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Information (Maps, Projects) Collected for Safety Space Management

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Abstract. The main aim of the study is to analyse the maps and projects which inform us about locations at risk of extreme weather events and other hazards to the space. In the last decade, research into hazards has become an area of interest to many projects under implementation. During their implementation, a lot of information with a different scope, accuracy and scale is obtained. The projects and maps under study provide valuable information for various levels of space management and planning as well as for crisis management. For the implementation of research aims, an analysis and synthesis of the obtained materials concerning the maps and projects were used. The results indicate that the gathered information does not always fulfil the needs of local governments. In spatial planning, information should refer to a cadastral parcel or real estate; however, certain projects and maps are not accurate enough and have a rather global coverage, which makes them useless for the purposes of spatial planning. To this end, an analysis and synthesis of the obtained materials concerning the maps and projects were used.

Keywords: management of the safe space, information, project, maps.

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Introduction

Taking decisions related to the space may be based on a set of information obtained from various sources of data. A space is a specific set of a certain number of facts with characteristic relationships. Depending on both the elements that form the space and the relations occurring within it, various types of a space are distinguished (geodesic, geographic, natural, economic, social, cultural, and others) (Cymerman 2001). A space is made meaningful by humans through their observations, thanks to their experience and tendency to classify things, and through their activities resulting from the desire to make use of the space in accordance with their current needs (Bajerowski 2003). While shaping a safe space, it is necessary to provide conditions for responding to various hazards such as hazards to people's health and lives, catastrophes and natural disasters, the state's economic hazards, crime and acts of terrorism (Kocur-Bera, Dudzińska 2015; Kocur-Bera 2016). Therefore, it appears that we will not avoid risks in a safe space but we may shape it so as to minimise their occurrences and consequences. Having analysed the relationships between the form of improvements on land and the level of the sense of safety, a few characteristics of a safe space can be distinguished. According to Newman (1972), a safe space should be characterised by the following: (1) territoriality (through the introduction of symbolic barriers); (2) surveillance (a possibility for carrying out visual supervision); (3) care (proper maintenance of the property); (4) the use, and (5) commonly taken actions in order to eliminate various hazards (social activities).

In the process of space management, many groups of information on the real world can be distinguished, which are necessary for taking measures aimed at the creation of a safe space. In principle, any piece of information on a space is significant, even if we are not always able to make use of it. Most frequently, the obtained data are diverse in nature depending on the source from which they are acquired. Modern technologies allow data to be obtained either directly as the so-called primary data or indirectly (secondary data). They are gathered in a digital form, e.g. data obtained directly from the outer space via satellites, satellite navigation systems, aerial photographs, monitoring systems, or results of land survey in a vector form. Secondary data are either in a digital or analog form, and have originally been obtained for other purposes (e.g. fiscal), therefore they need to be transferred to a digital format. These include data on land use along with the information on property rights, physical data e.g. surface topography, land cover, geological status, quality of soils, a group of data related to the value, as well as information originating from social, cultural, political, and economic environment of a country or a region. Very often, the boundaries between primary and secondary data fade away (Longley *et al.* 2006). Obtaining primary data involves direct measurements of objects, which also include satellite observations. It can be concluded that they have revolutionised the way of thinking about the problems of the modern world, and changed the perspective from which the causes and effects of natural and anthropogenic processes and phenomena were analysed. Remote sensing data along with ground (in-situ) data give the full picture of the condition of the Earth and the phenomena occurring on it. An analysis of the data provides a multitude of information, from evaluation of drought on the national level and forecasts about crops' growth to the level of ground settlement expressed in millimetres. Satellite observations of the Earth are among the best sources for obtaining large volumes of data in a short time. The aim of the study is to analyse projects and other information sources (maps) which can be used for purposes related to management and development of a space in terms of its safety.

