

**Wyjaśnienie dotyczące oceny  
wpływu/podatności/ryzyka wynikającego ze zmian klimatu  
(przeprowadzonej w projekcie KLIMADA)  
w odniesieniu do kryteriów EEA**

**1) The assessment covers several different thematic areas (e.g. water management, agriculture and biodiversity protection)**

The following thematic areas were assessed:

- 1) Agriculture
- 2) Forestry
- 3) Water management
- 4) Biodiversity
- 5) Energy
- 6) Construction,
- 7) Transportation,
- 8) Mining
- 9) Public health
- 10) Tourism
- 11) Poland's coastal zones
- 12) Cities

In the context of vulnerability of the above, there were also analysed horizontal issues, such as:

- 1) Spatial management
- 2) Local societies
- 3) Education,
- 4) Research,
- 5) Warning systems.

**2) The assessment includes a (brief) description of the climatic scenarios or Assumption underlying the analysis.**

There were elaborated detailed descriptions of selected characteristics of climate and weather events in the period 1971-2000, as well as climate change scenarios for both the entire country and selected regions. The climate scenarios were based on simulations run under the EU ENSEMBLES project - at that time, the largest available in Europe climate projection system for the 21st century. The scenarios for Poland used an ensemble of 8 simulations, including 7 regional models with boundary conditions from 4 global models (ARPEGE, ECHAM5, BCM, HadCM3Q0). The analyses were carried out for the two forecasting periods 2021-2050 and 2071-2100, with the long-term period (1971-2000) as the reference.

Each expertise relates to the observed and forecasted climate changes.

**3) The assessment includes a (brief) description of the methodology (e.g. literature review, expert judgment, quantitative modelling, etc.)**

The main climate change impacts/vulnerabilities/risks identified for each thematic area were assessed using the adopted methods of analysis. The adopted methods of analysis differed depending on the thematic area and data availability. Each assessment considered the results of climate models which provide estimates of future climate. The assessments based on modelling included uncertainty assessments. The latter were also provided in the majority of expert assessments, which also contained statistical analyses, indicators and scales.

Table 1. Methods used in assessments of the main climate change impacts/vulnerabilities/risks identified for each thematic area

Thematic area	Literature review	Quantitative modelling	Expert judgement	Spatial analysis	Uncertainty assessment
Agriculture	x	x		x	x
Forestry	x		x	x	
Water management	x	x		x	x
Biodiversity	x		x	x	x
Energy	x		x		
Construction	x		x	x	x
Transportation	x		x	x	x
Mining	x		x		x
Public health	x	x			x
Turystyka	x		x		
Spatial management	x			x	
Poland's coastal zones	x	x		x	x
Cities	x			x	

**4) The assessment includes a description of the main climate change impacts/vulnerabilities/risks identified for each thematic area.**

The analysis/assessment of the effects of climate change took into account climatic risks and impacts of climatic factors on a given sector. For each thematic area, the main and indirect climate risks were described in detail. Relationships between the sectors were considered, including particularly the dependence of certain sectors on water resources and water management.

Current climate changes have obvious impacts on some vulnerable aspects of the economy and society. In Poland, as in most countries, water management and agriculture are at particular risk in the face of climate change.

Now observed climate changes bring about modifications of the precipitation regime by increasing the frequency and intensity of rainfall and, at the same time, the frequency and intensity of droughts. As many sectors are essentially dependent on water resources, water

management affects the remaining sectors, in particular, agriculture, industry, energy and municipal management system (water supply). The results of the scenarios indicate that changes in the precipitation structure will deepen, which, combined with growing demands for water, especially in the case of agriculture, will have a negative impact on the economy.

In agriculture, changes in the precipitation structure affect the yield performance. The second aspect - air temperature - shows a systematic growing trend what is especially evident in winter months. This is conducive to reducing the frequency of snow cover occurrence and shorter periods with low temperatures, what negatively affects the condition of winter crops and soil water stock in spring. At the same time, the transitional seasons (spring and autumn) undergo shortening, while the main seasons (summer and winter) – lengthening.

Shortening of snow cover season also influences the conditions for tourism and winter sports. Favourable snow conditions can have a positive effect on transportation in winter, as then the incidence of road icing is reduced, however, at the same time, they can have a negative effect on power lines which may be damaged due to deposition of wet snow and glazed ice. In summer, long periods with high temperatures (max > 30°C) together with a high humidity can be hazardous to living conditions in cities and, especially, to the health of their residents.

Poland's coastal zones are particularly vulnerable to changes in climatic conditions, as in winter, with lacking ice phenomena, the beaches are susceptible to degradation by storms or heavy rainfalls, which wash away the cliff coasts. This is conducive to vanishing of coastal ecosystems. In summer, high temperatures favour the growth of cyanobacteria in the sea, which reduces the number of options to have safe relax on the Baltic beaches.

The temperature rise and shortening of snow cover season lead to vanishing of alpine plant communities in the Carpathian Mts. and the Sudetes. The water dependent habitats suffer water shortages and dry out, which is conducive to land desertification.

A separate event whose severity grows due to climate change is the increasing frequency of wind storms (e.g. tornadoes), which destroy primarily forests and loose housing in rural areas. Moreover, forests are threatened by fires due to long-lasting periods without rainfall.

