serious threat caused by the weapon (e.g. chemical) remaining since the Second World War on the bottom of the Baltic Sea, including its coastal zone. It has a high negative potential of spatial impact on the marine environment and the shore.

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[101] Team of authors of the Sustainable Development Institute, *Report on the execution of the Environmental Protection Programme in Podlaskie for the years 2015–2016,* Białystok, 2017, p. 74.

[102] Based on data from the STRATEG base.

[103] 1.0 million m^3 – ranked third in the Regional Directorate of National Forests in 2016 – *Report on the condition of forests in Poland in 2016*, p. 63, PGL LP 2017, and 0.9 million m^3 – ranked fourth in 2017 – *Report on the condition of forests in Poland in 2017*, p. 67, PGL LP 2018.

[104] WIOŚ, *Report on the condition of the environment in Pomorskie in 2017,* Gdańsk, 2018, p. 32.

[105] Team of authors of the "Eko-Log Sp. z o.o." company, *Forecast of the environmental impact of the "Environmental protection programme in the Pomorskie for the years 2018-2021 with prospects until the year 2025" project,* p. 36.

[106] Ibid., p. 36.

[107] Based on data from the STRATEG base. No data for 2017.

[108] Based on data from the STRATEG base.

9.12. Śląskie Voivodship

Considering the whole country, Śląskie is an area of one of the most serious problems associated with the condition of ground surface, the amount of precipitation, the quality of air and surface waters. This is due to factors related, e.g. to history of the region, its geology and economic policy.

One of the most serious remaining problems involves the relatively high share of devastated and degraded lands, requiring rehabilitation, in the overall area of the voivodship, resulting from the functioning of mining and industry[109]. The size of these areas increased in the years 2014–2017[110].

In the voivodship there is a considerable amount of accumulated waste[111] (stored so far), which also contributes to a deteriorating condition of the land surface, and in the future it will increase demand for land rehabilitation.

Another consequence of the industrial development of Śląskie involves the country's largest area of protective forests damaged by industry[112]. Due to this, it is a point of concern that the voivodship also has one of the country's smallest areas of forestation in public forests[113].

Bad air quality is a phenomenon causing negative health effects on people, which affects many areas and cities in Poland. In Śląskie, the permitted levels of $PM_{2.5}$ and PM_{10} suspended dusts and benzo(a)pyrene are frequently exceeded[114]. 13 out of 50 cities from the WHO list of heaviest air pollutions published in the 2016 report are located in Śląskie. In the voivodship there are many plants which are particularly harmful in terms of emission of pollutants into the air (329 in 2017), though, as indicated by numerous studies, air pollution in urbanised areas is caused primarily by the so-called low emission.

In the year 2016 Śląskie emitted the highest amounts of two greenhouse gases – carbon dioxide and methane – among all voivodships[115], which is of particular significance for conducting responsible climatic policy.

The condition of uniform parts of surface waters (JCWP) in the voivodship is mostly weak and bad. This is influenced, e.g. by the large amount of industrial (especially untreated) and municipal effluents requiring treatment, drained into the water or into the ground. In 2017, the amount of generated industrial and municipal effluents, requiring treatment and drained into the water or into the ground, which remained untreated, was the largest in the country[116]. In terms of generation of the effluents characterised above (without distinguishing untreated effluents), an upward trend occurred in Śląskie from 2015 until 2017[117].

[109] 476,284.6 ha – ranked second among all voivodships in the country in 2017; GUS, *Environmental protection 2018*, Excel file, section 6, table 3 (234).
[110] Based on data from the STRATEG base.
[111] 476 284.6 thousand tonnes – ranked second in the country in 2017; GUS, *Environmental protection 2018,* Excel file, section 6, table 3 (234).
[112] 182 729 ha – ranked first in the country in 2017; GUS, *Statistical Yearbook of Forestry 2018*, p. 143.
[113] 3,4 ha – ranked fifteenth of all voivodships in 2017; Ibid., p. 82.
[114] WIOŚ, *Condition of the environment in Śląskie in 2017,* Katowice, 2018, p. 19–23, 32–33.
[115] 50,601.717 thousand tonnes of CO_2 and 666.093 thousand tonnes of methane; GUS, *Environmental protection 2018*, Excel file, section 4, table 8 (121).
[116] 59.0 hm^3 – ranked first of all voivodships in 2017; GUS, *Environmental protection 2018*, Excel file, section 3, table 29(74).
[117] Based on data from the STRATEG base.

9.13. Świętokrzyskie Voivodship

Świętokrzyskie Voivodship has an agricultural-industrial nature and it does not belong to densely populated regions of Poland. In 2016, this voivodship subjected a large amount of generated waste to the process of recovery[118]. However, at the same time in Świętokrzyskie there were difficulties related to maintaining the best possible condition of ground surface. This is reflected by changes in the sizes of devastated and degraded lands requiring rehabilitation, which in the years 2014–2016 exhibited an upward trend[119]. One of factors which influence this involves the high number of quarries. Mining extraction of raw materials for the lime industry deteriorates the condition of ground surface. It is also affected by erosion, which in the area of Świętokrzyskie is very intense, since all of its types are encountered in there: water erosion, surface erosion, wind erosion and gully erosion.

In 2017, in several zones of Świętokrzyskie concentrations of the PM_{10} dust and average annual target level of benzo(a)pyrene exceeded the values permitted for daily concentrations[120], which is a relatively frequent phenomenon observed by voivodship inspectorates for environmental protection in other, more urbanised regions of Poland. Another phenomenon related to air quality which also occurred in several other voivodships involved the emission of gaseous pollutants from particularly harmful plants, which in the years 2014–2016 exhibited an upward trend. In the year 2017 there was a drop-in emission, but its reduced level exceeded the value of annual emissions from the years 2014 and 2015[121].

Also, it is not an exception in relation to other voivodships that the condition of uniform parts of surface river waters (JCWP) in Świętokrzyskie in 2017 was assessed as bad[122]. In the area of water and effluent management, a negative phenomenon with strong spatial impact involved the generation of a large amount of industrial and municipal effluents which remained untreated[123]. Its environmental effects were worsened by the low share of sewage systems in the voivodship, especially its rural areas. In 2017, 58.7% of the population of Świętokrzyskie used sewage systems, resulting in the 15th rank of the voivodship among all voivodships in the country[124].

In 2017, Świętokrzyskie had a high share of areas with particular natural assets protected by the law in the total area of the voivodship (65%)[125], but at the same time a low share of special protection areas for birds in the Natura 2000 network (1.9%)[126].

9.14. Warmińsko-Mazurskie Voivodship

Warmińsko-Mazurskie Voivodship does not appear at the top of statistics which present problems related to the condition of the environment. It has numerous natural

[118] 2075.1 thousand tonnes – ranked seventh of all voivodships – in 2017; GUS, *Environmental protection 2018,* Excel file, section 6, table 6 (237).
[119] Based on data from the STRATEG base.
[120] WIOŚ, *Air quality assessment in Świętokrzyskie in the year 2017*, Kielce, 2018, p. 19, 21.
[121] Based on data from the STRATEG base.
[122] *Results of classification and assessment of the condition of surface waters in Świętokrzyskie in the year 2017,* Kielce, 2018.
[123] 15.4 hm^3 – ranked second of all voivodships – in 2017; GUS, *Environmental protection 2018*, Excel file, section 3, table 29(74).
[124] Based on data from the STRATEG base.
[125] Ranked first of all voivodships in Poland. The national average in 2017 amounted to 32.5%; GUS, *Environmental protection 2018*, Excel file, section 5, table 3 (161).
[126] Ranked fifteenth of all voivodships in Poland. The national average in 2017 amounted to 15.7%; GUS, *Environmental protection 2018*, Excel file, section 5, table 22 (181).

and landscape assets, but it also has rather large areas of devastated and degraded lands requiring rehabilitation[127]. Several reports on the condition of the environment indicated the existence of problems related to waste management. Due to their nature, largely focusing on tourism, Warmińsko-Mazurskie are prone to contaminations of the earth surface (e.g. littering) and the water (e.g. waste from boats sailing on the lakes), which are particularly adverse for areas valuable in terms of nature and result largely from tourism.

Although Warmińsko-Mazurskie does not belong to intensely urbanised regions, in urban zones there are problems with air quality. The so-called low emission manifested itself by high levels of benzo(a)pyrene, which indicated exceeding the target level in the Elbląg city zone and the Warmińsko-Mazurskie in 2017[128].

An increase in industrial activity was observed in the voivodship, indicated by growing emission of gaseous pollutants from particularly harmful plants in the years 2015–2017[129].

In 2017, in terms of the condition of water resources of Warmińsko-Mazurskie, WIOŚ declared a bad condition of 38 uniform parts of waters[130]. Also, a bad condition was recorded regarding the water of the Vistula Lagoon[131], which additionally creates a flood hazard for coastal areas and Elbląg.

9.15. Wielkopolskie Voivodship

In the year 2017, Wielkopolskie Voivodship featured the country's greatest share of areas requiring land recultivation[132].

The amount of lands requiring recultivation also corresponded to data involving the large amount of municipal waste meant for storage per 1 inhabitant[133] and the significant amount of accumulated waste[134]. They are mainly side effects of processes such as: the development of industry, trade and industrial farming as well as an improvement in the inhabitants' standard of living.

In terms of air condition, there was a noticeable high emission of gaseous pollutants from particularly harmful plants (primarily sulphur dioxide and nitrogen oxides)[135]. These processes correlate with information on the high number of particularly harmful plants in terms of the emission of pollutants into the air[136].

Similar to numerous other areas of Poland, where the low emission phenomenon occurs, in Wielkopolskie there were higher than permitted concentrations of pollutants. Exceeded concentrations of substances occurring in 2017 required the preparation of air protection programmes for the zone of Wielkopolskie in the case of the $PM_{2.5}$ dust, for the urban agglomeration of Poznań and the zone of Wielkopolskie in the case of the

[127] 4,838 ha – ranked fifth of all voivodships in Poland – in 2017; GUS, *Environmental protection 2018*, Excel file, section 2, table 11(29).
[128] WIOŚ, *Report on the condition of the environment in Warmińsko-Mazurskie in 2017*, Olsztyn, 2018, p. 92.
[129] Based on data from the STRATEG base.
[130] WIOŚ, Report on the condition of the environment in Warmińsko-Mazurskie in 2017, Olsztyn, 2018, p. 38.
[131] Ibid., p. 64.
[132] 10,277 ha – ranked first of all voivodships in Poland in 2017; GUS, *Environmental protection 2018*, Excel file, section 2, table 11(29).
[133] 129 kg – ranked seventh in the country in 2017; Ibid., table 10 (241).
[134] 60,615.5 thousand tonnes – ranked seventh of all voivodships in Poland in 2017; Ibid., section 6, table 3(234).
[135] 14,447.5 thousand tonnes – fourth largest in all of Poland in 2017; Ibid., section 4, table 25(138).
[136] 144 – ranked second among all voivodships in the country in 2017; Ibid., section 4, table 22(135).

PM_{10} dust and for the zone of Wielkopolskie, Kalisz city and the urban agglomeration of Poznań in case of benzo(a)pyrene[137].

In the year 2016, Wielkopolskie emitted one of the largest amounts of two greenhouse gases – methane and nitrous oxide – in Poland[138].

In 2016 Wielkopolskie saw one of the highest drought risks in the country. Agriculture was facing problems related to this, but it was also generating environmental pressures itself, causing eutrophication of surface waters (with nitrogen compounds) and contamination of alluvial sediments. In the year 2017 the condition of all studied 124 river JCWPs, 44 lacustrine JCWPs was evaluated as bad[139].

In 2017, Wielkopolskie had one of the lowest woodiness ratios of the whole country[140].

9.16. Zachodniopomorskie Voivodship

In 2017, in Zachodniopomorskie Voivodship there were 561.5 ha of unrehabilitated waste dump areas, with no areas subjected to land rehabilitation during that year[141]. Problems related to waste management are confirmed by reports (e.g. of WIOŚ), which list numerous shortcomings in this area – e.g. a problem involving the accumulation of large amounts of waste, which is not processed properly. This corresponds with the fact that in this voivodship in 2017 there was one of the lowest achieved levels of packaging waste recycling[142] of all voivodships.

Another source of environmental problems with territorial impact involves farms where the concentration of animal production results in turn in: contaminations of the earth, the water and odours. The negative side effects of mass breeding – with a wide spatial impact – often cause protests of local communities. In 2016 there were 91 large farms in Zachodniopomorskie[143].

In 2017 exceeded average annual concentrations of benzo(a)pyrene were recorded in two zones of the voivodship – the urban agglomeration of Szczecin and the Zachodniopomorskie zone[144].

The area of Zachodniopomorskie is dominated by rivers. The condition of 60 out of 66 river JCWPs studied in 2017, which is the outcome of evaluation of the ecological status/potential and the chemical condition, was assessed as bad[145]. Studies performed under diagnostic monitoring of 2017 provided a basis for assessing the condition of all monitored transitional and coastal waters as bad[146]. The voivodship was at risk of the following phenomena of a spatial nature: drought (in particular agricultural), landslides and seashore erosion.

[137] WIOŚ, *Report on the condition of the environment in Wielkopolskie in the year 2017*, Poznań, 2018, p. 24.
[138] 163.777 thousand tonnes of methane – ranked third of all voivodships and 9.213 thousand tonnes of nitrous oxide – ranked first among all voivodships; GUS, *Environmental protection 2018,* Excel file, section 4, table 8 (121).
[139] WIOŚ, *Report on the condition of the environment in Wielkopolskie in the year 2017,* ditto, p. 36, 43.
[140] 25.8% – ranked twelfth in 2017 – with a national average of 29.6%; GUS, *Statistical Yearbook of Forestry 2018*, p. 37.
[141] GUS, *Environmental protection 2018*, p. 145.
[142] 55,6 % – ranked fourteenth of all voivodships in the country – below the national average of 57.5% in 2017; GUS, Environmental protection 2018, Excel file, section 6, table 28(259).
[143] WIOŚ, *Condition of the environment in Zachodniopomorskie. Report 2017,* Szczecin, 2017, p. 60.
[144] WIOŚ, *Report on the condition of the environment in Zachodniopomorskie. Report 2018,* Szczecin, 2018, p. 26.
[145] Ibid., p. 65.
[146] Ibid., p. 82.

10 Strategic intervention areas (OSIs)

In the perspective of 2030, regional policy will be more selective. On the one hand, it will be directed towards the straightening of factors building the competitiveness of regions, on the other hand it will focus on reducing disproportions in the economic development level of the country by supporting areas in which social-economic problems are concentrated.

According to a definition provided by the SOR, OSIs are areas with a characteristic set of social, economic or spatial conditions and features, deciding about the occurrence of structural development barriers or permanent, activatable development potentials within them. Among them, there were indicated medium cities loosing their social-economic functions[1], as well as areas at risk of permanent marginalisation[2].

The term strategic intervention area is used for planning state interventions with an integrated nature (combining investments, soft projects, i.e. investments in human resources and/or regulatory solutions), undertaken under various policies with regard to selected types of areas in the country. In this context, environmental policy plays a significant role due to the fact, that the goals of PEP2030 were formulated in response to the most important trends in the environmental area identified in a diagnosis, in a manner enabling harmonisation of issues related to environmental protection with economic and social needs.

There is a close relationship between marginalisation processes and environmental quality problems, as well as limited access to resources. Good quality of the environment (pure water, air, landscape assets) and access to infrastructure (sewage systems, water supply systems) is an important indicator of the inhabitants' quality of life, as well as a necessary condition for the development of tourism in the given area. On the other hand, access to resources determines, e.g. industrial development.

In this context, it is the aim of PEP2030 to give special consideration to the aspect of medium cities losing their social-economic functions when conducting the policy of adaptation to climate change, also carried out in relation to areas being at risk of permanent marginalisation. Not only should adaptive actions increase the resistance of OSIs to climate change, but they should also increase their inhabitants' quality of life, among other things by planning and execution of investments in green and blue infrastructure, economical and sustainable management of rainwater, as well as other actions related to adaptation, which would also allow increasing the attractiveness of these areas to investments. Preferences for OSIs related to the possibility of financing adaptive actions will be indicated in implementational instruments, including operational programmes.

For environmental policy, special intervention areas also include areas in which indicators of environmental status depart from the accepted standards, or for which the extent of provision of infrastructure departs from the standards (e.g. cities listed among the most contaminated in terms of air quality according to the WHO). These areas are indicated in chapters related to territorialisation and in a diagnosis of the environmental status, which is an appendix to PEP2030. At the same time, as part of execution of the postulate of preventing marginalization and the loss of social-eco-

[1] Śleszyński P., *Delimitation of medium cities loosing their social-economic functions*, Institute of Geography and Spatial Organisation, Polish Academy of Sciences, Warszawa, 2016.

[2] Appendix to resolution no. 8 of the Council of Ministers dated 14 February 2017 on adopting the *Strategy for Responsible Development until the year 2020 (with prospects until 2030)* (M.P. item 260), figure 12. *Areas at risk of permanent marginalisation*.

nomic functions by medium cities, it is planned to take the areas indicated in the SOR into account when planning specific supporting instruments. It will be possible to reflect orientation towards OSI in instruments involving for example the development of low-emission and zero-emission transport, improvement in air quality or protection of ground surface. In particular, under the national environmental protection financing system (funds of the National Fund for Environmental Protection and Water Management and voivodship funds for environmental protection and water management) and when planning support as part of a financial prospect after 2020, e.g. by formulating criteria, determining an allocation dedicated to these areas or additional points in competitions. At the same time, it should be pointed out that each time the generation of these mechanisms must be preceded by an analysis of relations between barriers existing in the given area and development chances provided by the given instrument.

Among other areas requiring intervention of environmental policy one should list those with particular natural assets. Protected areas should be an important element of social-economic development of regions characterised by great natural wealth. Support should involve determining the potential and indicating the possibilities of utilising natural resources of both existing and planned protected areas, for a social-economic development. The existence of a protected area in a given region (such as, e.g. a national park) should facilitate the acquisition of funds by local community for the development of nature-friendly tourism and services related to it. Other forms and types of economic activity which do not affect the environment negatively also deserve support and promotions.

11

PEP2030 implementation system

The development of PEP2030 is based on a medium-term development strategy for the country – SOR. PEP2030 determines directions of development for sectors of environment and water management, indicating actions which should be taken in order to accomplish detailed objectives, determining actions with a diverse nature (analytical, legislative, program-based, financial, investment-based). PEP2030 is associated with other horizontal integrated development strategies. This means that both the goals of PEP2030 are achieved by the implementation of other strategies, and the implementation of PEP2030 achieves the goals of other strategies. Relationships of PEP2030 with other horizontal strategies are presented below in the form of a correlation table.

11.1 Links to other horizontal integrated development strategies

PEP2030 is one of nine development strategies being prepared simultaneously, which constitute a basis for conducting development policy in Poland. It was a key rule during the preparation of strategy not to double actions and tasks. It was also important not to overlap reporting duties.

The actions and tasks of PEP2030 will be supplemented by actions and projects of the updated ***Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries until 2030*** (SZRWRiR), in particular resulting from Common Agricultural Policy and Common Fishing Policy, whose execution is the responsibility of the minister responsible for agriculture and the minister responsible for fishery, respectively. Actions for the protection of natural environment and biological diversity related to agricultural and fishing activities will be executed under these instruments. For example, this involves:

1) protection of water quality, including rational management of fertilisers and plant protection products;
2) increasing water retention, including in soil;
3) promoting pro-environmental methods of agricultural production, including ecological farming, integrated production;
4) protection of soils (against erosion, contaminations, acidification, depletion of organic substance);
5) supporting investments favouring environmental protection in agricultural and fishing holdings;
6) promoting knowledge on methods for environmental protection in agriculture and in rural and fishing areas, e.g. by improvement and development of an advisory system and promotion of good agricultural practices.

An equally important issue which will result from the updated *Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries until 2030* involves the adaptation of agriculture and fishery to climate change and their contribution to prevention of these changes. Actions executed under this direction of intervention will involve, for example:

1) carbon sequestration in soil and biomass generated in agriculture (e.g. cultivation of

intercrops, maintenance of permanent grasslands);
2) Reducing the emission of greenhouse gases from agriculture and the agricultural food chain, including proper storage and application of natural fertilisers; promoting the cultivation of fabaceans;
3) extending and spreading knowledge related to climate-friendly practices;
4) promoting practices for adaptation to climate change in agriculture, including the build-up of organic matter resources in soil;
5) increasing and restructuring forest resources in order to improve the balance of emission of greenhouse gases;
6) orienting plant cultivation and animal breeding towards adaptation and mitigation, as well as the maintenance of a wide spectrum of genetic resources in plant gene banks;
7) replacing motors and investments improving the energy efficiency of fishing boats and support for fishing holdings with actions related to installation of devices enabling the use of renewable energy sources.

Actions for climate are closely related to the draft of ***Energy Policy of Poland until 2040*** (PEP2040). Its goal is energy safety maintaining the competitiveness of economy, energy efficiency and decreasing the environmental impact of the energy sector, with an optimal use of own energy resources. The document indicates eight directions. The ones which will affect the environmental sector include:

1. optimal use of own energy resources (in terms of rational extraction of black coal and lignite deposits, as well as rational use of biomass and non-agricultural waste),
2. extending the production and network infrastructure for electrical energy (in terms of an increased use of renewable energy sources),
3. implementation of nuclear energy,
4. development of renewable energy sources (in terms of supporting the development of renewable energy sources, reducing the emission of the energy sector and diversification of energy production),
5. development of heating and cogeneration (in terms of the use of renewable energy sources and waste),
6. improvement of the energy efficiency of economy (in terms of improving ecological awareness; intense thermal modernisation of housing; limiting low emission).

Providing **energy safety** will mean satisfying current and future needs of receivers for fuels and energy in a technically and economically justified manner, maintaining the requirements of environmental protection. PEP2040 indicates that black coal and lignite are the main raw materials used to satisfy the demand for **electrical energy**, but the contribution of renewable energy sources (OZE) and natural gas is becoming increasingly significant. For the highest efficiency of utilising the raw material, as well as for the highest possible reduction of contaminants, it is necessary to provide competitiveness of effective and low-emission solutions. It is expected that the share of renewable energy sources will continue to grow in the balance due to the fulfilment of international commitments. In the nearest years, the increase in the **use of renewable energy sources** for production of electrical energy will be maintained at a stable level, and its dynamics will increase after 2025 due to the expected achievement of technological-economic maturity of the individual technologies. It is estimated that in 2030 the share of renewable energy sources in power engineering will amount to approx. 27%.

In order to ensure energy security of the country, it will be also important to implement nuclear energy – providing stable, clean and relatively cheap electrical power. According to PEP2040, it is planned to launch the first nuclear power plant around 2033.

The development of **heating**, and primarily the construction of energy-efficient heating systems, will be achieved by the following actions:

1) the development of cogeneration, which constitutes the most environmentally efficient way of using fossil fuels;
2) an increase in the use of renewable energy sources in district heating – it will proceed mainly by the use of local renewable energy resources, i.e. biomass, biogas or geothermal energy;
3) an increase in the use of waste in district heating.

Further development of the **use of energy from renewable sources** is considered as one of the instruments for limiting the environmental impact of the energy industry. The document assumes that a key role for reaching the goal in electricity and energy will be played by the development of photovoltaics (especially starting from 2022, in particular in terms of satisfying needs for coolth – in the summer peak of demand for electrical power for the purposes of cooling) and marine wind farms (the first one will be activated after 2025). It is estimated that the use of geothermal energy will grow at a faster pace – although its current use is at a relatively low level.

Although the fulfilment of environmental requirements affects improvement in energy efficiency and reduction of the environmental impact of the energy industry, this may lead to a premature termination of the operation of some production units. Due to the expected considerable reduction of power in the nearest dozen years or so (for natural and ecological-economic reasons) and an increasing demand for electric energy, there are plans to extend production resources.

In the existing situation it has become particularly important to use any available zero-emission and low-emission technologies with a simultaneous increase in the level of energy safety and a drop in the emission of contaminations. This is why one of the directions included in PEP2040 involves the **implementation of nuclear energy**. Nuclear units provide stability of energy production with zero emission of air pollutants. Currently used technologies (of generation III and III+) and rigorous global standards related to nuclear safety provide safety of operation for a nuclear power plant and waste disposal. Work aimed at increasing the safety level of reactors performed in the recent years have also led to a decrease in the environmental impact of nuclear power plants in the case of a possible serious malfunction. Nuclear power plants do not emit sulphur and nitrogen oxides, dusts or toxic chemical substances. Also, they do not emit carbon dioxide, and the amounts of emissions present at other stages of the fuel cycle are comparable to the emission levels of wind farms and hydropower plants.

The ***Sustainable Transport Development Strategy until 2030*** (SRT) is a document which sets the most important directions for the development of transport, also in an environmental aspect. The SRT involves all sectors of transport: by roads, by railways, by sea, by inland waterways, urban and intermodal. The main objective of national transport policy involves increasing the availability of transport, as well as improving the safety of traffic users and the efficiency of the transport sector by creating a cohesive, sustainable, innovative and user-friendly transport system in a local, national, European and global aspect. The SRT aims at limiting the negative

environmental and climatic impact of transport and improving its energy efficiency via the implementation of modern technological solutions, or the shaping of new mobility patterns. One significant aspect of the SRT involves the development of collective transport. The document also notices a need to take into account the observed and predicted climate change in transport policy, along with the performance of adaptive actions in that regard.

The following directions of intervention of the SRT are the most important for achieving the goals of environmental policy:

1) building an integrated, interconnected transport network serving competitive economy;
2) improving the method of organisation and management of the transport system;
3) changes in individual and collective mobility;
4) limiting the negative environmental impact of transport.

The main objective of ***Strategy for productivity*** (SP) has been defined as follows: "Fast and stable growth of productivity under the conditions of economy: low-emission, circular, data-based". The SP indicates that economic macrotrends which Poland will have to address in the upcoming years include the construction of circular economy, the low-carbon aspect of economy and bioeconomy. Therefore, the SP supports and supplements the execution of environmental policy in the area of air quality, waste management, resource management, climate protection and eco-innovations.

SP indicates objectives related to the area of natural resources, which include an increase in the resource efficiency of economy, as well as the growing use of renewable resources and biomass in economy. It points out that economy of the future requires that the production factors (including natural resources) enable the generation of commodities with the highest possible added value, with simultaneous minimisation of the negative impact of processes of manufacturing and using these commodities on the environment and society, while maintaining the future generations' ability to achieve economic growth (in compliance with the sustainable development principle).

The most important directions of intervention of the SP, which will support the execution of ecological policy, include:

1) optimising the management of non-renewable resources, with particular emphasis on their quality, value and possibility of repeated use;
2) increasing, in a sustainable manner, the use of renewable resources in the industry;
3) eco-innovations;
4) automation, robotization and digitisation of enterprises.

PEP2030 direction of intervention	Relationship between PEP2030 and:							
	SZRWRiR	PEP2040	SRT	SP	KSRR	SSP	SRKS	SRKL
Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters	strong	weak	weak	medium	medium	unidentified	unidentified	unidentified
Eliminating the sources of emission of pollutants into the air or a significant reduction of their impact	strong	strong	strong	medium	medium	unidentified	unidentified	unidentified
Protection of land surface, including soils	strong	weak	weak	medium	medium	unidentified	unidentified	unidentified
Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection	weak	medium	medium	weak	weak	unidentified	unidentified	unidentified
Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity	medium	weak	strong	medium	medium	unidentified	weak	unidentified
Supporting multifunctional, sustained and sustainable forest management	medium	weak	weak	medium	medium	unidentified	unidentified	unidentified
Waste management towards a circular economy	strong	medium	weak	strong	strong	unidentified	unidentified	unidentified
Managing geological resources by developing and implementing a Raw Materials Policy	unidentified	strong	unidentified	strong	medium	unidentified	unidentified	unidentified

PEP2030 direction of intervention	Relationship between PEP2030 and:							
	SZRWRiR	PEP2040	SRT	SP	KSRR	SSP	SRKS	SRKL
Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT)	weak	strong	medium	strong	medium	unidentified	unidentified	unidentified
Climate change mitigation	strong	strong	strong	medium	strong	unidentified	unidentified	unidentified
Adaptation to climate change and the management of the risk of natural disasters	strong	medium	strong	medium	strong	weak	unidentified	unidentified
Ecological education, including the shaping of sustainable consumption patterns	medium	medium	medium	medium	medium	unidentified	unidentified	weak
Improving the environmental protection control and management system and perfecting the financing system	weak	weak	unidentified	weak	medium	weak	unidentified	unidentified

11.2. Links to valid programming documents

Detailed objectives	Directions of intervention	Programming documents related to individual directions of intervention	Time horizon
Environment and health. Improving the quality of environment and ecological safety	Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters	Updating water management plans	2021
		Flood risk management plans	2021
		National municipal wastewater treatment programme	2021
		Marine water monitoring programme	2019
		Plan for counteracting the effects of droughts	2020
		National programme for protection of marine waters	2020
		Construction programme of the Świnna Poręba water reservoir	official opening took place in 2017
		„Comprehensive flood protection of Żuławy" programme	2030
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		Programme of actions aimed at decreasing the contamination of waters with nitrates originating from agricultural sources and preventing further contamination	2022 with prospects until 2024
		The State Environmental Monitoring Programme for the years 2016–2020	2020
		Roadmap for transformation towards circular economy	2030
	Eliminating the sources of emission of pollutants into the air or a significant reduction of their impact	National Transitional Plan (2020)	2020
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		National Air Protection Programme until the year 2020	2020 (with prospects until 2030)
		The State Environmental Monitoring Programme for the years 2016–2020	2020
	Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection	National waste management plan 2022	2022
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		The State Environmental Monitoring Programme for the years 2016–2020	2020

Detailed objectives	Directions of intervention	Programming documents related to individual directions of intervention	Time horizon
	Protection of land surface, including soils	Raw Materials Policy (in the consultation phase)	not specified
		Programme of actions aimed at decreasing the contamination of waters with nitrates originating from agricultural sources and preventing further contamination	2022 with prospects until 2024
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		The State Environmental Monitoring Programme for the years 2016–2020	2020
Environment and economy. Sustainable management of environmental resources	Managing geological resources by developing and implementing a Raw Materials Policy	Raw Materials Policy (in the consultation phase)	not specified
		ProGeO Geological Ocean Exploration Programme	2033
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
	Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity	Programme of protection and sustainable use of biological diversity with a plan of actions for the years 2015–2020	2020
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		The State Environmental Monitoring Programme for the years 2016–2020	2020
		National Spatial Development Concept 2030	2030
	Supporting multifunctional, sustained and sustainable forest management	National Woodland Extension Programme	2020
		Strategy of the Polish Forests State Forests Holding for the years 2014–2030	2030
		National Forestry Programme (in development)	in development
		National Silvicultural Policy	not updated since 1997
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		Strategic plan of adaptation for sectors and areas vulnerable to climate change until the year 2030	2020 with prospects until 2030
		The State Environmental Monitoring Programme for the years 2016–2020	2020
		National Spatial Development Concept 2030	2030
	Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT)	Strategic plan of adaptation for sectors and areas vulnerable to climate change until the year 2030	2020 with prospects until 2030
	Waste management towards a circular economy	National waste management plan 2022	2022
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		Raw Materials Policy (in the consultation phase)	not specified

Detailed objectives	Directions of intervention	Programming documents related to individual directions of intervention	Time horizon
		Roadmap for transformation towards circular economy	2030
Environment and climate. Climate change mitigation and adaptation to them along with managing the risk of natural disasters	Climate change mitigation	Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		National Woodland Extension Programme	2020
	Adaptation to climate change and the management of the risk of natural disasters	Strategic plan of adaptation for sectors and areas vulnerable to climate change until the year 2030	2020 with prospects until 2030
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		National Woodland Extension Programme	2020
		Construction programme of the Świnna Poręba water reservoir	official opening took place in 2017
		„Comprehensive flood protection of Żuławy" programme	2030
		Flood risk management plans	2021
		Plan for counteracting the effects of droughts	2020
		Seashore protection programme	2023
Horizontal objectives	**Directions of intervention**	**Programming documents related to individual directions of intervention**	**Time horizon**
Environment and education. Developing the ecological competence (knowledge, abilities and positions) of the society	Ecological education, including the shaping of sustainable consumption patterns	Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		Roadmap for transformation towards circular economy	2030
Environment and administration. Improving the functioning efficiency of environmental protection instruments	Improving the environmental protection control and management system and perfecting the financing system	The State Environmental Monitoring Programme for the years 2016–2020	2020
		Action strategy of the National Fund for Environmental Protection and Water Management for the years 2017–2020	2020
		Joint action strategy of the National Fund and voivodship funds for environmental protection and water management for the years 2017–2020	2020
		Operational Programme Infrastructure and Environment 2014–2020	2020 (n+3 rule: 2023)
		General directions for the actions of the Inspection for Environmental Protection in the years 2016–2020	2020

11.3. Implementing Agenda 2030 and sustainable development goals (SDGs)

Transforming our world: Agenda 2030 for sustainable development, approved in 2015 by 193 countries, is a programme of actions, defining a sustainable development model at a global level in the 2030 perspective. *Agenda 2030* indicates a number of economic, social and environmental goals, aiming at transformation of economies in such a way as to generate bases for long-term, sustainable development, favouring the generation of new jobs. *Agenda 2030* has a horizontal nature. It includes 17 SDGs and 169 targets. Polish perspective of actions for sustainable and responsible economic development was formulated in SOR, which is a strategic instrument for managing the policy of social-economic development of the country, executed by state institutions, with respect for the environment. The new model of development for Poland outlined in the SOR meets the expectations formulated in *Agenda 2030*. The concept of a lasting and responsible development which served as a basis for the SOR, is coherent with the ambitious vision of *Agenda 2030* – the vision of a world free of poverty, where each man has the ability to benefit from progress. The convergence of the SOR and *Agenda 2030* is noticeable at the level of priority goals, areas and actions.

As an extension of the environmental part of the SOR, PEP2030 implements 11 out of 17 SDGs. Correlation of PEP2030 directions of intervention was performed based on compliance with the 169 targets of *Agenda 2030*.

1	Sustainable water management, including ensuring access to clean water for the public and the economy as well as achieving good status of waters	
2	Eliminating the sources of emission of pollutants into the air or a significant reduction of their impact	
3	Protection of land surface, including soils	
4	Tackling threats to the environment and ensuring biological security, nuclear safety and radiological protection	
5	Managing the resources of natural and cultural heritage, including the improvement and protection of the state of biological and landscape diversity	
6	Supporting multifunctional and permanently sustainable forest management	

7	Waste management towards a circular economy	
8	Managing geological resources by developing and implementing a Raw Materials Policy	
9	Supporting the implementation of ecoinnovations and the dissemination of the best available techniques (BAT)	
10	Climate change mitigation	
11	Adaptation to climate change and the management of the risk of natural disasters	
12	Ecological education, including the shaping of sustainable consumption patterns	
13	Improving the environmental protection control and management system and perfecting the financing system	

11.4. Implementation and coordination system

The PEP2030 coordinator function is served by the minister responsible for environment in cooperation with the minister responsible for water management. Some of the tasks will be executed by means of programmes being currently in effect, provided in the national strategic management system (including operational programmes), which also decide about the amount and method of financing the actions and the precise course of their execution.

It will also be important for the execution of the goals of PEP2030 to participate in the implementation of subjects at a regional and local level, in particular a voivode and government of a voivodship, which is responsible for tasks related to programming and performing key actions for development in the region. State policy for environmental protection[1] is performed based on development strategies, programmes and programming documents, as well as by means of environmental protection

[1] The Act of 6 December 2006 on the rules of pursuing development policy (OJ L of 2019, item 1295)

programmes (POŚ) of voivodships, counties and municipalities. POŚ is prepared by the executive authority of a voivodship, county and municipality, respectively, and established by a voivodship council, a county council or a municipal council. The POŚ draft is opinionated by the Minister of Environment for a voivodship; by a provincial executive board for a county and by a county executive board for a municipality. The primary goal of preparing and adopting a POŚ is the execution of environmental protection policy by territorial government units **in compliance with the assumptions of the most important strategic and programming documents.** POŚ should constitute a basis for the functioning of an environmental management system, combining all actions and documents related to environmental protection and nature at the level of a given JST.

According to the guidelines of the Minister of Environment for the preparation of environmental protection programmes of voivodships, counties and municipalities, solutions adopted in POŚ must primarily take into account actions leading to sustainable management of environmental resources, improving the condition of the environment, improving the condition of air quality, providing rational waste management and wastewater management, counteracting climate change and adapting to them, preventing natural disasters and increasing the flood safety of the inhabitants. The goals, directions of intervention and tasks should be established based on an analysis of the current situation and expected changes in environmental protection. **When formulating them, one should take into account valid provisions of Polish and EU law, current national and regional strategies, concepts and planning documents, also including those for sectors.** A POŚ should define goals, directions of intervention and tasks, their schedule and means necessary to reach the goals, including legal-economic mechanisms and financial resources. During the development of a POŚ, particular attention should be paid to proper definition of goals and assignment of indices to them. Due to this, a POŚ is to identify **areas requiring urgent actions to be taken in order to improve the condition of the environment and redirect the highest financial support to these areas.** The following correlation should be preferred: the **worse** the condition of the environment in a given area, the **more** financial resources are to be used for remedial actions. The POŚ of a voivodship constitute ones of the bases for adopting plans of activity by voivodship funds for environmental protection and water management, and therefore it has a real impact on choosing which investment projects could be financed in a given voivodship.

Reports on the execution of a POŚ are prepared in biannual cycles.

In the execution of PEP2030 an important role will be played by the Coordinating Committee on Development Policy (KKPR), which as an opinion-providing advisory body of the President of the Council of Ministers provides efficient coordination of programming and implementation of valid development policies, as well as monitors and assesses the status of their execution.

11.5. Monitoring and reporting

PEP2030 will be monitored at the level of objectives, directions of intervention, actions, tasks and strategic projects. Also monitored will be the indicators of execution of the individual objectives, including indicators at a voivodship level which are mentioned in appendix no. 4 to PEP2030.

The reporting system of PEP2030 results from many years of experience of administration in the preparation of reporting documents involving the execution of a medium-term country development strategy and other development strategies. It is presented in detail in the document ***Monitoring system for Responsible Development Strategy and nine development strategies,*** which constitutes a strategic monitoring description of the SOR. The ***System*** compiles valid arrangements on monitoring included in documents with a strategic nature, as well as previous experience and practices related to monitoring the medium-term development strategy of the country and the remaining development strategies.

The PEP2030 report for the preceding year will be submitted to the KKPR until the end of April. Minister responsible for environment conveys the abovementioned information to minister responsible for regional development for the needs of preparing annual information on execution of the SOR. Annual monitoring of PEP2030 will be performed with consideration of tasks reaching beyond the scope of the SOR and it will provide basic information on the status of their implementation. In addition, three evaluations of the implementation of PEP2030 will be performed: for the years 2019–2022, 2023–2026 and 2027–2030, which will be brought to the attention of the Council of Ministers. The table of actions and tasks (chapter 9 PEP2030) takes into account strategic projects included in the SOR, proper for the *Environment* area, as well as new projects contributing to execution of the goals of PEP2030. The list of these projects has an open nature; ongoing management of the process of changes in strategic projects is performed by the Governmental Project Monitoring Office in Prime Minister's Chancellery (KPRM). Any possible changes related to the executed projects are approved by resolutions of the Council for Monitoring the Portfolio of Strategic Projects and considered in the portfolio of strategic projects, governed by the Council. The approved changes are reflected on the list of strategic projects during a comprehensive update of the document.

Strategic projects included in PEP2030 undergo cyclical strategic monitoring and ongoing operational monitoring, performed as part of the MonAliZa computer tool.

The monitoring of projects in the MonAliZa system takes place under a uniform monitoring system effective for all projects. The rules of managing monitored projects should take into account the specifics of organisation, scope of the project as well as good practice and recommended standards.

Designated project leaders provide data necessary to drive the MonAliZa system, and through it they indicate, e.g. risks and the produced results. For management purposes, projects can be combined into programmes whose execution is the responsibility of programme managers. It is also planned to use the computer tool to monitor the implementation of PEP2030 at the level of tasks, including tasks reaching beyond the scope of the SOR.

12 Financial framework*

Financial framework is meant to be understood as any funds for development and supporting expenditures. The financial framework is not limited to the presentation of funds for the execution of new actions. They show the wide range of financing possibilities for environmental policy. They present the areas within the frames of which the partners of PEP2030 can act.

The financial framework of PEP2030 is based on budget parts and departments, expenses in the units of the sector of government and local government institutions, the budget of European and foreign funds. PEP2030 is consistent with the priorities of European cohesion policy and Common Agricultural Policy. Therefore, a significant part of expenses related to the implementation of PEP2030 will be co-financed by European funds.

Table: Financial framework of PEP2030 (public funds).

NATIONAL ECOLOGICAL POLICY 2030 (PLN million)	Other strategy	2016	2017	2018-2020	2021-2025
DEVELOPMENT EXPENSES OF THE STATE BUDGET ACCORDING TO THE DEFINITION OF DEVELOPMENT EXPENSES CLASSIFICATION (CONSOLIDATED. EXCEPT FOR SUBSIDIES FOR JST)					
21. Maritime management		3276	33.65	120.22	319.41
900 Municipal management and environmental protection		32.76	33.65	120.22	319.41
22. Water management		0.00	0.00	oxj	0.00
710 Service activities		0.00	0.00	0.00	0.00
41. Environment		27.18	27.36	8181	136.36
020 Forestry		1.20	1.39	3.89	6.48
801 Education and upbringing		24.59	24.54	73.68	122.81
854 Educational upbringing care		0.04	0.04	0.12	0.21
900 Municipal management and environmental protection		1.35	1.39	4.11	6.86
68. National Atomic Energy Agency		0.88	1.01	2.83	4.71
150 Industrial processing		0.88	1.01	2.83	4.71
85. Voivodes – subsidies for JST	KSRR	29.21	2130	60.22	100.38
020 Forestry		0.10	0.33	0.65	1.09
900 Municipal management and environmental protection - subsidies for JST (paragraphs 221. 203. 633)	KSRR	9.62	1.41	1.01	1.69
925 Botanical and zoological gardens, as well as areas and objects of nature protection – subsidies for JST (paragraphs 223. 203. 653)	KSRR	19.49	19.55	58.56	97.60
Total		90.03	83.31	265.08	560.86
EXPENSES SUPPORTING DEVELOPMENT, NOT CLASSIFIED UNDER DEVELOPMENT EXPENSES					
22. Water management		92.39	93.38	278.65	464.42
710 Service activities		41.70	38.53	120.35	200.58
750 Public administration		50.69	54.85	158.31	263.84
41. Environment		417.54	334.34	1127.83	1879.71
020 Forestry		3.03	2.83	8.79	14.66
750 Public administration		97.10	96.10	289.81	483.02
801 Education and upbringing		1.85	3.39	7.87	13.11
854 Educational upbringing care		15.37	16.01	47.06	78.44
900 Municipal management and environmental protection		300.17	216.01	774.27	1290.44
925 Botanical and zoological gardens, as well as areas and objects of nature protection		0.01	0.00	0.03	0.05
68. National Atomic Energy Agency		30.98	3186	9426	157.11
150 Industrial processing		0.20	0.17	0.56	0.93
750 Public administration		30.78	31.70	93.71	156.18
35. Voivodes	KSRR	1424	0.50	2212	36.87
900 Municipal management and environmental protection	KSRR	14.17	0.37	21.81	36.35
925 Botanical and zoological gardens, as well as areas and objects of nature protection		0.08	0.13	0.31	0.52
Total		555.15	460.09	152287	253811

* This chapter is prepared based on the guidelines of the Ministry of Investments and Development.

EXPENSES OF THE REMAINING UNITS OF THE SECTOR OF GOVERNMENT AND LOCAL GOVERNMENT INSTITUTIONS (IF DATA ON FINAL EXPENSES IS MISSING, THIS IS THE AMOUNT OF STATE BUDGET SUBSIDIES FOR A UNIT)					
National Fund for Environmental Protection and Water Management - non-repayable means of assistance (subsidies, write-offs, interest rate subsidies)		1089.85	641.50	5600.00	14900.00
National Fund for Environmental Protection and Water Management – repayable (loans. capital activity)		818.50	521.50	6500.00	20400.00
Voivodship funds for environmental protection and water management - non-repayable means of assistance (subsidies, write-offs, interest rate subsidies)		593.00	525.00	1641.00	2179.00
Voivodship funds for environmental protection and water management – repayable (loans. capital activity)		1181.00	1227.00	4978.00	6649.00
Other units of the sector of government and local government institutions		86.47	87.42	260.85	434.74
Total		3 768 82	300242	1897935	**4456274**
EXPENSES UNDER COHESION POLICY AND CO-FINANCING					
Environment	KSRR	728.65	3102.84	14 866.19	13180.33
R+D and entrepreneurship	KSRR	0.00	3.47	13.45	11.92
Total		72865	3106.31	14879 £3	1319225
EXPENSES UNDER OTHER INSTRUMENTS AND FOREIGN FUNDS					
LIFE		42.96	72.10	137.36	244.66
Norwegian Financial Mechanism, EOG Financial Mechanism		41.04	33.70	112.10	186.84
National Green Investment Scheme		61.60	70.00	35.40	0.00
Total		145.60	175.80	28456	431.50
FINAL AMOUNT		5 28825	6827.93	35 93230	61285.47

In addition, it is assumed that environmental policy will be implemented based on private funds. Costs paid by households prevail in the structure of expenses for environmental protection. In 2017 their share amounted to approx. 66%[2].

Therefore, it is estimated that the financial framework for the conducted environmental policy, including public funds listed in the table above as well as private funds, will amount to approx. **106 billion zlotys** in the years 2018–2020 and **180 billion zlotys** in the years 2021–2025.

The provisions of the SOR and current projections related to the structure of potential financing sources for development actions listed in the SOR indicate that **after 2020 the burden of financing development investments will be transferred to a greater extent to domestic funds (both public and private)**. The significance of EU funds will be relatively smaller, though still effective.

Tasks of the public sector, which so far have been largely executed with EU's cofinancing, **will be financed to a greater extent based on national public resources.** These resources will originate from the central budget and budgets of local governments, which will become more significant in the financing of development effort. This is caused by the expected reduction of funding for Poland under cohesion policy and Joint Agricultural Policy in the financial framework of 2021–2027.

It should be kept in mind that the execution of development projects must proceed while **maintaining macroeconomic stability, including in particular the sector of public finances.** The implemented budgetary policy must consider limitations related to valid financial rules and aiming at gradually approaching to a medium-term budgetary objective, whose achievement will enable entering the path of stable equilibrium of public debt.

[2] Statistics Poland, *Environmental protection 2018*, p. 179.

This is indicated by the necessity to **effectively stimulate private sector investments** (from national and foreign funds) and further **increase the efficiency of public sector development expenditures**. The use of EU funds should be focused on projects with the highest added value and positive external effects.

When assessing the conditions of conducting economic policy (including primarily investment policy) in the upcoming years, it is also assumed that actions implemented under the SOR will result in positive impulses in the form of **mobilising private capital** (domestic and foreign). They will lead to an increase in its investment activity. Due to the need to provide stability of public finances, it is the **private capital that will play a key role in reaching the planned investment rate in economy**.

On the other hand, it should be also remembered that actions executed by the **public sector** (both for **investments and regulations**) favour the improvement of "boundary conditions" determining economic rationality and feasibility of the actions of private sector entities. This is because they contribute to the creation of attractive conditions favouring both the performance of economic activity and an increase in its efficiency (e.g. by **development of infrastructure necessary for the activity of economic entities and the generation of an institutional framework effectively supporting the economic growth)**.

Dynamic growth of the private sector which translates into an increase in its income and profit with a simultaneous increase in labour factor wages (possible due to growing efficiency) will in turn lead to **extending the tax base**. Therefore, this will contribute to an **increase in the income of the sector of government and local government institutions**, **ensuring the possibility to finance tasks resulting from functions of the state**.

It is assumed that due to the abovementioned directions of changes in the structure of development funds spent for achieving strategic objectives, the share of these funds in the GDP will be adequately high to ensure efficient execution of strategic tasks.

This should be favoured by the macroeconomic condition of Polish economy in the nearest dozen years or so. Forecasts of both local institutions as well as renowned international centres indicate the possibility of **maintaining a relative high** rate of economic growth (albeit lower from both what was recorded in the years 2017–2018 and what is forecast for the years 2019–2024). According to long-term forecasts of the Ministry of Finance[3], in the years 2025–2030 the rate of economic growth in real terms will fluctuate from 3% in 2025 to 2.7% in 2030, which will translate into an average annual growth rate of 2.8% during this period. **Along with economic growth, income of the public finances sector will increase, which should enable financing development actions from public resources with respect to their planned execution** .

[3] *Guidelines for the use of uniform macroeconomic indicators constituting a basis for the estimation of financial effects of the planned acts.*

13

Glossary

Blue-green infrastructure (BZI) – an important component of the spatial structure of a city. It consists of broadly understood areas of urban greenery, both developed as well as those remaining in their natural condition, as well as watercourses and waterbodies located in the given area. BZI is used, e.g. in actions related to adaptation to climate change (e.g. it allows collecting and utilising rainwater or counteracting urban heat islands)[1].

Ecoinnovation – innovation which improves the efficiency of utilising natural resources in the economy; it reduces the negative impact of human activity on the environment or enhances the resistance of economy to environmental pressures[2].

Eco-labels – ecological labels placed on products in order to distinguish them from the same category of products present on the market. The labelling of products influences the market and shapes a pro-environmental model of consumption. On the one hand, customers receive assistance when choosing a product fulfilling specified requirements in terms of environmental protection; on the other hand, by the shaping of demand, pressure is exerted on producers to perfect their technology of production, since better commodities eliminate competition from the market. Awarding a label to a product is preceded by its evaluation at various stages: pre-production, production, distribution (including packaging), using as well as recycling and disposal of waste[3].

Eco-labelling – tagging of products with signs informing consumers about the environmental impact of the product. There are numerous types of eco-labelling based on the country, region or type of activity[4].

Natura 2000 (the network of Natura 2000 areas) – the youngest of all forms of natural protection, introduced in 2004 in Poland as one of obligations related to the accession of our country to the European Union. (…) The main purpose of functioning of the European Ecological Network Natura 2000 is to preserve specified types of natural habitats and species which are believed to be precious and endangered in the whole Europe. Its second purpose is the protection of biological diversity[5].

Sharing economy – a trend opposite to consumerism. It assumes sharing, renting and exchanging products and services. Instead of buying a car, one can go on a journey together with someone else; instead of paying for a hotel, one can stay at a private person's place; instead of buying services (e.g. tutoring, language teaching) one can take advantage of the exchange of such services. This is usually based on a peer-to-peer model where two people communicate via a platform facilitating the " transaction "[6].

Eutrophication – enrichment of water with nutrients, in particular nitrogen or phosphor compounds, causing accelerated growth of algae and higher forms of

[1] Cf. *The significance and role of blue–green infrastructure in adaptation to climate change* – presentation of architect Justyna Gorgoń Eng.D., Institute for Ecology of Industrial Areas in Katowice, p. 2.
[2] Institute for Structural Research.
[3] Ekologia.pl portal
[4] Responsible Business Forum, http://odpowiedzialnybiznes.pl
[5] General Directorate for Environmental Protection.
[6] The "Sharing economy" portal, http://www.ekonomiawspoldzielenia.pl

plant life, which results in undesired disruption of biological relations in the water environment and deterioration of the quality of this water[7].

Eco-management – it is based on pro-environmental rules (systems) of management. Environmental management systems are for enterprises and other organisations one of tools aimed at improving the effects of their environmental activity, at the same time ensuring the saving of energy and other resources. Systems of eco-management (e.g. series ISO 14000) and audit (e.g. EMAS) constitute for enterprises and other organisations a management tool used to evaluate and improve the effects of their environmental activity and to file reports on that matter[8].

Low-carbon economy – an economy "whose growth is achieved due to integration of all aspects of economy around low-emission technologies and practices, efficient energy solutions, clean and renewable energy and pro-environmental technological innovations". Under such economy, energy and materials are consumed or produced in an efficient manner, along with the disposal or recovery of waste using methods minimising the emission of greenhouse gases[9].

Circular economy – a model of production and consumption which involves sharing, renting, reusing, repairing, restoring and recycling existing materials and products for as long as possible. This way the life cycle of products is extended. In practice, this means limiting waste to a minimum. When the life cycle of a product comes to an end, materials and waste which originate from it should remain in the economy. They can be successfully reused, this way creating an additional value[10].

Uniform part of surface waters – a separate element of surface waters such as a lake or another natural or artificial waterbody, brook, stream, beck, river, canal or their parts, marine transitional waters or coastal waters. The term has been introduced due to the implementation of the RDW; it is used in the context of water management, including its environmental monitoring[11].

Uniform part of groundwaters – a specified volume of groundwaters present in a given aquifer or a set of aquifers. The term has been introduced due to the implementation of the RDW; it is used in the context of water management, including its environmental monitoring[12].

Mitigation – limiting the impact of human activity on the generation of Earth's greenhouse effect, mainly by reducing emission of greenhouse gases into the atmosphere, limiting the combustion of fossil fuels, increasing energy efficiency in

[7] The Water Law Act of 20 July 2017, article 16, item 32 letter c).
[8] Cf. decision of the Comission (EU) 2017/2285 dated 6 December 2017 changing user's guidebook which defines actions necessary to participate in EMAS, in compliance with regulation of the European Parliament and of the Council (WE) no. 1221/2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) (notified as document no. C(2017) 8072) (OJ L 328 dated 12 December 2017, p. 38).
[9] "Low-carbon economy" – presentation, Kraków, 2 June 2015, authors: prof. of AGH Joanna Kulczycka Sc.D., Marcin Cholewa M.Sc., Department of Strategic Research, Mineral and Energy Economy Research Institute of the Polish Academy of Sciences.
[10] European Parliament, http://www.europarl.europa.eu
[11] „Teraz-srodowisko.pl" portal, https://www.teraz-srodowisko.pl/slownik-ochrona-srodowiska
[12] „Teraz-srodowisko.pl" portal, https://www.teraz-srodowisko.pl/slownik-ochrona-srodowiska

all areas of human activity, saving energy. The term climate change mitigation also includes actions intended to increase carbon sequestration in soils and forests or capturing carbon dioxide from the atmosphere in order to store it again[13].

Climatic neutrality – a balance between the emission of greenhouse gases and their absorption by oceans/seas, forests and soils or storage (e.g. using the technology of Carbon Capture and Storage – capturing and storing carbon, or Carbon Capture and Utilization – capturing and utilising carbon in industrial processes). The term "climatic neutrality" concerns not just carbon dioxide, but also other greenhouse gases (such as, e.g. methane)[14].

Remediation – it involves soil, earth and groundwaters. It means actions aimed at removing or reducing the amount of the so-called substances posing risk, along with controlling and limiting their spreading. The purpose of remediation is to bring about such a condition of contaminated land which would not pose hazard to humans and the environment. It should consider current and future land use. Remediation may involve self-purification. It can be performed in-situ (on site) or ex-situ when it involves the removal of polluted earth and its purification outside of an area undergoing remediation[15].

Renaturalisation – in nature protection, the process of restoring environment to its natural state, as close as possible to the original state from before the introduction of adverse changes by man. This term has a broader meaning than renaturing, because, apart from technical actions, it may also mean a parallel spontaneous natural process, possible, e.g. due to passive protection. Unlike renaturing, usually limited to hydrotechnical procedures, it may concern any ecosystems. In forest ecosystems it may involve, e.g. enabling spontaneous shaping of the composition and structure of a stand by eliminating breeding procedures[16].

Carbon sequestration (capture) – spontaneous processes of capturing CO_2 by oceans, forests (in the process of photosynthesis) and/or soil and active capturing of carbon dioxide by man from the atmosphere along with its storage in a form preventing (or heavily limiting) its release into the atmosphere due to physical processes (e.g. geological sequestration in deep geological structures) or due to biological processes (biosequestration).

Energy poverty – a phenomenon in which a household has difficulties with satisfying its energy needs (heating, hot water, electricity) due to low income or characteristics of an apartment. According to British approach, adopted by various international organisations, energy poverty occurs when the expenses of a household for providing heat and other types of energy necessary to satisfy basic needs exceed the threshold of 10% of their income[17].

[13] "Climate and agriculture" portal, https://klimatarolnictwo.pl
[14] "Energy anew" portal, http://energiaodnowa.pl/pl/pytania-i-odpowiedzi/
[15] „Teraz-srodowisko.pl" portal, https://www.teraz-srodowisko.pl/slownik-ochrona-srodowiska
[16] Forest encyclopaedia, https://www.encyklopedialesna.pl/haslo/renaturalizacja/
[17] Lewandowski P., Kiełczewska A., Ziółkowska K., *Ubóstwo energetyczne wśród mieszkańców domów jednorodzinnych (Energy poverty in single-family homes)*, Institute for Structural Research.

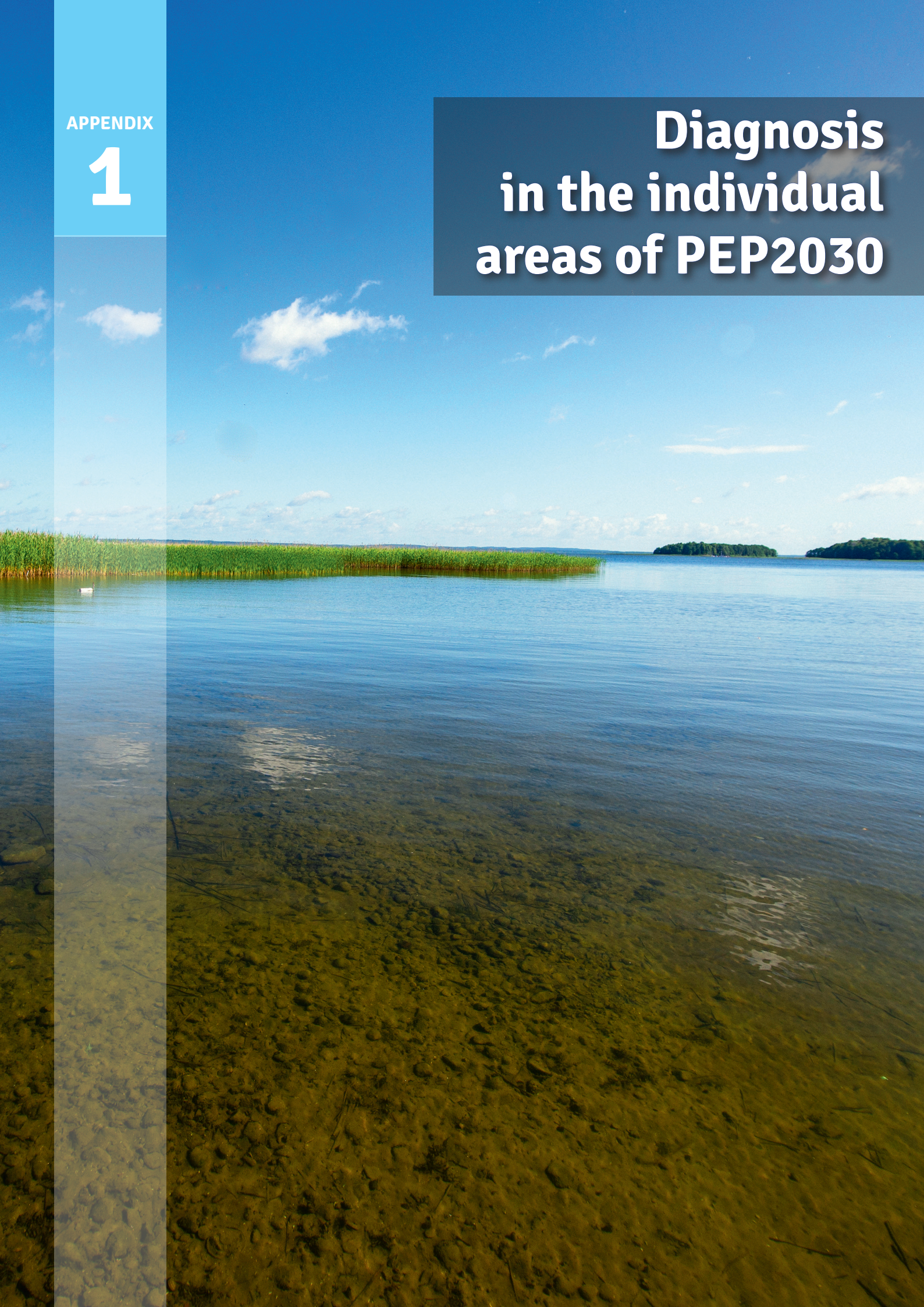
Ecosystem services (ecosystem benefits) – a set of products (e.g. wood, forest fruits, game animals) and functions of ecosystems (e.g. purification of water and air, production of oxygen, recreation sites) which are used by the society[18].

[18] "Chrońmy przyrodę ojczystą" (Let's protect our native nature), Book 1 January/February 2011, p. 3–20.

APPENDIX

1

Diagnosis in the individual areas of PEP2030



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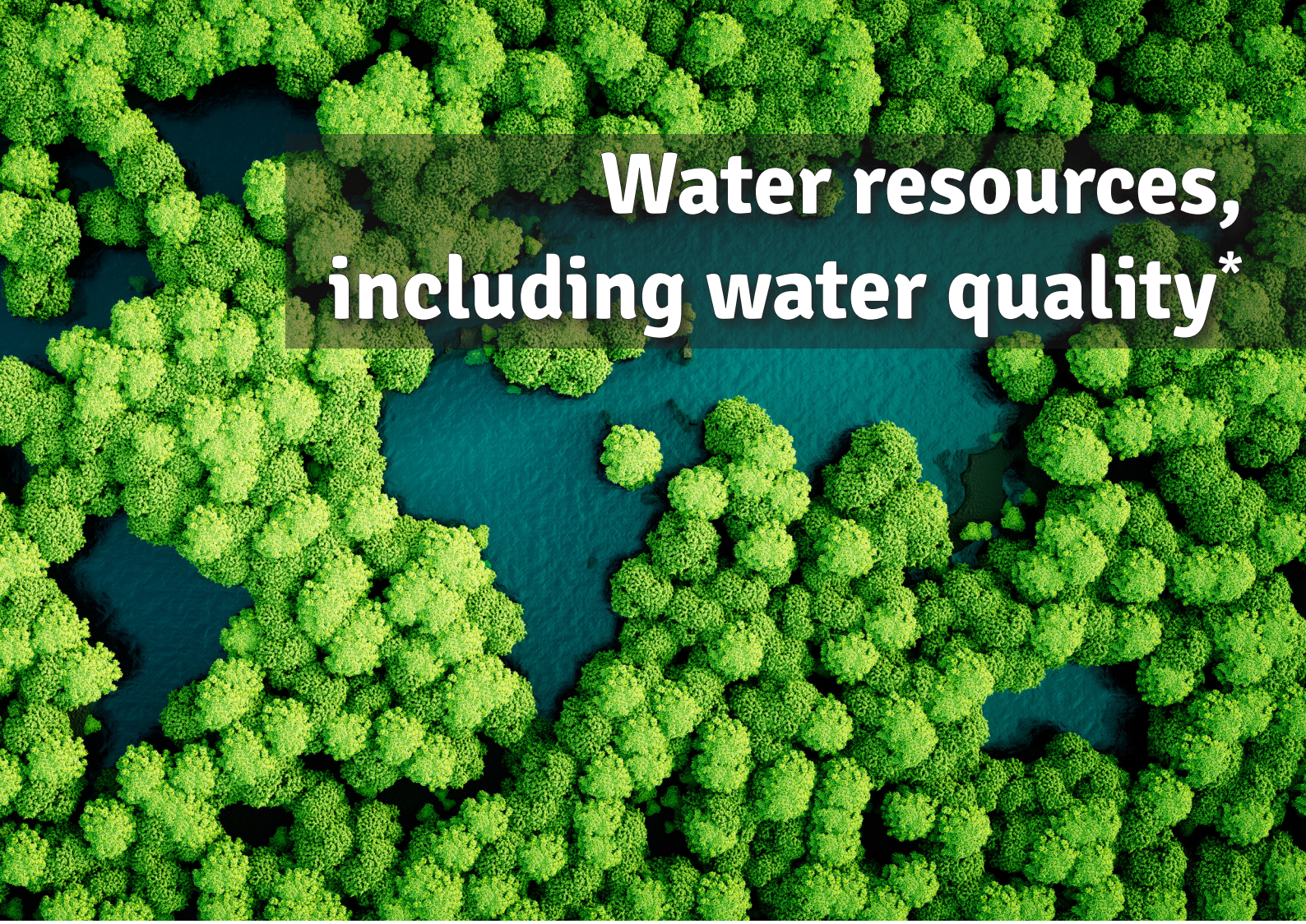
Introduction

In the course of works on the shape of the *2030 National Environmental Policy*, a detailed diagnosis of the current condition in all the areas covered by the scope of the PEP2030 was developed. The starting point for the study was the diagnosis prepared for the *Responsible Development Strategy (SOR)*.

The works on the diagnosis were coordinated by the Ministry of the Environment with the support of the members of the inter-ministerial PEP2030 team. **The diagnosis includes extensive fragments of reports by the Chief Inspectorate for Environmental Protection (GIOŚ**), furthermore, studies of other ministerial bodies (IMGW, KZGW, GDOŚ, PGL LP, IOŚ – KOBIZE) and Statistics Poland were used, supplemented and updated by aspects important from the point of view of other ministries.

It should be emphasised that when describing the state of individual components of the environment, it is not possible to adopt a uniform time period for the data. The manner of monitoring the indicators in selected areas differs in terms of research methodology and data availability. Measurements are also carried out by different entities.

The main objective of the diagnosis is to provide up-to-date and reliable information on the condition of the environment (also in the territorial aspect), which shall constitute the basis for State intervention in this area.



Water resources, including water quality*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland. Report 2014, (GIOŚ 2014).

Introduction

"Poland is distinguished by relatively low water resources of approx. 1580 m^3/year per capita, which constitutes only approx. 35% of the European average value"[1]. The effect of this is the occurrence of difficulties in water supply in parts of Poland. In particular, in the southern part of the country, water-intensive industry and the development of demographic processes as well as natural geographical and hydrographic conditions result in the occurrence of strong water deficits. In the south, there is also a significant variability in the flow of water in rivers during heavy rainfall and the flow of significant volumes of flood water, including runoff from mountain areas. All these factors hinder rational water management, and the relatively small retention capacity of artificial reservoirs does not allow for effective elimination of problems resulting from periodical excesses and deficits of surface water. Due to low rainfall, the most endangered region of Poland is the area of the broadly defined Polish lowlands – mainly Wielkopolskie and northern Mazowieckie. In the area of

[1] Report „Water Resources Management in Poland 2018", prepared as a result of the implementation of the GNCP program named „Water Resources Management 2018", with presentation at the Cities for Climate Urban Summit on 5 December 2018 as part of the 24th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24) in Katowice.

Wielkopolskie, the condition of water resources is also affected by intensive agriculture and lignite mining. The main problem for water supply to the population continues to be the low availability of high-quality water, despite a marked decline in water consumption rates by industry and households over the last decade. At the same time, it should be noted that groundwater resources in Poland are estimated at approximately 16 km^3, while approximately 2 km^3 are currently exploited.

Human economic activity and certain natural processes, as well as global climate change, are increasing the frequency of extreme weather events, including floods and droughts. In the last twenty years, droughts have become particularly frequent in Poland. This is mainly due to the increase in air temperature during the growing season and the occurrence of rain-free periods or periods with repeated precipitation values below average.

In the agricultural drought monitoring system run by the Institute of Soil Science and Plant Cultivation in Puławy – National Research Institute (IUNG-PIB), meteorological conditions are determined by means of a climatic water balance (CWB). Particularly in recent years, in spring and early summer, CWB values are decreasing, which means that drought periods are increasingly severe. This coincides with the period of the greatest demand for water by crops, especially cereals.

The intensification of agriculture, the unification of natural habitats, the construction of drainage systems and urbanisation have led to changes in the soil cover, resulting in less water being retained in catchment areas now compared to the past. The circulation of water and matter in the catchment areas is faster than years ago. All these factors increase the frequency of droughts and floods. When the water retention capacity in the catchment area decreases, natural fast runoff paths for rainwater and meltwater are formed along the surface. These phenomena intensify during heavy rainfall and intense snow melting.

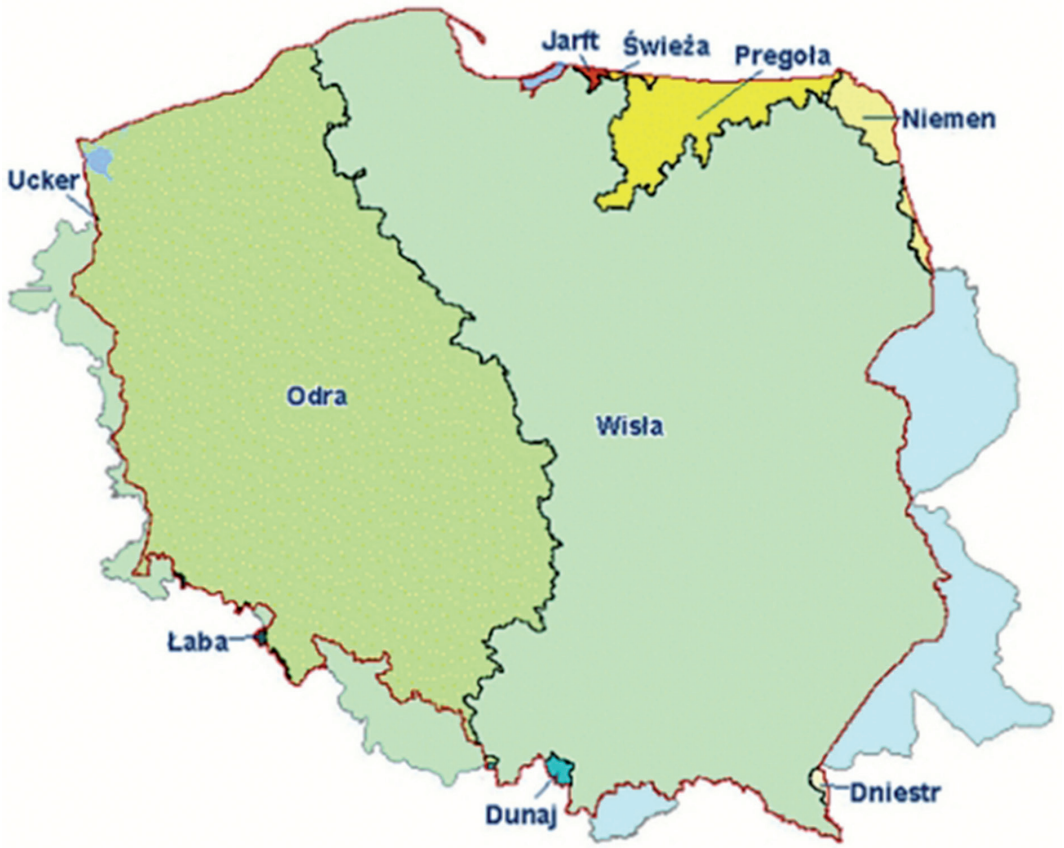
In the light of climate change predictions, it is expected that the intensity of primarily short, torrential rainfall shall increase, up to 50-75 mm in the central and southern part of the country, which may lead to an increase in the frequency of local floods. In this context, it is important to service and maintain irrigation and drainage systems. A telling example of their inadequate condition is the failure during the flood of 2010. Many areas were flooded only because of the malfunctioning of these systems. Surface water resources and their use to secure an adequate supply of water for all residents require appropriate technical facilities. There is therefore an urgent need to implement measures that would mitigate the negative impact of a temporary excess or shortage of water on business activity and the state of the natural environment.

The current state of water resources in Poland – both in terms of quantity and quality – is, apart from natural factors, the result of many years of underfunding of water management and scattered management responsibilities. Since access to an adequate amount of water resources of good quality is a prerequisite for development, it is necessary to increase the available water resources, improve their ecological and chemical quality. Rational management of water resources used for supply to residents and economic development should provide for sustainable consumption and recovery, while ensuring a sufficiently high level of waste water treatment.

Poland is situated in the catchment areas of three seas: The Baltic Sea (99.7% of the country's area), the North Sea (0.1% of the country's area) and the Black Sea (0.2% of

the country's area)[2]. In Poland, 9 river basin districts have been designated: the largest Vistula and Oder rivers and seven smaller international river basin districts: Dniester, Danube, Mamonovka (Banovka), Elbe, Neman, Pregolya and Prokhladnaya. Water regions were subsequently established within the river basin districts.