Methods

In order to achieve the set aims, the literature, source materials, and websites were analysed. The study focused on discussing the following projects: The Copernicus Initiative; Maps of Threats and Increased Natural Hazard; National Map of Security Threats; Agricultural Drought Monitoring System; *Klimat* and *Klimada* projects, and the IT System of the Country's Protection Against Hazards (ISOK).

The *Copernicus* Initiative

Copernicus is a new name of the European Commission's Earth observation programme previously known as GMES (Global Monitoring for Environment and Security), meaning Global Environment and Security Monitoring. This is an initiative undertaken in late 1990's by the European Union, which provides for the use of data from many types of satellites under the control of various organisations: European Commission (DG Enterprise), the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), space sector enterprises, national organisations and international consortia. The initiative aims at developing methods for monitoring the state of environment from satellite, aerial and ground levels (Królikowski *et al.* 2014; Mikołajek-Zielińska 2013). Data are gathered using satellites and ground measurements. The processing of the data will enable the provision of information services allowing more efficient management of the environment and the enhancement of European Union citizens' security. Thanks to this initiative, it is expected that it will be possible to respond to natural disasters more rapidly and effectively, to use natural resources more efficiently, and to better monitor the quality and purity of water, the air, etc.

The *Copernicus* was established by Regulation (EU) No 911/2010 of the European Parliament and of the Council (RPEiR 911/20101). This is a key element of the European Union policy in the area of space in accordance with Article 189 of the Treaty on the Functioning of the European Union, which allows the EU to conduct activities related to space. The Copernicus is also one of the programmes to be implemented as part of the "Europe 2020" strategy for smart and sustainable growth. The main areas of the use of satellite data include: (1) observations of the land (land cover, changes to the land, soil moisture, the state of crops, vegetation and biomass indicators, land surface temperature, the development of improvements on land and transport infrastructure, detecting land use violations, precision agriculture, deforestation and illegal grubbing, crustal deformations, ground settlement above mines, three-dimensional topographic models, and the urban heat island phenomenon); (2) observations of oceans (salinity, temperature of surface water, organic matter content, changes to the ocean level, indication of optimum fishing zones, the range and compactness of sea ice); (3) observations of the atmosphere (weather monitoring, concentrations of trace (including greenhouse) gases, natural and anthropogenic aerosols, volcanic ash monitoring, forecasting and tracking of intense storms, measurements of the air temperature and humidity); (4) crisis management (support at the stages of prevention of, preparation for, response during, and reconstruction after a crisis event – floods, fires, earthquakes, epidemics, droughts, volcanic eruptions, industrial accidents); (4) development of simulation scenarios, support for humanitarian assistance, estimation of losses and impact assessment, real-time charting; (5) public safety (marine fleet management, tightness of state borders, detecting petroleum and oil spills from ships, critical infrastructure monitoring, enforcement of international agreements, support for peacekeeping missions). Table 1 presents the area of interest implemented in the *Copernicus* Initiative.

Table 1. Areas of interest implemented under the *Copernicus* Initiative

Area	Products and services
Ensuring safety	– identification and early warning services in order to prevent the spread of crisis, and to observe treaties, determination of crisis indicators, critical resources, identification of illegal activities, road and boundary monitoring; – crisis management services: preparation for a crisis and its planning, development of an emergency plan, assessment of losses and reconstruction, support for reconstruction after the crisis; – monitoring large areas in near real-time, surveillance and alarm system in "hot spots", waterway monitoring; – a prototype of a portal for management and harmonisation of various types of services in a safe service network;
Surface of the Earth	– services providing maps of lands offer information on land cover, use, and changes to its cover, as well as biophysical parameters as a contribution to more advanced products; – services providing information offer specific data for the needs of the European environmental protection policy and international agreements concerning climate change, food security, and sustainable development in Africa (river flow, water consumption, the amount of groundwater, the level and properties of lakes, snow coverage, snow cover and snow water equivalent, the volume and range of glaciers and glacier plateaus, permafrost and periodically freezing ground, albedo 20, land cover (including the vegetation type), Leaf Area Index (LAI), biomass, fire disturbance, soil moisture content (on the surface, and the root zone);