Table 2. The main climate change impacts/vulnerabilities/risks identified for each thematic area - synopsis

Thematic area	Climate change impacts/vulnerabilities/risks identified
Agriculture	<ul style="list-style-type: none"> <li>– changes in crop yields as a result of alteration of plant requirements for cultivation and fertilisation, severity of diseases and outbreaks of pest insects;</li> <li>– change in water demand;</li> <li>– change in animal production costs due to the necessity for securing fodder supply, increased water requirements and protection against diseases and parasites;</li> <li>– increased impacts of agriculture on the environment (e.g. erosive factors, degradation of organic matter in the soil);</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>– changes in the ranges and shifts of ecological optimum of many tree species, displacement or disappearance of some forest formations;</li> <li>– changes in forest ecosystem productivity;</li> <li>– changes in the type and severity of the occurrence of pests and</li> </ul>

Thematic area	Climate change impacts/vulnerabilities/risks identified
	diseases; – changes in ecosystem functions (geo-biochemical cycles, energy transformation); – increase or decrease in nutrient retention; – changes in reproductive cycles (deterioration or improvement of forest regeneration conditions); – changes in the value of forest ecosystems as leisure and recreation sites;
Water management	– changes in the average annual runoff coefficient for the entire country; – changes in the maximum and minimum flows in rivers; – changes in the frequency, duration and volume of low waters; – changes in watercourse temperatures; – reduction of the occurrence of ice phenomena on rivers, changes in flood likelihood; – changes in the needs of water management on a national scale, by voivodships, and by sectoral needs for industry, energy, agriculture and municipal management;
Biodiversity	– changes in the productivity of marine areas and disturbances of the trophic structure, resulting in changes in all the components of marine ecosystems, including birds, predatory mammals and cetaceans; – changes in the range of coastal habitats as a result of transgression of the Baltic Sea and erosion of the sea coast; – changes in the salinity of the coastal zone due to strong wind and more frequent storms; – changes in the eutrophication processes of standing and flowing waters; – changes in the range and structure of the habitats of Alpine grasslands; – changes in the moisture of habitats dependent on water, followed by desertification; – changes in the range of animal species, changes in the phenology of their breeding periods and reproductive success; – expansion of invasive species;
Energy	– changes in the conditions of electricity distribution (impact on transmission energy infrastructure); – changes in electricity and heat demands; – changes in production capabilities as regards the technologies using fossil fuels and renewable energy sources;
Construction	– changes in the functional and operational conditions of construction works due to changes in thermal conditions and rainfall; – changes in building foundations as a result of ground freezing and groundwater level changes; – changes in requirements for building superstructure as a result of changes in permanent and variable loads;

Thematic area	Climate change impacts/vulnerabilities/risks identified
Transportation	<ul style="list-style-type: none"> <li>- changes in the conditions of use of the road, rail and air infrastructures;</li> <li>- changes in the safety of road, rail and air transport;</li> <li>- technical changes in the infrastructure due to extreme temperatures;</li> <li>- changes in the cost of maintaining infrastructure in winter;</li> </ul>
Mining	<ul style="list-style-type: none"> <li>- changes in risk of flooding of the ground infrastructure, increase in the cost of drainage of open-cast mines;</li> <li>- changes in the conditions of electricity distribution (impact on transmission energy infrastructure);</li> <li>- changes in electricity and heat demands;</li> <li>- changes in production capabilities of technologies using fossil fuels and renewable energy sources;</li> </ul>
Public health	<ul style="list-style-type: none"> <li>- changes in risks of heatstrokes and heat-related deaths, especially in the case of elderly, chronically ill, young children and socially isolated people;</li> <li>- changes in risks of tick-borne diseases;</li> <li>- changes in access to water and food resources, changes in risk of malnutrition, waterborne diseases and food poisoning;</li> <li>- changes in risks of death or injuries caused by the effects of strong wind, storms, hail;</li> <li>- changes in risks of skin cancer and other diseases caused by UV-C radiation excess;</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>- changes in the duration of tourist seasons in Poland;</li> <li>- changes in visitor motivations towards choosing destinations with high risk of occurrence of extreme weather events;</li> <li>- changes of a region's attractiveness for tourism due to the loss or reduction of its natural values;</li> </ul>
Poland's coastal zones	<ul style="list-style-type: none"> <li>- changes in the average Baltic Sea's level and in the occurrence of its extreme values;</li> <li>- changes in wavy motion of the Baltic Sea;</li> <li>- changes in the risk of flooding from the sea;</li> <li>- changes in thermohaline structure of the Baltic Sea and in the productivity of its waters;</li> <li>- spatial and temporal changes of algal blooms;</li> </ul>
Cities	<ul style="list-style-type: none"> <li>- changes in the frequency and intensity of urban floods;</li> <li>- changes in the range and intensity of the urban heat island as a result of temperature changes;</li> <li>- changes in living conditions in the city and quality of life.</li> </ul>

Table 3 Assessment of climate change vulnerabilities/risks identified for each thematic area

Thematic area	Heatwaves	Heavy rainfalls	Droughts	Floods	Harsh frosts and Icing	Storms	Rising sea level	Lack of snow	Strong wind
Agriculture	3	3	3	3	3	1	2	3	2
Forestry	3	1	3	2	3	0	0	2	3
Water management	2	3	3	3	1	3	1	2	0
Biodiversity	1	1	3	3	1	2	3	3	2
Energy	2	2	3	3	2	2	3	1	3
Construction	1	2	2	3	3	2	3	0	2
Transportation	3	2	1	3	3	2	3	0	2
Mining	1	3	1	3	1	0	0	0	1
Public health	3	1	2	3	3	0	1	0	2
Tourism	3	2	2	1	1	2	2	3	2
Poland's coastal zones	1	2	1	2	2	3	3	1	2
Cities	3	3	2	3	0	2	3	0	0
Vulnerability	<b>3 high</b>		<b>2 medium</b>		<b>1 low</b>		<b>0 none</b>		