CLIMATE CHANGE ADAPTATION POLICY IN RURAL DEVELOPMENT STRATEGY FOR POLAND

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Abstract. The European Union's policies take into consideration climate change and its adverse effect on most sectors of the economy. The 'European Union strategy on adaptation to climate change' adopted by the Council of Europe in 2013, is one of the most important adaptation initiatives addressing sustained changes in climate conditions, which affect, among others, rural areas. The EU's strategy complements actions taken by the member states, facilitating the exchange of information and mutual experience with reference to climate change predictions and the implementation of measures preventing or limiting the damage. Rural areas in Poland constitute over 90 % of the total territory, which makes them crucial for economic, social, natural and landscape development. Over the years, the catastrophic atmospheric events experienced in Poland have upset the balance of the local economy, particularly in agriculture, energy and transportation. The geographic, economic, social and environmental diversity of Poland makes it difficult to design uniform adaptation measures for the whole country. It is therefore necessary to develop solutions not only at the national level, but also dedicated to particular regions, which would allow for their distinct character. The aim of this work is to indicate the role and significance of both European and domestic measures in the adaptation of rural areas to climate change, leading to solutions, which will significantly limit the incidence of natural hazards (e.g., floods, hurricanes, thunderstorms, intense precipitation, landslides, heatwaves) or minimize their negative impact on the economy in general.

Keywords: natural hazards, rural area, climate change.

Introduction

Rural development policy in the EU continues to evolve and reflect the wider EU strategic priorities, as well as Member States' changing circumstances. Greater emphasis is now placed on the policy creating jobs and growth as well as lessening negative impacts from climate change. Agriculture and forestry remain the primary focus for policy actions, particularly their integrated roles in providing quality food and caring for the countryside environmental assets [1].Rural areas account for over 50 % of the EU territory and provide over 46 million (over 20 %) jobs. Poland's rural areas account for over 90 % of the total area of the country; therefore, they are very important from the economic, social, and environmental perspective of both Poland and the EU. Unfortunately, environmental changes that have been intensifying over recent years, which include global warming, result in the more frequent than usual occurrence of such natural hazards as floods, hurricanes, droughts, landslides, or fires.The results of scientific research clearly indicate that phenomena caused by climate change are a threat to the social and economic development of many countries in the world [2-5]. For this reason, the Member States have taken a number of measures aimed at the sustainable management of rural areas, with particular emphasis on the areas particularly vulnerable to the risk of tragic consequences of climate change. The most important projects aimed at the support of modern European strategy of multi-functional and sustainable development of rural areas at heightened risk of natural hazards include the implementation of a number of investment projects protecting three significant policy pillars such as the society, economy, and the natural environment, financed largely from the EU funds, e.g., the Rural Development Programme for 2014-2020.

Natural hazards in Poland

Flood is one of the most frequent natural hazards. It results from heavy rainfalls, the rapid melting of long-term snow cover, strong winds on the coast blowing from the sea inland or damage to flood protection structures (Figure 1).

The degree of flood risk throughout in Poland varies. It is determined by population density, the patterns of use of river valleys and flooded area, technical and transport infrastructure, etc. In terms of the area affected by this natural phenomenon, the following can be distinguished: local floods, usually caused by high intensity torrential rains, affecting small sub-basins; regional floods affecting a water region; and national floods affecting a river basin area, principally caused by long-term rainfall over large areas.