End of Table 1

Area	Products and services
	– Urban Atlas – contains 19 thematic classes along with a minimum terrain resolution of 0.25 ha for urban classes, and 1 ha for the other; – CORINE Land Cover (CLC) – the only harmonised European land cover database; it offers 44 thematic classes; it contributes to the formation and presentation of 5 high-resolution layers (impervious areas, forests, meadows, small water bodies, wetland areas)
Seas and oceans	– V0 Service (the current one – allows free access to a regional, European and global catalogue of products created thanks to the previous projects such as MERSEA, MARCOAST, POLARVIEW, ECOOP, GLOBCOLOR); – V1 Service (a fully integrated system offers access to one base and direct access to all products; the service contains the INSPIRE Directive functionalities: finding, visualisation, downloading, other tools, and 24/7 assistance section); – includes 7 geographical areas: The Mediterranean Sea, the Black Sea, the North West Shelf, the IBI-ROOS area (the Iberia-Biscay Ireland Regional Maritime Area), the Baltic Sea, the Arctic Ocean, the World Ocean (global ocean); – basic climatic data; surface data: sea surface temperature, sea surface salinity, the sea level, sea ice, the state of the sea, the colour of the sea (IOP + Chl_a), carbon dioxide absorption capacity of the sea; subsurface data: temperature, salinity, sea currents, nutrients, carbon dioxide, trace elements, phytoplankton
The atmosphere	– The European Air Quality Service, The Atmosphere Composition, The UV and Solar Energy Service, The Climate Service; – maps and data for the purposes of regional forecast of the air quality, evaluation of the air quality, identification of pollution sources, the preparation of tools for the assessment of the control of air quality measurement, contribution to local forecasts of the air quality, the air quality and health – a warning service; – support for the implementation of the policy and related services
Crisis management	– anticipation: assessment and planning of an intervention strategy; prevention: the implementation of implementing measures in order to reduce harmful effects; active intervention: an improvement in operations while rescuing; post-crisis: the determination of losses, assistance in the elimination of effects, updating the database; – crisis response service (GMES Emergency Response Service) available 24/7; – preparation of reference maps, maps of risk assessment, further products needed during a crisis e.g. flood models and analyses of flood risk models, early warning models, maps for disaster recovery, updating information about "hot" topics; – global geographical database ready prior to an event (reference maps are prepared within less than 6 hours).

Maps of threats and increased natural hazard

The presented maps mainly concern urban areas designated for infrastructural, industrial, residential and storage investment projects, areas degraded by mining and vulnerable to the occurrence of natural geodynamic phenomena, and areas of river valleys vulnerable to the occurrence of flood hazard (Grabowski *et al.* 2007). The contents of the maps include information (so far, only for the areas under the pilot project) concerning: (a) lithology of near-surface deposits; (b) geological structure; (c) types and subtypes of soil valuation classes; (d) the depth of the groundwater table; (e) environmental geochemistry (soils, land, surface waters and groundwaters); (f) natural hazards (geodynamic processes, karst phenomena, floods, radon emanations); (g) anthropogenic hazards (landfills, wastewater discharges, installations hazardous to the environment, noise, emissions of gases and dusts, electromagnetic radiation; (h) mining damage (areas at risk of discontinuous deformation, mining waste dumping grounds, flotation tailings tanks, areas at risk of continuous deformation, water accumulation and drying out of an area); (i) basic geological and engineering valuation, surface and subsurface technical infrastructure; (j) spatial management; (k) protection of mineral deposits; (l) protected areas and objects, and objects of cultural heritage.