Fig. 2.1. River basin districts in Poland



Map legend: Jarft – presently Mamonovka (Banovka); Świeża – Prokhladnaya; Pregoła – Pregolya; Niemen – Neman; Odra – Oder; Wisła – Vistula; Łaba – Elbe; Dunaj – Danube; Dniestr – Dniester.
Source: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 112.

Monitoring of surface water quality is carried out in surface water bodies (SWB) within the framework of the State Environmental Monitoring System. Research and assessment of the state of water in rivers is carried out by Voivodship Inspectorates for Environmental Protection. SWB is a division unit designated for water management by the National Water Management Authority. A surface water body is defined as a separate and significant surface water element, such as: (a) a lake or other natural reservoir; (b) an artificial reservoir; (c) a watercourse, stream, brook, river and canal or parts thereof; d) internal sea waters, transitional waters or coastal waters[3]. 4586 river SWBs (including dam reservoirs) were identified within the territory of Poland[4].

The assessment of the condition of SWBs consists of an assessment of the ecological

[2] Statistics Poland, Environmental Protection 2018, Warszawa, 2018, p. 22.
[3] Pursuant to the Act of 20 July 2017 – Water Law (OJ L of 2018, item 2268, as amended), Article 16(20) and the Act of 20 July 2018 amending the Water Law and certain other acts (OJ L of 2018, item 1722).
[4] In 2017, an updated division of the hydrographic network of the country into water bodies was developed. According to this division, there are 3116 river SWBs, 1068 lake SWBs, 7 transitional SWBs and 4 coastal SWBs.

state or potential and an assessment of the chemical state of the waters. The ecological state is determined for natural SWBs, i.e. those with hydromorphology not significantly altered by human activity. The ecological potential is determined for artificial or heavily modified SWBs. Both assessments consist of the classification of biological quality elements and the supporting physicochemical and hydromorphological indicators. Physicochemical indicators include water parameters describing thermal conditions, oxygen, salinity, acidity and concentration of nutrients (nitrogen and phosphorus compounds), as well as the presence of substances particularly harmful to the aquatic environment in water (such as petroleum-derived hydrocarbons, cyanides, volatile phenols, formaldehyde and a number of heavy metals). The ecological state and potential are determined by a five-point scale. For ecological state, these are: very good/good/moderate/poor/bad, and for ecological potential: maximum/good/moderate/poor/bad.

The assessment of the chemical state of a SWB shall be determined by examining concentrations of priority substances[5] and other pollutants in the area of water management indicated in the Regulation of the Minister of the Environment of 21 July 2016 on the method of classification of the condition of surface water bodies and environmental quality standards for priority substances (OJ L item 1187). The assessment of the chemical state is expressed on a two-point scale: chemical state good / below good.

The assessment of the state of a SWB is expressed on a two-point scale: chemical state good / below good. The classification of the state follows the "*one-out, all-out*" principle. This means that in order to achieve good ecological state, the SWB must achieve at least good ecological state/potential and good chemical state. At the same time, the classification of both assessments is determined by the results of measurements of the indicator with the worst assessment result. Depending on the monitoring programme, even more than 100 indicators may be measured. The large number of measured parameters results in the fact that only SWBs with water of high quality in almost every respect can be categorised as being in a good state. The number and type of indicators tested depend on the monitoring programme planned for the given SWB, the type of which is adapted to the objective of the planned study. The implementation locations shall be selected in such a way as to ensure the representativeness of the results within the scale of the catchment areas and river basin districts.

Due to the large number of SWBs identified in Poland, it is impossible to monitor all of them. Therefore, when presenting the assessment of the ecological state/potential, a distinction is made between results for monitored and unmonitored SWBs, which are classified by extrapolation. Due to a relatively low level of confidence, the results of the classification of ecological state/potential of unmonitored SWBs are presented by assigning two classes to the SWBs assessed in this way: ecological state/potential "at least good" and "below good".

[5] Pursuant to Article 16(3) and (6) of 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 (priority substances are substances hazardous to the environment).

Water resources in Poland[6]

The report regarding the state of water resources in Poland has been prepared on the basis of data from the hydrological monitoring network of the National Hydrological and Meteorological Service (PSHM) for the hydrological year 2016 (period from 1 November 2015 to 30 October 2016) and the groundwater monitoring network of the Polish Hydrogeological Survey (PHS) for the hydrological years 2016-2017.

In the hydrological year 2016, the total flowing water resources in Poland amounted to 41 438.9 million m^3 (including 5 073.4 million m^3 of water inflow from abroad and 36 365.5 million m^3 of outflow from catchment areas within Poland).

The average precipitation within Poland in the hydrological year 2016 was 698.9 mm (in the case of including the catchment areas supplying rivers flowing into Poland, the average precipitation was 684.5 mm). The water runoff layer from Poland was 115.2 mm.

In the Vistula river basin, the total flowing water resources in 2016 amounted to 23 799.1 million m^3 (including 2 675.1 million m^3 of water inflow from abroad and 21 124.0 million m^3 of outflow from Poland). The average precipitation in the Vistula river basin in the 2016 hydrological year was 704.4 mm (in the case of including the catchment areas supplying rivers flowing into Poland, the average precipitation was 706.6 mm). The water runoff layer in the 2016 hydrological year from the Vistula river basin within the borders of Poland was 108.9 mm.

In the Oder river basin, the total flowing water resources in 2016 amounted to 10 527.7 million m^3 (including 2 398.3 million m^3 of water inflow from abroad and 8 129.4 million m^3 of outflow from Poland). The average precipitation in the Oder river basin in the 2016 hydrological year was 656.0 mm (in the case of including the catchment areas supplying rivers flowing into Poland, the average precipitation was 662.5 mm). The water runoff layer in the 2016 hydrological year from the Oder river basin within the borders of Poland was 68.4 mm.

In the Baltic Sea catchment area (Rega, Parsęta, Wieprza, Słupia and Łeba basin), the total flowing water resources in 2016 amounted to 4 324.4 million m^3. The average precipitation in the catchment areas of the Baltic Sea in the hydrological year 2016 was 850.8 mm and the water runoff layer from this area was 250.8 mm.

In the years 1951-2016, the average value of total flowing water resources in Poland amounted to 60 400 million m^3. Against this background, in the hydrological year 2016, the volume of flowing water resources in Poland was lower and accounted for 68.6% of the average value.

Underground water supply contributes, on average, 52.5% of the annual volume of the river outflow in Poland, under average hydrological and meteorological conditions. After the extremely dry year 2015 and in view of the widespread drought in the country, in 2016 a significant decrease in the retention level was continued in shallow aquifers with a free water table, while the flow of rivers in the low periods was formed exclusively from underground water supply. Exploitable aquifers with a confined water table – being the main source of collective water supply – were not subject to any significant decrease. The year 2017 was average in terms of groundwater retention and outflow to rivers.

[6] *Based on data for 2016 and 2017.*

Ordinary groundwater (not classified as medicinal water, thermal water or brine) resources available for development (DR) are determined in the areas and balance units designated as river basins selected for water balance, which are hydraulically related to groundwater and include supply zones of groundwater intakes. The resources available for development are determined as available groundwater resources (AR), in accordance with the Act of 9 June 2011 on Geological and Mining Law (OJ L of 2019, item 868, as amended) and the Regulation of the Minister of the Environment of 18 November 2016 on hydrogeological documentation and geological engineering documentation (OJ L item 2033), as well as the Methodological Guide, in the course of preparing hydrogeological documentation approved by the Minister of the Environment. The available groundwater resources are determined in long-term average quantities in accordance with the course of their renewability appropriate to hydrogeological conditions prevailing in the balance units. Available resources are determined by the method of mathematical modelling of groundwater flow, predicted in conditions of acceptable level of resources development of the balance unit, within the environmental objectives set for achievement and maintenance in protected ecosystems. The mathematical model of the balance unit is created on the basis of a detailed analysis of the results of the existing geological, hydrogeological and hydrological identification, supplemented with additionally designed research and field measurements. As of 31.12.2017, available groundwater resources were identified for 80% of the surface area of Poland. Documentation works are underway for the remaining part of the country and shall be completed in 2019.

In the balance areas, not yet covered by completed documentation of available groundwater resources, the groundwater resources available for development were identified in 2003 using simplified hydrological methods as prospective groundwater resources (PR). Detailed information on groundwater resources available for development is collected and processed in the database of available resources maintained by the Polish Hydrogeological Survey (PHS).

As at 31 December 2017, the identified resources of ordinary groundwater available for development in the entire country amounted to approximately 12.73 km^3/year (approximately 35 million m^3/day).

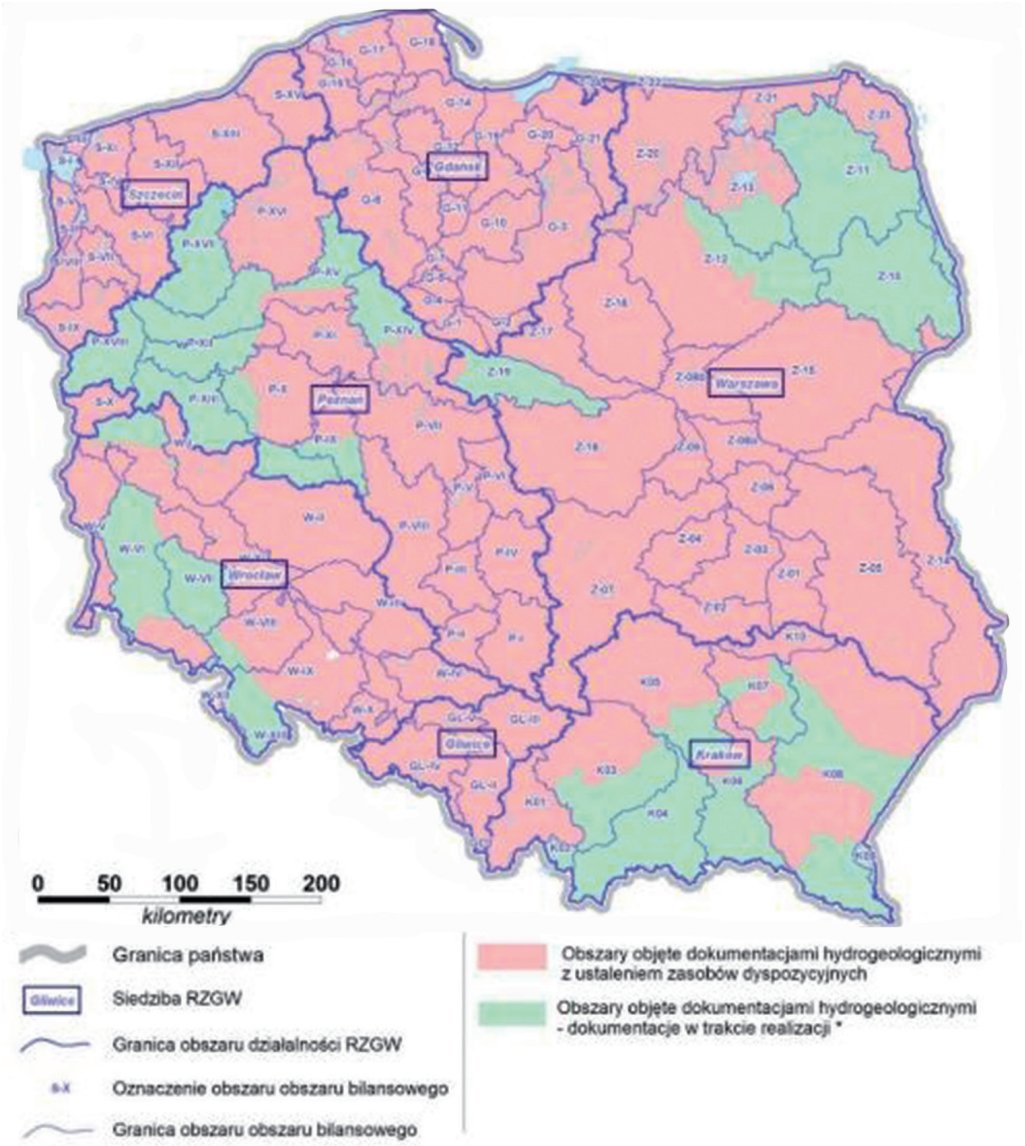
This total value includes:

9.82 km^3/year (approx. 27 million m^3/day) of available resources (AR), identified under the hydrogeological documentation procedure, in accordance with the Act of 9 June 2011 on Geological and Mining Law, for a total surface area of approx. 80% of the Polish territory;

2.91 km^3/year (approx. 8 million m^3/day) of prospective resources (PR), estimated as prospective resources for the remaining part of the country (approx. 20% of the area of Poland), until the available resources are documented in these areas.

For the Vistula river basin district, the total available and prospective groundwater resources amount to approx. 7.03 km^3/year (approx. 19.25 million m^3/day), which – taking into account the surface area of this district (approx. 183.2 thousand km^2) – results in the average value of the modulus of ordinary groundwater resources available for development equal to 105.1 m^3/(day·km^2). For the Oder river basin district, the total available and prospective groundwater resources amount to approx. 5.35 km^3/year (approx. 14.65 million m^3/day), which – taking into account the surface area of this basin (approx. 118.0 thousand km^2) – results in the average value of the modulus of resources available for development equal to 124.2 m^3/(day·km^2).

Fig. 2.2. Map of the status of documentation of available groundwater resources in Poland (as at 31.12.2017)



Map legend: kilometry – km; Granica państwa – Country border; Siedziba RZGW – Regional Water Management Board (RZGW) seat; Granica obszaru działalności RZGW – RZGW operation boundary; Oznaczenie obszaru bilansowego – Balance area marking; Granica obszaru bilansowego – Balance area boundary; Obszary objęte dokumentacjami z ustaleniem zasobów dyspozycyjnych – Areas covered by hydrogeological documentation with identification of available resources; Obszary objęte dokumentacjami hydrogeologicznymi – dokumentacje w trakcie realizacji - Areas covered by hydrogeological documentation (underway)

Source: Polish Association of Sanitary Engineers and Technicians in Częstochowa, Security of collective water supply in areas under anthropogenic pressure, ed. G. Malina, Częstochowa, 2018, p. 48, as in: Biuletyn Państwowej Służby Hydrologicznej (Bulletin of the National Hydrological Service), Tasks of the National Hydrological Service in 2017, SYNTEZA, 2018.

State of river waters (including dam reservoirs)

The assessment of the ecological state/potential of the waters of rivers and dam reservoirs was based on verified monitoring data from the years 2011-2016, applying the inheritance principle. 1974 SWBs were assessed in this manner on the basis of the measurement results.

On the national scale, 0.5% of the assessed natural SWBs achieved very good ecological state and 16% – good ecological state. Among the artificial and heavily modified SWBs, the maximum potential was achieved by 0.25% and good – 9% of the assessed SWBs.

Tab. 2.1. Assessment of the state of river surface water bodies monitored in 2017

ASSESSMENT OF RIVER SURFACE WATER BODIES		RIVER BASIN									
		DNIESTER	DANUBE	JARFT	ELBE	NEMAN	ODER	PPROKHLA DNAYA	ŚWIEŻA	VISTULA	TOTAL
ECOLOGICAL STATE CLASSIFICATION	VERY GOOD	0	0	0	0	0	1	0	0	0	1
	GOOD	0	1	0	0	1	10	0	0	23	35
	MODERATE	1	2	0	0	8	105	14	1	202	333
	POOR	0	0	0	1	2	34	2	0	79	118
	BAD	0	0	0	0	1	5	1	0	18	25
	NUMBER OF CLASSIFIED NATURAL SWBs	1	3	0	1	12	155	17	1	322	512
ENVIRONMENTAL POTENTIAL CLASSIFICATION	GOOD	0	0	0	0	0	14	0	0	22	36
	MODERATE	0	0	0	0	0	92	0	0	75	167
	POOR	0	0	0	0	0	43	0	0	38	81
	BAD	0	0	0	0	0	25	0	0	18	43
	NUMBER OF CLASSIFIED HEAVILY MODIFIED OR ARTIFICIAL SWBs	0	0	0	0	0	174	0	0	153	327
CHEMICAL STATE ASSESSMENT	GOOD	0	0	0	0	0	22	0	0	70	92
	BELOW GOOD	1	2	2	2	12	379	12	1	393	804
	NUMBER OF CLASSIFIED SWBs	1	2	2	2	12	401	12	1	463	896
STATE ASSESSMENT	GOOD	0	0	0	0	0	1	0	0	3	4
	BAD	1	3	2	2	14	511	20	1	601	1155
	NUMBER OF ASSESSED SWBs	1	3	2	2	14	512	20	1	604	1159

Source: Own elaboration based on the assessment of water bodies – rivers and dam reservoirs in 2017, http://www.gios.gov.pl/pl/stan-srodowiska/monitoring-wod (accessed: 05.02.2019).
The assessment of the ecological state/potential of the waters of rivers and dam reservoirs was based on verified monitoring data from the 2017, applying the inheritance principle. 839 SWBs were assessed in this manner on the basis of the measurement results.

On the national scale, 0.2% of the assessed natural SWBs achieved very good ecological state and 6.8% – good ecological state. Among the artificial and heavily modified SWBs, good potential was achieved by 11% of the assessed SWBs. Bad ecological state/potential of biological elements was found in just below one hundred SWBs. The most frequently obtained class of biological elements was class III (moderate state or potential). Bad ecological state or potential of biological quality elements (class V) was most often determined by the state of ichthyofauna, but this element is currently not included in the classification of ecological potential for dam reservoirs. However, the state of macrophytes, also not classified in dam reservoirs, reached class V only in individual cases.

In the case of physicochemical quality elements, the pH and hardness indices most frequently exceeded environmental quality standards for the good state. Since these are parameters of significant natural variability, it is possible that this condition does not result from water pollution. Works are currently underway to even more strongly tie the criteria for classifying the state of physicochemical elements to the state of biological elements, including a revision of the indicators used for classification. Quite often, the state below good was also demonstrated by indicators of contamination with biogenic elements (nitrogen and phosphorus) and organic matter. On a scale of several years, the basic indices of physicochemical pollution measured in the estuary sections of the Vistula and Oder rivers are subject to relatively small and irregular changes. Some decline was noted in the case of total phosphorus, especially in the Vistula river. It should be noted that the actual pollution load carried by rivers is associated with recorded concentrations, also indirectly depending on the volume of water flow, which in wet years is usually higher than in dry years.

Chemical state

The chemical state in 2017 was examined in 896 SWBs, of which 10.3% were found to be in good chemical state and the remaining 89.7% – in bad chemical state.

During this period, the levels of 56 priority substances were measured. The measurements were performed by laboratories of the Voivodship Inspectorates for Environmental Protection, as well as, in the case of substances that were not measured by voivodship inspectorates – by an external contractor performing tests on behalf of the Chief Inspectorate for Environmental Protection.

Among the assessed SWBs, the chemical state identified as below good was caused by exceeding the environmental quality standards as defined in Directive 2008/105/EC[7] and the subsequent Directive 2013/39/EU[8]. Most frequently, the exceeded parameters were concentrations of polycyclic aromatic hydrocarbons (PAH), mercury concentrations[9] and less frequently cadmium and fluoranthene concentrations.

[7] 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 (OJ L 348 of 24.12.2008, p. 84, as amended).

[8] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy (OJ L 226 of 24.08.2013, p. 1).

[9] The Minamata Convention on mercury, signed in Kumamoto on 10 October 2013, is an international instrument of the United Nations Environment Programme (UNEP) at global level, which aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The provisions of the Convention regulate in a comprehensive manner the issues related to the extraction of mercury, trade in products containing mercury, emissions of mercury to the atmosphere and its release to water and soil, as well as the use of mercury in industrial products and

In 2016, the Chief Inspectorate for Environmental Protection commissioned analytical tests for 11 priority substances in water fauna. These were the first studies in the so-called biota conducted within the framework of the PMŚ. According to Directive 2013/39/EU[10], these were the substances: brominated diphenylethers, fluoranthene, hexachlorobenzene, hexachlorobutadiene, mercury and its compounds, PAHs – benzo(a)pyrene, dicofol, perfluorooctane sulfonic acid (PFOS), dioxins and dioxin-like compounds, hexabromocyclododecane (HBCDD), heptachlor and heptachlor epoxide.

Fauna samples were collected from 200 measurement points, including rivers (153 SWBs), lakes (40 SWBs), transitional waters (4 SWBs) and coastal waters (3 SWBs). The assessment was carried out on the basis of the results of the analysis of priority substances in the biota in relation to the Environmental Quality Standards (EQS) laid down in Directive 2013/39/EU[11]. At none of the tested sites were fauna samples found to contain hexachlorobenzene, hexachlorobutadiene, dioxin, dioxin-like compounds and hexabromocyclododecane at concentrations higher than the EQS values established for these substances. It should be noted that for hexachlorobenzene, hexachlorobutadiene and dicofol – levels above the limit of quantification (LOQ) of the applied analytical method were not recorded. EQS were found to be exceeded for the following substances: brominated diphenylethers, mercury and its compounds and heptachlor.

State of the SWBs monitored in 2017 r.

The general state was assessed for 1159 SWBs, of which only 0.3% were in good state, while 99.7% were in bad state (see Tab. 2.1). Assessment of water state in case of lack of information on chemical state was performed if the ecological state/potential results were below good. The condition for such SWBs was identified as bad. No extrapolation of the assessment to unmonitored SWBs was used.

The highest number of SWBs was assessed in the basins of the Vistula and Oder rivers, according to their area range in Poland.

processes. The Convention establishes coherent actions and mechanisms at international level to identify possible ways of mercury management in order to reduce its use and minimise its negative impact on the environment and human health. The activities undertaken in the Minamata Convention on mercury continued with the Regulation (EU) 2017/852 of the European Parliament and of the Council of 17 May 2017 on mercury and repealing Regulation No. 1102/2008, adopted by the European Union (OJ L 137 of 24.05.2017, p. 1), which completes the transposition of the provisions of the Convention into the current EU legislation.

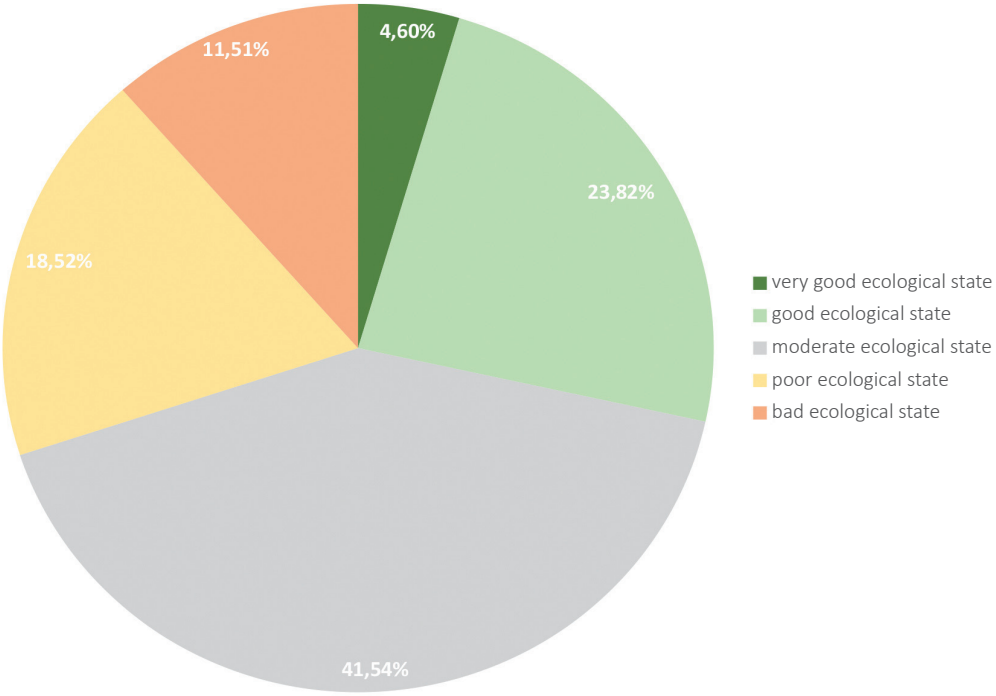
[10] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

[11] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

State of the lakes

In Poland, lakes occupy less than 1% of the country's surface area. The intensity of recreational pressure and need for economic use, on the one hand, and the need to protect sensitive habitats and species, on the other hand, require the introduction of appropriate protection and remedial measures.

Fig. 2.3. Ecological state of the natural lake SBWs in 2017 (%)

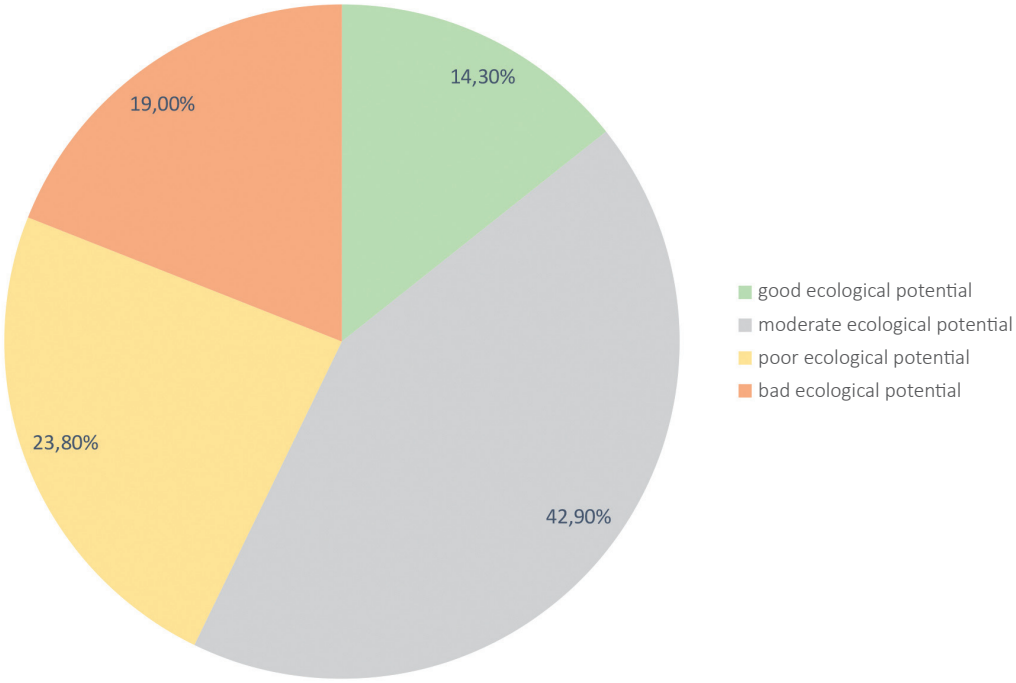


Source: own elaboration based on data from WIOŚ[12]

130 lake SWBs were monitored in 2017. Among them, 5% reached the maximum ecological potential, 24% – good, and the remaining did not reach the expected ecological potential (42% reached moderate ecological state, 18% – poor, and 11% – bad ecological state).

[12] *Data available on the websites of the individual Voivodship Inspectorates for Environmental Protection. Separate branches were incorporated into the headquarters of the Voivodship Inspectorates for Environmental Protection. For WIOŚ in Opole, Kraków, Rzeszów, Katowice, Łódź, Wrocław and Szczecin there are no data regarding lake SBWs.*

Fig. 2.4. Ecological potential of heavily modified lake SWBs in 2017 (%)



Source: own elaboration based on data from WIOŚ13

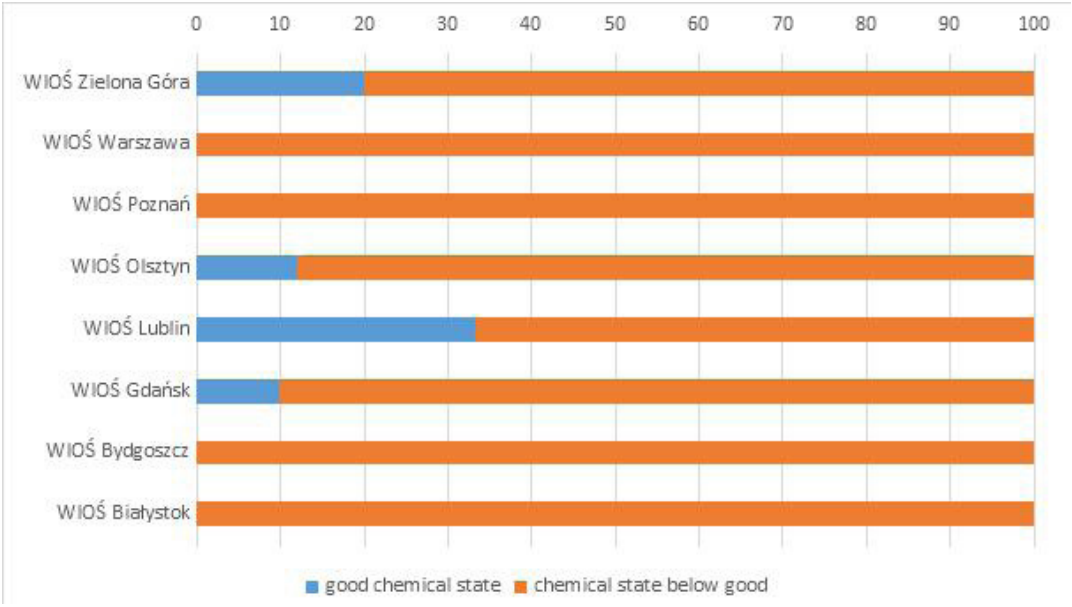
Fig. 2.4 shows the 21 studied strongly modified lake SWBs, of which 14% achieved good ecological potential, while the remaining 43% reached moderate, 24% – poor and 19% – bad ecological potential. None of the lake SWBs reached maximum ecological potential.

The biological indicator used to assess the ecological state or potential, which most often exceeded the environmental standards for lake SWBs, was mainly the PMPL index[14] describing the phytoplankton state (94 out of 212 lake SWBs for which the developed classification of biological elements indicated the ecological state or potential below good) and the ESMI Ecological State Macrophyte Index[15]. The state of the indicators described above demonstrates mainly the trophic state of the studied lakes, which indicates that the most frequently identified problem is the overfertilisation of lake water.

[13] Ibid.
[14] PMPL – Phytoplankton Metric for Polish Lakes.
[15] ESMI – Ecological State Macrophyte Index. It is a method of water assessment that must take into account the taxonomic composition and abundance of macrophytes, and these aspects must be expressed in terms of indicators (metrics) that respond well to pressure (showing clear directional variability in pressure gradient).

Chemical state

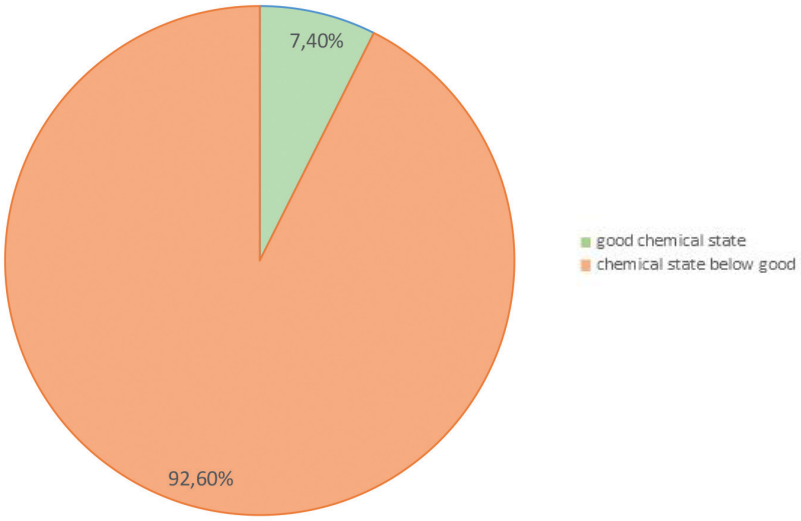
Fig. 2.5. Assessment of the chemical state of lake SWBs monitored in 2017 (%)



Source: own elaboration based on data from WIOŚ16

In the case of the Lubelskie Voivodship, it can be observed that the lake SWBs in good chemical state studied there constitute less than 40%. It is important to note that in the Mazowieckie Voivodship, Wielkopolskie Voivodship, Kujawsko-Pomorskie Voivodship and Podlaskie Voivodship, the chemical state of lake SWBs is below good.

Fig. 2.6. Assessment of the chemical state of all lake SWBs monitored in 2017 (%)



Source: own elaboration based on data from WIOŚ17

[16] Data available on the websites of the individual Voivodship Inspectorates for Environmental Protection. Separate branches were incorporated into the headquarters of the Voivodship Inspectorates for Environmental Protection. For WIOŚ in Opole, Kraków, Rzeszów, Katowice, Łódź, Wrocław and Szczecin there are no data regarding lake SBWs.
[17] Ibid.

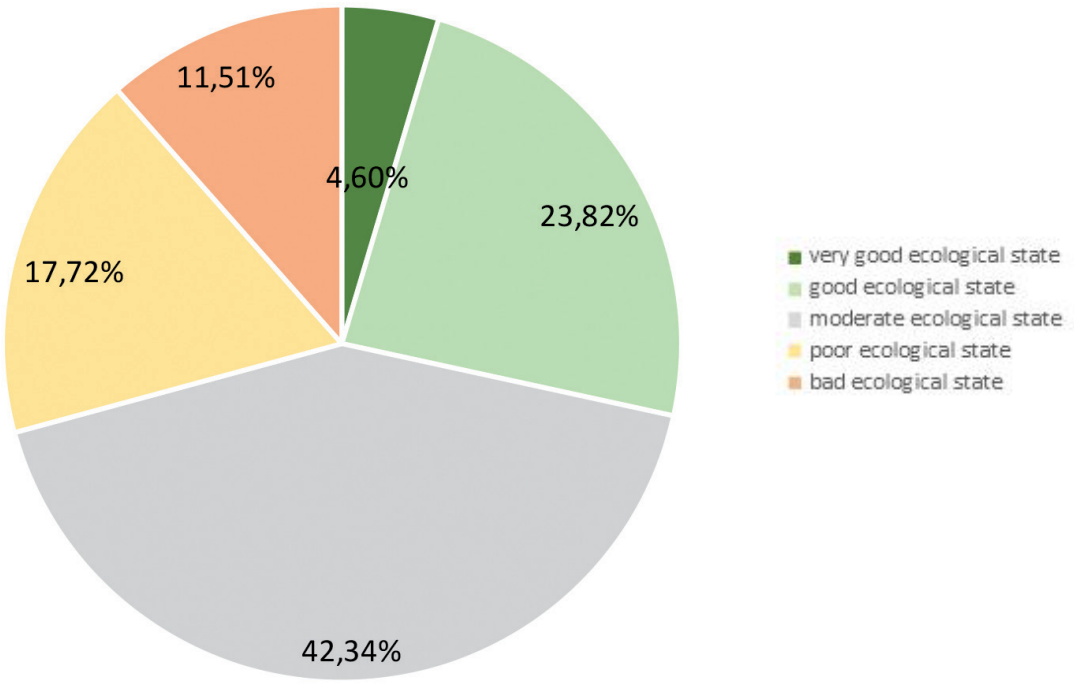
The classification of the chemical state was prepared for 148 lake SWBs in which the chemical indicators describing the occurrence of substances particularly harmful to the aquatic environment were studied. Exceeded values of the measured substances were not found in 7.4% of the monitored lakes, while in 92.6% of the monitored lase SWBs, the environmental standards for at least one of the 8 chemical substances were exceeded, which indicates a bad chemical state of these water bodies.

Studies conducted in water showed exceeded levels of lead and its compounds (6 lakes: Wigry, Pierty, Długie Augustowskie, Brežnik, Dmitrowo, Lubniewsko) and mercury and its compounds (lakes: Brežnik, Dmitrowo and Wigry) as well as benzo(g, h, i)perylene (20 lake SWBs).

The environmental standards for bioaccumulation of the following indicators were also exceeded: brominated diphenylethers - 87 lake SWBs, heptachlor – 39 lake SWBs, fluoranthene – 5 lake SWBs, benzo(a)pyrene – 79 SWBs and perfluorooctane sulfonic acid (PFOS) – 10 lake SWBs, naphthalene (1 lake SWB), nickel (2 lake SWBs), benzo(b)fluoranthene (15 lake SWBs), benzo(k)fluoranthene (14 lake SWBs), hexabromocyclododecane (1 lake SWB), heptachlor (6 lake SWBs).

In 10 lakes, exceeded levels of more than five priority substances were found. These were the following lake SWBs: Wigry, Długie Augustowskie, Berżnik, Stobno, Więcborskie, Trześniowskie (Ciecz), Wierzbiczańskie, Dominickie, Białe-Miałkie, Wieleńskie-Trzytniowe.

Fig. 2.7. Ecological state of the natural lake SBWs in 2017 (%)

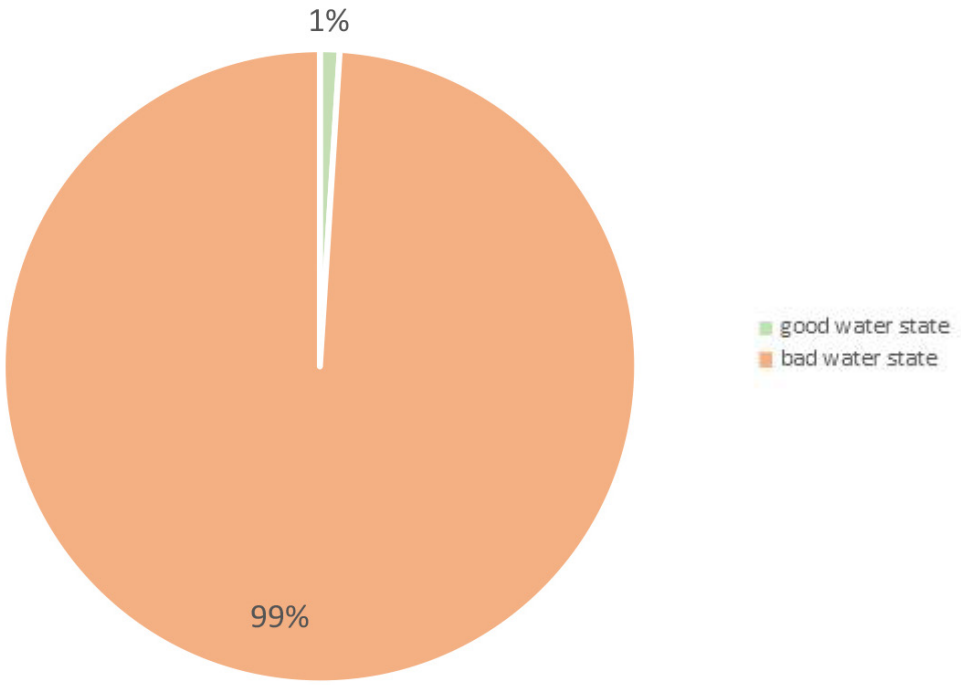


Source: own elaboration based on data from WIOŚ18

[18] Ibid.

Among the natural SWBs, 5% were in very good and almost 1/4 (24%) – in good ecological state. The remaining SWBs did not reach the expected ecological state (42% – moderate ecological state, 18% – poor, 11% – bad ecological state).

Fig. 2.8. Assessment of the state of lake SWBs monitored in 2017



Source: own elaboration based on data from WIOŚ19

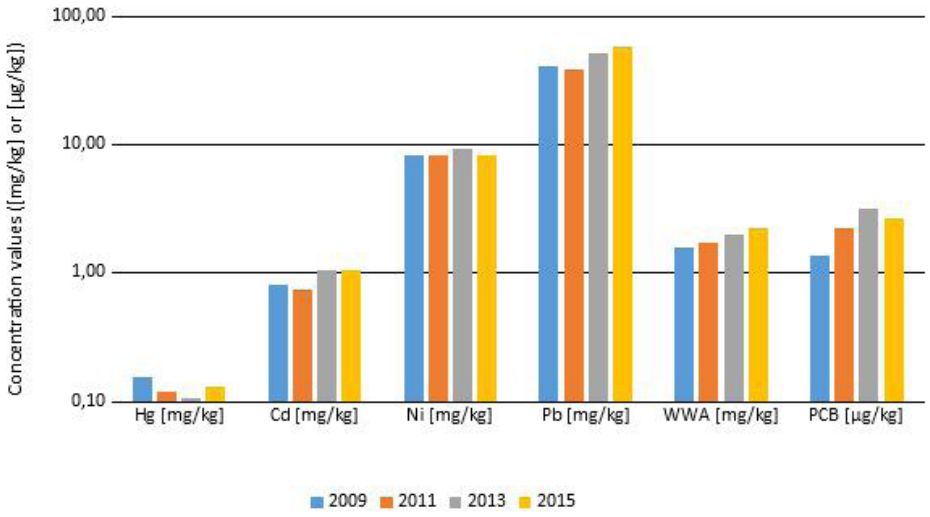
In 2017, 99% of monitored lake SWBs (84.2%) were in bad condition and only 1% in good condition.

[19] *Ibid.*

Trends of changes in concentrations of selected pollutants measured in the sediments of rivers and lakes of Poland

The presence of high concentrations of heavy metals or organic compounds in sediments adversely affects the quality of surface water ecosystems. Contaminants present in the sediments may be toxic to aquatic organisms and may accumulate in the food chain to dangerous concentrations in tissues (biomagnification), especially for predators living in waters with contaminated sediments.

Fig. 2.9. Average concentrations of selected heavy metals, sum of polychlorinated biphenyls and polycyclic aromatic hydrocarbons (BaP, BbF, BkF, IndP, Bper) in sediments of benchmark lakes in Poland monitored in the years 2009, 2011, 2013, 2015.



Source: GIOŚ/PMŚ

In Poland, the levels of the most important elements and the most important organic substances from the perspective of water environment pollution, including priority substances, are subject to constant observation and assessment within the framework of the State Environmental Monitoring. Among the elements measured in the sediments, the concentrations of those included in the list of priority substances in the field of water policy (Cd, Pb, Hg, Ni) are also controlled. The samples of collected river and lake sediments contain organic compounds dangerous for the environment: polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) – including benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i) perylene and indeno(1,2,3-cd)pyrene.

The analysis of data from the measurement series within the benchmark monitoring network[20] for lake sediments, carried out every two years since 2009, shows that the

[20] Benchmark monitoring network – a set of measurement and control points on surface water bodies selected as representative for Poland in order to monitor their quality. Monitoring in the benchmark points is carried out more frequently than in other locations.

highest concentrations of heavy metals among the group of priority pollutants are found for lead and the lowest for mercury. Average sum of PCB concentrations in samples of benchmark lake sediments are much lower than average contents of PAHs or heavy metals and remain at the level of a few μg/kg. It can be stated that the average concentrations of selected groups of contaminants in bottom sediments have been maintained at a very similar level for years. Only in the case of the sums of PAHs can a clear upward trend in the average concentrations of PAHs in benchmark lake sediments be observed, by approx. 0.2 mg/kg in the scale of two years (2013-2015).

Analysing the results of measurements on the annually monitored river sediments in the basin of the Vistula and Oder rivers, it can be observed that the present concentrations of chemical pollutants react to flood events. Monitoring results from years with high water levels in riverbeds (2010, 2013) are characterised by rapid decreases in average concentrations of heavy metals and organic pollutants in sediments. The largest one was recorded for lead – from 49.74 mg/kg in 2009 to 30.82 mg/kg in 2010. After the analysis of data for the purpose of determination of the pollution concentration trend, it can be concluded that the contents of particular parameters remained at a similar level in the period 2009-2015.

In general, the average contents of heavy metals, PAHs and PCBs in lake sediments are higher than in river sediments. This is primarily due to differences in sedimentation conditions, the content of organic matter and other elements forming the sediment, and the possibility of reintroduction of contaminants from the sediment to the water depths in still and flowing waters[21].

Transitional and coastal waters[22]

a) ecological state/potential

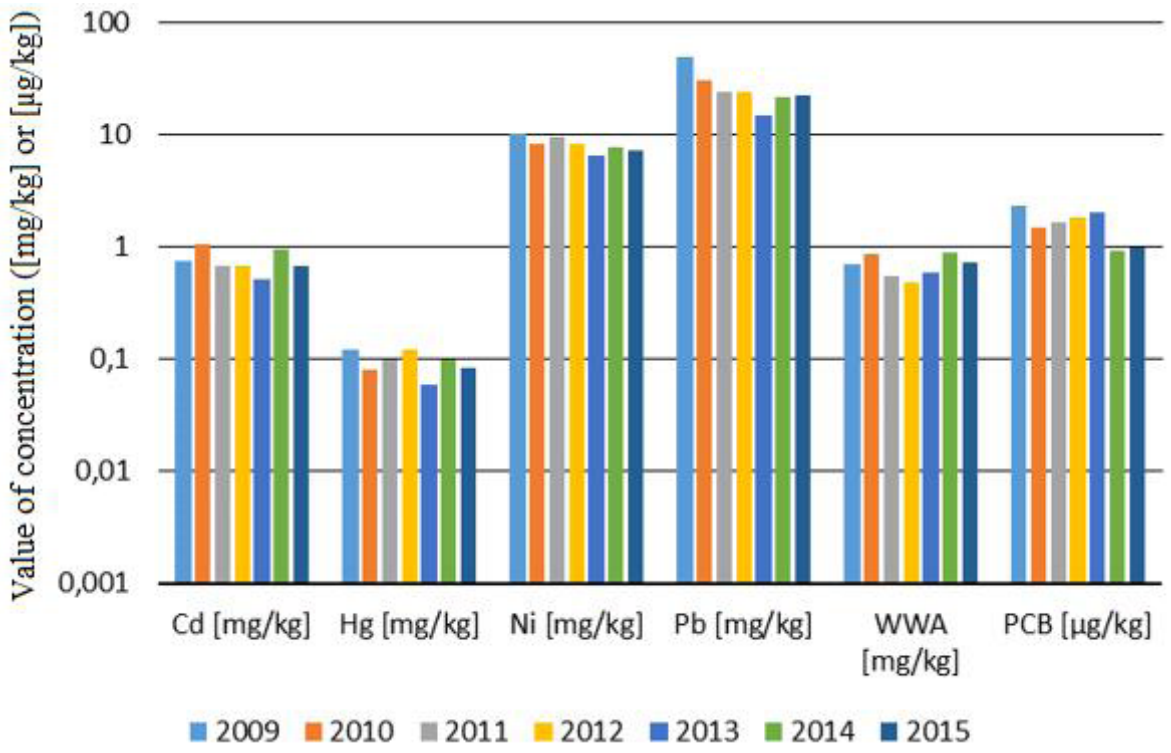
The programme of monitoring the quality of transitional and coastal waters is implemented within the framework of the State Environmental Monitoring on the basis of designated so-called water bodies, which should be understood as separate and significant elements of surface waters, constituting the basic unit of water management. In the research and assessment of the state of transitional and coastal water bodies, the 2013-2015 period is the second part of the six-year (2010-2015) water management cycle. The second cycle of water management is currently underway (2016-2021). The assessment of the ecological state/potential of the SWBs was carried out on the basis of averaged values of the results of physicochemical tests of water samples and biological indicators from individual measurement stations located on the SWBs for the period 2011-2016. The ecological state and potential rating for a SWB is the weakest result of three partial assessments for biological, hydromorphological and physicochemical elements. The biological indicators of water quality causing the

[21] Zieliński T., Sedimentology. Settlements of rivers and lakes. Published by Adam Mickiewicz University, Poznań, 2014.

[22] *cf. Robak-Bakierowska A., Kopiec J., Łużecki G., Łysiak-Pastuszak E. et al., Ocena stanu środowiska morskiego polskiej strefy ekonomicznej Bałtyku na podstawie danych monitoringowych z roku 2012 na tle dziesięciolecia 2002-2011 (Assessment of the State of the Marine Environment of the Polish Exclusive Economic Zone on the Baltic Sea Based on the Monitoring Data of 2012 against the 2002–2011 Decade),* Biblioteka Monitoringu Środowiska, Warszawa, 2013.

classification of ecological state or potential as "below good" were chlorophyll a and phytoplankton biomass as well as the number of macrozoobenthos organisms.

Fig. 2.10. Average concentrations of selected heavy metals, sums of polychlorinated biphenyls and polycyclic aromatic hydrocarbons (BaP, BbF, BkF, IndP, Bper) in sediments of Polish rivers at measurement points tested in the years 2009-2015.

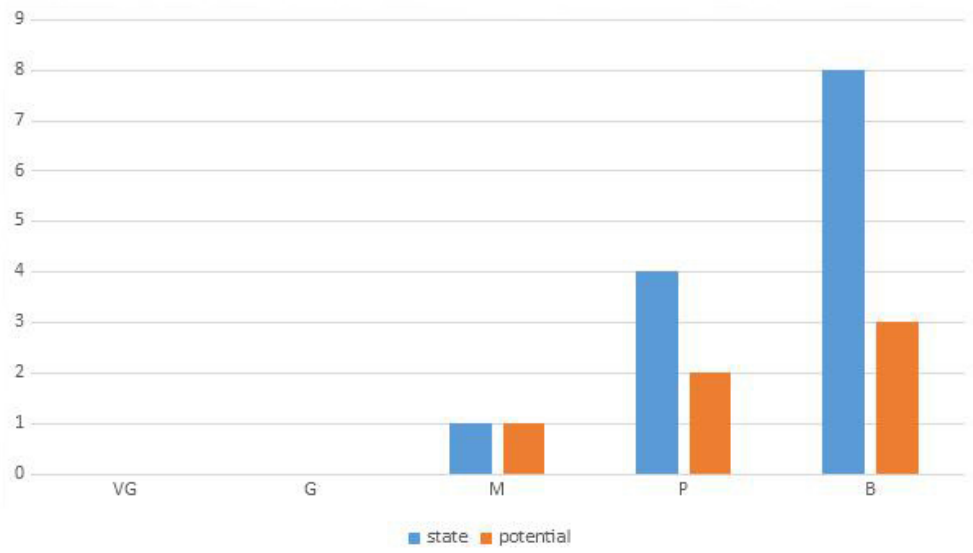


Source: GIOŚ/PMŚ

The assessment of the physicochemical elements below a good state or potential was influenced mainly by the results of water transparency studies (Secchi disk visibility), organic matter indices (TOC), observed occurrence of episodes of water oversaturation with dissolved oxygen and excessive concentrations of nutrients, especially total nitrogen and soluble forms of nitrogen (ammoniacal, nitrate, mineral nitrogen) and total phosphorus (Fig. 2.15).

b) chemical state

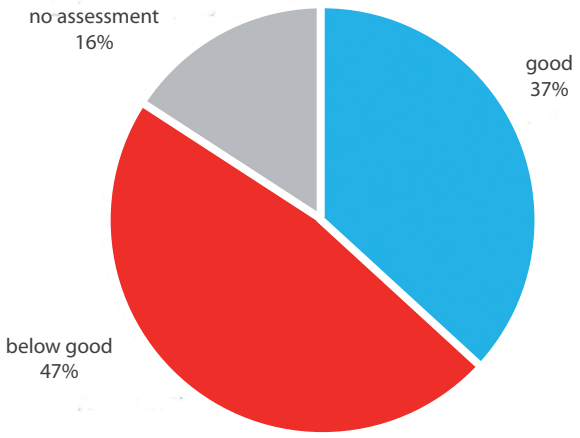
Fig. 2.11. Average assessment of the ecological state or potential of transitional and coastal waters in the years 2011-2016.



Graph legend: VG – very good; G – good; M – moderate; P – poor; B – bad.
Source: GIOŚ/PMŚ

The assessment of the chemical state of transitional and coastal waters was based on the results of 43 selected priority substances from the list of 44 substances measured by voivodship environmental inspectorates within the framework of diagnostic monitoring in 2011-2016 and 11 other pollutants measured in the biota, included in the Regulation of the Minister of the Environment of 21 July 2016 on the method of classification of the state of surface water bodies and environmental quality standards for priority substances. Of the 15 water bodies assessed in that period, 6 were in a good state and 9 in a state below good. The state below good was caused by exceeding the limit values for brominated diphenylethers, mercury and its compounds, benzo(g,h,i) perylene and heptachlor.

Fig. 2.12. Average assessment of the chemical state of transitional and coastal waters based on 21 substances12 between 2011 and 2016 (%).



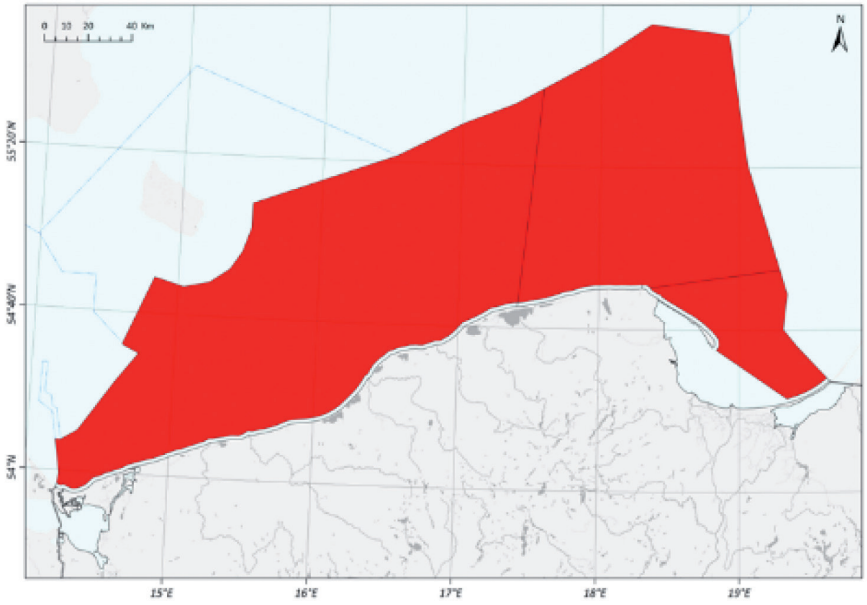
Source: GIOŚ/PMŚ

Baltic Sea

The state of the environment of the Polish zone of the Baltic Sea area has been regularly monitored since 1979 (since 1991 within the framework of the State Environmental Monitoring). Measurements and observations are carried out in accordance with the marine water monitoring programme adopted by the Council of Ministers in 2014. As part of the programme, measurements are carried out six times a year at stations located in deep and shallow water zones and 12 times a year at one high frequency station. "Hydrological measurements, chemical analyses and collection of biological material and bottom sediments are carried out during the expedition on board of the r/v "Baltica" in accordance with the procedures contained in the HELCOM[23] COMBINE[24] manual"[25].

Based on the studies conducted in 2016, the state of the marine environment of Polish marine areas in terms of eutrophication should be considered unsatisfactory (subGES). This is mainly due to the concentrations of total phosphorus, total nitrogen, chlorophyll a, water transparency and the content of dissolved oxygen near the bottom.

Fig. 2.13. Assessment of the condition of the marine environment in 2016 in terms of eutrophication. The red colour indicates the state of the water in terms of eutrophication, which is assessed as inadequate, i.e. below good (subGES).



Source: GIOŚ, State of the Environment in Poland. Signals 2016, p. 52.

The state of waters in the Polish Exclusive Economic Zone in 2015 in terms of eutrophication was assessed as inadequate, i.e. below good (subGES).

Biogenic substances are essential for the development of phytoplankton in the marine environment. However, their surplus leads to excessive development of

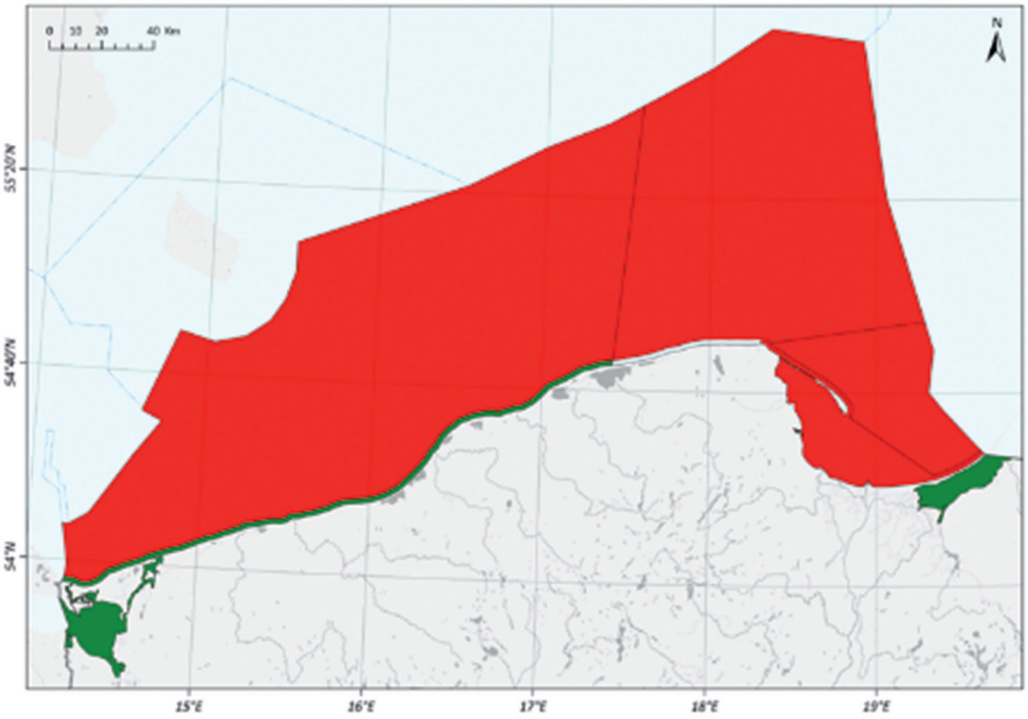
[23] HELCOM – Helsinki Commission, executive body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention).
[24] HELCOM COMBINE – Cooperative Monitoring in the Baltic Marine Environment.
[25] GIOŚ, *State of the Environment in Poland. Report 2018*, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 142.

phytoplankton, the so-called **phytoplankton bloom**. Dead phytoplankton, which decomposes and consumes oxygen, sinks to the bottom which may lead, even in shallow areas with a depth of 6-10 m, to a decrease in the concentration of oxygen at the bottom, or even to oxygen deficiency.

Persistent organic pollutants (POPs) in the marine environment are of anthropogenic origin. The main sources of POPs are industry, management of public utilities (waste incineration) and agricultural chemistry. Studies on persistent organic pollutants in fish tissues have been carried out since 1998. (7 PCB congeners: CB28, CB101, CB118, CB138, CB153, CB180 (according to IUPAC), HCH and its isomers: α-, β-, γ-HCH, HCB). The list of compounds tested in fish was extended in 2012 (PBDE, HBCDD) and 2014 (PFOS, TBT and its derivatives: DBT, MBT, TPhT). In the Szczecin and Vistula Lagoons, compounds are measured in perch tissues, in the Gotland Basin – in herrings, in the Bornholm Basin – herring and flounder, and in the Gdańsk Basin – flounder.

Compared to previous research years, in 2016 a decrease in PBDE content in fish muscle tissues was observed in all monitored waters. In 2016, there was also a change in the threshold value of the permissible concentration of the sum of 6 PBDE congeners, which resulted in a drastic change in the state of the marine environment for all analysed waters. In previous years, the environmental state was determined as good (GES) on the basis of the available data. Currently, based on the new good state threshold value (TV) of 0.008 µg kg-1m.m., the marine environment should be considered unsatisfactory (subGES) in terms of pollution with polybrominated diphenyl ethers for all monitored waters.

Fig. 2.14. The state of the marine environment in 2016 with respect to POP contamination in fish intended for consumption. The red colour indicates the state below good, while the green colour indicates good state.



Source: GIOŚ, State of the Environment in Poland. Signals 2016, p. 55.

"The state of the Polish Baltic Sea zone in 2015 with respect to metal pollution has been shown to be below good in the waters of the Szczecin Lagoon, the Vistula Lagoon, the Bornholm Basin and the Eastern Gotland Basin. Good condition has been achieved in the Polish coastal waters of the Bornholm Basin and Polish coastal waters of the Gdańsk Basin"[26].

Noise in the marine environment

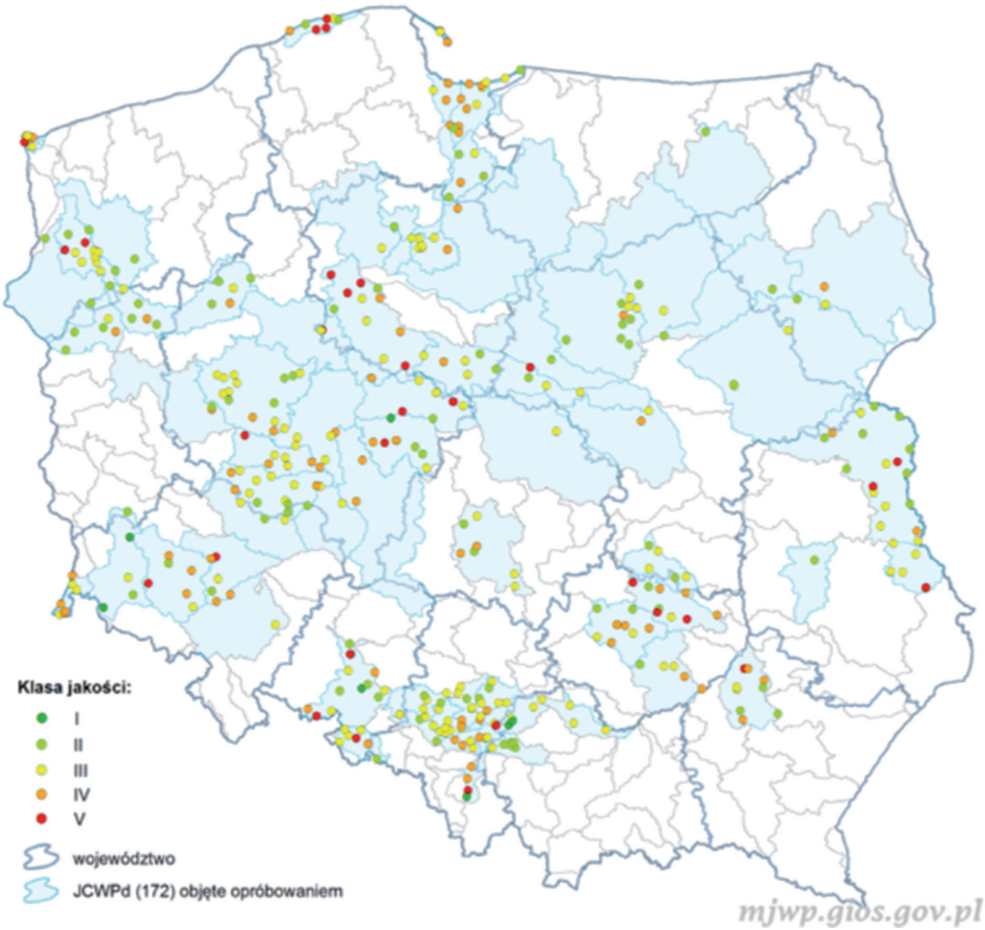
Maritime transport also has an impact on the acoustic climate of the environment, in particular the underwater ecosystems. The level of anthropogenic noise in the marine environment is increasing, for example, due to the increase in the number of ships operating at the same time in the Baltic Sea. Sources of underwater noise are typically the operation of ship engines, the operation of underwater hydrotechnical equipment (drilling rigs, dredgers, pile drivers), sonars and echo sounding equipment, geological exploration explosions, practice detonations in marine military training zones, underwater explosions accompanying munitions destruction. The sound from these sources can spread over long distances. While sound intensity can be easily measured, it is not easy to determine the environmental impact of sound. Underwater noise and acoustic disturbances are one of the most important threats to the life of marine fauna. For cetaceans, including porpoises occurring in the Baltic Sea, echolocation, functioning as a system of transmitting and receiving sounds, is the basic sense of orientation in water space. It is used to locate obstacles, organisms they hunt and for communication. The impairment of this ability to perceive sound interferes with the life processes of the porpoises, including reproduction. A pilot monitoring programme for underwater noise has been carried out since 2015 as part of the State Environmental Monitoring.

Groundwaters

Within the framework of the State Environmental Monitoring, the chemical state of groundwaters is assessed at measurements points by defining quality classes (Class I, II and III mean good chemical state and Classes IV and V mean poor chemical state) and at groundwater bodies (GWBs). "By 2015, 161 groundwater bodies (GWBs) had been monitored, and 172 groundwater bodies have been monitored since 2016"[27].

[26] GIOŚ, *State of the Environment in Poland. Signals 2016*, p. 55.
[27] GIOŚ, *Monitoring of Groundwater Quality*, http://mjwp.gios.gov.pl/ (accessed: 12.02.2019).

Fig. 2.15. Groundwater quality classes at operational monitoring points according to data from 2017

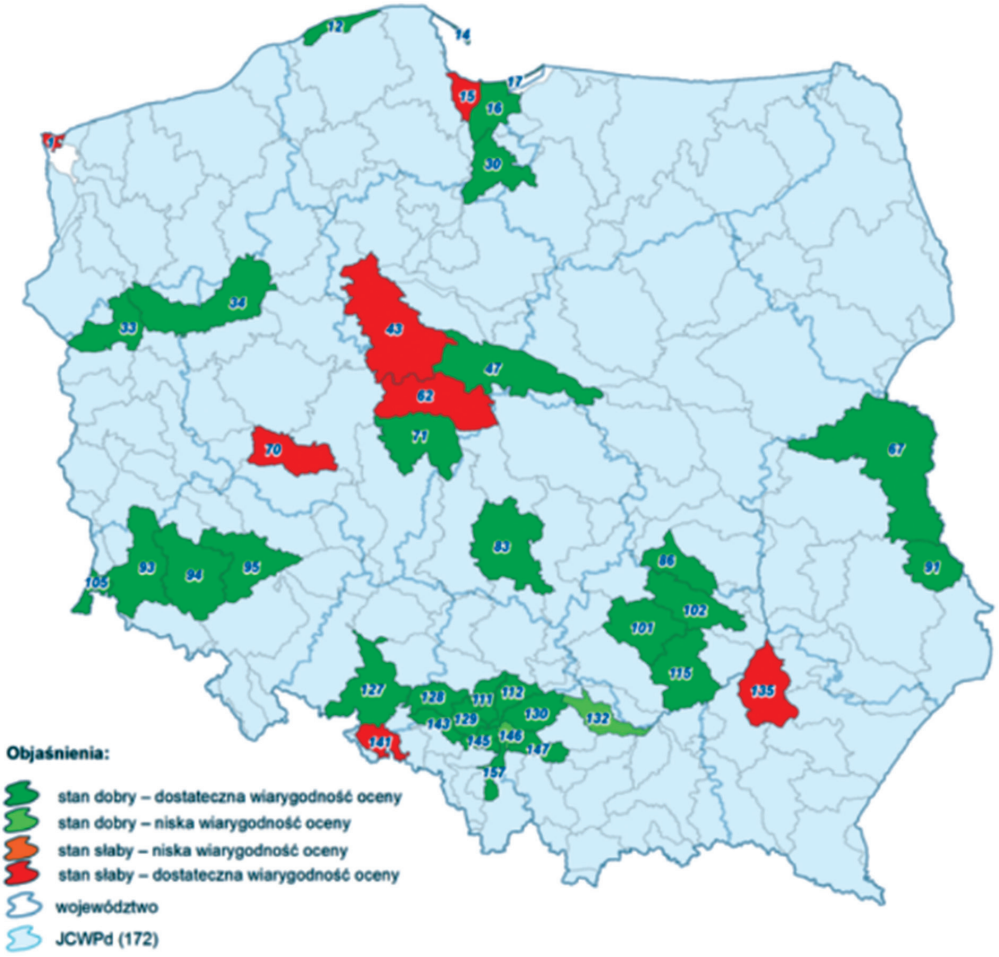


Graph legend: Klasa jakości – quality class; województwo – voivodship; JCWPd (172) objęte próbowaniem – GWBs (172) measured.
Source: GIOŚ, Monitoring of Groundwater Quality, http://mjwp.gios.gov.pl/ (accessed: 12.02.2019)

In 2017, operational monitoring of selected groundwater bodies was carried out within the framework of the State Environmental Monitoring. Samples were taken from 395 measurement points.

Since 2010, the assessment of the state of GWBs within the framework of the State Environmental Monitoring has been carried out with the use of classification tests. This enables the determination of the state of those waters, taking into account not only their chemical composition and the degree of utilisation of groundwater resources, but also the impact on the quality of waters abstracted for human consumption, on surface waters in direct contact with groundwater or on protected terrestrial ecosystems depending on groundwater.

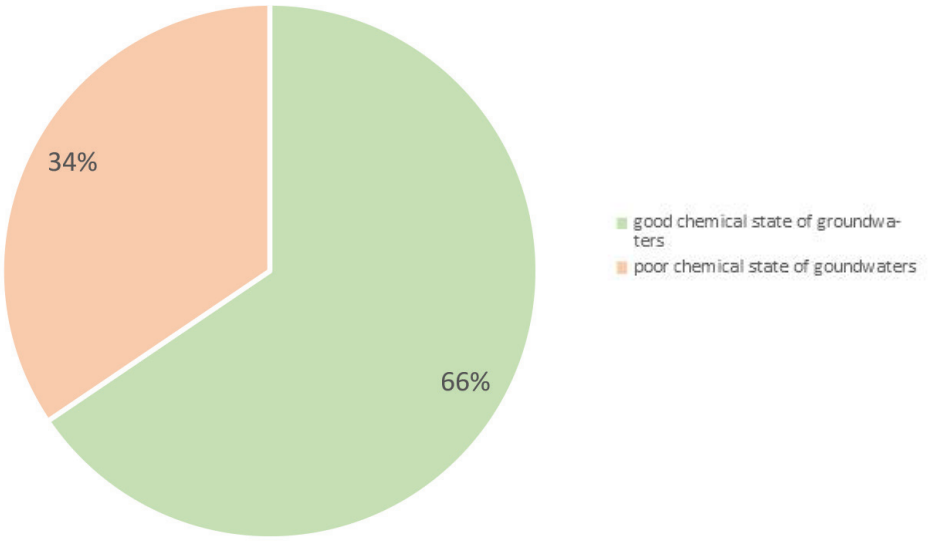
Fig. 2.16. Assessment of the state of groundwaters according to data from 2017



Map legend (objaśnienia): stan dobry – dostateczna wiarygodność oceny – good state – satisfactory assessment reliability; stan dobry - niska wiarygodność oceny – good state – low assessment reliability; stan słaby – dostateczna wiarygodność oceny – poor state – satisfactory assessment reliability; stan słaby - niska wiarygodność oceny – poor state – low assessment reliability; województwo – voivodship; JCWPd – GWBs (172)
Source: GIOŚ, Monitoring of Groundwater Quality, http://mjwp.gios.gov.pl/ (accessed: 12.02.2019).

According to the data from the Chief Inspectorate for Environmental Protection, most of the GWBs were found to be in a good state as a result of classification tests carried out in accordance with the adopted methodology for assessing the status of groundwater bodies.

Fig. 2.17. Chemical state of GWBs (%)



Source: own elaboration based on Polish Geological Institute – National Research Institute, Interpretation of the Results of Operational Monitoring, Assessment of Chemical State and Preparation of a Study on the Chemical State of Groundwater Bodies at Risk of Failure to Achieve Good State According to Data from 2017, Warszawa 2018, p. 41.

Of 172 groundwater bodies, good chemical state was found in 34%, of which 20 GWBs from the Vistula river basin and 12 GWBs from the Oder river basin. Poor chemical state was found in 66% of groundwater bodies. In the Vistula river basin, poor chemical state was found in 2 GWBs, and in the Oder river basin, poor chemical state was found in 5 GWBs[28].

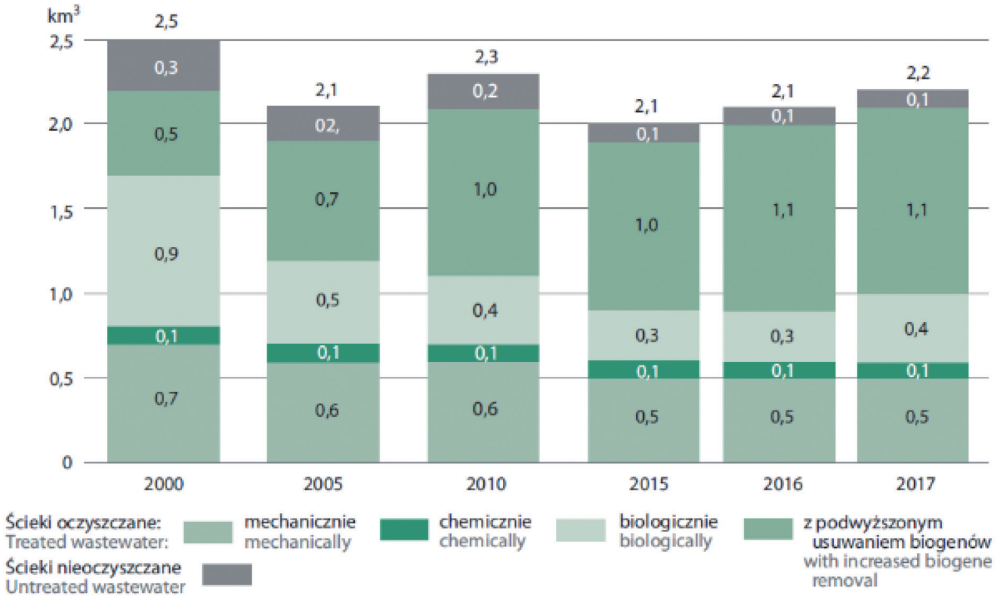
As a result of the comparison of the current assessment of the state of GWBs with the results of the groundwater assessment according to 2016 data, it was stated that in the case of 34 analysed bodies, the overall groundwater assessment remained the same (for 30 bodies the assessment remained good, for 4 bodies – poor). For five bodies, the chemical state in 2017 compared to the 2016 measurement has changed – from good to poor in three cases and from poor to good in two cases[29].