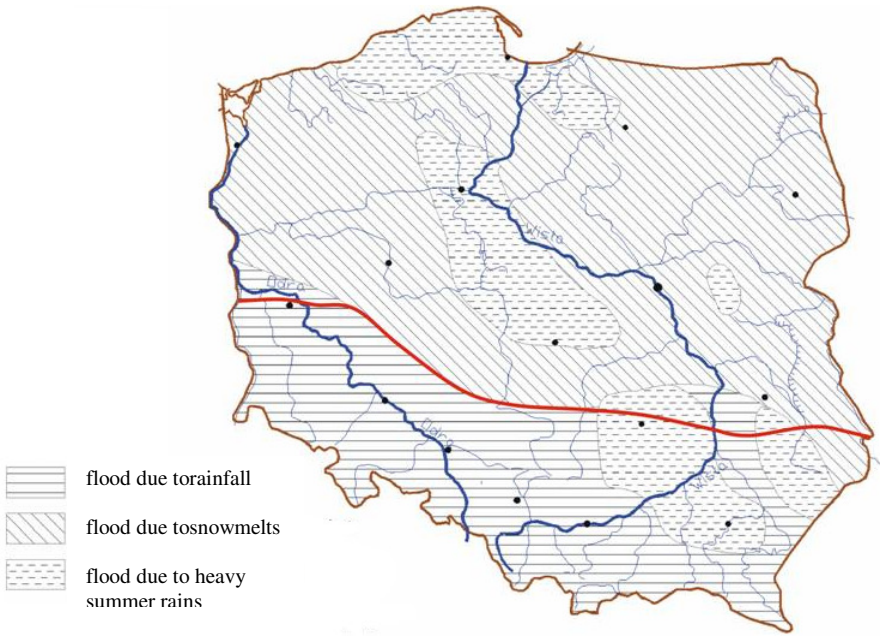

Fig. 1. **Floods in Poland, source: http://oki.krakow.rzgw.gov.pl**

The areas which are most at risk of rainfall floods are those of southern voivodeships: Malopolskie, Podkarpackie, Slaskie, Opolskie, Swietokrzyskie, and Dolnoslaskie, located within the catchment areas of the following rivers.

- In the Oder river basin: the sub-basin of the upper and middle Oder river along with the sub-basins of mountain tributaries (Olza, Osobloga, Mala Panew, Nysa Klodzka, Sleza, Bystrzyca, Kaczawa, Bobr, Nysa Lozycka rivers).
- In the Vistula river basin: the sub-basin of the upper and middle Vistula river (up to the Wieprz river mouth) along with the sub-basins of mountain and sub-mountain tributaries (Przemsza, Sola, Skawa, Raba, Dunajec, Wisloka, CzarnaStaszowska, Koprzywianka, San, Kamienna rivers).

In the event of a snowy winter, during the snow-melt season the areas of the middle and lower Oder River and of the middle and lower Vistula river are at risk, as well as the areas of lowland tributaries of the Oder river (Barycz, Warta, and Notec) and of the lowland tributaries of the Vistula rivers (Bug, Narew, Bzura, and Drweca) as well as of the rivers discharging directly to the Baltic Sea. The most dangerous ice jam floods occur on major lowland rivers in locations where jams are formed, mainly in Mazowieckie, Zachodniopomorskie and Pomorskie voivodeships. A storm flood poses a hazard to the areas in the mouths of rivers flowing into the Baltic Sea, the coastal zone and ZulawyWislane.The temperate climate zone in which Poland is situated is exposed to the occurrence of strong, sometimes violent gales related to the general circulation of the atmosphere in a particular latitudinal zone, and to the formation of strong local winds and particularly dangerous tornadoes. Strong gales occur most frequently from November to March, while tornadoes from June to August, and occasionally in May. In Poland, they occur from 1 to 4 times in a year. The regions of the country in which these phenomena are more intense and more frequent than in other areas include, in particular, Lower Silesia, the Oder river basin, Lesser Poland and southern Poland. From the perspective of forest management, fires are major hazards to forests. The vulnerability of forests to fires is primarily determined by the weather conditions, which affect the moisture content of the forest litter, whose decrease below 28 % significantly increases its susceptibility to inflammation. The areas at particular risk of the occurrence of fires throughout the country are monocultural forests (especially coniferous forests accounting for nearly 60 % of the forested area of the country), usually in the spring and summer period at the highest (Level 3) of forest fire hazard. Landslides are caused by the sudden displacement of earth masses, surface rock mantle and rock masses of the substratum, which are a result of the forces of nature or human activities. Landslides occur throughout Poland. Over 95 % of landslides are found in the Carpathian Mountains, where the flysch geological structure and the height differences are favourable to their development. Based on the previous works carried out under the