These maps are created on the basis of archive materials (all compilations concerning anthropogenic impacts and natural hazards) as well as aerial, satellite, and remote sensing photographs. As regards satellite images, it must be borne in mind that the created representation of a space and phenomena is a reflection of an instant, a selected moment in time, therefore it has certain limitations (Urbański 2012); however, they are very useful at the time of activities related to the occurrence and behaviour of dynamic phenomena (e.g. when determining the range of floods, flooding, landslides, dirty avalanches, and others) (e.g. Fig. 1).

Fig. 1. Examples of maps of degraded mining areas as well as areas destroyed by flood and degraded by mass movements of the Earth. Source: MTZ (2016)

National map of security threats

The Map of Security Threats should be considered to be a significant element of the process of public security management, implemented in an inter-institutional and social partnership. They should also serve for the optimal allocation of service equipment and staff resources, in particular for taking decisions as regards the establishment of police constabularies and stations. The National Map of Security Threats is based on information catalogued in three planes: (1) information gathered in police information systems; (2) information obtained from the public during direct contacts with citizens and representatives of local government, NGOs, etc., as well as during public debates on public security; (3) information obtained from citizens (Internet users) using an information exchange platform. The information presented in maps will take into account selected categories of crimes and offenses as well as threats which, subjectively perceived by inhabitants, have an adverse effect on their sense of security. They contain, *inter alia*, information on: acts of vandalism, homelessness, poaching, illegal dumping grounds, grouping of minors, hazardous places on water, illegal car races, illegal felling of trees, grassland burning, etc. (e.g. Fig. 2).

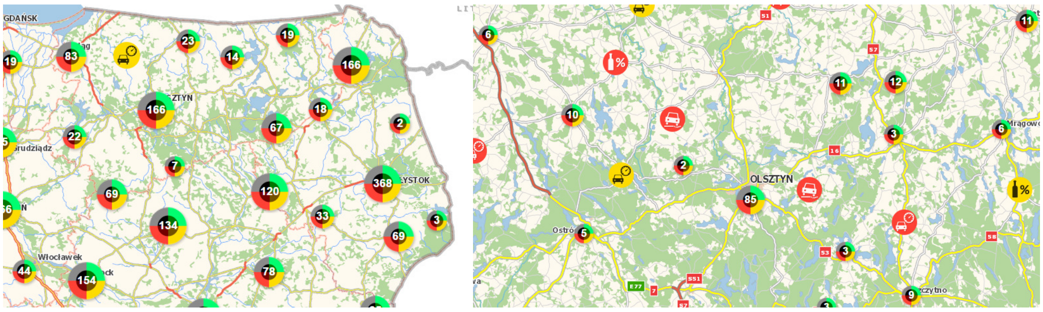

Fig. 2. An example of maps of security threats. Source: KMZB (2016)

Agricultural drought monitoring system

A tool supporting agricultural drought monitoring system and verifying the forecasted losses in the yield is a system comprising a network of measuring points distributed across representative complexes, types and textural group of soil on the national scale. During a growing season from April to October, it allows an ongoing assessment of the rate of changes to the moisture content of soils to be carried out on selected production fields, and enables the determination of the actual impact of water stress on the yield. Results of the performed work are made available to the public on the website of the Institute of Soil Science and Plant Cultivation (IUNG-PIB) in Puławy. It is implemented on the basis of an ongoing assessment of water shortage during a growing period, measures using the Climatic Water Balance. Monitoring takes into account spatially varied retention capacities expressed in the categories of vulnerability of various soils to drought. Sandy, very light and light soils are characterised by a very low water retention capacity in the soil profile, they dry out more quickly than medium-heavy and heavy soils, and shortage of water for plants sooner becomes evident on them.

The aim of the soil moisture monitoring system being established is to find out the relationship between water stress measured in terms of the number of days of moisture content below a critical value, corresponding to the point of permanent wilting of plants, and the yield of crops on soils of various textural groups under a variety of habitat and climatic conditions (e.g. Fig. 3). The obtained study results are used for the verification of the designation of spatial ranges of agricultural drought hazard for the successive six-decade periods during a growing season, and will provide a basis for better adjustment of the existing models of yield forecasts as an effect of the occurrence of water deficits to the soil and climatic conditions of Poland, and the differentiation of cultivation systems and the level of the applied crop production technique. The scale of compilations allows no identification of particular cadastral parcels and property, therefore it is difficult to make use of the information for the purposes of the project.