Summary

The most important factors causing pressure on surface waters are public utilities, agriculture and industry (particularly mining, energy, agri-food). Therefore, activities limiting the impact of anthropogenic pressure on the state of waters are also concentrated in these sectors and, since Poland's accession to the EU structures, they have been clearly strengthened by Community requirements.

[28] PIG-PIB, *Interpretation of the Results of Operational Monitoring, Assessment of Chemical State and Preparation of a Study on the Chemical State of Groundwater Bodies at Risk of Failure to Achieve Good State According to Data from 2017*, Warszawa, 2018, pp. 178-179.
[29] Ibid., p. 180.

Fig. 2.18. Industrial and municipal waste water in need of treatment discharged into water or soil.



Source: Statistics Poland, Environmental Protection 2018, Warszawa, 2018, p. 60.

Changes in the treatment of municipal waste water in Poland have a significant impact on the quality of waters in the Vistula, Oder and other river basins. The amount of waste water discharged to water or land in 2017 compared to 2010 decreased by about 5% (from 2.3 km^3 to 2.2 km^3). Nearly 84.4% is industrial waste water, of which 87.7% is, however, the so called "assumed clean" cooling water which does not require treatment. In 2017, there were 2197.7 hm^3/year of industrial waste water and municipal waste water requiring treatment. Of this amount, 95.1% of waste water was treated, of which 54.4% was treated with enhanced nutrient removal. Over the years, the amount of waste water treated in this way has doubled, which is an optimistic sign, as it allows to achieve an appropriate level of pollution reduction. 4.3% are untreated waste water discharged mainly directly from industrial plants. It is important, however, that the amount of untreated waste water in 2017 compared to 2010 decreased by approximately 40%.

In the period from 2010 to 2016, the efficiency of municipal waste water treatment plants in Poland increased by over 35% (data based on the National Programme for Municipal Waste Water Treatment (KPOŚK)). According to the data of the Statistics Poland statistical yearbook "Environmental Protection 2018", in the years 2000-2017, the share of the population using waste water treatment plants increased from 53% to 81%, while in cities this increase is respectively from 79% to 95% and in villages from 11% to 42%[30].

In 2017, the combined sewage system in villages reached the total length of 156.9 thousand km. As a result, 41% of the countryside population used the sewage system, and 90% in cities[31].

The increase in the capacity of municipal waste water treatment plants is a result of the implementation of the National Programme for Municipal Waste Water Treatment

[30] *Statistics Poland, Environmental Protection 2018, Warszawa, 2018, p. 60.*
[31] Ibid., p. 62.

adopted by the Government of Poland in December 2003. This program was prepared for the purpose of building, expanding and modernising collective sewage systems and municipal waste water treatment plants. In July 2017, the Council of Ministers approved the Fifth Update of the National Municipal Wastewater Treatment Programme (AKPOŚK2017), which aimed at setting realistic dates for completion of delayed investments in agglomerations. Measures specified in the National Programme for Municipal Waste Water Treatment shall also contribute to increasing the attractiveness of Poland and its regions for investors, through the development of technical infrastructure, with simultaneous protection and improvement of the environment, health and development of territorial cohesion.

An important factor affecting the condition of surface waters and groundwaters is also the use of septic tanks by a significant part of the population in rural areas. In this context, the problem of emptying these tanks bypassing waste water treatment plants, despite their technological and functional capabilities, should be pointed out. It seems necessary to take measures to increase supervision of both – the users of such tanks and providers of emptying services, so that the sewage from the tanks is discharged only at treatment plants.

Water quality is affected by intensification of agricultural production (both large-scale animal husbandry and intensive plant cultivation). The current legal regulations, due to the existing gaps, do not ensure protection of the water environment against the adverse impact of large investments related to intensive agriculture. The impact of agriculture on the water environment is directly related to the intensity of soil use and the degree of concentration of animal production. In Poland, in the first half of the 1990s, there was a significant decrease in the use of phosphorus fertilisers, related, among others, to systemic changes. Since the midpoint of the first decade of the 21st century, stabilisation (with some fluctuations depending on the economic situation) of phosphorus fertilisers consumption has been observed. After a significant decrease in the use of nitrogen fertilisers in the 1990s and a certain stabilisation by the midpoint of the first decade of the 21st century, their use has increased in recent years.

With the entry into force of the provisions of the Act of 20 July 2017 – Water Law, the approach to the implementation of the so-called Nitrates Directive[32] has changed in Poland. Instead of cyclical identification of waters sensitive to pollution by nitrogen compounds from agricultural sources and environmentally sensitive area (ESAs), a Programme of measures aimed at limiting nitrogen outflow from agricultural sources is developed and implemented throughout the entire country. This programme includes measures and practices in the field of agriculture, including the limitation of agricultural use of fertilisers; indication of periods during which agricultural use of fertilisers is permitted, fertiliser doses and methods of fertilisation; indication of storage conditions for livestock manure.

High concentration of industry (including mining industry), especially in the catchment areas of the upper sections of the Vistula and Oder rivers, causes changes in water conditions and the necessity of discharging waste water to the surface river network carrying small volumes of water. As a result, in the southern part of the country, some of the waters carried within SWBs are of poor quality – in poor and bad ecological state. It is difficult to meet the standards of good water state in these areas,

[32] Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (OJ L 375 of 31.12.1991, p. 1, as amended; Polish translation section 15, vol. 2, p. 68, as amended).

particularly because the concentration of industry is accompanied by high population density. This situation applies equally to the Vistula river basin and the Oder river basin.

In the case of groundwater, the main reasons for its poor quantitative status are water abstraction through large municipal and industrial intakes and mining drainage, which caused unfavourable changes in the location of the groundwater table.

The Baltic Sea is directly affected by these impacts on land (e.g. discharges of pollutant loads) and impacts resulting from the broadly understood maritime economy. According to the maritime law, maritime economy is included as an activity undertaken in the marine environment by various categories of entities. Experience shows that the sector-wide approach is gradually being replaced by an integrated approach, holistically treating parts of the maritime economy: activities of seaports, fishing, shipbuilding, exploitation of the resources of the global ocean, tourism and recreation, as well as maritime administration, education and rescue. Increasing attention is being paid to the sustainable development of coastal regions, which contributes to raising the living standard in these areas. Apart from maritime economy, a number of new activities concerning both land and sea pressures have been designed in the National Programme for the Protection of Marine Water (KPOWM). It includes, among others, activities related to the reduction of the amount of waste in the marine environment, as well as the popularisation of the Polish Code for Fishery Promotion and the development of port infrastructure. All activities in the KPOWM are to contribute to the achievement of good environmental status for the Baltic Sea.

Directive 2000/60/EC[33], the so-called Water Framework Directive, in its preamble states that the Community water policy requires a transparent, effective and coherent legislative framework, which should be read as a postulate to introduce legal provisions at the national level ensuring full and rational legal regulation of this area.

The scope of the water management reform achieved through the adoption of the Act of 20 July 2017 on Water Law has introduced instruments ensuring the achievement of the Water Framework Directive objective of full implementation of the basin water management policy that meets the criteria of functionality and safety, sustainable development, economic efficiency, sustainability of ecosystems and social acceptance in accordance with the principle of sustainable water management, including the economic use of water resources. It was necessary to develop legal, organisational, financial and technical solutions in water management that ensure sustainable and balanced social and economic development of the country, taking into account the needs of economic water use and ensuring the availability of water resources of appropriate quality and quantity.

It was also necessary to establish a real and effective water authority, understood as per Article 3 of the Water Framework Directive and its adequate impact on water management issues, including in particular water management planning, water resources protection and the introduction of a system of water law permits.

[33] 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 (OJ L 327 of 22.12.2000, p. 1, as amended; Polish translation section 15, vol. 5, p. 275, as amended), hereinafter referred to as the „Water Framework Directive".

Air*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland, Report 2014 (GIOŚ 2014).

Air quality has a major impact on human health and living conditions, ecosystems and climate change processes. Airborne pollutants significantly affect human health, causing many respiratory and circulatory problems, including cardiovascular disease, asthma, decreased lung function, lung cancer and chronic obstructive pulmonary disease. The greatest impact of air pollution on human and animal health is observed in industrial and urban areas. The groups most exposed to the negative effects of air pollution are young children, pregnant women and the elderly, as well as people with respiratory **or cardiovascular** diseases**.**

Due to the adverse impact of air pollution on human health and the condition of ecosystems, an assessment of air quality is carried out annually for the protection of human health and the protection of plants. The assessments carried out with a view to meeting the criteria established to protect human health currently include: sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), benzene (C_6H_6), ozone (O_3), PM_{10}[1] and $PM_{2.5}$ particulate matter, heavy metals: lead (Pb), arsenic (As), cadmium (Cd) and nickel (Ni) in PM_{10} and benzo(a)pyrene (B(a)P) in PM_{10}[2]. Assessments related to plant protection criteria include sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ozone (O_3).

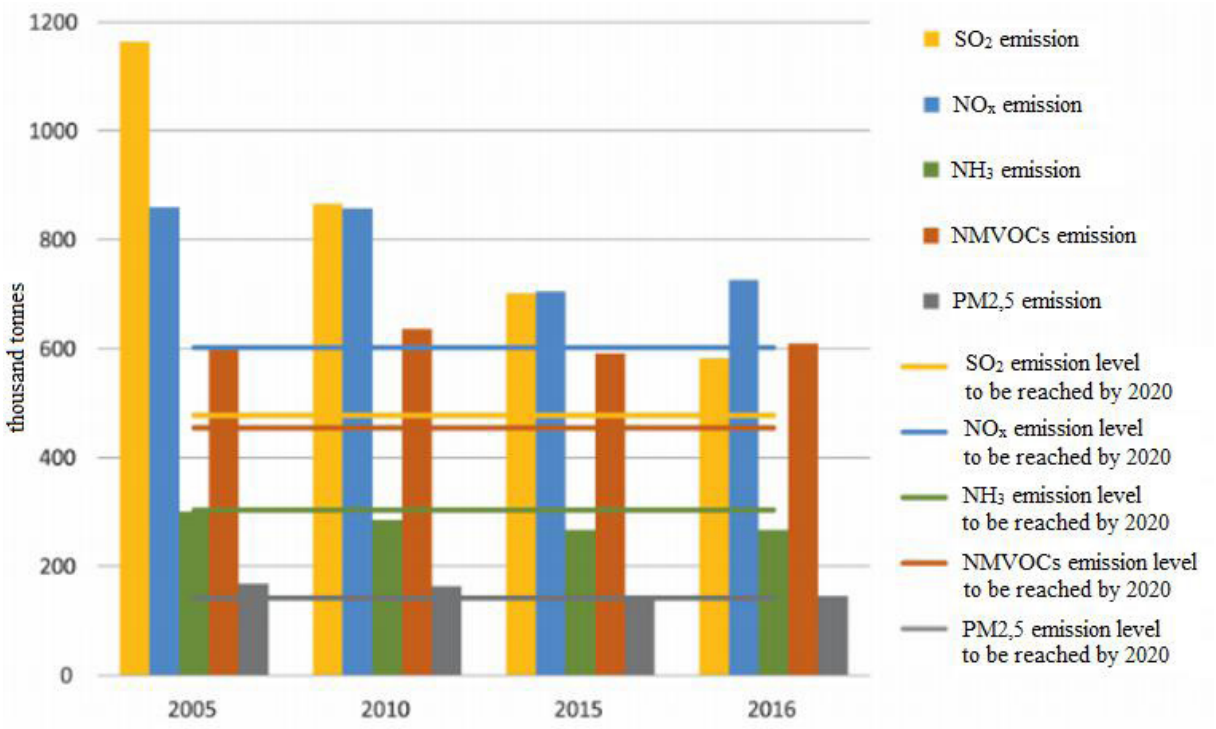
[1] PM_{10}, $PM_{2.5}$ – suspended particulate matter with a particle size of 10 micrometres or less and 2.5 micrometres or less, respectively.

[2] Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air (OJ L item 1031).

The system of air quality assessment and monitoring is based on measurements carried out within the national monitoring network in 46 zones: 12 agglomerations, 18 cities over 100,000 inhabitants, 16 voivodship areas which are not part of agglomerations or cities over 100,000 inhabitants. The assessment is carried out in accordance with applicable national and European law.

The results of annual assessments of air quality carried out by the Inspectorate for Environmental Protection as part of the State Environmental Monitoring unequivocally indicate that, at present, the inadequate condition of air quality in Poland is caused primarily by the so-called low emissions from the household and municipal sector and from transport. Excessive concentrations of PM10 and PM2.5 particulate matter and benzo(a)pyrene in the winter season and excessive concentrations of tropospheric ozone in the summer season are still a significant problem in Poland. In addition, individual cases of excessive nitrogen dioxide concentrations are observed[3], the main cause of which is the impact of emissions related to heavy traffic in the city centres and the emissions related to traffic on the main roads in the vicinity of measurement stations.

Fig. 3.1 Emissions of SO2, NOx, NH3, NMVOCs and PM2.5 against the ceilings for 2020 set in the Directive on the reduction of national emissions of certain atmospheric pollutants[4].



Source: LRTAP, Eionet, as in: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 104.

[3] GIOŚ, *State of the Environment in Poland. Signals 2016,* Warszawa, 2016, p. 23.

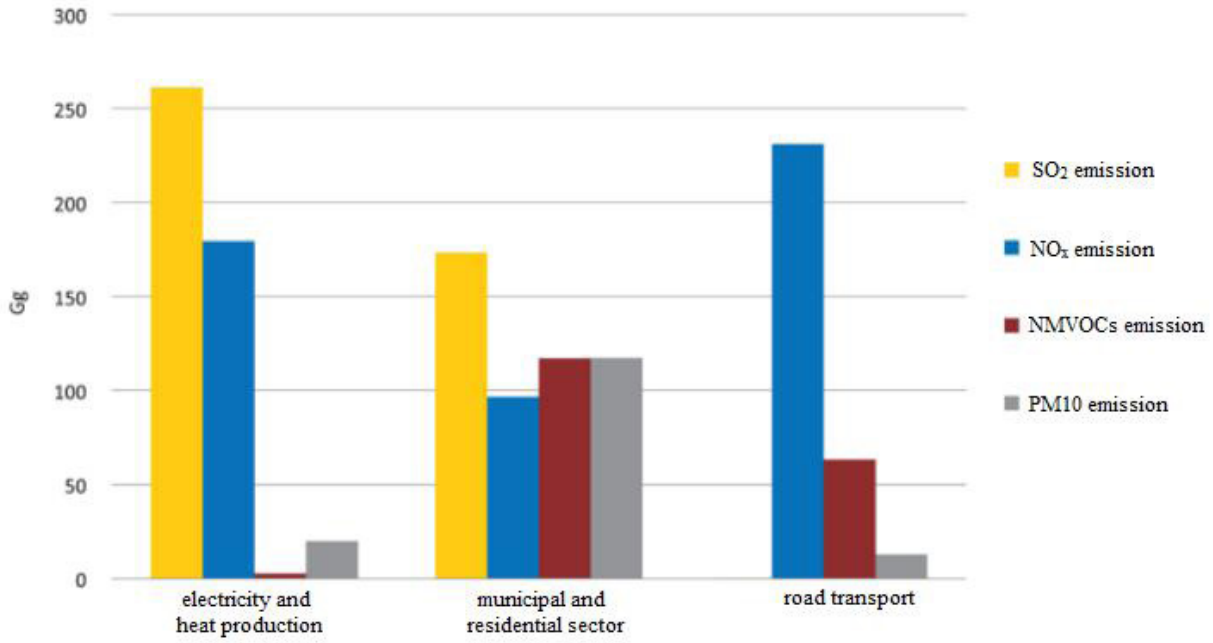
[4] *Directive 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (OJ L 344 of 17.12.2016, p. 1).*

After significant reductions in the emission of all pollutants to the air in Poland in the 1990s, the downward trend in the emission of sulphur dioxide clearly continued after 2000. Emissions of the other main pollutants nitrogen oxide (NO_X), ammonia (NH_3) and particulate matter are decreasing more slowly, while emissions of non-methane volatile organic compounds (NMVOCs) and particulate matter remain at similar levels.

Poland has achieved and complies with the emission limits set for 2010 in the Treaty of Accession of the Republic of Poland to the European Union with respect to Directive 2001/81/EC[5].

At the same time, within the framework of the Convention on Long-Range Transboundary Air Pollution, in order to counteract acidification, eutrophication and ground-level ozone, new emission reduction targets have been set for gaseous pollutants covered by the agreements mentioned above, and additionally, reduction targets for $PM_{2.5}$ have been set in Directive 2016/2284 of the European Parliament and of the Council (EU)[6]. The new emission ceilings should be reached by 2020 and 2030 respectively.

Fig. 3.2. Structure of emissions of the main pollutants in Poland in 2016 by sectors of the economy.

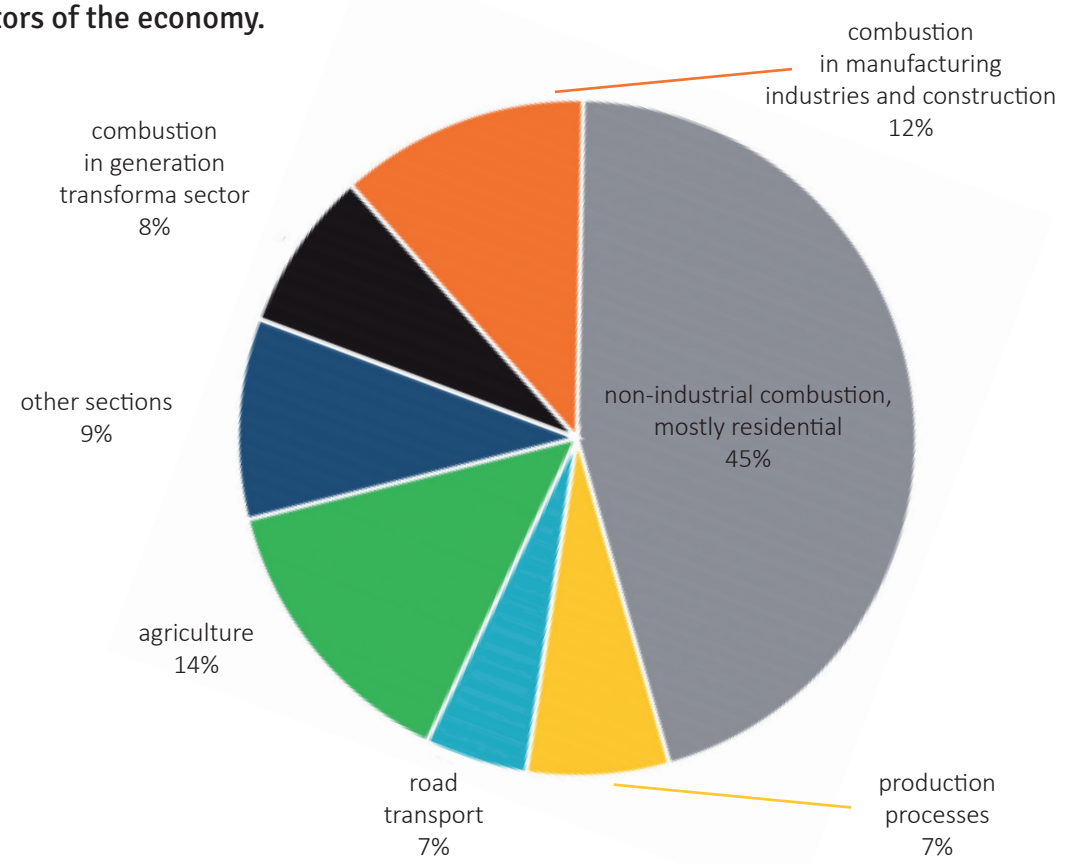


Source: LRTAP as in: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 105.

[5] Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (OJ L 309 of 27.11.2001, p. 22, as amended; Polish translation section 15, vol. 6, p. 320, as amended).

[6] Directive 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.

Fig. 3.3. Structure of PM10 primary particulate matter emissions in Poland in 2016 by sectors of the economy.



Source: KOBIZE, as in: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 106.

The structure of pollutant emissions in Poland results from the structure of fuel consumption and quality. These factors determine the amount of emissions of most air pollutants. Production technologies in the commercial power sector and fuel combustion technologies used in the household and municipal sector (Fig. 3.2 and Fig. 3.3) are also of great importance for the volume of emissions. It is worth noting that the energy sector has significantly reduced its emissions – in case of both NO_x and SO_2 – over the last several years. The issues of the emission of pollutants from the industrial sector, including in particular power generation, were regulated through the implementation of the provisions of the MCP[7] and IED[8] directives. As a result, this sector is no longer a significant environmental problem in terms of air quality.

Taking into account the scale and historical starting point, the Polish energy sector is undergoing dynamic changes. In just 10 years (2007-2017), the installed capacity[9] of renewable energy sources (RES) increased almost 5-fold: from 4% to about 20% of the total installed capacity in the Polish Power System (PPS). However, hard coal is still the primary energy medium in the national economy. Its share in the structure

[7] Directive 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium-sized combustion plants (OJ L 313 of 28.11.2015, p. 1).

[8] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334 of 17.12.2010, p. 17, as amended).

[9] It is the nameplate capacity *(rated power, nominal power*) of a device used to generate electricity, i.e. a generator, a photovoltaic cell or a fuel cell, specified by the manufacturer, expressed in watts [W] or in multiples of that unit (kW, MW) – as in : information of the President of the Energy Regulatory Office no. 44/2016 of 21 September 2016 on the application of the concept of „installed electrical capacity".

of primary energy consumption in Poland in 2016 was 39.84%. According to data for 2017, energy production from hard coal and lignite in Poland amounted to 78.4% of total energy production.

One of the results of the fuel consumption structure in Poland is also a large emission of polycyclic aromatic hydrocarbons (PAHs), including benzo(a)pyrene. These compounds are emitted mainly as a result of combustion of solid fuels in households. In 2015, the emission of PAHs from this source amounted to over 87% of the total air emissions of PAHs in Poland. Production processes, including processes related to the production of coke or aluminium, are also an important source of PAHs emissions.

Air pollution also has a negative impact on water status. Various chemicals in gases and particulate matter emitted from land-based sources and sea transport enter the sea from the air. As a result of the process of combustion of hydrocarbon fuels, harmful and toxic products in the form of carbon dioxide – CO_2, carbon monoxide CO, sulphur oxides SO_X, nitrogen oxides NO_X, hydrocarbons HC, particulate matter PM and many other toxic substances affecting both the natural environment and human health and life are introduced into the atmosphere. The dynamic development of industry, transport and automotive production are significant contributors to the emission of these pollutants to the atmosphere. Intense ship traffic in coastal areas results in significant changes to their ecosystems. It is estimated that the maritime economy uses about 3% of the world's fuel production – often the worst fuels in terms of quality and high sulphur content. The combustion of this type of fuels releases approximately 7% of total atmospheric pollution by sulphur oxides and approximately 11-13% by nitrogen oxides.

However, it should be noted that 80% of the pollution of the marine environment comes from the land. The remaining 20% are attributable to marine sources, with only 4% of pollution coming from maritime transport.

Annex VI to MARPOL 73/78 is a provision that has a major impact on the construction and equipment of ships. This Annex concerns the prevention of air pollution from ships and introduces provisions for Sulphur Emission Control Areas (SECAs) and Nitrogen Emission Control Areas (NECAs).

It should be noted that the Baltic Sea has been a SECA since 19 May 2006 and at the 71st session of the Marine Environment Protection Committee (MEPC), the International Maritime Organisation (IMO) established the Baltic Sea and the North Sea, including the English Channel, as a NECA. New, stricter rules on nitrogen oxide emissions from ships shall apply from 1 January 2021.

In addition, Directive 2016/802[10] concerns the reduction of the sulphur content of certain liquid fuels. Its contents refer to the regulations of the International Maritime Organization, which forced the reduction of sulphur content in marine fuel to 0.1%, from 1 January 2015 in SECAs, and from 2020 shall globally limit the use of fuels with sulphur content above 0.5%. Meeting the requirements may involve switching to more expensive fuel with reduced sulphur content, e.g. Marine Gas Oil, installing the so-called scrubbers on ships, spraying the exhaust gases with water, or switching to liquefied natural gas (LNG) propulsion entirely.

On 16 April 2018, the European Commission published the "Report from the Commission to the European Parliament and the Council on implementation and compliance with the sulphur standards for marine fuels set out in Directive (EU)

[10] Directive (EU) 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels (OJ L 132 of 21.05.2016, p. 58).

2016/802 relating to a reduction in the sulphur content of certain liquid fuels". The report shows that the mandatory use of marine fuels with a sulphur content of 0.10% in SECAs contributes effectively to achieving the Directive's objective of reducing the harmful effects of sulphur dioxide emissions from ships on human health and the environment. More than 93% of the ships inspected in the SOx Emission Control Areas complied with the stricter sulphur content requirements, which led to a significant reduction of sulphur dioxide concentrations in the air in the regions bordering the SECAs.

The state of air in Poland depends mainly on the size and spatial distribution of emissions from stationary and mobile sources, as well as transboundary flows and physicochemical transformations occurring in the atmosphere. These processes affect both the formation of the so-called background pollution resulting from the establishment of the dynamic equilibrium state in the further distance from the emission sources, as well as the extent to which increased concentrations occur in the area of direct impact of the sources. Unfavourable meteorological conditions (windless conditions – stills, low temperature, fog, lack of rainfall, inversion) are particularly important in the case of low emission sources, e.g. household hearths, local boiler plants and car traffic. Furthermore, in the case of some Polish cities, topographical conditions have a significant impact on the level of air pollution, i.e. the location of emission sources e.g. in mountain valleys or river basins, making it difficult to disperse pollution – lack of ventilation wedges and concentration of industry in agglomerations or in their immediate vicinity, as is the case in the Kraków and Upper Silesian Agglomeration. These factors are compounded by errors in urban planning, in particular the construction of ventilation wedges, which makes it more difficult to ventilate cities. The reasons for not meeting the air quality standards should also be attributed to insufficient public awareness of the health effects of burning waste in domestic hearths.

Air pollution also affects rural areas, in particular due to the use of heating systems with insufficient pollutant emission parameters by private households.

Particulate matter

Suspended particulate matter is a mixture of very small solid and liquid particles composed of both organic and inorganic compounds. Particulate matter may include hydrocarbons, elementary carbon, silicon, aluminium, iron, trace metals, sulphates, nitrates, chlorides, and ammonium compounds, but the composition may vary with site, season and weather conditions. "Particulates of fine and very fine dust either originate from direct emissions – mainly from municipal sources and transport – or are formed in the atmosphere as a result of reactions between substances in the air. The precursors of the latter (so-called secondary aerosols) are mainly: sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs) and ammonia (NH_3).

In particulate matter, a fraction with a particle size of less than 10 μm (PM_{10}) is distinguished which includes a fraction with a particle size below 2.5 μm ($PM_{2.5}$). Both fractions are subject to assessment concerning their effect on human health. The health impact of fine particles (PM_{10}) and very fine particles ($PM_{2.5}$) depends on the

number of particles retained in different parts of the respiratory system. $PM_{2.5}$ has the ability to reach the deepest parts of the lungs, where it is accumulated or dissolved in biological fluids. As a result, it may be the cause of exacerbated asthma symptoms, acute respiratory reactions, decreased lung function and, consequently, chronic obstructive pulmonary disease, etc."[11].

Despite the observed decrease in emissions of particulate matter precursors (particularly sulphur dioxide) and actions taken to reduce concentrations of particulate matter in the air, the smallest fractions in particular, exceeding the standards for PM_{10} and $PM_{2.5}$ remains the most important problem of air quality in Poland. These exceeded values occur both in relation to the daily (PM_{10}) and annual (PM_{10} and $PM_{2.5}$) standards.

Exceeding the daily limit values for PM_{10} concentrations usually occurs in the winter. In all voivodships, exceeded values are most often related to particulate matter emission from individual heating of buildings and from transport. Emissions from industrial plants, heating plants, power plants and adverse meteorological conditions (including long-term inversions, wind stills) should be mentioned as further causes of exceeded values.

Fig. 3.4. Zone classes based on 24-hour concentrations of PM10 as a result of the assessment of air quality in 2017 (health criteria), where Class A – concentration level of PM10 does not exceed the limit value, Class C – concentration level of PM10 exceeds the limit value.

Map legend: Klasyfikacja stref w 2017 – Zone classification in 2017; Klasa wg parametrów PM10 - 24h – Class acc. to parameters, PM10 – 24h; aglomeracje i miasta – agglomerations and cities; pozostałe strefy – other zones; Granice stref – województw – Zone borders – voivodships; Granice stref – aglomeracji i miast – Zone borders – agglomerations and cities; Źródło danych: Powiatowy Monitoring Środowiska – Data source: County Environmental Monitoring; Opracowanie: Instytut Ochrony Środowiska – Państwowy Instytut Badawczy – Elaboration: Institute of Environmental Protection – National Research Institute

Source: Chief Inspectorate for Environmental Protection – Inspection for Environmental Protection, Assessment of the Air Quality in Zones in Poland for 2017, Warszawa, 2018, p. 52.

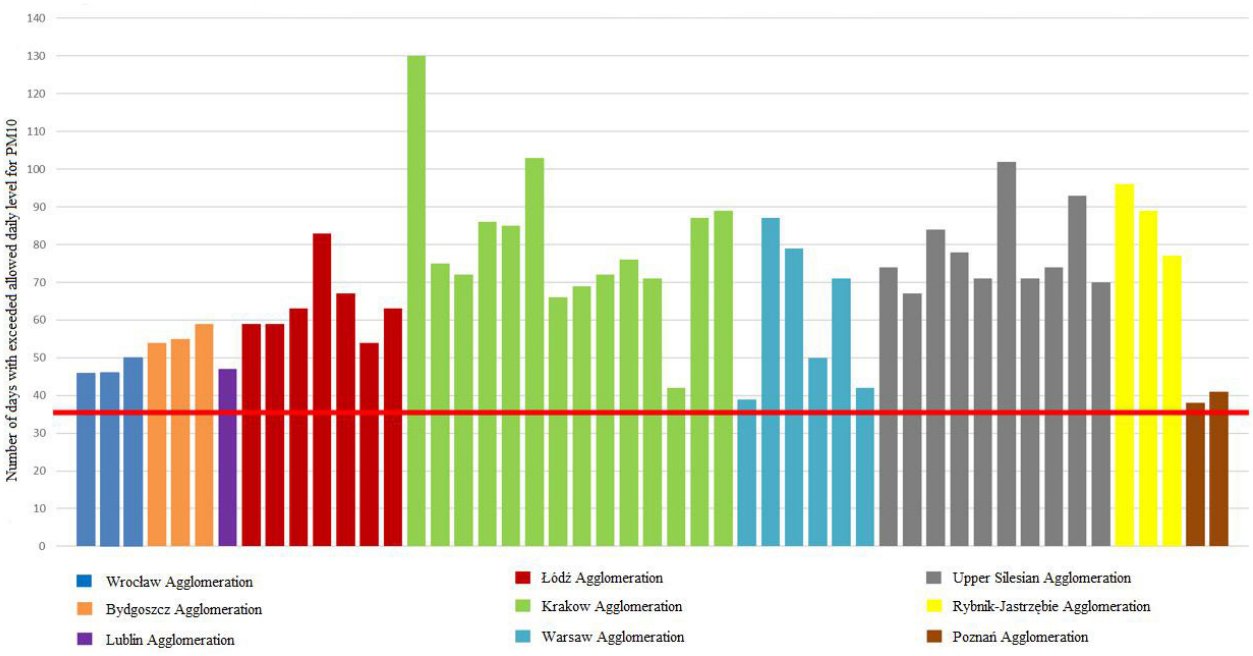
[11] GIOŚ, *State of the Environment in Poland. Report 2018*, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 91.

In the assessment of air quality for 2017 concerning PM_{10} carried out as part of the State Environmental Monitoring, among 46 zones subject to assessment based on 24-hour concentrations, only 12 zones were classified as Class A. The rest, i.e. 34 zones, have been classified as Class C[12].

Exceeded values of the PM_{10} daily limit value occur in large cities and agglomerations as well as in smaller cities and towns and even in rural areas, especially in valleys and depressions where the topography is conducive to the accumulation of pollutants.

Due to the topography, dominant heating method and population density, exceeded values of acceptable levels for particulate matter are most frequent in cities and agglomerations located in southern and central Poland (Upper Silesian Agglomeration, Kraków Agglomeration, Rybnik-Jastrzębie Agglomeration, Łódź Agglomeration). For example, in 2017, in 9 out of 12 Polish agglomerations, the number of days on which the average daily concentration of PM_{10} exceeded 50 $\mu g/m^3$ was greater than 35, which means that the limit for this pollutant was exceeded. In three Agglomerations, i.e. Szczecin, Trójmiasto (Tri-City) and Białystok, this limit was not exceeded. The number of days with exceeded values determined on the basis of measurements at the station with the highest number of days with exceeded values was 24 each for the first two agglomerations and 13 for Białystok.

Fig. 3.5. Number of days with exceeded values of the 24-hour limit value for PM10 in 2017 at measuring stations located in agglomerations, with an exceeded values limit of 35 days (red line).



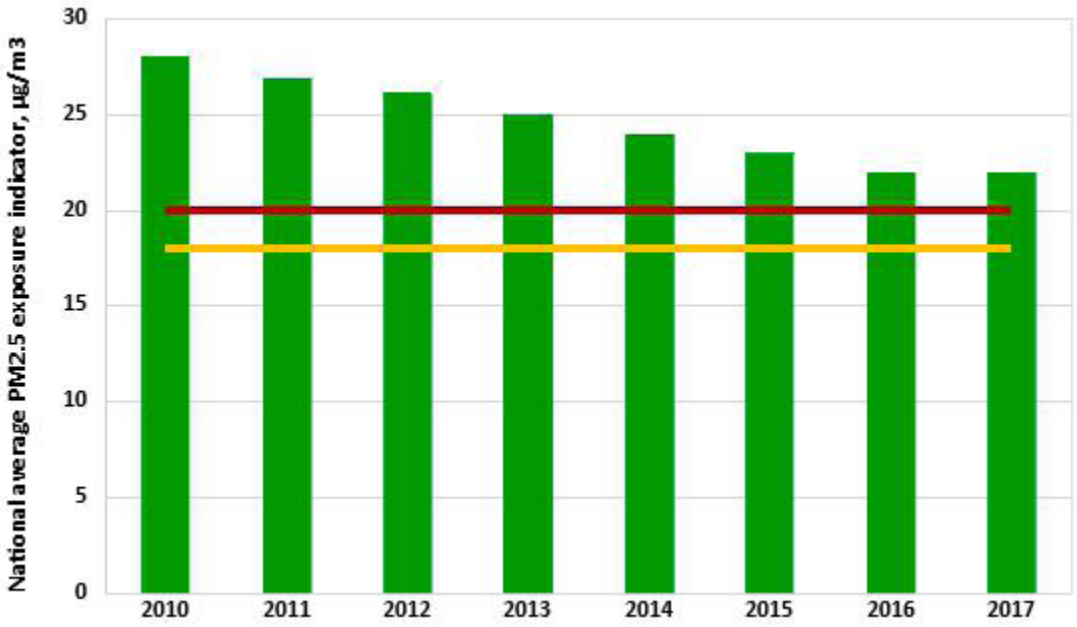
Source: GIOŚ

[12] The classification of zones is carried out in accordance with the Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air and the Regulation of the Minister of the Environment of 2 August 2012 on zones in which air quality is assessed (OJ L item 914), where for Class A, the concentration levels do not exceed the permissible level, and for Class C the concentration levels are above the permissible level. For the averaging period of: 24 hours – the limit value for PM10 in air is 50 $\mu g/m^3$ and the threshold excess frequency is 35 times in a calendar year, calendar year – limit value for PM10 in air is 40 $\mu g/m^3$. One station where the admissible level is exceeded is sufficient for the entire zone to be categorised as Class C.

The agglomerations with the highest number of days with exceeded values of the PM_{10} admissible level for particulate matter are the Kraków Agglomeration, in which in 2017 the number of days with exceeded values at measurement stations ranged from 42 (number of days at the station with the lowest number of days with exceeded values – minimum number of days with exceeded values) to 130 days with exceeded values (number of days at the station with the highest number of days with exceeded values – maximum number of days with exceeded values); Upper Silesian Agglomeration, where 67 to 102 days with exceeded values were recorded at measurement stations, and Rybnik-Jastrzębie Agglomeration, where, depending on the station, 77 to 96 days with exceeded values were recorded.

As part of the State Environmental Monitoring, measurements of $PM_{2.5}$ have been carried out since 2010 at urban background stations located in agglomerations and cities with over 100 000 inhabitants in order to determine the average exposure of the people to $PM_{2.5}$. Those measurements shall be used to calculate the national average exposure indicator and the city-specific average exposure indicator for cities with over 100 000 inhabitants and agglomerations.

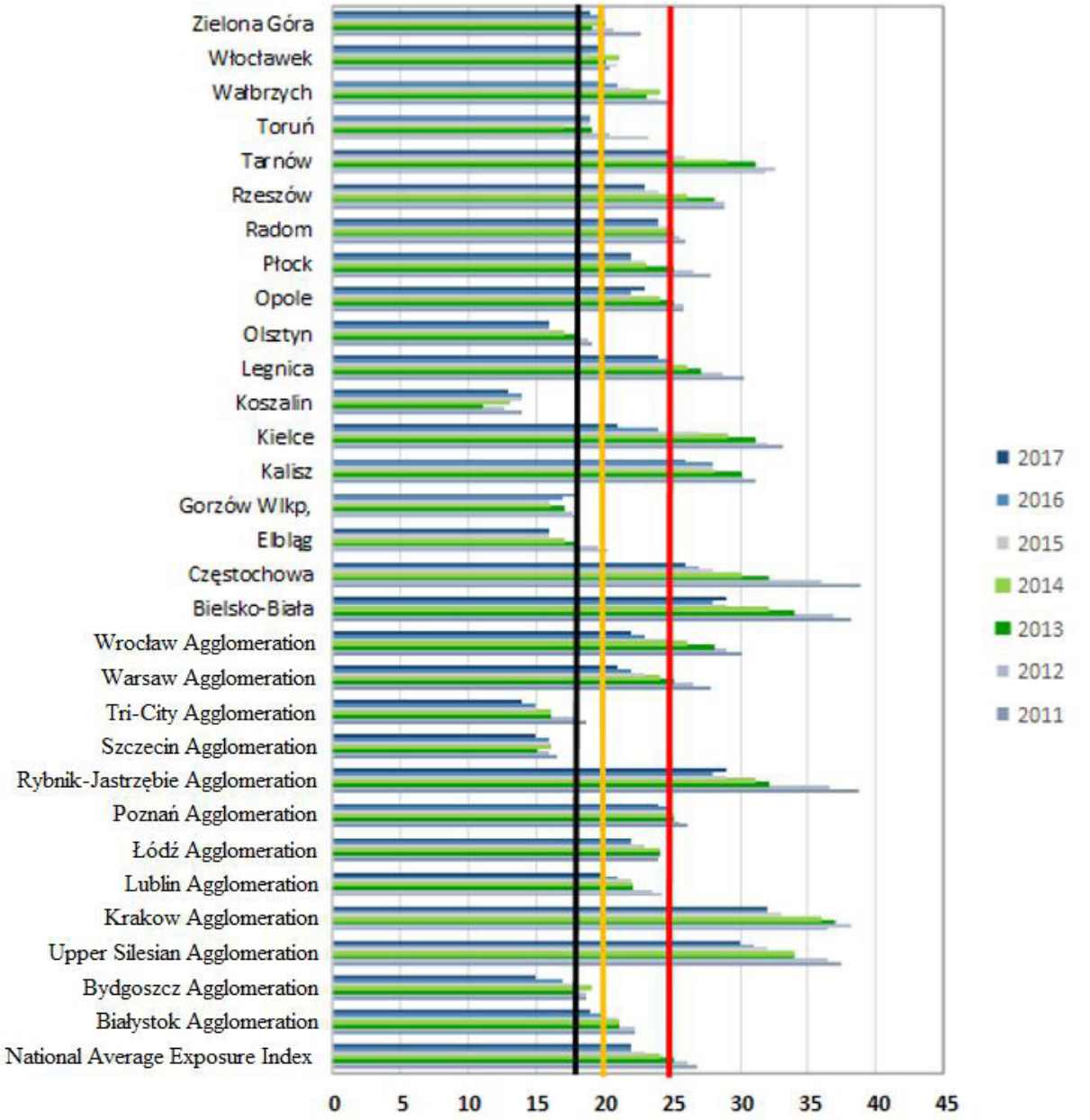
Fig. 3.6. National average exposure indicator for PM2.5 over the period 2010-2017 for: (a) the national exposure reduction target (yellow line), (b) the exposure concentration ceiling (red line).



Source: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 98.

The national average $PM_{2.5}$ exposure indicator for 2017 was 22 $\mu g/m^3$ and its value exceeded both the national $PM_{2.5}$ exposure reduction target and the exposure concentration ceiling.

Fig. 3.7. Average PM2.5 exposure indicators for the years 2011-2017 in relation to: (a) the national exposure reduction target – 2020 target for urban background areas of large cities and agglomerations (black line), (b) the exposure concentration ceiling – 2015 ceiling for urban background areas of large cities and agglomerations (yellow line), (c) the limit value – 2015 target for the entire country (red line).



Source: GIOŚ/PMŚ.

In 2017, only 4 cities (Koszalin, Gorzów Wielkopolski, Olsztyn, Elbląg) and 3 agglomerations (Szczecin, Tri-City and Bydgoszcz) achieved the national $PM_{2.5}$ exposure reduction target (18 $\mu g/m^3$). Cities: Zielona Góra, Toruń, Włocławek and Wałbrzych as well as agglomerations: Lublin and Białystok complied with the exposure concentration ceiling (20 $\mu g/m^3$).

Despite a decrease in the value of part of the average exposure indicators for 2017 compared to 2016 and 2015, in all large cities as well as central and southern

agglomerations of Poland, the average $PM_{2.5}$ exposure indicators exceed the exposure concentration ceiling (20 μg/m^3). In the Agglomerations: Upper Silesian, Rybnik-Jastrzębie, Kraków and in three cities with over 100 thousand inhabitants: Bielsko-Biała, Częstochowa and Kalisz, measurement sites for the average $PM_{2.5}$ exposure, the acceptable level (25 μg/m^3) has been exceeded.

The average exposure indicator values for rural areas of southern and south-western Poland are close to the national exposure reduction target (18 μg/m^3) – "Osieczów" station – 16 μg/m^3 and "Złoty Potok" station – 20 μg/m^3. The comparison of the calculated average exposure indicators clearly shows that the greatest potential for the reduction of $PM_{2.5}$ concentration in the air is demonstrated by cities and agglomerations from the following voivodships: Śląskie and Małopolskie, which confirms the significant impact of low emissions on the concentration of $PM_{2.5}$.

It is estimated that air pollution by $PM_{2.5}$ is responsible for more than 400 000 premature deaths in the European Union, including nearly 80% of deaths from respiratory diseases and lung cancer (EEA, 2014).

Particulate matter can also affect vegetation both directly – through leaf surface deposition and indirectly – by changing soil chemistry. Their impact reduces the resistance of plants to biotic stresses such as fungal diseases, viral diseases, pathogens and pests[13].

Polycyclic aromatic hydrocarbons (PAHs) are also important air pollutants in terms of effects on health. These compounds have proven carcinogenic and mutagenic properties. In the assessment of air quality, the indicator of PAHs air pollution level is benzo(a)pyrene determined in PM_{10} suspended particulate matter.

[13] Juda-Rezler K., Toczko B. (ed.), *Pyły drobne w atmosferze. Kompendium wiedzy o zanieczyszczeniu powietrza pyłem zawieszonym w Polsce (Particulate Matter in the Atmosphere. Suspended Dust Air Pollution in Poland – Compendium).* Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), Chief Inspectorate for Environmental Protection, Warszawa 2018, p. 2016.

Fig. 3.8. Classification of zones in Poland for benzo(a)pyrene on the basis of annual air quality assessment for 2017 (health protection).

Map legend: Klasyfikacja stref w 2017 – Zone classification in 2017; Klasa B(a)P, zdr. – Class, B(a)P, health; aglomeracje i miasta – agglomerations and cities; pozostałe strefy – other zones; Granice stref – województw – Zone borders – voivodships; Granice stref – aglomeracji i miast– Zone borders – agglomerations and cities; Źródło danych: Powiatowy Monitoring Środowiska– Data source: County Environmental Monitoring; Opracowanie: Instytut Ochrony Środowiska – Państwowy Instytut Badawczy – Elaboration: Institute of Environmental Protection – National Research Institute.
Source: Chief Inspectorate for Environmental Protection – Inspection for Environmental Protection, Assessment of the Air Quality in Zones in Poland for 2017, Warszawa, 2018, p. 85.

The assessment of air quality for the year 2017 for benzo(a)pyrene carried out as part of the State Environmental Monitoring showed that out of 46 zones subject to assessment, 3 zones were classified as Class A (Tri-City Agglomeration, cities: Olsztyn and Koszalin). As many as 43 zones were classified as Class C. Such a large number of zones categorised as Class C is associated with a very low threshold value defined for benzo(a)pyrene[14] which is difficult to meet and the structure of fuel consumption in households. The source of air pollution with benzo(a)pyrene is incomplete combustion of fuels. Therefore, the highest concentrations of benzo(a)pyrene and other polycyclic aromatic hydrocarbons occur in the autumn and winter in densely developed areas where houses or apartments are heated individually with coal or wood.

[14] The classification of zones is carried out in accordance with the Regulation of the Minister of the Environment of 24 August 2012 on the levels of certain substances in the air, where for Class A, the concentration levels do not exceed the permissible level, and for Class C the concentration levels are above the permissible level. While, for the averaging period of one calendar year, the target level for benzo(a)pyrene in air shall be 1 ng/m^3.

Ozone

Ozone is a powerful photochemical oxidant that can have a significant impact on human health. "Increased concentrations of ozone in the air above the legal limits may lead to inflammatory reactions of the eyes or respiratory tract diseases, including exacerbation of asthma symptoms and decreased lung function"[15]. It can also lead to exacerbating cardiovascular diseases. Ozone can cause drowsiness, headache and fatigue, as well as a drop-in blood pressure[16]. In addition, increased ozone concentrations destroy vegetation and cause accelerated corrosion of materials.

"Tropospheric ozone is a secondary pollutant and is produced by photochemical reactions of nitrogen oxides and volatile organic compounds"[17]. In addition to precursor emissions, its concentration is also significantly influenced by meteorological conditions. "The formation of ozone is favoured by sunny weather, high air temperatures. Ozone has the ability to be transported over long distances, therefore its concentrations in Poland depend to a large extent on its concentration in the air masses flowing into Poland – mainly from southern and south-western Europe"[18].

Fig. 3.9. Classification of zones in Poland for O3 on the basis of air quality assessment for 2017 (target level, health protection). A and C refer to the classification of zones for human health impact: zone A – areas where ozone concentrations did not exceed the target level; zone C – areas where ozone concentrations exceeded the target level.

Map legend: Klasyfikacja stref w 2017 – Zone classification in 2017; Klasa, poziom docelowy, O3, zdr. – Class, O3 target level, health; aglomeracje i miasta – agglomerations and cities; pozostałe strefy – other zones; Granice stref – województw – Zone borders – voivodships; Granice stref – aglomeracji i miast – Zone borders – agglomerations and cities; Źródło danych: Powiatowy Monitoring Środowiska– Data source: County Environmental Monitoring; Opracowanie: Instytut Ochrony Środowiska – Państwowy Instytut Badawczy – Elaboration: Institute of Environmental Protection – National Research Institute Source: Chief Inspectorate for Environmental Protection– Inspection for Environmental Protection, Assessment of the Air Quality in Zones in Poland for 2017, Warszawa, 2018, p. 44.

[15] GIOŚ, *What is Ozone and How Does It Affect Life on Earth?* , http://powietrze.gios.gov.pl/ (accessed: 4.01.2019).
[16] EEA, *Every Breath we Take. Improving Air Quality in Europe. Signals, European Environment Agency,* Copenhagen, 2013.
[17] GIOŚ, *What is Ozone…*, ibid.
[18] Ibid.

A Class C designation does not mean that air quality does not meet the criteria throughout the entire zone. Nor does it mean that intensive efforts are required to improve air quality across the entire zone. It means, however, the need to take appropriate action in relation to selected areas in the zone (usually of limited range).

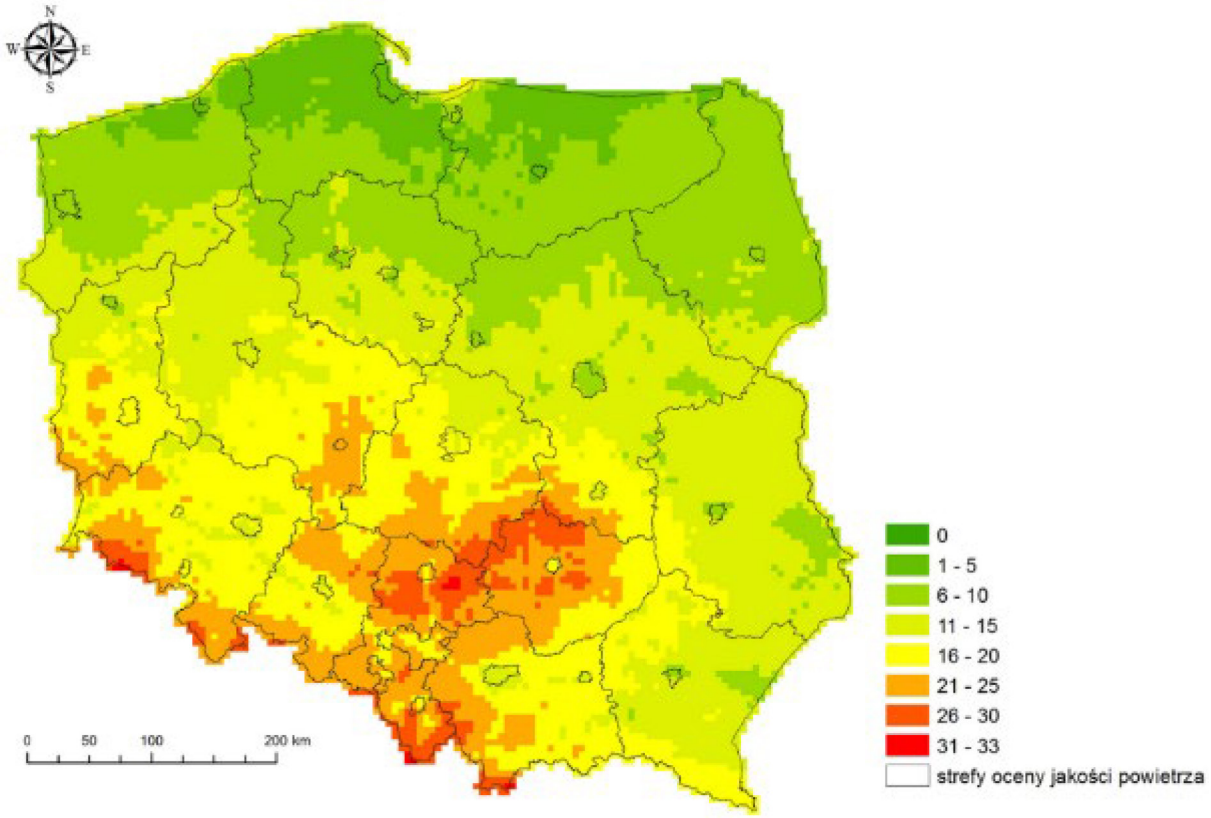
In the annual assessment of air quality for the year 2017 concerning ozone, carried out within the framework of the State Environmental Monitoring, in terms of meeting the target level set for health protection, the classification was based on the number of days with an 8-hour concentration exceeding 120 μg/m^3 averaged over the period of 1-3 years. In this assessment, only within 6 zones in the country (out of 46 zones in total) there were areas where the target level in terms of health protection was exceeded.

The classification of zones for ozone in relation to the target level shall take into account concentrations between one and three years (subject to available measurement results), that is to say concentrations in 2015, 2016 and 2017. The year 2015 was characterised by a relatively frequent occurrence of unfavourable meteorological conditions favourable for the formation of ozone in the atmospheric air. In addition to ozone precursor emissions, this was the main reason for frequently exceeding the target ozone concentration level. In 2016 and 2017, the frequency and intensity of occurrence of meteorological conditions favourable for the formation of ozone in the atmosphere were lower than in 2015.

In the annual air quality assessment for 2017, the level of the long-term health objective (maximum 8-hour concentration of 120 μg/m^3) was exceeded in 42 zones. In the remaining 4 zones (in the Szczecin Agglomeration, cities: Toruń, Olsztyn and Elbląg), this level was met.

The main reason for exceeding the long-term target for ozone is the impact of natural emission sources or natural phenomena not related to human activities and the occurrence of meteorological conditions favourable to the formation of ozone in the atmosphere. Additional causes are emissions of ozone precursors in urban areas and air pollution inflows from outside the country (transboundary nature of pollution).

Fig. 3.10. Average number of days with exceeded values of the 8-hour moving average of the target concentration of ozone (120 µg/m3) from the period 2015-2017 for the area of Poland; modelling results at the resolution of 5 km.



Map legend: strefy oceny jakości powietrza – air quality assessment zones.
Source: GIOŚ, State of the Environment in Poland. Report 2018, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 89.

The current system of international cooperation for the protection of the ozone layer is based on the Vienna Convention for the Protection of the Ozone Layer, concluded in Vienna on 22 March 1985. The Convention was the first successful attempt to establish a framework and principles for joint action by different countries for the protection of the ozone layer. The Republic of Poland acceded to the Vienna Convention on 13 July 1990.

The Montreal Protocol on Substances that Deplete the Ozone Layer was drawn up on 16 September 1987 as a follow-up to the Convention concluded two years prior. The signatories undertook to take action to save the ozone layer. In the case of Poland, the Protocol entered into force on 11 October 1990. On 1 January 2019, the 5th amendments to the Montreal Protocol – the Kigali Amendments – entered into force. In order to protect the health of the population and the natural environment in Poland, a number of pollution reduction instruments have been established to help achieve good air quality. The most important of these are permits to emit gases and particulate matters into the air, integrated permits, emission standards for plants, fuel quality standards and air protection programmes in areas where air quality standards have not been met. Furthermore, the energy consumption in the Polish economy is gradually decreasing.

On 9 September 2015, the National Air Protection Programme was adopted, the implementation of which is to enable the achievement of permissible levels of particulate matter and other harmful substances in the air resulting from the binding provisions of law in the shortest possible time. It is worth noting that in order to strengthen the effectiveness of activities resulting from air protection programmes and short-term action plans, local governments have received an additional tool under the amendment of the Environmental Protection Law (the so-called Anti-Smog Law) of 10 September 2015. (OJ L, item 1593). Pursuant to Article 96 of the Act of 27 April 2001 – Environmental Protection Law (OJ L of 2018, item 799, as amended), the Voivodship Assembly may, by way of a resolution, impose restrictions or prohibitions on the operation of plants involving the combustion of fuels in order to prevent a negative impact on human health or the environment. At the same time, the resolution specifies the types or quality of fuels allowed or prohibited for use. Due to the unsatisfactory condition of air quality in Poland, at the request of the Prime Minister Beata Szydło, the Economic Committee of the Council of Ministers on 25 April 2017 presented recommendations to the Council of Ministers – the "Clean Air" programme. It should be emphasised that measures to improve air quality were also included in other key documents, including the Strategy for Responsible Development – Clean Air Project, as well as in the Electromobility Development Plan – Energy for the Future. An important step in this process is the publication of the Regulation of the Minister of Development and Finance of 1 August 2017 on requirements for solid fuel boilers (OJ L, item 1690, as amended). The Regulation requires the entities responsible for marketing solid fuel boilers with a rated thermal input of 500 kW or less to apply the design requirements established to ensure that the emission limit values for carbon monoxide, organic gaseous compounds and particulate matter laid down in the Regulation are complied with. In addition, it prohibits the use of "failure grates" in the construction of boilers.

Land surface, including soils*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland. Report 2014, (GIOŚ 2014).

Soil is an important and usually non-renewable natural resource and is defined as the superficial, biologically active layer of the Earth's crust resulting from the soil-forming process of a geological formation as a result of weathering processes. The soil consists of mineral particles, organic matter, water, air and living organisms. It is one of the main elements of the natural environment and the habitat of a large number of living organisms.

In the Polish legal system, soil protection is related to a broader concept of land surface protection and includes also protection against pollution and other forms of degradation, including ground layers underneath the soil. According to the provisions of the Act of 27 April 2001 on Environmental Protection Law, the surface of the Earth is defined as the relief of the land, soil and groundwater, whereby soil means the upper layer of the lithosphere, composed of mineral parts, organic matter, soil water, soil air and organisms, including the upper layer of the soil and subsoil, land – means the upper layer of the lithosphere, located below the soil, to the depth of human influence, while groundwater – means groundwater within the meaning of Article 16(68) of the Act of 20 July 2017 on Water Law, which is located in the saturation zone and is in direct contact with the soil or subsoil.

In the traditional approach, the importance of soils was limited to their production functions in agriculture and forestry. In fact, in addition to providing us with food, biomass and raw materials, soil has many other environmental, economic, social and cultural functions.

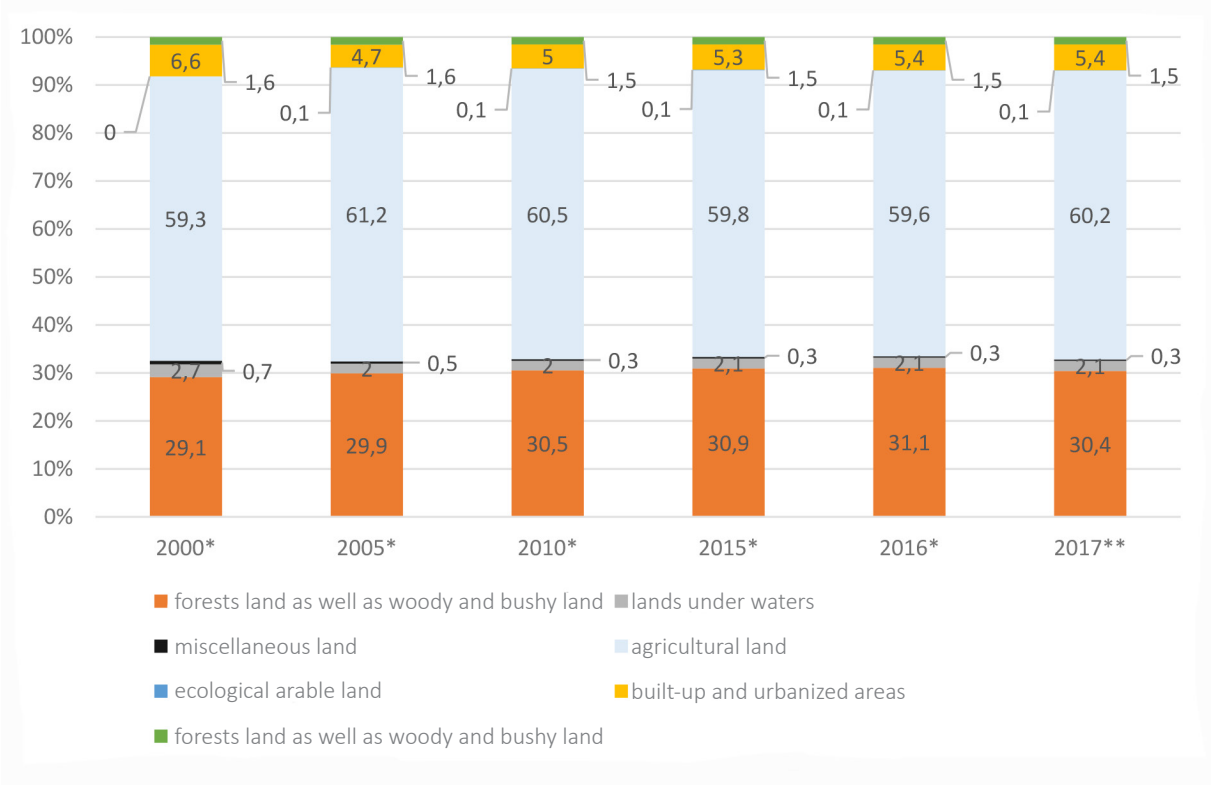
Soil is the basis for the development of life and biodiversity. It plays an important role in storing, filtering and transforming nutrients, substances and water. It is a carbon sink. The role of soil in landscape design and protection of geological, geomorphological and archaeological heritage is also important.

The land surface, including soil, provides space and resources for human life and economic development. It is necessary to carry out various production processes (e.g. cultivation of plants, extraction of raw materials) and it is also a place of various social and economic activities (e.g. construction of road, industrial, service and housing infrastructure).

Soil resources should be used in such a way as to ensure that they are in the best possible condition for future generations.

The structure of land use in Poland (according to the Statistics Poland) is determined by agricultural and forestry functions, constituting the largest share in the country's area (about 90%), where forests, including tree and shrub groups, constitute about 30%. Urbanised and developed areas take up about 5% of the country's area, and among them the dominant group are areas with a transport function. Of the remaining area, about 4% is underwater land (2%), ecological land (0.1%), wasteland (1.5%) and miscellaneous land (0.3%)[1].

Fig. 4.1. Structure of land use (%).



Source: Own elaboration based on the data from Statistics Poland, Environmental Protection 2017, p. 47 (for the years 2000-2016) and Environmental Protection 2018, p. 35 (for the year 2017).

[1] Statistics Poland, *Environmental Protection 2018*, p. 35.

Over the last two decades, there have been no significant changes in the land use structure in Poland. Whereas significant importance for soil protection should be attached to land use planning principles affecting the re-use of brownfield sites in order to prevent soil being excluded from agricultural and forestry use.

Soil is the basic production resource of agriculture, so its good condition in Poland represents a potential for the production of high-quality food. In Poland there are mainly levisols, brown, podsolic and rusty soils, mainly from postglacial formations. The soil cover in Poland is characterised by a mosaic-like structure with the predominance of soils of the medium quality class (IVa and IVb) – 35.2% and poor and very poor soils (V and VI) – 37.3%. Agricultural land of high suitability for agricultural production are relatively rare: soils of Classes I-III constitutes about 25% of the total area and therefore should be subject to special protection.

In addition to very slow soil formation processes, they are also subject to degradation processes (chemical, physical and biological). Human activity modifies the properties of soils in many directions, which affects their functions. The degradation processes include the following phenomena: pollution, erosion, organic matter decline, thickening, salinisation, acidification, sealing. An important result of these processes is loss of soil fertility, reduction of soil biodiversity, lower water retention capacity, disturbance of the gas and nutrient cycle and slower decomposition of pollutants. Among the identified numerous threats to soils, the issue of soil pollution and the issue of organic matter decline and erosion seem to have the highest priority from the point of view of environmental protection in Poland. Soil pollution should be considered as a hazard of the highest level, as it affects human health and the environment regardless of the area affected. The risk of soil erosion is also important in terms of nutrient displacement and water pollution, as well as the reduction of soil fertility. The need to counteract the decline in soil organic matter is linked to the need to maintain fertility. In addition, it is also important that humus is an important part of the lithosphere carbon reserves and therefore limiting organic matter decline in soils is important to prevent climate change. At present, the poorly perceived phenomenon of sealing may become a problem in the future.

Pollution of the soil surface shall be assessed on the basis of the exceeding the acceptable levels of substances causing risk in the soil or in the land. The tolerable content of a substance constituting a risk is considered to be that below which no function of the land surface is significantly impaired.

Pollutants have a toxic effect on soil organisms, potentially disrupting habitat functions and limiting biodiversity. The transport of pollutants to water and their absorption by plants may cause health hazards as a result of their penetration into the food chain. On the basis of the assessment of the quality of agricultural products carried out by the competent authorities, it can be concluded that they confirm no significantly exceeded values of the maximum residue levels of various types of organic compounds.

The economic sectors affecting soil pollution include mainly waste management, industry, transport, energy production, mining and agriculture. Soil pollution in Poland is strongly differentiated due to different intensity of industrial production and its nature.

Within the framework of the State Environmental Monitoring in the field of land and soil quality, research is conducted in order to observe changes in a wide range

of chemical properties of soils used for agriculture, occurring under the influence of agricultural and non-agricultural human activity. Monitoring of the chemistry of arable soils in Poland has been carried out since 1995. At 5-year intervals, soil samples are taken and analysed from permanent monitoring stations located throughout the country. The summary of the data obtained in the fifth sampling edition shows that in 2015, for most of the characteristics describing soil properties and quality, there were no significant changes in 20 years compared to the baseline situation. The analysis of data for 2015 with the use of pollution assessment criteria specified in binding regulations indicates that 98% of arable soils in agricultural areas in Poland are not contaminated with trace elements. Furthermore, in the analysis of trace elements, no trend of accumulation in the surface layer of soils in the case of areas used for agricultural purposes was observed.

Also, the results of measurements of the content of polycyclic aromatic hydrocarbons in individual years do not indicate an increase in the content of the sum of these compounds over the last 20 years. The PAHs content in soils within agricultural areas away from emission sources is generally low. The content of other organic pollutants in soils has so far, as in other countries, been measured to a much lesser extent and the information is limited. In industrial and urbanised areas, the highest PAHs contents are recorded in the vicinity of coking plants and petrochemical plants, as well as in areas related to road transport.

There is currently no consistent information regarding local land and soil pollution in a single system, both at regional level and for the entire country. The General Director for Environmental Protection maintains a register of historical pollution of land surface and a register of environmental damage (including environmental damage to the surface). The register of historical pollution of the land surface has not yet reached its full functionality, as the process of identification of potential historical pollution is in progress and is carried out by starostas (county administrators). The lists drawn up by them will be incorporated in the existing registry.

An important indicator of soil quality is the content of organic matter. It determines physicochemical properties such as sorption and buffer capacity, soil retention properties and biological processes occurring in the soil. High humus content in soils is a factor stabilising the structure, reducing susceptibility to compaction and degradation as a result of water and wind erosion. Soils, are the second largest carbon sink after the oceans, having a significant impact on the carbon content of the atmosphere. Forest soils play a special role in this respect. Therefore, soil, as a carbon sink, deserves special protection because of its role in limiting climate change.

Significant reasons leading to a decrease in the content of organic matter are the deterioration of water conditions of soils (dryness, ineffective irrigation and drainage systems), introduction of simplified crop rotations (e.g. cereal monocultures), limitation of organic fertilisation. A decrease in the organic matter content leads to negative physical, chemical and biological changes in the soil and a decrease in soil fertility, biodiversity decline and localised erosion.

According to the data obtained within the framework of the State Environmental Monitoring, in 2015 the average humus content in the tested arable soils amounted to 1.94% with the median of 1.68% and did not differ significantly from the results of the previous measurement cycles. Within the entire group of analysed soils, the majority were classified in the range of average content (1-2%), their share amounted to 62.9%.

With the exception of 2005, this share has remained relatively stable since 1995[2].

The quality of soil is also affected by its pH, which is one of the most important factors determining the course of many soil processes and has a significant impact on the formation of soil capability and fertility. Acidic soils are predominant in Poland. The share of acidic and very acidic soils amounts to approximately 50%. Acidification is mainly due to natural conditions, such as the mineralogical composition of the soil and the type of parent rock, as well as the content and transformation of organic matter. The anthropogenic factors of soil acidification include the use of nitrogen fertilisers, mainly in the form of ammonium sulphate and to a lesser extent urea and ammonium nitrate, as well as industrial emission of acidogenic air pollutants (SO_2, NO_X, NH_3), originating from the combustion of minerals, most frequently coal and petroleum derivatives.

Soil protection from agricultural pressure is linked to the rational use of fertilisers, minerals and crop protection products, as well as the introduction of production methods in agriculture which comply with the general principles of integrated pest management.

The effect of fertilisation is optimised through the continuous improvement of fertilisation consulting, including the introduction of better soil tests and electronic advice systems that take into account not only the production aspects of fertilisation but also its environmental effects. Optimization of fertilization is possible due to the functioning of the agrochemical system of agricultural services in Poland, implemented by the National Chemical and Agricultural Station and 17 district chemical and agricultural stations carrying out, among others, soil fertility tests, and consulting fertilisation plans. The fertilisation consulting system is also widely implemented by the Agricultural Advisory Centres, which provide training in the scope of fertilisation (nutrient balancing, preparing fertilisation plans) and offer direct consulting services for farmers. Scientific institutions, including the Institute of Soil Science and Plant Cultivation in Puławy, which provides specialist computer software – Naw Sald and Macrobil – to help farmers optimise fertilisation, also contribute to the promotion of proper nutrient balancing and sustainable fertilisation methods.

One of the conditions for producing safe food is to prevent risks associated with the use of crop protection products. This objective is made possible by the mandatory application of the principles of integrated pest management, introduced on 1 January 2014. Monitoring the progress in the application of integrated pest management and supporting activities conducive to limiting the use of crop protection products is possible due to the implementation of the National Action Plan (KPD) for limiting the risk related to the use of crop protection products.

Erosion is also an important process of soil degradation. It involves soil particles removal by water or wind and transporting them to sedimentation locations. The factors causing erosion can be divided into two groups, i.e. natural factors (topography, soil, precipitation, wind and vegetation) and anthropogenic factors (soil/land use structure, farming system).

The direct consequence of erosion is the disruption of ecological, technical, economic and cultural functions of soil. Erosion exacerbated by anthropogenic factors is a socially and economically undesirable phenomenon, causing water pollution,

[2] Report from Stage 3 of the contract: *Monitoring of Arable Soil Chemistry in Poland in the Years 2015-2017*, Institute of Soil Science and Plant Cultivation in Puławy – National Research Institute, Puławy, 2017, p. 39.

decline of agricultural production, permanent land degradation and destruction of infrastructure.

In Poland, potential water erosion occurs in about 29% of the country's area, with medium to very strong erosion in about 13% of the area and wind erosion in 28.2% of the area.

Sealing is the most visible form of soil transformation by man and, at the same time, the most far-reaching form of soil degradation, regardless of the extent of the economic benefits it provides. Soil sealing is defined as the separation of soil from other ecosystem elements such as biosphere, atmosphere, hydrosphere and anthroposphere by artificial layers made of wholly or partially impermeable material. In 2016, an approx. 13.7% increase in the area of developed and urbanised land was observed in Poland compared to the data for 2005, while the total area of developed and urbanised land in Poland only amounts to approx. 5%. The initiated upward trend is therefore only visible on a local scale.