project called Anti-Landslide System, it is estimated that in the Carpathian Mountains alone, the number of landslides may be as high as 50,000 – 60,000. Landslides often cover large areas, sometimes up to 35 % of the area of communes. Most damage caused by mass movements is also noted in the Carpathian Mountains. In Poland outside the Carpathians, landslides most frequently occur on the cliffed coast of the Baltic Sea, within the lowland belt of northern and central Poland, within the upland belt of central Poland, and in the Sudetes. Landslides and rockfalls along the coastline of the Baltic Sea are formed on cliffs which are eroded by sea water. In the lowland belt of northern and central Poland, landslides are primarily formed on the sides of large valleys of the following rivers: Vistula, Warta, Narew, the Bug River, Notec, Skrwa, and other major tributaries of the Vistula and Oder rivers. The most vulnerable sections within the Vistula river valley are the Vistula scarps in Warsaw and over the sections of Wyszogrod-Plock, Dobrzyn-Wloclawek, and Torun-Bydgoszcz. Many landslides are found within the upland belt of Central Poland, mainly on the sides of the Vistula river valley near Tarnobrzeg and Sandomierz. Mass movements also occur in the areas covered by thick loess deposits (areas in the vicinity of Kazimierz Dolny, Pulawy, and Krasiczyn). The periodic occurrence of atmospheric droughts and the resulting soil droughts is a natural feature of the climate in Poland. In Poland, droughts occur most frequently, when very warm and dry air flows in during the growing period. If this period is preceded by rainfalls lower than the average, the drought phenomenon may become intensified. Statistically, in Poland, such a situation occurs once in 4-7 years. Atmospheric and soil droughts disappear relatively quickly, while hydrological drought usually lasts for a long time, even as long as several seasons, as the reconstruction of water resources requires abundant and long-term rain- and snowfalls. Atmospheric droughts occur most frequently in the following regions of Poland: the Greater Poland Lowland, the Greater Poland Lakeland, the Silesian Lowlands, the Sudetian Foothills, the Mazovian Lowland, the Podlasie Lowland, and the Masurian Lakeland. Hydrological droughts are most often recorded in the following regions of Poland: Wielkopolskie Lakeland and the Greater Poland Lowland, the Podlasie Lowland, and the Lublin Upland. According to the same analysis, low-water flows in rivers, the so-called low-waters, last the longest in the following regions: the Pomeranian Lakeland, the Greater Poland Lakeland, the Greater Poland Lowland, the Podlasie Lowland, and the Lublin Upland. The phenomenon of low-waters is least frequently observed in the central and eastern part of the Pomeranian Lakeland, the western part of the Masurian Lakeland and the central part of the Carpathian Plateau [6].

Results and discussion

Many economic sectors are directly dependent on climatic conditions and are already facing the impact of climate change in areas such as agriculture, forestry, beach and snow tourism, health and fisheries. Major utilities, such as energy and water providers, are also affected. Ecosystems and the services they provide are suffering from the adverse impacts of climate change, which is accelerating the decline of biodiversity and reducing their ability to buffer natural extremes. Climatic changes will have consequences for the availability of basic natural resources (water, soil) leading to significant changes in conditions for agriculture and industrial production in some areas [7]. In Europe, attempts have been made for years to counteract the destructive forces of nature, which include inter alia the currently functioning EU programmes such as the RDP 2014-2020 or the Infrastructure and Environment, which are aimed at supporting measures related to climate change, presented inter the "EU Strategy on adaptation to climate change". The Commission adopted an EU adaptation strategy to climate change in April 2013, which has been welcomed by the Member States. Complementing the activities of Member States, the strategy supports action by promoting greater coordination and information-sharing between Member States, and by ensuring that adaptation considerations are addressed in all relevant EU policies. The EU's role can be particularly appropriate when climate change impacts transcend borders of individual states - such as with river basins - and when impacts vary considerably across regions. The role of the EU can be especially useful to enhance solidarity among Member States and ensure that disadvantaged regions and those most affected by climate change are capable of taking the necessary measures to adapt. Adaptation means anticipating the adverse effects of climate change and taking appropriate action to prevent or minimize the damage they can cause, or taking advantage of opportunities that may arise. It has been shown that well planned, early adaptation action saves money and lives later. Examples of adaptation measures

include: using scarce water resources more efficiently; adapting building codes to future climate conditions and extreme weather events; building flood defenses and raising the levels of dykes; developing drought-tolerant crops; choosing tree species and forestry practices less vulnerable to storms and fires; and setting aside land corridors to help species migrate [7].