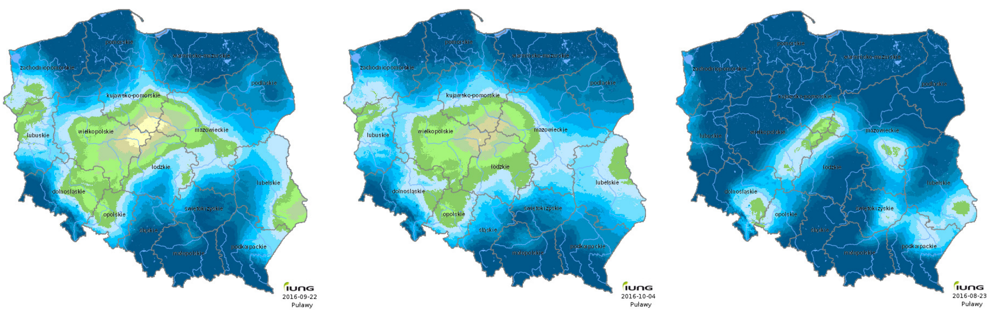

Fig. 3. Examples of maps of water balance components from various periods of time. Source: IUNG (2016)

KLIMAT project

The issues of climate change are among the major environmental, social, economic as well as political problems. The substantive scope of this project takes into account comprehensive knowledge including the issues of climate change and adverse effects of this change on the environment (e.g. Fig. 4), economy, and society. The project fulfills the following aims: short-term ones, involving the development of a system of current warnings and the guarding of the economy and society against extreme atmospheric and hydrological events, and long-term ones, involving the development of climatic models on the regional scale, and various variants of scenarios of climate's impact on the agricultural production and forests, forecasts of water needs, a strategy for the protection of surface waters and groundwaters, a strategy for Poland's energy security, and forecasts of economic and social effects resulting from the progressive climate change and the occurrence of extreme events. The main tasks carried out in the project include: (a) climate change and its impact on the natural environment of Poland, and the determination of its economic consequences; (b) the state of air pollution in Poland, and its impact on the quality of life – possibilities for limiting the consequences; (c) sustainable management of water as well as geological and forest resources of the country; (d) natural disasters and the internal (public and economic) security of the country; (e) the development of forecasting methods and systems warning of dangerous hydrological and meteorological phenomena, and using them for guarding the country; (F) the Baltic Sea as an element of the climate system, and its role in the development of emergencies; (g) risks and determinants of, and possibilities for the implementation of national public water supply under provisions of European Union legislation; (h) preventing the degradation of Polish holding tanks; (i) prospective development of Vistula river drainage basin into the system of assessment of the impact of hydro-engineering investment projects on the environment. Particular tasks carried out under the projects are performed either for selected Polish cities or for the entire country. The scale of maps and other cartographic data prevents them from being used for the aims of the project.