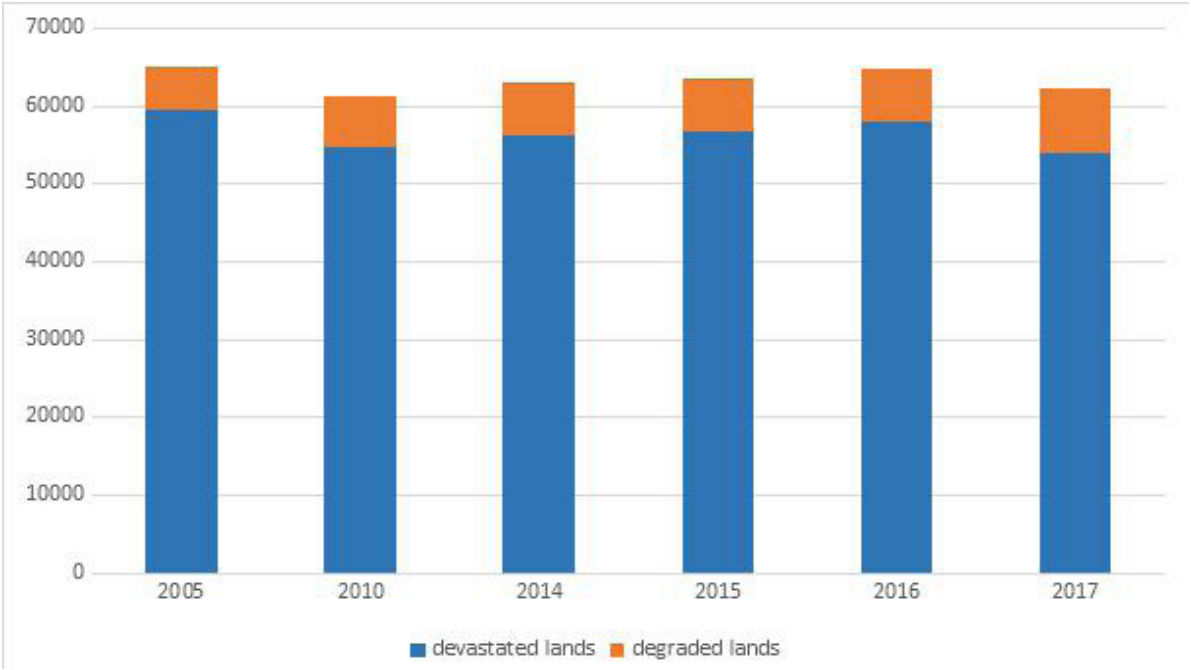
The causative factor of soil sealing is a strong dependence of economic development on soil loss and transformation of soil functions. The list of areas of socioeconomic life benefiting from sealing includes transport and communication; housing; healthcare; security; social development; physical and information technology environments; use of natural resources; provision of goods and services; communication; urban and spatial planning.

The issues of transforming natural topography are not without significance for the protection of land surface. Surface transformation is an unfavourable change in its structure and properties, as well as a disturbance in water conditions in a given area. Very often, the cause of morphological degradation are locations associated with the mining of minerals now and in the past (the so-called workings and sinks).

Data regarding devastated and degraded land requiring rehabilitation and management pertain to land that has lost all its value in use (devastated land) and land whose agricultural or forestry value has decreased as a result of natural or environmental deterioration or changes in the environment and industrial activity, as well as incorrect agricultural activity (degraded land).

Devastated and degraded lands were inventoried on the basis of criteria and principles specified in the regulations on the protection of agricultural and forestry land. Therefore, it is worth noting that these regulations are correctly applied to the rehabilitation of land after mining activities, and do not apply to contaminated land. Changes in the area of devastated and degraded lands are presented in the chart below, prepared on the basis of data from Statistics Poland.

Fig. 4.2. Devastated and degraded lands (ha).



Source: own elaboration based on Statistics Poland – Local Data Bank, State and Protection of the Environment.

In order to ensure effective protection and sustainable use of soils, all activities in this respect should be based on principles warranting prevention of soil degradation and maintenance of its functions, and in case of occurrence of these processes, restoration of proper functions to degraded soils, taking into account the current and planned use of soils.

Environmental hazards*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland, Report 2014 (GIOŚ 2014).

Biosafety, including genetically modified organisms

The use of the products of modern biotechnology in many areas of everyday life can pose a threat to the both human health and the environment. The task of the government administration is primarily to create conditions for conducting activities involving genetically modified organisms.

The development and possibility of application of biotechnological methods in agriculture and food production is one way of promoting modern methods for these sectors. The marketing of products obtained by biotechnological methods shall be preceded by their production in processes of contained use and testing within the framework of their deliberate release into the environment. Among other functions, this is to guarantee the high quality of these products. The use of biotechnological processes in various areas of life should serve the needs of society while ensuring the safety of the natural environment. The use of genetically modified organisms (GMOs) must be preceded by the authorisation of such organisms on the basis of an advanced procedure and analysis of risk through the use of a genetically modified organism for human health, animal health and the environment. The pre-marketing decision process for GMO products is based on scientific expertise and a reliable risk assessment.

The fundamental role that the law should play in the field of biotechnology is to protect human life, health and the environment. The principle of protection of human health and the environment was the guiding principle of both the authors of European

law on genetically modified organisms and the authors of international regulations on the issue of transboundary movements of living modified organisms (LMOs).

The basic legal acts of the European Union regulating the issues related to genetically modified organisms are:

- Directive 2009/41/EC of the European Parliament and of the Council of 6 May 2009 on the contained use of genetically modified micro-organisms (OJ L 125 of 21.05.2009, p. 75), which lays down common measures for the contained use of genetically modified micro-organisms with the aim of protecting human health and the environment,
- Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC (OJ L 106 of 17.4.2001, p. 1, as amended); Polish translation section 15, vol. 6, p. 77, as amended). This Directive regulates the deliberate release of GMOs into the environment for purposes other than placing on the market (experimental purposes) and the marketing of GMO products. It implements the obligation to take into account the cumulative effects of a GMO on human health and the environment.

The issue of transboundary movements of genetically modified organisms in European Union legislation should be considered in two aspects. On the one hand, it concerns the movement of genetically modified organisms between the territories of the Member States of the Community, and on the other – it concerns the movement of GMOs between the Community (Community countries) and third countries. The issue of intra-Community movements of GMOs is regulated by Directive 2001/18/EC[1]. In accordance with the provisions of this Directive, any deliberate release of GMOs into the environment, as well as the marketing of GMOs as or within products, may be carried out after a decision has been taken to authorise such activities. At the same time, all Member States of the Community have the opportunity to express their views and reservations on the proposals for the activities in question.

A particularly important instrument of international law applicable to the transboundary movement, transit, transfer and use of all living modified organisms that may have a negative impact on the conservation and sustainable use of biological diversity, including threats to human health, is the Cartagena Protocol on Biosafety to the Convention on Biological Diversity. The Protocol shall not apply to transboundary movements of living modified organisms which are pharmaceuticals for human consumption covered by other relevant international agreements or activities of international organisations. The Republic of Poland ratified this document on 26 November 2003. It entered into force on 9 March 2004 and, as a result, Poland became a Party to this Agreement from that date.

The basic legal act regulating the issues of genetically modified organisms and micro-organisms is the Act of 22 June 2001 on genetically modified micro-organisms and organisms (OJ L of 2019, item 706). The material scope of this law includes:

- the contained use of micro-organisms and genetically modified organisms (GMMs and GMOs) and the establishment of genetic engineering facilities,
- the deliberate release into the environment of GMOs for purposes other than placing on the market,

[1] Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC.

- the marketing of GMO products,
- the competence of government administration bodies in matters relating to GMOs.

The aim of this act is to ensure biological safety and protection of the environment and human health in relation to activities involving genetically modified organisms. This law transposes European legislation and the scope of the Cartagena Protocol on Biosafety.

Acoustic climate

Noise shall mean sounds at frequencies from 16 Hz to 16 000 Hz[2].

Noise is a stressor and a significant public health risk[3]. Long-term exposure to noise causes: irritability, sleep disorders, impaired perception and performance of generally any activity, contributes to the development of psychosomatic diseases.

The sources of environmental noise are roads, railway lines, tramways, airports and airplanes, power lines, industry, services, commerce, entertainment and any other activities related to the emission of acoustic energy.

Exposure to noise in Poland as well as in Europe generally shows an increasing trend, particularly in urban areas. The increasing exposure to noise at night is a worrying phenomenon.

According to the World Health Organisation (WHO) and the Joint Research Centre (JRC) of the European Commission[4], every year, traffic-related noise causes a loss of a total of more than 1 million years of healthy life by the citizens in the Member States of the European Union and in other countries of Western Europe[5].

The assessment of the acoustic climate of the environment in Poland is carried out within the framework of the State Environmental Monitoring on the basis of acoustic maps prepared in accordance with the Directive 2002/49/EC of the European Parliament and of the Council[6] every five years, starting from 2007. Furthermore, in the areas not covered by the acoustic mapping, the assessment of the acoustic climate of the environment is carried out by Voivodship Inspectorates for Environmental Protection on the basis of annual planned and intervention noise measurements and on the basis of noise measurements carried out by the legally obliged entities.

At present, acoustic maps are made with reference to:

- cities with over 100 000 inhabitants,
- major roads (i.e. roads with over 3 million vehicles of traffic volume annually),
- main railway lines (i.e. railway lines with over 30 000 trains of traffic volume annually),
- major airports (i.e. civil airports with over 50 000 annual take-off or landing operations – excluding those for training purposes).

[2] Pursuant to Article 3(5) of the Act of 27 April 2001 – Environmental Protection Law.

[3] Chief Inspectorate for Environmental Protection, *Loud Music and the Activities of the Inspection for Environmental Protection in Warszawa*, http://www.gios.gov.pl/ (accessed: 07.01.2019).

[4] World Health Organization – Joint Research Centre (WHO – JRC), 2011, *Burden of Disease from Environmental Noise,* http://www.euro.who.int/ (accessed: 14.02.2019).

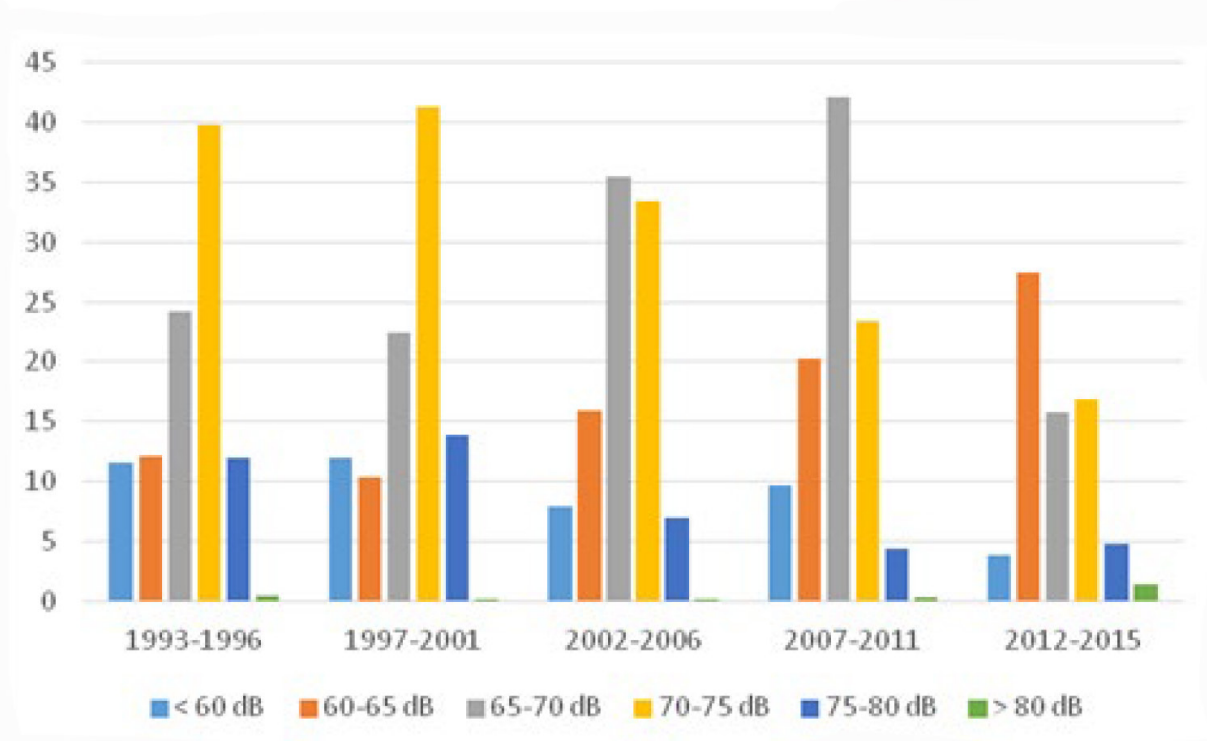
[5] Ibid.

[6] 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 (OJ EC L 189 of 18.7.2002, p. 12, as amended); Polish translation section 15, vol. 7, p. 101, as amended).

Road noise

Road noise is the source of the greatest negative and burdensome acoustic impact on the environment both in urban areas, where the number of people exposed to this noise is still increasing, and in areas outside agglomerations. Road noise is particularly troublesome at night, as it causes significant sleep disturbance. At the same time, it should be pointed out that there is an increase in the traffic volume on the roads, as well as the construction of new roads.

Fig. 5.1. Percentage distribution of short-term road noise in the light of the 1993-2015 survey.

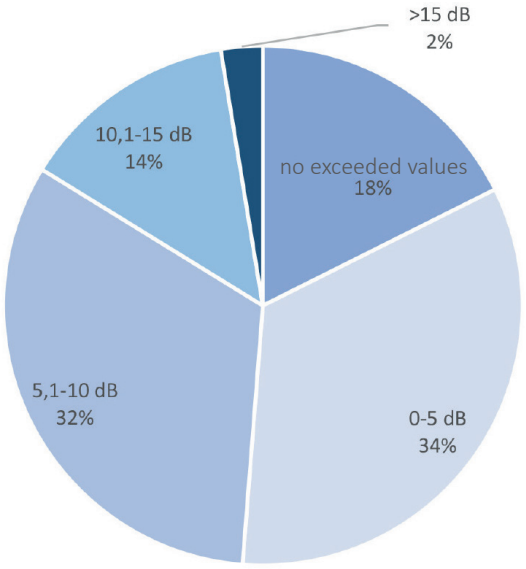


Source: own elaboration based on data from the "Ehałas" database (GIOŚ/PMŚ).

Comparing successive periods of noise monitoring studies, it should be remembered that since 2007 the Voivodship Inspectorate for Environmental Protection has been carrying out measurements at roads not covered by the process of preparing acoustic maps, i.e. at roads with fewer than 3 million vehicles per year. However, as the measurements of the WIOŚ show, roads with lower traffic intensity also exceed the permissible sound levels in areas protected from an acoustic point of view.

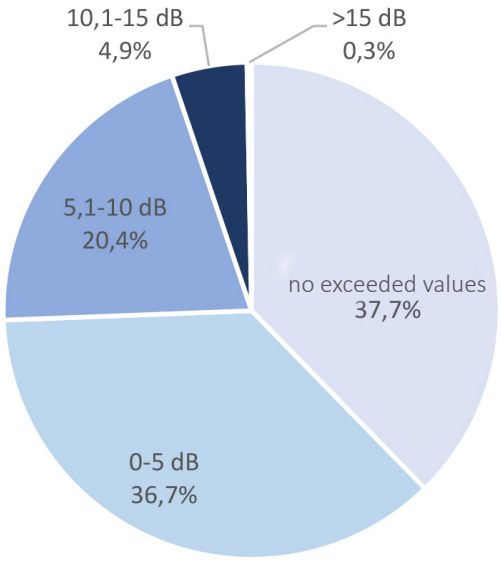
In total, in the years 2012-2015, the Voivodship Inspectorates for Environmental Protection in Poland took measurements of long-term noise in areas subject to acoustic protection at 698 measurement locations.

Fig. 5.2. Percentage of long-term road traffic noise measurement points (expressed as the LAeqN index7) for individual classes of exceeding permissible sound levels in 2012-2016.



Source: own elaboration based on: GIOŚ, Summary of Noise Measurements in 2012-2016, p. 9, http://www.gios.gov.pl/ (accessed: 15.02.2019).

Fig. 5.3 Percentage of long-term road traffic noise measurement points (expressed as the LAeqD index8) for individual classes of exceeding permissible sound levels in 2012-2016.



Source: own elaboration based on: GIOŚ, Summary of Noise Measurements in 2012-2016, p. 9, http://www.gios.gov.pl/ (accessed: 15.02.2019)

[7] L_{AeqN} is a long-term average A sound level expressed in decibels (dB) over all night periods of the year (defined as the time interval from 10 p.m. to 6 a.m.).

[8] L_{AeqD} is a long-term average A sound level expressed in decibels (dB) over all day periods of the year (defined as the time interval from 6 a.m. to 10 p.m.).

The noise level ranges comply with the Regulation of the Minister of Environment of 1 October 2007 on the detailed scope of data included in acoustic maps and their arrangement and manner of presentation (OJ L, item 1340, as amended).

Tab. 5.1. Population of cities with over 100,000 inhabitants exposed to road noise, expressed as the LN index on the basis of acoustic maps prepared in the second round of mapping (year 2017)[9].

L_N 50–54 dB	L_N 55–59 dB	L_N 60–64 dB	L_N 65–69 dB	L_N over 70 Db
1 510 600	**862 000**	**313 530**	**64 500**	**19 600**
Total: 2,770,230				

Source: own elaboration based on: EIONET, Strategic Noise Maps, https://cdr.eionet.europa.eu/ (accessed: 05.03.2019).

Data from acoustic maps prepared within the framework of the second round of mapping (2012) indicate that the **exposure of the population in Poland to road noise** is a significant problem. Out of over 10 million people living in cities with more than 100 000 inhabitants, nearly 4 million people are exposed to noise at night.

The population exposed to road noise at night in areas for which there is no obligation to make acoustic maps is just over 23 000. This value was calculated in a simplified way on the basis of monitoring tests of road noise carried out by the Voivodship Inspectorates for Environmental Protection. For this calculation, the number of single-family buildings and the number of apartments in multi-family buildings exposed to noise were taken into account in the specific exceeded value ranges, assuming that, on average, 3 individuals live in a single-family house and 2 individuals live in a flat.

Industrial noise

According to the environmental protection regulations, its source are not only industrial plants or service providers, but also all activities (apart from the operation of roads, railway lines, airports, power lines) causing noise.

Measurements of industrial noise are usually performed as interventions – in response to complaints of residents regarding burdensome activities. The percentage of businesses exceeding noise limits has been on a downward trend over the last twenty years. In the 2002-2006 measurement cycle, 55% of industrial facilities surveyed in the entire country exceeded the permissible noise levels, and in the 2007-2011 cycle – 45% of facilities. In the last monitoring cycle (2012-2015) this percentage is 34[10].

Railway noise

The impact of railway noise on the environment is systematically decreasing due to the modernisation of railway lines and the application of technical solutions more friendly to the acoustic environment (contactless rails, anti-vibration mats, type and condition of brakes), a decrease in the number of trains, as well as the decommissioning

[9] The table does not include the number of inhabitants subject to exceeded values of 40-44 and 45-49 dB due to lack of data in these categories (despite their mandatory reporting).

[10] Chief Inspectorate for Environmental Protection, *Noise Monitoring. Summary*, http://www.gios.gov.pl/ (accessed: 07.01.2019).

of some railway lines. Since the 1990s, we have been observing a systematic decrease in the length of railway lines in operation and a decrease in the number of transported passengers and cargo[11].

Air traffic noise

The importance of air transport has increased significantly in recent years. Air traffic is intensifying, with more and more passengers and freight carriers using it. At the same time, the development of regional airports is being observed. Air traffic noise ranges are high due to the high noise levels during take-off and landing operations of all types of aircraft. It should be pointed out that there is a lack of effective environmental protection against air traffic noise. Measurements taken as part of the continuous noise monitoring around airports show that air traffic does not cause significant nuisance in residential areas for the entire year, but there are periods during the year when such nuisance may be significant within one day. The results of the assessment of air traffic noise indicate that exceeded values of acceptable sound levels outside the restricted use areas, i.e. exposed to excessive noise, are only found at individual points. It is important that airport operators, when monitoring noise around airports, control their arrival and departure routes in such a way that air traffic causes as little pressure as possible on residential areas. At the same time, attention should be paid to technological progress in the manufacture and operation of aircraft engines aimed at reducing the level of noise generated.

Electromagnetic fields[12]

Electromagnetic field (EMF) is a natural element of the environment. However, since the beginning of the 20th century, we have witnessed rapid technological progress and development of broadcasting techniques. Our broadcasting and reception needs are growing, the number of personal, domestic and commercial devices is increasing, and the environment is under increasing pressure from artificially generated EMFs.

The main source of EMFs commonly found in the human environment are radio-communication installations, such as mobile phone base stations, radio and television stations, high voltage substations and power lines. Devices such as mobile phones, microwave ovens or Wi-Fi routers may also be a problem. It should be noted that the amount of radiation decreases quickly with the distance from the source, so conscious use of devices can significantly reduce our exposure to EMF radiation.

In Poland, the **level of electromagnetic fields** in the environment (electromagnetic background) is subject to observation and assessment within the framework of the State Environmental Monitoring (PMŚ). Voivodship Inspectorates for Environmental Protection carry out EMF monitoring, measuring the intensity of the electric component of the EMFs within a frequency range of at least 3 MHz to 3 GHz[13] (i.e. radio frequencies). The measurements are performed on **three types of areas** accessible to the populace, i.e. (a) in central districts or urban settlements with over 50,000 inhabitants, (b) in other

[11] Railway Transport Authority, *Report on the Functioning of the Railway Transport Market in 2016*, Warszawa, 2017, https://utk.gov.pl/ (accessed: 08.01.2019).

[12] *The chapter quotes extensive excerpts from the study: State of the Environment in Poland Signals 2016* (GIOŚ 2017), ed. B. Albiniak.

[13] Pursuant to §2 of the Regulation of the Minister of the Environment of 12 November 2007 on the scope and manner of conducting periodic examinations of electromagnetic field levels in the environment (OJ L, item 1645).

cities and (c) in rural areas[14]. Since 2008, EMF monitoring has been carried out in a uniform manner throughout the country, and the requirements are set out in national law. On the territory of each voivodship, there are 135 measurement points tested within a three-year cycle. The points are located at a distance of not less than 100 m from the projection of the installation antennas on land surface.

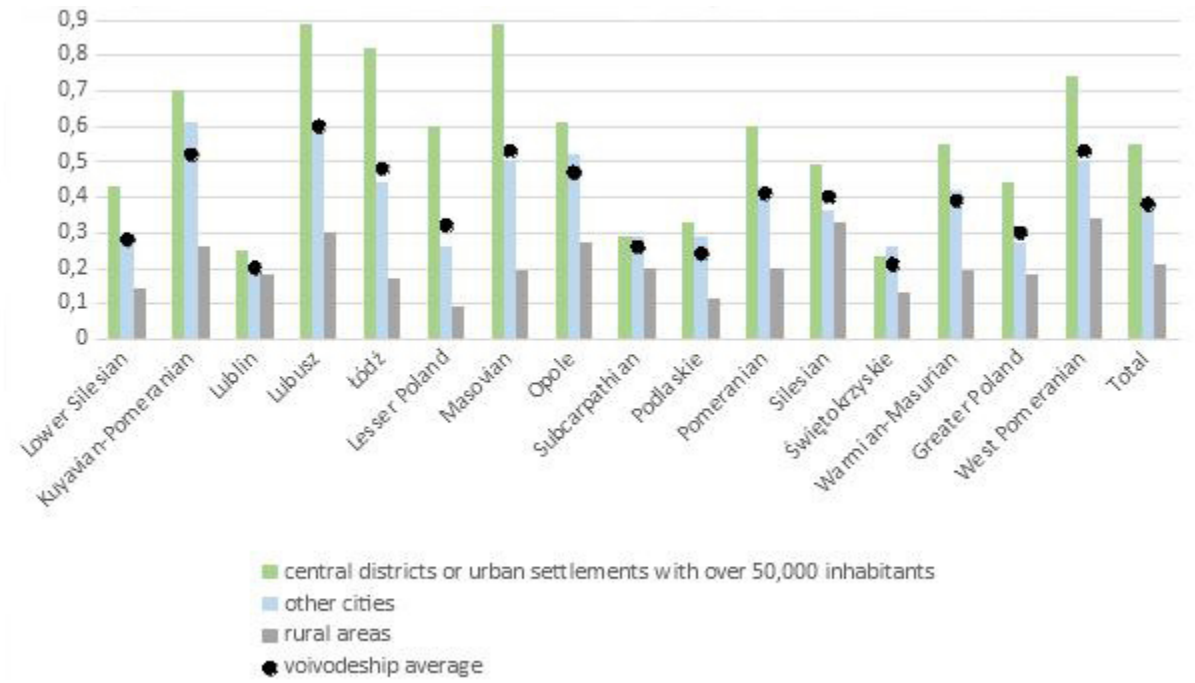
The latest results of EMF monitoring obtained within the State Environmental Monitoring indicate that the values of electromagnetic fields in the environment (electromagnetic background) remain at a very low level. None of the measurement points at which the WIOŚ carried out monitoring measurements in 2016 exceeded the permissible EMF levels in the environment. The arithmetic means of all measurements made in 2016 was 0.36 V/m, which represents only 5% of the limit value, which for the frequencies measured is 7 V/m.

In order to distinguish between the different types of areas for which monitoring is carried out, the values are as follows:

- for central districts or urban settlements with a population exceeding 50,000 – 0.52 V/m,
- for other cities – 0.32 V/m,
- for rural areas – 0.22 V/m.

The analysis of the results of monitoring since 2008 shows a rather stable level of electromagnetic fields in the environment. The values of the electrical component for individual areas, over the years, do not vary significantly.

Fig. 5.4 Average values of electromagnetic field strength in the environment obtained as part of the State Environmental Monitoring in 2017 (V/m).



Source: own elaboration based on: GIOŚ, Assessment of the Levels of Electromagnetic Fields in the Environment for 2017 – based on the results of measurements of the Voivodship Inspectorates for Environmental Protection, Warszawa, 2018, p. 25.

[14] Voivodship Inspectorate for Environmental Protection in Gdańsk, *Electromagnetic Radiation in 2018*, https://www.gdansk.wios.gov.pl/ (accessed: 08.01.2019).

The trend is that in highly urbanised areas, EMF levels are much higher than in other areas, which is associated with a higher number of installations emitting EMFs to the environment. "Within the specific types of areas monitored, the values are as follows: for central districts or urban settlements with a population exceeding 50 000 inhabitants – 0.55 V/m, for other cities – 0.39 V/m, and for rural areas – 0.21 V/m"[15].

The health effects of electromagnetic waves have been studied intensively for decades. Studies are carried out on animals, but data on human populations are also collected and analysed. Despite the large number of high-quality studies regarding the risk of developing cancer, especially in the brain, head and neck area as a result of increased exposure to electromagnetic fields, there has been no evidence of an increase in this risk[16]. Although monitoring results show that EMF values in the environment are at a low level, due to network developments and public concerns about the effects of EMFs on humans, continuous monitoring of EMF levels in the environment as well as of the operators and users of equipment emitting electromagnetic fields, including mobile phone base station operators, is necessary, based on applicable legislation, including criminal sanctions for exceeding the EMF limits.

In addition, information on average electromagnetic field levels is essential for the proper conduct of the procedures for locating new installations emitting electromagnetic fields and for the design of changes in the configuration of the transmitting equipment for existing installations.

Ionising radiation

Ionising radiation is a phenomenon omnipresent on Earth. The radiation caused by sources permanently present in the nature is called background radiation[17]. It is essential for the functioning of all living organisms. Natural radioactive isotopes present in the Earth's crust are subject to constant transformations. In addition to the radioactive isotopes permanently present in the environment, further radionuclides, both natural and artificial, are released as a result of human activity. In Poland, about 68%[18] of the radiation affecting humans is ionising radiation resulting from natural background radiation. Natural radionuclides are released by the mining and energy industries (various types of spoil tips, heaps and settlement ponds), as well as during fertilisation with phosphorus and potassium compounds. Artificial radioactive isotopes are released in a controlled way e.g. during normal operation of nuclear reactors (power generation and research reactors) and during the use of diagnostic equipment and laboratories using radioisotopes. Uncontrolled releases of artificial radioactive isotopes occurred during experimental nuclear explosions, particularly in the late 1950s and early 1960s, and during nuclear accidents.

In Poland, ionising radiation is used for medical, scientific and industrial applications. The activity of a nuclear facility – the MARIA research reactor, located at the National Centre for Nuclear Research in Świerk, is crucial for these applications. There are over

[15] GIOŚ, *Assessment of the Levels of Electromagnetic Fields in the Environment for 2017 – based on the results of measurements of the Voivodship Inspectorates for Environmental Protection*, Warszawa, 2018, p. 25.

[16] Ministry of Digital Affairs, *Electromagnetic Fields and Humans. Regarding Physics, Biology, Medicine, Standards and 5G Networks*, Warszawa, 2019, https://www.gov.pl/web/cyfryzacja (accessed: 19.06.2019).

[17] Ministry of Energy, Ionising Radiation, https://www.gov.pl/web/energia *(accessed: 18.06.2019).*

[18] Report on the Activities of the President of the National Atomic Energy Agency and the Assessment of the State of Nuclear Safety and Radiological Protection in Poland in 2016.

25 thousand radioactive sources in Poland. Their potential is widely used in cancer treatment, medical diagnostics, multiple research and industrial projects. The use of radiation is supervised by the President of the National Atomic Energy Agency (PAA) through a system of licensing, inspections, assessment and enforcement of nuclear safety and radiation protection requirements.

Monitoring of radioactive contamination enables the conclusion that the radiation situation in Poland is stable and does not threaten human health and the environment. Activities involving exposure to ionising radiation, including nuclear facilities (MARIA research reactor and spent nuclear fuel storage facilities) and the National Radiation Waste Repository located in Poland do not adversely affect the health of the population.

All available results of measurements of the power of ionising radiation dose, as well as concentrations of individual natural and artificial radioactive isotopes in all components of the environment, are collected and analysed by the President of the National Atomic Energy Agency. These results are collected from all monitoring systems and measurement programmes (in particular those carried out as part of the State Environmental Monitoring and those carried out with PAA funds). The collected data and information allow the President of PAA to assess the current radiation situation in Poland.

The monitoring of ionising radiation carried out in part by the President of the PAA is also an element of the State Environmental Monitoring coordinated by the bodies of the Environmental Protection Inspection[19]. This environmental monitoring subsystem includes:

- measurements at early detection stations for radioactive contamination,
- monitoring of Cs-173 concentration in soil,
- monitoring of radioactive contamination of surface waters and bottom sediments.

In Poland there is a network of early detection stations belonging to the National Atomic Energy Agency, the Central Laboratory of Radiological Protection, the Institute of Meteorology and Water Management and the Ministry of National Defence. These stations measure gamma radiation in the environment and determine the concentrations of radioisotope activity in air aerosols and atmospheric precipitation. The monitoring of radioactive contamination of food, drinking water and feeds is carried out by the so-called primary bodies (State Sanitary Inspection stations) and selected veterinary inspection bodies.

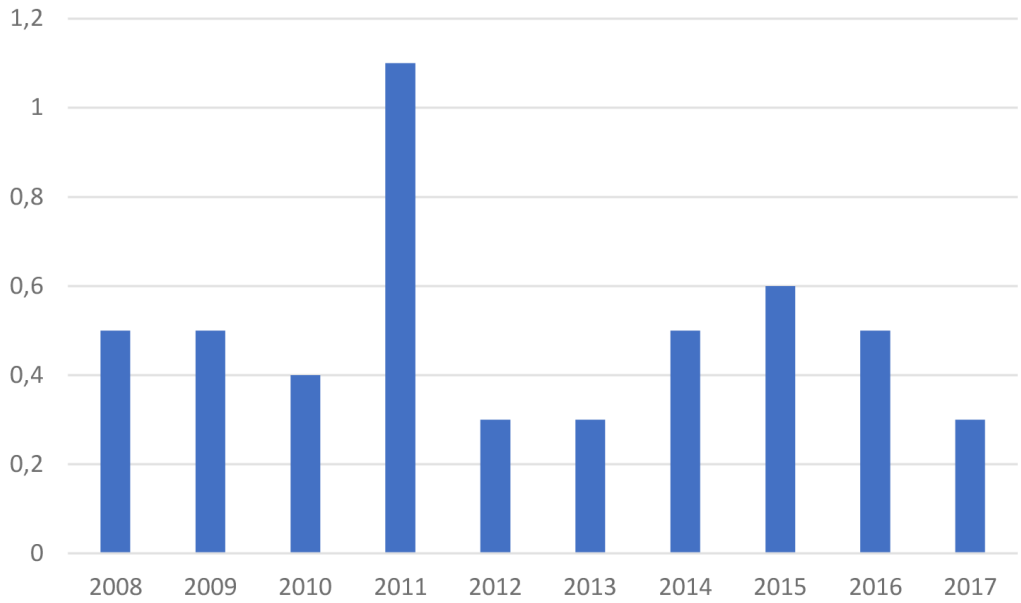
In 2016, the average daily values of gamma radiation dose rate in the air, taking into account cosmic radiation and radiation from radionuclides contained in the soil, varied in Poland from 68 to 141 nSv/h[20], with an annual average of 93 nSv/h.

In addition to natural radioisotopes, atmospheric air contains small concentrations of other isotopes, in particular Cs-137, which is a remnant of nuclear atmospheric explosions and nuclear accidents. Due to its relatively long decay time (30 years), it is a radioactive isotope which is a marker of environmental pollution by artificial radionuclides. As part of the State Environmental Monitoring, radionuclide Cs-137 is tested in air, water, sediments and soil.

[19] State Environmental Monitoring Programme for 2016-2020, Warszawa, 2015.

[20] nSv/h – nanosieverts per hour. A sievert (Sv) is a unit that determines the absorbed dose in a tissue or organ, taking into account the type and energy of radiation. It enables the determination of the biological effects of radiation on exposed tissue.

Fig. 5.5 Cs-137 activity in the average annual total precipitation in Poland in the years 2008-2017 (Bq/m2).



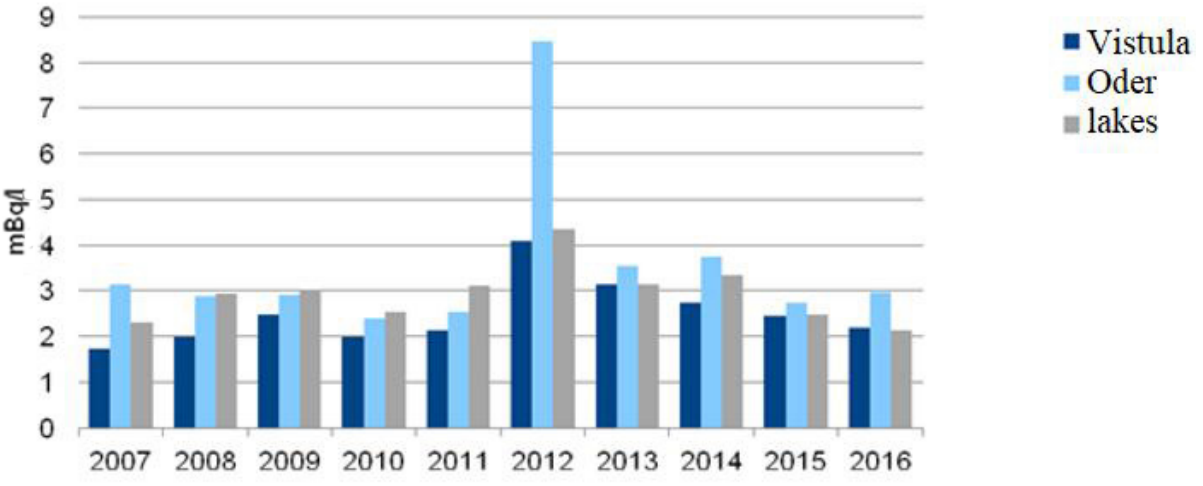
Source: own elaboration based on: PAA, Annual Report. Activities of the President of the National Atomic Energy Agency and the Assessment of the State of Nuclear Safety and Radiological Protection in Poland in 2017, Warszawa, p. 81.

Total precipitation monitoring is carried out in the network of early detection of radioactive contamination at the stations of the Institute of Meteorology and Water Management – National Research Institute, located in Warszawa, Gdynia, Włodawa, Świnoujście, Gorzów Wielkopolski, Poznań, Lesko, Zakopane, Legnica and Mikołajki. The Cs-137 isotope concentration in the monthly total precipitation is determined as part of this monitoring. The results of the measurements indicate that the concentration of Cs-137 in the average annual precipitation in 2016 was at the level observed in the previous years.

"In 2011, increased deposition was reported due to the inflow of contaminated air masses from Fukushima"[21].

[21] Institute of Meteorology and Water Management, National Research Institute, Marine Branch in Gdynia, *Monitoring of Ionising Radiation, Carried Out as Part of the State Environmental Monitoring. Task 1: Measurements in the Early Detection Network for Radioactive Contamination. Stage III Report Presenting the Results and Analyses for 2016,* Gdynia, 2017, p. 49.

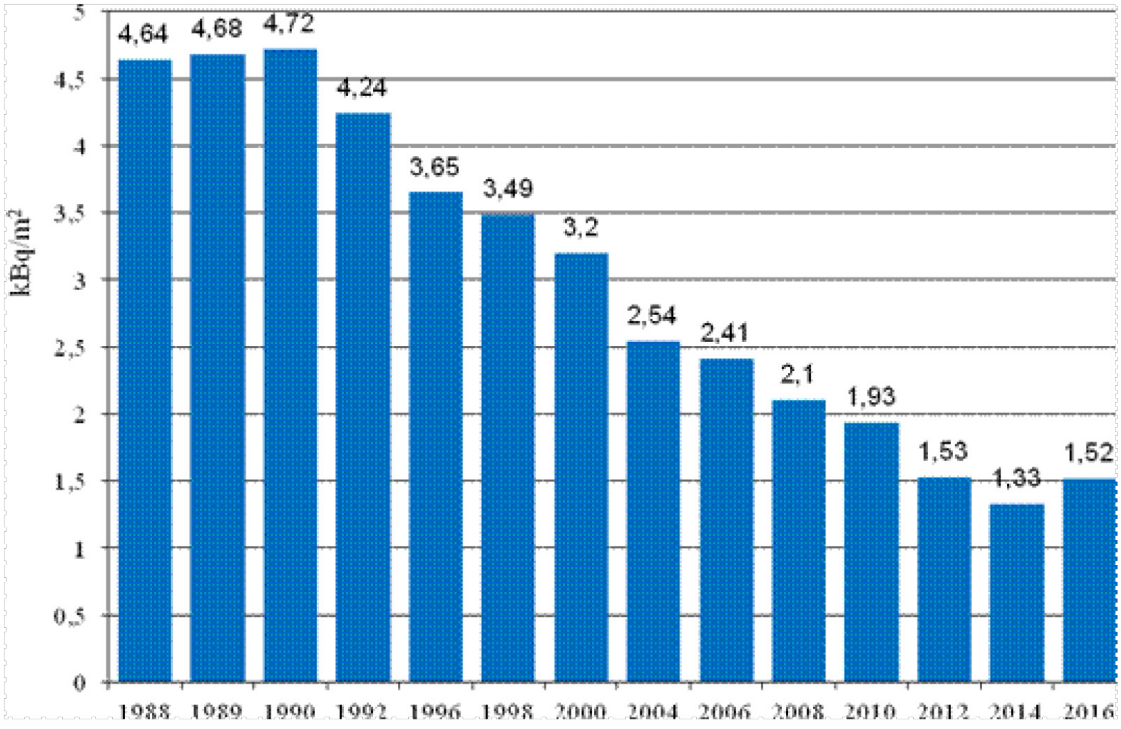
Fig. 5.6. Average annual concentrations of Cs-137 in the waters of the Vistula, Oder and lake basins in the years 2007-2016.



Source: GIOŚ/PMŚ.

Monitoring of radioactive contamination of surface waters and bottom sediments within the framework of the PMŚ is carried out in 18 measurement points located in the Vistula river basin (7 points), in the Oder river basin (5 points) and in six lakes. The results obtained from its implementation show that Cs-137 levels in surface water and sediments are very low and do not pose a threat to human health and the environment.

Fig. 5.7. Concentrations of Cs-137 in the surface layer of soil in the years 1988-2016.



Source: GIOŚ/PMŚ

Monitoring of Cs-137 concentration in soil is carried out at 254 soil sampling points located throughout Poland. The points are located in meteorological gardens of the stations and posts of the Institute of Meteorology and Water Management – PIB.

The average Cs-137 concentration in soil in Poland decreased from 4.64 kBq/m^2 in 1988 to 1.33 kBq/m^2 in 2014. Changes in Cs-137 concentrations are caused by the radioactive decay of this isotope (T1/2 half-life is 30.15 years) and by migration processes in the environment, mainly caesium penetration into deeper soil layers.

The monitoring of radioactive contamination carried out under the State Environmental Monitoring reveals that the levels of Cs-137 in air, surface water, sediments and soil are low and do not constitute a threat to human health or the environment, and that the obtained results indicate that there have been no new releases of radioactive isotopes into the environment.

Natural resources*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland, Report 2014 (GIOŚ 2014).

The natural environment is a natural capital and as such it constitutes a potential for the development of a specific space which can be described in terms of geography. Its resources (renewable and non-renewable) generate a stream of benefits defined as ecosystem services. The basic resources for economic and social development are energy potential, water resources, atmospheric air, climate, **spatial and landscape resources and associated biodiversity (habitat, species and gene resources)**, soil and geological resources, and non-economic uses of the environment. The state and availability of these resources and the limited capacity of ecosystems to sustain an equilibrium and provide services to the economy affect investment opportunities and the satisfaction of basic living needs. Modern environmental management, based on the principle of protection by sustainable use of natural resources, promotes their conservation for future generations and ensures high value standards, such as spatial order, and contributes to counteracting the marginalisation of areas. In the modern world, the requirements of environmental protection have become one of the most important determinants of social and economic development, and global climate change and growing pressure related to economic and social development have highlighted the importance of the state policy in managing natural environment resources and carrying out adaptation activities, reducing the effects of climate change. The observed unfavourable changes in the number and composition of plant and animal species most often result from faulty spatial management: rapid,

uncontrolled urban development, settlement spreading within the areas of natural importance or in their immediate vicinity, crossing ecological corridors by transport infrastructure, unification and depleting landscapes. Invasive species pose a serious problem, threatening the stability of ecosystems and economies as well as human health. Changes in agriculture are also important – both intensification of cultivation towards large area agriculture and abandonment of agricultural use lead to the disappearance of ecosystems associated with agricultural crops and loss of traditional agricultural landscapes, which constitute a habitat for multiple species. The decline of green areas and the building inside ventilation corridors, cutting off open spaces from the city interior are detrimental to climatic conditions and the quality of life – the functions of protection against noise and particulate matter disappear – among other things, the ability to restore water resources and oxygen decreases[1].

The negative factors indicated in the diagnosis of the Responsible Development Strategy until 2020 (with an Outlook until 2030), such as inadequate air quality, low water resources, effects of progressing climate change, deficit of tools for creating spatial order significantly increase current development costs and generate losses caused by lack of investments, directing development funds to restore the desired quality of air, soil, water and treatment of diseases dependent on environmental factors. Taking appropriate action in the long term can help to avoid significantly higher macroeconomic costs of inaction. The objective is to increase the effectiveness of the environmental development potential, allowing its use to satisfy current development needs and increase the quality of life and preserve development resources for future generations[2].

Biodiversity

Nature enables and conditions human life. It is a source of numerous goods and services such as: food, raw materials, clean air, clean water, oxygen, unpolluted soil. It provides shelter, reduces the gradation effects of biotic factors, protecting against pests and pathogens. It makes a decisive contribution to the regulation of the Earth's climate processes. Its overarching feature is diversity, understood as the richness of the surrounding ecosystems, species and their gene resources. Diversity guarantees a balance between nature's elements and the proper functioning of ecosystems. The loss of biodiversity in ecosystems is a threat to the proper functioning of our planet, with further consequences for the economy and humanity[3].

Biodiversity is in crisis. Almost a quarter of Europe's wild species are threatened with extinction and most ecosystems are degraded to the point where they are no longer able to provide valuable services. This degradation means very high social and economic losses for the EU. The main causes of biodiversity loss (e.g. habitat conversion, over-exploitation of natural resources, introduction and expansion of invasive alien species and climate change) are increasing, undermining the beneficial effects of mitigation efforts[4].

[1] Responsible Development Strategy until 2020 (with an Outlook until 2030) adopted by Resolution No. 8 of the Council of Ministers dated 14 February 2017 (M.P. item 260).
[2] Own elaboration by GDEP.
[3] EC, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Our life insurance, our natural capital: an EU biodiversity strategy to 2020,* Brussels, 2010.
[4] EC, *EU Biodiversity Strategy to 2020,* Information leaflet, 2011, http://ec.europa.eu/ (accessed: 08.01.2019).

The nature of the Member States of the European Union is highly endangered. It is a region with high population and consumption rates, which translates into high negative pressure on the environment. The results of the assessment of the conservation status of natural habitats, carried out in all EU Member States, show that the status of habitats and species is unsatisfactory and continues to deteriorate. The development of the communication infrastructure and the expansion of the construction industry takes nature away from new areas, destroying it and deepening the phenomenon of fragmentation of the natural space, without giving many species a chance for sustainable existence. In order to counteract these dangerous processes, the European Union already took a number of initiatives at the end of the 1970s and the beginning of the 1990s to preserve Europe's biodiversity. One of the most important instruments of these activities is the Natura 2000 network created on the basis of two European Union directives: The Birds Directive[5] and the Habitats Directive[6]. However, the introduction of these directives and their implementation in the Member States is still not sufficient.

In May 2011, the European Commission adopted a new strategy, setting out a framework for EU action in the next decade to meet the 2020 biodiversity headline target set by EU leaders in May 2010: "Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss[7].

The EU Biodiversity Strategy 2020 includes six mutually supportive targets addressing the main drivers of biodiversity loss and aiming to reduce the key threats to nature and ecosystem services in the EU[8].

Objective 1 of the above-mentioned Strategy is the full implementation of the Birds and Habitats Directives by stopping negative trends in relation to the state of conservation of species and natural habitats covered by EU legislation. The objective is that by 2020, compared to 2010 (base year), 100% more assessments for habitats and 50% more assessments for species under the Habitats Directive are in a favourable or better conservation status than in the previous assessment of conservation status (at the level of the biogeographical region). In addition, 50% more assessments for birds protected under the Birds Directive would indicate a favourable conservation status (at EU level) or improved compared to the previous assessment. It should be stressed that the assessments cover all natural habitats and plant and animal species within and outside protected areas.

A detailed analysis of the state of preservation of natural habitats and species protected by natural directives concerning Poland is included in the further part of the material. In the overall assessment of the conservation status of natural habitats and species in biogeographical regions located in Poland, carried out on the basis of the national report on the implementation of the Habitats Directive based on Article 17[9] for the years 2007-2012, the relatively good conservation status of forest habitats and the poor conservation status of peat bogs, meadow areas and coastal dunes and

[5] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ L 20 of 26.01.2010, p. 7, as amended), hereinafter referred to as the "Birds Directive".

[6] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ EC L 206 of 22.07.1992, p. 7, as amended; Polish translation section 15, vol. 2, p. 102, as amended), hereinafter referred to as the "Habitats Directive".

[7] EC, *EU Biodiversity Strategy to 2020,* Information leaflet, 2011, http://ec.europa.eu/ (accessed: 08.01.2019).

[8] EC, *Biodiversity...*, ibid.

[9] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

habitats deserve special attention. In terms of species, mammals, fish and non-vascular plants are in a relatively good conservation status. The conservation status of the Baltic Sea species has been assessed as inadequately poor (100% of species)[10]. A full analysis of progress towards Objective 1 of the EU Biodiversity Strategy 2020 shall be possible after the submission of the national reports in 2019.

Poland is a country with a relatively large biodiversity. This is due to the transitional climate, varied terrain, geological structure and variability of the soil substrate, with no natural geographical barriers at the same time. In Poland, biodiversity is shaped primarily by relatively large areas: forests and wetlands, as well as agricultural areas. Forests in Poland currently occupy (in 2016) 9230 thousand ha[11], terrestrial hydrogenic habitats 4340 thousand ha (about 13.9% of the area of Poland, including ¼ of them peat bogs)[12]. Agricultural lands constitute about 46% of the country's area. A significant part of them, about 1/5, are permanent grasslands – various semi-natural ecosystems shaped and maintained through hay or grazing. Polish agriculture is characterised by a fragmented structure of farms and land – about 1.37 million farms, with average surface area of approx. 10.6 hectares. Agrarian fragmentation, which is economically disadvantageous, helps preserve the landscape and biodiversity.

The most numerous groups of species include algae, of which in Poland were found more than 10 thousand species. Fungi are the second largest group with 3 times fewer species than algae. The number of vascular plant species is 2750. According to estimates, the animal kingdom is represented in Poland by 47 thousand species (over 35.3 thousand species were recorded), of which 98% are invertebrates, among which the largest group are insects (as much as 75% of all animals). Among vertebrates, the most numerous groups of species are birds (458 species, including about 230 nesting species) followed by mammals (112 species)[13].

Among all native species occurring in Poland, the species threatened with extinction[14] include[15]:

- 1159 animal species, including 1080 invertebrate species (including 784 insect species, 6 crustacean species and 61 mollusc species) and 79 vertebrate species (13 mammal species, 34 bird species, 3 reptile species and 29 fish species, including 9 marine species),
- 488 vascular plant species, 83 moss species, 545 lichen species, 583 macrofungi species and 232 algae species.

[10] Based on the GDEP material to the Senate of the Republic of Poland entitled *Implementation of the Birds Directive and Habitats Directive*, November 2017.
[11] National Forest Holding State Forests, *Report on the state of Forests in Poland 2012,* Warszawa, 2013.
[12] Ministry of the Environment, *Strategy for the Protection of Wetlands in Poland Together with Action Plan (for the Years 2006-2013),* Warszawa, 2006.
[13] GIOŚ, *State of the Environment in Poland. Report 2018*, Warszawa, 2018, p. 57.
[14] According to the IUCN classification (critically endangered: CR, endangered: EN, or high risk, vulnerable: VU).
[15] Data from 2013. GIOŚ, *State of the Environment in Poland. Signals 2014,* Warszawa, 2014.

Tab. 6.1. Number of species/habitat types listed in the Annexes of the Habitats Directive occurring in Poland (some of which occur in both biogeographical regions and in the Baltic Sea marine area).

Groups of species/natural habitat types	Number of species/natural habitat types				
	Alpine Biogeographical region	Continental Biogeographical region	Baltic Sea marine area	Entire country	Including EU priority species/ habitats
Natural habitats	41 40 (data from 2010)	71 73 (data from 2010)	4 2 (data from 2010)	81	17
Plants	21	42	-	49	10
Animals	92	128	7	143	17

Source: GIOŚ/PMŚ, Report for the EC 201316.

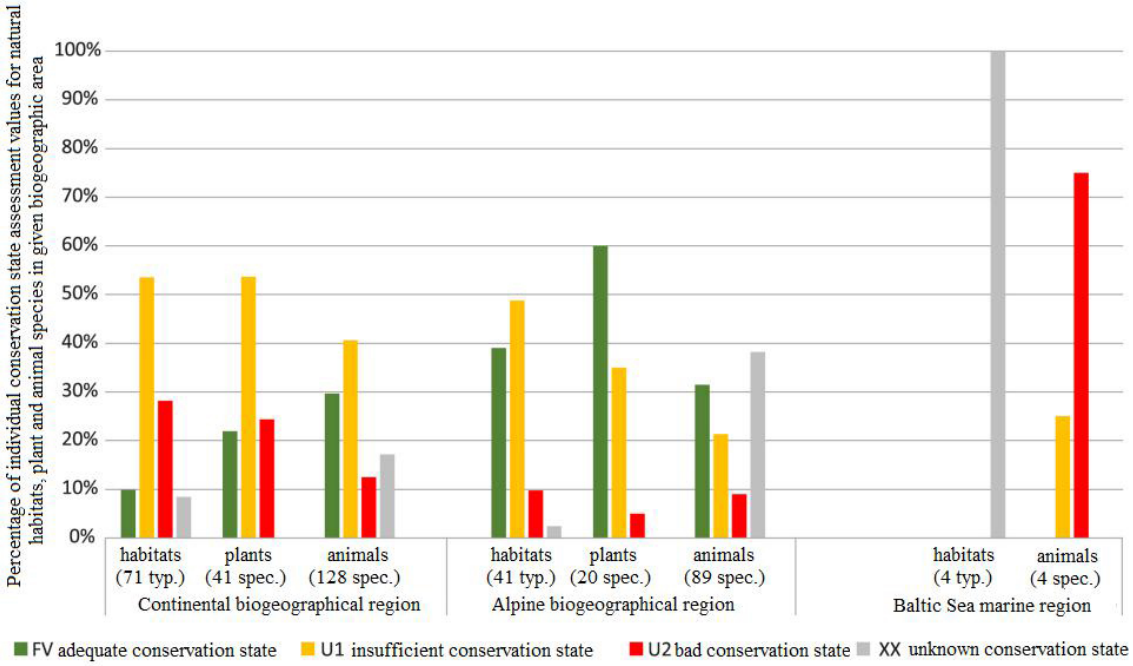
Natural habitats as well as plant and animal species that are rare and endangered on a European scale are protected under the so-called Habitats Directive[17]. There are currently 81 types of natural habitats in Poland, including 17 of principal importance, 49 plant taxa, including 10 of principal; importance and 143 species or groups of animal species excluding birds, including 13 of principal importance[18].

The Habitats Directive requires monitoring of the conservation status of natural habitats and species important for the EU in a given country. Not only is their current state of preservation being monitored, but also their prospects for protection in the foreseeable future. The monitoring of species and natural habitats has been carried out since 2006, with particular emphasis on special areas of protection within the framework of the State Environmental Monitoring. The main objective of the monitoring is to obtain data allowing for the **assessment of the conservation status** (condition) of the monitored habitat types and species.

Indicators concerning the size and structure of the species population, the quality of species' habitats and the surface area and degree of conservation of characteristic features of natural habitats are taken into account. Information is also collected on various threats to species and habitats, as well as on the applied methods of their protection, allowing to determine the prospects for the preservation of species and habitats. This enables the assessment of selected parameters of the conservation status and outlook for the protection of the species and natural habitat. For most species and habitats, monitoring is carried out every 6 years, and for rapidly changing habitat types and species with negative trends in populations or associated with unstable habitats – every 3 years. Based on the results of monitoring studies, the conservation status of species and natural habitats in biogeographical regions is assessed at the sites.

[16] Data according to the current checklist available at http://cdr.eionet.europa.eu/help/habitats_art17 (accessed: 27.02.2019).
[17] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
[18] Data according to the current checklist available at http://cdr.eionet.europa.eu/help/habitats_art17 (accessed: 27.02.2019).

Fig. 6.1. Conservation status of species and natural habitats in biogeographical regions and the marine area of the Baltic Sea.



Source: GIOŚ, State of the Environment in Poland. Report 2018, p. 30.

Poland has the following biogeographical regions: continental and Alpine, as well as marine area of the Baltic Sea. According to the latest report for the European Commission prepared by Poland in 2013 and covering the period 2007-2012[19] (section concerning the conservation status was prepared on the basis of data from the State Environmental Monitoring), the species and habitats in the Alpine region (the Carpathians), "representing only 3% of the land area of the country"[20], demonstrated a much better conservation status. "This is mainly due to the region's characteristic inaccessibility of high mountain areas, also areas difficult in economic management and largely subject to area-based conservation, i.e. with significantly lower anthropogenic pressure than in the continental region. Within the continental region (97% of the land area of Poland), most habitats and species demonstrate unsatisfactory conservation status (U1)"[21].

According to the publication by GIOŚ – "State of the Environment in Poland. Report 2018" – in the case of animals, attention should be paid to the following facts:

- A relatively large "share (nearly one third) of animal species demonstrating appropriate conservation status (FV) (...) indicates the importance of Poland in their protection as a threatened species on a European scale"[22]. Furthermore, knowledge of some animal species is still incomplete, particularly in the Alpine region. "The inappropriate overall assessment of animals (U1 and U2) was determined not only by the population but also by the habitat parameter"[23].

[19] The 2013-2018 report will be prepared in 2019 after the end of the next monitoring cycle.
[20] Land area of Poland: 312,480 km^2.
[21] Voivodship Inspectorate for Environmental Protection in Rzeszów, *Subcarpathian Nature. Results of Nature Monitoring Studies 2012-2014*, Rzeszów, 2015.
[22] GIOŚ, *State of the Environment in Poland. Report 2018*, Warszawa, 2018, p. 46.
[23] Ibid.

- There are some successes in the protection of animal species and a stable (not deteriorating) situation for many of them. Three large predators remain in the country, with different conservation statuses (the best situation is for the wolf, as it inhabits new areas; the bear population seems stable, while the lynx is of some concern due to declining population size and food base). Three species of rare mammals are also in good condition, but with very limited occurrence: marmot and chamois (occurs only in the Tatra Mountains) and European bison (good assessment in the continental region – in the Białowieża Forest, Knyszyn Forest, Borek Forest and Mirosławiec Forest). There are also 7 dragonflies in good conservation status, as well as multiple species of bats.
- A cause for concern may be the conservation status of certain butterfly species, such as the Colias myrmidone, Polyommatus eros, Coenonympha hero, Phengaris arion, for which succession changes in habitats are partly responsible. Similarly, the situation of the European hamster is worsening with the intensification of farming. However, not in all cases, the reasons for the incorrect status are clear. The status of some species associated with the water and mud environment: Astacus (various causes), Unio crassus (various causes, including water pollution), Rhynchocypris percnurus (overgrowing and shallowing of water reservoirs), Anisus vorticulus (it is difficult to clearly determine the causes), Emys orbicularis (predation, poaching, plant succession in nests), is also disturbing. According to some experts, the overall situation of ichthyofauna is unsatisfactory due to negative impacts (pollution and engineering) commonly observed in Polish rivers.

According to the report to the European Commission of 2013, in both regions (continental and Alpine), the best preserved are thicket habitats and the worst – peat bogs (...). In the continental region, meadow and sward habitats (...) receive worse assessments. The predominantly inadequate conservation status (...) is also demonstrated in coastal habitats. In the Alpine region, rocky (...) and high mountain habitats (swards, snow patch habitats, herbaceous communities) as well as forest habitats stand out in a positive manner. It should be noted that the Alpine region is characterised by areas which are difficult to manage. This fact may have a positive impact on the conservation status of forest natural habitats, whereas in the case of semi-natural habitats, e.g. mountain hay meadows or matgrass swards, it hinders their protection. This is particularly evident in the current decline of the hay management in higher mountain locations. (...) in the continental region, many habitats received a bad assessment (...) due to the "surface area" parameter. This indicates a high fragmentation of natural habitats in the lower parts, as well as significant surface area decline of some of the habitat types occurring here. In the Alpine region, the reduction of the overall assessment of habitats was mainly influenced by the assessment of the "conservation outlook" parameter. The latter may indicate that some semi-natural habitats are subject to secondary succession and that the programmes and conservation measures undertaken are still insufficient"[24].

According to the aforementioned report for the European Commission of 2013, plant species which are characterised by "unsatisfactory conservation status (...) are species which are sensitive to the processes taking place in their habitats, as well as to various factors affecting their populations. They are threatened mainly by the disappearance of potential habitats and deterioration of their status, most often through eutrophication,

[24] GIOŚ, *State of the Environment in Poland. Report 2014*, Warszawa, 2014, pp. 42–43.

progressive succession processes due to lack of use, drainage or mechanical destruction, and other factors not directly attributable to human activity. For many of the analysed species, the conservation status was assessed as inappropriate, mainly due to the small number of sites.

Throughout Poland, the conservation status received the worst assessment scores (...) for 11 plant species (17%), which: (a) are very rare, occur at single sites; (b) have extremely small populations, counted as individuals; or (c) despite the relatively large number of sites, demonstrate strong negative population trends especially at a deteriorating habitat"[25].

"Birds are an important element of the natural environment and at the same time – its good indicators. They are one of the most numerous groups of vertebrates"[26]. In Poland so far, 458 species[27] have been found, including about 230 common or locally nesting species[28]. "Among the domestic bird species, Acrocephalus paludicola (approx. 90% of the EU population in Poland) and Haliaeetus albicilla (approx. 45% of the EU population in Poland) are among the significant resources of Poland in the EU"[29].

"15 of the regularly nesting species in our country have been included, with the status of endangered or nearly endangered, in the Red List of Birds of Europe, developed on the basis of the criteria of the International Union for the Conservation of Nature IUCN in 2015 by the European Commission and BirdLife International. The list includes: Clanga – with the EN category (endangered) – threatened with extinction in the near future, Limosa , Aythya ferina, Haematopus ostralegus, Vanellus , Numenius arquata, Alcedo atthis , Lanius excubitor, Acrocephalus paludicolaola and Streptopelia turtur – with the VU category (vulnerable) – threatened with extinction, Larus argentatus, Trudus iliacus, Anthus pratensis, Milvus and Fulica atra with the NT category (near threatened)"[30].

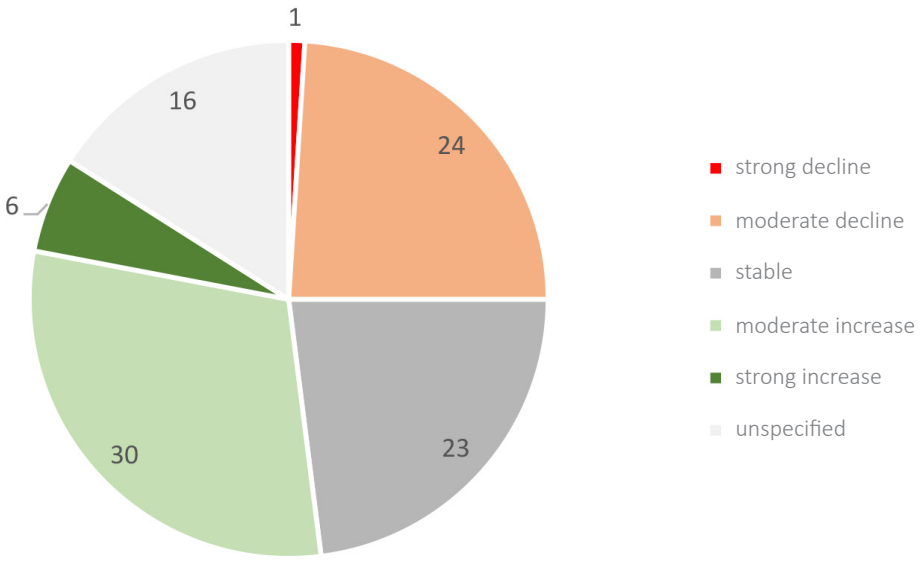
Since 2006, within the framework of the State Environmental Monitoring, the **Polish Birds Survey** (MPP) has been carried out in Poland for particular species or groups of bird species, mainly those considered as endangered in the European Union countries, as well as in Poland, i.e. those listed in the annexes to the Birds Directive and/or in the Polish red lists. Monitoring is carried out on the basis of a representative observation network at the national and regional level. The assessed parameters of the population condition include, first of all, population size indices, less frequently, estimates of the total population size of the national population and prevalence indices. For selected species the reproduction results are also evaluated (Chodkiewicz et al., 2015).

"Data collected by the Polish Birds Survey (MPP) until 2017 estimate the average annual rate of change in population numbers for 163"[31] nesting bird species, i.e. approx. "71% of the national nesting avifauna"[32]. Using the trend classification used by the Pan-European Common Bird Monitoring Scheme PECBMS, it is estimated that 3% (5 species) of nesting species in Poland show a strong upward trend, and a further

[25] Ibid., p. 45.
[26] Ibid., p. 51.
[27] Fauna Commission, *Bird Species Confirmed in Poland – Status as of 30.06.2013* http://www.komisjafaunistyczna.pl/ (accessed: 15.11.2013).
[28] GIOŚ, *State of the Environment in Poland. Report 2018*, Warszawa, 2018, p. 57.
[29] GIOŚ, *State of the Environment in Poland. Report 2014,* Warszawa, 2014, p. 45.
[30] GIOŚ, *State of the Environment in Poland. Report 2018*, Warszawa, 2018, p. 57.
[31] Inspection for Environmental Protection, *Nature Monitoring Bulletin. Monitoring of Birds of Poland in 2016-2018*, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), no. 17 2018/2, p. 16.
[32] Ibid., p. 7.

33% (54 species) – moderately upward trend. The downward trend is observed for the population numbers of 26% of species, including 37 species – moderately downward, and 5 species – strongly downward. Populations of 44 species, 27% of the entire nesting avifauna, are stable in numbers. The direction of change in the numbers of 19 species remains uncertain[33]. The fastest growing species are Cygnus, Phoenicurus, Picus viridis, Columba oenas, Phasianus colchicus[34]. The most rapid decrease in the population numbers is observed for Coracias garrgulus and Larus canus, as well as Coturnix, Vanellus, Corydalla campestris, Gallinago media and Anthus pratensis[35]. "In the years 2007-2016 the presence of Calidris alpina schinzii in Poland was not confirmed, only pairs performing courtship displays or individuals in the delta of the Świna river and in the Beka reserve on the Bay of Puck were observed"[36].

Fig. 6.2. Rate of change in the population numbers of 160 species of nesting birds monitored under the MPP. Status as at 2017 (%).

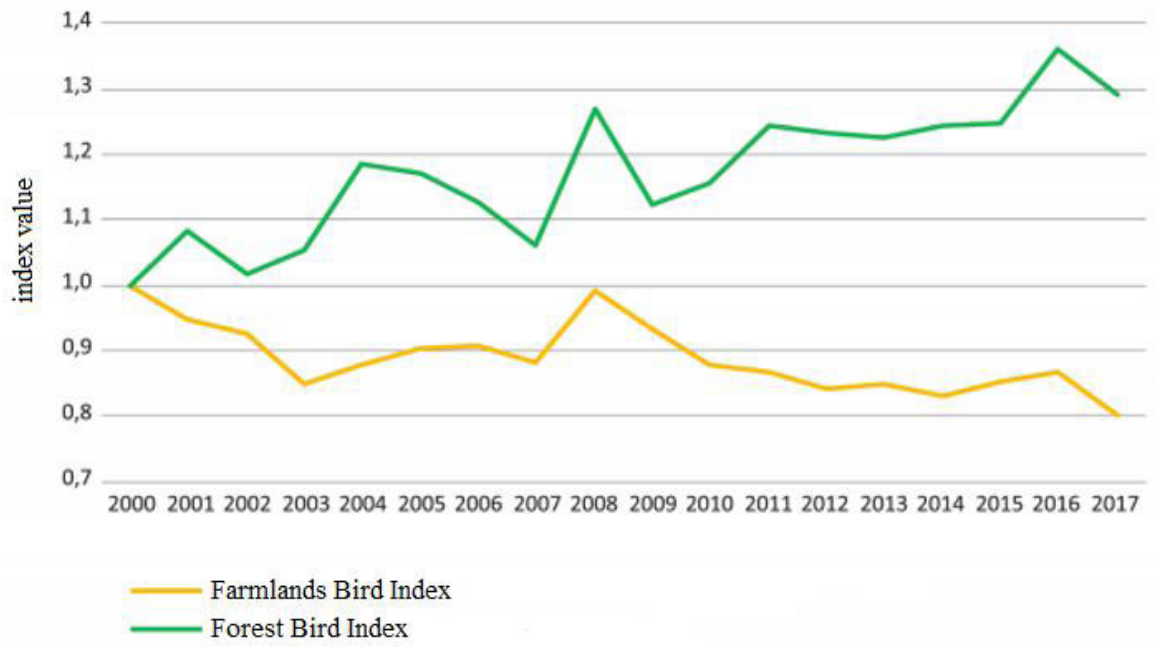


Source: own elaboration based on: Inspection for Environmental Protection, Trends in the Population of Birds in Poland, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, pp. 41–362.

The Pan-European index characterising a group of commonly occurring birds (referred to as indicator species) is the Farmland Bird Index (FBI 22[37]). It includes 22 common species of open area birds in our country. This index is calculated within the framework of the State Environmental Monitoring. In the first half of the last decade, the index showed a rapid decline in value, which was strongly correlated with the trend in farmland bird numbers across Europe. In the following years, the index increased significantly and in 2008 it returned to the reference level of 2000. In 2017, the value of the index was at the level of 0.80, i.e. 20% less than in the baseline year.

[33] Ibid., p. 16.
[34] Ibid., p. 19.
[35] Ibid., p. 18.
[36] Inspection for Environmental Protection, *Trends in the Population of Birds in Poland*, Biblioteka Monitoringu Środowiska (Environmental Monitoring Library), 2018, p. 100.
[37] The Farmland Bird Index (FBI 22) for our country includes such species as: *Ciconia ciconia*, *Falco tinnunculus*, *Vanellus vanellus*, *Limosa limosa*, *Upupa epops*, *Streptopelia turtur*, *Galerida cristata*, *Alauda arvensis*, *Hirundo rustica*, *Motacilla flava*, *Anthus pratensis*, *Saxicola rubetra*, *Saxicola rubicola*, *Sylvia communis*, *Lanius collurio*, *Sturnus vulgaris*, *Passer montanus*, *Carduelis cannabina*, *Serinus serinus*, *Emberiza citrinella*, *Emberiza hortulana*, *Miliaria calandra*.

Fig. 6.3. Changes in the Farmland Bird Index (FBI) and Forest Bird Index 34 (FBI34) between 2000 and 2017.



Source: GIOŚ, State of the Environment in Poland. Report 2018, p. 60 as in: GIOŚ/PMŚ/Polish Society for the Protection of Birds.

An index similar to FBI 22 is the index for birds (34 species) associated mainly with forest areas (*Forest Bird Index* – FBI34[38])[39]. This index is also calculated within the framework of the State Environmental Monitoring. Between 2000 and 2011, the population of widespread forest birds showed a clear upward trend and the aggregate index grew by about 2% per year. In the years 2012-2016, the index demonstrated similar values and was about 25% higher than in the baseline (2000). In 2017, it was 129.22%.

Within the framework of the State Environmental Monitoring carried out by the Chief Inspectorate for Environmental Protection, the assessment of the state of population conservation is also carried out in other systematic groups, e.g. mammals. Currently, the Chief Inspectorate for Environmental Protection is conducting a pilot project of wolf and lynx monitoring in Poland. As a result of this project, new monitoring methodologies for wolf and lynx shall be developed for monitoring the condition of the environment.

[38] Species belonging to the *Forest Bird Index – Parus major*, *Poecile montanus*, *Lophophanes cristatus*, *Carduelis spinus*, *Dendrocopos major*, *Dryocopus martius*, *Pyrrhula pyrrhula*, *Coccothraustes coccothraustes*, *Sylvia atricapilla*, *Turdus merula*, *Sitta europaea*, *Lullula arborea*, *Ficedula hypoleuca*, *Ficedula parva*, *Regulus*, *Certhia brachydactyla*, *Certhia familiaris*, *Phylloscopus collybita*, *Phylloscopus trochilus*, *Turdus viscivorus*, *Phoenicurus phoenicurus*, *Prunella modularis*, *Aegithalos caudatus*, *Erithacus rubecula*, *Poecile palustris*, *Columba oenas*, *Periparus ater*, *Garrulus glandarius*, *Turdus philomelos*, *Troglodytes*, *Anthus trivialis*, *Phylloscopus sibilatrix*, *Fringilla coelebs*, *Regulus ignicapilla*.

[39] Ostasiewicz M., *Monitoring of Birds of Poland in the State Environmental Monitoring in 2007-2012,* Aura 11/2013, Warszawa, 2013, pp. 20-22; Ostasiewicz M., Chodkiewicz T., Chylarecki P., Neubauer G., Woźniak B., *Index of the Number of Common Nesting Birds – what can we do based on the data of the Monitoring of Common Nesting Birds in the State Environmental Monitoring?,* 2011; Chodkiewicz T., Neubauer G., Meissner W., *Monitoring of the Polish Bird Populations in 2010-2012.* Biuletyn Monitoringu Przyrody (Nature Monitoring Bulletin) 9, 2012, pp. 1-44.

Water and marsh ecosystems

Marshland ecosystems are particularly important in the management of environmental resources (in particular water and organic matter in soil) and in the preservation of the country's biodiversity. They play a significant role in the formation of organic carbon and nitrogen resources, they are biofilters purifying water circulating in the landscape from biogenic and heavy metals, they significantly affect climatic conditions and shape the landscape.

Hydrogenic terrestial habitats in Poland occupy 4 340 thousand ha, which constitutes 13.9% of the country's area. Approximately ¼ of them are peat bogs, while the remaining ones are wetlands on mineral substrate, associated with river floodplains. Inland open waters, including water bodies and watercourses (rivers, lakes, estuaries, ponds and dam reservoirs), cover about 3% of the country's surface area. Peat bogs, defined as living peat-forming ecosystems, occupy about 202,000 ha (0.6% of the country's area). The total length of watercourses is approx. 98 thousand km.

Wetlands are one of the most species-rich ecosystems in the world. Particularly important "for biodiversity are the large wetlands of river valleys, characterised by a high degree of habitat and species diversity"[40]. Fens, located mostly in their area, belong to the most abundant in species-rich ecosystems of the temperate zone. A significant number of rare and endangered species are associated with them, many of which with a biogeographical range centre in Central Europe. "For many species of animals and plants, valley sequences of wetland ecosystems serve as ecological corridors. Marsh valleys or mosaic complexes of eutrophic lakes, rushes and extensively used wet meadows and pastures are characterised by a particular richness of bird species. One of the richest types of forest ecosystems in terms of avifauna is the riparian forest associated with periodical floods of river waters.