In Poland, in 2010, work was undertaken to develop a national adaptation policy related to the rapid climate change. The effect of this work was the adoption in 2013 of the Polish National Strategy for Adaptation to Climate Change (NAS 2020) with the perspective by 2030. This strategy has been prepared with a view to ensure the conditions of stable socio-economic development in the face of risks posed by climate change, but also with a view to use the positive impact, which adaptation actions may have not only on the state of the Polish environment, but also on the economic growth. SPA 2020 indicates the objectives and directions of adaptation actions to be taken in the most vulnerable sectors and areas within the period by 2020: water management, agriculture, forestry, biodiversity and protected areas, health, energy, building industry, transport, mountain areas, coastal zone, spatial development and urban areas. The vulnerability of those sectors has been identified on the basis of climate change scenarios adopted for SPA. The objectives, action lines and specific actions that correspond to strategy documents, have been proposed, in particular the National Development Strategy 2020 and other development strategies that are complementary in the context of adaptation. Current and future climate change impacts have been taken into account and analyzed, including climate change scenarios for Poland by 2030, which showed that in this period the greatest threat to the economy and society will be extreme weather events (torrential rains, floods, flooding, landslides, heat waves, droughts, hurricanes, landslips, etc.), which result from climate change. These phenomena will take place with the increasing frequency and intensity and on a greater scale [8].

The key objectives of the Strategic Adaptation Plan until 2020 (SPA 2020) take into account a number of existing national development strategies, which include the "Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries for 2012-2020", adopted in 2012, which focuses on the development of the security infrastructure and on the protection of the environment and adaptation measures for climate changes in rural areas. The security infrastructure for rural areas mainly includes systems related to the protection against and prevention of natural hazards. In particular, the development of irrigation and drainage infrastructure, the primary role of which is to minimize the effects of natural hazards such as strong gales, floods, and droughts, should be promoted. These measures should take into account, where possible, the natural resources of the environment. Objectives and course of actions in the process of adaptation to climate change by 2020:

1. Reforming water management structures with consideration of adaptation to climate change:
   - water management for protection against floods, drought and water shortages.
2. Taking into account the current and potential sea level rise and flood risk in investment plans in the coastal zone and coastal waters:
   - organization of space management,
   - water management for protection against floods, drought and water shortages,
   - preservation of the richness of biodiversity, including multifunctional forest management.
3. Preparation of strategies, protection plans, protection programmes or protective task plans for the nature preservation, taking into account the changes in climatic conditions:
   - preservation of the richness of biodiversity, including multifunctional forest management,
   - protection of the natural environment in the agricultural sector and of biodiversity in rural areas,
   - adaptation of agriculture and fisheries sectors to climate change and their participation in preventing this change.
4. Development of systems for monitoring and early warning of possible consequences of climate change for plant and animal production.
5. Investment support for holdings, training and technological advice taking into account aspects of adapting agricultural production to the increased climate risks and preventing climate change.
6. Promotion of innovative solutions in the field of adaptation of agricultural and fisheries production to climate change.

7. Education and raising awareness in the field of: climate change and methods to minimize its impact, impact of invasive alien species and the importance of and the need to save resources, especially water:
   - raising social awareness and level of knowledge on challenges of the sustainable development and climate change.
8. Development of comprehensive solutions in the field of state aid granted for loss compensation in the event of natural disasters and development of the insurance system covering risks resulting from climate change [8].

Adaptation actions will be financed from various sources, i.e. both national and foreign (especially the EU) and from private funds. The Cohesion Fund is aimed at Member States which Gross National Income per inhabitant is less than 90 % of the EU average. It aims to reduce economic and social disparities and to promote sustainable development. For the 2014-2020 period, the Cohesion Fund concerns Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia [9]. The EU policy of multi-functional and sustainable development of rural areas is also financed from the European Agricultural Fund for Rural Development, which budget amounts to EUR 100 billion in the period of 2014-2020.