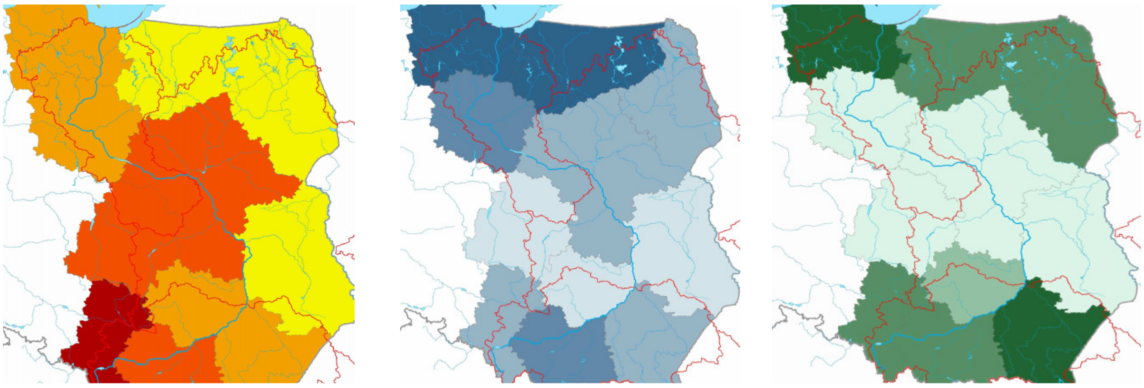

Fig. 4. Percentage of urbanised land, water bodies and watercourses, and forests in the region under study
Source: Klimat (2016)

Klimada project

The full title of the project is the "Development and implementation of a Strategic Adaptation Plan for the sectors and areas vulnerable to climate change – KLIMADA; it was implemented by order of the Ministry of the Environment in the years 2011–2013 with funds of the National Fund for Environmental Protection and Water Management (NFOŚiGW). It indicates the aims and directions of adaptation measures which need to be taken in the most vulnerable sectors and areas in the period up to 2020: water management, agriculture, forestry, biological diversity and legally protected areas, health, energy, construction, transport, mountainous areas, coastal zone, spatial economy, and urban areas. Vulnerability of these sectors has been determined on the basis of climate change scenarios adopted for the Strategic Adaptation Plan. Aims, directions of measures, and specific actions were proposed, which correspond with strategic documents, in particular with the National Development Strategy 2020, and with other development strategies, and, at the same time, they are a necessary supplement in the context of adaptation. The current and anticipated climate change were considered and analysed, including climate change scenarios for Poland by the year 2030, which demonstrated that, during this period, the greatest hazard to the economy and the public will be extreme weather events (torrential rains, floods, flooding, landslides, heat waves, droughts, hurricanes, etc.) resulting from climate change. These phenomena will occur with an increasing frequency and intensity, and will affect increasing areas of the country. The Internet platform *www.klimada.mos.gov.pl* (Klimada 2016) provides various circles with a forum for discussion on the tasks implemented in the context of the changing climate and the occurring hazards of extreme weather phenomena. It contains no cartographic compilations concerning the occurring hazards; however, documents about the economic consequences of climate change can be found there.

The *ISOK* (IT system of the country's protection against hazards) project

The *ISOK* has been established to ensure an effective system of country's protection against extraordinary hazards. This is particularly important due to the increasing number of such events, and an increasing scale of both economic and social effects produced by these events (Kocur-Bera, Dudzińska 2015). Another problem arises from the fact that the information systems existing in Poland and used for the protection of the population and economy are scattered and heterogeneous, based on various technical solutions, and use various data (databases). The ISOK initiative is aimed at the consolidation of information on hazards, and the incorporation of this information in a professional information system using an integrated database as well as a modern module for dissemination of information to final users, ensuring access for both the administration and citizens. Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, commonly referred to as the Floods Directive, which entered into force on 26 November 2007, has become an additional incentive for the intensification of measures enhancing the country's security in the context of a flood event. The Directive requires Member States to draw up planning documents concerning the flood risk management, and providing the public with access to their results.
The main aim of the project is to create a new element significantly improving the protection of the public, economy and the environment against the flood effects and other extraordinary hazards.

The project is primarily addressed to the public and institutions responsible for spatial planning as well as planning of flood protection. These are primarily regional water management authorities responsible for the protection of areas vulnerable to floods against their development in a manner hindering the protection. On the other hand, municipality administrators and voivodeship marshals are responsible for spatial planning. Their responsibility will be to take into account results of the project (Maps of Flood Hazard and Maps of Flood Risk) in area development plans for municipalities and voivodeships.