Many ecologically unique species of flora and fauna occur, among others, on raised and transitional peat bogs or spring wetlands"[41]. Mid-field wetlands also play an important role in shaping the biodiversity of vast areas used for agricultural purposes[42].

Wetlands in the broadest sense of the term are now significantly transformed. Most of them are heavily degraded, which is especially true for fens, which, due to high productivity in the first years after drainage, were reclaimed for agricultural purposes in the vast majority of cases. For example, currently at least 14% of fens in Poland are preserved in relation to their original state. The reason for this situation is irrigation and drainage system built mostly up to 1970s in flooded river valleys, which do not have (usually as a result of failure to maintain them) damming facilities. It is estimated that they have a significant impact on the water conditions of about 60% of the river valley area.

Untransformed river valleys serve as flood protection. Polish rivers are still characterised by a high degree of naturalness in comparison with the rest of Europe. The Vistula, as the only large river on our continent, has preserved its natural character over a distance of over 300 km. Its valley, like the Oder valley, is one of the most important migration corridors in this part of Europe. River engineering (regulations and embankments of riverbeds) is sometimes the cause of large-scale changes in water

[40] Ministry of the Environment, *The Role of Wetlands in the Environment*, http://www.gis-mokradla.info/ (accessed: 09.01.2019).
[41] Ibid.
[42] Ibid.

conditions, which also has a significant impact on the condition of other wetlands. It is estimated that Polish rivers are regulated in about 40% of their total length.

Peat bogs play an important role in the prevention and reduction of climate change effects due to the permanent sequestration of atmospheric carbon in peat deposits. On the other hand, their degradation through drainage results in the release of significant amounts of carbon dioxide into the atmosphere. Degraded peat bogs are a significant source of greenhouse gases, pollution of surface and underground waters, their role in water retention in the catchment area also decreases. Their protection and restoration are therefore a priority not only for biodiversity protection, but also for management of other environmental resources.

Biodiversity in agricultural areas

Objective 3 of the EU Biodiversity Strategy 2020 is to enhance the contribution of agriculture and forestry in maintaining and enhancing biodiversity. For agriculture, this objective is expressed by maximising "agricultural areas of grassland, arable land and permanent crops that are subject to biodiversity measures under the CAP in order to ensure the maintenance of biodiversity and a measurable improvement in the conservation status of species and habitats that depend on or are affected by agriculture and the provision of ecosystem services as compared to the 2010 EU baseline, thereby contributing to improved sustainable management"[43].

Agriculture as a branch of the economy is aimed at food production, but at the same time it has very important environmental functions. The objective of the Common Agricultural Policy (CAP), in accordance with Article 11 TFEU, is protecting the environment in order to promote sustainable development. The role of direct payments in environmental protection is explicitly mentioned in recital 37 of the preamble to Regulation (EU) No 1307/2013 of the European Parliament and of the Council[44], which states that through the mandatory "greening" element, direct payments aim at improving environmental performance. As part of the greening process, three greening practices have been made mandatory: crop diversification, maintenance of permanent grassland (PG) and maintenance of ecological focus areas (EFA), which have an impact on environmental protection and biodiversity conservation. Furthermore, apart from the greening of direct payments implemented since 2015, under the first pillar of the CAP, the cross-compliance principle is also implemented, which made the payment of full payments to farmers conditional, among others, on maintaining the land of the holding in good agricultural and environmental condition and on observance of a number of environmental requirements.

Under the second pillar of the CAP, in the perspective of 2014-2020, it was obligatory to allocate 1/3 of the funds of rural development programmes to measures for the environment and climate, which in the case of Poland means that the total public expenditure on this objective shall amount to EUR 4.46 billion (including the EU contribution of EUR 2.88 billion). Environmental and climate objectives are implemented in RDP 2014-2020 through the following measures: agri-environmental

[43] EC, *EU Biodiversity Strategy to 2020,* Information leaflet, 2011, http://ec.europa.eu/ (accessed: 08.01.2019).
[44] Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009 (OJ L 347, 20.12.2013, p. 608, as amended).

and climate measure, organic farming measure, payments for areas with natural or other specific constraints (LFA), afforestation activity and instruments supporting pro-environmental investments of agricultural holdings. The agri-environment-climate measure, which supports the voluntary use by farmers of environmentally friendly production methods, plays a particular role in the protection of biodiversity. This measure allows, among others, for the protection of valuable natural habitats within and outside Natura 2000 areas.

Biodiversity conservation must also be seen in terms of the genetic resources of crops and livestock. One of the manifestations of intensification of agriculture is the pressure to introduce highly productive, genetically homogeneous plant species and varieties adapted to modern conditions. In livestock production, traditional breeds are being displaced as a result of the desire to increase productivity and change rearing conditions. The narrowing of the gene pool of crops and animals used for agriculture is a negative phenomenon as it implies the loss of characteristics that could potentially ensure the stability of agricultural production in the future, especially in the event of changes in the environment. To this end, measures are being taken to conserve genetic resources in agriculture, including programmes to conserve animal genetic resources, gene banks, support for farmers using traditional animal breeds or plant species and varieties for agricultural production. In 1999, 32 programmes for the conservation of genetic resources were approved, covering 75 breeds, varieties and families of farm animals. Over the years, protection programmes have been revised and extended to include other livestock populations. In 2016, 83 breeds, varieties, families and lines of farm animals participated in protection programmes. Thanks to the protection of breeds, varieties, families and lines of farm animals, the population of native breeds has increased. These breeds are characterised by robustness and good health, longevity, good fertility, good adaptation to local, often very difficult environmental conditions. In addition, these breeds can be maintained with poor feed resources on the basis of permanent grasslands, which provides opportunities to manage and protect areas of high landscape value.

In order to conserve biodiversity in terms of animal genetic resources, it is necessary to continue the measures taken for the conservation of genetic resources in agriculture

One of the measures of RDP 2014-2020 is the agri-environment-climate measure (AECM). This measure promotes practices contributing to sustainable land management and biodiversity protection through the protection of valuable natural habitats and endangered bird species, the protection of endangered genetic resources of crops and farm animals, as well as the protection of landscape diversity. Of the 7 AECM packages, the following deserve special attention in the context of the protection of plant and animal genetic resources:

- Package 3. Preservation of orchards of traditional fruit tree varieties,
- Package 6. Preservation of endangered plant genetic resources in agriculture,
- Package 7. Preservation of endangered animal genetic resources in agriculture.

Package 3 "aims at protecting old varieties of fruit trees that have been largely abandoned"[45]. The support shall cover traditional varieties of apple (97 varieties), pear (36 varieties), sweet cherry (16 varieties), sour cherry (10 varieties) and plum (7 varieties) trees. In addition, other varieties traditionally grown in the territory of the

[45] *Agri-environmental-climate Measure Manual AECM 2014-2020*, Warszawa, 2017, p. 16. https://www.gov.pl/web/rolnictwo (accessed: 09.01.2019).

Republic of Poland before 1950 may also be supported. Traditional orchards are also a refuge and feeding ground for rare and endangered animal species, including birds and pollinating insects, and thus contribute to biodiversity conservation.

Package 6 aims to preserve and disseminate endangered and rare species, varieties, ecotypes, diversify crops in rural areas, extend the availability of regional or amateur seed of varieties listed in the National Register and seeds of plant species threatened by genetic erosion. These include the following plants: emmer wheat, einkorn wheat, *Secale montanum* Guss., *Camelina sativa, Melilotus albus,* lentil, parsnip, *Anthyllis vulneraria,* buckwheat.

Package 7 is aimed at the preservation of native breeds of animals threatened with extinction by supporting their breeding in accordance with the programmes for the protection of genetic resources developed and implemented by the Zootechnics Institute – National Research Institute in Balice near Kraków. The following species and breeds of animals are supported:

- cattle (4 breeds): Polish Red, Lowland (Białogrzbiete), Polish Black-and-White, Polish Red-and-White
- horses (7 breeds): Hucul, Małopolska, Śląska, Wielkopolska, Sokolska, Sztumska and Polish Konik,
- sheep (15 breeds): wrzosówka, świniarka, olkuska, Polish mountain sheep – coloured, coloured merino, uhruska, wielkopolska, żelaźnieńska, koridеil, kamieniecka, pomorska, cakla podhalańska, old-type Polish merino, blackhead, Polish Pogorze sheep,
- pigs (3 breeds): puławska, złotnicka white, złotnicka spotted,
- goats (1 breed): Carpathian goats[46].

In the 2018 campaign, the number of applications, the declared area and the number of animals in the Packages 3, 6 and 7 of the agri-environment-climate measures amounted to[47]:

– Package 3 – 721 applications, area 539.3 ha,
– Package 6 – 2936 applications, area 11,450.6 ha,
– Package 7 – 2765 applications, number of animals 79,023 pcs.

The programme of protection of plant genetic resources is one of the areas of the multiannual programme of the Minister of Agriculture and Rural Development, entitled "The Programme for the Protection of Plant Genetic Resources". "Creation of scientific basis for biological progress and protection of plant genetic resources as a source of innovation and support for sustainable agriculture and national food security", realised by the Plant Breeding and Acclimatization Institute – PIB, Research Institute of Horticulture in Skierniewice. A number of institutions also participate in the programme: Arboretum and the Department of Physiography in Bolestraszyce; Central Research Centre for Varieties of Cultivated Plants Experimental Station for Varieties Assessment in Karżniczka – Experimental Station for Variety Testing in Lisewo Malborskie; Institute of Natural Fibres and Medicinal Plants in Poznań; Institute of Soil Science and Plants Cultivation – National Research Institute in Puławy; Institute of Plant Genetics pf the Polish Academy of Sciences in Poznań; Polish Academy of Sciences Botanical Garden Center for Biological Diversity Conservation in Powsin; Warsaw University of Life Sciences (SGGW); Lower Vistula River Friends Society in

[46] Ibid., p. 26.
[47] Data from the Agency for Restructuring and Modernisation of Agriculture of 20.01.2019.

Gruczno; University of Life Sciences in Lublin; University of Life Sciences in Poznań; University of Warmia and Mazury in Olsztyn - Hodowla Roślin Strzelce; Małopolska Hodowla Roślin – Breeding and Production Plant in Palikije; PlantiCo Growing and Horticultural Seed Production in Zielonki; „Spójnia" Hodowla i Nasiennictwo Ogrodnicze Sp. z o.o. in Nochów; Poznańska Hodowla Roślin Sp. z o.o. in Tulce.

Within the framework of the programme for the protection of genetic resources of utility plants, more than 80 thousand objects of crop genetic material and other plant species of importance for food and agriculture are preserved in their living state. They are characterised, evaluated and shared. Work is also underway to increase plant genetic diversity in rural areas and to raise public awareness of the importance of plant genetic resources.

Collections of plants maintained in the gene bank include: agricultural plants (cereals, root crops, special, herbal, fodder, reclamation and energy crops, small-seeded legumes, marginal coarse legumes), vegetable plants, fruit plants (including rootstocks of seed trees, rootstocks of stone trees, rare species of fruit plants, berry plants), melliferous and ornamental plants. Resources are stored in the form of seeds and vegetative form – most often field collections, but also in vitro and in liquid nitrogen, located in the Plant Breeding and Acclimatization Institute – National Research Institute Radzików (central seed storage facility) and in a number of other institutions.

Preservation of the gene resources of cultivated plants is the basis for the food security of the country. The collections collected in gene banks are a reserve of genetic material that can be used for breeding, science and education, for the production of improved varieties adapted to changing climatic conditions, as well as being important for the preservation of the surrounding nature and cultural heritage.

The gene resource collection is also used by farmers implementing Package 3. Preservation of orchards of traditional fruit tree varieties and Package 6. Conservation of endangered plant genetic resources in agriculture under PROW 2014-2020.

Forests

Objective 3 of the EU Biodiversity Strategy 2020[48] is to enhance the contribution of agriculture and forestry to maintaining and enhancing biodiversity. In the case of forests, this objective refers to the adoption of forest management plans or similar instruments, in accordance with sustainable forest management, for all publicly owned forests and forest holdings above a certain size (defined by Member States or regions and listed in their rural development programmes) that receive EU rural development policy funding to deliver a measurable improvement in the conservation status of species and habitats that depend on or are affected by forestry and in the provision of ecosystem services compared to the 2010 EU benchmark. Analysis of changes in the bird index (34 species) associated mainly with forest areas (Forest Bird Index – FBI34) carried out as part of the Polish Birds Survey in the State Environmental Monitoring 2007-2012 indicates improving habitat conditions of forests in Poland for this group of animals.

[48] EU Biodiversity Strategy, objective 3B.

Fig. 6.4. Map of forest distribution in Poland in 2018

Source: CORINE Land Cover, http://clc.gios.gov.pl/ (accessed: 19.02.2019).

Forest areas, occupying almost 1/3 of the area of Poland, play an important role in maintaining the ecological security of the country. Forest management in Poland is carried out in accordance with the principles of universal forest protection, durability of their maintenance, continuity and sustainable use of all forest functions and increasing forest resources.

Sustainable, multifunctional forest management aims to preserve forests and their beneficial effects on climate, air, water, soil, natural resources and human health. The measures aim to ensure that the structure of forests is shaped so that the manner and rate of their use ensures the sustainable maintenance of their biological wealth, high productivity and regenerative potential. Forests should remain capable of fulfilling, both now and in the future, all important protective, economic and social functions at local, national and global levels, without harming other ecosystems.

The area of forests in Poland is 9.2 million ha[49], which corresponds to 29.6% forest

[49] Statistics Poland, *Statistical Yearbook of Forestry 2018*, Warszawa, 2018, p. 37.

cover. In 2017, the forest cover of Poland calculated according to the international standard was 2 percentage points lower than the European average (Poland's forest cover 30.9%, European average 32.8%), but similar to that of other large countries located in the Central European Plain (i.e. France – 32% and Germany – 33%). The forest cover in Poland has been systematically increasing since 1945. In accordance with the objective set out in the "National Programme for Increasing the Forest Cover", the forest cover of Poland should increase to 30% in 2020 (and to 33% in 2050). At present, the achievement of the target is facing increasing difficulties due to the low supply of land for afforestation.

In Poland, public forests are dominant, constituting 80.7% of the total forest area, of which 76.9% is managed by National Forest Holding State Forests (PGL LP), 2% are national parks, the remaining forests are owned by municipalities and other entities. Private forests account for 19.3% of the total forest area[50]. Concentration of the vast majority of forest areas in the country in public hands, gives much greater opportunities for the implementation of multifunctional forest management.

The dominance of state ownership in the governance structure has facilitated the introduction of a multifunctional forestry model that ensures the maintenance of a high level of biodiversity and the stability of ecosystems and their sequencing processes. This is evidenced by the fact that 39% of the State Forests area was covered by the Natura 2000 network areas in order to preserve specific types of natural habitats and species considered valuable and endangered on a European scale. The multifunctional and sustainable forest management of PGL LP enables the balance between the natural (protective), social and economic functions provided by the forests to be maintained. At the same time, it creates conditions for preserving the natural richness of forests, at the same time using their resources to satisfy social and economic needs and maintaining financial independence of the State Forests. Forests are the place where the game management is carried out.

Sustainable forest management ensures the supply of timber to meet the needs of various sectors, including wood, furniture, pulp and paper, construction and energy production (forest biomass). Timber resources in Polish forests reached the volume of almost 2.58 billion m^3 (including 2.03 billion m^3 in the State Forests)[51]. In terms of the volume of these resources, our country ranks fourth in the European Union. In the last 50 years, the supply of standing timber has doubled. Approximately 90% of the timber used in the country is supplied by the State Forests. Since 1990, the consumption of timber in Poland has more than doubled (to over 1 m^3 per person per year). Thanks to the growing resources, the State Forests are able to meet the growing demand, increasing the supply of timber to the market: from 17 million m^3 in 1990 to 38.3 million m^3 large timber net in 2015.

Forests are an important element in stabilising the local and global climate. It is estimated that the carbon content of forest biomass in Poland is 822 million tonnes[52], including 685 million tonnes in standing timber and 32 million tonnes in underground wood. The amount of CO_2 absorbed annually (including the use and absorption of gas by the soil) is estimated at 41.4 million tonnes, which translates approximately into 11.3 million tonnes of carbon. In comparison with European countries, Poland is one

[50] Ibid.
[51] National Forest Holding State Forests, *Report on the State of Forests in Poland 2017*, Warszawa, 2018, p. 21.
[52] Ibid., p. 30.

of the leaders in the amount of carbon bound in wood biomass in forest areas. This is largely due to the size of resources and the species, habitat and age structure of Polish forests.

Forests not only represent a significant carbon stock, but also have great potential to mitigate climate change, which can be enhanced by additional measures in the forest sector. Such actions also contribute to the increase of biodiversity. The forest area where additional activities shall be carried out shall also become an area of increased biodiversity.

Poland plans to establish a system of additional forestry measures to increase carbon sequestration. This system would be based on additional activities related to sustainable forest management. Within the framework of these activities, it is planned to develop long-term programmes of reconstruction of the species composition of stands and programmes of shaping their multi-stratum structure.

Forests significantly improve natural water retention and water management in catchment areas, stopping and reducing the outflow of rainwater. The water protection function is dominant in 21.7% of forests managed by PGL LP, and the method of forest management is aimed at improving water management. The role of forests in shaping favourable health and recreation conditions for the society is also important. The challenge for forestry is to develop methods of forest non-productive services valuation, which fits into a broader subject of ecosystem services valuation.

Landscape

The landscape is the external image of all elements of the natural environment and human activity, as well as the universal resource of cultural message. Its resources consist of spaces changed to a different extent by human activity, in large part saturated with material souvenirs – starting from the landscape of cities, through fully anthropogenic agricultural areas to unique natural and near-natural complexes, such as the Białowieża Primeval Forest or Biebrza Valley.

In contrast to other elements of the environment, the resource potential of the landscape is least defined and recognised. There is a lack of universal education about it, its cultural, natural, social and economic significance and, what is extremely important, instruments for the protection of spatial order. This is a significant obstacle to rational management of spatial development, including effective protection of unique landscapes, important for the preservation of national identity. Meanwhile, the use of the unique potential of the Polish natural and landscape resources is an opportunity for the sustainable development of the country.

On 24 June 2004, Poland ratified the European Landscape Convention, hereinafter referred to as "ELC". The Parties to the ELC, while accepting its objectives, are obliged to take general and specific measures for the protection, planning and management of the landscape. General measures include the legal recognition of landscape as an important component of the human environment, establishment and implementation of a landscape policy, creation of procedures for public participation in the creation of this policy and inclusion of landscape issues in all other policies which directly or indirectly affect the landscape.

Among the special measures (defined in Article 6 of the Convention), an important element of measures for the protection of landscape is raising awareness of the public and other entities with regard to the value of landscape, its role and changes introduced in it.

According to the *Recommendation CM/Rec(2008)3 of the Committee of Ministers on guidelines for the implementation of the European Landscape Convention*, knowledge about landscape contributes to strengthening relations between society and its environment and constitutes the basis for sustainable development, which affects the entire process of defining landscape policy. "The high quality of the landscape is conducive to the formation of social bonds, and the inhabitants identify more strongly with the harmonious and rationally shaped environment. The environment of human life inspires and influences human activity, creating an inseparable connection with space. The economic importance of the landscape is important for the inhabitants of tourist resorts. It is the surrounding space that constitutes an element of territorial marketing within the framework of regional promotion and, at the same time, is a specific source of income"[53].

Awareness-raising aims to clarify the relationship between environmental characteristics and living conditions of society and the daily activities of authorities and society.

With this in mind, since 2010 the General Directorate for Environmental Protection (GDOŚ) has been undertaking activities aimed at raising public awareness in the field of relations between landscape and man, including, among others, the initiation and celebration of the Landscape Day.

An important step in the implementation of the ELC to the Polish legal system was the adoption of the Act of 24 April 2015 on the amendment of certain acts in connection with the strengthening of landscape protection tools (OJ L, item 774, as amended), hereinafter referred to as the Landscape Act. The Landscape Act, by introducing the obligation to prepare a landscape audit, takes into account the ELC regulations on identification and assessment of landscapes (Article 6C), as well as, partly, on definition of landscape quality objectives for identified and assessed landscapes (Article 6D) and introduction of instruments aimed at landscape protection, management and planning (Article 6E). In addition, measures are being implemented over legislative changes concerning the strengthening of legal protection of landscape. Pursuant to the Act of 27 March 2003 on spatial planning and development (OJ L of 2018, item 1945, as amended), a detailed methodology for conducting and scope of landscape audit were defined in the Regulation of the Council of Ministers of 11 January 2019 on landscape audits (OJ L of 2019, item 394).

The landscape audit shall be prepared in order to identify, characterise and evaluate the landscapes occurring in the territory of particular voivodships, as well as to define the principles of shaping landscapes recognised as the most valuable, so called priority landscapes.

When taking measures to protect and shape landscapes, it should be borne in mind that landscape includes many aspects of human life. It is a very complex concept, and at the same time understood in different ways by different social and professional groups. Public participation in landscape planning and planning as well as in spatial

[53] Regional Directorate for Environmental Protection in Białystok, *Different faces of the landscape*, http://bialystok.rdos.gov.pl/ (accessed: 19.02.2019).

planning is a prerequisite for reaching compromises and balancing individual and public interests. Insufficient level of participation and the manner in which the relevant authorities carry out their activities make it difficult to understand and accept planning decisions, which results in social conflicts[54].

In order to achieve the objective set for voivodship self-governments, a holistic approach should be applied to landscape audit. In view of the above, activities aimed at developing the methodology of landscape identification and assessment (methodology of landscape audit) started already in 2013, when, as part of the implementation of the ELC regulations, GDOŚ organised the first national conference devoted to this issue. In the following year, GDOŚ commissioned the development of a methodology for identification and assessment of landscapes ("Identification and Assessment of Landscapes – Methodology and Main Threats", 2014), which was discussed in a very broad group during the next national conference. In 2015, the Ministry of the Environment commissioned the testing of the developed methodology in a selected pilot area ("Conducting a Landscape Audit – Testing the Methodology for Identification and Assessment of Landscapes", 2015).

Furthermore, within the framework of annual conferences organised by GDOŚ, devoted to current issues related to landscape, there is an exchange of information and integration of various circles dealing with the issues of landscape shaping and protection. Issues related to the protection and shaping of the landscape are particularly important due to implemented and planned investments, including linear investments. Well planned investments are those that have a limited negative impact on the environment and fit harmoniously into the landscape. It is crucial to make the society aware that interference in the environment starts with changes in the landscape and the quality of the landscape in the long term is inseparable from the quality of life. Therefore, it is very important to conduct education on the role of landscape at different levels[55].

Proper landscape shaping and conservation can play a key role in maintaining ecological connectivity in the environment. Spatial planning taking into account important elements of the landscape and natural environment is able to guarantee the maintenance and restoration of ecological communication in the environment.

Summary

Poland is distinguished by its natural wealth, including relatively large biodiversity. The number of areas of high natural value subject to conservation measures is increasing. The value of nature is also evidenced by the large area of the Natura 2000 network of areas created for the protection of endangered species and natural habitats on a European scale. This network constitutes about 20% of the country's area.

However, the conservation status for most endangered species and natural habitats on a European scale is described as unsatisfactory. The reason for such an assessment is not only the population status for species or a specific structure and function for natural habitats, but also the status of those habitats, small surface area or poor conservation outlook, and sometimes also the scope. The fact that many rare species of fauna and flora as well as types of natural habitats (some of them preserved in good

[54] Own elaboration by GDOŚ.
[55] Richling A., Solon J., *Ekologia Krajobrazu* (Landscape Ecology), PWN, Warszawa, 2011.

condition) occur in Poland makes Poland particularly responsible for the protection of the European natural heritage.

At present, there is a decrease in the number of many bird species (e.g. common farmland birds, open wetlands birds). At the same time, the number of some of them is increasing (e.g. common forest birds, Haliaeetus albicilla, Nycticorax nycticorax), while others are stable.

The abandonment of extensive agricultural use of valuable non-forest areas, intensification of agriculture, improperly functioning irrigation and drainage systems with negative impact on the maintenance of open habitats, including wetlands and wet and damp meadows, development of transport, tourism, industrial and energy infrastructure (small hydroelectric power plants, wind turbines) pose serious threats. These factors contribute in particular to secondary succession, habitat fragmentation, disappearance of habitats of rare species of wetland fauna and flora and landscape decline. Natural factors such as severe winters in the case of birds are also important.

Waste*

* W rozdziale zacytowano obszerne fragmenty opracowań: Stan środowiska w Polsce Sygnały 2016 (GIOŚ 2017), pod red. B. Albiniak oraz Stan środowiska w Polsce, Raport 2014, (GIOŚ 2014).

Waste management is one of the areas of environmental protection where we face many challenges. Waste is a potential resource if it is prepared for re-use, recycled or otherwise recovered. On the other hand, neutralised waste may be treated as a loss of resources and a manifestation of inefficiency of the economy. Recycling of waste is part of the bioeconomy concept whereby waste can be processed into value-added products such as feed, biomaterials, bioproducts and bioenergy.

Inappropriate waste management has a direct negative impact on the quality of all parts of the environment, and thus on the health of ecosystems and humans. Leachate from poorly operated landfills can contaminate water and soil. Landfills can also cause air pollution through the emission of odours, volatile pollutants and methane, contributing to climate change. Landfills occupy large areas (loss of space – most often valuable biologically active surface) and reduce the aesthetic value of the landscape. Irrational waste management is also a sign of environmentally inefficient use of resources.

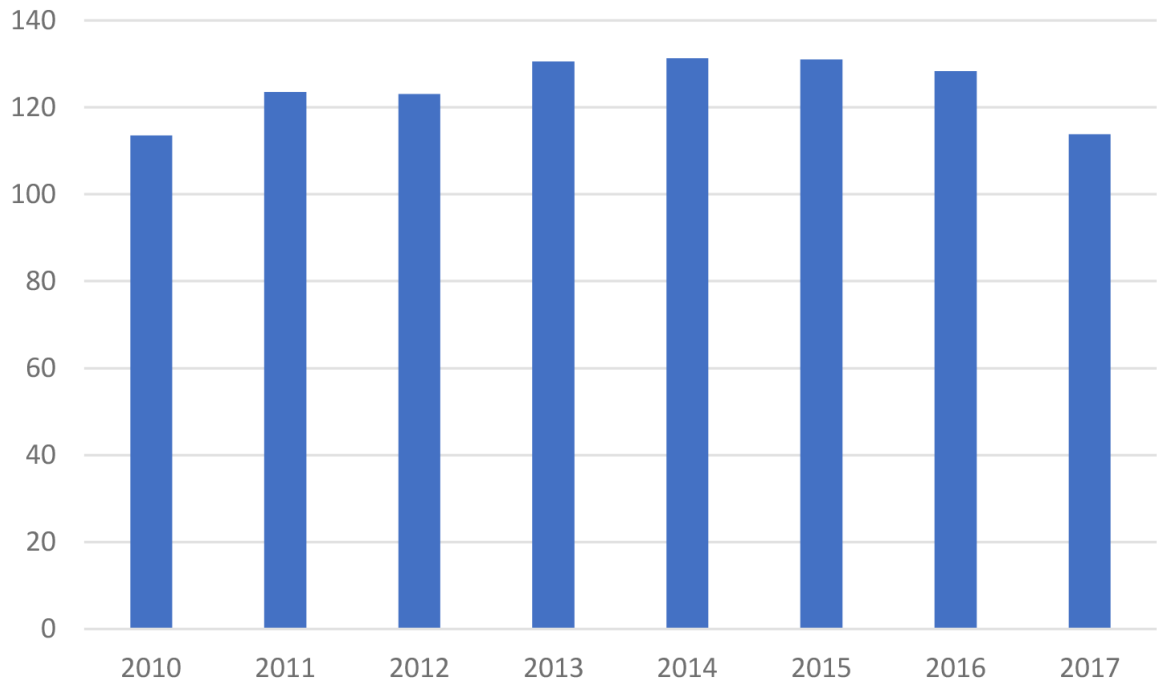
A detailed analysis of the current state as well as objectives and directions of development of waste management at the national level have been included in the National Waste Management Plan 2022 (KPGO 2022) adopted by the Council of Ministers. KPGO 2022 is supplemented by voivodship waste management plans (WPGO) adopted by the Voivodship Assemblies. Investment requirements for achieving waste management objectives are set out in the WPGOs, which include

investment plans as annexes. Therefore, the planning of the necessary infrastructure and the determination of the waste stream to be processed in the installations results from the analysis of the state of waste management in the voivodship, which was carried out within the framework of the project. In addition, with respect to municipal waste, investment plans include an indication of the planned investments with an estimate of the costs and the sources of financing, as well as a schedule for implementation.

Polish and EU law introduced a hierarchy of waste management procedures, according to which waste generation should be prevented in the first place (e.g. by reusing objects or materials), and if waste has already been generated, it should be managed by preparing it for reuse, recycling or other recovery processes. If waste cannot be used, it should be disposed of, with landfilling being the least desirable form of waste management.

The main factor determining the amount of waste generated is economic development, which affects both the intensity of production and the level of individual consumption and patterns of consumption. Analysing the dynamics of changes in the amount of waste generated in relation to the changes in GDP since 2000, a positive trend can be observed – a constant level of waste generation at over 50% increase in GDP. This can be considered as an effect of actions taken to rationalise waste management in Poland.

Fig. 7.1. Industrial waste generated in Poland in the years 2010-2017 (million tonnes).

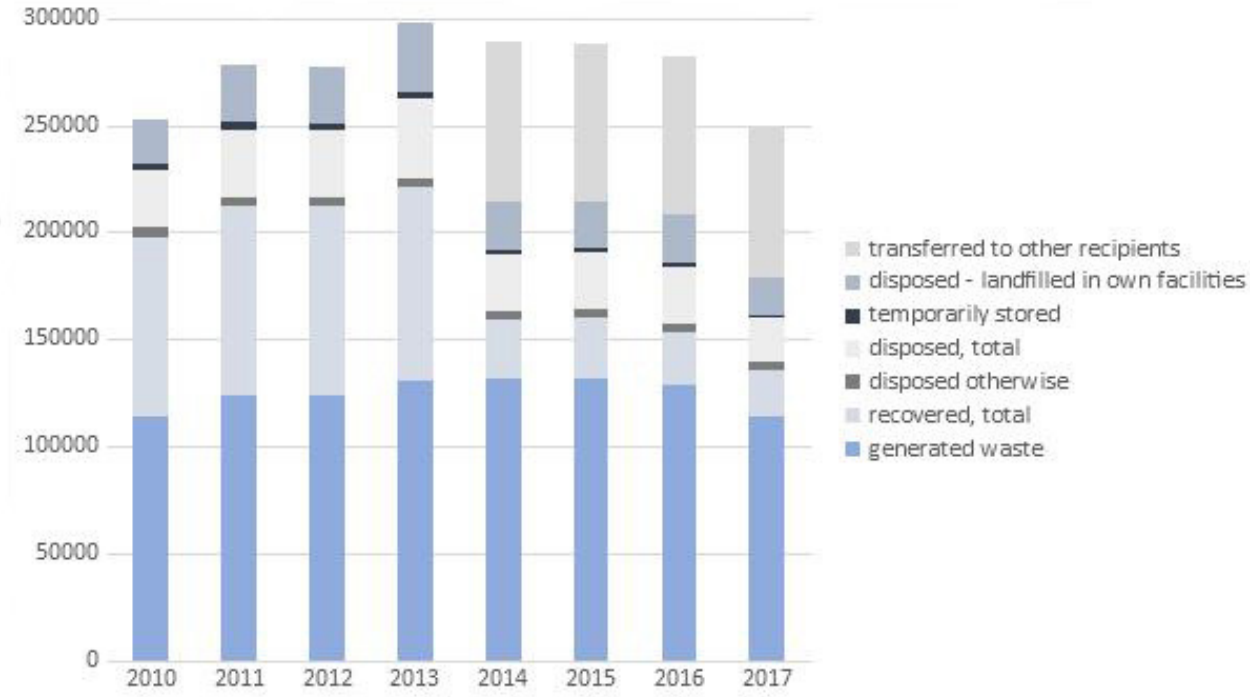


Source: Own elaboration based on LDB data – Statistics Poland, State and Protection of the Environment.

In 2017, 114 million tonnes of industrial waste (i.e. excluding municipal waste) were generated in Poland. Since the beginning of the 21st century, the weight of industrial waste generated has remained relatively stable, at around 120 million tonnes.

The main source of industrial waste generation in 2017 was mining, in particular hard coal and lignite mining (over 25% of the total amount of industrial waste generated). The production and distribution of electricity, gas and steam accounts for approximately 15%, production of metals – 8.4%, and production of chemicals and chemical products – 4.7% of the total mass of industrial waste generated in 2017. The largest share in industrial waste generated in 2017 was accounted for by waste arising from washing and preparation of minerals (approximately 27.7%), waste from flotation enrichment of non-ferrous metal ores (approximately 24.8%) and ash-slag mixtures from wet removal of furnace waste (7.2%).

Fig. 7.2. Management of industrial waste in Poland in the years 2000-2017 (thousand tonnes).



Source: Own elaboration based on LDB data – Statistics Poland, State and Protection of the Environment.

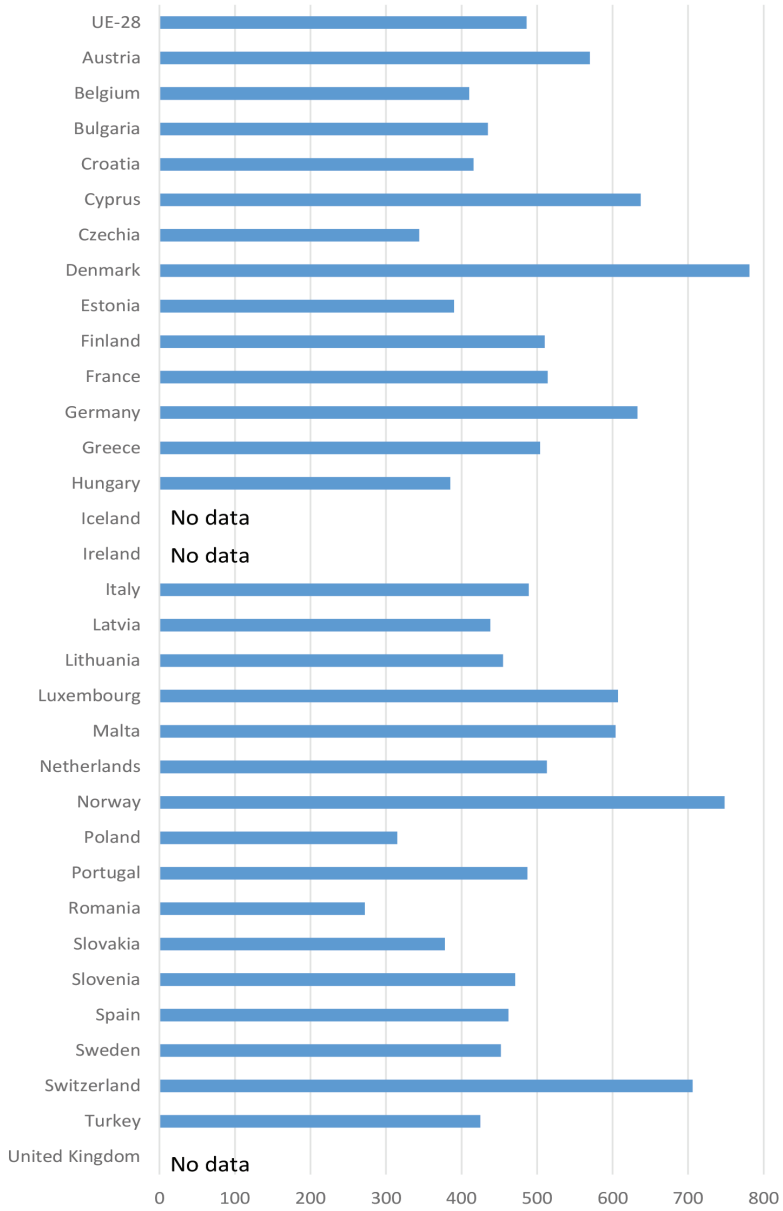
Out of the total amount of industrial waste generated in 2017, 28.2% was transferred to other recipients, 8.7% was recovered, 6.8% was disposed of through storage, over 1.5% was disposed of in a manner other than storage, and about 0.5% was temporarily stored.

The data presented by GUS show that until 2005 there was a successive increase in the share of industrial waste recovered in the total weight of waste generated, with a simultaneous decrease in the share of landfilled waste. However, since 2006 the opposite trend has been observed. The increase in the share of waste sent to landfills is a disturbing phenomenon and may indicate that actions taken to increase the amount

of recovered industrial waste are not sufficient. It may also be related to the fact that from 2014 onwards, the phenomenon of transferring waste to other recipients has been recorded, which may result in an increase in the number of illegal landfills, and thus in a reduction in the amount of recovered waste.

In the European Union countries, an average of 483 kg of municipal waste is generated per year per capita (data for 2016). In Poland, this indicator in 2017 amounted to 312 kg and is one of the lowest in the EU. The change in the municipal waste management system made in 2011 introduced new regulations assuming that municipalities are responsible for organising the municipal waste collection and management system in their area. Since the introduction of the "waste reform", data on municipal waste have shown an improvement in the situation in this area. In 2012, 84% of collected waste was stored at landfills, while in 2017 it was 41.8%. The share of segregated waste in the total amount of collected municipal waste increased from 10.5% in 2012 to 27% in 2017.

Fig. 7.3. The amount of municipal waste generated per capita in 2017 in the EU countries (kg).

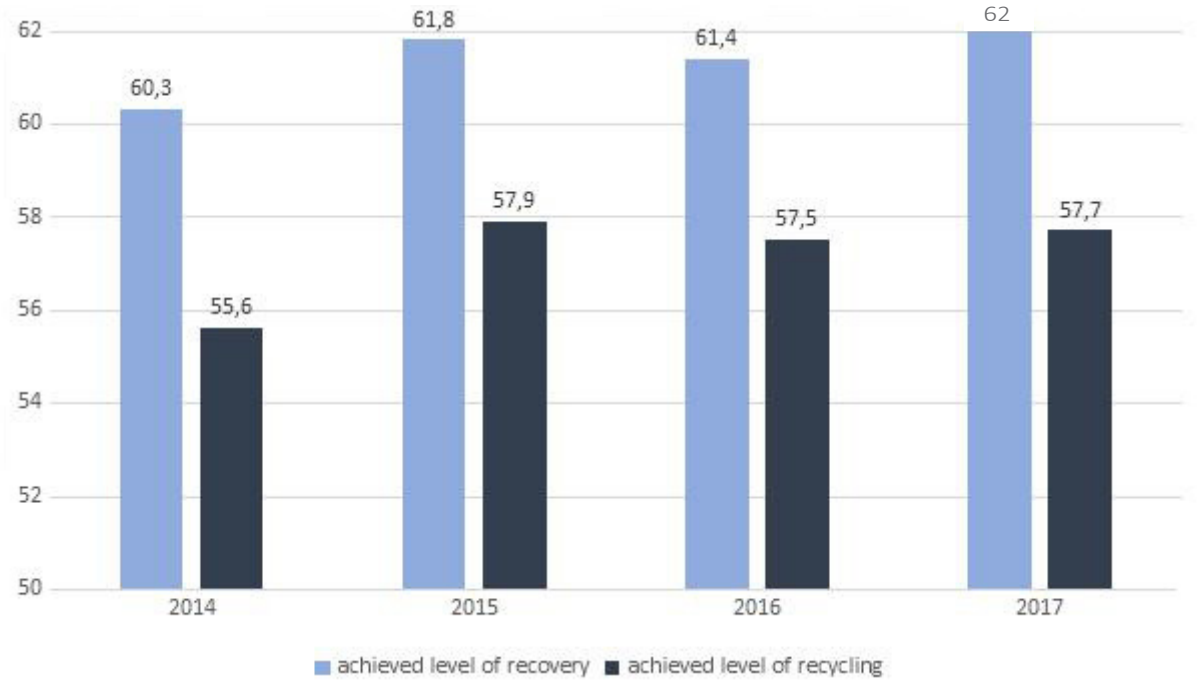


Source: Eurostat – Municipal waste by waste management operations (env_wasmun).

Since 2005, there has been a noticeable increase in the amount of collected waste: from 9.4 million tonnes in 2005 to 12.0 million tonnes in 2017 (from 2014, the amount of collected waste includes waste collected from all property owners, in accordance with the new waste management system introduced by the municipalities on 01.07.2013).

Out of the 12.0 million tonnes of waste collected in 2017, 27% were segregated. The collected municipal waste was subjected to landfilling (41.8%), recycling (26.7%), composting or fermentation (7.1%) and thermal transformation (24.4%).

Fig. 7.4. Annual levels of recovery and recycling of packaging waste in Poland in the years 2014-2017 (%).



Source: own elaboration based on Statistics Poland, Environmental Protection 2017, Warszawa, 2017, p. 339. Statistics Poland, Environmental Protection 2018, Warszawa, 2018, p. 156.

The Act of 13 June 2013 on packaging and packaging waste management (OJ L of 2019, item 542), which transposes Directive 94/62/EC[1], establishes, the general levels of recovery, including recycling of packaging waste. According to the Annex, the required level of recovery of packaging waste is 61%, including 56% for recycling. Comparing the levels achieved between 2015 and 2017, it can be seen that the required recovery and recycling rates were achieved in 2015 and maintained in later years. In 2014, the national targets were not met (60.3% recovery and 55.6% recycling), but it is worth noting that the targets set by the aforementioned directive (60% of recovery and 55% of recycling) were met.

[1] Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste (OJ L 365 of 31.12.1994, p. 10, as amended; Polish translation section 13, vol. 13, p. 349, as amended).

Fig. 7.5. Waste electrical and electronic equipment collection rate in Poland in the years 2007-2016 (%).

Source: own elaboration based on: GIOŚ, Report on the Functioning of the Waste Electrical and Electronic Equipment Management System2.

European Union regulations on waste electrical and electronic equipment management were implemented in 2006. The waste electrical and electronic equipment management system is supervised by the Chief Inspectorate for Environmental Protection (GIOŚ). Positive trends in the handling of "e-waste" are noticeable: annual increase in the level of collection of waste electrical and electronic equipment from 4.88% in 2008 to 47.99% in 2016. At the same time, an increase in the level of collection of electronic equipment in households is observed from 1.85% in 2008 to 33.66% in 2013 (from 2013 the level of collection of waste equipment is given in total without specifying the achieved level of collection of waste equipment from households). Calculated per capita, the amount of waste electrical and electronic equipment collected increased from 0.71 kg in 2007 to 5.58 kg in 2016.

The Act of 24 April 2009 on batteries and accumulators (OJ L of 2019, item 521) transposed the provisions of Directive 2006/66/EC[3], which obliges Member States to achieve the following minimum collection rates for waste portable batteries and accumulators:

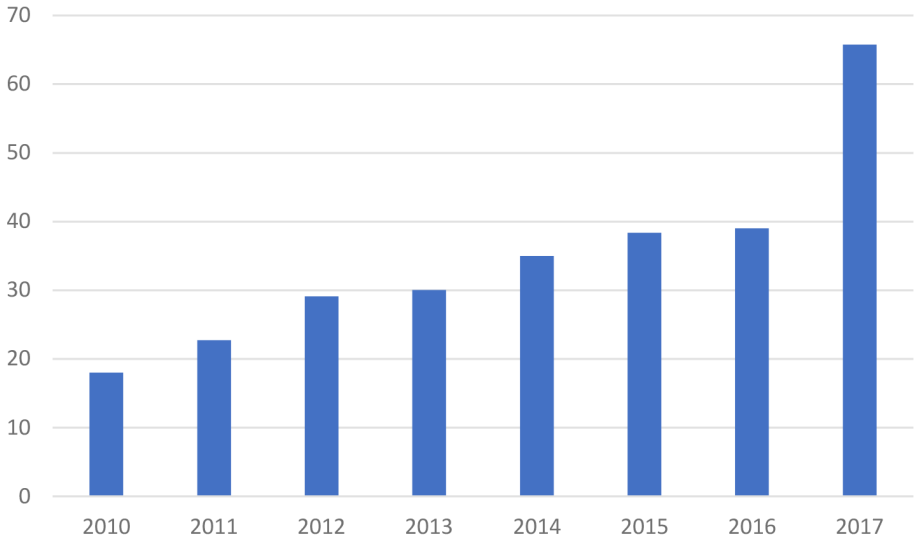
(a) 25% by 26 September 2012,

(b) 45% by 26 September 2016.

[2] Individual reports were used for each year. The data in the chart are contained in the following documents, respectively: *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2007*, Warszawa, 2008, p. 5; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2008*, Warszawa, 2009, p. 5; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2009*, Warszawa, 2010, p. 8; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2010*, Warszawa, 2011, p. 7; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2011*, Warszawa, 2012, p. 8; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2012*, Warszawa, 2013, p. 9; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2013*, Warszawa, 2014, p. 9; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2014*, Warszawa, 2015, p. 10; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2015*, Warszawa, 2016, p. 10; *Report on the Functioning of the Waste Electrical and Electronic Equipment Management System in 2016*, Warszawa, 2017, p. 14.

[3]Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC (OJ L 266 of 26.09.2006, p. 1, as amended).

Fig. 7.6. Annual collection rates for waste portable batteries and waste portable accumulators in Poland 2010-2017 (%).



Source: own elaboration based on the reports of the Chief Inspectorate for Environmental Protection on the functioning of the management of batteries and accumulators and waste batteries and accumulators for the years 2010-20174.

Despite a clear upward trend in the collection rates of this type of waste over the years 2010-2017, the data for 2017 indicate that Poland, by reaching an annual collection rate of more than 65%, met its obligation to reach the level of 45% imposed by Directive 2006/66/EC[5]. This situation is undoubtedly influenced by the annual increase in the sales of batteries and accumulators due to the growing demand for electrical and electronic equipment, which is largely powered by portable batteries or accumulators. It should be noted that the weight of portable batteries and accumulators placed on the market is growing faster than the generation of such waste. This is due, among other factors, to the improvement in the quality of batteries and accumulators, which manifests itself in their longer service life.

In 2005, European Union legislation on the treatment of end-of-life vehicles was implemented. Analysing the available data, a systematic increase in the number of end-of-life vehicles delivered to disassembly stations can be observed: from 151,000 in 2006 to over 365,000 in 2016. In the same period, the level of reuse and recycling of this waste stream increased from 84.7% to 94.7%, and the level of reuse and recovery increased from 85.8% to 97%[6].

[4] *GIOŚ, Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2010*, Warszawa, 2012, p. 7; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2011*, Warszawa, 2012, p. 7; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2012*, Warszawa, 2013, p. 7; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2013*, Warszawa, 2014, p. 6; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2014*, Warszawa, 2015, p. 6; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2015*, Warszawa, 2016, p. 7; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2016*, Warszawa, 2017, p. 7; GIOŚ, *Report on the Functioning of the Management of Batteries and Accumulators and Waste Batteries and Accumulators for 2017*, Warszawa, 2018, p. 7.

[5] Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

[6] Data provided to the European Commission in the reports on the achieved levels of reuse and recovery and reuse and recycling of end-of-life vehicles in relation to the Directive 2000/53/EC of the European Parliament and of the Council of 18

The instruments supporting rational waste management are waste management plans. Waste management plans are developed at the national and voivodship level. The role of municipality, county and voivodship local government units in creating proper waste management habits among the residents in order to conduct rational waste management in accordance with the law is important. Rational management of waste generated by individual entities; households should be conducted by increasing the awareness of residents about possible threats to the environment arising from improper management of waste.

September 2000 on end-of-life vehicles (OJ L 269 of 21.10.2000, p. 34, as amended, Polish translation section 15, vol. 5, p. 224, as amended), accessible through the Eurostat Waste Database.

Geological resources

Poland has large reserves of hard coal and lignite, relatively small reserves of conventional natural gas, small reserves of crude oil and yet undefined resources of shale gas[1]. "In total, approx. 400 million tonnes of minerals are mined in Poland, of which approx. 25% is hard coal, 22% natural aggregates, 15% lignite, 9% limestone and marl for the cement industry, 7% copper ore, 6% road and construction rock, 3% sands"[2].

Hard coal mining is currently carried out in two regions: The Upper Silesian and Lublin Coal Basins, and the documented recoverable resources as at 31 December 2017 amount to 60 496 million tonnes. The resources of the developed deposits currently account for 37.19% of the recoverable resources and amount to 22 497 million tonnes. In 2017, Polish mines extracted 56 824 thousand tonnes of hard coal. As at 31 December 2017, the documented recoverable resources of lignite in Poland amounted to 23 385 million tonnes, with all the resources being used for power generation purposes. The largest currently exploited lignite deposit "Bełchatów" (Bełchatów – "Bełchatów" Field and Bełchatów – "Szczerców" Field) covers over 70% of the national production, and the remaining part of the demand is covered by the deposits of Turów near Bogatynia and the deposits of the Konin region: Pątnów and Adamów. Lignite production in 2017 amounted to 63 060 thousand tonnes and, with unchanged demand, these resources will last for almost 350 years[3].

[1] This strategy follows the name most frequently used in public discussion for the general term „gas from unconventional resources". It should be noted that unconventional gas covers a much wider range of resources than shale gas alone.
[2] PWN Encyclopaedia, *Poland. Natural conditions. Mineral resources*, https://encyklopedia.pwn.pl/ (accessed: 05.03.2019).
[3] Polish Geological Survey, *Balance of Mineral Resources as at 31 December 2017*, Polish Geological Institute – National Re-

The main region in which natural gas deposits occur in Poland is the Polish Plain. The documented recoverable resources of natural gas as at 31 December 2017 amounted to 119.19 billion m^3 (total recoverable and non-recoverable resources), while the resources of the developed deposits amounted to 94.48 billion m^3 [4]. In 2017, the consumption of natural gas in Poland amounted to 19.1 billion m^3 [5], of which approx. 4.1 billion m^3 came from domestic production converted into high-methane natural gas. With unchanged share of gas imports in domestic consumption, domestic deposits shall be sufficient for about 30 years and for about 10 years if the demand was met entirely from own resources, assuming that there shall be no exploration and recovery strategy. These calculations do not take into account the potential of shale gas production, as these deposits are not yet documented. According to various sources, these resources may exceed the current reserves of natural gas from conventional deposits by several to more than a dozen times.

Crude oil is present in small quantities in Poland in the Carpathians, in the Polish Plain and in the Exclusive economic zone of Poland in the Baltic Sea. In 2017, the recoverable resources of crude oil and condensate amounted to 23,994 thousand tonnes (with annual production of 939.24 thousand tonnes)[6], while imports of crude oil amounted to 23,981 thousand tonnes[7].

Among chemical raw materials, the key role is played by native sulphur (resources as of 31 December 2017 – 503.85 million tonnes) and rock salt (resources as of 31 December 2017 – 85.27 billion tonnes)[8]. Sulphur deposits occur around Tarnobrzeg (Piaseczno, Machów, Jeziórko), south of Szydłowiec (Grzybów, Osiek) and near Lubaczów (Horyniec, Basznia). Rock salt deposits occur in the area of the Carpathian Foredeep (Bochnia, Wieliczka, Łężkowice, Siedlec), in the form of salt intrusions in the north-eastern Wielkopolskie and Kujawsko-Pomorskie (Inowrocław, Góra, Kłodawa, Izbica Kujawska, Rogóźno, Mogilno). There are deposits of potassium salt (polyhalite) over the Bay of Gdańsk.

Among the most abundant metallic resources in Poland are copper ore deposits (recoverable resources – 1931.95 million tonnes of ore containing 34.59 million tonnes of copper – 10% of world resources and 104.47 thousand tonnes of silver)[9] and zinc and lead (84.42 million tonnes of ore containing 3.63 million tonnes of zinc and 1.43 million tonnes of lead)[10].

The occurrence of deposits of thermal waters, medicinal waters, brines and medicinal peats has been documented in Poland. Thermal waters in Poland are found in a large part of the Polish Plain in vast reservoirs of regional importance, as well as in the Carpathians and their foothills and in the Sudetes, where the deposits have the character of small basins (Podhale) or are limited to tectonic zones. They are used mainly for heating purposes in several existing geothermal heat plants (including Bańska, Pyrzyce, Mszczonów, Uniejów, Stargard) and for recreational purposes (including Szaflary, Bukowina Tatrzańska, Białka Tatrzańska, Mszczonów). Most

search Institute, Warszawa, 2018, pp. 33-44.

[4] Ibid., p. 13.

[5] *BP Statistical Review of World Energy. June 2018. https://www.bp.com (accessed: 4.6.2019).*

[6] Polish Geological Survey, *Balance of Mineral Resources ..., ibid.*, p. 29.

[7] Polish Geological Institute, *Import and Export of Minerals and Certain Semi-finished Products in 2017*, http://geoportal.pgi.gov.pl/ (accessed: 20.02.2019).

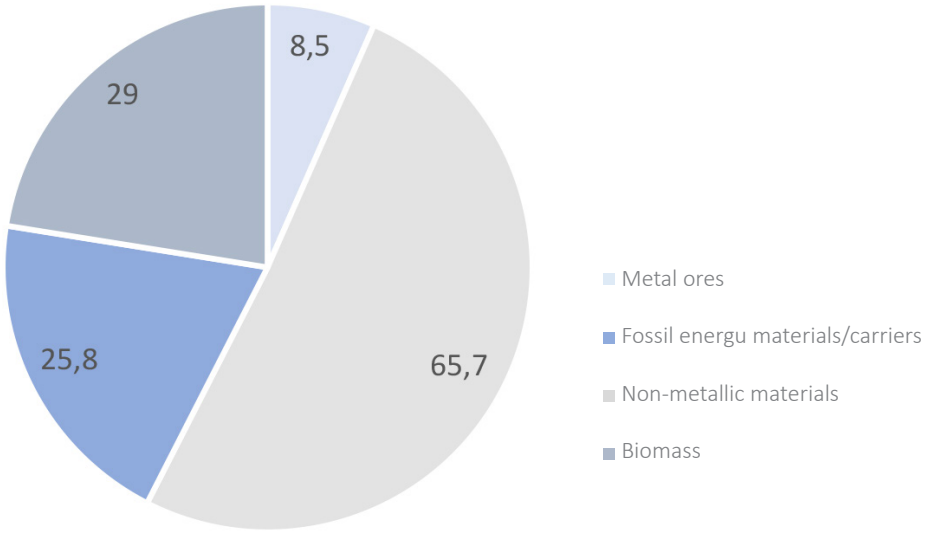
[8] Polish Geological Survey, *Balance of Mineral Resources ..., ibid.*, pp. 70, 77.

[9] Ibid., p. 53.

[10] Ibid., p. 50.

of the medicinal waters occur in the towns grouped in the southern part of Poland, including the Sudetes and the Carpathians, together with the Carpathian Foredeep. Over 70% of the total number of spas and resorts with medicinal waters in Poland are located in these regions. In addition, medicinal waters in a larger accumulation occur in Zachodniopomorskie and in several places in the remaining part of the Polish Plain. Medicinal waters are used for balneotherapeutic purposes in 42 spas and other localities, for bottling purposes, as well as for the production of spa products, i.e. salts, lyes, sludges, pharmaceutical preparations. Furthermore, in the area of Poland there are deposits of medicinal peat bogs (including Kamień Pomorski, Bronowo) used in balneology for baths and compresses and for manufacturing medicinal products, as well as brines used in the production of medicinal salt and bathing brine (Łapczyca)[11].

Fig. 8.1. Structure of domestic extraction of minerals in Poland in 2017 (%).



Source: Eurostat, http://appsso.eurostat.ec.europa.eu (accessed: 12.03.2019)12.

Domestic extraction of minerals, as part of domestic extraction and expressed by the domestic extraction used (DEU) rate, amounted to 462.2 million tonnes in 2015. The dominant category in this case are non-metallic minerals.

The measure of the material intensity of the economy is the resource productivity index calculated as the ratio of GDP to domestic material consumption (DMC). The higher the value of this indicator, the less material is used to produce a GDP unit. The value of this indicator achieved by Poland, similarly as in the case of most other so-called new EU Member States, is much lower than the EU average, which proves the high material intensity of our economy. It is caused, among others, by the structure of the Polish economy with a significant share of heavy industry and agriculture. The productivity index of the Polish economy resources in 2015 amounted to 0.7 EUR of the generated GDP per kg of materials directly used in the economy, compared with the EU average of 2.2. In 2015, Poland was among the most material-intensive economies behind Estonia, Bulgaria and Romania.

[11] PIG-PIB, *Balance of Mineral Resources in Poland as at 31 December 2016,* p. 458.

[12] Domestic material consumption (DMC) – material directly used in the economy, defined as domestic extraction plus imports, minus exports. The DMC represents the assessment of resource use in absolute terms; data for 2017 are preliminary estimates by Eurostat.

Domestic material consumption (DMC) in 2017 amounted to 654 million tonnes. Since 2011, a decrease in the value of the domestic material consumption index has been noticeable. About half of the domestic material consumption is made up of non-metallic minerals (this category includes construction materials such as sand and gravel), biomass – 29%, fossil fuels – 20%, while the rest is made up of metal ores. The value of DMC for Poland recorded in 2015 was one of the highest in the European Union. Poland was among the top three countries with the highest material use, after Germany and France. The material uses per capita in Poland amounted to nearly 17 tonnes, while the EU average was below 13 tonnes.

It can be assumed that with the change in the structure of the economy, the productivity rate shall increase, among other factors, due to the use of better technologies or the increasing share in the economy of services that consume less resources than industry and agriculture. However, it should be remembered that the competitiveness of the economy and the possibility of building advanced services is only possible with an existing, strong industrial base. It is therefore necessary to pursue policies that shall result in an increase in resource efficiency.

The Raw Materials Policy, which has a direct impact on the environment, society and economy, is an integral part of the sustainable development policy. Rational management of geological resources is a prerequisite for long-term economic security of the country, and thus for national security.

The effectiveness of the Raw Materials Policy depends on its comprehensive and coordinated implementation. In order to ensure this effectiveness, in 2016 the Council of Ministers appointed the Government Plenipotentiary for Raw Materials Policy, and the Prime Minister established the Inter-ministerial Group for the Raw Materials Policy. Due to the importance of the management of natural resources for the functioning of the state and due to the work undertaken by the aforementioned Plenipotentiary, the issues related to geological resources are fully covered by the document entitled *Raw Materials Policy*.

The existing challenge is to define a product policy and support resource-efficient production systems. In comparison to the largest EU economies, Poland does not have a fully formed policy on supporting effective use of materials, and the law applied in Poland is most often limited to the application of minimum standards resulting from the requirements of EU law.

Environmental technologies

Eco-innovations

Eco-innovation or innovative environmental technologies are processes, products and services that produce environmental added value, i.e. that have a more favourable or less favourable environmental impact in relation to conventional solutions currently in use or that measure the parameters that indicate environmental impact. Compared to conventional solutions, eco-innovation should exhibit an innovative approach in terms of design, raw materials used for its production, manufacturing process, operation, recyclability or final disposal, in terms of the resulting performance, i.e. its functional or technological efficiency.

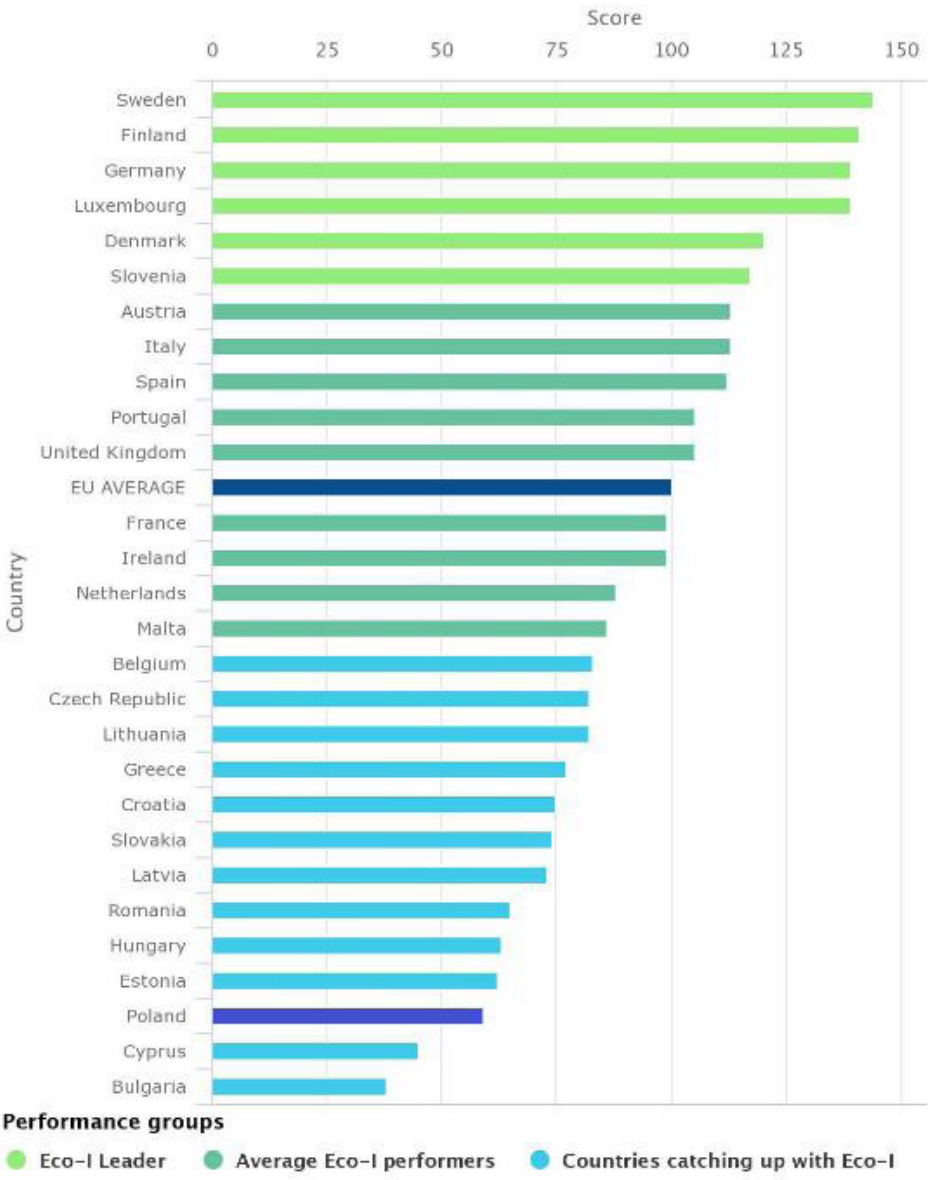
Eco-innovation contributes to improving resource efficiency in the economy and to reducing the negative impact of human activities on the environment. Apart from the ecological dimension, the economic and social aspects are also important – their introduction contributes to the reduction of operating costs, the use of new development opportunities, creating a positive image of the individual, and as a result to the increase of its competitiveness.

In order to enable comparisons in the field of eco-innovation, the European Union has set up an *Eco-Innovation Observatory* to collect data regarding this matter. On the basis of 16 indicators grouped in 5 thematic areas, the *Eco-Innovation Scoreboard* was created, which compares the results of eco-innovation achieved by individual EU-28 member states compared to the EU average[1].

[1] Statistics Poland in Białystok, *Green Economy Indicators in Poland 2017*, Białystok, 2017, p. 64.

The *Eco-Innovation Scoreboard* ranking includes five groups of indicators in its index. Three of them directly relate to eco-innovation. These are: outlays (government expenditure on environmental and energy R&D, total number of researchers, green investments of PE/VC funds), activities (companies introducing eco-innovations improving material and energy efficiency and holding ISO 14001 certificates) and results (patents, publications, media coverage of eco-innovations). The other two groups of indicators are the effects of eco-innovations – environmental (energy efficiency, mineral efficiency, water efficiency and emissions) and socio-economic (development of the "eco-industries" within the economy).

Fig. 9.1. Eco-innovation index for European Union countries in 2017



Source: https://ec.europa.eu/ (accessed: 17.01.2019).

In the Eco-innovation Scoreboard ranking, Poland has been ranked among the countries with the lowest eco-innovation index, significantly below the EU average, since 2010. Although, compared to 2012, Poland's overall ranking increased from second last position to the 23rd place, the low values for 4 out of 5 indicators taken into account in the assessment significantly reduce Poland's position in the EU ranking. Only in the case of one indicator – social and economic effects of introducing eco-innovations, in 2016 Poland performed best in comparison to other EU countries. This indicator refers to the development of the so-called eco-industry and the increase in employment in this sector. It is worth noting that in the same category, in 2012 Poland was 10th from the end.

Poland is still not allocating enough resources on R&D&I in eco-innovative technologies. While there is an increase in funding for eco-innovation projects in their early stages of development, as evidenced by the number of programmes under which it is possible to undertake R&D&I in eco-innovation, these resources are scattered. The programmes within which they are available have different strategic objectives and are supervised by different operators (NCBiR programmes: GOSPOSTRATEG, BIOSTRATEG, Advanced energy generation technologies E-KUMULATOR, NFOŚiGW programmes: Sokół, GEKON, SGOP competitions dedicated to innovation: Fast track, Market research, etc.). These programmes lack a uniform approach to defining environmental technologies and eco-innovations and to formulating measurable environmental parameters that must be met by the solutions developed in R&D&I projects, e.g. in the case of water efficient processing technologies – reduction of water consumption by at least 30%. This makes it impossible to monitor the results of translating R&D&I expenditure into concrete market and environmental results and to obtain information about developed and available technologies more quickly.

The technological offer in the field of eco-innovation presented by Polish technology transfer centres operating at universities or at the regional level contains, admittedly, proposals for solutions that show potential as environmental technologies, but the manner of describing solutions, lack of specific information about technical and utility parameters and benefits obtained from implementation limits both the interest of companies in these solutions and the probability of commercialisation.

As a result, there is no institutionally supervised national system of information on environmental technologies available on the market, ready for commercialisation or still in the research phase. This system should be a reference, contain a credible technological offer of new solutions, e.g. verified within the ETV, enable technology benchmarking based on technical and performance parameters in accordance with the needs of purchasers and selected environmental aspects (emissions, waste generation, noise, etc.).

At present, the designers of large installations are mainly following proven conventional solutions. The market offers of innovative technologies, especially in the field of water and waste water management and waste management, is dominated by technologies offered by foreign suppliers with an established position, which makes it difficult for Polish companies to compete on the market.

Despite the fact that eco-innovations in the EU and in the world are one of the most dynamically developing markets, ahead of even the ICT or pharmaceutical markets, the Polish capital market shows moderate interest in investing in new environmental technologies. Out of 32 companies operating in 2016, 12 declare interest in eco-

innovation areas such as: energy, innovative industrial processes, innovative clean-tech materials and environmental engineering. It is worth noting, however, that in the 2017 edition of the BRIdge Alfa[2] competition, one fund qualified for financing, with capital support dedicated exclusively to green technologies.

Eco-innovations are quite widely represented in both national and regional smart specialisations. However, this does not translate directly into research and implementation priorities of R&D&I programmes, which are not systematically connected with the economy's demand for eco-innovations or the search for innovative solutions for priority problems requiring a quick and effective response, e.g. in the field of air protection, adaptation to climate change or implementation of circular economy.

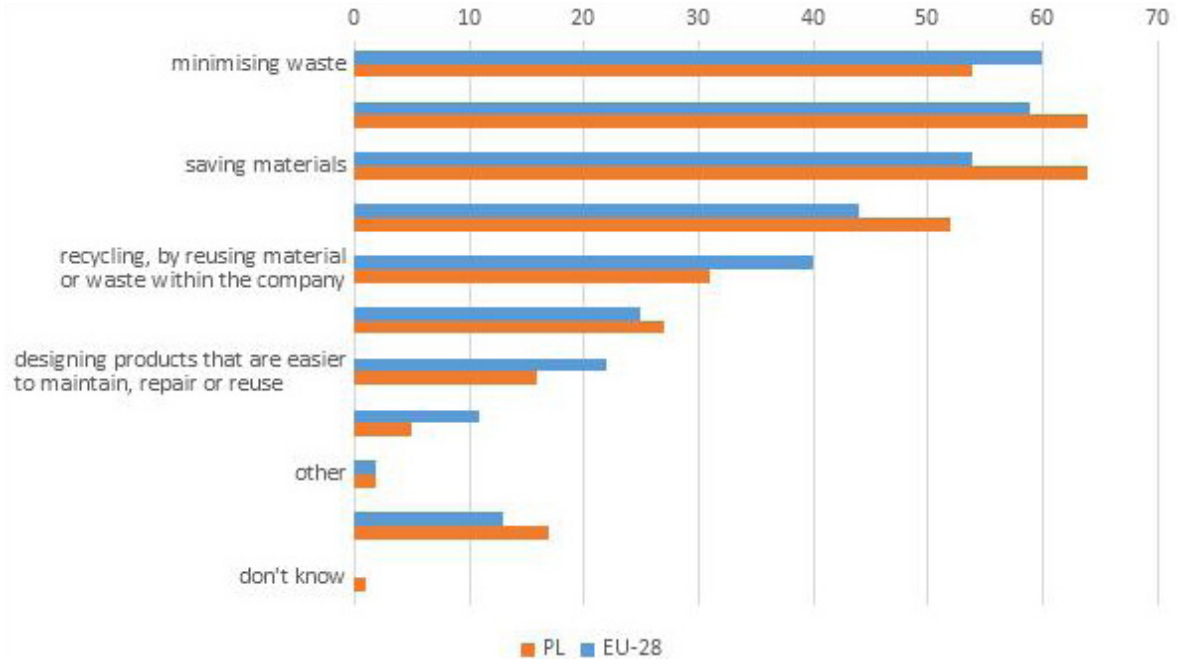
Another important issue is the insufficient actions taken by companies to improve resource efficiency. Poland shows a dynamic economic growth, but it does not go hand in hand with a reduction in resources and energy intensity. In 2015, the domestic consumption of raw materials in Poland amounted to 16.9 tonnes compared to the EU average of 14.6 tonnes. According to EIO (Eco-innovation Observatory) data, in 2016 in Poland only 10% of companies implemented innovations resulting in ecological benefits for the company (EU average 53%) and 12% of companies introduced innovations to the market resulting in ecological benefits for the end user (EU average 50%).

The economy sector makes limited use of available funds, mainly structural funds for the implementation of innovative ecological solutions. The assessment criteria do not sufficiently promote eco-innovative solutions and refer to the environmental aspect of technology, focusing exclusively on the assessment of the fulfilment of horizontal requirements for sustainable development referred to in Article 8 of the Regulation of the European Parliament and of the Council (EU) laying down common provisions on the ERDF, ESF, CF, EAFRD and EMFF[3], e.g. in projects under Measure 3.2.1 SGOP "Research for the market" the criterion of innovation is considered exclusively as a new or significantly improved product or service and the improvement may concern technical characteristics, components, materials, embedded software and other functional characteristics of the product or service. However, the project selection criterion concerning the impact of this innovation on the environment is not decisive. For meeting these requirements, the application receives only 1 point.

[2] BRIdge Alfa concerns ideas at the seed stage, where the risk of investment failure is the greatest, but they can be verified at a relatively low cost. The projects supported in this way are an attractive product for Venture Capital Funds. This will close the capital gap which prevents scientists from reaching the business with their projects. Investors shall receive non-refundable support, granted by NCRD to create an investment vehicle. Their network shall create an ecosystem supporting the incubation of spin-off businesses. The vehicle shall be used to select ideas with a high commercialisation potential. They will enter the market by providing a transition through the proof of principle and proof of concept phase and all the services necessary to transform them into spin-offs. The budget of one vehicle ranges from PLN 10 to 30 million, and the non-refundable financing from NCRD is 80%. The support available for an individual project, as a standard, amounts to PLN 1 million, and in justified cases even up to PLN 3 million.

[3] Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006 (OJ L 347 of 20.12.2013, p. 320, as amended).

Fig. 9.2. Activities of companies undertaken in Poland to improve resource management (%).



Source: own elaboration based on: Flash Eurobarometer 426, SMEs, Resource Efficiency and Green Markets, September 2015.

Polish companies do not perceive investing in eco-innovations as a way of building a competitive advantage. The level of business awareness of the environmental and economic benefits of implementing eco-innovations is also low. At the same time, data from Eurobarometer survey[4] conducted in 2015, presented in Fig. 9.2., concerning the effectiveness of resource management in enterprises in Poland, show that businesses are chiefly interested in taking action to reduce energy and material intensity, and then water consumption and waste generation, as this translates directly into their operating costs. These trends are in line with those of companies in the EU.