In Poland, one of the national programmes, which is co-funded by the Cohesion Fund, is the Operational Programme "Infrastructure and Environment" 2014–2020. One of the aims of the programme is to support measures associated with:

- increasing the volume of impounded water and enhancing the efficiency of conduct, recognition and response in the event of natural hazards and major emergencies,
- implementation of projects aimed at increasing the resistance to hazards associated with climate change and enhancing the opportunities to prevent natural hazards to which Poland is particularly exposed, i.e. floods and droughts, and to respond to them.

As regards the activities, the projects, using natural methods for reducing the flood risk to the greatest extent possible, and those with technical measures being properly justified and with solutions meeting the environmental requirements will be preferred. Technical measures will primarily focus on the tasks restoring natural water retention and on securing urbanised areas in situations, where it is not possible to apply natural methods for flood protection. As a rule, projects interfering with river channels will only be eligible where they do not block (aquatic and riparian) ecological corridors. The need for water impoundment is a key element in the overall planning works, taking into account the needs of the country as regards water management. This is why the support will be mainly directed towards activities related to the storage of water in the environment, which is the best form of the collection of water resources and is one of the measures aimed at reducing the risk of a flood. In addition, the implementation of tasks of combating ice hazards is planned, which will contribute to a reduction in the hazard of the occurrence of flood events (ice jam floods). Support will also be provided to projects in the field of precipitation water management in towns and cities, which will enhance their resistance to partial inundation and flooding [10]. The financial support necessary for the implementation of the projects mentioned amounts to 4 127 263 725 EUR, of which 3 508 174 166 EUR comes from the Cohesion Fund, which accounts for 85 % of the Union assistance. The national financial support amounts to 619 089 559 EUR.

The Rural Development Programme for 2014-2020 is aimed at the improvement of competitiveness of the agricultural sector, while taking into account the natural environment components and rapid climate change. The actions under the Rural Development Programme for 2014-2020 support investments related to:

- restoration of production potential of a farm, which has been damaged or destroyed due to the occurrence of a natural disaster or adverse climatic events,
- limitation of the effects of probable natural disasters, adverse climatic phenomena and catastrophes.

The total budget of the Rural Development Programme for 2014-2020 amounts to 13.6 billion EUR, of which 8.7 billion comes from the European Agricultural Fund for Rural Development and the remaining part comes from national public funds.

Conclusions

The EU policy of multi-functional and sustainable development of rural areas also takes into account natural and climatic aspects. Sudden and unpredictable climate change resulting in the occurrence of a number of natural hazards forces the Member States to take a variety of adaptation measures of both a technical nature (e.g., the construction of flood protection infrastructure) and a legal nature, related to an amendment to the existing provisions of the system of spatial development of the areas at risk of the occurrence of, e.g., floods or mass movements of the earth. It is also important to implement systems of monitoring the areas at potential risk, and to disseminate knowledge on changes to economic behaviour in areas vulnerable to the occurrence of natural hazards. The Member States, while developing strategies including adaptation measures related to climate change for the agricultural sector, take into account the following principles:

- it is required to reduce the vulnerability to the risk associated with climate change, inter alia, by taking this aspect into account at the investment planning stage,
- it is necessary to develop rapid response plans in the event of climate disasters (floods, droughts, heat waves), so that public institutions are prepared to provide immediate help to victims,
- it is required to determine priority actions in terms of the cost-effectiveness in the first place, it is required to be prepared to address threats to health and life of humans and permanent loss and damages [8].

Thanks to the EU programmes such as the Rural Development Programme for 2014-2020 and the Operational Programme "Infrastructure and Environment" 2014-2020, the implementation of a number of adaptation measures is real and possible. The Member States' financial support provides a real opportunity to increase the resilience of rural areas to adverse climate change. Floods, forest fires and landslides are natural hazards, which bring about unexpected and undesirable changes to the environment, which have an adverse effect on both the humans and their property. Therefore, efforts should be made to expand the scope of consolidation works shaping, in an optimal manner, spaces, which are potentially at risk, e.g., of floods, to include the needs and requirements related to the prevention and protection against such extreme natural events.

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