The institutions responsible, under the Act on crisis management, for the prevention of crisis situations, preparation for taking control of them through planned actions, and response where they occur, will be the recipients of ISOK products. This applies in particular to voivodeship centres of crisis management and other government and local government administration units at the national, regional and local level, which deal with the issues of flood protection and other hazards as well as emergency response. Access to complete and reliable information on possible natural and technological hazards is also very significant to enterprises planning the implementation of investment projects.

Thanks to the acquisition of a numerical topography model, a numerical land cover model, digital ortophotomap, and a database of topographic objects, it will be possible to create the following under the project:

- maps of hazards to the population health and lives due to meteorological conditions and the social sensitivity to hazards;
- map of surface water and groundwater intakes in the areas vulnerable to the flood hazard; selected surface water and groundwater intakes supplying the population with water for consumption or domestic purposes, where water is a component of or has a direct contact with food or pharmaceutical products, will be detailed. Hazard resulting from the interruption of water intake operation will include: prevention of water abstraction due to flooding the water intake or a water supply facility, and a possibility for water contamination with substances likely to affect the quality of drawn water as a result of a major industrial failure.
- maps of the air pollution due to meteorological hazards – above-standard concentrations of dust pollutants, sulfur dioxide, nitrogen dioxide, and ozone;
- a map of a risk of major industrial accident due to meteorological hazards;
- a map of a risk of interference in the power network due to meteorological hazards.

Thanks to the ISOK project, it will be possible to reduce losses caused by the occurrence of flood hazards through showing risk areas to the public, allowing proper spatial planning, particularly in the context of flood hazards present in river valleys, including those resulting from failure of water facilities, especially river embankments, ensuring that it is possible to consciously make investment decisions as regards their location in areas at risk of a flood hazard, increasing the public sense of security, reducing the number of casualties in the population due to the occurrence of the elements, in particular flood, and improving the functioning of crisis management systems at all levels (e.g. Fig. 5).

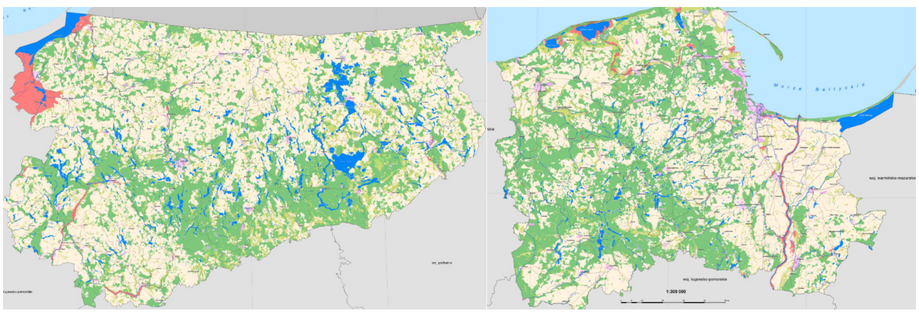

Fig. 5. Maps of the initial flood risk assessment for Warmińsko-Mazurskie and Pomorskie voivodeships
Source: KZGW (2016)

Conclusions

Taking decisions related to spatial management is becoming increasingly difficult due to the emerging new hazards. Climate change, extreme weather events, and industrial pollution are more and more frequently the factors leading to hazards. Projects implemented in the field of protection against hazards make use of increasingly newer measurement technologies and forecasting models, so that the decision-making processes may take place based on a lot of information which has so far been rather unobtainable.

For the areas of Poland, initiatives related to obtaining and sharing information on hazards are in the phase of development. The scope of gathered and shared information does not always meet the local needs. Spatial management involves making decisions on a cadastral parcel or property, and the information made available have scales related to a region. Therefore, there is a strong need for obtaining more precise information in scales which will allow it to be managed, particularly for areas at a significant risk of hazard.

References:

Bajerowski, T. 2003. *Niepewność w dynamicznych układach przestrzennych.* UWM, Olsztyn.