The aforementioned needs of companies indicate the market demand for eco-innovative technologies. However, there is a lack of expert advice for SMEs, e.g. on the use of business opportunities offered by eco-innovation, technological advice and assistance to eco-innovative companies to compete in global markets. In Poland there is a network of accredited Business Environment Institutions (BSI), but they do not have specialist knowledge, e.g. in the field of building export potential of eco-innovative technologies.

In the case of large enterprises (over 250 employees) a similar trend is confirmed by data from the Central Statistical Office concerning innovative activities undertaken by enterprises in the years 2012-2014, presented in the EIO report for Poland for 2017. They show that production plants implemented solutions mainly in the scope of waste management, water and waste water management, reduction of raw material consumption towards recovery of these resources for own needs or resale, while the services sector invested in energy-saving technologies and reducing CO2 emissions.

[4] Flash Eurobarometer 426, SMEs, Resource Efficiency and Green Markets, September 2015, http://ec.europa.eu/ (accessed: 20.02.2019).

Another serious limitation are too high expenditures on eco-innovations with simultaneous lack of access to financing mechanisms enabling to obtain funds for investments in eco-innovations on preferential terms. Although instruments for companies to implement innovations are developing, there is still no system of incentives to prefer investments in eco-innovative solutions, bringing measurable benefits for the environment. Entrepreneurs are afraid of an uncertain return on investment in eco-innovation or too long a payback period. Potential investors and financial institutions apply the same criteria for eco-innovation as for other investments, often without taking into account the added value of reducing environmental burdens, which is marginal in investment decisions. In addition, there is still no system of economic and fiscal incentives, e.g. in the form of tax breaks and green vouchers, which would stimulate greater interest in eco-innovation on the part of *companies.*

Tab. 9.1. The level of green public procurement in Poland.

year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Level of green public procure-ment	4%	10,5%	9%	12%	12%	12,1%	9,25%	11,40%	20% assumed level

Source: Public Procurement Office, National Action Plan Regarding Sustainable Public Procurement for 2017-2020, Warszawa, 2017, p. 35.

The public finance sector is one of the most effective instruments for shaping the demand for eco-innovations. The value of the public procurement market in Poland in 2016 amounted to PLN 107.4 billion, constituting about 5.80% of the gross domestic product (GDP) in 2016[5] and it is showing an upward trend. The Act on Public Procurement Law (OJ L of 2018, item 1986, as amended) amended in 2016 provides for the promotion of the real application of non-economic objectives of public procurement, such as environmental protection, social integration or support for innovation. However, the percentage of green public procurement in Poland, although increasing, is still insufficient. In 2015, it amounted to 11.40% (i.e. PLN 13.26 billion).

The purchasing policy of the state – one of the strategic projects of *the Strategy for Responsible Development* – is to favour green public procurement. It defines the state's priority actions in the area of public procurement, indicating, among other things, the principle of preference for innovative and ecological solutions. However, this requires a change in the systemic approach to public procurement, in particular with regard to the preparation of tenders and the assessment of tenders, with particular attention to both environmental criteria and the environmental management requirements for the contractors. Despite the increasing level of environmental awareness, businesses and investors, particularly in the public finance sector, show a conservative approach to the implementation of eco-innovation. Some support may be provided by the Public Procurement Office's publication in 2017 of the guide "Sustainable Public Procurement.

[5] *Report of the President of the Public Procurement Office on the Functioning of the Public Procurement System in 2016*, Warszawa, June 2017.

Social and Environmental Aspects in the Procurement Procedure in the Light of the Amendment of the Public Procurement Law". However, the guidelines contained in this document are not binding for the businesses. The number of good practice examples is limited to construction, transport and street lighting. A more widespread use of green public procurement would attract more interest from companies in the implementation of management schemes, such as the EU Eco-Management and Audit Scheme (EMAS) or other environmental management standards based on relevant European or international standards developed by accredited bodies (e.g. ISO 14000 series). The same applies to the inclusion of environmental criteria in the description of the subject-matter of the contract, which offers relatively the greatest potential for making the procurement green. The lack of knowledge of the entities compiling public procurement documentation regarding the performance/efficiency levels of innovative technologies, together with the lack of a credible market offer for eco-innovation enabling technology to be compared on an equal footing with specific user needs, results in the underutilisation of the detailed technical parameters determining the environmental impact of the technology or the environmental benefits sought as environmental criteria in public procurement. As a result, public procurement primarily concerns conventional solutions. Companies in Poland are not interested in obtaining EMAS certificates because they do not reinforce their market position. The same is true of the limited interest of companies in obtaining an ETV Certificate, as it does not result in a higher assessment when awarding a public contract.

The potential of cities to stimulate and use eco-innovation is not fully exploited. The Smart City concept, the greening of cities or the creation of adaptable cities, i.e. open to various effective models of problem solving and provision of public services so as to ensure the highest quality of life for the inhabitants at the lowest possible cost, create new opportunities for eco-innovative processes, products and services or innovations inspired by nature. In addition to issues related to transport systems, lighting, energy efficiency of buildings, the adaptation of cities to climate change fosters the implementation of innovations that improve urban ecosystem services, e.g. rainwater retention, standing water purification, carbon sequestration, etc. Thanks to funds from the K2020 EU Research Programme, Poznań and Wrocław participate in projects developing and implementing such solutions.

Poland engages in activities supporting research, development, implementation and promotion of eco-innovation. Industry organisations associating both SMEs and public finance entities organise a number of professional conferences dedicated to particular sectors, where innovative solutions are presented. The promotion of eco-innovation is also provided in trade publications and portals. Companies have the opportunity to get acquainted with the specialist technological offer presented during the trade fairs, which take place in Poland several times a year.

Other examples of activities undertaken in this period include implementation of the *Strategy for Innovation and Efficiency of the Economy*, undertaking initiatives to such as "GEKON – Generator of Environmental Concepts" (joint initiative of NFOŚiGW and NCBiR), E-kumulator, GOSPOSTRATEG and BIOSTRATEG (NCBiR) "Sokół – implementation of innovative environmental technologies" (initiative of NFOŚiGW).

Since 2011, the Ministry of the Environment has been implementing the *Pilot Programme for Environmental Technologies Verification (ETV) of the European Union* – the

ETV System as an implementation of the European Action Plan for Eco-innovation[6] and the Environmental Action Plan for SMEs[7]. A support instrument prepared jointly by the Ministry of the Environment and the National Fund for Environmental Protection and Water Management (NFOŚiGW) was launched under the name "Popularisation of technologies verified within the ETV Environmental Technologies Verification System". There are 4 accredited verification units in Poland, which enable verification of the effects of technology in all three areas of the EU ETV pilot programme: water and waste water in the municipal and industrial sectors, water quality monitoring, energy technologies, including RES technologies and energy efficiency in the construction industry, use of energy from waste and materials, and recycling including, among others, waste management technologies, innovative bio and recycled materials, etc. All the above areas are important from the point of view of Poland's priorities in the area of improving the efficiency of resource use or implementing a circular economy, and thus they should result in the interest of the economy in the implementation of innovations in this area. ETV as a system providing impartial and reliable information on the operation of the technology and the environmental effects obtained through its implementation should play an important role in increasing the commercialisation and export potential of Polish technologies, creating the basis for the development of a systemically attractive technological offer. However, despite the creation of a suitable tool for verification supported by a financial instrument, the interest of creators and suppliers of new environmental technologies in verification is low. First of all, there is a lack of awareness and interest of buyers and users of solutions in the opportunities provided by ETV in terms of reducing technological and investment risk and selecting solutions best suited to the needs of the buyer. This is particularly true for the public finance sector enterprises (possibility to use ETV in tenders as a confirmation of compliance with the requirements set out in the ToR). Furthermore, ETV is not sufficiently widespread as part of a marketing strategy to increase the likelihood of successful commercialisation of a technology or to increase its export potential. ETV is not used by scientific-industrial consortia, e.g. for demonstration projects or projects with implementation obligations, nor is there any guidance on the eligibility of verification costs in various competitions advertised, e.g. as part of the SGOP. In addition, a new standard was adopted and published in Poland in July – ISO-PN 14034: 2016 Environmental management: Verification of environmental technologies. This standard provides a structured approach to assessing eco-innovative technologies and defines environmental technologies. Verifications carried out in Poland are based on this standard. Its adoption as a national standard is a milestone in systematising the approach to eco-innovation and building the offer of Polish eco-innovations based on ETVs that can effectively compete on global markets.

Another example of activities supporting the promotion of eco-innovation is the implementation of subsequent editions of the GreenEvo – Technology Accelerator – an original programme of the Ministry of the Environment. As in the case of ETV, GreenEvo aims to support Polish entrepreneurs in promoting their eco-innovative

[6] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Innovation for a Sustainable Future - The Eco-innovation Action Plan (Eco-AP) COM(2011) 899, final.

[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Green Action Plan for SMEs Enabling SMEs to turn environmental challenges into business opportunities, COM/2014/0440, final.

solutions on the domestic and foreign markets. However, it should be noted that there is no connection between ETV and GreenEvo, which weakens the potential of both projects.

Measures aimed at improving the implementation of eco-innovation in Poland also include the GreenInn project – creating preferences for green technologies in applications in programmes, including the creation of industry-specific accelerators, which will promote solutions on the global market. This project is being implemented by the Ministry of Entrepreneurship and Technology.

An increasing number of national key clusters are focused on eco-innovative projects (e.g. Waste Management and Recycling Cluster, West Pomeranian Chemical Cluster "Green Chemistry", Sustainable Infrastructure Cluster, Bydgoszcz Industrial Cluster).

However, these measures are implemented in isolation, there is no synergy between priorities and measures undertaken in other areas, e.g. research and development of innovations, management of natural resources, waste management, water and waste water management, adaptation to climate change, air quality protection, preservation of biodiversity, green public procurement, etc. This makes it difficult to build a coherent, systemic approach to eco-innovation.

Eco-management and audit scheme (EMAS)

EMAS[8] is a Community environmental management system based on the ISO 14001 standard and its formal requirements are laid down in Regulation (EC) No 1221/2009[9]. It is the only environmental management system that has an official and reliable (managed by the European Commission services), publicly available register[10].

EMAS is an important environmental protection instrument that aims to stimulate positively business forms and methods that ensure systematic reduction of environmental impacts by introducing a unified system of self-assessment and self-control of environmental impacts of individuals and by ensuring that reliable information on these impacts is made available to the public[11]. It assumes active involvement of employees in the process of improving the organization's relations with the environment, as well as informing the public about the effects of these activities in the environmental declaration validated annually by an independent environmental verifier.

Organisations can join EMAS regardless of their size, activity or geographical location (registration from outside the Community is possible). It may be a company, corporation, firm, enterprise, authority or institution, public or private. In addition to micro, small, medium and large enterprises, the Community EMAS Register is also open to hospitals, schools and universities, religious associations and public administration

[8] EMAS – Eco-Management and Audit Scheme is an EU environmental management system integrated with a quality certificate concerning environmental management ISO 14001. It is open to voluntary participation of organisations seeking to achieve the best possible results of their activities aimed at improving environmental protection.

[9] EMAS – Eco-Management and Audit Scheme introduced by the Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation of organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC (OJ L 342 of 22.12.2009, p. 1, as amended). In Poland, the provisions of the regulation are clarified by the Act of 15 July 2011 on the national eco-management and audit scheme (EMAS) (OJ L, item 1060).

[10] EC, *EMAS Register*, http://ec.europa.eu/environment/emas/emas_registrations/register_en.htm [accessed: 17.01.2019]

[11] Environmental Information Centre, *Eco-Management in the Company. Manual*, http://emas.gdos.gov.pl/ (accessed: 17.01.2019).

bodies. The European Commission promotes best practices in environmental management in its own sectoral reference documents for selected priority sectors[12].

By implementing the requirements of EMAS, organisations optimise the consumption of resources and energy and confirm compliance with the law in the field of environmental protection. They undertake voluntary commitments in the field of environmental protection, often going beyond or even outside the scope of legislation. Thus, they create their own ***green image*** confirmed by a certificate granted in Poland by the General Director for Environmental Protection.

In Poland, the first national EMAS organisation was registered in 2006. Since then, their number has been constantly increasing. In 2015, 48 organisations had EMAS certification (an increase of 6.7% compared to the previous year) and 122 sites of these organisations, while in April 2018 there were already 69 organisations and 369 sites. This places Poland on the 6th place in the ranking of EU Member States just after the Federal Republic of Germany (1st place), Italy (2nd place), Spain (3rd place), Cyprus (4th place) and Belgium (5th place). The growth of EMAS-registered organisations is the result of the increasing environmental awareness of companies, which makes EMAS a scheme with the highest environmental management standard[13].

[12] EC, *Sectoral Reference Documents*, http://ec.europa.eu/environment/emas/ (accessed: 17.01.2019).
[13] Study by Statistics Poland: Green Economy Indicators in Poland, 2016 and the EU EMAS Database – as of April 2018.

Climate change – mitigation and adaptation measures*

* The chapter quotes extensive excerpts from the following studies: State of the Environment in Poland Signals 2016 (GIOŚ 2017), ed. B. Albiniak and State of the Environment in Poland, Report 2014 (GIOŚ 2014).

Globally visible climate change is one of the greatest environmental, social and economic threats. The increase in average Earth air temperature, observed especially since the last decade of the 20th century, contributes to the increase in the intensity and frequency of many climatic and related phenomena which are relevant to economic and social development. These include extreme natural events, such as tornadoes, hail, heat waves and frost waves, torrential rains, storms and prolonged droughts, as well as floods, depletion of water resources, soil erosion and coastal erosion. As warming progresses, it is expected that the effects of climate change will be felt even more acutely in the future[1]. Further warming will result in climate migration, which will also affect Poland.

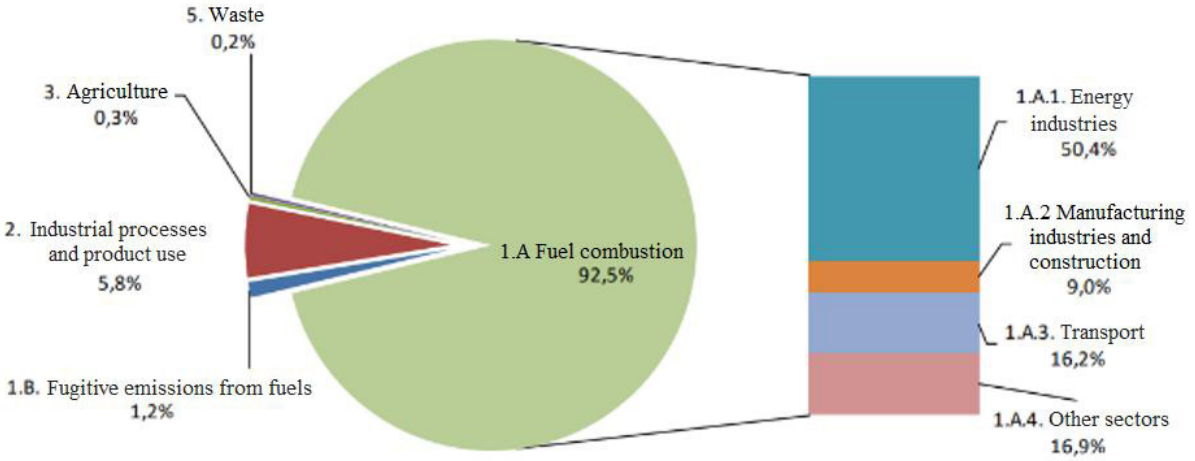
In the absence of the possibility to avoid all consequences of climate change, even if an ambitious policy to limit global greenhouse gas emission growth was successfully implemented, it was deemed necessary for the international community to take action to adapt to unavoidable climate change. Equivalent international treatment of mitigation and adaptation is reflected in the provisions of the global agreement, referred to as the Paris Agreement, adopted by the Parties to the Climate Convention in December 2015 in Paris.

[1] Intergovernmental Panel on Climate Change (IPCC). 2009. Climate Change 2007: Synthetic Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Ed. Institute of Environmental Protection, Warszawa.

Mitigation measures

According to the latest reports of the *Intergovernmental Panel on Climate Change* (IPCC), it can be claimed with near-certainty that the cause of the observed global warming is mainly human activity since the mid-18th century. The effect of anthropogenic impact on the environment is, on the one hand, an increase in the concentration of greenhouse gases in the atmosphere, which leads to warming of the Earth's surface, and on the other hand, limiting the potential of the biosphere to absorb greenhouse gases from the atmosphere. Changes in atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation affect the energy balance of the entire climate system. Concentrations of the main greenhouse gases in the atmosphere have reached levels never recorded in the last 800,000 years. The concentrations of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) exceed the natural range of concentrations of these gases in the atmosphere occurring before the industrial era by 40%, 150% and 20%, respectively. The main sources of greenhouse gas emissions are fossil fuel combustion (CO_2, CH_4), changing land use (CO_2) and agricultural activity (CH_4, N_2O)[2].

Fig. 10.1. Carbon dioxide emissions in Poland (without category 4) in 2016 by category.



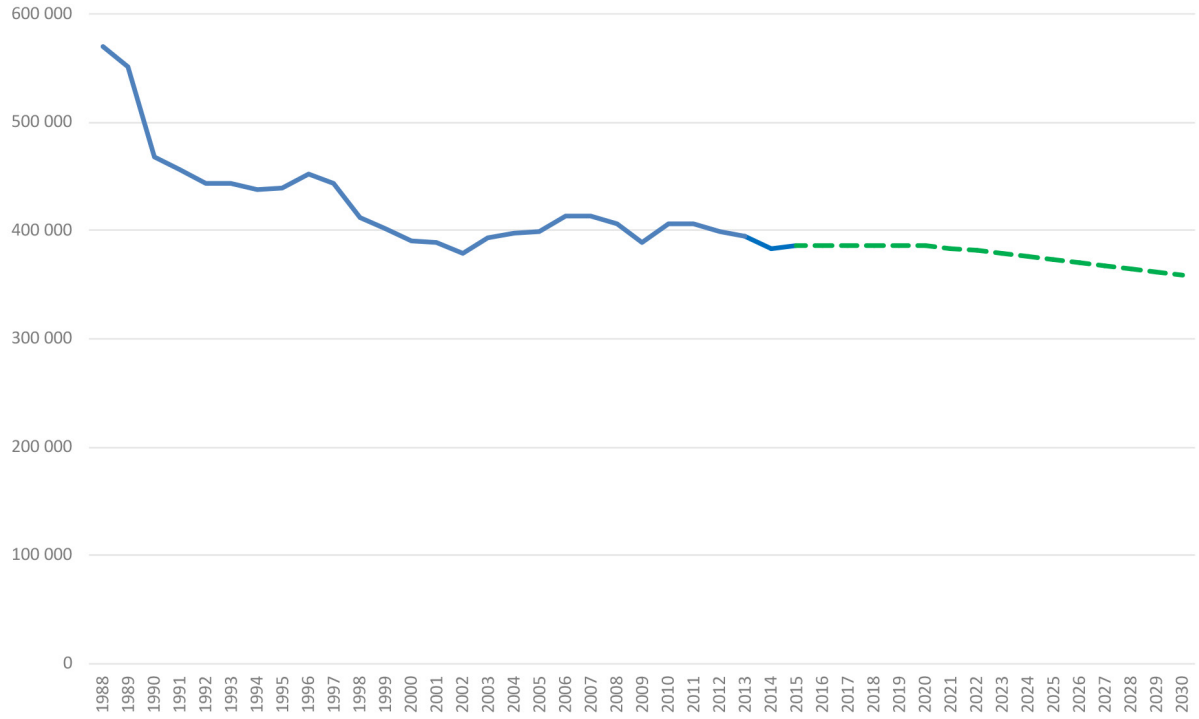
Source: IOŚ-PIB/KOBIZE, Poland's National Inventory Report 2018. Greenhouse Gas Inventory for 1988-2016 Synthetic Report, Warszawa, 2018, p. 9.

The main greenhouse gas emitted in Poland is CO_2 (over 80% of emissions). The majority of emissions of this gas are caused by fuel combustion (nearly 93%), both in stationary sources (e.g. power plants, CHP plants) and mobile sources (transport). The remaining amount, about 6%, is related to industrial processes[3].

[2] European Environment Agency (EEA). 2008. Impacts of Europe's changing climate - 2008 indicator-based assessment. Report; Intergovernmental Panel on Climate Change (IPCC). 2013. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

[3] KOBIZE, *Poland's National Inventory Report 2018. Greenhouse Gas Inventory for 1988-2016,* http://www.kobize.pl/ (accessed: 5.6.2019).

Fig. 10.2. Historical (1988-2015) and projected (2020-2030) greenhouse gas emissions in Poland [kt CO2e].



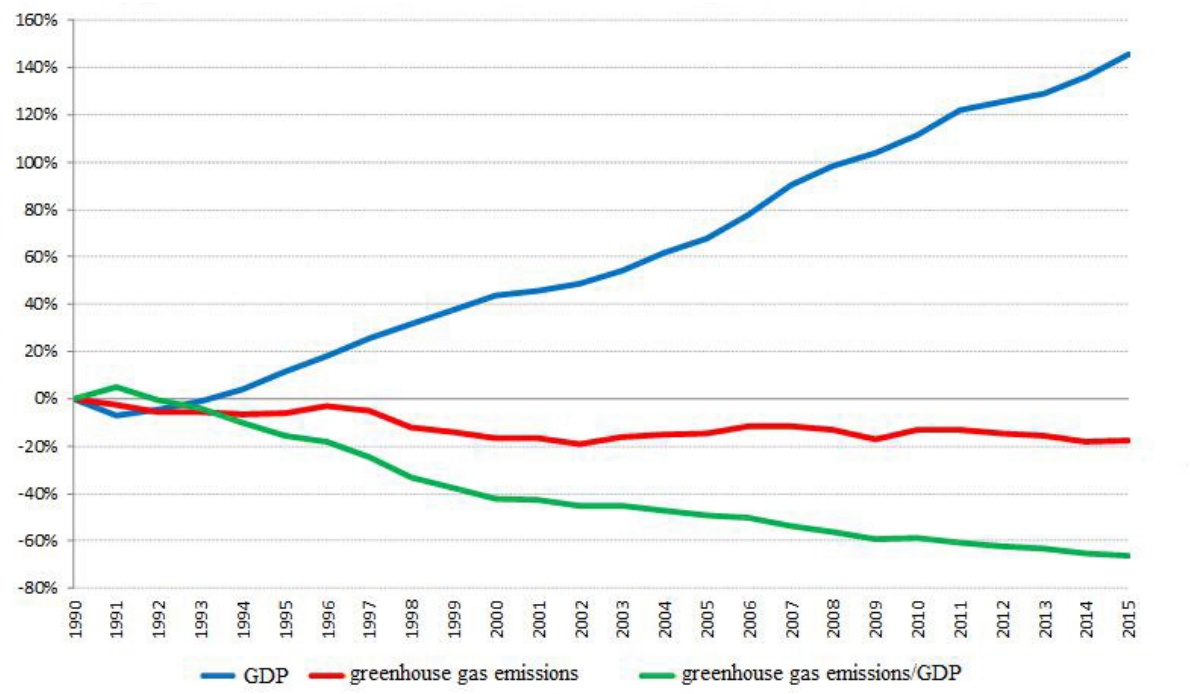
Source: own elaboration based on: National Centre for Emissions Balancing and Management.

In 2015, the level of greenhouse gas emissions (excluding LULUCF[4]) in Poland was 32% lower than in 1988. According to preliminary data for 2016, emissions increased slightly (by 1%) compared to the previous year, with domestic emissions not exceeding 400 million tonnes of CO_2e since 2012.

According to the national greenhouse gas emission projections prepared in 2015 for the Second Biennial Report to the Conference of the Parties to the United Nations Framework Convention on Climate Change, it is estimated that in 2030 total emissions in Poland will be 23% lower than in 1990 and 37% lower than in 1988.

[4] *LULUCF – Land Use, Land Use Change and Forestry*

Fig. 10.3. Changes in GDP, greenhouse gas emissions and emission intensity ratio in the economy (ratio of emissions to GDP) in Poland in the period 1990-2015 (%).



Source: own elaboration based on data from the National Centre for Emission Balancing and Management.

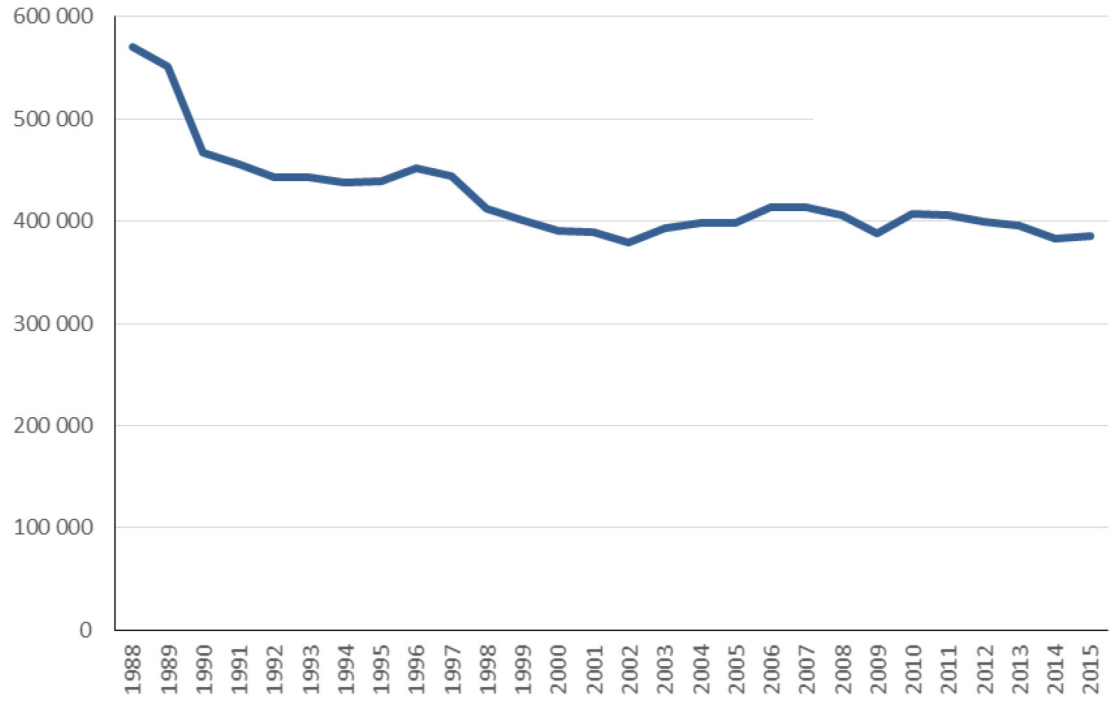
In Poland, there is still a phenomenon known as *decoupling*, i.e. the distinction between economic growth and its environmental costs, both due to the increase in pollutant emissions and other pressures on the environment. Between 1990 and 2015, total gross domestic product increased by 145%, while total emissions (excluding LULUCF) decreased by 18%. Between 1990 and 2015, the intensity of greenhouse gas emissions in the economy, defined as the ratio of emissions to GDP, decreased by more than 66%. Faced with the adverse and increasing impacts of climate change, all countries in the world have taken action and cooperated internationally to reduce greenhouse gas emissions in order to reduce the risks posed by climate change by adoption of the *United Nations Framework Convention on Climate Change* (UNFCCC, hereinafter referred to as the Convention) in 1992, the Kyoto Protocol (KP) in 1997, under which some developed countries and economies in transition adopted reduction targets for the period 2008-2012 (the first commitment period)[5] and the Doha Amendment to the Kyoto Protocol in 2012, under which further reduction targets for 2013-2020 (the second commitment period) were adopted.

The objective of quantified GHG emission reduction commitments was to stimulate countries to implement measures such as improving energy efficiency, protecting and increasing the efficiency of natural greenhouse gas reservoirs and "sinks" (e.g. forest areas), promoting sustainable forms of farming, increasing the use of new and renewable energy sources, implementing CO_2 storage technologies and other advanced and innovative environmentally friendly technologies, and many other measures to combat climate change[6].

[5] Further information at: unfccc.int.

[6] Institute of Environmental Protection – National Research Institute (IOŚ-PIB), *United Nations Framework Convention on*

Fig. 10.4. The trend of aggregated greenhouse gas emissions between 1988 and 2015, together with the national reduction target for the first commitment period of the Kyoto Protocol (KP) between 1988 and 2015 [kt CO2e].



Source: own elaboration based on data from the National Centre for Emission Balancing and Management.

By joining the international efforts to combat climate change, Poland ratified the Convention in 1994 and the Kyoto Protocol in 2002 [and the Doha amendment in 2018]. Thus, our country has assumed the obligation to reduce its greenhouse gas emissions in 2008-2012 by 6% compared to the base year (1988 for the main gases: CO_2, CH_4 and N_2O and 1995 for fluorinated gases). In fact, Poland reduced its emissions in the first commitment period of the Kyoto Protocol by 29%.

However, in the absence of the possibility of preventing global climate change by reducing emissions solely by Kyoto Protocol countries, it was already clear in the middle of the first decade of the 21st century that there was a need to negotiate a new agreement on the efforts of all countries to halt this phenomenon. The Paris Agreement, adopted in 2015 by 195 countries, including the Member States of the European Union, aimed at keeping a global average temperature rise below 2°C compared to pre-industrial levels, has become such a document. In the Paris Agreement the concept of climate neutrality, understood as the achievement of balance between greenhouse gas emissions and their absorption, as well as technological neutrality, which allows the Parties to decide independently on the manner of achieving the objective of the Agreement, as supported by Poland, has been taken into account. The Parties to the Agreement shall implement its objectives by implementing the *Nationally Determined Contributions* submitted by them to the Secretariat of the Convention. At the same time, *non-state actors,* especially in the period prior to 2020, have been identified as playing a major role in mitigating climate change. The actions taken by these actors are intended

Climate Change, International conventions and resolutions of international organisations. Vol. 7, Warszawa; *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (OJ L of 2005, item 1684).

to support the efforts of the global community to close the gap between the cumulative effects of the activities of the Parties to the Convention and the level of reduction necessary to achieve the objectives of both the Convention and the Paris Agreement. Poland, being an EU Member State, did not submit an independent contribution to the Agreement, but is a party implementing together with other Member States the contribution submitted by the European Union.

The EU's climate change policy is based on the Emissions Trading Scheme (EU ETS) and emission reductions in areas not covered by the EU ETS – the so-called non-ETS. The EU ETS covers mainly the industrial and energy sectors, while non-ETS covers transport, agriculture, buildings, waste and industrial emissions outside the scope of the EU ETS. The share of domestic emissions in Poland from the EU ETS and non-ETS is roughly comparable, as in the period 2005-2015 the EU ETS and non-ETS emissions each accounted for about 50% of total domestic emissions. In this period, the volume of emissions from the EU ETS decreased in Poland by 3%, and from non-ETS by 6%. It should be noted that emissions have decreased despite an increase in the number of installations in the period covered by the EU ETS. Additional gases (NO_2 and PFCs in the primary aluminium production sector) have also been taken into account.

Unlike the EU ETS, which is directly related to emissions from individual installations, non-ETS emissions are determined at the level of EU Member States. The legal basis for this is the so-called Effort Sharing Decision (ESD)[7].

Fig. 10.5. Difference in emissions in the non-ETS sectors in Poland in 2013-2015 and projected for 2016-2020 in relation to the annual emission limits granted. Negative values denote the national surplus in achieving the reduction target [kt CO2e].

Source: own elaboration based on data from the National Centre for Emission Balancing and Management.

[7] Decision No. 2009/406/EC of the European Parliament and of the Council of 23 April 2009 on the efforts of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 (OJ L 140 of 05.06.2009, p. 136, as amended).

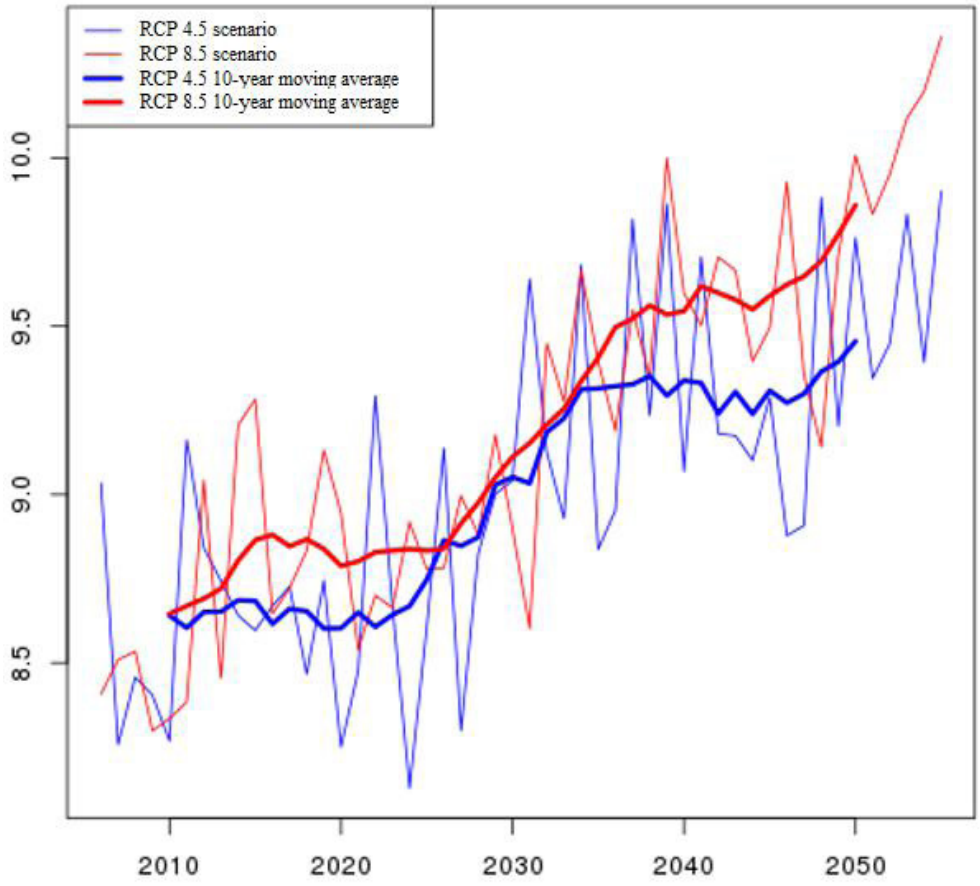
The emission volume allocated to Poland in the period 2013-2020 amounts to +14% in relation to 2005, which means that the increase of non-ETS emission cannot exceed this limit, which becomes the national reduction target. All EU Member States have, in accordance with their reduction targets, received annual emission quotas allocated to them in the non-ETS sectors. These relate to domestic emissions – reporting and accounting is the responsibility of the government. The results of the current settlement of non-ETS emissions for 2013-2015 and the national greenhouse gas emission forecasts prepared in 2015 for the Second Biennial Report to the Conference of the Parties to the United Nations Framework Convention on Climate Change indicate that Poland will achieve the aforementioned reduction target with a large surplus in relation to the entire period of 2013-2020.

At present, European policy on combating climate change focuses exclusively on reducing greenhouse gas emissions, whereas a broader approach to this issue is needed, which also includes the sequestration of CO_2 – in particular by forests. The implementation of the EU climate and energy policy is to be supported by, among others, the legislative package on the non-ETS sector and the inclusion of the LULUCF sector in the implementation of the EU's energy and climate policy objectives. Only such an approach can enable effective, quick and cost-effective limitation of the increase in CO_2 concentrations in the atmosphere and achieving international objectives. From 2020, the EU shall also include LULUCF emissions mitigation in a common approach, ensuring that this is combined with efforts in other non-ETS sectors. Poland has great potential in reducing CO_2 concentration in the atmosphere by using the potential of forests (absorption of 30.6 million tonnes of CO_2 annually from forest land) and implementing development projects such as the pilot project of Carbon Forests.

Climate change and its effects

The concept of climate change refers to those climate change that persist over a longer period (usually decades or longer) and can be identified as changes in average values and/or in the variability of its elements. This applies to all climate change over time, whether resulting from natural variability or human activity[8].

Fig. 10.6. Projected change in the average annual air temperature averaged over the area of Poland in the period 2006-2055.

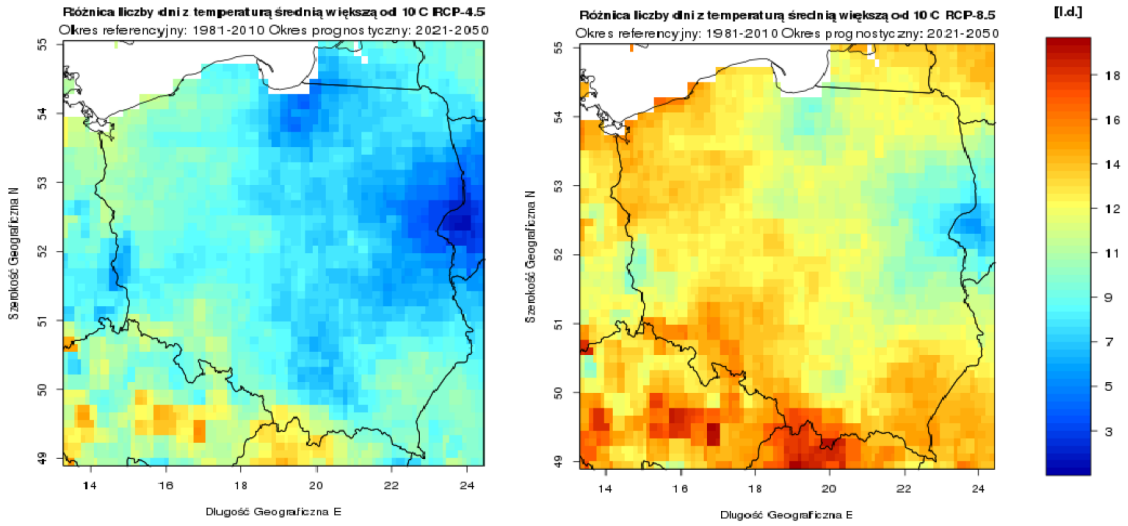


Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

Warming up of the climate is evident, particularly since 1950, many of the observed changes have occurred on a scale unprecedented for decades or even millennia. Global warming is manifested by the rise in global average air and ocean temperatures, the widespread melting of snow and ice and the rise in global average sea levels. The last 30 years in the series of instrumental measurements turned out to be a particularly warm period[9].

[8] Intergovernmental Panel on Climate Change (IPCC). 2009. *Climate Change 2007: Synthetic Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Institute of Environmental Protection, Warszawa.
[9] Intergovernmental Panel on Climate Change (IPCC). 2013. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Fig. 10.7. Difference in number of days with average 24-hour temperature above 10°C (Tdies>10°C) predicted for the period 2021-2050 compared to the reference period 1981-2010, for RCP4.5 (left) and RCP8.5 (right). Forecast values were calculated on the basis of a bundle of climate models from the EURO-CORDEX repository in 0.11° resolution, corrected with the use of E-OBS temperature fields. E-OBS repository was used as reference observation data.



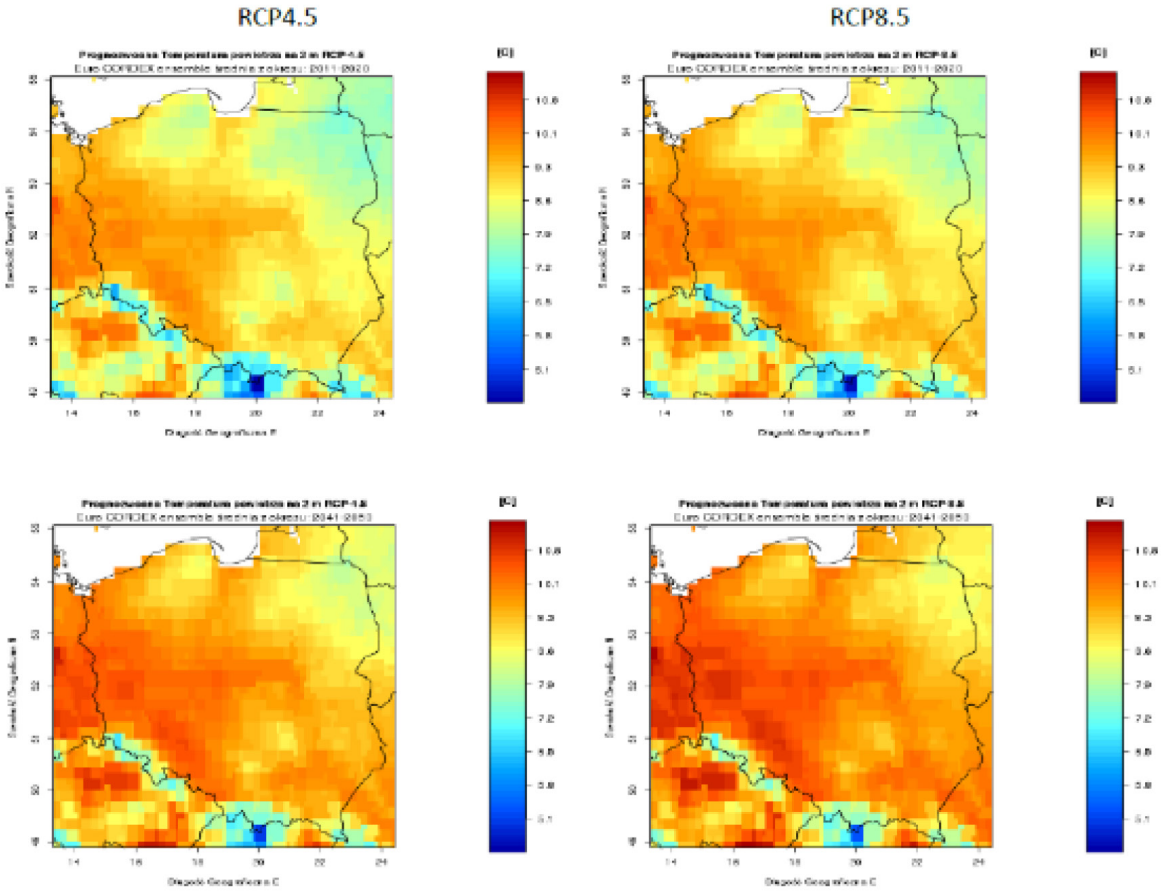
Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

According to researchers in the Copernicus programme, 2016 was the warmest year in the history of measurements. Observations by researchers from the US National Ocean and Atmosphere Administration (NOAA) and NASA showed that in 2016 the air temperature was 0.07 degrees Celsius higher than in the previous year. The temperature rose by almost one degree compared to the average of the entire 20th century. This has also been confirmed by the World Meteorological Organisation (WMO), which analyses data from various sources. The reason for this was an increase in carbon dioxide emissions and an exceptionally strong El Niño, a weather phenomenon in which the temperature of the water in the equatorial zone is maintained at high levels. The hottest month in the history of measurements was July 2016. Scientists note that the exceptional situation is that for the third time in a row, we have recorded the hottest year in history. During the entire period of temperature measurements, i.e. from the end of the 19th century, out of 16 hottest years, 15 occurred after 2001.

With warming, global sea levels have also risen. The area of snow cover decreased in both hemispheres, especially in spring and summer, and snow cover duration significantly decreased as well. On a continental and regional scale, other elements of the climate, such as precipitation levels and distribution, are also changing. A long-term trend of changes in precipitation levels has been observed in many large areas, although these changes are very spatially and temporally diversified. Global warming entails an increased probability of extreme weather events. Further warming could cause losses of billions of euros per year and affect access to drinking water and crop yields in the most vulnerable countries.

In Poland, climate change is also observed, which is manifested primarily by: an increase in the average annual air temperature, a change in the structure of precipitation and an increase in the frequency of occurrence of extreme phenomena. In all seasons of the year an increase in air temperature is observed, but it is much stronger in winter. A change in the precipitation structure is also observed. A common phenomenon that is evident in most parts of the country is the trend towards higher precipitation in spring and autumn and a decreasing contribution of summer precipitation to total annual values.

Fig. 10.8. Projected annual average temperature at 2 metres, averaged over the period 2011-2020 (top) and 2041-2050 (bottom), based on a bundle of climate models from the EURO-CORDEX repository, corrected using E-OBS temperature fields, for RCP4.5 (left) and RCP8.5 (right), at 0.11o resolution.



Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

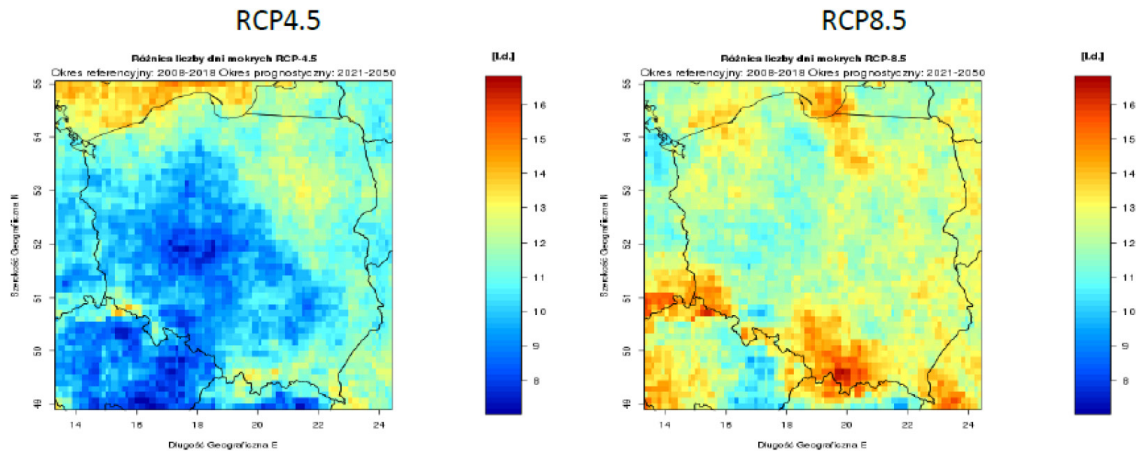
A significant and often underestimated problem is the occurrence of droughts in Poland. Droughts can be much more dangerous than flooding, as their effects can last for many years. According to the date from the IUNG Institute of Soil Science and Plant Cultivation, the last year in which no drought was recorded in Poland was 1980. The droughts are "massive", as in 2006, 2008, 2015, 2016. Between these catastrophic years, smaller droughts are observed. Small retention, such as planting

forests or creating water ponds, which counteract "desertification" and groundwater depletion are important in counteracting the effects of drought. The hydrotechnical infrastructure developed in Poland is more focused on the prevention of floods, not necessarily droughts. In order to counteract droughts, it is not only dry tanks or polders or multifunctional wet reservoirs (water retention reservoirs), from which water can be supplied during drought, e.g. irrigation and drainage channels, that are important. Water provision for social and living purposes also plays an important role.

Flooding is one of the main natural hazards occurring in Poland, which, in certain circumstances, may take the form of a disaster. Long-term climate change projections point to an increase in the frequency and scale of such phenomena. There are a number of factors affecting the evolution of flood risk. These include changes in the frequency, intensity and timing of precipitation and the reduction of snow cover associated with warming as well as changes in land use, the evolution of flood protection systems and an increase in the potential for flood losses.

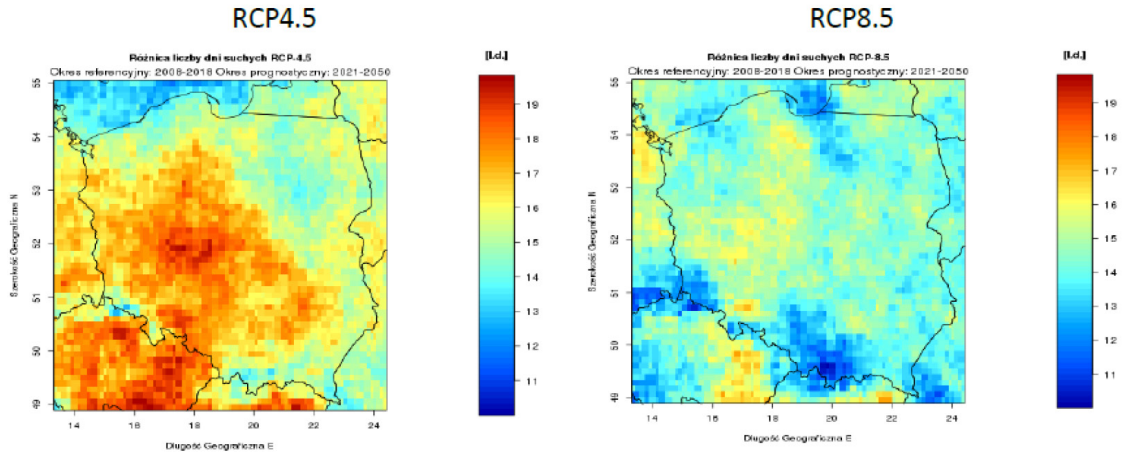
The largest floods in our country include the "Millennium Flood", which affected southern and western Poland and neighbouring countries in July 1997. Water has caused significant damage to residential buildings and road infrastructure. In Poland 56 people died, and the material losses were estimated at approx. PLN 12 billion. The flood damage started a nationwide discussion about the danger of building houses in floodplains and the harmful effects of river engineering.

Fig. 10.9. Difference in the number of days of precipitation (Pr > 1mm/day) projected for the period 2021-2050 in relation to the reference period 2008-2018 for RCP4.5 and RCP8.5. Projected values were calculated on the basis of a bundle of climate models from the EU-RO-CORDEX repository at a resolution of 0.11o, corrected with the use of ERA5 reanalysis. ERA5 reanalysis was used as reference observational data.



Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

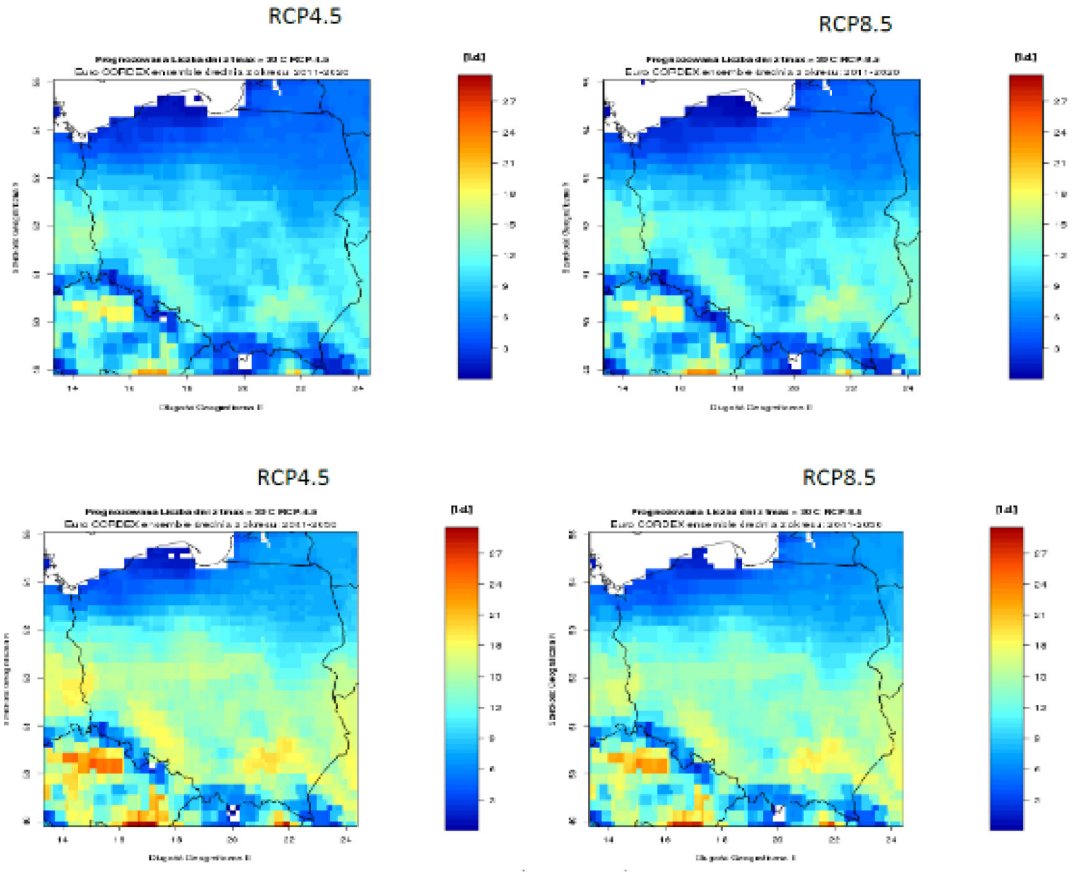
Fig. 10.10. Difference in the number of days without precipitation (Pr<1mm/day) projected for the period 2021-2050 compared to the reference period 2008-2018 for RCP4.5 and RCP8.5. Projected values were calculated on the basis of a bundle of climate models from the EURO-CORDEX repository at a resolution of 0.11o, corrected with the use of ERA5 reanalysis. ERA5 reanalysis was used as reference observational data.



Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

These events were followed by the floods in Poland in May and June 2010, where 811 municipalities suffered losses. The flood destroyed 18,000 residential buildings, damaged more than 10,000 km of roads and many other elements of infrastructure. As a result of the flood, over 105 thousand farms were affected. The voivodships which were most affected by the floods in 2010 are: Małopolskie, Podkarpackie, Śląskie, Opolskie and Lubelskie Voivodships. The losses caused by the flood in 2010 amounted to about PLN 12.2 billion (including losses in agriculture). This figure exceeded 0.6% of GDP in 2009, which allowed submitting a request to the European Commission for financing for the damage caused by the floods in 2010.

Fig. 10.11. Projected number of hot days per year (Tmax>30°C), averaged over the period 2011-2020 (top) and 2041-2050 (bottom), based on a bundle of climate models from the EURO-CORDEX repository, adjusted using E-OBS temperature fields, for RCP 4.5 and RCP 8.5, at 0.11o resolution.



Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

Among the natural phenomena unfavourable and burdensome for the population, the environment and economy, the occurrence, especially since the 1990s, of severe heat waves[10] and hot days[11], most frequently occurring in the south-western part of Poland should be mentioned. Also problematic are the increased wind speeds, especially in summer, as well as hurricane wind speeds combined with violent storms, occurring in the so-called squall line. In Poland, reliable hurricane measurements and classifications have been carried out since 2006. Just over 10 years of reliable measurements is not enough to assess whether the phenomenon is increasing or decreasing. It is necessary to have a well-developed precise system for the detection of dangerous storms. The development of an early and rapid alert system in the form of meteorological alerts, covering only a given part of Poland with a strong storm and alerting the residents in areas at risk, may increase public confidence in all meteorological messages and in particular – the alerts.

[10] Continuous periods with a maximum daily air temperature ≥30°C for at least 3 days.
[11] Days with a maximum temperature of ≥30°C.

An increase in storm-related swelling (increase in the number of storms and in the average sea level) in the southern Baltic Sea will be a significant threat to the functioning of the coastal zone, apart from the general increase in the sea level. The predicted changes indicate that the risk of these phenomena is increasing[12]. The swellings cause damage to the coastal zone, transform the undercoast and submerged bar zone, cause damage to beaches, dunes, cliff coasts and hamper maritime economy activities. The greatest risk of storm-related swelling shall remain at a constant level and shall concern Świnoujście. In the central coastal area (Ustka), there is a clearly increasing trend in the annual rate of swellings. The lowest risk is in Hel, where in the course of the long-term annual index we can see only a slightly growing trend and quite low values.

Sea ice formation, as one of the significant parameters in climate change research, also affects the business and economic development of ports, fisheries and maritime trade, through the threats posed by sea ice. A steady rise in sea levels and increased storm activity, especially in spring and winter, shall affect the destruction of beaches and cliffs and may threaten tourism infrastructure (marinas, harbours, beach infrastructure, etc.).

Among the threats caused by climate change, changes in the average sea level are important from the ecological and economic point of view in the Polish Coast region. Scenarios of changes in meteorological conditions[13] indicate that the average annual sea level in the period 2011-2030 shall increase by about 4-5 cm in relation to the values from the reference period 1971-1990. Scenarios developed for the period 2081-2100 show that the average annual sea level shall increase further. The smallest increase is expected for the B1 emission scenario and is approx. 20 cm. In the case of the A1B emission scenario, the expected increase in the average sea level is about 25 cm, and in the case of A2 – about 28 cm.

"In the period 2011-2030 the number of ice days on the Polish coast is expected to decrease"[14]. Projected land loss, calculated on the basis of the findings developed in the system of morphodynamic regions, indicates an increasing erosion of the shore depending on the rate of sea level rise.

Even at a minimum rate of sea level rise, the expected loss of land, assuming the rate of change of the last century, shall be about 6.4 ha/year. The predicted further increase of the sea level even in the minimum variant (30 cm/100 years) shall result in an increase of the length of eroded sections, an increase of the rate of destruction and greater loss of coastal sediments. An increase in the threat to the coast and nearby land should change the existing approach to coastal protection in order to preserve those elements of the coastal system or infrastructure of the coast and nearby land areas which shall be prioritised for protection in the overall quality classification of the zone.

A strong wind in the Baltic coastal zone blowing from the northern sector may be the cause of storm floods, the so-called "backwater". A storm wind blowing towards the shore hinders the outflow of rivers into the sea, causing water build-up in the

[12] Information based on the study *„Assessment of the Impact of Current and Future Climate Change on the Polish Coastal Zone and the Baltic Sea Ecosystem"*, which was carried out on the basis of contract no. DZR/2/U/2014 of 18.09.2014, concluded between the Ministry of the Environment and the Institute of Meteorology and Water Management – National Research Institute, financed from the funds of the National Fund for Environmental Protection and Water Management.

[13] ECHAM5 model.

[14] Institute of Meteorology and Water Management – National Research Institute, Marine Branch in Gdynia, *Assessment of the Impact of Current and Future Climate Change on the Polish Coastal Zone and the Baltic Sea Ecosystem. Summary*, Gdynia, 2014, p. 12.

estuary sections. Storm swellings are most often observed in autumn and winter. Whirlwinds also occur on the Polish Baltic coast. In recent years, the phenomenon has been observed on 10 August 2002 near Jastarnia (waterspout), 31 July 2005 near Jastrzębia Góra, 1 and 2 September 2010 in Kołobrzeg.

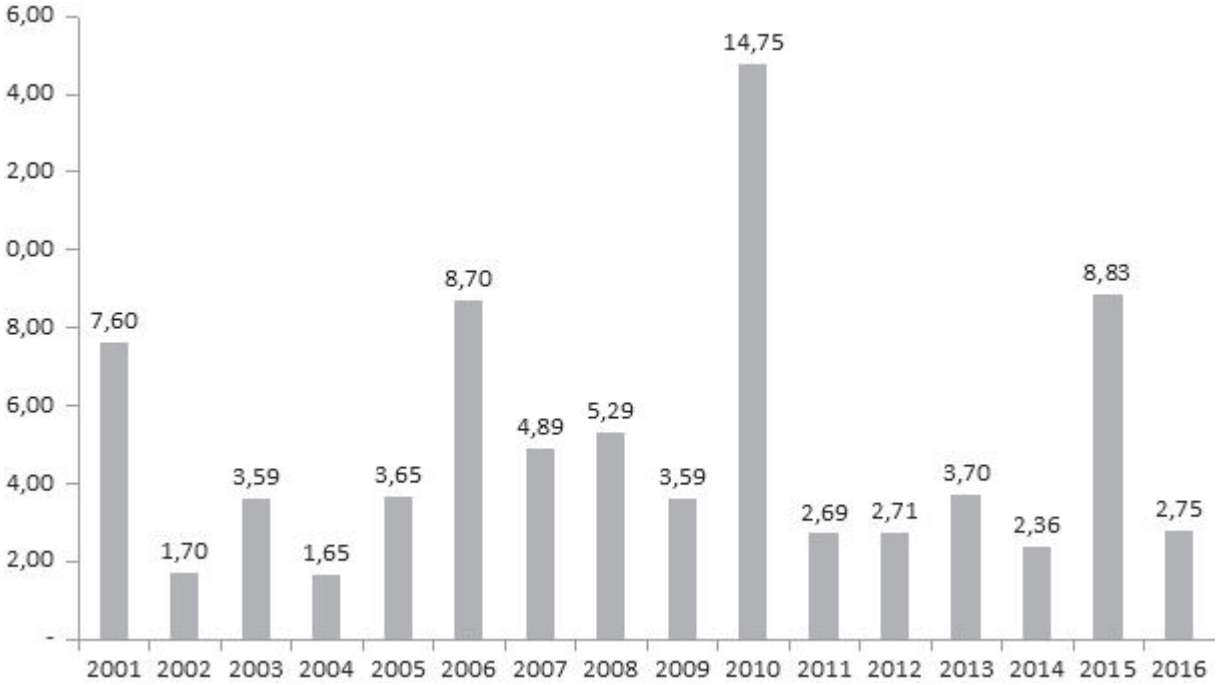
The Protection Program until 2023 provides for the protection of seashores over the length of 211.86 km, i.e. 42% of their total length. The assessment of the level of coastal safety shows, however, that 238.4 km of the coast, i.e. 48% of the total length must be protected in order to ensure that the coast can withstand a 100-year storm. The establishment and respect of a *seatback* zone seems to be the most important element in the protection of both property and the shore. In order to specify the safety standards of the coastal zone it is necessary to determine the resistance of the shore to hydrodynamic factors and then the limits of safe management in the coastal zone. This is one of the basic tasks of protecting the seashores until 2050. This does not apply to those stretches of coastline for which total maintenance of the natural or artificial coastline is planned.

The analysis of data concerning the amount of losses, on the basis of data collected within the framework of the KLIMADA project from tens of institutions (ministries and subordinate units, local government units) and expert opinions carried out within the framework of the KLIMADA project[15], showed that during the last 16 years, the phenomena causing the highest damage in Poland were mainly floods and adverse atmospheric phenomena in agriculture. The problem of flooding affected all sectors of the economy and, in addition to agriculture, was also damaging and costly for infrastructure in urban areas. On the other hand, drought (2015) and frost have also caused negative effects in agriculture. Storms have also proved to be a major and costly problem, causing not only material damage, but also a threat to human health and life.

The total value of direct losses caused by extreme weather and climate events in the years 2001-2016 was estimated at over PLN 78 billion, including losses of PLN 20.5 billion in the years 2012-2016 (at 2015 prices).

[15] In accordance with the methodology adopted in the *Strategic Adaptation Plan for Sectors Vulnerable to Climate Change until 2020 with an Outlook to 2030*.

Fig. 10.12. Estimation of losses caused by extreme weather and climate events in the years 2001-2016 (defined by the investment price index of 2015 in billion PLN).

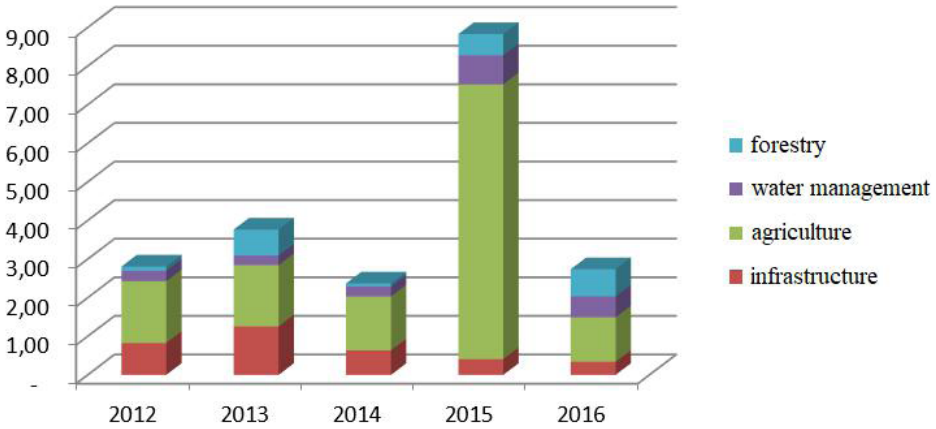


Source: Siwiec E., Institute of Environmental Protection – National Research Institute (2017).

Every year, extreme events cause losses ranging from PLN 2 to 5 billion. Once every few years, above-average damage occurs. During the analysis period, floods in 2001 and 2010 and extreme events, including drought in agriculture in 2006 and 2015, caused severe impacts.

According to the assumption that indirect losses compare to about 60% of direct losses[16], it can be assumed that the total losses caused by extreme events in Poland in the last 16 years amounted to approx. PLN 126 billion.

Fig. 10.13. Losses from extreme weather and climate events in 2012-2016 by sector, following 2015 prices in billion PLN.



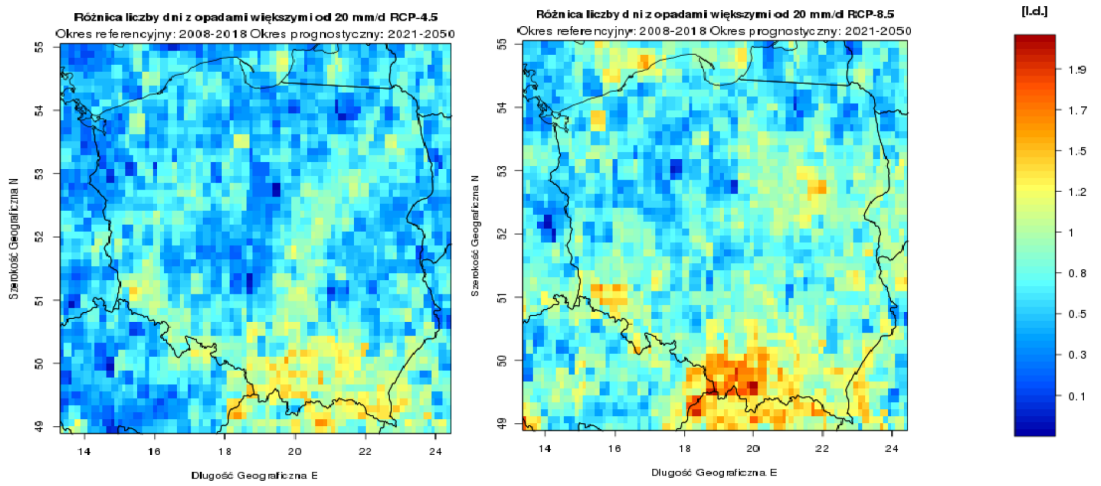
Source: Siwiec E., Institute of Environmental Protection - National Research Institute (2017).

[16] The assumptions adopted in the Programme for Protection against Floods in the Upper Vistula River Basin concerning indirect flood damage have been applied to all adverse atmospheric phenomena.

In the years 2012-2016, there were no significant flood damages on a national scale. The highest direct losses were recorded in 2015 in the agricultural sector and amounted to approximately PLN 12.5 billion (mainly related to drought). Losses in infrastructure were estimated at about PLN 3.5 billion, while in forestry and water management each, losses of PLN 2 billion were recorded.

By 2030, climate change will have a twofold impact, both positive and negative, on the economy and society. A positive effect shall be, for example, an increase in the average air temperature in the form of extending the vegetation period, shortening the heating period and extending the tourist season. Unfortunately, the predicted negative consequences of climate change are predominant.

Fig. 10.14. Difference in the number of days with a daily precipitation sum greater than 20mm/d projected for the period 2021-2050 in relation to the reference period 2008-2018 for RCP4.5 (left) and RCP8.5 (right). Projected values were calculated on the basis of a bundle of climate models from the EURO-CORDEX repository at a resolution of 0.11o, corrected with the use of ERA5 reanalysis. ERA5 reanalysis was used as reference observational data.



Source: Institute of Environmental Protection – National Research Institute, carried out as part of the project: Knowledge base on climate change and adaptation to its impacts and its dissemination channels in the context of enhancing the resilience of the economy, the environment and society to climate change and preventing and minimising the impact of exceptional threats.

Adverse changes in hydrological conditions are directly linked to climate change. Although the predicted annual precipitation values do not change significantly, they become more random and uneven in nature. The result shall be longer rain-free periods, interrupted by sudden torrential rainfall. The projected reduction of groundwater levels shall have a negative impact on biodiversity and forms of nature conservation, in particular on water bodies and wetlands. The negative impact of climate change will also be observed in the winter season, when the period of snow cover and its thickness will decrease and the evaporation process will intensify, which will result in a decrease in the country's water resources.

At the same time, the effect of climate change will be to increase the frequency of occurrence of extreme weather phenomena and disasters with a significant impact

on sensitive areas and the economy of the country. The greatest hazard will be posed by torrential rainfall, causing flood, often accompanied by landslides, mainly in mountainous and upland areas. The occurrence of strong winds and even incidentally accompanying tornadoes and atmospheric discharges will increase. This will have a significant impact on, among others, the construction, power and transport infrastructure.

Adaptation measures

Climate policy does not only consist in limiting greenhouse gas emissions, but also adapting our societies, the environment and the economy to new climate conditions. In Poland, a number of measures have been implemented to improve the resilience of the economy and society to climate change and to reduce the related losses. A *Strategic Adaptation Plan for Sectors Vulnerable to Climate Change until 2020 with an Outlook to 2030* (SPA 2020) has been developed and adopted with a view to ensuring conditions for sustainable socio-economic development in view of the risks posed by climate change.

Policies focusing on the management and protection of water, land and biological resources to maintain and restore healthy and functioning ecosystems capable of adapting to climate change are one way of tackling the impacts of climate change. These strategies can also contribute to disaster prevention, as stated in the recent European Commission Communication[17]. Evidence suggests that using the nature's capacity to mitigate and control impacts in urban and rural areas can provide more effective means of adaptation than relying solely on physical infrastructure. Green infrastructure[18] can be an important contribution to the effective implementation of all policies where some or all of the desired objectives can be achieved in entirety or in part by nature-based solutions. It can play a key role in the adaptation process, as it provides resources important from social and economic points of view in extreme climate conditions. For example, it contributes to improving soil carbon and water storage capacity and water retention in natural systems, thereby mitigating the effects of drought and preventing floods, soil erosion and desertification.

In the context of projected climate change, rainwater management is becoming an increasingly serious problem, in particular with regard to urbanised areas and areas functionally linked to them.

Climate change combined with urbanisation through changes in land use patterns and practices shall lead to an increase in the frequency and intensity of precipitation in the coming years, including an increase in the frequency of torrential rains, which in turn shall result in urban floods, including flash floods, and other types of flooding, in a significant number of cases related to the insufficiency of urban drainage systems. In order to limit the occurrence of the discussed effects of heavy rainfall, often causing significant losses in urban infrastructure and the risk of loss of health or life of city dwellers, it is necessary to take adaptation measures. Such activities should include construction of sustainable rainwater management systems, reduction of soil sealing,

[17] COM(2009) 82: A Community approach on the prevention of natural and man-made disasters.

[18] Green infrastructure: a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings. As in: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Green Infrastructure (GI) — Enhancing Europe's Natural Capital (SWD(2013)155 final).

construction of retention reservoirs as well as shaping and strengthening the role of the blue and green infrastructure in rainwater retention (small retention). Adaptation measures in the discussed scope should lead to limiting the amount of rainwater run-off and increased retention, as well as increasing the retention of rainwater in open areas. Consideration should be given to both the flood protection function of such measures and the functions related to drought control and the creation of favourable microclimatic conditions around open retention reservoirs. Local authorities should promote small retention at different scales (from backyards to urban forests) and the use of excess rainwater and ensure that the city structure creates a mosaic of open and developed areas, avoiding large, uniform impermeable spaces.

Preventive action brings clear economic, environmental and social benefits by addressing potential impacts and minimising threats to ecosystems, human health, the economy and infrastructure. Available sources suggest that in the medium to long term, the costs of measures undertaken to combat climate change (including mitigation and adaptation measures) shall be significantly lower than the costs of inaction[19].

The development and maintenance of green and blue infrastructure, especially in cities, plays an important role in the planned and implemented actions related to adaptation to climate change. The application of solutions based on urban greenery, apart from a positive adaptation effect, performs a number of other functions, related to health, aesthetics, biodiversity, impact on urban microclimate, absorbing pollution, etc. Therefore, the design, application and maintenance of green and blue infrastructure solutions is crucial for building the resilience of cities to climate change and is an integral part of the implementation of climate change adaptation. The management of "blue-green" infrastructure should combine environmental and recreational functions (integration into small infrastructure, walking and cycling routes, town squares, etc.).

[19] White Paper, Adapting to Climate Change: Towards a European Framework for Action, COM(2009)147.

Environmental education and access to information about the environment

Sustainable consumption patterns and environmental education

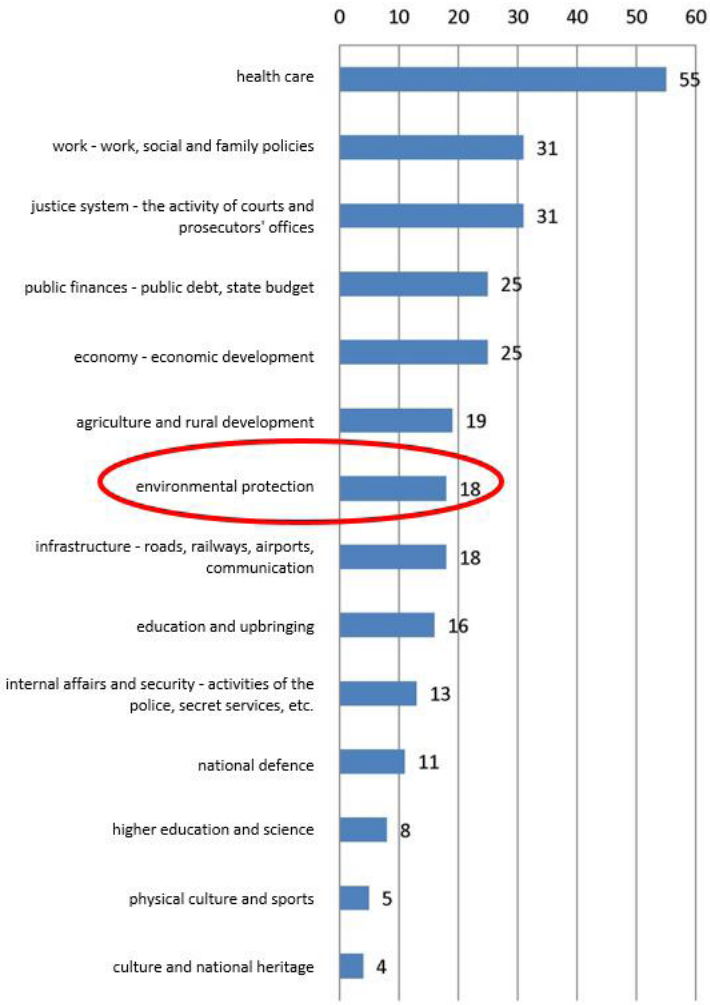
Many negative environmental changes are caused by the increasing use of natural resources necessary to meet the needs of existing production and consumption patterns. In order to reverse or even stop these trends, profound changes are necessary in both production and consumption patterns at the level of administration, households and individuals.

Environmental education is a horizontal issue concerning all areas of environmental protection and water management. The sustainable development of the country requires not only investments in modern, environmentally friendly technologies and rational management of natural resources, but also a high level of environmental awareness of the society. This means that environmental education, while guaranteeing the transfer of up-to-date knowledge and content, must be constantly adapted to the changing environment and the demand for supplementing knowledge and development of competences. Environmental education conducted in an orderly and systematic manner may have a significant positive impact on economic development with respect to the constitutional principle of sustainable development, and thus on the quality of life. Involvement, mutual coordination and cooperation of public institutions, NGOs as well as business and academia determine whether environmental education is effective and brings results (see Environmental Education Strategy of the National Fund for Environmental Protection and Water Management for 2013-2016 with the perspective to 2020).

As such, environmental awareness growth is an objective of environmental policy and contributes to the achievement of other objectives. Pollution of the environment in Poland results not only from infrastructural problems, but also from insufficient environmental awareness and environmentally unfriendly behaviours of Poles, as shown by the results of Tracking studies of environmental awareness and behaviour of Poland's inhabitants[1], conducted by the Ministry of the Environment.

The research shows unequivocally that the majority of Poles gives priority to economics over care for the natural environment. Most people are not ready to spend more money on environmentally friendly solutions, e.g. clean energy. The driving force behind saving energy or water is therefore more a concern for the home budget than a conscious environmentally friendly attitude.

Fig. 11.1. Distribution of answers to the question: In which area do you think our country has most problems to solve? (%)

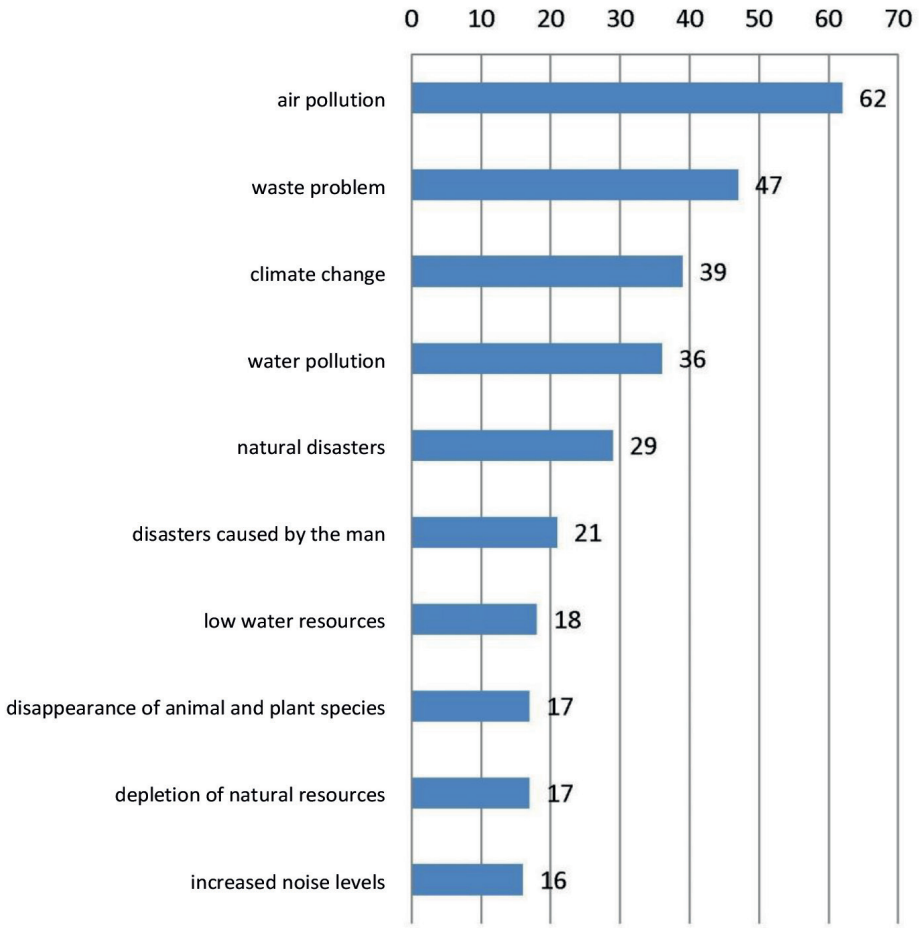


Source: own elaboration based on data from: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018, p. 18.

[1] *These are regular studies carried out within the framework of a long-term research program of the Ministry of the Environment. The program was launched in 2011. Annual tracking studies, conducted until 2014, made it possible to track the dynamics of changes in awareness and to program activities e.g. in the field of environmental education (environmental projects, including nationwide social campaigns).*
The measurements were made at the end of each year on a sample of about 1000 adult Poles. The results are available at: https://www.gov.pl/web/srodowisko/badania-swiadomosci-ekologicznej

Consequently, from the very beginning of the measurements[2], from among the various fields that the state deals with, the majority of Poles consider health protection and labour problems as the most challenging issues. There are no environmental problems on the list of the most "urgent" areas, as these are indicated by only 18% of the respondents. However, it is noteworthy that this percentage has increased compared to the previous survey (in 2014 only 8% of the respondents indicated environmental protection).

Fig. 11.2. Distribution of answers to the request: Please select three most important, in your opinion, environmental problems in Poland (%)



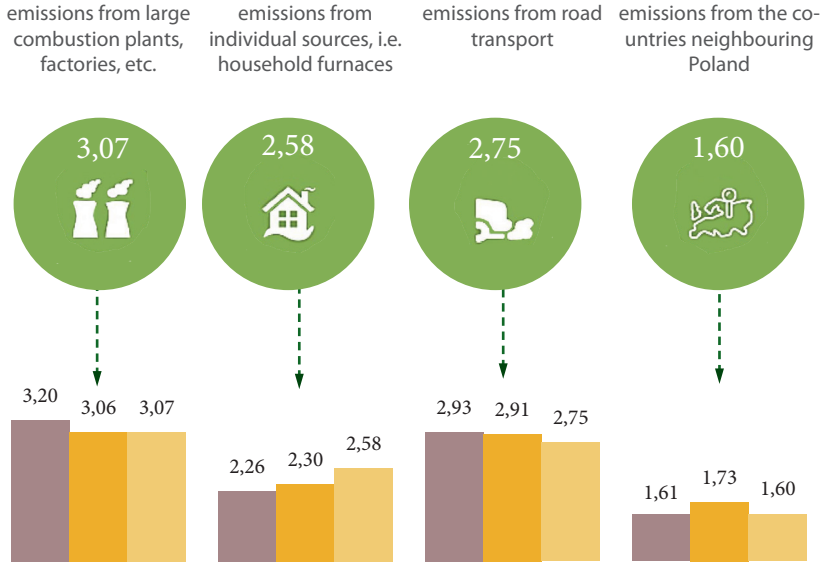
Source: own elaboration based on data from: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018., p. 23.

However, when asked directly about the most important environmental problems in Poland, the respondents consider air pollution as most important (62% of the respondents indicated this problem), with waste problem being the second (47%), and climate change the third (39%).

According to the respondents, air pollution is a significant environmental problem in Poland.

[2] The diagnosis presents the result of the study carried out in 2018.

Fig. 11.3. Distribution of answers to the request: Please rank the following reasons for poor air quality in Poland in the order FROM the most important for you TO the least important – the most important (average score)

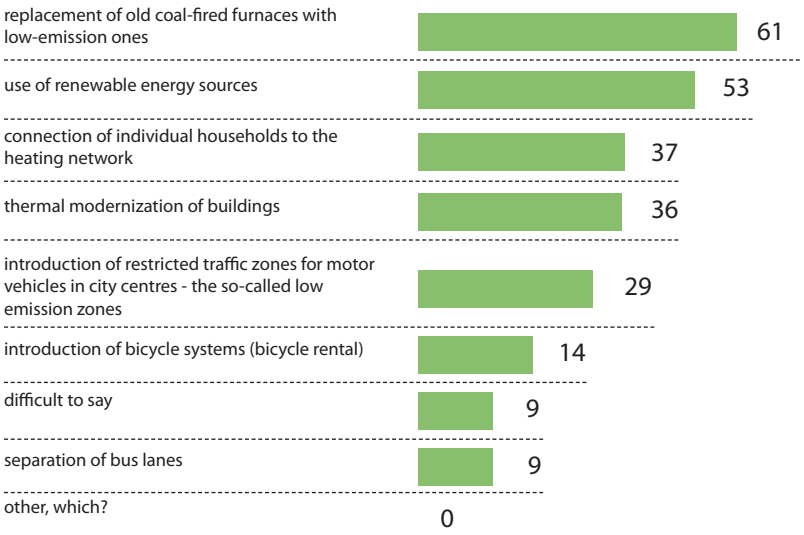


* The respondents' answers were scored from 4 for the most important reason to 1 for the least important reason. The average was calculated from the indications of all respondents. The higher the score, the more significant the reason.

Source: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018., p. 47.

According to the respondents, the reason for poor air quality are mainly emissions from large combustion plants, factories, etc. (average score 3.07) and emissions from individual sources, i.e. household furnaces (average score 2.58).

Fig. 11.4. Distribution of answers to the request: Please indicate which measures, in your opinion, should be applied in order to improve air quality in Poland? (%)

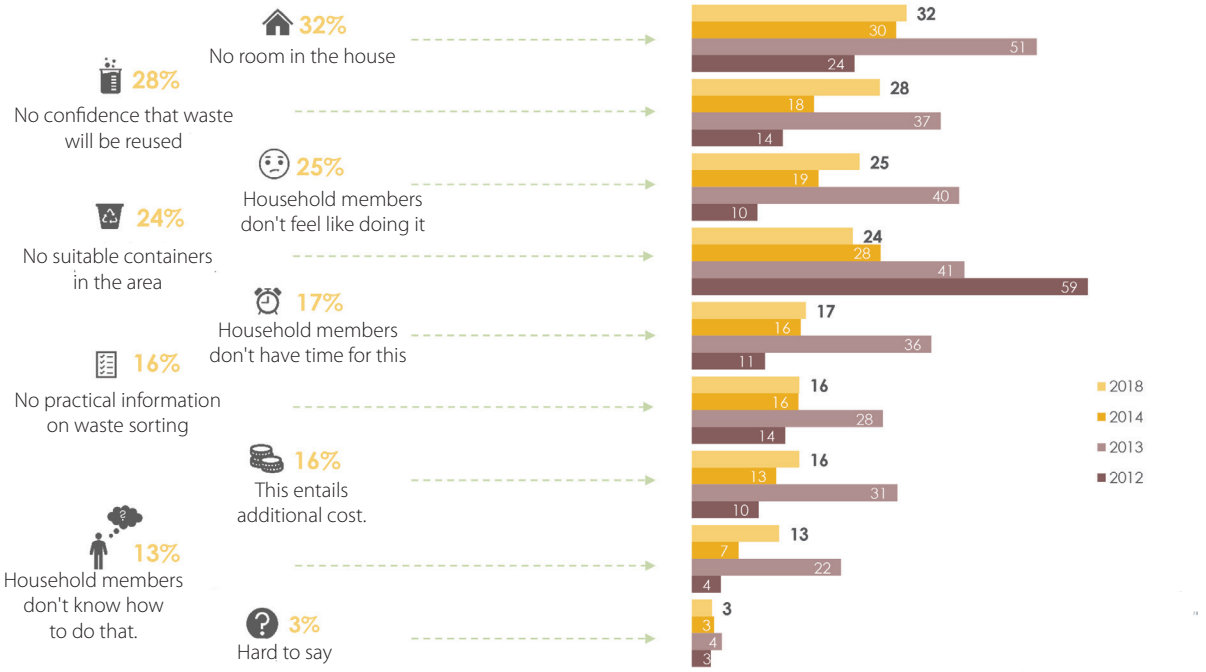


Source: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018., p. 51.

In order to improve air quality in Poland, according to the respondents, old coal-fired furnaces should be replaced with low-emission furnaces (this answer was indicated by 61% of the respondents), and renewable energy sources should be used (53% of the answers).

The environmental awareness of Poles should be confronted with the actual actions taken to protect the environment. In 2018 the percentage of persons declaring regular waste segregation was only 62% (down from 68% in 2014). Despite the declared waste segregation, the level of recycling and preparation for reuse for paper, metal, plastics and glass was only 28% in 2016 in Poland[3]. Every fourth Pole (26.6%) threw waste into one basket, and almost every sixth Pole (17.2%) segregated waste sporadically.

Fig. 11.5. Distribution of answers to questions related to waste segregation: Why in your household is waste not segregated or is it done sporadically?

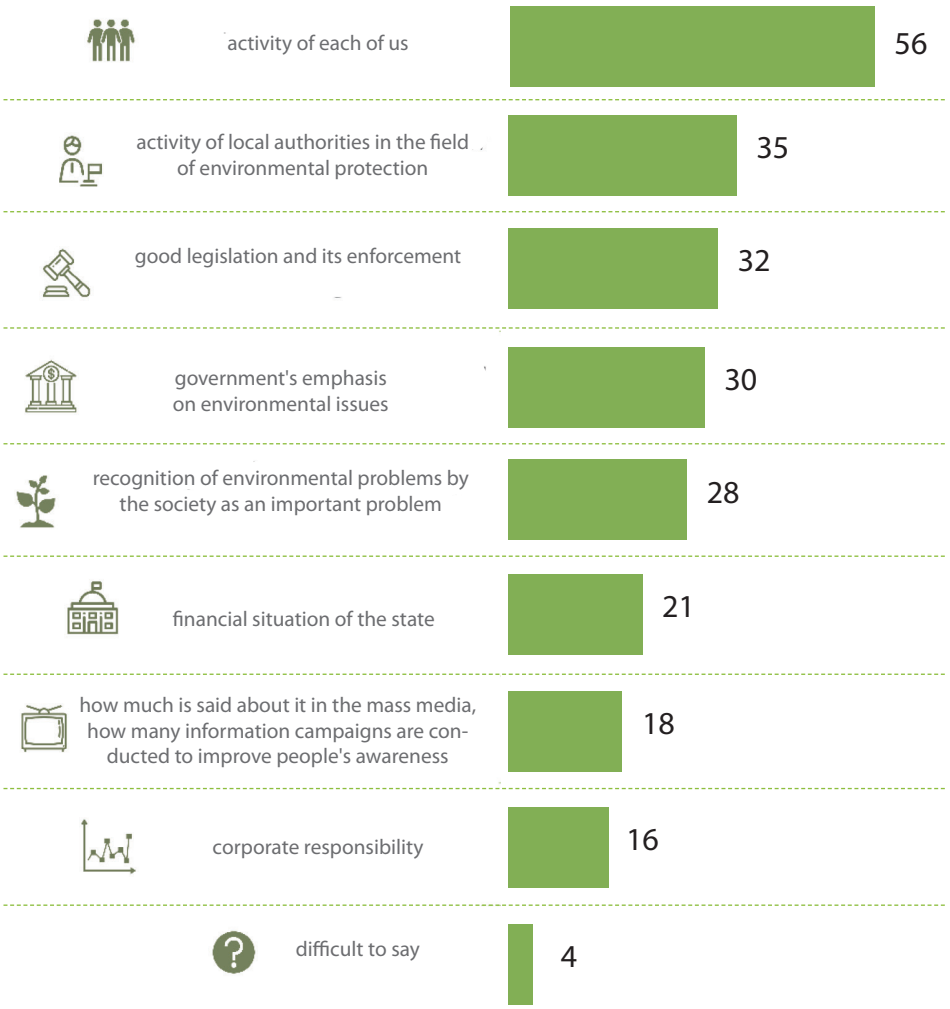


Source: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018, p. 59.

Persons who did not declare waste segregation or do not do it regularly were asked what the reason for the missing segregation habit in their case is. The most common answer was the lack of space for waste segregation (32%). The lack of faith that waste will be reused was the reason why more than a quarter of the respondents (28%) did not separate their waste. The reluctance of household members is also of great importance (25%, increase by 6 percentage points compared to the 2014 survey), which shows how important in environmentally friendly attitudes is the internal motivation of people and the lack of adequate containers in the area (24%, decrease by 4 percentage points)[4].

[3] Based on data from the STRATEG database.
[4] A one-themed study of the environmental awareness of Poland residents. Waste management. Study report, 2017.

Fig. 11.6. Distribution of answers to the question: In your opinion, what is the most important factor that determines the condition of the environment? (%)



Source: Tracking study of the awareness of environmentally friendly behaviours of Poland's inhabitants. Study report. 2018., p. 35.

The respondents were motivated to protect the natural environment mostly by care for human health and care for future generations – these factors were mentioned by 64% of Poles.

According to Poles, the state of the natural environment depends primarily on the activity of each citizen. Institutional factors (good law, government action, etc.) do count, but are on further positions. As a society, we attribute responsibility for the well-being of nature mostly to individuals rather than institutions. Such a conclusion is also confirmed by the answers to the question who should take care of shaping environmentally friendly attitudes and behaviours – the answer "each individual", next to the school and local and regional authorities, appears most often.

In the course of the 2017 survey concerning waste management[5], Poles were asked whether they have a habit of performing certain activities that can be considered as supporting environmental protection. The two most frequently undertaken environmentally friendly activities by Poles are the use of reusable bags (69%) and

[5] A one-themed study of the environmental awareness of Poland residents. Waste management. Study report, 2017.

avoidance of waste generation by purchasing only necessary products (64%). More than half also declare that they repair broken devices before buying new ones and reuse unnecessary objects by giving them back or selling them (54.4% each). The least common practice was to avoid the use of non-returnable bottles, for example by drinking tap water, which was admitted by only 32% of the respondents.

As mentioned earlier, the majority of the respondents believe that environmental problems are not the most important challenge facing Poland. A consequence of this belief may be that there is no need to search for information about the natural environment and its protection. The results of the study indicate that the first source of information about the natural environment is television (mainly for the age group of 40+ recipients), and another preferred source is the Internet (especially for the age group of 15-39-year-old recipients).

Creating environmentally friendly behaviours results in the reduction of the negative impact of the man on the environment, which in the long run will contribute to the reduction of expenditures on the removal of threats and pollution of the environment. The promotion of environmental behaviour meets the requirements of the so-called activities at source, i.e. preventing negative impacts on the environment, and not just eliminating existing problems. The state of the environment depends both on good regulations and their enforcement as well as on the behaviours of individual inhabitants, therefore it is important to conduct effective environmental education and shape sustainable consumption patterns.

Access to environmental information

Effective and efficient release of environmental information and its protection by public authorities is of multidimensional importance. It is essential for the proper functioning of civil society and building the national economy based on knowledge of the processes taking place in the natural environment and the impact of human activity on these processes. It provides a comprehensive analysis of the risks to human life and health arising from phenomena and changes in the natural environment. By providing reliable and verified data, access to environmental information supports effective, evidence-based environmental education.

The Aarhus Convention[6], the Directive on access to environmental information[7] and the INSPIRE Directive[8] and the national legislation implementing them together form the legal basis for the exchange of environmental information between state authorities and the society. They are also an integral part of the existing EU Government Action Plan for the public administration[9]. Effective implementation of the law on access to information on the environment and its protection is part of the implementation of the Sustainable Development Goals and the related UN strategy for the IT revolution.

[6] UNECE, Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, 1998 (OJ L of 2003, item 706).

[7] Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC (OJ L 41, 14.2.2003, p. 26; Polish translation, Chapter 15, Volume 7, p. 375).

[8] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (OJ L 108, 25.4.2007, p. 1, as amended), hereinafter referred to as the 'INSPIRE Directive'.

[9] European Union, EU eGovernment Action Plan 2016-2020 - Accelerating digital transition in government COM (2016) 179 final.

Information shall be made available on request from interested parties and in an active manner. Electronic databases containing environmental information will be crucial in the near future. They should allow as wide direct access to up-to-date information via the Internet in real time as possible. They should also allow for the automatic exchange of information for other databases operated by stakeholders interested in their further use, transformation and dissemination. To this end, it is necessary to ensure the greatest possible interoperability between existing and future databases. It is also important to build access points which would aggregate many different databases in one place and thus enable the society to access them more easily.

The INSPIRE Directive sets standards for the exchange of specific spatial data between public authorities. It also requires the Member States to maintain a national geoportal through which spatial data are to be accessible. The thematic scope of the data covers not only those related to the environment, but also, inter alia, reference data[10], which are e.g. addresses, parcels of land or the administrative division of the state. The availability of environmental data (as defined in the INSPIRE Directive) and the data exchange policies ('open data') of each Member State are regularly reviewed[11]. Poland has achieved good results in implementing the INSPIRE Directive by allowing active access to environmental information, but there are areas for improvement. The applicable national rules define the entities entitled to receive data free of charge and the scope of the data to be made available. Poland does not envisage charging for the use of INSPIRE spatial data sets through discovery and viewing services. In accordance with the current deadlines, full implementation of the INSPIRE Directive should be completed by 2021.

Applications for mobile devices and web portals are an important tool for accessing environmental data. The forms of such access to environmental information are derived from the existence of public sources of information and data. Often, only the administration has the ability to develop and update databases, which are then used by applications for mobile devices or web portals. Databases can be built for a specific service or in a universal format that allows their use by different digital tools. The creator of the final product for the citizen is usually a private entity.

Until now, environmental data has been published in many different formats, including non-digital formats. Currently, the administration's efforts are focused on standardizing environmental data and making them available through network services. This is in line with the expectations of the market (digital toolmakers) and the society (digital tool users). During consultations on the amendment of the Act on Access to Public Information in 2015 comments were reported to ensure maximum interoperability of public data so that they can be used by entities outside the public administration. Actions are also being taken at the international level to ensure adequate data interoperability. The most ambitious initiative in this respect is the above-mentioned INSPIRE Directive and the creation of the EU-wide area-based geoportal (the vast majority of environmental information is area-based). The UN Economic Commission for Europe is also taking action to ensure as wide interoperability of

[10] The detailed scope of the data is contained in the Annexes to the Directive and in the implementing provisions.

[11] Member States are obliged to submit implementation reports to the European Commission once every 3 years. An annual monitoring of the resources and services made available is also carried out, and in 2016, at the request of the Commission, most Member States, including Poland, presented an action plan on INSPIRE addressing the problems of implementation of the Directive.

data as possible. Present activities of public administrations will be continued and developed so that market participants can use public data in parallel for social and commercial purposes. Therefore, public administrations will increase the availability of public environmental data and ensure that they will be continuously updated, and that existing systems and databases will be interoperable.

Instruments of the national environmental policy

Entities involved in environmental management

The competence structure and organization of environmental protection bodies and institutions at the national level aim at systematic improvement of the condition of the environment and implementation of the principles of sustainable development. It is also crucial to meet growing national and EU requirements on environmental protection standards.

The system of organizations of environmental protection services, which has been developing for over the last dozen or so years, is currently a very extensive system, with complex and complicated competence relations, covering increasingly vast areas of problems. The Polish lawmaker adopted the so-called mixed concept of environmental protection services organization, imposing environmental protection competences on existing public administration bodies both governmental and self-government ones, which will perform environmental tasks alongside many other tasks. At the same time, it has set up specialized bodies dealing only with environmental issues. Competences in the application of environmental protection law were granted not only to central but also to local government administration bodies and bodies at practically all levels of the administrative division of the country (self-government authorities at the level of municipality, county and voivodship both of a legislative and executive nature).

The supreme body of public administration in the field of environmental protection is the minister in charge of the environment, which in the current organizational structure is the Minister of the Environment (MŚ). At the central level, there are also such government bodies supervised by the Ministry of the Environment, as the Chief

Inspector for Environmental Protection (GIOŚ), the General Director for Environmental Protection (GDOŚ) and the President of the State Atomic Energy Agency.

At the local level, a distinction should be made between the combined administration and the non-combined administration. The field offices of the combined administration include the voivode and the Voivodship Inspector for Environmental Protection (WIOŚ), who has his own auxiliary staff in the form of the Voivodship Inspectorate for Environmental Protection, which is a separate budgetary unit. However, the Regional Directorate for Environmental Protection (RDOŚ) may be indicated among the non-combined administration bodies performing functions in the field of environmental protection.

The administrative grouping significantly influences the functioning of the State Environmental Monitoring, due to, among others, the fact that such a structure makes it more difficult to ensure efficient and cost-effective management of measurement and laboratory infrastructure, prioritization of tasks performed by individual units or specialization of laboratories over the administrative division. A problem of the Chief Inspectorate for Environmental Protection is also the gradual increase of duties and tasks to be performed without strengthening in financial and HR terms. The main challenges are to ensure the effectiveness of inspection activities in building a stable system of financing research and assessment of the condition of the environment as well as to fight against the so-called "grey zone" in waste management. The studies performed[1] show that the phenomenon of the "grey zone" in waste management is growing, and its range concerns 7.8 million tonnes of various types of waste and translates into a market share of approximately PLN 2.7 billion (excluding vehicles).

Among the self-government administration bodies performing tasks in the field of environmental protection there are no specialized bodies for environment protection. The bodies performing tasks in the field of environmental protection are general administration entities:

- at the voivodship level: voivodship council, voivodship board and voivodship marshal;
- at the county level: county council, county board, starosta (or president of the city in case of cities with county rights);
- at the municipality level: municipality council and mayor (or president of the city in case of cities with municipality rights).

It is worth noting that the Polish legislator also distinguishes, among environmental protection bodies, the nature protection bodies as specialized environmental protection authorities, which have matters related to nature protection within the scope of their competence and tasks. As a general rule, it has been assumed that the tasks in the field of nature protection may be performed by the environmental protection authorities specified in the act of 27 April 2001 on Environmental Protection Law (mayor, president of the city, starosta, voivodship marshal, voivode, minister in charge of environmental issues, General Director for Environmental Protection and Regional Director for Environmental Protection). From 1 January 2012 (pursuant to Article 91 of the Act of 16 April 2004 on nature protection (OJ of 2018, item 1614, as amended)[2], the structure of nature protection bodies also includes the director of a national park (currently

[1] Expert opinion Estimation of the size of the "grey zone" in waste management and its impact on the state budget, commissioned by the Chief Inspector for Environmental Protection, developed by Krzysztof Kawczyński.

[2] Hereinafter referred to as u.o.p.

a specialized administration authority). An important element of this organizational structure is also the obligation to cooperate in the field of nature protection with the nature conservation officer. The Ministry of the Environment performs nature conservation tasks with the assistance of the Chief Nature Conservation Officer[3] and RDOŚ – the regional nature conservation officer[4]. The nature conservation service also includes the director of a landscape park, the national park services and the landscape park services as well as the forest services.

The organization structure of environmental protection services in Poland also includes a very extensive catalogue of consultative and advisory bodies.

The discussed structure also includes organizational units supervised by the Ministry of the Environment. These are the National Fund for Environmental Protection and Water Management (NFOŚiGW) and the State Forest Holding State Forests (PGLLP) as well as the Forest Seed Production Bureau in Warsaw. The National Fund for Environmental Protection and Water Management is the largest separate public institution established to finance environmental protection in Poland. At the regional level, the tasks in this respect are performed by the voivodship environmental protection and water management funds (WFOŚiGW). These entities have legal personality and the possibility to decide independently on the directions of intervention within the limits of the applicable law, in particular the Act of 27 April 2001 on Environmental Protection Law.

PGLLP comprises organizational units, i.e.: General Directorate of State Forests, regional directorates of State Forests, forest districts and other organizational units without legal personality, which perform an auxiliary function[5]. Research institutes are also under the umbrella of the Ministry of the Environment, i.e. The Forest Research Institute, the Institute for Ecology of Industrial Areas and the Institute of Environmental Protection (which performs e.g. tasks of the KOBIZE). In addition, the Ministry of the Environment also runs forest schools.

The system of organization of environmental protection services in Poland also includes ecological institutions of quasi-police nature, appointed to monitor compliance with environmental protection regulations and to react quickly to detected violations. The scope of state natural guards includes:

- State Hunting Guard (acts within the scope of the Act of 13 October 1995 on Hunting Law (OJ L of 2018, item 2033, as amended)),
- two nature guards operating within the structures of state entities: Forest Guard (acts on the basis of the Act of 28 September 1991 on forests (OJ L of 2018, item 2129, as amended) and the Park Guard (operates on the basis of the u.o.p. in the structure of the National Park Services).

On 2 August 2017 the President of the Republic of Poland signed the new Water Law. The Act of 20 July 2017 on Water Law replaced the Act of 18 July 2001, which regulated water management, in particular the shaping and protection of water resources, the use of water and the ownership of water and land covered by water.

The system of legal and organizational structure of water management bodies, which has been in force for over a dozen years, has revealed numerous dysfunctions which

[3] Article 92(1) of u.o.p.

[4] Article 124 of the Act of 3 October 2008 **on providing information on the environment and its protection, public participation in environmental protection and environmental impact assessments (OJ of 2018, item 2081, as amended).**

[5] Article 32, section 2 of the Act of 28 September 1991 on forests (OJ of 2018, item 2129, as amended).

have a significant impact on the difficult situation in the water management sector. The previous version of the Water Law Act provided for the functioning of the President of the National Water Management Authority as the central body of government administration competent in matters of water management, and in particular in matters of water management and water use, as well as directors of regional water management boards as governmental non-combined administration bodies competent in matters of water management in the water region. The scope of competence of the President of the National Water Management Authority was very broadly defined, while the scope of competence of the minister in charge of water management was so narrow that the real influence of the minister, and thus of the Council of Ministers, on water management was generally limited. This significantly hindered, for the minister in charge of water management, the possibility of effective and efficient intervention in cases requiring such intervention due to the implementation of the policy of the Council of Ministers in the area of water management and investment activity in water management. The director of the regional water management board performed tasks both on the administrative level (establishing local law, issuing permits under the Water Law) and on the level of management of State Treasury assets and conducted key investment processes in the area of water management. The combination in one body of two types of competences of a completely different nature adversely affected the effectiveness, efficiency and timeliness of actions undertaken in their scope.

Particular concern was raised by numerous problems with regard to the investment process in the water management system. The nature of investments in water management, which have a significant impact on the life, health and property of the population, justified the creation of such legal and organizational conditions in the area of water management to ensure that the investment process, both at the planning stage and at the stage of implementation, is conducted in a timely, reliable and effective manner. The previous legal and organizational structure of water management did not guarantee fulfilment of this postulate. It was also necessary to ensure real and effective water authority and influence of the minister in charge of water management and his subordinate bodies on all decisions concerning water management, including in particular water management planning, water protection and the system of water permits.

The scope of the currently implemented reform of water management aims at introducing instruments ensuring achievement of the Water Framework Directive[6] objective, i.e. full implementation of the catchment-based water management policy that meets the criteria of functionality, safety and sustainable development, economic efficiency, sustainability of ecosystems and social acceptance in accordance with the principle of sustainable water management, including economic use of water resources. Therefore, it is necessary to develop legal, organizational, financial and technical solutions in water management, which will ensure sustainable and balanced social and economic development of the country, taking account of the needs of economic water use and ensuring the availability of water resources of appropriate quality and quantity.

The new Water Law was created in response to the need to create an effective system of financing water management. It provides for payment for water services exceeding

[6] Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, hereinafter referred to as the "Water Framework Directive".

the scope of normal or universal water use. The establishment of such a regulation was a condition which Poland had to meet in order to use the funds from the European Union's operational programmes for 2014-2020.

The Act changed the system of water resources management in Poland. The authorities previously competent in this matter have been replaced by a new entity – Państwowe Gospodarstwo Wodne Wody Polskie ("Polish Waters"). Polish Waters are a state legal person (Article 9(14) of the Act of 27 August 2009 on Public Finances (OJ L of 2019, item 869)), which includes the following organizational units:

- The National Water Management Authority with its registered office in Warszawa,
- regional water management boards based in Białystok, Bydgoszcz, Gdańsk, Gliwice, Kraków, Lublin, Poznań, Rzeszów, Szczecin, Warszawa and Wrocław,
- 50 water catchment boards,
- 330 water surveillance bodies.

Polish Waters implement a catchment policy of water management at every level of the catchment area, water region and river basin. Moreover, Polish Waters exercise ownership rights in relation to public waters owned by the State Treasury, with the exception of inland waterways of special importance for transport, in respect of which ownership rights will be exercised by the minister in charge of inland navigation. According to the transitional provision, until the end of 2019 it will not be possible to change the tariffs for water charges.

Polish Waters conduct activities in the field of flood and drought protection and protection of the quality of our water resources, charge and collect fees for water services, issue administrative decisions (water consents). Polish Waters also serve as a regulatory authority to protect residents against unjustified increases in the prices of water and sewage services.

The President of Polish Waters or directors of regional water management boards approve tariffs for collective water supply and collective sewage disposal, give opinions on draft regulations for water supply and sewage disposal and settle disputes between water supply and sewage system companies and the recipients of their services.

One of the weakest points of the current legal and organizational system of environmental protection services in Poland is performance of the control function. The effectiveness of this function has a significant impact on ensuring effectiveness in the enforcement of the environmental law.

Table 12.1. SWOT analysis for the System of Environmental Protection Services.

STRENGTHS	WEAKNESSES
• adoption of the so-called mixed concept for the organization of environmental protection services, i.e. the imposition of environmental protection competences both on the existing public administration bodies as well as on the established bodies specializing in environmental protection; • functioning within the organization of environmental services of specialized bodies with specialist knowledge from the field of legal sciences and administration, but also natural and technical sciences and dealing only with environmental issues, which is important in particular in view of the need to ensure the proper performance of the tasks for fulfilment of the obligations under the EU law; • development of a system of organization of environmental protection services over the last several years, large human resources potential and technical background in the field of environmental protection; including the background of a network of accredited laboratories operating in provincial environmental protection inspectorates, performing measurements, research and studies in connection with the performance of tasks aimed at verifying compliance with the protective obligations imposed by law on certain entities; • delegation of tasks of executive nature to commune authorities as the basic unit of local government and the unit of public administration that is closest to the society; • functioning of the State Environmental Monitoring as a reliable and objective source of information on the state of the environment, which is necessary for the development, conduct and evaluation of the national environmental policy.	• entrusting self-government administration bodies of a general nature (especially commune bodies) with tasks that require a very high level of professional and profiled knowledge of legal sciences and administration as well as natural sciences and technical sciences to ensure substantive correctness of performing these tasks; • weakness of instruments of cooperation between general administration bodies with the bodies specialized in environmental protection; • making the possibility for the specialized body to carry out highly specialized environmental procedures conditional on the final decision of the general administrative body; • under-utilization of the potential of existing specialized bodies; frequent “dispersal” of this potential by assigning a number of tasks to such bodies covering a wide range of different cases (not always requiring particularly high expertise and profiled knowledge); • the lack of precise rules defining the tasks of each authority; • the multiplicity and complexity of organizational and competence links, as well as personal links between bodies at different levels of administration; • lack of a properly shaped preventive function of inspection and control services for environmental protection; • lack of a modern human resources management system.

OPPORTUNITIES	THREATS
• possibility of using the possessed, large human resources potential, research facilities to create new structures in order to effectively perform public tasks in the field of environmental protection, effective fulfilment of tasks by Poland in the field of environmental protection management and implementation of sustainable development objectives.	• inadequate assessment of the facts established by general administration bodies, low quality of environmental procedures and lack of substantive correctness of decisions issued; • prolongation of investment processes by several months, and even years through repeated dismissal in appeal proceedings and transfer to reconsideration of the same erroneous decisions in environmental cases and through subsequent verifications in administrative court proceedings; • the lack of a uniform interpretation of the conditions for the adoption of the same type of decision by different authorities; • the need for both public administration bodies and entrepreneurs who are direct addressees of environmental legal norms to operate in conditions of high uncertainty as to the correctness of applied environmental protection law provisions; • occurrence of numerous risks for an investor planning to implement projects (including even the final blocking of project implementation, generating additional, unnecessary costs, because they do not serve environmental protection, withdrawal of EU funds or stimulation of social conflicts); uncertainty among entities planning to implement the project; • inhibition of investment initiatives, lack of economic development of the state; • inability to effectively prevent environmental problems that may arise due to the activities of entities that are harmful to the environment; • conflicts of competence of various entities; competence disputes and the risk of a decision being taken in breach of the rules on competence, which is a premise for cancelling such a legal act; • lack of independence, weak institutional position of bodies (in particular the Environmental Protection Inspectorate) and a real inability to take effective action, smaller effectiveness in law enforcement, inability to fully exploit the potential of expertise; • low effectiveness of the control function; • lack of financial resources for the implementation of environmental protection tasks; • low organizational, financial and substantive effectiveness of public tasks in the field of environmental protection; • incorrect transposition of EU legal standards by administration bodies; referrals to the EU Court of Justice.

Source: prep. by the author on the basis of: Analysis of the effectiveness of functioning of environmental protection services, in particular in the area of law enforcement, together with recommendations for systemic changes (2013)7.

[7] The work was prepared for the Minister of the Environment as part of a project financed from the funds of the Fifth Indicative Environmental Programme of the PHARE Partnership Fund, managed by the National Fund for Environmental Protection and Water Management. The study was developed by a team of authors composed of both the employees of the National School of Public Administration and external advisors. In particular, a team of consultants from Maciej Rudnicki & Partners Law Firm under the leadership of Prof. dr hab. Maciej Rudnicki participated in the preparation of the legal part. The study was also based on materials prepared by a team of experts from ATMOTERM S.A.

Table No. 12.1 lists strengths, weaknesses, opportunities and threats to the current legal and organizational system, with particular emphasis on the causes of inefficiency in the area of environmental law enforcement.

Environmental protection financing system

Multi-level system

The system of financing tasks from the area of environmental protection consists of institutions, economic instruments and regulations defining the rules of gathering and using financial resources in order to improve the quality of the natural environment or to preserve it in a non-deteriorated condition. The sources of financing are both public and private entities.

The largest separate public institution established to finance environmental protection in Poland is the National Fund for Environmental Protection and Water Management (NFOŚiGW), while at the regional level there are voivodship funds for environmental protection and water management (WFOŚiGW). These entities have legal personality and the possibility to decide independently on the directions of intervention within the limits of the applicable law, in particular the Act of 27 April 2001 on Environmental law. The activities of the National Fund for Environmental Protection and Water Management are supervised by the Minister of the Environment. An important entity financing environmental protection is the State Forest Enterprise (Państwowe Gospodarstwo Leśne Lasy Państwowe).

Environmental protection is a horizontal issue; therefore, its financing is also carried out with the participation of entities whose objectives include, e.g. economic development, support for rural areas, infrastructure development and science. Due to the size and number of projects implemented, the most important entities include the National Centre for Research and Development (research funding), the Polish Agency for Enterprise Development (business support) or the Agency for Restructuring and Modernisation of Agriculture (environmental support of agricultural producers and rural development). Measures related to projects taking account of environmental aspects are also implemented by entities responsible for the construction or modernization of road infrastructure (e.g. The General Directorate for National Roads and Motorways (GDDKiA)), railway infrastructure (e.g. PKP Polskie Linie Kolejowe) or power lines.

At the regional and local level, local government units are an important element of the system. The Marshal of the Voivodship, starosta, mayor, president of the city is obliged, among others, to provide access to basic infrastructure the proper functioning of which affects the state of the environment (e.g. sewerage systems). Voivodship governments are also responsible for the implementation of regional operational programs and the implementation of the voivodship contract.

Regardless of this, the key element of the system of financing environmental protection in Poland are households and enterprises.

It is estimated that there are over 14 million households in Poland. According to GUS (Statistics Poland) and EUROSTAT data, Polish households are much less affluent than households in Western Europe, they have a lower disposable income per capita. Such a state of affairs results in a specific structure of expenditures, dominated by the purchase

of basic goods and services related to food, use of flats, energy carriers or purchases of clothing. Issues related to the adaptation of Polish law to EU requirements are of particular importance for the costs incurred by households for the use of their homes and for the purchase of energy carriers. Meanwhile, these entities cover almost half of all environmental protection expenditures in Poland[8]. Therefore, the introduction of additional environmental requirements should always take account of the impact of regulation on the burden on household budgets.

The group incurring significant costs for environmental protection in Poland is the business sector. According to the REGON register[9], the number of registered entities exceeds 4 million (most of them are registered natural persons conducting private businesses). The vast majority of enterprises (almost 99%) are micro and small companies, which finance their activity from their own resources. The consequence of the structure of the Polish economy with a significant share of agriculture and industry is a high share of costs incurred by enterprises for the purchase of energy and raw materials used in the process of production or provision of services. On the other hand, the price of raw materials and energy depends to a large extent on the legal conditions concerning their acquisition, the possibility of using them using specific technologies and the current waste management method. Therefore, the introduction of changes tightening the norms and requirements concerning the use of the environment directly affects the size and direction of investments and current outlays of enterprises operating in Poland. Independent of the above, the financial cost of business for environmental protection is the recording and transmission of statistical data, including those related to the environment. According to research (also conducted by public administration), there are several thousand information obligations in Poland, which are recorded in several hundred legal acts. In the case of small enterprises, expenditure related to the management of the information needed to communicate to all relevant institutions can be a heavy burden on economic activity[10].

An important role in financing environmental protection is played by the banking sector, including Bank Gospodarstwa Krajowego and Bank Ochrony Środowiska S.A (BOŚ Bank). These banks participate, among others, in the efficient disbursement of assistance funds and the provision of preferential financial products to facilitate environmental investments.

The existing construction of the system of financing environmental protection leads to many challenges related, among others, to:

- limited possibility to coordinate a system managed by multiple independent entities,
- presence of not always justified differences in granting assistance for the same environmental projects in different parts of the country or depending on the entities carrying out assistance activities,
- implementation of large integrated projects, for which the financial engineering requires use of various sources,
- difficulties in recording and classifying the environmental effects achieved, which are developed within the framework of activities supported from various sources,

[8] GUS (Statistics Poland), *Environmental Protection 2018,* Warszawa, 2018. Data on outlays for fixed assets serving the purpose of environmental protection shall be presented in accordance with the Regulation of the Council of Ministers of 2 March 1999 on the Polish Statistical Classification of Environmental Activities and Equipment (OJ L, item 218).

[9] National Official Register of National Economy Entities, data from 2015

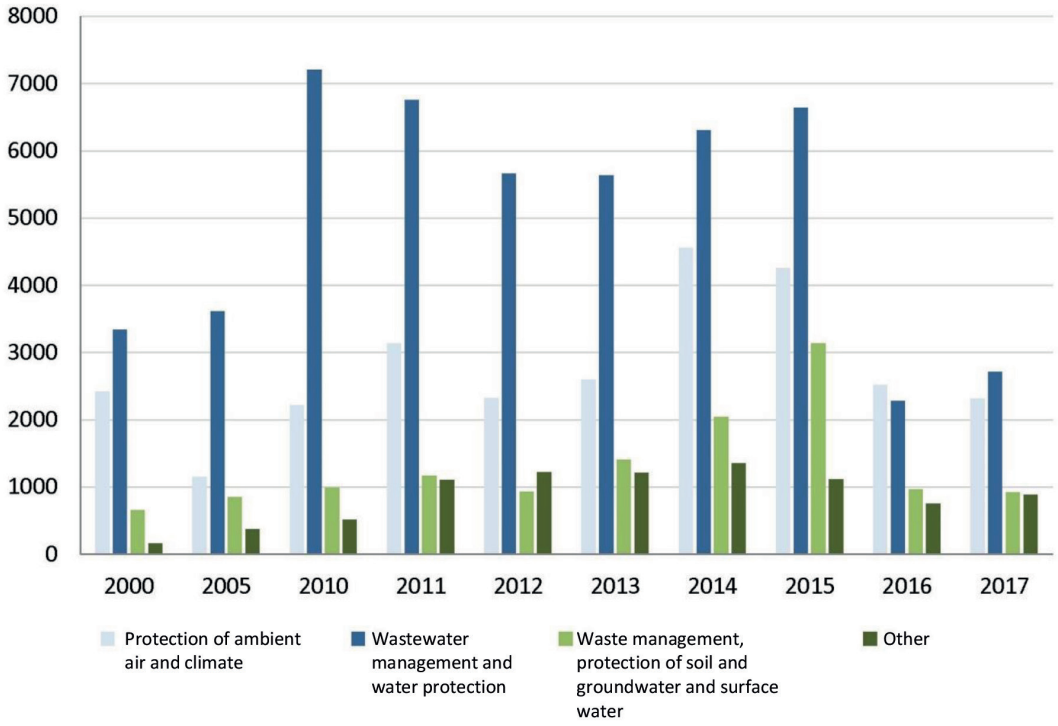
[10] *Small and medium-sized enterprises and entrepreneurship policy in Poland*, OECD Review; Ministry of Development, *Entrepreneurship in Poland,* Warszawa, 2016.

- the emergence, on the one hand, of a phenomenon of competition between different measures in selected areas and, on the other hand, the risk of shortages for financing certain categories of projects,
- limited capacity of the system to quickly reorient the directions of assistance in the event of an emergency.

System financed from multiple sources

The consequence of the deconcentration and decentralization of the system is a variety of the sources of funding. According to GUS data, total expenditures on environmental protection (expenditures on fixed assets and net current costs) amounted, in 2017, to about 1.5% of GDP, which corresponds to expenditures of about PLN 29 billion. About 66% of these costs were borne by households [11].

Fig. 12.1. Expenditures on fixed assets for environmental protection (million PLN).



Source: own elaboration based on data from: GUS (the Polish Central Statistical Office), Environmental protection 2018, Warszawa 2018, p. 183.

GUS data indicate that in the years 2000-2015 there was an increase in expenditures on fixed assets serving the protection of the environment. The decrease in investment, which took place in 2016, resulted from the completion , in 2015, of many large, expensive investments, financed from the ending EU perspective for 2007-2013 and from the fact that in 2016 the funds under the new financial perspective 2014-2020 were not fully invested yet[12]. in 2017, the volume of these outlays amounted to approximately PLN 6.8 billion and was lower by almost a half as compared to 2015 (when these outlays amounted to PLN 15.2 billion).

[11] GUS (Statistics Poland), Environmental protection 2018, Warszawa, 2018, p. 179.
[12] Ibidem p. 181.

The structure of financing of fixed assets serving environmental protection was dominated by own funds of municipalities and enterprises, which constituted 64% of all sources of financing. Another important source of financing were foreign funds (12%), environmental funds – loans, credits and subsidies (10%). The remaining outlays were financed with domestic loans and borrowings and other funds, including non-financial outlays and central budget funds. It should be remembered that about 70% of investment outlays were incurred by enterprises, 24% by municipalities, while budget units financed about 6% of all outlays[13].

In the case of public funds, the specificity of the Polish system of financing environmental protection consists in the directional, strictly defined spending of funds from fees and penalties related to the use of the environment. In this way, the "polluter pays" principle is implemented in Poland, and the funds obtained as a result are transferred to investments reducing environmental pollution. According to the Act of 27 April 2001 on Environmental Protection Law the financial and legal means of environmental protection include in particular: fee for using the environment; administrative fine; differentiated rates of taxes and other public levies serving the purposes of environmental protection. Revenues from fees for using the environment and fines for exceeding or breaching the conditions of using the environment are revenue of the National Fund for Environmental Protection and Water Management (NFOŚiGW), WFOŚiGW and revenue of the budgets of counties and municipalities. Additionally, tasks related to environmental protection are also co-financed from the state budget funds (e.g. tasks related to water management).

In this context, it should be noted that, as a consequence of the positive developments taking place in the Polish economy and the reduction in its negative impact on the environment, it is possible that the impact of environmental protection funds from penalties and environmental charges will be limited. In the situation of the existing uncertainty concerning the scope and amount of financing of environmental protection from foreign funds after 2020 – it seems important to take this possibility into account when programming the environmental protection financing policy in Poland. In doing so, it seems necessary to take account of the fact that the "polluter pays" principle cannot always lead to security of access for the society to critical ecosystem services (very often of the nature of public goods - e.g. ensuring adequate air quality in urban areas). This situation means that there is still a need for the state support for investment, including non-repayable forms of assistance.

The National Fund for Environmental Protection and Water Management finances or co-finances environmentally friendly undertakings from its own resources and the European funds at its disposal (or operated by them)[14]. In the years 2007-2016, from the so-called "ecological income", the National Fund for Environmental Protection and Water Management was provided with PLN 16.2 billion, while it spent (own funds) approximately PLN 22.9 billion in total. The National Fund for Environmental Protection and Water Management co-finances environmental protection and water management, using non-repayable and repayable forms of financial support.

The funds managed by 16 WFOŚiGW are an important source of financing for environmental protection. In the period 2007-2016, they spent approximately PLN

[13] GUS signal information, Outlays on fixed assets for environmental protection and water management in Poland in 2017., Warszawa, 2018, p. 1.

[14] **EU funds (OPI&E 2007-2013, OPI&E 2014-2020, Life), EEA Financial Mechanism and Norwegian Financial Mechanism.**

21.4 billion on environmental protection and water management. In the period 2007-2016, the statutory revenues of WFOŚiGW with regard to fees for economic use of the environment and penalties for non-compliance with pollution emission standards totalled PLN 6.5 billion.

The use of repayable forms of financing, in particular loans, by the National Fund for Environmental Protection and Water Management and WFOŚiGW, ensures partial revolving of the financial resources of these Funds, and is therefore one of the mechanisms to ensure continuity in the performance of their tasks and access by stakeholders to non-commercial and preferential sources of financing for environmental protection projects.

Foreign funds play a noticeable role in financing environmental protection (especially in the investment part). Under the Infrastructure and Environment Operational Programme (2014-2020), an amount (from the Cohesion Fund) of over EUR 3.5 billion was allocated for projects related to adaptation to climate change, waste management, water and sewage management, nature protection and environmental education and urban environment. Under the previous financial perspective (2007-2013), this amounted to approximately €4.8 billion. The most important measures financed under OP I&E 2007-2013 included: water and sewage management, waste management and land surface protection, resource management, protection against threats, nature protection and environmental education as well as support for enterprises.

Significant amounts of assistance are managed by bodies independent of the minister for the environment.

The Minister of Agriculture and Rural Development manages the Rural Development Programme (RDP) for 2007-2013 and 2014-2020. These programs are financed by the European Agricultural Fund for Rural Development (EAFRD) and the state budget. Under RDP (both in the years 2007-2013 and 2014-2020), co-financing is provided for measures aimed at improving the condition of the environment, e.g. by means of sustainable use of agricultural land, encouraging farmers to use environmentally friendly agricultural production methods and compensating farmers for costs incurred due to the location of their farm in a NATURA 2000 network area (e.g. in the framework of agri-environmental payments). In addition, farmers may apply for financial support for the afforestation of agricultural and non-agricultural land, measures to protect forests against fires and natural disasters.

In RDP 2007-2013, the amount (part of co-financing from the EAFRD) of EUR 4 238 958 902 was allocated to axis 2 (including measures implementing environmental objectives), which accounts for approximately 31.6% of the total budget.

In RDP 2014-2020 for priority P4 (restoring, preserving and enhancing ecosystems linked to agriculture and forestry) and priority P5 (supporting resource efficiency and the transition to a low-carbon and climate-resilient economy in the agricultural, food and forestry sectors), EUR 2,875,137,420 was allocated (part of EAFRD co-financing), which accounts for approximately 33.1% of the total budget.

Pro-environmental measures are also financed from the European Regional Development Fund under 16 Regional Operational Programs. A key role in management and implementation of ROPs is played by voivodship boards, which, as Managing Authorities of the programs (MA), are responsible for the preparation and implementation of ROPs. In the 2007-2013 perspective, for environmental protection and hazard prevention, an allocation of almost EUR 1.8 billion was earmarked. These

funds were used for projects related, among others, to water and sewage management, management of municipal and industrial waste, promotion of biodiversity, nature protection, revalorization of industrial areas and reclamation of contaminated land, air protection and pollution control. In the 2014-2020 perspective, EUR 2.6 billion has been earmarked for investments in: improving flood safety and drought prevention, securing urban areas, developing early warning and threat forecasting systems, the waste management sector, construction and modernization of the sewage system and sewage treatment plants, protection of biodiversity. The ROPs also finance projects related to the so called low-carbon economy (the EU contribution exceeds €4.5 billion).

However, the minister in charge of energy supervises the financing of projects implemented under priority axis I of the Operational Programme Infrastructure and Environment 2014-2020. The EU contribution to activities related to the low-carbon economy under the first axis of the OPI&E 2014-2020 exceeds EUR 1.8 billion.

Upon accession to the EU, Poland also became a beneficiary of funds under the Norwegian Financial Mechanism (NMF) and the Financial Mechanism of the European Economic Area (FM EEA). From the funds allocated for the years 2004-2009 for the implementation of environmentally friendly investments, support amounting to approximately EUR 112 million was obtained, while for the years 2009-2014 another EUR 180 million was obtained. Under the new financial perspective (2014-2021), the total amount earmarked for Poland is over EUR 800 million.

Since 2008 Poland have also benefited from the LIFE Programme, which is the only financial instrument of the European Union focusing exclusively on co-financing projects in the field of environmental and climate protection. In the 2007-2013 perspective, under LIFE+ the allocation for Poland amounted to approximately EUR 88.3 million. In the financial perspective 2014-2020, the method of distribution of funds was changed: national allocations were determined only for the years 2014-2017 and only for the Sub-Programme for the Environment. The allocation earmarked for Poland amounts to EUR 51 million.

Poland is also a beneficiary of the Swiss-Polish Cooperation Program. In 2007-2017, financing covered activities related to the management of hazardous waste (asbestos), increasing energy efficiency and protecting biodiversity. The amount of co-financing exceeded 160 million Swiss francs.

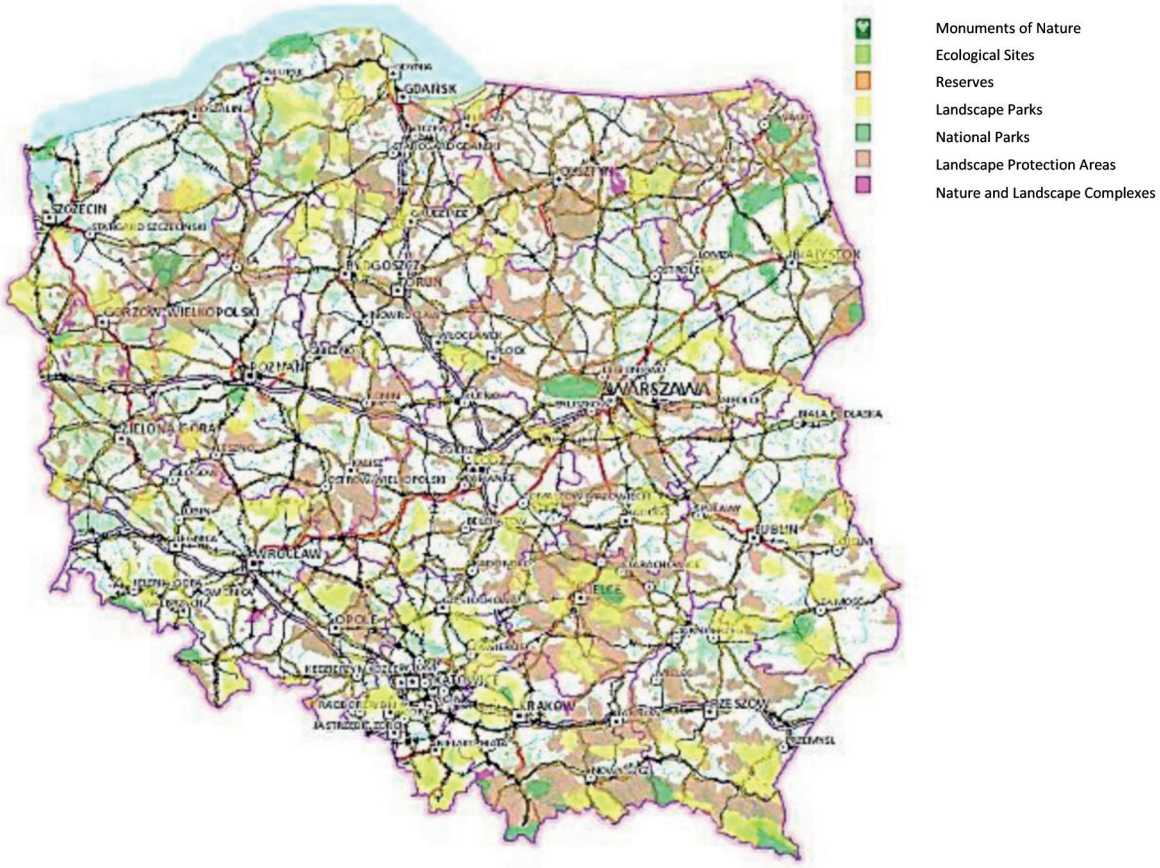
Bank Ochrony Środowiska S.A. (BOŚ Bank) also plays an important role in the system of financing environmental protection in Poland, providing, among others, specialized banking services to support environmental protection and water management activities. Bank Ochrony Środowiska S.A. has experience in financing environmentally friendly tasks and participates in co-financing of investment projects implemented within the framework of programs supplied with foreign funds. For over 20 years, it has spent PLN 11 billion on financing environmental projects.

Forms of nature conservation

The creation and functioning of forms of nature protection is an important element in the implementation of nature protection objectives in Poland. The forms of nature protection function on the basis of scientific foundations and many years of national nature protection practice. Each of the forms fulfils a different role in the Polish system of nature protection and serves different purposes, therefore it is characterized by a different protective regime and the scope of restrictions in use. In the Act of 16 April 2004 on nature protection, the following forms of nature protection are distinguished: national parks, nature reserves, landscape parks, protected landscape areas, Natura 2000 areas, natural monuments, documentation stands, ecological sites, natural and landscape complexes, species protection of plants, animals and mushrooms.

There is a Central Register of Forms of Nature Protection in Poland, which is operated by the General Director for Environmental Protection (pursuant to Article 113(1) of the Act of 16 April 2004 on nature conservation). The register constitutes the basis for forms of nature protection and is updated on a regular basis. In order to preserve the natural heritage of Poland, until the end of September 2017, according to GDOŚ data, 11,330,100 ha of the area of Poland were covered by national forms of area nature protection. From November 2008 to September 2017 regional directors for environmental protection created 79 reserves in total.

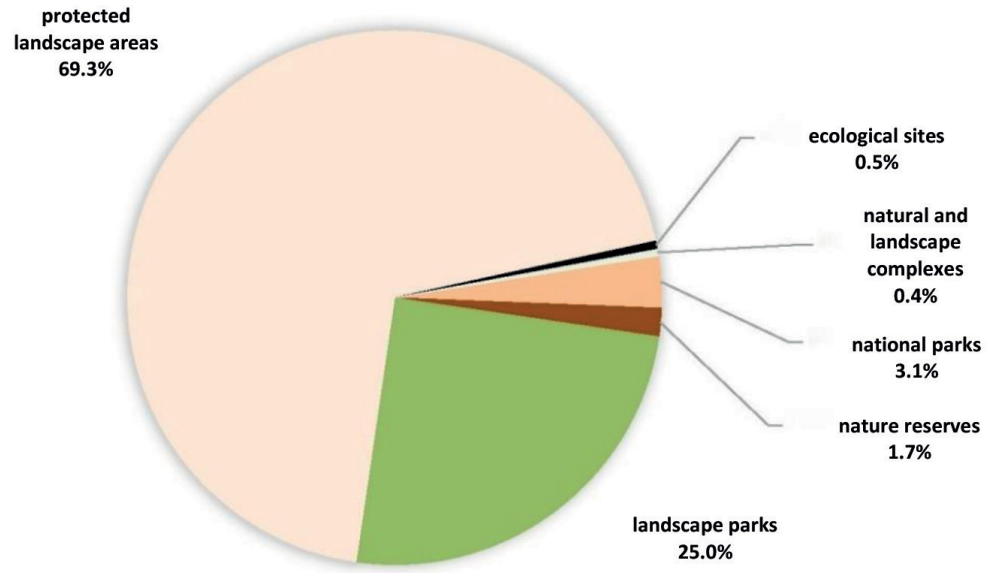
Fig. 12.2. Protected areas in Poland.



Source: http://geoserwis.gdos.gov.pl/ (accessed 31.01.2019).

Area-based forms of nature protection with low protection regimes dominate in Poland (e.g. areas of protected landscape, landscape parks). National parks and nature reserves occupy only 5% of the area of all objects and areas of special natural value in our country. There are 23 national parks in Poland. The oldest of them is the Białowieża National Park, established in 1932 (then called "National Park in Białowieża" – the current name was given in 1947), and the youngest one – "Warta Mouth" National Park (2001)[15]. In terms of the area, the largest one is the Biebrza National Park (nearly 60,000 ha), and the smallest one – Ojcowski National Park with an area of less than 2.2 thousand ha.

Fig. 12.3. Objects and areas of special natural values legally protected in 2016



Source: own elaboration based on data from: GUS (the Polish Central Statistical Office), Environmental protection 2017, p. 265.

The highest form of nature protection in Poland is national park, which covers an area distinguished by its special natural, scientific, social, cultural and educational values, with an area not smaller than 1000 ha, where the entire nature and landscape values are protected. A national park is created in order to preserve biodiversity, resources, creations and components of inanimate nature and landscape values, to restore the proper state of resources and components of nature. The aim of the park is also to restore distorted natural habitats, plant, animal or mushroom habitats.

The area of national parks in Poland is small. Compared to other countries, we occupy 26th place in Europe. They account for only 1.1% of the country's surface area, compared to an average of 3.4% in Europe.

Species and natural habitat types that are valuable and located within the territory of the European Union (i.e. listed in the Annexes to the Habitats and Birds Directives) have been included for conservation purposes in the Natura 2000 network. This

[15] Świętokrzyski National Park, 24 May - European Day of National Parks, https://www.swietokrzyskipn.org.pl/ (accessed on 04.02.2019).

network is being established in accordance with the requirements of both the above-mentioned directives and consists of the so-called Bird Special Protection Areas (SPAs) and Sites of Community Importance (SCIs)/Special Protection Areas (SPAs). After the relevant regulations of the Minister of the Environment have been issued, the SCIs will eventually become the so-called special areas of habitat protection. As at the end of September 2017, 83 areas have been granted the SPA status.

Presently[16], the Natura 2000 network in Poland consists of 987 areas, including 145 "bird" areas with a total area of 55,599 km^2 (17.3% of the country's total area) (of which 7209km2 lies at sea), and 849 "habitat" areas covering 38 510 km2 (11.8% of the country's total area) (of which 4346 km2 lies at sea[17])[18]. Seven areas with a total surface area of 3490 km2 has "common" status, i.e. created for the protection of birds as well as species and natural habitats. The network of Natura 2000 areas includes a large part of legally protected areas, including all national parks and some landscape parks.

Irrespective of the coexistence of Natura 2000 areas and other forms of nature protection established on the basis of national legislation, it should be noted that the system of protected areas in Poland is coherent and complementary. It is worth noting that the national forms of nature protection have different protection objectives and a separate protection regime than Natura 2000 areas, and other entities may be responsible for protection activities, supervision and their proper functioning. At the central level (national parks, nature reserves and Natura 2000 areas), statutory provisions prescribe the merging of management functions of these areas. For example, as a rule, the Regional Director for Environmental Protection, who also supervises nature reserves, is the supervisor of the Natura 2000 area located in a given voivodship. However, in accordance with Art. 32(5) of UOP (Nature Protection Act), if the Natura 2000 area includes, in whole or in part, a national park area, the director of the national park is responsible for supervising the Natura 2000 area within the boundaries of the national park. Coexistence of different forms of nature protection in a given area makes it necessary to develop appropriate (sometimes compromise-based) synergic measures aimed at achieving the protection objectives, which in general terms gives beneficial effects for nature and landscape.

[16] According to GDOŚ, as of 6 October 2017.
[17] Includes internal sea waters, territorial sea and the exclusive economic zone, which is not on the territory of the Republic of Poland.
[18] GDOŚ, Natura 2000 Statistics.

Fig. 12.4. Natura 2000 areas in Poland.

Source: http://geoserwis.gdos.gov.pl/ (accessed on 01.02.2019).

An example of such a synergic approach is the provision of Art. 20 par. 5 of the u.o.p, according to which the protection plans for a national park, nature reserve or landscape park in the part corresponding to the Natura 2000 area should take account of the scope of the plan of protection tasks for the Natura 2000 area, or the scope of the protection plan for the Natura 2000 area. According to the legislator, at the voivodship and local level, local governments may decide which objects to protect, which gives them a certain autonomy in terms of nature and landscape protection and constitutes an element of hierarchically balanced management. Not everything that is protected at the local level could and should be protected at the central level. Thanks to such a system and diversity of forms, it is possible to protect the full spectrum of diversity of natural forms and resources of the country.

The Polish areas of natural value were also granted other international and even world statuses. These are:

- Ramsar Areas – The Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, known as the Ramsar Convention, was signed in Ramsar

on 2 February 1971. To date, 168 states have ratified it and have designated 2186 wetlands of international importance. The aim of the Ramsar Convention is the protection and sustainable use of all wetlands through national and local action and international cooperation. These activities contribute to the achievement of sustainable development worldwide.

In Poland there are 13 protected nature areas (in total over 145 thousand ha), including the areas of 7 national parks and 6 nature reserves included in the list of the Ramsar convention. Poland has been a Party to the Convention since 22 March 1978.

- UNESCO-MaB biosphere reserves (Man and Biosphere) – International Program "Man and Biosphere" was initiated by UNESCO in 1971. The aim of the Program is to create balanced relations between humans and the biosphere, and the method of achieving this goal is to create an international Network of Biosphere Reserves. It currently comprises 669 such sites in 120 countries. 16 of them are cross-border reserves. The reserves aim to protect biodiversity and improve the ability to observe ecological changes across the planet. They also serve to stimulate public awareness of the links between ecological and cultural diversity.

  On the UNESCO World Biosphere Reserve List there are 10 Polish sites with a total area of 717 532 ha. These include, inter alia, 7 national parks and other protected areas, 3 of which have cross-border status (the "Eastern Carpathians" Biosphere Reserve, the "Karkonosze" Biosphere Reserve and the "Tatra Biosphere Reserve").
- HELCOM marine protected areas[19] – The basic document of the Helsinki Convention, determining the directions of work of its parties, is the Baltic Sea Action Plan (BSAP) signed by the representatives of the governments of the Baltic Sea countries in 2007 in Krakow. It consists of 4 basic segments, one of which is "Biodiversity and nature conservation". It states, inter alia, that the parties to the Convention commit themselves to designate a coherent network of Baltic Sea Protected Areas (BSPAs) by the end of 2009.

  Until then, 4 BSPA areas had been designated in Poland, covering two national parks (Wolin National Park and Słowiński National Park) and two landscape parks: Nadmorski and PK Mierzeja Wiślana (Vistula Spit). As from 31 December 2009 the Minister of the Environment nominated the remaining marine Natura 2000 sites as BSPA sites. Currently nine Natura 2000 sites with a total area of 7939 km^2, covering the largest areas of marine waters, have the status of HELCOM Marine Protected Areas (HELCOM MPAs)[20].

A number of other activities were also implemented. Until 1 September 2017 the planning documents were established (i.e. plans of protection tasks (PZO), plans of protection of nature reserves containing the range of PZO and protection plans for national parks containing the range of PZO) for 525 Natura 2000 areas, which constitutes 53.2% of all areas. This includes the plans of protection tasks for 504 areas (51.1% of all areas). Planning documents have been established for 94 Special Protection Areas, 429 SCIs/Habitats Special Areas and 2 areas which are both "Birds" and "Habitats" areas. Draft protection plans for 7 national parks have also been developed. Until 2017 the

[19] HELCOM i.e. Commission for the protection of the marine environment of the Baltic Sea HELCOM, which is the executive body of the Helsinki Convention.

[20] Ecological coherence assessment of the Marine Protected Area network in the Baltic Sea, Baltic Sea Environment Proceedings No. 148, HELCOM, Baltic Marine Environment Protection Commission, Helsinki Commission, 2016, p. 9.

General Director for Environmental Protection also approved 5 protection programs for: doublet, lesser spotted eagle, greater spotted eagle, Montagu's harrier and harbour porpoise.

In 2013 the Minister of the Environment developed and approved the Priority Action Framework for the Natura 2000 Network for the Multiannual EU Financing Program 2014-2020 (PAF). It contains an analysis of the most urgent financial needs in the context of the conservation status of species and natural habitat types and a list of the most important actions necessary for the protection of these natural values.

Environmental impact assessment system

Environmental impact assessment is, in Poland and worldwide, one of the basic tools for environmental protection and sustainable development, applied individually, i.e. in relation to specific plans, programs and projects.

As the name suggests, these assessments are used to determine the impact of the planned intervention on the environment. However, this is not the end of their role, as this concept covers much more important - although feasible after a thorough impact assessment - aspects: preventing, minimizing and compensating for adverse environmental impacts that are or would result from the intervention.

The national system of environmental impact assessments includes:

1) strategic environmental impact assessments;
2) proceedings concerning projects that may have a significant impact on the environment, including the assessment of the impact of projects on the environment;
3) proceedings concerning projects that may significantly affect the Natura 2000 area (other than those that may significantly affect the environment), including the assessment of the impact of projects on the Natura 2000 area.

Strategic environmental impact assessments

This procedure is applied to plans and programs implementation of which may result in the occurrence of significant environmental impacts. The aim of the procedure is to identify the possibility of such impacts as early as possible - at the planning stage, before the investment stage - in order to effectively prevent or, if not possible, limit them and minimize their effects. It is also important to ensure public participation in the preparation of these documents. The strategic environmental impact assessment also examines the possibility of environmental impacts of transboundary nature and, if necessary, proceedings are conducted with the participation of affected countries.

Directive 2001/42/EC is the European Union law on strategic environmental impact assessment[21]. It has been transposed into national regulations with the act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments[22].

In accordance with the provisions of the EIA Act, strategic environmental impact assessment is conducted for documents prepared or adopted by administrative bodies or other entities performing public functions. These documents include:

[21] Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the impact of certain plans and programmes on the environment (OJ L 197, 21.7.2001, p. 30; Polish translation, Chapter 15, Volume 6, p. 157), hereinafter referred to as the "SEA Directive".

[22] Further: EIA Act.

- the concept of spatial development of the country, studies of conditions and directions of spatial development of the commune, spatial development plans and regional development strategies,
- policies, strategies, plans or programs in the fields of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, providing a framework for the subsequent implementation of projects likely to have a significant impact on the environment,
- other policies, strategies, plans and programs where their implementation is likely to have a significant impact on a Natura 2000 site, if they are not directly related with or do not result from the protection of a Natura 2000 site,
- documents other than those mentioned above, if they set the framework for the later implementation of projects likely to have a significant impact on the environment or if the implementation of their provisions may cause a significant impact on the environment.

A strategic environmental assessment must also be carried out in the event of amendments to already adopted documents.