Cymerman, R. 2001. *Planowanie i zagospodarowanie przestrzenne w gospodarce nieruchomościami*. Educaterra sp. z o.o., Olsztyn.

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 *on the assessment and management of flood risks.*

Grabowski, D.; Lewandowski, P.; Gabryś-Godlewska, A.; Bąk, B.; Formowicz, R.; Koźma, J.; Mrozek, T.; Zdanowski,A.; Sikorska-Maykowska, M. (Ed.). 2007. *Mapy terenów zdegradowanych i podwyższonego zagrożenia naturalnego*. Compilation Instructions. Polish Geological Institute, Warszawa.

IUNG. 2016. *System monitoring suszy rolniczej* [online], [cited 29 November 2016]. Instytut Upraw, Nawozenia i Gleboznastwa, Państwowy Instutut Badawczy. Available from Internet: http://www.susza.iung.pulawy.pl/kbw/09/.

Kocur-Bera, K. 2016. *Kształtowanie bezpiecznej przestrzeni obszarów wiejskich w aspekcie wystepowania ekstremalnych zjawisk pogodowych*. UWM Olsztyn.

Kocur-Bera, K.; Dudzińska, M. 2015. Managing rural areas considering climate changes and extraordinary weather phenomena – a concept of solutions on a local scale, in *15th International Multidisciplinary Scientific GeoConferences SGEM2015 proceedings, section 8 – Geoinformatics. Informatic, Geoinformatic and Remote Sensing,* June 18–24, 2015, Book 2 Vol. 1, 707–714. ISBN 978-619-7105-34-6 / ISSN 1314-2704.

Klimada. 2016. *Adaptacja do zmian klimatu* [online], [cited 20 November 2016]. Departament Zrówmnowazonego Rozwoju. Available from Internet: www.klimada.mos.gov.pl.

Klimat. 2016. *Wpływ zmian klimatu na środowisko, gospodarkę i społeczeństwo* [online], [cited 20 November 2016]. Europejski Fundusz Rozwoju Regionalnego. Available from Internet: http://klimat.imgw.pl/wp-content/uploads/2011/02/zad.9_R2010.pdf

KMZB. 2016. *Krajowa Mapa Zagrożeń Bezpieczeństwa* [online], [cited 29 November 2016]. Policja.pl. Available from Internet: https://mapy.geoportal.gov.pl/imaplite/kmzbpublic.html

Królikowski, K.; Trzaskalska-Stroińska, O.; Skrzyński, Z. 2014. Bezpieczeństwo i obrona w europejskiej polityce kosmicznej, *Magazyn fakty* 6(72) November/December.

KZGW. 2016. *Wstępna ocean ryzyka powodziowego* [online], [cited 29 November 2016]. Krajowy Zarząd Gospodarki Wodnej. Available from Internet: http://www.kzgw.gov.pl/files/file/materialy_i_informacje/worp/woj_pom/3.jpg.

Longley, P. A.; Goodchild, M. F.; Maguire, D. J.; Rhind, D. W. 2006. *GIS teoria i praktyka*. Państwowe Wydawnictwo Naukowe, Warszawa.

Mikołajek-Zielińska, B. 2013. *Copernicus – European programme for global monitoring for environment and security* [online], [cited 20 November 2016]. Available from Internet: https://www.nauka.gov.pl/g2/oryginal/2013_09/ff067cae5d64bea78d1d85cb33cc03a8.pdf

MTZ. 2016. *Mapy terenów zdegradowanych* [online], [cited 29 November 2016]. Państwowy Instytut Geologiczny. Available from Internet: http://geoportal.pgi.gov.pl/srodowiskowa/mapy/terenow_zdegradowanych.

Newman, O. 1972. *Defensible space. People and design in the violent city.* Architectural Press, London.

RPEiR 911/20101. *Regulation* (EU) No 911/2010 *of the European Parliament and of the Council*.

Urbański, J. 2012. *GIS w badaniach przyrodniczych*. E-book, version 2012.