The main stages of the procedure are: obtaining agreements and opinions required by law, developing an environmental impact assessment, conducting proceedings with the participation of the public and preparing a written summary, in which there is a justification for the choice of the adopted document with reference to the alternatives under consideration. It shall also contain information on how the following have been taken into account and to what extent they have been taken into account: findings of the environmental impact forecast; opinions of the competent bodies; comments and conclusions of the public; results of the investigation concerning cross-border environmental impact, if any, and proposals concerning the methods and frequency of monitoring the effects of the implementation of the provisions of the document. The body responsible for carrying out the strategic environmental impact assessment is the body preparing the draft document. The General Director for Environmental Protection is the body competent for issuing opinions on documents and agreeing the scope of the environmental impact assessment in the case of draft documents prepared and amended by the national or central government administration bodies and in the case when the planned implementation of a given document covers the area of more than two voivodships. The Regional Director for Environmental Protection is a competent body for issuing opinions on documents and agreeing the scope of the environmental impact assessment in the case of draft documents prepared at the regional level (maximum 2 voivodships) and lower levels. The Sanitary Inspection Authority, i.e., depending on the type of the draft document - the Chief Sanitary Inspector, the State Voivodship Sanitary Inspector or the State District Sanitary Inspector - is the authority competent for issuing opinions on documents and agreeing the scope of the forecast of environmental impact within the scope of the impact of the draft document's findings on human safety and health. The Director of the Maritime Office is the competent authority for issuing opinions on documents and agreeing the scope of the environmental impact assessment in the case of draft documents, the findings of which may have an impact on marine areas.

On average, several hundred strategic environmental impact assessment proceedings are carried out each year in each of the voivodships. Most of these proceedings are concerned with drafts and draft amendments to planning documents

in the field of spatial management, prepared at the municipality level - studies of conditions and directions of spatial development and local spatial development plans. In addition, several dozen proceedings are conducted annually for documents prepared at the central level and/or covering the area of three or more voivodships, for which the General Director for Environmental Protection plays the role of an opinion-forming and agreeing body. Recently, a large part of these studies have been documents and amendments to documents created in connection with the programming of the EU financial perspective for 2014-2020 (e.g. Operational Program Infrastructure and Environment 2014-2020, Operational Program Eastern Poland 2014-2020, Operational Program Fisheries and Sea 2014-2020, Rural Development Program 2014-2020) and documents related to water management (e.g.: updates of water management plans, plans of counteracting the effects of drought).

Proceedings concerning projects likely to have a significant impact on the environment

Environmental impact assessment, as a tool for environmental protection, is usually identified with projects that may have a significant impact on the environment. The basis for assessment proceedings in the EU legislation is Directive 2011/92/EU of the European Parliament and of the Council[23], whereas in Poland this area is regulated by the aforementioned EIA Act. There are two categories of the mentioned projects, which, according to the Polish nomenclature, are projects:

– which may always have a significant impact on the environment,
– likely to have a significant potential impact on the environment.

The former of them, listed in Annex I of the EIA Directive (EU law) and §2 of the Regulation of the Council of Ministers of 9 November 2010 concerning projects that may significantly affect the environment (OJ of 2016, item 71) (national transposition), each time require an environmental impact assessment. This assessment covers in particular:

– verification of the report on the environmental impact of the project,
– obtaining opinions and agreements required by the act,
– ensuring the possibility of public participation in the proceedings.

With regard to projects in the second category, listed in Annex II to the EIA Directive and in §3 of the above-mentioned Regulation of the Council of Ministers, the need to assess the impact of the project on the environment is analysed individually for the projects with a defined scope and location. As a result of the impact analysis of these projects it is possible, among others on the basis of the project information sheet, for the authority to state that the project which may potentially have a significant impact on the environment:

– requires an environmental impact assessment of the project (in such a case the procedure is analogous to projects that may always have a significant impact on the environment),
– does not require an assessment of the environmental impact of the project, and in the course of the procedure the conditions for the execution of the project were determined,
– does not require an environmental impact assessment or the determination of the

[23] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, hereinafter referred to as the "EIA directive".

conditions for the execution of the project.

These proceedings are conducted within the framework of administrative procedures, regulated by the Code of Administrative Procedure, aimed at issuing a decision on environmental conditions (this decision is issued only for projects that may have a significant impact on the environment, regardless of the need to carry out an environmental impact assessment of the project).

In the case of both groups of projects, when the environmental impact assessment was carried out, it is possible to apply the reassessment of the environmental impact. This procedure usually takes place within the framework of a procedure aiming at the issuance of the building permit and is not related to the need to obtain another decision on environmental conditions and is of corrective nature.

Regardless of the adopted procedure, activities related to the assessment of the environmental impact of the project are aimed at determining individual methods of effective environmental protection, even before the commencement of the project. They are of preventive nature and are a basic tool for sustainable development.

The bodies competent to issue decisions on environmental conditions are mainly Regional Directorate for Environmental Protection (RDOŚ), village heads, town mayors and city mayors. The important thing is that RDOŚ also participates in the proceedings conducted by authorities other than RDOŚ, expressing their opinion on the need to assess the environmental impact of the project and determine the conditions for the execution of the project.

Every year in Poland there are several thousand proceedings concerning the issuance of a decision on environmental conditions.

The following aspects are taken into account in the strategic environmental impact assessments and proceedings concerning projects that may have a significant impact on the environment:

- regulated by Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora,
- regulated by Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds,
- regulated by 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,
- related to climate change mitigation and adaptation.

It should be emphasized that in the case of assessments of draft documents and planned projects it is possible that impacts beyond the borders of Poland may occur. In such cases, a transboundary environmental impact assessment is carried out. The national legal basis for this procedure is defined in the EIA Act, and the international legal instrument, devoted to environmental impact assessment in a transboundary context for planned projects that may have a significant negative impact on the territory of another country, is the Espoo Convention (the Convention on Environmental Impact Assessment in a Transboundary Context drawn up in Espoo on 25 February 1991). As an attachment, the so-called Strategic Protocol (Protocol on Strategic Environmental Impact Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context, drawn up in Kiev on 21 May 2003) has been signed, which applies in relation to draft strategic documents, i.e. plans, programs or policies. Poland is a party to both these legal instruments.

The aim of cross-border proceedings is to ensure the participation of an affected country in the proceedings, including to conduct proceedings with the participation of the public in that country. Comments made during the proceedings are taken into account in the formulation of the final content of the document/decision. In recent years, Poland has repeatedly participated in the cross-border procedure both as the party of origin and as an affected party. In the event that the effects of the implementation of draft strategic documents prepared by Poland could cause transboundary impacts on the territory of other countries, Poland, as the party of origin, effectively notified the affected parties and carried out a full procedure according to Article 7 of the SEA Directive and Article 10 of the Strategic Protocol. This assessment was carried out in most cases for planning documents, such as: spatial development plans at local and regional level and studies of conditions and directions of spatial development in communes. In addition, Poland conducted a cross-border SEA procedure for the Polish Nuclear Energy Program, notifying 10 countries, and then entering into a full cross-border consultation procedure with 7 countries. On the other hand, when Poland was a party to the transboundary SEA procedure, the proceedings were conducted primarily for planning documents concerning spatial management, including mainly for the implementation of specific projects, e.g. wind farms or nuclear power plants. In addition, this procedure was conducted for draft documents in the following sectors: energy (mainly documents related to wind and nuclear energy), transport, mining, flood protection, regional development, operational programs. The General Director for Environmental Protection is an environmental authority participating in cross-border proceedings within the strategic environmental impact assessment.

Proceedings concerning projects likely to have a significant impact on Natura 2000 sites

With regard to any intervention not mentioned in the above-mentioned Regulation of the Council of Ministers, it is necessary to consider its impact on Natura 2000 areas. This is due to the fact that, pursuant to Article 6(3) of the Habitats Directive, all projects - and not only those which may have a significant impact on the environment - require an analysis of the possibility of their impact on Natura 2000 areas.

Studies in this respect, with the participation of the RDOŚ, are conducted within the framework of proceedings aimed at issuing various investment permits, including decisions on development conditions and land use conditions and building permits.

The Polish system of environmental impact assessments, compliant with the requirements of the international law, is a well-functioning and positively evaluated structure. Together with the legal institutions of applications and decisions allowing for the implementation of projects, it is an important element of sustainable development.

Integrated permits

Integrated permit is a formal and legal instrument introduced into the EU law with the so-called IPPC Directive[24] (Integrated Pollution Prevention and Control), now replaced by the IED Directive[25] (Industrial Emissions Directive).

The purpose of integrated permits is to eliminate or, where not possible, reduce the negative impact of industrial plants on the environment. This is done by issuing permits based on Best Available Techniques (BAT), which also include emission limit values that do not, under normal operating conditions, exceed the BAT-associated emission levels. BAT requirements are published in the form of Commission implementing decisions, so-called BAT conclusions. In addition to emission requirements, integrated permits regulate issues related to emission monitoring, waste management, use of energy and raw materials. Integrated permits are therefore an effective tool for improving environmental quality.

Installations which require obtaining an integrated permit, due to the scale and type of activity conducted in them, have been specified in the Regulation of the Minister of the Environment of 27 August 2014 on the types of installations which may cause significant pollution of particular natural elements or the environment as a whole (OJ L, item 1169). In Poland there are about 3500 installations requiring an integrated permit[26].

There are six categories of industrial activities for which an integrated permit is required:

- energy industry,
- production and processing of metals industry,
- mineral industry,
- chemical industry,
- waste management facilities,
- other activities (e.g. paper, textile and agri-food industries).

The integrated approach to the determination of environmental conditions in the permit consists in practice in replacing sectoral permits for the introduction of substances or energy into individual components of the environment with a single document, which allows to limit the transfer of pollution between individual components of the environment. Installations requiring an integrated permit must comply with the BAT environmental protection requirements developed at the European level under the so-called Sevilla Process involving the exchange of information between Member States, industry and NGOs on the pro-environmental techniques used in various industries.

The solutions identified in the BAT conclusions are, as a rule, proven on an industrial scale and available to the industry, but in some cases the adaptation of installations requiring an integrated permit to the requirements set out in the BAT conclusions will require the operator to implement cost-intensive technological solutions.

[24] Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (OJ L 257, 10.10.1996, p. 26, as amended; Polish translation, chapter 15, volume 3, page 80, as amended).

[25] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

[26] The knowledge base is built within the framework of the "Innovative and efficient administration" project co-financed by the EU, the leader of which is the Association of Polish Counties.

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APPENDIX

2

Summary of the implementation of the Strategy "Energy Security and Environment – perspective to 2020" (BEiŚ) in the environmental part

The Strategy "Energy Security and Environment – perspective to 2020" (BEiŚ) was adopted by the Council of Ministers on 15 April 2014 [1]. It was one of nine integrated strategies entering the system of managing the development of Poland, which was based on the Act on the principles of conducting the development policy[2]. On 14 February 2017, the Council of Ministers adopted the Responsible Development Strategy until 2020 (with an Outlook until 2030) – SOR, which replaced the medium-term National Development Strategy 2020. As a result of the adoption of the SOR, nine integrated strategies had to be updated. The Coordination Committee for Development Policy decided to replace BEiŚ with two separate strategies: 2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management (PEP2030) and the Energy Policy of Poland until 2040 (PEP2040).

The BEiŚ Strategy integrated the environmental policy with the energy policy, setting out the directions of power industry development and indicating the priorities in environmental protection. The main objective of BEiŚ was to ensure a high quality of life for present and future generations, taking into account environmental protection, and to create conditions for sustainable development of a modern energy sector capable of ensuring energy security as well as competitive and efficient economy for Poland. Two of the three specific objectives were directly related to environmental issues: objective 1 – sustainable management of environmental resources and objective 3 – improvement of the condition of the environment.

The level of implementation of BEiŚ was measured by a set of indicators assigned to specific objectives. The base year for the indicators was 2010. The analysis of the data available in 2018 indicates that the targets were met for six out of 15 indicators. The value of two indicators, despite the activities carried out within the framework of BEiŚ, deteriorated in comparison with 2010. Six indicators came close to the 2020 objective, but the dynamics of changes do not guarantee that the objective will be met. One indicator had the same value as in 2010.

BEiŚ implementation and monitoring should be evaluated as not effective if most of the indicators for achieving the objectives will be not met by 2020. Some tasks and activities within the framework of BEiŚ were formulated in a vague way or did not clearly define the entity responsible for them and for initiating inter-ministerial cooperation. Another problem was the low level of awareness of the BEiŚ Strategy as a government document, even in the departments responsible for its implementation. This resulted in a lack of prioritisation of activities. Actions taken in previous years have rarely been referred to the priorities of BEiŚ. This was also apparent in the lack of full consistency between the existing financial instruments and the types of interventions that should be undertaken on the basis of BEiŚ. The inefficiency of the system of state institutions also contributed to the unsatisfactory level of performance.

[1] Resolution no. 58 of the Council of Ministers of 15 April 2014 on the adoption of the Strategy „Energy Security and Environment – perspective to 2020" (M.P. item 469).
[2] Act of 6 December 2006 on the principles of development policy (OJ L of 2018, item 1307, as amended).

No.	Indicator	Base value in 2010	Value achieved in 2014/2015/2016	Value expected in 2020
Objective 1. Sustainable management of environmental resources				
1	Water consumption for the needs of national economy and general population in hm3 (cubic hecto-metres)	10 356,5 hm^3	9656,3 hm^3 [2017]	10 100,0 hm^3
2	Industry share in total water con-sumption (%)	74%	73% [2017]	65%
3	National forest cover level (%)	29,2%	29,6% [2017]	30%
4	FBI – Farmland Bird Index (2000 = 100%)	88%	79,98% [2017]	90%
5	Percentage of the areas covered by current spatial development plans in the total surveying area of the country	26,4%	30,5% [2017]	35%
[…]				
Objective 3. Improvement of the condition of the environment				
6	Ecological condition/potential of water bodies (Class I-V)	rivers (natural WBs) – very good and good – 16%	27,9% [2015]	increase in the percentage of WBs in good and very good condition/potential
		rivers (natural WBs) – below good – 84%	72,1% [2015]	
		rivers (artificially and strongly modified WBs) – maximum or good – 17.1%	31% [2015]	
		rivers (artificially and strongly modified WBs) – below good – 82.9%	69% [2015]	
7	Chemical condition of water bodies (good/below good)	rivers – good condition – 44%	69,4% [2015]	increase in the percentage of WBs in good condition
		rivers – condition below good – 56%	30,6% [2015]	

8	Condition of water bodies (good/ bad)	rivers – good condition – 11.2%	10,9% [2015]	increase in the percentage of WBs in good condition
		rivers – bad condition – 88.8%	89,1% [2015]	
9	Air quality condition – percentage of zones with exceeded air quality standards	91% – 42 zones with exceeded air quality standards	76% [2016]	min. 45%
10	Percentage of the population using sewage treatment plants	64,7%	73,6% [2017]	71,5%
11	Level of recycling and preparation for re-use of selected waste groups: paper, metals, plastics and glass (% by weight)	18% [2012]	28% [2016]	50%
12	Level of recycling, preparation for re-use and recovery by other means for non-hazardous construction and demolition waste (% by weight)	69%	105% [2015]	70%
13	Degree of reduction of biodegradable municipal waste transported to landfills (in relation to waste produced in 1995)	85%	12% [2016]	35%
14	Number of Polish environmental technologies verified under the ETV system (European Union Environmental Technology Verification Programme)	0	2 [2017]	20
15	Percentage of “green” public procurement tenders	9%	9% [2014]	25%

Legend:

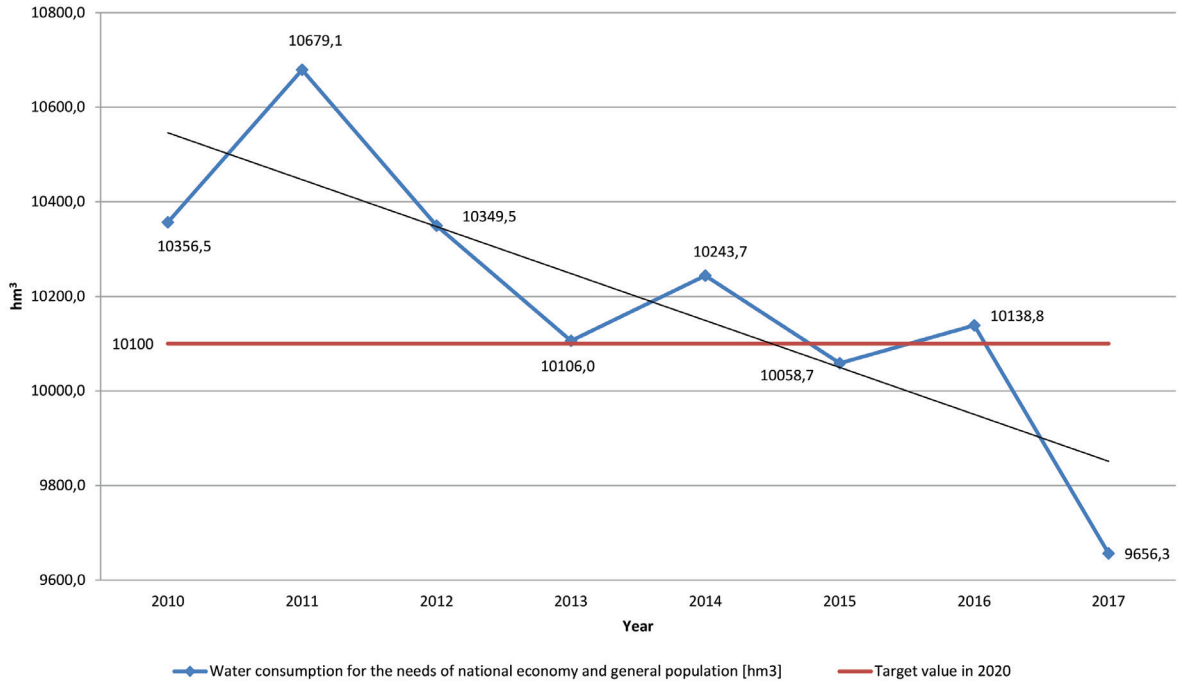
Achieved 2020 target value
Negative trend of indicator value change
Risks to the achievement of target in 2020
Positive trend of indicator value change or no change in indicator value

Water consumption

Water consumption for the needs of national economy and general population includes water consumption for the industry, agriculture, forestry, fishpond filling and replenishment, water supply networks operation and for individual households. This consumption in 2017 amounted to 9656.3 hm^3, which is below the objective for 2020 (10 100 hm^3). The trend over the years 2010-2017 was downward, despite the recorded economic development.

In implementing the BEiŚ provisions, the goal was to manage water in accordance with the "user pays" principle. The measures taken were intended to encourage users to save water. Rationalisation of water use and special protection of high-quality water resources were perceived as the most effective method of ensuring full access to good quality water for the Polish population. One of the key instruments to optimise water use is the new Water Law[3], which was adopted in 2017.

Water consumption for the needs of national economy and general population [hm^3]



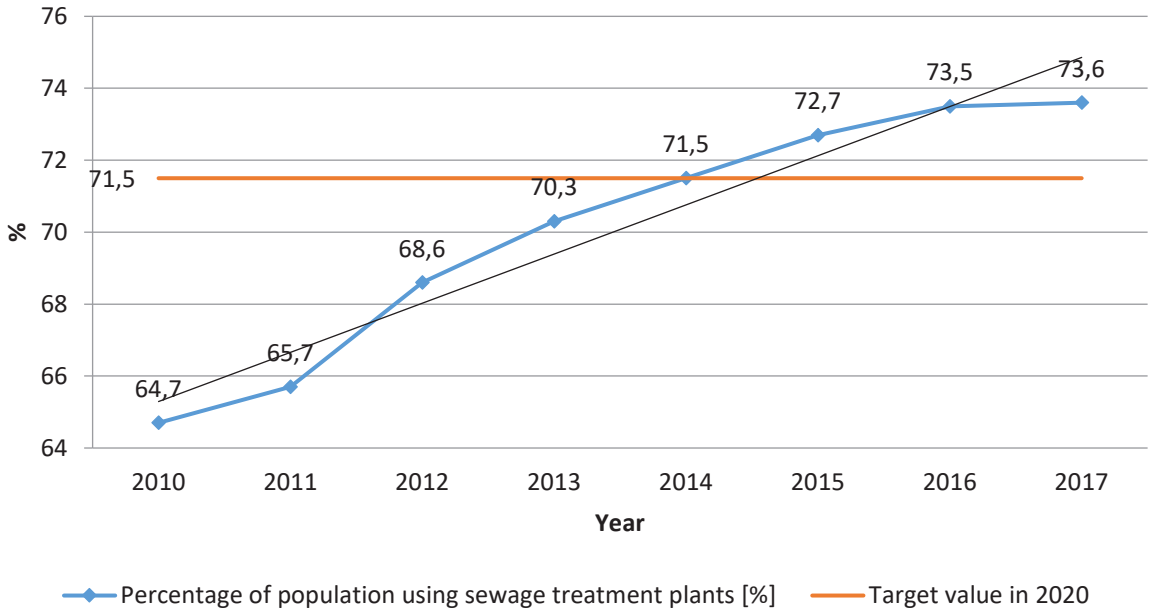
Source: Own study based on data in the STRATEG database.

Sewage treatment

BEiŚ states that the development of sewage treatment infrastructure is important for the improvement of water quality. Significant investments have been made in this area in recent years. As a result, in the years 2010-2017, the percentage of the population using sewage treatment plants increased by 8.9 percentage points, i.e. to 73.6%. The 2020 objective was reached in 2014.

[3] Act of 20 July 2017 – Water Law (OJ L of 2018, item 2268, as amended)

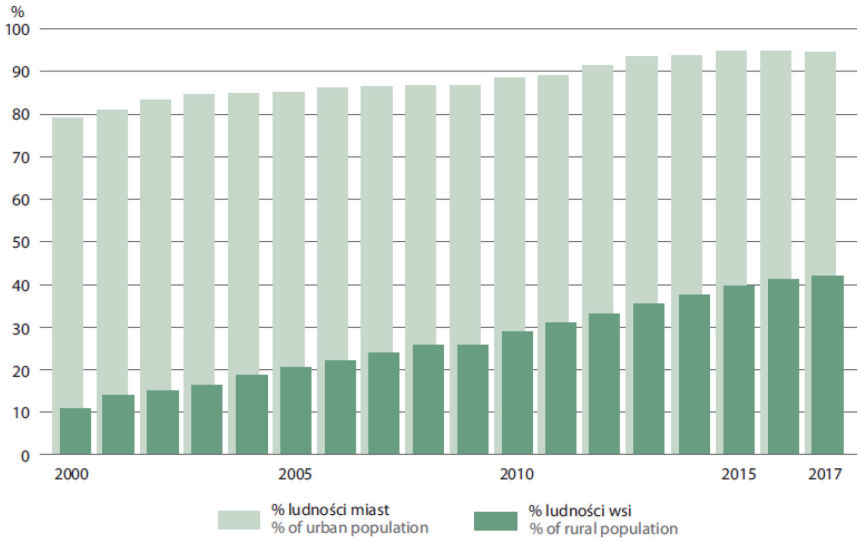
Percentage of population using sewage treatment plants [%]



Source: Own study based on data in the STRATEG database.

The length of the sewage network in Poland in 2017 amounted to 156 800 km [4]. In cities, the network was used by about 95% of the population, and in rural areas by 42%. Out of the total number of 923 cities in Poland in 2017, 2 cities were not serviced by sewage treatment plants[5]. Rural areas with low population density and developing tourism infrastructure still lack local sewage systems and sewage treatment infrastructure.

Population connected to wastewater treatment plants

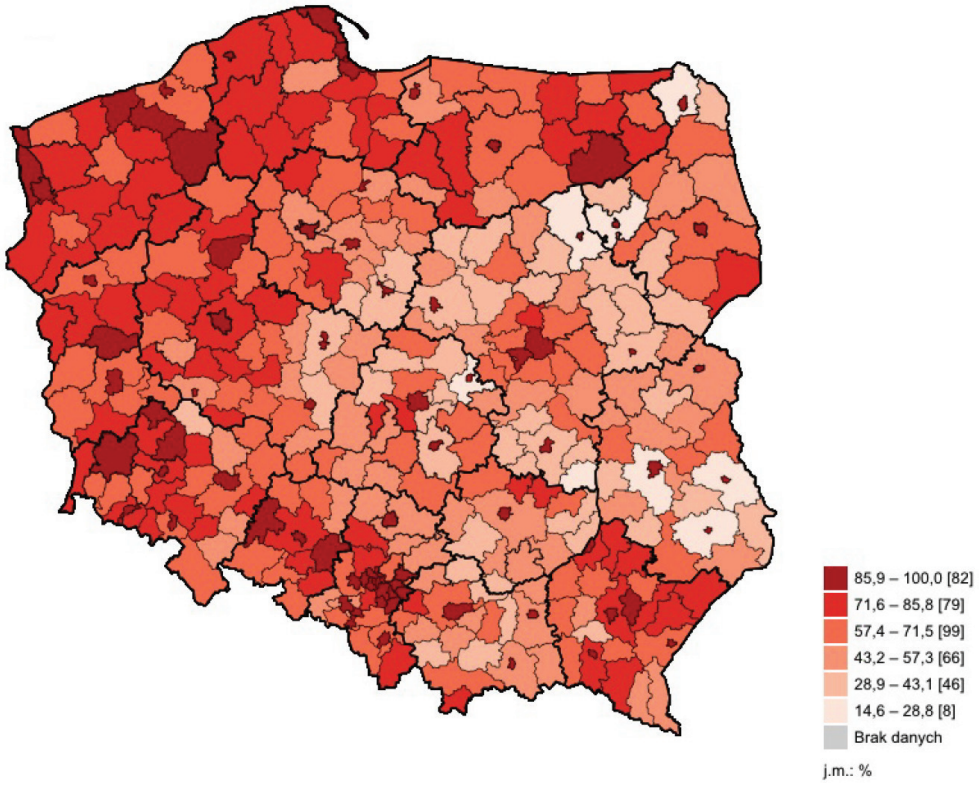


Source: "Environmental Protection 2018", Statistics Poland (GUS), p. 66.

[4] *Water and sewage management in Poland in 2017*. Statistics Poland (GUS).
[5] Environmental Protection 2018, Statistics Poland (GUS), p. 66.

However, the achievement of the indicator pertaining to percentage of the population using sewage treatment plants does not translate into the BEiŚ objective of improving the condition of water bodies. This is mainly due to the time required for the reaction of the water environment and the existence of other sources of pollution, particularly of agricultural nature. For this reason, on 5 June 2018 the Council of Ministers adopted a regulation on the adoption of the Action Programme to reduce water pollution by nitrates from agricultural sources and to prevent further pollution[6]. Proper implementation of the requirements of the Action Programme is expected contribute to reducing the agriculture share in the amount of nitrogen loads discharged to water.

Access of residents to sewage treatment plants services is the most common in Pomorskie, Zachodniopomorskie, Dolnośląskie and Śląskie voivodships, where the indicator exceeds 80%. The smallest percentage of the population using sewage treatment plants is located in Lubelskie Voivodship and amounts to less than 60%. A clear differentiation in the percentage of population with active access to sewage treatment plants services is visible both at the level of voivodships and counties, which may suggest a need to focus activities on selected local government units in the future. The applied technology should be economically efficient, which is facilitated by the construction of biogas plants near local sewage treatment plants, which has an additional positive impact on the improvement of energy security of the area.



Map legend: Rok – year; Kartogram – choropleth map; Odsetek ludności korzystającej z oczyszczalni ścieków [%] - percentage of population using sewage treatment plants [%]; Brak danych – no data; j.m. – units: %; Opracowanie własne na podstawie danych systemu Strateg na dzień 13.9.2017 - own study based on the data from the Strateg system as at: 13.9.2017.

Source: Own study based on data in the STRATEG database.

[6] OJ L of 2018 item 1339.

Waste management

Waste management has been recognised by BEiŚ as one of the most difficult areas of environmental protection. Measures were taken to gradually move from the system consisting in landfill storage to the system supporting the processing and recovery of raw materials and the use of waste for power generation. According to the Waste Framework Directive, by 2020, at least 50% of the four groups of municipal waste – paper, glass, metals and plastics – should be prepared for re-use and recycled. Between 2012 and 2016, this indicator rose from 18% to 28%. The year 2014 was the first full year of application of the amended Act on maintaining cleanliness and order in municipalities[7]. The rate of growth of the indicator value so far does not guarantee that the target value will be reached in 2020, due to the fact that the share of selectively collected municipal waste in the entire stream of waste is too low, among other factors. At the same time, it should be noted that the amount of waste being recycled is expected to increase steadily in subsequent years.

Efforts to reach the required levels have been intensified. Among the measures taken, the following should be mentioned:

- issuing a regulation on the detailed method of separate collection of selected waste groups[8], which introduces uniform standards of separate collection of municipal waste throughout the country,
- a revision of the Regulation on environmental charges[9], providing for increased landfill fees in the case of waste that should be recycled,
- introduction of the reporting obligation[10] for entities which collect municipal waste in groups: paper, metals, plastics and glass, which makes it possible to count this waste towards the recycling levels achieved by the communes and prepare it for reuse,
- introducing the principle of extended manufacturer responsibility for burdensome waste, including packaging waste.

[7] Act of 25 January 2013 amending the Act on maintaining cleanliness and order in municipalities (OJ L, item 228).
[8] Regulation of the Minister of the Environment of 29 December 2016 on the detailed method of separate collection of selected waste groups (OJ L of 2017, item 19, as amended).
[9] Regulation of the Council of Ministers of 6 March 2017 amending the Regulation on environmental charges (OJ L, item 723).
[10] The obligation was introduced by the provisions of the Act of 12 October 2017 amending the Act on packaging and packaging waste management and several other acts (OJ L, item 2056, as amended).

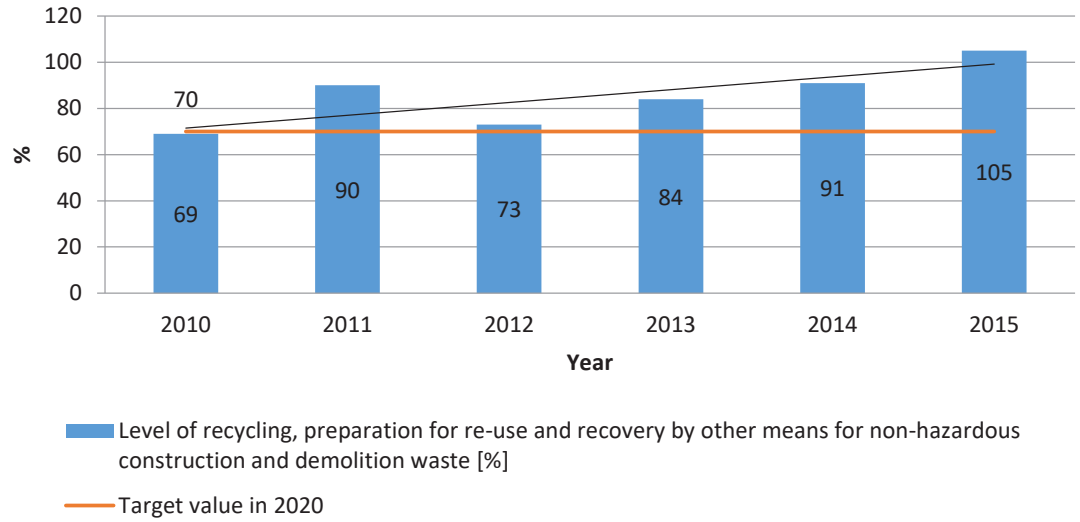
Level of recycling and preparation for re-use of selected waste groups: paper, metals, plastics and glass [%]

Source: Own study based on data in the STRATEG database.

The level of recovery of construction and demolition waste is more favourable. Concrete, brick and ceramic debris contained in construction and demolition waste after simple processing may constitute a construction aggregate of full value. It is used in the production of construction materials and elements, as well as in the construction of buildings and roads. Therefore, the level of recovery of this type of waste is not only of environmental but also of economic significance.

The target level of recycling, preparation for re-use and recovery by other means for non-hazardous construction and demolition waste, set for 2020 at 70%, has already been reached in Poland. In the years 2010-2015, this indicator oscillated around the target value. In 2015, the indicator reached as much as 105% of the target, which may be due to the treatment of waste stored in previous years.

Level of recycling, preparation for re-use and recovery by other means for non-hazardous construction and demolition waste [%]



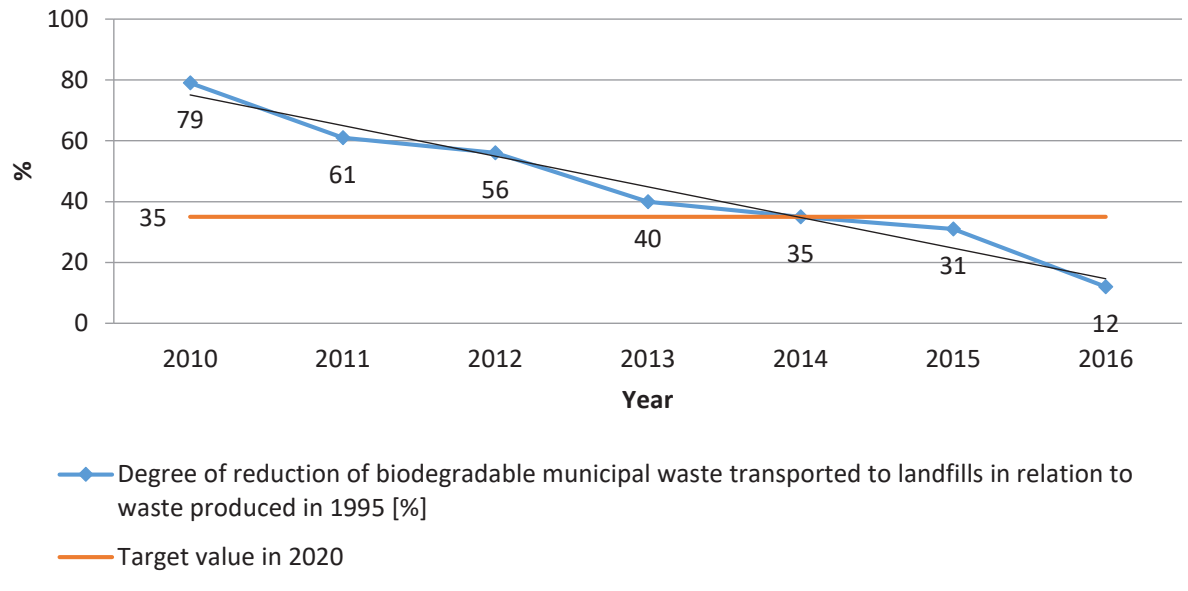
Source: Own study based on data in the STRATEG database.

An important element of the environmental policy is the reduction of the amount of landfilled waste. The activities undertaken in this area resulted in a gradual reduction of the mass of biodegradable municipal waste which was transferred to landfills. The 2020 objective has already been met.

The management of municipal waste is carried out considering the hierarchy of waste management methods. Municipal waste that could not be prevented is subject to the recovery process, including preparation for reuse and recycling, as well as other processes, e.g. thermal processing, biological treatment and landfill storage (mixed waste goes to landfills after previous processing). The amount of municipal waste recycled in 2016 has quadrupled compared to 2012 and the amount of thermally processed waste has increased forty-two-fold. Such a large increase in the stream of waste directed for thermal processing was caused by opening new municipal waste incineration plants, which started operating at the turn of 2015/2016[11]. An indirect impact on the increase in the amount of waste directed for thermal processing was caused by the regulation of the Minister of Economy of 8 January 2013 on the criteria and procedures for allowing waste to be stored at landfills[12].

Between 2012 and 2016, the amount of municipal waste subjected to biological processes increased by 67%, while the total weight of municipal waste sent for landfill storage decreased by as much as 40%.

Degree of reduction of biodegradable municipal waste transported to landfills in relation to waste produced in 1995 [%]



Source: Own study based on data in the STRATEG database.

[11] *Change in the municipal waste management system in Poland in the years 2012-2016*, Statistics Poland (GUS), 29.09.2017.
[12] Regulation of the Minister of Economy of 8 January 2013 on the criteria and procedures for allowing waste to be stored at landfills for a given type of waste (OJ L, item 38).

Air quality

Although BEiŚ has identified curbing air pollution as a priority, in recent years, exceeded concentrations of pollutants have still been recorded in most parts of the country. In 2016, exceeded air quality standards were recorded in 76% of the zones where measurements were made. Achievement of the target value (45%) in 2020 is unlikely based on the actions taken. This has a direct impact on the quality of life, the health of the population and the condition of ecosystems.

In view of the unsatisfactory state of air quality, the Ministry of the Environment intensified its activities in 2015 with the adoption of the National Air Protection Programme (KPOP). It aims to achieve, as soon as possible, the limit values for particulate matter and other harmful substances in air laid down in EU legislation and, with a view to 2030 – those set by the World Health Organisation. Within the framework of the amendment of the Environmental Protection Law[13], the effectiveness of actions resulting from air protection programmes and short-term action plans has been increased. Thanks to this amendment, the Voivodship Assembly may, by way of a resolution, introduce restrictions or bans on the operation of plants relying of fuel combustion and specify the types or quality of fuels allowed for use. So far, anti-smog resolutions have been prepared and are being implemented for the city of Kraków and ten voivodships: Małopolskie, Śląskie, Opolskie, Mazowieckie, Łódzkie, Dolnośląskie, Lubuskie, Wielkopolskie, Podkarpackie and Zachodniopomorskie. Works on the resolution for the Lubelskie Voivodship (Lublin Province) are nearing completion.

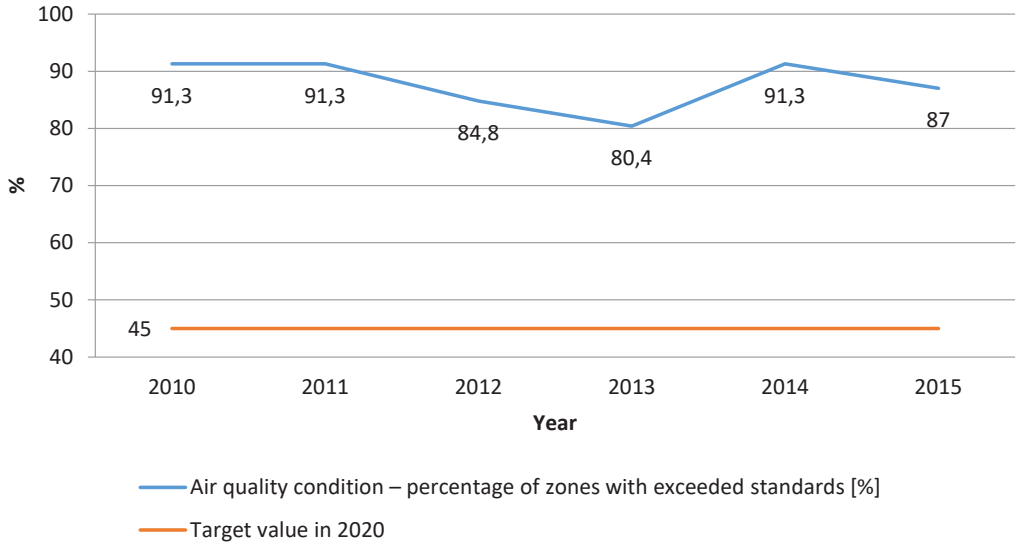
In 2017, the Economic Committee of the Council of Ministers, at the request of the Prime Minister, presented recommendations under the name of the "Clean Air" programme. Measures to improve air quality were also included in government strategic documents – the Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) and the Electromobility Development Plan "Energy for the Future". The implementation phase of measures to improve air quality is currently underway.

In all activities aimed at improving air quality, it is very important to raise environmental awareness and develop appropriate social attitudes, as it is the municipal and household sector that is the main source of emission of harmful compounds, the so-called low emission. Therefore, one of the directions of action, which is emphasised, is to form the right behaviours and attitudes of the public by educational campaigns, including campaigns on the optimal ways of combustion in boilers and the associated effects. Educational activities shall be continued under PEP2030.

The problem is also the poor energy efficiency standard of buildings. Its solution lies in the widespread use of deep thermal modernisation of buildings using the most effective technologies, as well as in the enforcement of the current regulations. Comprehensive activities aimed at improving air quality shall be carried out within the framework of the strategic Clean Air programme.

[13] Act of 10 September 2015 on amending the Environmental Protection Law (OJ L, item 1593).

Air quality condition – percentage of zones with exceeded standards [%]

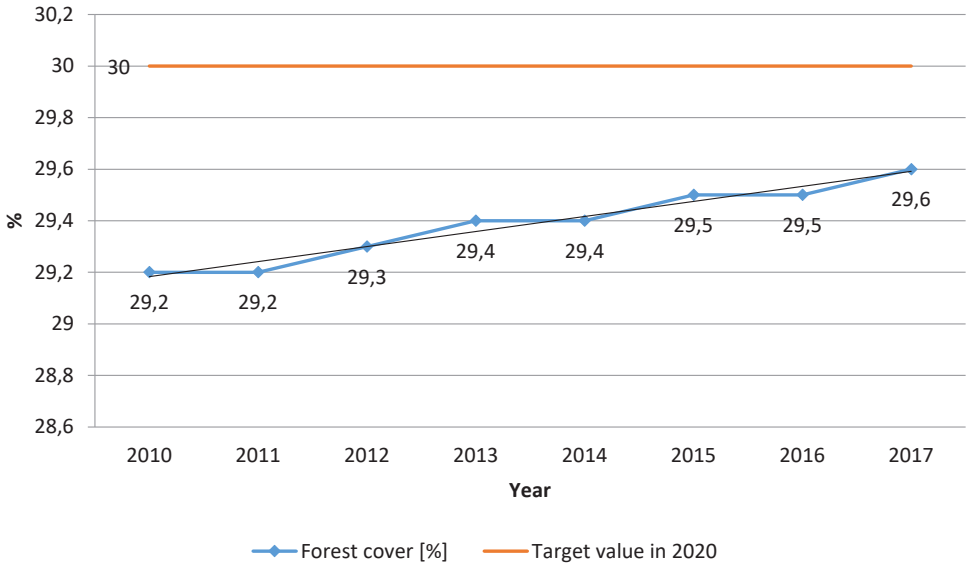


Source: Own study based on data in the STRATEG database.

Forest cover

The share of forest area in the total area of the country was gradually increasing, reaching the level of 29.6% in 2017. The positive trend in the described period is to a large extent an effect of afforestation of private agricultural land unsuitable for agricultural production. Afforestation was carried out mainly under the Rural Development Programme and as a result of reclassification of land on which afforestation occurred as a result of natural succession.

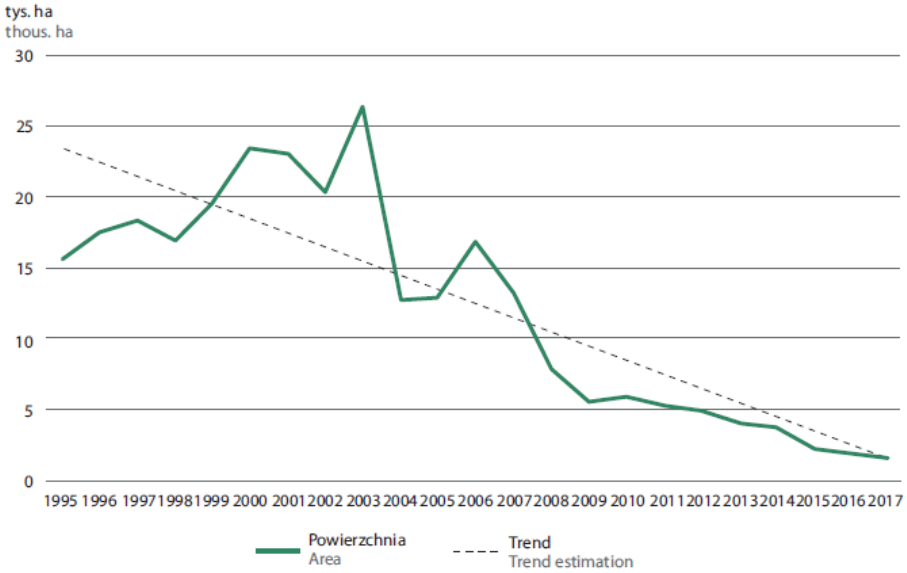
Forest cover



Source: Own study based on data in the STRATEG database.

Despite the positive trend, the achievement of the objective (30%) may be jeopardised due to the decreasing area of land available for afforestation. From the base year onwards, the area of land used for future forests decreased annually. In 2017, a total of 1.6 thousand ha was afforested, including 0.5 thousand ha belonging to the State Forests[14].

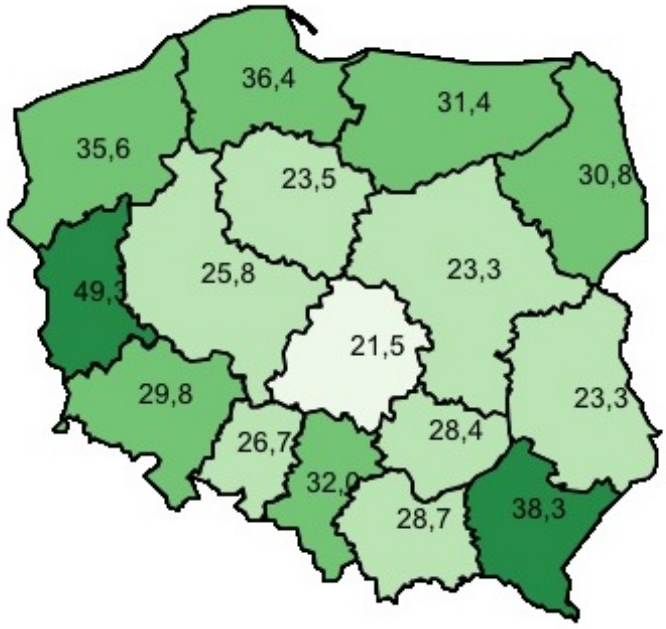
Afforestations of land



Source: "Environmental Protection 2018", Statistics Poland(GUS), p. 135.

The forest cover of the country is not evenly distributed. The values range from 21.5% in the Łódzkie Voivodship to 49.3% in the Lubuskie Voivodship.

Forest cover per voivodship in 2017



Prepared using the data and tools of the STRATEG database.

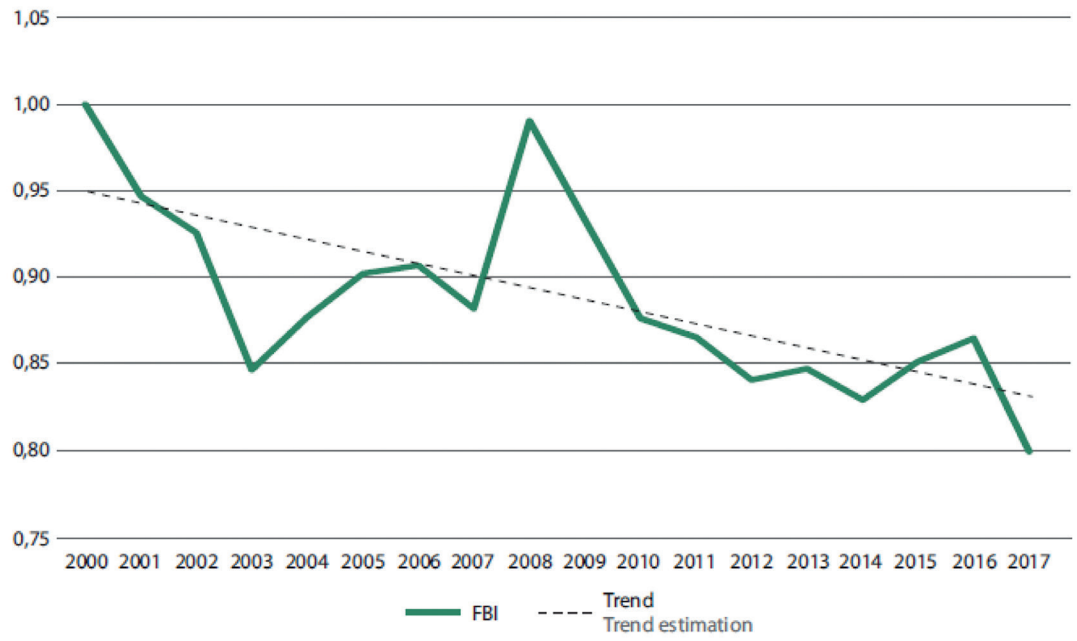
[14] *Statistical Yearbook of Forestry*, Statistics Poland (GUS), Warszawa, 2018, p. 81.

Farmland Bird Index

The FBI is a population index of 22 bird species typical for agricultural landscape habitats. It is treated as an indicator of the state of "health" of ecosystems used for agricultural purposes, which constitute about 60% of the country's area. The Polish portfolio of species whose numerical indices make up the FBI currently includes: Ciconia, Falco tinnunculus, Vanellus vanellus, Limosa limosa, Upupa epops, Streptopelia turtur, Galerida cristata, Alauda arvensis, Hirundo rustica, Motacilla flava, Anthus pratensis, Saxicola rubetra, Saxicola rubicola, Sylvia communis, Lanius collurio, Sturnus vulgaris, Passer montanus, Carduelis cannabina, Serinus serinus, Emberiza citrinella, Emberiza hortulana, Miliaria calandra.

In 2017, the FBI value was 0.7998, the lowest level in the recorded history. The trend of changes in species abundance is downwards. The indicator decreased by 20% in relation to 2000. The highest level of the indicator was recorded in 2008 (0.99). The individual data show that the value of the indicator in relation to the base year increased the most for the Saxicola rubicola (by 66%) and decreased the most for the Vanellus (by 76%). According to Eurostat data, the aggregate index for the European Union countries in 2014 amounted to 0.84 and was 16% lower compared to the base year[15].

Changes in common formland bird species (Formland Bird Index - FBI)



Source: "Environmental Protection 2018", Statistics Poland (GUS), p. 123.

[15] *Environmental Protection 2018*, Statistics Poland (GUS), p. 123.

The current CAP serves to protect many rare and endangered bird species. Within the framework of the agri-environment-climate measure of the Rural Development Programme for 2014-2020, support is provided for environmental practices conducive to the preservation of breeding habitats of endangered bird species in the Special Protection Area (SPA). The support is intended in particular for the following species: Limosa, Gallinago gallinago, Tringa totanus, Vanellus, Acrocephalus paludicola, Gallinago media, Numenius arquata and Crex crex.

Packages of measures contributing to stopping the decline in the number of the indicator species of agricultural landscape are implemented in the Rural Development Programme 2007-2013 and 2014-2020, while in the perspective of 2014-2020, they have been assigned to agricultural areas located in special bird protection areas.

Environmental technologies

BEiŚ pointed to the need to reinforce research, implementation and promotion of environmental technologies as a necessary element to achieve an innovative low-carbon and environmentally friendly economy. Such activities as: promotion of Polish environmental technologies abroad as part of the GreenEvo project or implementation of the ETV system in Poland were intended to support it. They were to strengthen the transfer of ecological innovation research results to market practice, support the commercialisation of environmental technologies and create a market offer for these solutions on the domestic and foreign markets.

The Environmental Technology Verification (ETV) system, based on the EU Environmental Technology Verification (ETV) pilot programme[16], verifies the effect of the given technology declared by the manufacturer. The verification is performed by ETV Verification Units (VUs) accredited by the Polish Centre for Accreditation (PCA). Since August 2016, four such units have been operating in Poland. They are prepared to verify environmental technologies in all pilot EU areas. Each Verification Unit has been accredited by the type A inspection body, i.e. with the highest degree of impartiality and reliability of the performed testing. In this way, ETV realistically supports the commercialisation and promotion of innovative environmental technologies, and the Certificate of Verification obtained by businesses facilitates, and often allows them to access foreign markets.

BEiŚ assumes that by 2020, 20 Polish technologies will have been verified under ETV. However, it is unlikely that the indicator estimated in BEiŚ is achieved. By the end of 2018, two Polish technologies had been verified, with a total of 29 verifications in the EU. The main reasons are high verification costs and poor recognition of ETV verification certificates on the market. This is a result of insufficient knowledge of businesses and administration, entities financing research and implementation of ecological innovations and investment projects, as well as scientific and industrial consortia, implementing R&D&I projects, regarding ETV and the possibility of using this tool to increase the probability of implementing the technology and increasing its commercialisation potential, building a competitive position of the company on the market. ETV can also be used to make innovation more credible, to confirm the environmental

[16] *EU Environmental Technology Verification (ETV) pilot programme https://ec.europa.eu/environment/ecoap/etv/)*

effect of the technology, in green public procurement tenders – as a confirmation that the offered technology meets the expectations of the contracting authority. Another factor limiting the number of verified technologies is the slower than expected pace of verification. The length of the verification process depends on the type and complexity of the technology and operating parameters to be verified. Some technologies may require tests confirming the efficiency throughout the entire year (e.g. sewage treatment technologies), hence the verification process before issuing the ETV verification certificate may take from a few months to over a year. Furthermore, the verification process is also slowed down by the degree and possibility of process involvement by the business and the availability of resources at its disposal.

The main barrier to joining the programme turned out to be high costs of testing conducted by qualified units, including accredited laboratories. The answer to this problem is the subsidy programme of the National Fund for Environmental Protection and Water Management[17], launched in 2017. The subsidy for businesses is a real incentive to verify as many Polish ecologically innovative technologies as possible. However, the proposed level of co-financing was perceived as too low in comparison with the assumed costs of testing. The decision to increase the maximum amount of co-financing was made in 2018. Insufficient level of co-financing combined with poor recognition of ETV on the market caused limited interest of Polish companies in the verifications. Since the ETV support programme in Poland has been operating only recently, the effects of the programme remain to be seen in the following years. The increase in the number of verified technologies in the future should be influenced by increased financing of the National Fund for Environmental Protection and Water Management and more effective dissemination of information on the ETV system in order to increase the recognition of ETV verification certificates on the market among the suppliers and purchasers of technologies, especially from the public finance and public administration sectors.

The expansion of the technological areas with the implementation of the full ETV programme at EU level may also have a significant impact on the number of verifications. This expansion covers technological areas closely related to the implementation of strategic projects in Poland, requiring innovative technical and technological solutions, including e.g. improvement of air quality management system, improvement of resource efficiency, protection of the land surface or new technologies related to natural resources.

The increased interest in ETV will also be influenced by the wider possibilities of using ETV verification certificates due to the fact that the verification units run their processes in accordance with the global standard adopted also in Poland[18]. This will increase the recognition of verification certificates issued for Polish technologies on international markets, e.g. in North America and Asia. Increasing the number of verified technologies should also result in using ETV as a system element to increase the probability of implementation and commercialisation potential of new environmental technologies in R&D&I projects.

[17] Priority Programme *Support for innovation towards a resource-efficient and low-carbon economy. Part 2) Popularisation of technologies verified within the ETV Environmental Technology Verification System*.
[18] PN-ISO 14034:2016.

APPENDIX

3

PEP2030 strategic projects

Direction of intervention: Removal of the sources of emission of air pollutants or significant reduction of their impact			
No.	**Project name**	**Project description**	**Duration**
1	**Clean air**	The most important direction of activities in the field of air protection is to reduce the emission of pollutants into the air in a manner enabling the improvement of its quality and meeting the standards set out in the law. First of all, it is necessary to maintain the beneficial trends in air quality improvement and reduction of health risks resulting from exposure to the atmosphere the substances harmful to health, i.e. PM10 and PM2.5 particulate matter, benzo(a)pyrene and ozone. The project involves creating legal and financial mechanisms at the national level, enabling effective implementation of air protection programmes at the voivodship and local levels, mainly in the area of the household/municipal and transport sectors, primarily through: - creating and improving a legal framework conducive to the implementation of effective measures aimed at air quality improvement, - promoting financial mechanisms conducive to the improvement of air quality, - involving the public in efforts aimed at improving air quality by raising public awareness and creating sustainable platforms for dialogue with civil society organisations, - developing and promoting technologies conducive to the improvement of air quality, - developing mechanisms for controlling near-ground emission sources, which are conducive to the improvement of air quality. The main objective of the project is to achieve, as soon as possible, an improvement of air quality to a level preventing even greater exposure of human health and the environment, i.e. to levels set by EU legislation (Directives 2008/50/EC1 and 2004/107/EC2). The project aims to achieve by 2030 substance levels set out in the WHO guidelines. The functioning of working teams for legislative, strategic, financial, development, technical and technological issues at the Steering Committee on National Air Protection Programme shall strengthen the air quality management system in Poland by undertaking effective and integrated corrective actions at the national, voivodship and local levels.	2016–2030

Direction of intervention: Management of natural and cultural heritage resources, including the protection and improvement of biodiversity and landscape			
2	**Landscape audits**	*Landscape audits* are aimed at inventorying landscape resources at the voivodship level through the identification, characterisation and assessment of landscapes. These measures shall be the basis for identifying priority landscapes, i.e. landscapes particularly valuable for the society due to their natural, cultural, historical, architectural, urban, rural or aesthetic and visual value. For these and other landscapes, recommendations and conclusions concerning their protection and shaping should be formulated pertaining to the areas or objects indicated in the Act of 27 March 2003 on spatial planning and development (OJ L of 2018, item 1945, as amended). These recommendations should carry over to spatial planning, i.e. they should be included in planning documents at the voivodship and municipality level. These recommendations and applications should also concern protected areas, including landscape parks and nature parks, which shall significantly strengthen landscape protection in these areas. At the same time, applications and recommendations shall include substantial grounds for the verification and shaping of the network of protected areas. Landscape audits should be developed in a uniform and coherent manner across the country. Therefore, in accordance with the Act of 27 March 2003 on spatial planning and development, the detailed methodology of preparation and the scope of landscape audits were defined in the Regulation of the Council of Ministers of 11 January 2019 on the preparation of landscape audits (OJ L, item 394).	2016–2023
Direction of intervention: Management of geological resources through the development and implementation of the Raw Materials Policy			
3	**Developing and implementing a coherent and comprehensive Raw Materials Policy**	*The Raw Materials Policy (RMP)* shall enable rational, sustainable management of natural resources at the national level, taking into account the interests of the industry. Thus, it shall increase the stability of supply of the natural resources used by the industry in the domestic market and the efficiency of their use. It shall also enable an increase in the export volume. The development and implementation of the Raw Materials Policy shall significantly improve the management of the domestic potential in the scope of natural resources, which in the long run shall increase the prosperity of Poland. *The Raw Materials Policy* shall define effective tools and actions leading to securing a permanent supply of natural resources necessary for the development of national and European economy. The overarching objective of the RWP shall be to ensure access to essential natural resources both now and in a longer perspective, taking into account the needs of future generations. *The Raw Materials Policy* shall be implemented by the Polish Geological Agency (PGA). The scope of intervention shall concern both the national and local economy, with particular emphasis on local resource predispositions typical for a given area. This intervention shall be horizontal or local, depending on the direction of actions within particular keystones of the RMP. The Raw Materials Policy shall be implemented through executive programmes developed and implemented mainly by the PGA. Tasks shall be financed with the revenues guaranteed by the law for this institution.	2016–2030

Direction of intervention: Supporting eco-innovation deployment and promoting the best available techniques (BATs)			
4	**GreenEvo – Technology Accelerator**	*GreenEvo – Technology Accelerator* is an innovative programme of the Ministry of the Environment aimed at the promotion of Polish green technologies. The basis for functioning of the programme is the implementation of the role of Minister of the Environment, which aims to support environmentally friendly Polish technologies in Poland and abroad as part of the environmental protection policy. So far, six editions of the Programme have been carried out in years 2009-2015, in which a total of 74 technologies have been selected – GreenEvo awards for the following technological areas: - renewable energy sources, - environmentally friendly solutions for the mining industry, - energy saving solutions, - systems supporting the environmental monitoring and information collection, - climate protection technologies, - technologies supporting waste management, - water and wastewater management technologies, - low-carbon transport technologies. The programme has been restarted after a break needed to provide legal basis for its implementation by the Ministry of the Environment. The previous editions, as a unique, award-winning government initiative, were an inspiration for other institutions as well as an effective tool for supporting the transfer of environmentally friendly Polish technological solutions, which directly increase the environmental effect in the process of building sustainable development with the transition to circular economy. The programme consists of awarding GreenEvo winners within each of its editions. Thanks to trainings' participation, the winners receive substantive information in the field of foreign technology, and then have the opportunity to present their awarded technological solutions during international promotional events. The 7th edition of the programme (2018) is intended exclusively for the winners of previous editions of GreenEvo and focuses on the use of the existing potential of proven technologies which have so far built the GreenEvo brand together with the Ministry of the Environment. Within the framework of the programme, in the years 2019-2020, the Ministry of the Environment plans to open up for new environmental technologies and to increase the group of awarded entrepreneurs. The GreenEvo programme is financed by the National Fund for Environmental Protection and Water Management.	2019–2020

Direction of intervention: Combating climate change			
5	Carbon Forests	The goal of the Carbon Forests project is to show the role of forest areas in mitigating the negative effects of climate change. The project's activities are aimed at sequestering additional amounts of organic carbon and reducing the level of released gases, including carbon dioxide, from soils. The project has been implemented in 23 forest districts, in the area of 13 regional directorates of the State Forests. The total area of operation is approximately 12 000 ha. Project activities include: increasing the area of forest divisions where underplanting and undergrowth will be planted; changing the forest management method at the stage of felling; increasing the effectiveness of forest regeneration by reducing the scope of work within the framework of interplanting and fill-in planting; changing the method of forest protection against animal damage or other biotic and abiotic factors; introducing fast-growing species; leaving the soil for natural succession in non-forest areas. These works shall be initiated between 2017 and 2026 and will have an additional carbon storage effect for a period of 30 years, i.e. until the end of 2046, using the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3) software. The project is estimated to absorb an additional 1 000 000 t of carbon dioxide. The additional quantity of absorbed carbon dioxide is expressed in terms of Carbon Dioxide Units (CDU). It is the quantity of organic carbon corresponding to one tonne of additional accumulated carbon dioxide. Studies are also underway to adapt the CBM-CFS3 model to local conditions. It is planned to auction CDUs to business entities. Sales to private individuals shall involve the voluntary purchase of the so-called green certificates. The added value of the auction is that the buyers will be able to indicate the goal to which the funds from the purchase of CDUs will be allocated (using a complied list). The list will include projects in the field of natural and historical education, biodiversity protection, tourism and recreation.	2017–2047
6	Wooden buildings	The aim of the project is to increase the availability of housings (particularly for individuals with moderate incomes), create conditions for the development of the wooden buildings in Poland and to create a demand for ecological constructions. The project foresees the implementation of tasks in the following areas: - financial and institutional (measures aimed at developing and implementing support mechanisms for the wooden buildings), - legislation and standardisation (measures aimed at reducing legal barriers for the development of the wooden buildings market), - education and information (education and information campaign, training, promotion of good practices, international cooperation). The implementation of the project shall contribute to: - improving the carbon balance (reducing CO2 emissions from the production of construction materials used in the masonry technology – cement, polystyrene foam, brick, steel, plastic, etc.; wood as a construction material has a low carbon footprint), - promotion of energy-efficient wooden buildings (improvement of energy balance, lower consumption of energy required for maintenance, promotion of effective use of wood resources as a construction material), - combating climate change (wood stores CO2 which reduces its concentration in the atmosphere).	2017–2027

Direction of intervention: Adaptation to climate change and disaster risk management			
7	**Adaptation to climate change**	The effects of climate change, in particular the increase in temperature, frequency and intensity of extreme events, are rising[1]. Scientific researches clearly show that the weather events caused by climate change are a threat to society, the economic development of EU countries and the environment. They expose society and the economy to additional costs and damage to nature. Adaptation to the changing climatic conditions and the related phenomena is currently one of the most important challenges for the Polish economy and the society. The project aims to provide the necessary knowledge on climate change and assess its impact, as required to improve the effectiveness and efficiency of adaptation actions in sectors and areas vulnerable to climate change, in particular those identified in *the Strategic Adaptation Plan for Sectors Vulnerable to Climate Change until 2020 (SPA 2020)*. The project shall equip state institutions with effective instruments for the implementation of the adaptation policy. These instruments shall help to strengthen the country's resilience to climate change, resulting in tangible savings. In this way, the costs of functioning of the society and economy, including infrastructure, will be reduced. The project foresees the development of climate scenarios necessary to assess the social, economic and environmental impacts of climate change and to plan for adaptation, including the necessary research, as a basis for effective adaptation actions. The effectiveness of state intervention in the area of adaptation to climate change shall also be assessed. Analyses to develop recommendations for necessary legislative changes shall also be used. Proposals will be developed for legal and economic tools to be used by various administration authorities in the process of law-making, planning and taking actions to adapt to the effects of climate change and to counteract the effects of violent weather events. The key result of the project shall be the development of a programme/implementation document for the adaptation policy until 2030 (the so-called post-SPA) together with a set of indicators monitoring its implementation.	2017–2023

[1] Climate Change Impacts and Vulnerability in Europe, European Environment Agency, 2012.

8	**A comprehensive programme of adaptation of forests and forestry to climate change until 2020**	*A Comprehensive programme of adaptation of forests and forestry to climate change until 2020* is the basis for the implementation of projects implemented by the State Forests, co-financed by the Cohesion Fund within the framework of OPI&E for 2014-2020. The projects are listed below: – "A comprehensive programme for the adaptation of forests and forestry to climate change – small retention and counteracting water erosion in lowland areas" (MRN2), – "A comprehensive programme for the adaptation of forests and forestry to climate change – small retention and prevention of water erosion in mountain areas" (MRG2), – "A comprehensive programme for the adaptation of forests and forestry to climate change – prevention and mitigation of the effects of forest fire hazards (PPOŻ). All activities shall be carried out by organisational units of the State Forests. Within the framework of the project (MRN2), lowland areas shall see investments related to: – construction, conversion, reconstruction of reservoirs, – restoring function to wetland areas, – protecting forest infrastructure against the effects of water erosion caused by heavy rainfall. Within the framework of the project (MRG2), mountain areas shall see investments related to: – construction, conversion, reconstruction of reservoirs, – restoring function to wetland areas, – protecting forest infrastructure against the effects of water erosion caused by heavy rainfall, – anti-erosion development of felling trails and roads. Within the framework of the fire protection project (PPOŻ), the following investments shall be implemented: – construction of fire observation stations, – modernisation of fire observation stations, – purchase of patrolling and fire-fighting vehicles, – purchase of fire detection equipment, – purchase of equipment for emergency dispatch points (PAD), – purchase of meteorological stations.	2018–2022
9	**Water for agriculture**	The aim of the project is to improve the stability and continuity of agricultural production in conditions of periodic water shortages and excesses, including in particular – support for family farms in the construction, reconstruction and proper use of drainage facilities to improve production conditions, increase water retention and achieve the desired environmental effects. Support is planned for: – construction and reconstruction of damming structures on canals, ditches and small watercourses, – construction and reconstruction of drainage ditches, taking into account the retention function, – reconstruction and construction of drainage systems, taking into account the retention function, – construction of reservoirs and micro-reservoirs (waterholes, ponds), – construction of facilities for capturing and storing water from drainage networks and rainwater, – water companies in the scope of maintenance of specific water melioration devices, – renaturalisation of wetlands to restore retention functions, – restitution of floodplains, – training of farmers in the purposes of melioration and the principles of maintenance of melioration facilities, agrotechnical procedures and landscape management procedures conducive to water retention.	2016–2030

APPENDIX

4

Base values of PEP2030 monitoring indicators at voivodship level

Voivodship Indicator	Dolnośląski	Kujawsko-Pomorskie	Lubelski	Lubuski	Łódzki	Małopolski	Mazowiecki	Opolski	Podkarpacki	Podlaski	Pomorski	Śląski	Świętokrzyski	Warmińsko-Mazurski	Wielkopolski	Zachodniopomorski
number of zones categorised as Class C for exceeding the daily standard for PM10 / number of zones used for measurements (pcs.)	**3/4** (2016) PMŚ	**4/4** (2016) PMŚ	**2/2** (2016) PMŚ	**2/3** (2016) PMŚ	**2/2** (2016) PMŚ	**3/3** (2016) PMŚ	**4/4** (2016) PMŚ	**2/2** (2016) PMŚ	**1/2** (2016) PMŚ	**0/2** (2016) PMŚ	**1/2** (2016) PMŚ	**5/5** (2016) PMŚ	**2/2** (2016) PMŚ	**0/3** (2016) PMŚ	**3/3** (2016) PMŚ	**1/3** (2016) PMŚ
number of zones categorised as Class C for exceeding the daily standard for PM2.5 / number of zones used for measurements (pcs.)	**1/4** (2016) PMŚ	**1/4** (2016) PMŚ	**1/2** (2016) PMŚ	**0/3** (2016) PMŚ	**2/2** (2016) PMŚ	**2/3** (2016) PMŚ	**3/4** (2016) PMŚ	**1/2** (2016) PMŚ	**0/2** (2016) PMŚ	**1/2** (2016) PMŚ	**0/2** (2016) PMŚ	**4/5** (2016) PMŚ	**0/2** (2016) PMŚ	**0/3** (2016) PMŚ	**2/3** (2016) PMŚ	**0/3** (2016) PMŚ
capacity of small water retention structures (dam3)	**156453,2** (2016) MRiRW[1]	**14323,8** (2016) MRiRW	**9465,2** (2016) MRiRW	**82556,2** (2016) MRiRW	**19235** (2016) MRiRW	**8901,2** (2016) MRiRW	**56500,6** (2016) MRiRW	**48403** (2016) MRiRW	**5011,2** (2016) MRiRW	**3223,0** (2016) MRiRW	**17140,1** (2016) MRiRW	**13266,8** (2016) MRiRW	**7440,8** (2016) MRiRW	**127751,6** (2016) MRiRW	**190889** (2016) MRiRW	**65773,8** (2016) MRiRW
percentage of population using sewage treatment plants (%) - total - countryside	80,9 **47,4** (2017) GUS	72,7 **39,0** (2017) GUS	57,0 **25,0** (2017) GUS	76,7 **43,1** (2017) GUS	69,3 **26,0** (2017) GUS	66,1 **39,3** (2017) GUS	72,3 **31,1** (2017) GUS	75,6 **54,1** (2017) GUS	73,9 **58,0** (2017) GUS	67,8 **23,4** (2017) GUS	82,7 **62,0** (2017) GUS	80,8 **46,6** (2017) GUS	64,0 **38,2** (2017) GUS	76,6 **47,4** (2017) GUS	73,1 **48,1** (2017) GUS	81,4 **57,1** (2017) GUS
area of land requiring recultivation (ha)	**5661** (2017) GUS	**3830** (2017) GUS	**3114** (2017) GUS	**1704** (2017) GUS	**5203** (2017) GUS	**2197** (2017) GUS	**3794** (2017) GUS	**2555** (2017) GUS	**1742** (2017) GUS	**2658** (2017) GUS	**2707** (2017) GUS	**5259** (2017) GUS	**3699** (2017) GUS	**4838** (2017) GUS	**10277** (2017) GUS	**2800** (2017) GUS
municipal waste collected from households (kg per capita)	**307,3** (2017) GUS	**250,6** (2017) GUS	**167,7** (2017) GUS	**284,1** (2017) GUS	**243,8** (2017) GUS	**260,5** (2017) GUS	**293,8** (2017) GUS	**268,0** (2017) GUS	**172,5** (2017) GUS	**198,5** (2017) GUS	**277,3** (2017) GUS	**301,6** (2017) GUS	**141,2** (2017) GUS	**228,1** (2017) GUS	**283,2** (2017) GUS	**276,2** (2017) GUS
forest cover (%)	**29,8** (2017) GUS	**23,5** (2017) GUS	**23,3** (2017) GUS	**49,3** (2017) GUS	**21,5** (2017) GUS	**28,7** (2017) GUS	**23,3** (2017) GUS	**26,7** (2017) GUS	**38,3** (2017) GUS	**30,8** (2017) GUS	**36,4** (2017) GUS	**32,0** (2017) GUS	**28,4** (2017) GUS	**31,4** (2017) GUS	**25,8** (2017) GUS	**35,6** (2017) GUS
surface area of parks and urban green areas (% of total area of cities)	**2,3** (2017) GUS	**4,0** (2017) GUS	**2,3** (2017) GUS	**2,2** (2017) GUS	**2,9** (2017) GUS	**2,2** (2017) GUS	**2,8** (2017) GUS	**1,7** (2017) GUS	**1,3** (2017) GUS	**1,3** (2017) GUS	**2,5** (2017) GUS	**2,2** (2017) GUS	**1,5** (2017) GUS	**2,7** (2017) GUS	**2,6** (2017) GUS	**1,8** (2017) GUS

[1] Ministry of Agriculture and Rural Development

Republic of Poland

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